Draft Environmental Impact Report

Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)

Volume I

SCH#: 2003011118

State of California
The Resources Agency
Department of Water Resources
October 2007

Prepared by:
PBS&J

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BACKGROUND

The State Water Project (SWP) is a large water storage and conveyance project that supplies water to about 24 million Californians including farmers that use it to irrigate 750,000 acres of cropland. The California Department of Water Resources (Department) manages the SWP and supplies water to 29 agricultural and municipal water supply agencies in accordance with long-term water supply contracts. The water supply agencies are referred to collectively as the SWP contractors and their service areas extend from Plumas County in the north to San Diego County in the south.

The amount of water available for delivery to the SWP contractors varies from year to year depending on hydrologic conditions, including annual rainfall, snowpack, and storage in SWP reservoirs. The long-term water supply contracts specify how the Department will allocate water to the contractors in times of shortage and surplus. Each contractor's long-term water supply contract includes a Table A amount which serves as a basis for allocating the available annual water supply among the contractors. During several dry years in the late 1980s and early 1990s, the Department and the contractors disagreed over water allocation procedures and other provisions of the long-term water supply contracts. In 1994, the Department and some of the contractors, meeting in Monterey, executed the Monterey Agreement, an agreement to modify the long-term water supply contracts. The modifications were incorporated into the long-term water supply contracts in what became known as the Monterey Amendment, which was signed by 27 of 29 contractors.

An Environmental Impact Report (EIR) on the Monterey Amendment was prepared by the Central Coast Water Authority, a joint powers agency representing several contractors. After the EIR was certified in 1995, the Planning and Conservation League challenged the adequacy of the EIR. Later, the Citizen's Planning Association of Santa Barbara and Plumas County Flood Control and Water Conservation District joined the action as plaintiffs. In 2000, the court ruled that the EIR was inadequate because it failed to analyze invocation of Article 18(b) of the then-existing SWP contracts as a no-project alternative, and that the Department must serve as the lead agency for a new EIR on the Monterey Amendment. Following the court's ruling, the Department, the contractors and the plaintiffs executed the Settlement Agreement in 2003. The Settlement Agreement specifies a process for the plaintiffs and the contractors to advise the Department in preparation of the new EIR, sets forth some specific items to be included in the content of the new EIR and establishes a process for mediation of CEQA issues raised by either the plaintiffs or contractors. The Settlement Agreement also requires the Department to carry out various actions and modify some of its administrative practices.

POTENTIAL AREAS OF CONTROVERSY AND CONCERN

The Department issued a Notice of Preparation (NOP) for this new EIR in January 2003. Responses to the NOP and comments received during the scoping sessions held across the state identified potential areas of controversy and concern to a range of local, state, and federal interests. They included the following:

- The EIR must analyze reductions of future deliveries to agricultural contractors, the associated loss of agricultural land and the change in agricultural economics as a result of the Monterey Agreements.
- Definition of the baseline for the proposed project must be based on pre-Monterey Agreement conditions.
- The EIR must analyze the SWP's water reliability and address the potential shortfalls in water delivery instead of relying on "paper water".
- Potential effects of the proposed project on operation of the U.S. Bureau of Reclamation's Central Valley Project (CVP), deliveries to CVP contractors and existing water rights holders must be analyzed.
- The EIR must include reasonable and feasible alternatives, including the No Project Alternative, to reduce deliveries, conserve water, and find other reliable sources of water for deliveries to southern California.
- Storage outside of the contractors' service area could result in potential for growth in areas previously unserved or limited by water supplies and must be analyzed in the EIR.
- The transfer of the Kern Fan Element should be analyzed for potential economic and environmental effects.
- The EIR should contain a review of the existing contracts for the public to see how the Monterey Agreement changed the contract provisions.
- Exposure of cultural resources due to construction of groundwater percolation basins and changes in operations of dams and reservoirs must be analyzed in the EIR.
- The EIR must evaluate reliance on the Environmental Water Account (EWA) for future use and potential limitations to mitigate for effects on the Delta.
- The EIR is required to analyze potential effects on Delta flows, water quality, and biological resources from operations of the water diversion pumps in the southern portion of the Delta.
- Impacts from the proposed project and other water supply projects must be analyzed for cumulative effects on the environment, including growth inducing effects.

The foregoing areas of controversy and concern are addressed in this EIR as necessary for compliance with the California Environmental Quality Act.

PROPOSED PROJECT

The proposed project is the Monterey Amendment and the Settlement Agreement. The primary elements of the Monterey Amendment are:

- altered water allocation procedures. Shortages and surpluses would be shared among contractors in proportion to their Table A amounts. During shortages, agricultural contractors would no longer be subject to cuts in supply before municipal contractors;
- permanent transfers of Table A amount. Agricultural contractors would transfer 130,000 acre-feet (AF) of Table A amount to municipal contractors and 45,000 AF of Table A amount would be permanently retired;
- transfer of ownership of approximately 20,000 acres of land known as the Kern Fan Element from the Department to Kern County Water Agency;

- facilitation of several water supply management practices including storage of SWP water outside contractors' service areas, borrowing of water by contractors from Castaic Lake and Lake Perris, and establishment of a turnback pool to promote transfers of SWP water from contractors with excess allocated Table A amounts to contractors with a need for water; and

- restructuring of rates for financing the SWP and using its facilities, including the establishment of a trust fund to help agricultural contractors meet their SWP financial obligations during water shortages.

The primary elements of the Settlement Agreement are:

- better information on SWP reliability by substituting "Table A amount" for "entitlement" in the SWP contracts and by implementing new procedures for disclosure of SWP delivery reliability;
- more public review of major SWP actions by issuing guidelines for review of permanent transfers of Table A amounts, and issuing principles for public participation in negotiations for project-wide long-term water supply contract amendments and Table A transfers.
- Table A transfers completed prior to the Settlement Agreement would remain in place;
- assurance regarding the Kern Fan Element transfer including confirmation of title to Kern Fan Element lands; placement of restrictions on the use of Kern Fan Element lands ; and an independent study of some Kern Water Bank operations;
- establishment of a watershed forum and funding for Plumas County Flood Control and Water Conservation District (Plumas County) to pursue watershed restoration, and; amendment of Plumas County's SWP contract with respect to allocation to SWP water; and
- providing specified amounts of funding to the plaintiffs for multiple purposes.

Proposed Project-Induced Changes In SWP Operations

Many of the actions implemented through the Monterey Amendment involve changes in the way the SWP was operated. Analysis of historical data and the CALSIM II model were used to characterize Monterey Amendment-induced changes in SWP operations by comparing SWP operations with and without the Monterey Amendment. Comparisons are made to a baseline scenario in which the Department would have continued to operate the SWP in accordance with the pre-Monterey Amendment long-term water supply contracts. Most of the environmental impacts of the proposed project are a result of proposed project-induced changes in SWP operations.

With the Monterey Amendment in place, average annual total deliveries under 2020 conditions to agricultural contractors collectively would decrease by about 5 percent and deliveries to municipal contractors collectively would increase by about 2 percent as a result of the transfers and retirements of Table A amounts and altered water allocation procedures. However, agricultural contractors would increase their share of deliveries in critically dry years. Overall deliveries to contractors would increase by 1 to 2 percent as a result of the water supply management practices.

ENVIRONMENTAL IMPACTS

The impact of the proposed project on the following environmental elements was analyzed; surface water hydrology, water quality and water supply; groundwater; fisheries resources; terrestrial biological resources; visual resources; agricultural resources; air quality; geology, soils and mineral resources; recreation; land use and planning; hazards and hazardous materials; noise; cultural and paleontological resources; public services and utilities; traffic and transportation; and energy. The results of the analysis are summarized in Table ES-1. The results of the analysis for the period 1996 to 2003 and for the future are listed separately. The level of significance of the environmental impacts of the proposed project before and after the application of mitigation measures are shown in the table.

Impacts - 1996-2003

<u>Less-than-Significant Impacts</u>

The proposed project had less-than-significant impacts on surface water hydrology, water quality and water supply; groundwater; terrestrial biological resources; fisheries resources; visual resources; agricultural resources; air quality; geology, soils and mineral resources; recreation; land use and planning; hazards and hazardous materials; noise; cultural resources; public services and utilities; traffic and transportation; and energy.

<u>Significant Impacts</u>

The proposed project had no significant and unavoidable or significant mitigable impacts between 1996 and 2003.

Future Impacts

<u>Less-Than-Significant Impacts</u>

The proposed project would have less than significant impacts on surface water hydrology, water quality and water supply, groundwater; agricultural resources; land use and planning; hazards and hazardous materials; noise; public services and utilities; traffic and transportation; and energy.

The increased reliability of agricultural contractors’ SWP water supply as a result of the Monterey Amendment would enable more farmers to switch from growing annual crops to permanent crops. Based on current trends, it is expected that more farmers in the SWP service area would choose to replace annual crops with permanent crops. This might reduce the water contractor’s management flexibility during droughts but this impact is considered to be less-than-significant.

The periods when the proposed project allows the Banks pumps to operate at full capacity for added periods could affect CVP water supplies by reducing the periods when the CVP could share use of the Banks pumps under Joint Point of Diversion. This impact would occur only in certain circumstances when the CVP has not yet filled San Luis Reservoir in the winter or spring, and would decide to pay the added cost of sharing use of the Banks pumps. It is estimated that this impact could occur in about 8 percent of years, and the impact in some years could be up to 100,000 AF of reduced opportunity to the CVP. Because there is a small proportion of total CVP pumping from the Delta it is considered to be a less-than-significant impact.

The water supply management practices would encourage the development of groundwater banks in Kern Fan Element. Construction of percolation ponds and other facilities as part of the groundwater banks could have significant adverse impacts on terrestrial biological and cultural resources. However, since 1997, the Kern Water Bank Authority has managed the Kern Fan Element lands in accordance with a Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) approved by the US Fish and Wildlife Service and the California Department of Fish and Game that includes mitigation measures designed to protect biological resources. Also, the Environmental Assessment for the HCP/NCCP identified archeological sites at the Kern Fan Element and the Kern Water Bank Authority adopted mitigation measures designed to protect cultural resources. It is expected that the mitigation measures adopted by the Kern Water Bank Authority would protect terrestrial biological and cultural resources in the future and thus the impact to these resources would be less-than-significant.

Potentially Significant Unavoidable Impacts

The proposed project would have potentially signficant and unavoidable impacts on: terrestrial biological resources; visual resources; air quality; geology, soils and mineral resources; recreation; and cultural resources.

The water supply management practices would encourage the development of groundwater banks in Kern County other than in the Kern Fan Element. Construction of percolation ponds and other facilities as part of the groundwater banks could have significant adverse impacts on terrestrial biological and cultural resources. When new groundwater banks are proposed in Kern County, other than in the Kern Fan Element, they will undergo project-level CEQA review. It is likely that the impacts on terrestrial and cultural resources can be reduced to a less-than-significant level by mitigation measures; however, this cannot be determined with certainty until the project-level CEQA review is completed.

Article 54 of the Monterey Amendment would enable certain contractors to borrow water from Castaic Lake and Lake Perris provided it is replaced within five years. If contractors borrowed the maximum amount of water permitted under the Monterey Amendment and did not replace it for an extended period of time (longer than one year, thus longer than any drawdown period when compared to baseline levels), this could cause significant adverse impacts. No mitigation measures are practical or appropriate. Impacts on Castaic Lake and Lake Perris are not the same due to differing biotic and abiotic characteristics of each water body. Castaic Lake could experience signficant and unavoidable impacts on terrestrial biological resources, visual resources, geology and soils, and recreation. Lake Perris could experience significant and unavoidable impacts on terrestrial biological organisms, visual resources, air quality, and recreation.

Potentially Significant Mitigable Impacts

The proposed project would have signficant and mitigable impacts on fisheries resources. Based on the fisheries analysis, increased future pumping due to the proposed project under 2020 conditions could change Delta flow patterns; disrupt movement of species of fish, and increase entrainment losses of adult delta smelt and salmonid smolts. The fishes most susceptible to November-March hydrodynamic changes and export increases are outmigrating salmonids and delta smelt moving upstream to spawn. Increased entrainment of a special status species that resulted from the proposed project under 2020 conditions would be considered an adverse effect and would reduce a species' abundance. Delay of upstream or downstream migration could be considered an interference with the movement of resident and migratory species. As compared to baseline conditions, the potential exists for the proposed project to have an adverse impact on Delta fish species by increasing salvage at the Skinner Facility as a result of higher pumping at Banks Pumping Plant during certain periods when San Luis Reservoir is full. This impact is potentially significant.

The Department estimates the water supply management practices that are a part of the proposed project would result in an annual increase of around 50,000 AF in diversion of water from the Delta by the SWP. Of this pumping, an estimated 38,000 AF would be diverted during times when fish species could be at risk. The additional pumping due to the water supply management practices would only occur when the contractors had all the SWP water they could use or store, all SWP reservoirs south of the Delta were full, and all EWA debt was repaid.

Operations of the Department are currently subject to a court remedy which is designed to prevent harm to the delta smelt. Ongoing reconsultation on the Operations Criteria and Plan (OCAP) with United States Fish and Wildlife Service is expected to yield a new Biological Opinion for delta smelt that would, upon court approval, replace the court's remedy for operation of the project. That new Biological Opinion would then provide the mitigation required to address the impacts of this proposed project. As part of the resources to provide that fish protection, both in the remedy phase and for the longer term under a new Biological Opinion, the Department has already committed the operational assets that are currently a part of the Environmental Water Account (EWA). These assets may be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon.

Additionally, the following list identifies other environmental programs already in place or forthcoming that are relevant to the SWP (thus the proposed project) and Delta fisheries for the 2003-2020 timeframe:

1. The Anadromous Fisheries Biological Opinion of 2004;
2. The Delta Pumping Plant Fish Protection Agreement ("Four Pumps Agreement", 1986);
3. The Delta Smelt Biological Opinion of 2005;
4. The Delta Smelt Action Plan of 2005;
5. The Bay-Delta Conservation Plan;
6. The Pelagic Fish Action Plan of 2007;
7. The Adaptive Management Process; and
8. The Interagency Ecological Program;
9. The Delta Risk Management Study;
10. The Delta Vision Program; and
11. The NOAA Fisheries Biological Opinion of 2004.

Growth Inducement

As a result of the proposed project, eight M&I contractors would receive an increase in average annual deliveries of SWP water of 90,900 AF and seven M&I contractors would receive an increase in average annual deliveries of 91,400 AF of combined Table A and Article 21 deliveries under 2020 conditions. The additional water supply that would be made available by the Monterey Amendment through average annual Table A deliveries to eight M&I contractors could support a maximum increase in population of approximately 392,808 to 561,684 (depending on the future scenarios) in their service areas. Average annual Table A and Article 21 deliveries to seven M&I contractors could support a maximum population of 405,104 to 561,685. The estimates are high for a variety of reasons including the fact that some M&I contractors may choose to use the water to increase reliability or for groundwater recharge and other purposes. To accommodate the additional people, currently undeveloped land in the service areas of some M&I contractors would be converted to urban uses or existing urban lands would be redeveloped at higher densities. Population growth would have secondary or indirect environmental effects that include but might not be limited to the following, loss of special status species and their habitat, increased emission of air and water pollutants with consequent adverse effects on air and water quality, increased traffic and noise, and increased demand for utilities and public services.

Neither the Department nor the contractors make local decisions regarding growth or where it will occur. Cities and counties in the contractors' service areas affected by the increased population are responsible for considering the environmental effects of their growth and land use decisions. Therefore, mitigation measures of these impacts are subject to local agencies decision making.

Water Supply Reliability and Growth

There is an argument that because the sum of the Table A amounts (previously "entitlements") in the long-term water supply contracts is greater than the amount of water that the SWP can reliably deliver on an annual basis, land use planners and decision-makers have had an exaggerated impression of the SWP's delivery capability and the amount of urban growth that can be supported by SWP water. The difference between the sum of the Table A amounts and the actual delivery capacity of the SWP is sometimes referred to as "paper water".

Furthermore, it is hypothesized that, as a result of paper water, land use planners and decision-makers may have approved urban development that would not have been approved if they understood the available information on SWP's actual delivery capacity. A provision of the long-term water supply contracts (Article 18(b)) called for reducing the sum of the Table A amounts in line with the SWP's actual available dependable annual supply of water in the event of a permanent water shortage. The Monterey Amendment removed Article 18(b) from the long-term water supply contracts.

The "paper water" question is really a question of whether local planners recognize the limitations on the reliability of SWP supplies. In the early years of the SWP, the total Table A amount was important because this number was also intended to be the minimum project yield or the firm yield of the SWP. In recent years, the concept of firm yield has been replaced with water delivery curves which show the likelihood of water deliveries by the SWP in any year given the range of historical hydrologic events. Table A amounts now serve primarily as a way of allocating shortages and surplus among the contractors and as a way of allocating costs of the SWP. Reducing the Table A amount through invocation of Article 18(b) is not relevant given current day operations and planning based on water delivery reliability curves.

The surveys and literature reviews undertaken as part of this EIR show no evidence that a “paper water” problem was created by the contractual SWP Table A amounts and that it affected urban growth decisions. However, even if a “paper water” problem did arise from land use planners relying on the Table A amounts, the passage of SB 610 and 221 and the State Water Project Reliability Report have led to better information dissemination to local planners regarding the reliability of SWP supplies. Thus, the elimination of Article 18(b) by the proposed project would not have an effect on urban growth and would not create a continued “paper water” problem because land use planners either do not consider SWP water supplies when approving growth at the General Plan level, or have more detailed SWP delivery information available to them to consider at the development approval level.

ALTERNATIVES TO THE PROPOSED PROJECT

CEQA requires that an EIR must describe and evaluate a reasonable range of alternatives to the proposed project that would feasibly attain most of the project’s basic objectives, but that would avoid or substantially lessen any significant adverse environmental effects of the project. An EIR is not required to consider every conceivable alternative to a proposed project. Rather, it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation. In addition to any other alternatives considered, an EIR must include an evaluation of “no project” to allow decision-makers to compare the results of approving or disapproving the proposed project.

If the Monterey Amendment had not been implemented in 1995, management of the SWP might have proceeded in any number of ways. It is, of course, impossible to know which path SWP management would have been followed and so several possibilities rather than a single path were examined. The several versions of “no project” examined in this EIR, together with a single “action” alternative (Alternative 5), encompass a range of alternatives within which all reasonable possibilities lie. Evaluation of these different scenarios can help decision-makers understand the environmental consequences of different courses of action.

No Project Alternative 1

Under No Project Alternative 1, none of the provisions of the Monterey Amendment or of the Settlement Agreement would have been be implemented and the Department would have used the Kern Fan Element to increase SWP reliability. None of the significant impacts of the proposed project would have occured but neither would any of the proposed project’s objectives have been met.

No Project Alternative 2

Under No Project Alternative 2, it was assumed that all of the Table A transfers and retirements that occurred between 1996 and 2003 with the proposed project would have occurred under No Project Alternative 2. Furthermore, water would have been allocated in accordance with the post-Monterey Amendment allocation method and the alternative would include the water supply management practices that were carried out between 1996 and 2003. After 2003, no further transfers or retirements of Table A amounts would occur and water would be allocated in accordance with the pre-Monterey Amendment long-term water supply contracts. The water supply management practices would be discontinued but outside-service-area storage would continue using facilities that were in place in 2003. No new outside-service-area storage would occur.

Between 1996 and 2003 No Project Alternative 2 would have had the same environmental effects as the proposed project. In the future, No Project Alternative 2 would have environmental impacts similar to but less than those of the proposed project.

No Project Alternative 2 would have resulted in some of the same significant impacts as the proposed project. It would also have met some of the proposed project's objectives.

Court-Ordered No Project Alternatives 3 and 4

Under Court-Ordered No Project Alternatives 3 and 4, the Department would have continued to administer the SWP in accordance with the pre-Monterey Amendment long-term water supply contracts. None of the elements of the proposed project would be implemented. A permanent water shortage would have been declared and Article 18(b) of the long-term water supply contracts would have been invoked. Court-Ordered No Project Alternatives 3 and 4 would be the same except for differences in how the Department would allocate water to the contractors. None of the environmental impacts associated with the proposed project would have occured under Court-Ordered No Project Alternatives 3 and 4. Court-Ordered No Project Alternatives 3 and 4 might have met some of the proposed project's objectives with regard to disputes over allocations between agricultural and M&I contractors.

Alternative 5

Under Alternative 5, the Monterey Amendment and the Settlement Agreement would be implemented with the exception of the water supply management practices. Alternative 5 would avoid any potential significant adverse effects of the proposed project ground water banks in the Central Valley, on Delta outflow and on environmental resources at Lake Perris and Castaic Lake. Although Alternative 5 would meet some of the proposed project's objectives, it would not meet other objectives and it would leave a significant number of M&I users with less water and no additional benefits. Even though there is doubt about whether this alternative is feasible, this analysis still provides useful information since this alternative would avoid most of the environmental impacts of the Monterey Amendment.

TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

	Impact	Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	Future		1996 – 2003	Future
7.1 Surface Water Hydrology, Water Quality and Water Supply						
7.1-1	**The proposed project would have no impact on flows in the San Joaquin and American rivers. Delta outflows from 1996-2003 were reduced by an estimated 0.03 percent. Changes in water flows in the Feather and Sacramento rivers were less than 0.15 percent under 2003 and 2020 conditions. Future Delta outflow impacts are estimated to be less than 0.35 percent.**	NA	NA	NA	NA	NA
7.1-2	**The proposed project would have a less than significant impact on ambient water quality in the Feather, Sacramento, American, and San Joaquin rivers because there is little to no change in water flows relative to the baseline under 2003 and 2020 conditions.**	LS	LS	7.1-2 None required.	NA	NA
7.1-3	**The proposed project would have a less than significant impact on water quality in the Delta and the San Francisco Bay Estuary under 2003 and 2020 conditions. The position of X2 would not be significantly impacted by the Monterey Amendment.**	LS	LS	7.1-3 None required.	NA	NA
7.1-4	**The proposed project would have a less than significant effect on water levels or water quality in Lake Oroville under 2003 and 2020 conditions, The proposed project would delay filling of San Luis Reservoir under certain circumstances under both 2003 and 2020 conditions but would have little effect on water quality. From 1996 to 2003 water levels in Lake Perris and Castaic Lake were higher than in the period 1974-1995 and changes in water quality were minimal. In the future, Lake Perris and Castaic Lake could be drawn down for longer than in the past. However, the water level changes at Castaic Lake and Lake Perris would not alter water quality sufficiently to impair beneficial uses.**	LS	LS	7.1-4 None required.	NA	NA

LS = Less than Significant
PSU = Potentially Significant and Unavoidable
PS = Potentially Significant
BE = Beneficial Effect
NI = No Impact
NA = Not Applicable

TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	Future		1996 – 2003	Future
7.1-5	**The proposed project would have a less than significant impact on the quality of the water supplies for SWP contractors and the water agencies they serve under 2003 and 2020 conditions.**	LS	LS	7.1-5 None required.	NA	NA
7.1-6	**The proposed project would have a less than significant effect on the availability and quality of water supplies for the Feather River water rights contractors. Proposed project-induced flow changes in the Feather River would be too small (0.15%) to effect water availability or quality.**	LS	LS	7.1-6 None required.	NA	NA
7.1-7	**The proposed project would have a less than significant impact on the availability and quality of water to the CVP and its contractors. Proposed project induced changes in river flow and Delta outflow would be too small to affect the availability or quality of waster at CVP diversion points. Between 1996 and 2003, the proposed project had no effect on the CVP's use of Banks Pumping Plant under JPOD. In the future, the proposed project could reduce the CVP's Delta diversions at the Banks Pumping Plant by 5,000 AF per year.**	LS	LS	7.1-7 (Future) None required.	NA	NA
7.1-8	**The Settlement Agreement provide funds to Plumas County to improve environmental conditions in the Feather River watershed. Each project may have some temporary impacts to water quality due to construction; however, the long-term results will be beneficial to water quality.**	NA	LS	7.1-8 None required.	NA	NA

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PSU = Potentially Significant and Unavoidable
PS = Potentially Significant
BE = Beneficial Effect
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TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

	Impact	Level of Significance Prior to Mitigation			Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	**Future**			**1996 – 2003**	**Future**
7.1-9	**Because the fish action and proposed project-induced increased pumping occurred at different times in the month, it was concluded that the proposed project would have no impact on the EWA from 2000 to 2004.** **The Department estimated that in the future, the proposed project would enable an increase in pumping at the Banks Pumping Plant of 50,000 AF per year and that, using the 1996 through 2004 hydrology, increased pumping would occur in 11 months in the nine year period (108 months). The Department estimated that the proposed project could affect the EWA in three of the nine years. The affect could increase the EWA debt by an average of 27,000 AF in the years that an increase in pumping could occur. The EWA has averaged about 250,000 AF of pumping curtailments at the Banks and Jones Pumping Plants from 2001 through 2006. Thus, the proposed project could increase EWA debt by about 10-percent in years when curtailments occurred. If the EWA program continues in the future, the proposed project could increase its cost. However, because this is an economic and not a physical environmental impact no significance conclusions were drawn.**	NI	NI	7.9-1	None required.	NI	NI
	7.2 Groundwater Hydrology and Quality						
7.2-1	**During the late 1990s and early 2000s, the proposed project facilitated groundwater banking in Kern County and raised the levels of groundwater by several feet relative to the baseline scenario. This trend is expected to continue for the future, having a beneficial impact on groundwater levels in the Kern County Groundwater Subbasin.**	BE	BE	7.2-1	None required.	NA	NA

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PSU = Potentially Significant and Unavoidable
PS = Potentially Significant
BE = Beneficial Effect
NI = No Impact
NA = Not Applicable

TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
7.3 Fisheries Resources							
7.3-1	**The proposed project resulted in a 0.0066 percent annual decrease in Feather River flows from 1996-2003. The maximum future annual decrease in Feather River flow would be less than 0.028 percent. These flow changes would have a less than significant impact on special-status fish species in the Feather River.**	LS	LS	7.3-1	None required.	NA	NA
7.3-2	**The proposed project would result in minor increases in flows due to releases from Folsom Reservoir to meet downstream water quality requirements. For the 1996-2003 period and the future, this would have a less than significant impact on special-status fish species in the American River**.	NI	NI	7.3-2	None required.	NA	NA
7.3-3	**The proposed project would have a 0.016 percent annual decrease in Sacramento River flows from 1996-2003. The maximum future annual decrease in Sacramento River flow would be 0.0542 percent. These flow changes would have a less than significant impact on special-status fish species in the Sacramento River.**	LS	LS	7.3-3	None required.	NA	NA
7.3-4	**None of the elements of the Monterey Amendment involves operation of facilities on the San Joaquin River. Thus, the proposed project would have no impact on special-status fish species in the San Joaquin River due to water flow changes.**	NI	NI	7.3-4	None required.	NA	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

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	1996 – 2003	Future		1996 – 2003	Future
7.3-5 Implementation of the water supply management practices could result in increased pumping in November through March which could change Delta flow patterns in 1995 – 2003 and in the future. The changed flow patterns could disrupt the movement of fish species and increase entrainment of adult delta smelt and salmonid smolts. The magnitude of this impact depends on the delta outflow and relative reduction generated by increased pumping. Misdirection or delay of upstream movement could have been a problem when Delta flow was low. Compliance with existing environmental programs relevant to the SWP would minimize impacts attributed to the proposed project in the future; however, the potential exists for the proposed project to have an adverse impact on Delta fish species by increasing salvage at the Skinner facility as a result of higher pumping at Banks during certain periods.	LS	PS	7.3-5 The Department shall implement operational assets that could be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon that would limit any adverse impact resulting from the proposed project on special status Delta fish species as a result of higher pumping at Banks during periods when San Luis Reservoir, absent of the proposed project, would be full. The Department will continue to operate the SWP and its facilities in accordance with all statutory requirements. To ensure compliance to all environmental guidelines, the Department follows a set of mitigation and environmental programs (some already in place and some forthcoming). Any additional pumping due to the proposed project under 2020 conditions in the Delta will be addressed by requirements that govern the operation of the Delta facilities of the SWP. In the immediate short-term time frame, the operational remedies imposed by the United States District Court, Eastern District of California, in Fresno will govern SWP operations to provide protection for the listed fish, that are subject to litigation. Conclusion of current consultation on the OCAP with USFWS and NOAA Fisheries is expected to provide a new Biological Opinion for delta smelt, salmon, and green sturgeon that would replace the court's order regarding for operation of the project. The new Biological Opinions would then continue to provide the mitigation required to address the impacts of this proposed project.	NA	LS

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		1996 – 2003	Future			1996 – 2003	Future
7.3-6	**Implementation of the proposed project could result in changes in Delta outflow which could adversely affect special-status fish species. Review of X2 salinity position under both 1996-2003 and future conditions shows that the location would move further into San Francisco Bay under periods of high outflow and upstream into the Delta during periods of low outflow; however, the change when compared to baseline scenario would be plus or minus 100 meters. The change is considered immeasurable in the filed, and therefore, is not considered a substantial alteration of habitat used by special-status fish species.**	LS	LS	7.3-6	None required.	NA	NA
7.3-7	**The proposed project would have a less than significant impact on the recreational fisheries at Lake Perris and Castaic Lake because any decrease in fish populations would be supplemented by the annual stocking program, and there is no evidence to indicate that fish populations would drop below self-sustaining levels.**	LS	LS	7.3-7	None required.	NA	NA
7.3-8	**Any impact to Lake Oroville due to the proposed project would be less than 1 percent of storage. The impact on fisheries resources at Lake Oroville would be less than significant.**	LS	LS	7.3-8	None required.	NA	NA
7.3-9	**The San Luis Reservoir for the 1996-2003 and future has and will likely continue to experience lowered water levels due to the proposed project; however, these changes would be minimal. These changes would not adversely affect any special-status fish species because none exist in the reservoir, nor would it significantly reduce populations of fish that have economic or social value or affect any habitat or other sensitive natural community.**	LS	LS	7.3-9	None required	NA	NA

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		1996 – 2003	Future			1996 – 2003	Future
7.4 Terrestrial Biological Resources							
7.4-1	**The proposed project could impact special-status terrestrial biological resources in the southern San Joaquin Valley portion of Kern and King's Counties as a result of changes in agricultural practices. However, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributed to the proposed project that can be discerned from the historical analysis period. To the extent that some land was converted to permanent crops as a result of the proposed project, this would not have affected special-status species habitat.**	LS	LS	7.4-1	None required.	NA	NA
7.4-2	**The proposed project could impact special-status terrestrial biological resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) resulting from construction of new groundwater storage facilities. In the future, the water supply management practices could encourage the development of additional groundwater banks in Kern County. Construction of percolation ponds and other facilities could result in potentially significant adverse impacts on terrestrial biological resources.**	LS	PS	7.4-2 a) b)	(Future) Special-status species surveys shall be conducted prior to the site selection for future recharge basins, to determine if any special-status plants or wildlife would be impacted. To the extent possible, the basins shall be sited such that any special-status species and their habitats are avoided. If special status species cannot be avoided, then mitigation for impacts shall be required consistent with current requirements from the CDFG and USFWS. If the future projects are located within the Kern Water Bank Master Permit Credit Area, then mitigation credits may be purchased at the Kern Water Bank Conservation Bank.	NA	PSU

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			c) The water districts shall prepare CEQA documents to assess any environmental impacts from the construction and use of future recharge basins. This mitigation would prevent any adverse impact to special-status terrestrial biological resources through avoidance of special-status species and their habitat. If avoidance is not possible, then consultation with the resource agencies will be required to determine appropriate mitigation. At this time, without knowing the future site locations, it is unrealistic to provide specific mitigation for the special-status species that may be affected.		
7.4-3 The proposed project could impact special-status terrestrial biological resources at the Kern Fan Element due to changes in land use and management. In the future, the Proposed project could encourage land use changes at the Kern Fan Element. Any construction activities or land use changes could potentially have significant adverse impacts on terrestrial biological resources.	LS	PS	7.4-3 (Future) The proposed project would result in impacts to terrestrial biological resources on the Kern Fan Element property that would be reduced to less than significant through the following mitigation measures currently implemented by the KWBA. These measures were outlined in the Initial Study and Addendum to Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP: a) **Biological Monitor** A qualified biologist shall monitor all ground disturbing activities during construction in the Sensitive Habitat Sector and will oversee measures undertaken to reduce the take of listed species.	NA	LS

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	1996 – 2003	**Future**		**1996 – 2003**	**Future**
			b) **Construction practices** i. Delineation of Disturbance Areas – During construction, KWBA shall clearly delineate disturbance area boundaries by stakes, flagging, or by reference to terrain features, as directed by CDFG and USFWS to minimize degradation or loss of adjacent wildlife habitats during operation. ii. Signage – During construction, KWBA shall post signs and/or place fencing around construction sites to restrict access of vehicles and equipment unrelated to site operations. iii. Resource Agency Notification – At least 20 working days prior to initiating ground disturbance for project facilities in designated salvage/relocation areas, KWBA shall notify the Fresno Field Office of CDFG and the Sacramento Field Office of USFWS of its intention to begin construction activities at a specific location and on a specific date. The agencies will have ten working days to notify the KWBA of their intention to salvage or relocate listed species in the construction area. If KWBA is notified, it shall wait an additional five days to allow the salvage/relocation to take place. iv. Salvage and Relocation – KWBA shall allow time and access to USFWS and/or CDFG, or their designees, to relocated listed species, at the Resource Agencies' expense, from construction areas prior to disturbance of areas that have been identified by the Resource Agencies as having known populations of the listed species they wish to salvage or relocate.		

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			v. Construction Site Review – All construction pipes, culverts, or similar structures with a diameter of three inches or greater that are stored at a construction site on the Kern Water Bank for one or more overnight periods shall be thoroughly inspected for trapped kit foxes and other animals before the subject pipe is subsequently buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight shall be capped. If during construction a kit fox or other animal is discovered inside a pipe, that section of pipe shall not be moved or, if necessary, shall be moved only once to remove it from the path of construction activity until the animal has escaped.		

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			vi. Employee Orientation – An employee orientation program for construction crews, and others who will work on-site during construction, shall be conducted and shall consist of a brief consultation in which persons knowledgeable in endangered species biology and legislative protection explain endangered species concerns. The education program shall include a discussion of the biology of the listed species, the habitat needs of these species, their status under FESA and CESA, and measures being taken for the protection of these species and their habitats as a part of the project. The orientation program shall be conducted on an as needed basis prior to any new employees commencing work on the Kern Water Bank. Every two years or at the beginning of construction for the Supply/Recovery canal, a refresher course will be conducted for employees previously trained. A fact sheet conveying this information shall also be prepared for distribution to all employees. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be filed at KWBA's office and shall be accessible by CDFG and USFWS. vii. Standards for Construction of Canals - Concrete lined canals will have a side slope of 1.5 to 1 or less and the sides will have a concrete finish which will assist in the escape of animals. If canals are determined by CDFG or USFWS to be substantial impediments to kit fox movement, plank or pipe crossings will be provided across concrete canals in areas identified as having high kit fox activity.		

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			c) **On-Going Practices** i. Equipment Storage - All equipment storage and parking during site development and operation shall be confined to the construction site or to previously disturbed off site areas that are not habitat for listed species. ii. Traffic Control - KWBA's project representative shall establish and issue traffic restraints and signs to minimize temporary disturbances. All construction related vehicle traffic shall be restricted to established roads, construction areas, storage areas, and staging and parking areas. Project related vehicles shall observe a 25 MPH speed limit in all project areas except on county roads and state and federal highways. iii. Food Control - All food-related trash items such as wrappers, cans, bottles, and food scraps generated both during construction and during subsequent facility operation shall be disposed of in closed containers and shall be regularly removed from the site. Food items may attract kit foxes onto a project site, consequently exposing such animals to increased risk of injury or mortality. iv. Dog Control - To prevent harassment or mortality of kit foxes or destruction of kit fox dens or predation on this species; no domestic dogs or cats, other than hunting dogs, shall be permitted on-site.		

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			v. Pesticide Use - Use of rodenticides and herbicides on the site shall be permitted in accordance with the Vegetation Management Plan, which incorporates by reference the Interim Measures for Use of Rodenticides in Kern County, and which will incorporate by reference any other applicable laws, rules and regulations regarding the use of pesticides as they take effect. d) **Project Representatives** KWBA shall designate a specific individual as a contact representative between KWBA, USFWS, and CDFG to oversee compliance with protection measures-detailed herein. KWBA shall provide written notification of the contact representative to CDFG and USFWS within 30 days of issuance of the Permits and the Management Authorizations. Written notification shall also be provided by KWBA to CDFG and USFWS in the event that the designee is changed.		

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			e) **Notification Regarding Dead, Injured or Entrapped Listed Animals** Any employee or agent of KWBA who kills or injures a San Joaquin kit fox, blunt nosed leopard lizard, Tipton kangaroo rat, San Joaquin antelope squirrel, or other listed species listed as a threatened or endangered animal under FESA or CESA, or who finds any such animal either dead, injured, or entrapped on the Kern Water Bank shall report the incident immediately to KWBA's representative who shall, in turn, report the incident or finding to USFWS and CDFG. In the event that such observations are of entrapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape unimpeded. In the event that such, observations are of injured or dead animals, KWBA shall immediately notify USFWS and CDFG by telephone or other expedient means. KWBA shall then provide formal notification to USFWS and CDFG, in writing, within three working days of the finding of any such animal(s). Written notification shall include the date, time, location, and circumstances of the incident. The USFWS contact for this information shall be the Assistant Field Supervisor for Endangered Species, Sacramento Field Office. The CDFG contact shall be the Environmental Services Supervisor at the San Joaquin Valley-Southern Sierra Region Headquarters. USFWS or CDFG will be notified if any other animal, which is otherwise a listed species, is found dead or injured.		

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			f) **Construction of Supply/Recovery Canal** Within 60 days prior to the construction of the supply/recovery canal within the zone marked within the Map of the Kern Water Bank, KWBA shall conduct a limited survey within the area of the Kern Water Bank, which will be affected by that construction, with the sole goal of identifying potential San Joaquin kit fox dens. KWBA shall contact USFWS and CDFG pursuant to the salvage procedures set forth above if any kit fox dens are found. g) **Take Avoidance Protocol for Fully Protected Species** Existing data on the blunt nosed leopard lizard at the Kern Water Bank indicates that populations occur within habitat set asides (either sensitive, compatible, or conservation bank habitat), thus the likelihood of take from project construction, operation, and maintenance is negligible. However, in the future adaptive management measures may expand to areas of suitable habitat. Until such time that the KWBA obtains appropriate authorization for take of the state-designated fully protected blunt-nosed leopard lizard by the Fish and Game Commission, the following take avoidance protocol shall apply in any areas that contain suitable habitat of the blunt-nosed leopard lizard:		

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	1996 – 2003	Future		1996 – 2003	Future
			i. A qualified biologist shall survey any areas proposed for project related disturbance that contain suitable habitat for the blunt-nosed leopard lizard to determine the likelihood of presence. Suitable habitat consists of valley and foothill grasslands, saltbush scrubland, iodine bush grassland, and alkali flats. ii. If blunt nosed leopard lizards are found to occur in areas proposed for project facilities construction or maintenance, consideration of avoidance should take place first. If avoidance is not practicable, then the blunt nosed leopard lizard will be trapped and relocated prior to disturbance at KWBA's expense in accordance with the applicable annual management plan. This work must be done by or under the direction of USFWS staff by persons with appropriate experience and with their own take for scientific purposes permits. This procedure will avoid any violation of state law. Three other species, which may be found on the Kern Water Bank, are also state designated fully protected species: American peregrine falcon, Greater sandhill crane, and White-tailed kite. The likelihood of the take of any of these species from project construction, operation, and maintenance is negligible due to their mobility and preferred habitats. However, to avoid any take of these species, the same take avoidance protocol as set out for the blunt nosed leopard lizard shall apply to each of these three species.		

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	1996 – 2003	**Future**		**1996 – 2003**	**Future**
			The use of a biological monitor, and special construction activities and on-going practices will result in a heightened awareness and education regarding sensitive biological resources, which will reduce the potential for impacts on special-status species. In addition, the use of a project representative as a liaison between the KWBA and the resource agencies will expedite notification regarding any take of a listed animal. While take of a fully protected species is not anticipated, this mitigation outlines avoidance protocol to further reduce the likelihood of said take. Together these mitigation measures and the beneficial net increase of habitat for special-status species through implementation of the HCP/NCCP will reduce any potential impact to a less-than-significant level.		
7.4-4 Implementation of the proposed project could potentially affect special-status terrestrial biological resources at Castaic Lake. In the event of a future prolonged drawdown in water levels at Castaic Lake, the reduction in water levels could adversely affect terrestrial biological resources that use the lake to forage. However, this slight change in lake surface elevation would not adversely affect the quality of riparian habitat upstream or downstream from Castaic Lake or the productivity of the lake, which would not adversely affect foraging opportunity.	LS	LS	7.4-4 None required.	NA	NA

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		1996 – 2003	Future		1996 – 2003	Future
7.4-5	**The proposed project could impact special-status terrestrial biological resources at Lake Perris. In the event of a future prolonged drawdown in water levels at Lake Perris, although the worst case condition could occur, it would be unlikely because it is in the interests of the Department and the contractors that receive water from Lake Perris that it be kept full most of the time. A reduction in lake levels could reduce overall fish populations, which in turn could adversely affect terrestrial biological resources that use the lake to forage. As part of the Department's ongoing seismic repairs at Lake Perris, the Santa Ana Watershed Association (SAWA) is currently conducting quarterly bird surveys to document how that drawdown affects birds in the area. The results of these surveys may provide insight into the effects on the reduction of food resources as a result of future drawdowns. Regardless, a reduction in food resources could result in reduced nesting success for raptors, bats, and waterfowl.**	LS	PS	7.4-5 (Future) None feasible.	NA	PSU
7.4-6	**The proposed project could impact riparian habitat and the special-status terrestrial biological resources it supports at Lake Perris. In the event of a future prolonged drawdown in water levels at Lake Perris, the riparian vegetation on the east end of the reservoir could potentially be adversely impacted and die-offs of the vegetation may occur. If die-offs occur, the special-status species that are dependent on this vegetation would be adversely impacted.**	LS	PS	7.4-6 (Future) (a) Baseline Studies - A surface and groundwater hydrology study shall be conducted to determine what water source is maintaining the riparian habitat. In addition, a qualified biologist shall conduct a complete habitat assessment of the riparian habitat documenting the size of the habitat, and all wildlife and plant species that use this habitat, including any special-status species. Protocol-level surveys for species known or expected to occur in the riparian habitat (e.g. least Bell's vireo) shall be conducted. A certified arborist shall evaluate the health of the trees and prepare an arborist report.	NA	PSU

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	1996 – 2003	Future		1996 – 2003	Future
			Based on concerns for the riparian habitat associated with Lake Perris, the Department has installed an irrigation system to assist the vegetation during the recent drawdown for the seismic retrofit of the dam at lake Perris. (b) Annual Monitoring - Once a baseline is established, annual monitoring will be required to determine changes in hydrologic activities, changes in the health of the riparian habitat, and changes in the use of said habitat by special-status and other wildlife species. Should a prolonged drawdown (longer than one year) occur, an irrigation system shall be installed to water the riparian habitat (assuming it is successful in maintaining riparian vegetation during the seismic repairs). In addition, monthly monitoring shall occur to document any changes in the riparian habitat and allow for a timely adjustment of the watering schedule. Implementation of the above mitigation measures may reduce the impact on the riparian habitat and the associated special-status species to a less-then-significant level, if the changes in water do not impact the riparian habitat, or if any loss of water is supplemented through the sub-surface or surface irrigation. However, because of the complexity of the system, it is unknown at this time what the real impacts on the riparian habitat will be and therefore, the residual impact cannot be assessed.		

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		1996 – 2003	**Future**			**1996 – 2003**	**Future**
7.4-7	**The average increase in surface elevation and the occasional lowered water levels of San Luis Reservoir due to the proposed project would not adversely affect the riparian habitat, foraging quality for special-status birds, or limit San Joaquin kit fox migration. Therefore, the proposed project would not affect special-status terrestrial biological resources at the San Luis Reservoir**.	LS	LS	7.4-7	None required.	NA	NA
7.4-8	**The proposed project would minimally alter the water flow of the Feather, American, Sacramento and San Joaquin rivers and the change would not likely affect any terrestrial resources along the rivers.**	LS	LS	7.4-8	None required.	NA	NA
7.4-9	**The proposed project would not substantially change Delta outflow and would, therefore, not likely affect special-status terrestrial biological resources within the Sacramento/San Joaquin Delta.**	LS	LS	7.4-9	None required.	NA	NA
7.4-10	**The Settlement Agreement would allow Plumas County to improve conditions of its streams with watershed improvement projects. Therefore, the proposed project would have a beneficial effect on special-status terrestrial biological resources in Plumas County.**	NI	BE	7.4-10	None required.	NI	NA

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		1996 – 2003	Future			1996 – 2003	Future
7.5 Visual Resources							
7.5-1	**The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in visual character. Furthermore, any changes would be seen by a limited number of viewers and probably noticed by even fewer.**	LS	LS	7.5-1	None required.	NA	NA
7.5-2	**The Monterey Amendment facilitated the construction and operation of new groundwater storage facilities in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element). Around 520 acres of vacant land or cropland were replaced with percolation ponds. It is assumed that in the future, more percolation ponds would be developed. However, these ponds would not alter the appearance of the area in a way that would be perceived as adverse.**	LS	LS	7.5-2	None required.	NA	NA

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7.5-3	**The Monterey Amendment facilitated the construction and operation of new groundwater storage facilities in the Kern Fan Element. As a consequence of the proposed project, around 1,200 acres of land will be converted to percolation ponds. Although these changes would alter the appearance of lands within the Kern Fan Element, the alteration in appearance would be minimally visible.**	LS	LS	7.5-3 None required.	NA	NA
7.5-4	**The effects of borrowing of water on water surface elevations in the two reservoirs in the future would depend on the extent to which the three eligible contractors make use of Article 54 and future hydrologic conditions. Significant drawdowns at both Castaic Lake and Lake Perris could expose a wide band of barren soil and silt that is below normal operating lake levels. It is possible that future borrowing could drawdown the reservoirs more often than would occur without the project which could increase the exposed area around the perimeter of the two reservoirs, diminishing the natural lake appearance. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Castaic Lake and Lake Perris are economically and physically infeasible because of the scale of the area to be covered at either reservoir.**	LS	PS	7.5-4 (Future) None available.	NA	PSU
7.5-5	**At Lake Oroville and San Luis Reservoir, the changes in the amount of water stored were small and would not be expected to affect the visual character at San Luis Reservoir and Lake Oroville.**	LS	LS	7.5-5 None required.	NI	NA

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Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
7.5-6	**The Settlement Agreement allows Plumas County to improve conditions of its streams with watershed improvement projects. Therefore, the proposed project would have a beneficial effect on visual resources in Plumas County.**	NI	BE	7.5-6	None required.	NA	NA
7.6 Agricultural Resources							
7.6-1	**The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land and would not be converted to urban uses. No Prime, Unique or Farmland of Statewide Importance would be converted to non-agricultural uses nor would a conflict be created with respect to existing agricultural zoning or Williamson Act contracts as a result of the proposed project.**	LS	LS	7.6-1	None required.	NA	NA

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TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
7.7 Air Quality							
7.7-1	**The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in soil disturbance. Because associated PM_{10} emissions would not be expected to increase as a result of the proposed project, adopted thresholds would not be exceeded.**	LS	LS	7.7-1	None required.	NA	NA
7.7-2	**The Monterey Amendment facilitated the expansion of groundwater storage facilities outside contractor service areas. Any construction-related emissions would have been temporary and would continue to be temporary into the future. Additionally, the pumps that work at the groundwater banks are electric and are relatively pollution-free. The proposed project would not be expected to generate less than significant emissions including PM_{10}, NO_X, and diesel TAC emissions in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element).**	LS	LS	7.7-2	None required.	NA	NA

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	Impact	Level of Significance Prior to Mitigation			Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
7.7-3	**The proposed project from 1996-2003 did not result in a net increase in criteria air pollutants from construction of KWBA percolation ponds and canals or operation of the pumping facilities resulting from the transfer of Kern Fan Element. While construction activities in the future could temporarily be a source of air emissions, this would not result in a net increase in criteria air pollutants in a non-attainment area that could conflict with implementation of the adopted air quality plan for the region.**	LS	LS	7.7-3	None required.	NA	NA
7.7-4	**The proposed project water supply management practices (for the period of 1996-2003) that allow greater flexibility in reservoir storage at Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville would not have altered the amount of recreational boating at the reservoirs, which could impact ROG emission levels. In the future, depending on the use of the flexible storage program of the proposed project at Castaic Lake and Lake Perris, the amount of boating emissions at the reservoirs would either decrease or be similar so emissions would not be expected to exceed thresholds.**	LS	LS	7.7-4	None required.	NA	NA
7.7-5	**The proposed project water supply management practices allow greater flexibility in reservoir storage at Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville and this could alter the amount of recreational uses at the reservoirs, which could impact vehicle emissions associated with travel to and from the reservoirs. At Lake Oroville and San Luis Reservoir, these changes from 1996-2003 were minimal and are likely to stay that way into the future. At Castaic Lake and Lake Perris, water levels from 1996-2003 were similar to pre-Monterey levels. Therefore, there would be little or no increase in air emissions.**	LS	LS	7.7-5	None required.	NA	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

	Impact	**Level of Significance Prior to Mitigation**		**Mitigation Measure(s)**	**Level of Significance After Mitigation**	
		1996 – 2003	**Future**		**1996 – 2003**	**Future**
7.7-6	**The effects of borrowing of water on water surface elevations in the two reservoirs in the future would depend on the extent to which the three eligible contractors make use of Article 54 and future hydrologic conditions. Significant drawdowns at both Castaic Lake and Lake Perris could expose a wide band of barren soil and silt that is below normal operating lake levels. It is possible that future borrowing could drawdown the reservoirs more often than would occur without the project which could increase the exposed area around the perimeter of the two reservoirs, increasing the potential for wind-borne PM_{10} emissions. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Castaic Lake and Lake Perris are economically and physically infeasible because of the scale of the area to be covered at either reservoir.**	LS	PS	7.7-6 (Future) None available.	NA	PSU
7.7-7	**The proposed project did not and, in the future, would not alter the water surface elevation significantly as compared to baseline levels at San Luis Reservoir and Lake Oroville. As a result, the flexible storage and extended carryover practices, would not alter the amount of shoreline exposed to wind erosion.**	LS	LS	7.7-7 None required.	NA	NA

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		1996 – 2003	Future			1996 – 2003	Future
7.7-8	**The proposed project could impact air quality in Plumas County due to construction and operation of watershed improvements. The proposed project did not impact air quality in Plumas County due to construction and operation of watershed improvements because the Settlement Agreement was not executed in the 1996-2003 time period. In the future, air emissions due to construction would be temporary. Additionally, the projects would be expected to improve soil erosion conditions, such that the potential for wind-generated PM_{10} emissions from exposed soils would ultimately be reduced over the long-term.**	NI	LS	7.7-8	None required.	NA	NA
7.8 Geology, Soils, and Minerals Resources							
7.8-1	**The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in soil disturbance and associated wind-generated erosion.**	LS	LS	7.8-1	None required.	NA	NA

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Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
	Although changes in agricultural practices could potentially alter the rate of soil erosion within the KCWA's boundaries, the changes would not be considered significant. Furthermore, soils in Kern County can generally be characterized as being slightly erodible.						
7.8-2	**The proposed project would have had (from 1996-2003) and is expected in the future to have a less than significant impact on rates of erosion in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) as a result of construction of new groundwater storage facilities. Construction of the ponds and associated levees occurred on topography that is relatively flat and required only minor grading and compaction of soils. Although replacement of 520 acres of vacant land or cropland with percolation ponds changed rates of erosion, this impact is considered less than significant. In the future, approximately 500 acres of ponds would be constructed. Conversion of approximately 500 acres of land to percolation ponds would not substantially change rates of erosion.**	LS	LS	7.8-2	None required.	NA	NA
7.8-3	**The proposed project would have had (from 1996-2003) and is expected in the future to have a less than significant impact on rates of erosion in the Kern Fan Element due to changes in land use. Between 1996 and 2003, an additional 1,665 acres were converted to shallow percolation ponds. Construction of the ponds and associated levees would have had a less than significant impact. In the future, an additional conversion of approximately 1,200 acres of land to percolation ponds would not substantially change rates of erosion.**	LS	LS	7.8-3	None required.	NA	NA

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	Impact	Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	Future		1996 – 2003	Future
7.8-4	**The proposed project could impact rates of erosion at Castaic Lake and Lake Perris. The geology of Castaic Lake is characterized by steep slopes and clay soils. Lake Perris is characterized by sandy soils. Therefore, soils at Lake Perris could be subject to increased rates of wind and rain erosion associated with exposure from a potential extended drawdown attributed to Article 54. Mitigation measures such as hydroseeding or landscaping to prevent erosion are not economically or physically feasible to cover such a wide area to prevent runoff of soil into the lake.**	LS	PS	7.8-4 (Future) None available.	NA	PSU
7.8-5	**At Lake Oroville and San Luis Reservoir, the changes due to the Proposed project in the amount of water stored were small and would continue to not be significant when compared to baseline levels. Therefore, the proposed project would not leave more soil around the reservoirs exposed to erosion.**	LS	LS	7.8-5 None required.	NA	NA
7.8-6	**The proposed project did not impact the rates of soil erosion in Plumas County as a result of watershed improvement projects because the Settlement Agreement was not executed in the 1996-2003 time period. In the future, the proposed project would result in short-term construction impacts that would be regulated by State water quality regulations which minimize erosion and sedimentation from construction activities.**	NI	LS	7.8-6 None required.	NI	NA

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		1996 – 2003	**Future**			**1996 – 2003**	**Future**
					7.9 Recreation		
7.9-1	**From 1996-2003 the proposed project had a less than significant impact on recreational resources at Castaic Lake and Lake Perris because water levels were comparable to the baseline. However, potential future prolonged drawdown periods at Castaic Lake and Lake Perris would have a potentially significant and unavoidable impact on recreational resources due to decreased water levels. Impacts would include decreased boating availability, fishing opportunities, water skiing opportunities, swimming opportunities, availability of hunting, disabled access, etc.**	LS	PS	7.9-1	(Future)	NA	PSU
				a)	*The Department shall notify the public at the onset of the loss of recreational resources due to Article 54 drawdowns at Perris Lake and Castaic Reservoir. Notification shall be made until the withdrawal is repaid through local media outlets including, but not limited to, newspapers and radio, local parks and recreation departments, and on the CDPR's website. If the maximum amount in Article 54 is withdrawn from either reservoir, then the Department shall use television advertisements to inform the public of the severity and duration of the Article 54 drawdown.*		
				b)	*To the extent feasible, the Department shall install, extend, or upgrade existing facilities (including lifeguard towers and emergency assistance equipment) to allow safe access to lower lake levels during multi-year drawdowns.*		
				c)	*The Department shall monitor water quality during drawdown periods and when swimming is allowed using the current full-body contact criteria and laboratory methods adopted by the California Department of Health Services or the U.S. Environmental Protection Agency, as applicable.*		
				d)	*The Department shall prepare and provide funding for a management plan to control invasive plant species that could expand into recreational areas during extended drawdown periods.*		

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		1996 – 2003	Future			1996 – 2003	Future
7.9-2	**The proposed project would have had (from 1996-2003) and is expected in the future to have a less than significant impact on recreational resources at San Luis Reservoir and Lake Oroville. At Lake Oroville and San Luis Reservoir, the changes due to the proposed project in water levels were small and would continue to have a minimal affect on recreational opportunities at San Luis Reservoir and Lake Oroville in the future.**	LS	LS	7.9-2	None required.	NA	NA
				7.10 Land Use and Planning			
7.10-1	**The proposed project would have had (from 1996-2003) and is expected in the future to not alter overall land use in the southern San Joaquin Valley portion of Kern County. Implementation of the proposed project has altered the physical use of the land; however, overall land use and designations have not changed. Also, development of uses in the Kern Fan Element was consistent with the HCP. In the future, construction of percolation ponds and associated levees could alter land use patterns. However, the land use designations would not change and the percolation ponds would be compatible with the surrounding uses.**	LS	LS	7.10-1	None required.	NA	NA
				7.11 Hazards and Hazardous Materials			
7.11-1	**The proposed project related construction activities would have had (from 1996-2003) and are expected in the future to have less than significant impacts on the amount of exposure to unidentified hazards or hazardous material. Construction contracts have in the past included, and into the future would include specific language requiring contractors to comply with applicable State hazardous materials laws and regulations. Also, the potential for inadvertent spills of materials has been and would continue to be managed through construction site Best Management Practices.**	LS	LS	7.11-1	None required.	NA	NA

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		1996 – 2003	Future			1996 – 2003	Future
7.12 Noise							
7.12-1	**It is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have altered the traffic volumes and use of agricultural machinery in affected areas. A doubling of traffic volumes or pieces of machinery operating at any one time would be needed to create a 3 dBA increase in roadway noise levels. The number of vehicular trips to fields with permanent crops would have likely been the same or slightly less than the number of trips to fields with annual crops and would have been unlikely to affect traffic volumes on affected rural roads. Likewise, the use of agricultural machinery would also have been the same or less.**	LS	LS	7.12-1	None required.	NA	NA
7.12-2	**The proposed project would have had (from 1996-2003) and is expected in the future to have a less than significant impact on noise levels in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) as a result of construction and operation of new groundwater storage facilities. Any equipment associated with new groundwater storage facilities would not be expected to affect sensitive receptors.**	LS	LS	7.12-2	None required.	NA	NA

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		1996 – 2003	Future			1996 – 2003	Future
7.12-3	**From 1996 – 2003 and in the future, the installation and operation of pumps associated with the construction of percolation ponds in the Kern Fan Element attributable to the proposed project would result in an increase in noise emissions from pumps. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Ongoing maintenance of the new facilities is intermittent and not considered a substantial source of increased noise levels at sensitive land uses.**	LS	LS	7.12-3	None required.	NA	NA
7.12-4	**From 1996-2003, water levels at Castaic Lake, Lake Perris, Lake Oroville, and San Luis Reservoir were similar to pre-Monterey conditions therefore, recreational boating opportunities would have been similar. In the future, Lake Oroville and San Luis Reservoir boating numbers would remain unchanged by the proposed project. However, at Lake Perris and Castaic Lake, the potential reduction in water levels due to flexible storage could reduce recreational boaters and associated noise levels.**	LS	LS	7.12-4	None required.	NA	NA
7.12-5	**From 1996-2003 water levels at Castaic Lake, Lake Perris, Lake Oroville, and San Luis Reservoir were similar to those found in the baseline. Therefore, recreational opportunities and associated noise levels would have been similar pre-Monterey conditions. In the future, it is unlikely that the number of vehicles would be substantially different than baseline conditions. Therefore, the proposed project would not significantly increase noise levels at the reservoirs due to altered numbers of recreational visits.**	LS	LS	7.12-5	None required.	NA	NA

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Impact	Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
	1996 – 2003	Future		1996 – 2003	Future
7.12-6 Because the Settlement Agreement was not completed within the 1996-2003 time period, there was no impact on noise levels in Plumas County. In the future, the watershed projects could result in temporary increases in construction noise levels at the site of the improvements. The improvements would generally occur in locations where little or no development is present. No operational increase in noise levels would be anticipated. The potential noise impact from construction activities would be short-term.	NI	LS	7.12-6 None required.	NI	NA

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Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
		1996 – 2003	Future		1996 – 2003	Future
				7.13 Cultural and Paleontological Resources		
7.13-1	**Agricultural activity existed prior to implementation of the proposed project. The land had been disturbed for a variety of agricultural uses, therefore any resources present on the site would most likely have already been disturbed or destroyed. While the conversion from annual to permanent crops would likely reduce the amount of land disturbance associated with crop maintenance, the potential to disturb or destroy cultural and paleontological resources would remain unchanged or be reduced. The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing annual crops with permanent crops is expected to continue. Ground disturbance associated with agricultural activity could expose artifacts resulting in damage and/or destruction of potentially significant cultural and paleontological resources. Prior to implementation of the proposed project the land was disturbed for a variety of agricultural uses depending on the availability of water, among other factors. Any resources present on the site would most likely have been disturbed or destroyed when agricultural practices began in the area.**	LS	LS	7.13-1 None required.	NA	NA

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	1996 – 2003	**Future**		**1996 – 2003**	**Future**
7.13-2 The proposed project related development or expansion of groundwater banks could impact cultural and paleontological resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element). In the future, the water supply management practices would encourage the development of groundwater banks in Kern County other than in the Kern Fan Element. Construction of percolation ponds and facilities related to groundwater banks could have significant adverse impacts on cultural and paleontological resources.	LS	PS	7.13-2 (Future) a) *An analysis to identify the potential presence of archaeological resources on the project site shall be conducted. The analysis shall include, at a minimum, a records check and literature survey from the appropriate California Historic Resources Information System (CHRIS) center and a Phase I Cultural Resources Investigation by an archaeologist listed on the Register of Professional Archaeologists (RPA). If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection, or the recovery, preservation, study, and curation of the resource, as appropriate. The analysis and the measures developed shall be consistent with the practices and intent described in Section 21083.2 et seq. of the Public Resources Code, as well as Sections 15064.5 et seq. and 15126.4(b) of the California Code of Regulations, and shall be consistent with current professional archaeological standards.* *The archaeologist shall prepare a report of the results of any study prepared, following accepted professional practice. Copies of the report shall be submitted to the Lead Agency and to the appropriate CHRIS information center.* *The Lead Agency shall also consult, as appropriate, with the Native American Heritage Commission and appropriate Native American tribal representatives to address Native American cultural values with respect to archaeological contexts.*	NA	PSU

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Impact	Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
	1996 – 2003	Future		1996 – 2003	Future
			Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost. b) *An analysis to identify the potential presence of paleontological resources on the project site shall be conducted. If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection or recovery, preservation, study, and curation of the resource, as appropriate. The analysis and measures developed shall be consistent with the practices and intent described in the Conformable Impact Mitigation Guidelines developed by the Society of Vertebrate Paleontology (News Bulletin No. 163, 1995) and shall be consistent with current professional paleontological standards.* Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost.		

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	1996 – 2003	**Future**		**1996 – 2003**	**Future**
			c) In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately, the area of the find shall be protected, and the Lead Agency immediately shall notify the County Coroner of the find and comply with the provisions of PRC Section 5097 with respect to Native American involvement, burial treatment, and re-burial, if necessary. Implementation of Mitigation Measure 7.13-2(c) would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.		
7.13-3 From 1996-2003, mitigation measures were adopted to ensure that if previously unidentified archaeological resources were discovered during construction activities, that work would cease and a qualified archaeologist would examine the discovery and make recommendations for appropriate data recovery. Therefore, the proposed project related transfer of land in the Kern Fan Element to the Kern County WA is considered to have had a less than significant impact on cultural and paleontological resources. In the future, the water supply management practices would encourage the development of groundwater banks in the Kern Fan Element. Construction of percolation ponds and other facilities as part of the groundwater banks could result in damage and/or destruction of cultural and paleontological resources.	LS	PS	7.13-3 (Future) a) *Prior to any ground-disturbing work on the KWB, anthropologists or other qualified individuals shall engage in pedestrian surveys of the areas to be impacted, with the survey reconnaissance to be at 5- to 15-meter transects.* b) *Any cultural resources found during the survey process will be recorded, mapped evaluated, and mitigated prior to the ground-disturbing activity, pursuant to Section 106 of the National Historic Preservation Act.* c) *The eight recorded archeological sites on the KWB will be evaluated and mitigated pursuant to Section 106*. d) *If any human remains are found at any time on the KWB, work will be halted in the area of the discovery, and the Kern County coroner will be notified.* e) *Implement Mitigation Measures 7.13-2(a) through (c).*	NA	LS

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	1996 – 2003	**Future**		**1996 – 2003**	**Future**
7.13-4 Water in Castaic Lake and Lake Perris were at historically comparable levels between 1996 and 2003. Therefore, between 1996 and 2003, the proposed project water supply management practices that provide greater flexibility in the location, frequency, and amount of water stored or borrowed at Castaic Lake and Lake Perris would not significantly increase the risk of potential for exposing any cultural and/or paleontological resources to damage and/or destruction . In the future, if a prolonged drawdown occurs due to the proposed project, there is potential for known and unknown cultural or paleontological resources to be exposed and risk damage or destruction.	LS	PS	7.13-4 (Future) Implement Mitigation Measures 7.13-2(a) through (c).	NA	LS
7.13-5 Although between 1995 and 2003 there were instances when reductions in water levels occurred in the San Luis Reservoir and Lake Oroville, cultural resources would not have been affected. Therefore, the proposed project water supply management practices that provide greater flexibility in the location, frequency, and amount of water stored or borrowed at Lake Oroville and San Luis Reservoir would not significantly increase the risk of exposing any cultural and/or paleontological resources around Lake Oroville and the San Luis Reservoir. In the future, various provisions of the proposed project could affect water levels in San Luis Reservoir (changes at Lake Oroville would be minimal). Most of the time the proposed project would raise water levels in San Luis Reservoir by 10 to 20 feet under 2003 conditions. Occasionally, the Article 56 provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir for a short time. Therefore, the potential for	LS	LS	7.13-5 None required.	NA	NA

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		1996 – 2003	Future		1996 – 2003	Future
	exposing any cultural and/or paleontological resources around Lake Oroville and San Luis Reservoir to damage and/or destruction would be limited.					
7.13-6	**Because the Settlement Agreement was not completed within the 1996-2003 period, the proposed project had no significant impact to cultural and paleontological resources in Plumas County. Although the number and size of the future watershed improvement projects that would result form the proposed project are expected to be relatively small, implementation of proposed watershed improvement projects would nevertheless result in potential to damage or destroy cultural and paleontological resources.**	NI	PS	7.13-6 (Future) Implement Mitigation Measures 7.13-2(a) through (c).	NI	PSU
7.14 Public Services and Utilities						
7.14-1	**None of the proposed project elements would have directly resulted in changes in population that would have generated a need for new or expanded governmental facilities or an increase in demand for public services and utilities. Therefore the proposed project would not have had and would not be expected to have an impact on public services and utilities.**	NI	NI	7.14-1 None required.	NI	NI
7.15 Traffic and Transportation						
7.15-1	**The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be**	LS	LS	7.15-1 None required.	NA	NA

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TABLE ES-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	Future			1996 – 2003	Future
	attributable to the proposed project that can be discerned for the historical analysis period. **It is possible that additional land could be converted to permanent crops as a result of the proposed project, and that changes in agricultural practices could alter the traffic volumes in affected areas. The number of vehicular trips to fields with permanent crops would likely be the same or slightly less than the number of trips to fields with annual crops and would be unlikely to affect traffic volumes on affected rural roads.**						
7.15-2	**The proposed project has had in the past (1996-2003) and is likely to continue, into the future, to have a less than significant impact on traffic and transportation in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element). While construction and operation of new groundwater banks may have increased traffic temporarily, the vehicular movements associated with maintenance of new facilities are likely to be the same or less than those associated with the pre-1995 use of land for agriculture.**	LS	LS	7.15-2	None required.	NA	NA
7.15-3	**The proposed project has had in the past (1996-2003) and is likely to continue, into the future, to have a less than significant impact on traffic and transportation in the Kern Fan Element. Although construction and operation of percolation ponds would increase vehicular movements, the increase on these rural roads would be minimal.**	LS	LS	7.15-3	None required.	NA	NA

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Impact	Level of Significance Prior to Mitigation		Mitigation Measure(s)	Level of Significance After Mitigation	
	1996 – 2003	Future		1996 – 2003	Future
7.15-4 Recreational activities would not have changed as a result of project implementation at San Luis Reservoir. Recreational activities could have been enhanced in Castaic Lake and Lake Perris as a result of increased water levels during the boating season. However, the range of water surface fluctuations would have been within the range of operating conditions prior to project implementation. **Higher water surface elevations could have created more opportunities for recreational activities and this could have increased the number of vehicle trips to and from the reservoirs on a seasonal basis. However, in relation to existing traffic loads and roadway capacity, it is unlikely that level of service standards would have been exceeded on a permanent basis.** **In general, future operation of Castaic Lake and Lake Perris would result in similar fluctuations as those recorded for the period between 1996 and 2003 and are expected to be within the range of more recent (post-Monterey) historical fluctuations. Recreational visits, and associated increases in vehicle trips, would likely be the same as baseline conditions or if the worst-condition were to occur, could decrease due to drawdown conditions at Castaic Lake and Lake Perris in the future.**	LS	LS	7.15-4 None required.	NA	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation		Mitigation Measure(s)		Level of Significance After Mitigation	
		1996 – 2003	**Future**			**1996 – 2003**	**Future**
7.15-5	**The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of stream bank in a county with thousands of miles of stream channels. These activities could result in temporary increases in construction vehicles at the site of the improvements, which would cause a temporary increase in local traffic. No operational increase in traffic would be expected.**	NI	LS	7.15-5	None required.	NI	NA
7.16 Energy							
7.16-1	**In the future, some power plants would generate less energy (Gianelli, Alamo, Mojave, and Devil Canyon), some would produce the same amount of energy (Oroville and Thermalito), and some would produce more energy (Warne and Castaic). An overall increase of 86 GWh in energy loads at the pumping plants is also observed. Four pumping plants show a decrease in energy loads: Banks, Dos Amigos, Las Perillas, and Badger Hill.** **SWP pumping facilities are designed to meet the anticipated demands of the SWP Contractors, and this rated capacity would not be exceeded by implementation of the proposed project. With a total long-term net load increase of 2.02 percent due to the proposed project, the amount of additional power required would be within the limits of the planned power supply, and no expansion or construction of new facilities to generate power would be required. No new long-term or short-term contracts would be necessary under the 2020 Post-Monterey conditions.**	LS	LS	7.16-1	None required.	NA	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
CUMULATIVE IMPACTS OF THE MONTEREY PLUS EIR			
Surface Water Hydrology, Water Quality, and Water Supply			
The cumulative context for surface water hydrology, water quality and water supply includes the Feather and Sacramento Rivers and the Sacramento-San Joaquin Delta.			
10.1-1 Future projects and actions (including the proposed project) that substantially alter flow in the Sacramento and Feather rivers and Delta inflow and outflow could produce changes in water quality. Flow related changes on water quality together with storm water and treated wastewater discharges from new urban development in the Sacramento and Feather river watersheds and the Delta could have a potentially significant cumulative impact on water quality; however, the project's contribution would not be considerable (0.15 percent and 0.35 percent, respectively).	LS	10.1-1 None required.	NA
Groundwater Hydrology and Water Quality			
The cumulative context for ground water hydrology and water quality is the groundwater basins underlying the San Joaquin Valley. The proposed project would not have a cumulative impact on groundwater levels and quality in the San Joaquin Valley. The proposed project would raise water levels in some groundwater subbasins in Kern County. The proposed project would have a negligible effect on groundwater quality but would not contribute to cumulative effects on water quality. Groundwater basin storage projects would raise groundwater levels most of the time with a reduction in levels during extended droughts.			
Fisheries Resources			
The cumulative context for fisheries resources includes the Feather and Sacramento Rivers and the Sacramento-San Joaquin Delta. There was no project-specific impact identified to fisheries in the American and San Joaquin Rivers, and therefore, there would be no cumulative impact.			

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-2 The proposed project will increase pumping in the Sacramento-San Joaquin Delta and could have a significant cumulative impact on the decline of special-status fish species. The increase in cumulative pumping could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult smelt and salmonid smolts. Increased entrainment of a special-status species that results from cumulative projects could reduce species' abundance. Delay of up or downstream migration could interfere with the movement of resident and migratory species. This could result in a significant cumulative impact. The proposed project's contribution to potential increased entrainment losses of adult smelt and salmonid smolts would be considerable and this would result in a significant cumulative impact.	PS	10.1-2 Implement Mitigation Measure 7.3-5. Mitigation Measure 7.3-5 requires the Department to implement operational assets that could be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon that would limit any adverse impact resulting from the proposed project on special status Delta fish species as a result of higher pumping at Banks during certain periods when San Luis Reservoir would otherwise be full.	LS
Terrestrial Biological Resources			
The cumulative context for terrestrial resources includes the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Feather River, Sacramento River, San Joaquin River, Sacramento-San Joaquin Delta and Plumas County. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur at Castaic Lake. **Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Therefore, the pond and plug and stream bank stabilization and channel form projects, in combination with the Plumas County Watershed Forum watershed improvement projects would result in a beneficial effect for special-status species and therefore, no cumulative impact would occur.**			

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-3	**Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The existing trend of replacing irrigated annual crops with permanent crops is expected to continue in the future. While it is possible that additional land could be converted to permanent crops as a result of the increased availability and reliability of water, no clear trend can be discerned. To the extent that some land would be converted to permanent crops, this would not prohibit San Joaquin kit fox migration, but could adversely impact Swainson's hawk, as this habitat is not suitable for foraging.** **Even though the creation of new recharge ponds would periodically create open water and wetland habitat for waterfowl, the conversion of land for use as groundwater banking facilities could result in the loss of special-status species habitat.** **The KWBA manages lands within the Kern Fan Element property in accordance with an approved HCP/NCCP. Because the Kern Fan Element property is under a HCP/NCCP, the KWBA is required to follow specific guidelines to prevent take of special-status species and to enhance and preserve the natural habitat currently present. While no incidental take has occurred since the KWBA's development of the Kern Water Bank (with exception of San Joaquin woolly threads), it is possible that cumulative development could result in take during construction, operation and maintenance, through collapsed burrows, road kills, crushed by grading equipment, harassment, habitat loss, drowning, etc.**	PS	Implementation of Mitigation Measure 7.4-3 is currently implemented by the KWBA as required by the Kern Water Bank HCP/NCCP cumulative impacts to special-status species at the Kern Water Bank would be reduced to a less than significant level. Implementation of Mitigation Measure 7.4-2 would reduce the project's contribution to this cumulative impact but not to a less-than-significant level. Impacts to terrestrial biological resources in the southern San Joaquin Valley portion of Kern and King's Counties would be reduced through the following mitigation measures; however because the Department has no jurisdiction over local agency decisions and cannot enforce implementation of Mitigation Measure 7.4-2, and the impacts of individual activities are unknown at this time cumulative impacts to terrestrial biological resources would remain a potentially significant and unavoidable cumulative impact. 10.1-3 Implement Mitigation Measures 7.4-2 and 7.4-3. Mitigation Measure 7.4-2 would prevent any adverse impact to special-status species through avoidance of the species and their habitat. If avoidance is not possible, then consultation with the resource agencies would be required to determine appropriate mitigation. However, even though impacts to terrestrial biological resources in the San Joaquin Valley would be reduced, because the impacts of individual activities are unknown at this time, the cumulative impact would remain significant and unavoidable. Mitigation Measure 7.4-3 would require the use of a biological monitor, special construction activities and on-going practices that would result in a heightened awareness and education regarding sensitive biological resources. In addition, the use of a project representative as a liaison between the project and the resource agencies would expedite notification regarding any take of a listed species. This mitigation measure also outlines avoidance protocol to further reduce the likelihood of take.	PSU

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Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
Therefore, the proposed project, in combination with other cumulative water development and water reallocation projects, could result in significant impacts to biological resources in the southern San Joaquin Valley due to the construction of additional groundwater storage facilities and the project's contribution to this impact could be considerable.			
10.1-4 Changes in SWP reservoir levels could be impacted by cumulative projects, but such changes would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Changes in the Sacramento-San Joaquin Delta are so small that they would not substantially affect any special status terrestrial species or their habitat.	LS	10.1-4 None required.	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

	Impact	Level of Significance Prior to Mitigation 1996 – 2020		Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-5	**Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the drawdown of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. As part of the Department's ongoing seismic repairs at Lake Perris, the Santa Ana Watershed Association is currently conducting quarterly bird surveys to document how that drawdown affects birds in the area. The results of these surveys may provide insight into the effects on the reduction of food resources as a result of future drawdowns. The reduction in fish populations and that is attributed to maintaining a lower pool volume would be significant but short-term. Regardless, a reduction in food resources could result in reduced nesting success for raptors, bats, and waterfowl, which would result in a short-term potentially significant and unavoidable cumulative impact.**	PSU	10.1-5	None available.	PSU

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-6	**The seismic retrofit project in combination with borrowing water under Article 54 as allowed under the proposed project, could result in a drawdown of the reservoir that could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Drastic changes in surface elevation during the growing season or a prolonged drawdown could have substantial impacts on riparian vegetation, which supports a variety of wildlife species, providing food, shelter, and nesting habitat.** **As part of the Department's ongoing seismic repairs at Lake Perris, a number of mitigation measures have been initiated to reduce impacts to riparian vegetation. An irrigation system that draws water from Lake Perris and feeds the entire stretch of riparian vegetation has been installed. As of May 2007, the riparian vegetation is irrigated twice per week. The success of this system is being monitored monthly by the California Department of Parks and Recreation and may provide insight into the effects of drawdown on the riparian habitat.** **Regardless, the project's contribution to a decline in the riparian vegetation would be considerable because this habitat is considered sensitive by DFG, and it supports special-status species.**	PS	Implementation of Mitigation Measure 7.4-6 could reduce the project's contribution to the loss of riparian habitat and the associated special-status species to a less-then-significant level, if the changes in water do not impact the riparian habitat, or if any loss of water is supplemented through the sub-surface or surface irrigation. However, because of the complexity of the system, it is unknown at this time what the real impacts on the riparian habitat would be and therefore, the residual impact cannot be assessed. 10.1-6 Implement Mitigation Measure 7.4-6. Mitigation Measure 7.4-6(a) requires the development of baseline studies to determine what water source is maintaining the riparian habitat. In addition, a qualified biologist would conduct a complete habitat assessment of the riparian habitat documenting the size of the habitat, and all wildlife and plant species that use this habitat, including any special-status species. Mitigation Measure 7.4-6(b) requires that once a baseline is established, annual monitoring would be required to determine changes in hydrologic activities, changes in the health of the riparian habitat, and changes in the use of said habitat by special-status and other wildlife species. Mitigation Measure 7.4-6(c) requires that an irrigation system be installed to water the riparian habitat or the existing irrigation system shall be maintained and operated (assuming it is successful in maintaining riparian vegetation during the seismic repairs). In addition, monthly monitoring should be conducted to document any changes in the riparian habitat and allow for a timely adjustment of the watering schedule.	PSU

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
Visual Resources			
The cumulative context for visual resources includes view sheds in the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Therefore, the pond and plug and stream bank stabilization and channel form projects, in combination with the Plumas County Watershed Forum watershed improvement projects would result in a beneficial effect on visual resources and therefore, no cumulative impact would occur.			
10.1-7 The proposed project would have a less than significant cumulative impact on visual resources in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville and Plumas County. Changes in cropping patterns and the conversion of land to groundwater banking facilities would not represent a substantial change in the existing visual character. Because changes in the amount of water stored at San Luis Reservoir and Lake Oroville is not anticipated to have a significant effect on water surface elevations compared to normal operating levels, changes in the visual character at these two facilities would not be significant.	LS	10.1-7 None required.	NA

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact		Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-8	**Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the visual effects of drawdown would be temporary, the project's contribution to this cumulative impact would be considerable.**	PS	10.1-8 None available.	PSU

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Impact		Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
Agricultural Resources				
The cumulative context for agricultural resources is lands in agricultural production in the southern San Joaquin Valley.				
10.1-9	**Implementation of the proposed project, combined with other cumulative water development and reallocation projects, could result in a reduction of average annual deliveries of SWP water to agricultural contractors. However, there would be little or no impact on the acreage of irrigated land in the southern San Joaquin Valley. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land and would not be converted to urban uses. Under the proposed project, no Prime, Unique or Farmland of Statewide Importance would be converted to non-agricultural uses nor would a conflict be created with respect to existing agricultural zoning or Williamson Act contracts. Therefore, the project's contribution to cumulative conversion of special-status agricultural lands would not be considerable.**	LS	10.1-9 None required.	NA
Air Quality				
The cumulative context for air quality would be the SVAB (southern San Joaquin Valley and San Luis Reservoir), SCAB (Lake Perris and Castaic Lake) and NSVAB (Pumas County). Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.				

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Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-10 The proposed project would have a less than significant cumulative impact on emissions of PM_{10}, NO_x and ROG in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, and Plumas County. The proposed project would have little or no impact on the acreage of irrigated land in southern San Joaquin Valley. In addition, the amount of shoreline exposed to wind erosion, boat emissions, and vehicle emissions associated with recreational trips to and from San Luis Reservoir and Lake Oroville would not be expected to significantly change. Therefore, the emissions attributed to the proposed project would not be expected to result in a net increase in criteria pollutants over SJVAPCD, BCAPCD and Northern Sierra Air Quality Management District thresholds. The project's contribution would not be considerable.	LS	10.1-10 None required.	NA
10.1-11 Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the increased rate of soil erosion attributed to the drawdown would be temporary, the project's contribution to this cumulative impact would be considerable.	PS	10.1-11 None available.	PSU

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
Geology, Soils and Mineral Resources			
The cumulative context for soil erosion would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.			
10.1-12 The proposed project would have a less than significant cumulative impact on rates of soil erosion in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, and Plumas County. The disturbance of land resulting from changing agricultural practices and the conversion of land for use as groundwater banking facilities could result in land disturbance which could increase the rate of wind-generated soil erosion in the southern San Joaquin Valley. The proposed project, in combination with cumulative water development and reallocation projects would contribute to this effect. However, soils in the southern San Joaquin Valley are characterized as having slight to very slight potential to experience wind-generated erosion. In addition, the amount of soil along the shorelines of San Luis Reservoir and Lake Oroville would not be expected to significantly change over existing conditions.	LS	10.1-12 None required.	NA

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Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-13 Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce exposure of soil erosion impacts at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the increased rate of soil erosion attributed to the drawdown would be temporary, the project's contribution to this cumulative impact would be considerable.	PS	10.1-13 None available.	PSU
Recreation			
The cumulative context for recreation resources would be Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.			
10.1-14 The proposed project would have a less than significant cumulative impact on recreational resources at San Luis Reservoir and Lake Oroville. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to cumulative projects (including Monterey Plus) would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels.	LS	10.1-14 None required.	NA

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Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-15 Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. **A multi-agency MOU signed by the Departments of Water Resources, Parks and Recreation, Boating and Waterways, and Fish and Game along with MWDSC, establish the "Lake Perris Operations Guidelines" which provide for recreational resource protection, benefits to fishery resources and protection of water quality at Lake Perris. Never the less, because the proposed project, in combination with the Seismic Retrofit Project, could result in a worst-case scenario where the reduction in elevation and the associated decrease in the availability of recreational facilities could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project, and the project's contribution would be considerable.**	PS	Implementing the following mitigation measures would ensure that the project's contribution to impacts to recreation resulting from Article 54 extended drawdowns would be reduced. However, because these mitigation measures would not guarantee the restoration of recreation opportunities, this would remain a short-term potentially significant and unavoidable cumulative impact. 10.1-15 Implement Mitigation Measure 7.9-1(a) through (d). Mitigation Measure 7.9-1 requires the Department to notify the public at the onset of the loss of recreational resources due to Article 54 drawdowns at Lake Perris until the withdrawal is repaid. In addition, to the extent feasible, the Department would install, extend, or upgrade existing facilities (including lifeguard towers and emergency assistance equipment) to allow safe access to lower lake levels during multi-year drawdowns. The Department would also be required to monitor water quality during drawdown periods and when swimming is allowed using the current full-body contact criteria and laboratory methods adopted by the California Department of Health Services or the U.S. Environmental Protection Agency, as applicable. Finally, Mitigation Measure 7.9-1 would require the Department to prepare and provide funding for a management plan to control invasive plant species that could expand into recreational areas during extended drawdown periods.	PSU

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Land Use and Planning			
The cumulative context for land use and planning is the southern San Joaquin Valley.			
10.1-16 The proposed project would have a less than significant cumulative impact on land use designations in the southern San Joaquin Valley. The proposed project would have little or no impact on the acreage of irrigated land in southern San Joaquin Valley. With the proposed project, approximately 500 acres of ponds would be developed as part of other groundwater storage facilities in Kern County and approximately 1,200 acres of ponds in the Kern Water Bank. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. While construction of these facilities could alter land use patterns, land use designations would not change and these uses would be compatible with existing land uses.	LS	10.1-16 None required.	NA
Hazards and Hazardous Materials			
The cumulative context for hazards and hazardous materials would be the southern San Joaquin Valley and Plumas County.			
10.1-17 The proposed project in combination with cumulative water development and reallocation projects would have a less than significant cumulative impact on workers or public exposure to previously unidentified hazards or hazardous materials in southern San Joaquin Valley. This cumulative risk of exposure would be temporary and regulated by federal and State laws that govern the storage, application and disposal of these chemicals to minimize risk of exposure.	LS	10.1-17 None required.	NA
Noise			
The cumulative context for increases in noise levels would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.			

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TABLE S-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-18 The proposed project in combination with cumulative water development and reallocation projects would have a less than significant cumulative impact on noise levels in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, and Plumas County. The proposed project would have little impact on the acreage of irrigated land in southern San Joaquin Valley thus the project would not impact noise levels. Cumulative vehicle noise levels associated with boat use and recreational trips to and from San Luis Reservoir and Lake Oroville would not be expected to significantly change over baseline conditions. **The number and size of watershed improvement projects to be constructed in Plumas County would be relatively small and the construction activities temporary. In addition, the improvements are likely to occur in locations where little or no sensitive receptors are present. While cumulative noise levels attributed to the construction and/or operation of cumulative water development and reallocation projects could increase, the proposed project's contribution to cumulative noise levels would not be considerable.**	LS	10.1-18 None required.	NA
Cultural and Paleontological Resources			
The cumulative context for cultural and paleontological resources would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County. Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.			

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PSU = Potentially Significant and Unavoidable
PS = Potentially Significant
BE = Beneficial Effect
NI = No Impact
NA = Not Applicable

TABLE S-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-19 Increased construction of banking facilities could increase the risk of damage or destruction of known or previously unidentified cultural resources. Therefore, this is considered a potentially significant cumulative impact. The project's contribution would be considerable because it would include construction of groundwater banking facilities in Kern County, including on the Kern Fan Element property which could contribute to the exposure of cultural resources to damage or destruction.	PS	Implementation of the following mitigation measure would substantially limit the project's contribution and this cumulative impact but it would remain significant and unavoidable because the Department can not guarantee the implementation or monitoring of Mitigation Measure 7.13-2. Therefore, the potential to damage or destroy cultural resources in southern San Joaquin Valley would remain a potentially significant and unavoidable cumulative impact. 10.1-19 Implement Mitigation Measures 7.13-2(a) though (c) and 7.13-3(a) through (d). Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost. Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost. Implementation of Mitigation Measure 7.13-2© would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.	PSU

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TABLE S-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
		Mitigation Measures 7.13-3 (a) through (d) were outlined in the Initial Study and Addendum to the Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP. Under the Settlement Agreement, the parties recognize that the Addendum has been completed and agree not to challenge the mitigation measures (Settlement Agreement, III.F). The measures require that prior to any ground disturbing work on the Kern Water Bank that qualified professionals conduct a pedestrian survey and that any cultural resources identified during a survey be recorded, evaluated and mitigated pursuant to Section 106 of the National Historic Preservation Act. The measures also include a requirement to evaluate, consistent with Section 106 the eight recorded archeological sites on the Kern Water Bank and that if any human remains are found that work would be halted and the Kern County Coroner notified.	

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SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
10.1-20 The potential for damage or destruction of cultural resources attributed to changes in reservoir levels in San Luis Reservoir and Lake Oroville would be cumulatively less than significant because water surface elevations are not anticipated to significantly change and the chance of uncovering resources currently below the normal operating water surface elevations is minimal. **Drawdown of Lake Perris and the construction of watershed projects in Plumas County could increase the risk of damage or destruction of known or previously unidentified cultural resources. Therefore, this is considered a potentially significant cumulative impact. The project's contribution would be considerable because it could include extended drawdown of Lake Perris under Article 54 and construction of watershed improvement projects in Plumas County, all of which could contribute to the exposure of cultural resources to damage or destruction.**	PS	10.1-20 Implement Mitigation Measures 7.13-2(a) through (c) and 7.13-3(a) through (d). Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost. Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost. Implementation of Mitigation Measure 7.13-2(c) would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.	LS

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TABLE S-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
		Mitigation Measures 7.13-3(a) through (d) were outlined in the Initial Study and Addendum to the Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP. Under the Settlement Agreement, the parties recognize that the Addendum has been completed and agree not to challenge the mitigation measures (Settlement Agreement, III.F). The measures require that prior to any ground disturbing work on the Kern Water Bank that qualified professionals conduct a pedestrian survey and that any cultural resources identified during a survey be recorded, evaluated and mitigated pursuant to Section 106 of the National Historic Preservation Act. The measures also include a requirement to evaluate, consistent with Section 106 the eight recorded archeological sites on the Kern Water Bank and that if any human remains are found that work would be halted and the Kern County Coroner notified.	
Public Services and Utilities			
None of the project elements would directly result in changes in population that would generate a need for new or expanded government facilities or an increase in demand for public services and utilities. Because there would be no impact, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.			
Traffic and Transportation			
The cumulative context for increases in noise levels would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.			
10.1-21 The proposed project in combination with cumulative water development and reallocation projects could have a less than significant cumulative impact on vehicle trips resulting in level of service violations in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, and Plumas County. The numbers of vehicle trips to agricultural fields due to the proposed project will remain unchanged. In addition, changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to cumulative projects (including Monterey Plus) would not be anticipated to have a significant effect on water surface elevations; therefore, vehicle trips on local and regional roads would not be expected to significantly change.	LS	10.1-21 None required.	NA

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TABLE S-1

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Prior to Mitigation 1996 – 2020	Mitigation Measure(s)	Level of Significance After Mitigation 1996 – 2020
Cumulative Impacts: Energy			
The cumulative context for energy would be SWP hydroelectric facilities (including, but not limited to Thermalito Diversion Dam, Hyatt-thermalito, Gianelli, Alamo, Warne, Mojave Siphon, and Devil Den) and other energy providers in California, the Northwest and the Southwest which the Department has agreements to sell, buy or exchange energy.			
10.1-22 The proposed project in combination with cumulative water development and reallocation projects would have a less than significant cumulative impact on energy demand. SWP pumping facilities are designed to meet the anticipated demands of the SWP Contractors, and this rated capacity would not be exceeded by implementation of the proposed project. The amount of additional power required would be within the limits of the planned power supply, and no expansion or construction of new facilities to generate power would be required. No new long-term or short-term contracts would be necessary under future conditions. Additionally, with a total long-term net load increase of 1.6 percent, the project's contribution to increased energy demand would not be considerable.	NA	10.1-22 None required.	NA

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GLOSSARY AND ABBREVIATIONS

GLOSSARY

Acre-Foot	Volume of water (43,560 cubic feet, or 325,900 gallons) that would cover one acre to a depth of one foot.
Alluvial Fan	An area of gravelly stream/river deposits spread out in fanlike deposits over a large area during a long period of time. These areas are generally found in the southern and eastern portions of the Central Valley and emanate from valley canyons.
Article 18	An article of the SWP long-term water supply contracts between the Department and each individual contractor; which addressed water supply shortages. The subdivisions of the original article addressed short-term water shortages and related water delivery priorities, permanent shortages and related reductions in Table A amounts, permanent shortages related to areas-of-origin water rights settlement contracts, reinstatements of Table A amounts, advance notice of delivery reductions, and no liability for shortages.
Article 21 Water	An article of the SWP long-term water supply contracts between the Department and each individual contractor; which addressed non-Table A water that becomes available on an intermittent, interruptible basis. The subdivisions of the original article defined SWP water types; set priorities and procedures to reduce deliveries of Article 21 water; and provided provisions for schedules, rates, power, costs, and other considerations.
Approved Table A	A prorated amount of water that the SWP can deliver to a contractor in a particular year, and can be equal to 100% of a contractor's Table A or some other reduced percentage.
Burns-Porter Act	Authorized the submission for voter approval of a $1.75 billion general obligation bond issue to finance construction of the SWP (Water Code, §12930, et seq.).
CALFED Bay-Delta Program	A federal and State multi-agency program whose goals are to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System.
California Aqueduct	The primary conveyance facility of the State Water Project. The 444-mile California Aqueduct conveys water from the Delta, through the San Joaquin Valley along the eastern slope of the Coastal Range, to Southern California.
California Endangered Species Act (CESA)	The California Endangered Species Act of 1985 (CESA; Fish and Game Code Section 2050 et seq.) is implemented by the California Department of Fish and Game (CDFG). CESA prohibits the "take" of listed threatened or endangered species. Take under CESA is restricted to the direct killing of a listed species and does not prohibit indirect harm by way of habitat modification.
CALSIM II	A computer model that simulates operations of the SWP and CVP Water Systems. CALSIMII is a planning tool that was jointly developed by the Department and the U.S. Bureau of Reclamation. The model's inputs include hydrological data for specified study planning years, water demands, infrastructure and regulatory change, and other factors; outputs include deliveries to the project's contractors, river flows, reservoir changes, Delta hydrological parameters, and other data.
Carryover Water	Table A water that is allocated to a contractor in a given year, but is unused by it that year, which is stored for that contractor in SWP supply reservoirs (when storage space is available) for use by that contractor in a following year.
Central Valley Project (CVP)	The CVP is a water storage and delivery system of reservoirs, aqueducts, and pumping plants operated by the U.S. Department of Interior's Bureau of Reclamation. The CVP's main purpose is to store water and distribute it to urban and agricultural contractors in northern California, the San Joaquin Valley, and portions of the San Francisco Bay area (primarily Santa Clara and Santa Cruz counties). CVP facilities include reservoirs on the Trinity, Sacramento, American, Stanislaus, and the San Joaquin rivers. In addition, the CVP owns approximately one-half of the storage capacity of San Luis Reservoir. The CVP's Tracy Pumping Plant at the southern end of the Delta lifts water into the Delta-Mendota Canal for delivery to CVP contractors. The CVP has organized its facilities and operations into the Trinity River, Shasta and Sacramento River, American River, Eastside, Delta, West San Joaquin, San Felipe, and Friant Divisions. CVP water users include Sacramento River water rights contractors, San Joaquin River exchange contractors, CVP water service contractors, Friant Division contractors, and Cross Valley Canal contractors; these contractors have a wide variety of contract provisions for water service with Reclamation.

Delta	The legal Delta, as described in the California Water Code Section 12220, generally extends from Sacramento to the north, at the I Street Bridge, Tracy to the south, Interstate 5 to the east, and Collinsville to the west. The Delta covers approximately 738,000 acres.
Decision 1485	The SWRCB's Water Right Decision 1485 established terms and conditions regulating operations of the SWP and CVP. The Decision went into effect in 1978, but was disapproved by the California courts in *United States v. State Water Resources Control Board.* 182 Cal.App.3d 82 (1986). Nevertheless, the Decision remained effective until it was modified in 1995 (95-06) and 1998 (98-09), and was superseded by Decision 1641 in 1999 (as revised in 2000).
Endangered Species	Those species listed as endangered under FESA and CESA; any species, which is in danger of extinction throughout all or a significant portion of its range.
Endemic Species	Plant and animal species that are native to and confined to a certain region.
Extended Carryover Storage	Article 12(e) of the long-term water supply contracts allows contractors to carryover Table A water from one year to next under certain conditions. The water is temporarily stored or carried over in State Water Project reservoirs, primarily San Luis Reservoir. Article 56 of the Monterey Amendment expanded the circumstances under which contractors could carryover or temporarily store water in San Luis Reservoir. However, contractors must take delivery of carryover water before storage space in San Luis Reservoir is needed by the State Water Project. Any carryover water remaining in the reservoir when the State Water Project needs the storage capacity reverts to the State Water Project.
Federal Endangered Species Act (FESA)	The Federal Endangered Species Act of 1973 is administered by the Interior Department's U.S. Fish and Wildlife Service (USFWS) and by the Commerce Department's National Oceanic and Atmospheric Administration-Fisheries (NOAA Fisheries). FESA section 9 and its implementing regulations prohibit "take" of individual members of species listed as threatened or endangered. FESA defines "take" as meaning "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." (16 U.S.C.§ 1532(19)). "Take" may result from significant modification of habitat occupied by a listed species, but only if the modification actually causes the death or physical injury of an individual member of a listed species. (*Babbitt v. Sweet Home Chapter of Communities for a Great Oregon,* 515 U.S. 687, 700 (1985); *Defenders of Wildlife v. Bernal,* 204 F.3d 920, 924-925 (9th Cir. 2000))
Hydrology	Science dealing with natural runoff and its effects on streamflows.
Indirect (Secondary) Impact/Effect	Environmental impact that is the indirect result of a project, such as the growth-inducing effects of building new roads and water supply infrastructure.
In-Lieu Groundwater Banking Programs	Programs where water agencies may deliver excess water (typically in wet years) to agricultural irrigators for use in-lieu of pumping groundwater. The surface water used is credited against a supply (bank) in the underlying groundwater basin, for future use by the groundwater "banking" agency.
Interruptible Water	Term given to Article 21 Water in the Monterey Amendments.
Kern Fan Element	A component of a proposed SWP groundwater bank in Kern County for use by the SWP and local agencies. The Department purchased property in Kern County for the facility and negotiated an agreement with KCWA to operate a demonstration ground water project on the property. The Department developed a First Stage Feasibility Study and Draft Supplemental EIR for the water bank.
Minimum Project Yield	The annual supply of the SWP to be made available to SWP Contractors, as determined by DWR. For modeling purposes SWP projects yield has been defined as the maximum amount of water that can be delivered on demand during the 1928-34 dry period sequence while shortages up to 25% are allocated in four years so the total shortage over the seven years is 100% of the demand. The project yield was originally estimated to be 4,000,000 AFY, was increased to 4,230,000 AFY in 1964, and decreased to 4,185,000 AFY as part of the Monterey Amendment. Under a recent amendment, estimated amounts are no longer included in the Water Supply Contract. (The project yield would be reduced under a scenario in which DWR implemented Article 18 (b); such a scenario is evaluated as part of this EIR.) In more recent years the concept of firm yield has been replaced with water delivery reliability curves which show the likelihood of water deliveries by the SWP in any year given the range of historical hydrologic events.
Non-project water	Water that is not SWP water. Other water supplies acquired by SWP contractors, or non-SWP water moved through SWP facilities.

Racanelli Decision	In 1986, the California appellate court in the Racanelli Decision (named after Judge Racanelli who wrote the opinion) broadly interpreted the State Water Resources Control Board's authority and obligation to establish water quality objectives and its authority to set water rights permit terms and conditions that provide reasonable protection of beneficial uses of Delta water and of San Francisco Bay. The court stated that State Water Resources Control Board needed to separate its water quality planning and water rights functions. State Water Resources Control Board needs to maintain a "global perspective" in identifying beneficial uses to be protected (not limited to water rights) and in allocating responsibility for implementing water quality objectives (not just to the State Water Project and Central Valley Project, nor only through the Board's own water rights processes). The court recognized the State Water Resources Control Board's authority to look to all water rights holders to implement water quality standards and advised the Board to consider the effects of all Delta and upstream water users in setting and implementing water quality standards in the Delta, as well as those of the State Water Project and Central Valley Project.
Special Status Species	Plants or animals legally protected under either the federal or California Endangered Species Acts or the California Fish and Game Code; those species not currently protected by statute, but considered to be rare or endangered under CEQA; and species considered by the scientific community to be sufficiently rare to qualify for such listing [e.g., candidate species for listing as threatened or endangered, species of special concern to the CDFG or USFWS, or rare plants identified by the California Native Plant Society (CNPS).
State Water Project (SWP)	A term to describe all facilities for which the contractors assume a repayment obligation. Specifically, the California State Water Project is a water storage and delivery system of reservoirs, aqueducts, powerplants and pumping plants.
Surplus Water	Pre-Monterey Amendment provision of Article 21 that defined a water classification for water that the SWP could supply from reservoir storage or from the Delta; that was in excess of supplies needed for Table A deliveries, reservoir storage, regulatory requirements, and other needs; and that could be scheduled in advance of its delivery. Article 21 defined delivery priorities, scheduling, rates, and other provisions.
SWP Allocations	The percent of Table A amount, as determined by DWR, that each SWP Contractor can receive in any one year based on that year's water supply availability and Contractor requests.
Table A (Table A amounts)	The maximum amount of SWP water that the State agreed to make available for delivery to a contractor during the year. The State and SWP contractors also use Table A amounts to serve as a basis for allocation of some SWP costs among the contractors.
Threatened Species	Those species listed as threatened under FESA and CESA; any species, which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Turnback Pool Program	A program in which Contractors with allocated Table A supplies that are in excess of their needs in a given year may turn back that excess supply for purchase by other SWP Contractors that need additional supplies that year. The Turnback Pool can make water available in all types of hydrologic years, although there is generally less excess water turned back in dry years.
Watershed	The total area above a given point on a watercourse that contributes water to its flow; the entire region drained by a waterway or watercourse that drains into a lake, or reservoir.
Water Supply Contracts	Contracts between DWR and individual urban and agricultural public water agencies that provide for the repayment of the SWP costs and for delivery of SWP water. (DWR 1962)
Water Transfer	Voluntary water transactions. The State agency most involved in regulatory water transfers is the State Water Resources Control Board.
Water Year	From October 1st through the following September 30th.
X2	The location (measured in kilometers from the Golden Gate Bridge) of 2 parts per thousand total dissolved solids. The length of time X2 must be positioned at set locations in the estuary each month is determined by a formula that considers the previous month's inflow to the Delta and a "Level of Development" factor, denoted by a particular year. X2 is currently used as the primary indicator in managing Delta outflows. The X2 indicator is also used to reflect a variety of biological consequences related to the magnitude of fresh water flowing downstream through the estuary and the upstream flow of salt water in the lower portion of the estuary. The outflow that determines the location of X2 also affects both the downstream transport of some organisms and the upstream movement of others and affects the overall water operations of the State Water Project and Central Valley Project.

ABBREVIATIONS

AB	Assembly Bill
ADA	Americans with Disabilities Act
ADEIR	Administrative Draft EIR
AF	acre-feet
AFY	acre-feet per year
amsl	above mean sea level
BCAG	Butte County Association of Governments
BCAPCD	Butte County Air Pollution Control District
BDCP	Bay-Delta Conservation Plan
BMP	best management practice
BP	before present
Cal EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CALVIN	California Value Integrated Network
CARB	California Air Resources Board
CBC	California Building Code
CCR	California Code of Regulations
CCWA	Central Coast Water Agency
cfs	cubic feet per second
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CEA	Capacity Exchange Agreement
CEC	California Energy Commission
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CFS	cubic feet per second
CH4	methane
CHP	California Highway Patrol
CHRIS	California Historic Resources Information System
Cl	Chloride
CMA	Congestion Management Agency
CMP	Congestion Management Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPA3	Court-Ordered No Project Alternative 3
CNPA4	Court-Ordered No Project Alternative 4
CNPS	California Native Plant Society
CO	Carbon Monoxide
COA	Coordinated Operating Agreement
Corps	United States Army Corps of Engineers
CRHR	California Register of Historic Resources
CTC	California Transportation Commission
CUPA	California Unified Program Agency
CVMod	Central Valley Model
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWC	California Water Code

dB	Decibel
dBA	A-weighted decibel
DEIR	Draft Environmental Impact Report
Delta	Sacramento-San Joaquin River Delta
Department	California Department of Water Resources
DOT	United States Department of Transportation
DPR	California Department of Parks and Recreation
DRMS	Delta Risk Management Study
DWR	California Department of Water Resources
DWSP	Delta Water Supply Project
EC	Electrical Conductivity
EHD	Environmental Health Division
EHSD	Environmental Health Services Department
E/I	export/Delta inflow
EIR	Environmental Impact Report
EMBUD	East Bay Municipal Utilities District
EPA	United States Environmental Protection Agency
ERP	Ecosystem Restoration Program
EWA	Environmental Water Account
FCD	Flood Control District
FC&WCD	Flood Control and Water Conservation District
ft	feet
FERC	Federal Energy Regulatory Commission
FESA	Federal Endangered Species Act
FMWT	fall mid-water trawl
FONSI	Finding of No Significant Impact
GCM	General Circulation Model
GHG	greenhouse gas
GPCPD	gallons per capita per day
GW	giga-watts
GWh	Giga-Watt hours
HCP	Habitat Conservation Plan
HSC	Health and Safety Code
HWCL	Hazardous Waste Control Law
I-5	Interstate 5
ID	Irrigation District
IEP	Interagency Ecological Program
IPCC	Intergovernmental Panel on Climate Change
JPOD	Joint Point of Diversion
KCOG	Kern Council of Governments
KCWA	Kern County Water Agency
KFE	Kern Fan Element
KWB	Kern Water Bank
KWBA	Kern Water Bank Authority
LADWP	Los Angeles Department of Water and Power
LBNL	Lawrence Berkeley National Laboratory
LPOC	Lake Perris Operations Committee
LPSRA	Lake Perris State Recreation Area
M&I	Municipal and Industrial
MCAG	Merced County Association of Governments
MCL	maximum contaminant level
Metro	Los Angeles County Metropolitan Transportation Authority
mgd	million gallons per day
mg/l	milligram per liter
MID	Madera Irrigation District
MMP	Mitigation Monitoring Program
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MSHCP	Multiple Species Habitat Conservation Plan
MTBE	Methyl tertiary-butyl ether

MWD	Metropolitan Water District
MWDSC	Metropolitan Water District of Southern California
mya	million years ago
NCCP	Natural Community Conservation Plan
NIH	National Institutes of Health
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOD	Notice of Determination
NOP	Notice of Preparation
NO_x	Nitrogen Oxides
NPA1	No Project Alternative 1
NPA2	No Project Alternative 2
NPC	Nevada Power Company
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	National Resources Conservation Services
NRHP	National Register of Historic Places
NSVAB	Northern Sacramento Valley Air Basin
O3	ozone
OCAP	Operations Criteria and Plan
OES	Office of Emergency Services
OPR	Governor’s Office of Planning and Research
PCL	Planning and Conservation League
PCWA	Placer County Water Agency
PIER	Public Interest Energy Research
PM_{10}	Particulate Matter
POD	Pelagic Organism Decline
PRC	Public Resources Code
PRMS	Precipitation-Runoff Modeling System
PUC	Public Utilities Commission
RBDD	Red Bluff Diversion Dam
RCHCA	Riverside County Habitat Conservation Agency
RCRA	Resource Conservation and Recovery Act
RCTC	Riverside County Transportation Commission
Reclamation	United States Bureau of Reclamation
ROD	Record of Decision
ROG	Reactive Organic Gasses
RPA	Register of Professional Archaeologists
SAWA	Santa Ana Watershed Association
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SDIP	South Delta Improvement Program
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SHOPP	State Highway Operations and Protection Program
SIP	State Implementation Plan
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_x	Sulfur Oxides
SR	State Route
SRA	State Recreational Area
SSWD	Sacramento Suburban Water District
SVWMP	Sacramento Valley Water Management Program
SWP	State Water Project
SWRCB	California State Water Resources Control Board
SWSD	Semitropic Water Storage District
TAC	Toxic Air Contaminant
TAF	Thousand acre-feet
TDF	Through-Delta Facility

TIP	Transportation Improvement Plan
TMDL	Total Maximum Daily Load
TNS	townet survey
TSM	Transportation System Management
UBC	Uniform Building Code
UCR	University of California, Riverside
USGS	United States Geological Survey
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
UWMP	Urban Water Management Plan
VAMP	Vernalis Adaptive Management Program
VdB	Vibration decibel
VIC	Variable Infiltration Capacity
VOC	volatile organic carbons
WA	Water Authority or Water Agency
WD	Water District
WQCP	Water Quality Control Plan
WSD	Water Service District or Water Storage District

1. INTRODUCTION

1. INTRODUCTION

1.1 PROJECT UNDER REVIEW

The Monterey Amendment and Settlement Agreement together comprise the proposed project that is under review in this Environmental Impact Report (EIR). Chapter 3 provides a description of the events and circumstances that led to the Monterey Amendment and the Settlement Agreement. Chapter 4 includes a detailed description of the proposed project.

1.2 INTENDED USES OF THIS EIR

This Draft EIR has been prepared in conformance with the California Environmental Quality Act 11 (CEQA) of 1970 (as amended) to evaluate the environmental impacts associated with the proposed project. This EIR analyzes the potential environmental impacts of the provisions of the Monterey Amendment and the Settlement Agreement (Monterey Plus or proposed project).

The EIR process is specifically designed to objectively evaluate and disclose potentially significant direct, indirect, and cumulative impacts of a proposed project; to identify alternatives that reduce or eliminate a project's significant effects; and to identify feasible measures that mitigate significant effects of a project. In addition, CEQA requires that an EIR identify those adverse impacts that remain significant after mitigation.

The purpose of an EIR is not to recommend approval or denial of a proposed project, but to provide decision-makers, public agencies and the public with an objective and informational document that fully disclosed potential environmental effects of a proposed project. This EIR will be used primarily by the California Department of Water Resources (Department), as the lead agency, and the State Water Project (SWP) contractors, as responsible agencies, to evaluate the environmental impacts of the proposed project and to decide whether to continue operating under the proposed project: the Monterey Amendment and the Settlement Agreement, as described in Chapter 4, or to decide to implement one of the alternatives to the proposed project. The Department will evaluate the proposed project's environmental impacts measured against the baseline, contrast those with the impacts under the alternative scenarios and consider, where appropriate, mitigation measures. As part of its overall consideration, the Department will also review legal, economic and social impacts. Once the EIR is complete, the Department will consider all options available to it under the law. Upon completion and certification of this EIR, the Department will make written findings and decisions and file a Notice of Determination (NOD).

This EIR serves as both a Project EIR and a Program EIR under CEQA. As a Project EIR, this EIR provides comprehensive analysis of those actions of the Monterey Plus project that take effect directly from the modification of the long-term SWP water supply contracts and thus do not require any subsequent decisions or actions to implement. These actions, described in detail in Chapter 4, include revisions to the methodology used to allocate water among the SWP contractors, permanent retirement of 45,000 acre-feet of agricultural "Table A amount," transfer of the property known as the "Kern Fan Element property," changes in the manner in which Castaic Lake and Lake Perris may be operated, and certain water supply management practices. This EIR also serves as a Program EIR under CEQA for those actions that require subsequent decisions or approvals. A Program EIR may be prepared for a series of actions that can be characterized as one large project because the actions are related to each other in specified ways. (CEQA Guidelines, Section 15168.)

As a Program EIR, this EIR may be used as CEQA compliance for subsequent activities. The Department's actions that are covered in this EIR are subject, consistent with the Settlement Agreement, to the normal CEQA review. Some subsequent activities could be within the scope of this EIR and no further environmental documentation would be required. Other actions may require additional environmental analysis. To the extent appropriate, later environmental documents may use information in this EIR to provide CEQA-required information, especially with regard to consideration of policy alternatives, state-wide impacts and cumulative impacts. For example, further permanent transfers of the 130,000 acre-feet of agricultural Table A amount and development of specific contractor out-of-service area storage programs will continue to be the subject of project-specific environmental documentation of local impacts, but would not require further analysis of state wide or SWP-wide impacts.

1.3 ENVIRONMENTAL REVIEW AND APPROVAL PROCESS

The Department issued a Notice of Preparation (NOP) to prepare an EIR on the Monterey Amendment and the Settlement Agreement in January 2003. The Department held scoping meetings in Sacramento, Riverside, Ventura, Bakersfield and Quincy in February 2003. Various parties submitted 16 comment letters to the Department, and several persons made oral comments at the scoping meetings. The NOP is contained in Appendix A. Comments received in response to the NOP and at the scoping meetings are contained in Appendix B.

A first EIR on the Monterey Agreement, which was a statement of principles that was the basis for and preceded the Monterey Amendment, was challenged and the Department was required to prepare a new EIR (see Chapter 3 for the history of the litigation). A settlement agreement among the parties to the litigation required the Department to establish an advisory committee (called the "EIR Committee") with representatives of the plaintiffs (Planning and Conservation League, Citizens Planning Association of Santa Barbara, and the Plumas County Flood Control and Water Conservation District) and SWP contractors to provide advice and recommendations to the Department in its preparation of this Draft EIR. The EIR Committee has eight members—four representing the SWP contractors and four representing the plaintiffs. Over 24 meetings have been held with the committee. The committee has reviewed and commented on two administrative drafts. This Draft EIR reflects changes made as a result of comments from members of the committee.

This Draft EIR is being circulated for public review and comment for a period of 60 days. During this period, the general public, organizations, and agencies can submit comments to the Department on the Draft EIR's accuracy and completeness. The 60-day public review period for the Monterey Plus Draft EIR will be from October 15, 2007 to December 13, 2007, ending at 5:00 PM.

Upon completion of the public review period, a Final EIR will be prepared that will include written comments on the Draft EIR received during the public review period and the Department's responses to those comments. The Final EIR will address any revisions to the Draft EIR made in response to agency and/or public comments. The Draft EIR and Final EIR together will comprise the EIR for the Monterey Plus project. A Mitigation Monitoring Program (MMP) will also be prepared and will be the guide for reporting and monitoring compliance with adopted mitigation measures.

Before the Department makes a decision with regard to the proposed project, it must first certify that the EIR has been completed in compliance with CEQA, that the Department has reviewed and considered the information in the EIR, and that the EIR reflects the independent judgment of the Department.

The Department also would be required to adopt Findings of Fact, and for those impacts determined to be significant and unavoidable, adopt a Statement of Overriding Considerations. Upon filing a NOD, the Department will submit the new EIR and appropriate documents to the Superior Court.

1.4 LEAD, RESPONSIBLE AND TRUSTEE AGENCIES

1.4.1 Lead Agency

The Department is the lead agency for preparation of the Monterey Plus environmental analysis. In conformance with Sections 15050 and 15367 of the State CEQA Guidelines, the Department has been designated the “lead agency” which is defined as the “public agency which has the principal responsibility for carrying out or disapproving a project.” The lead agency is also responsible for scoping the analysis, preparing the EIR and responding to comments received on the Draft EIR.

1.4.2 Responsible Agencies

Responsible agencies are state and local public agencies other than the lead agency that have some authority to carry out or approve a project or that are required to approve a portion of the project for which a lead agency is preparing or has prepared an EIR or other CEQA compliance document. The 29 SWP contractors are identified as those agencies that could potentially act as responsible agencies for the proposed project.

1.4.3 Trustee Agencies

Trustee agencies under CEQA are designated public agencies with legal jurisdiction over natural resources that are held in trust for the people of California and that would be affected by a proposed project, whether or not the agencies have authority to approve or implement the proposed project. Trustee agencies with potential jurisdiction by law over the proposed project or the resources affected by it include the California Department of Fish and Game (CDFG), the California State Water Resources Control Board (SWRCB), the State Historic Preservation Office, and the Department of Food and Agriculture. The U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) do not serve as either responsible or trustee agency under CEQA for the proposed project. Both federal agencies as well as some of the state Trustee agencies do, however, have regulatory authority which affects SWP operations.

1.5 LEAD AGENCY CONTACT

Delores Brown
California Department of Water Resources
Chief, Office of Environmental Compliance
901 P Street
Sacramento, CA 95814

1.6 SCOPE OF THIS EIR

The Department identified in the NOP for this EIR, potentially significant impacts that could result from implementation of the proposed project. Based on the NOP (see Appendix A), the Department determined that this EIR address the following technical issue areas:

- Surface Water Hydrology, Water Quality, and Water Supply
- Groundwater Hydrology and Quality
- Fisheries Resources
- Terrestrial Biological Resources
- Visual Resources
- Agricultural Resources
- Air Quality
- Geology, Soils and Mineral Resources
- Recreation
- Land Use and Planning
- Hazards and Hazardous Materials
- Noise
- Cultural and Paleontological Resources
- Public Services and Utilities
- Transportation and Circulation
- Energy

The specific topics evaluated are described in each of the technical sections presented in Chapter 7.

1.7 REPORT ORGANIZATION

Glossary and Abbreviation of Terms This chapter provides a glossary and abbreviations of the common terms used in the EIR.

Executive Summary This chapter provides a summary of the proposed project, its alternatives and their environmental impacts. A table is provided summarizing the impacts that would result from implementation of the proposed project, proposed mitigation measures, and conclusions as to the level of significance of impacts before and after mitigation.

Chapter 1 Introduction This chapter includes a description of the intended use of this EIR, the environmental review and approval process, and report organization.

Chapter 2 State Water Project This chapter provides a description of the SWP, its components, the long-term water supply contracts and contractors, important contract provisions, financing, and SWP deliveries.

Chapter 3 Project Background This chapter provides a description of the events and circumstances that led to the Monterey Amendment and the Settlement Agreement.

Chapter 4 Proposed Project This chapter provides a description of the proposed project.

Chapter 5 Methods This chapter describes the methods used and the assumptions made in the environmental analysis.

Chapter 6 Effects of Proposed Project on SWP and SWP Contractor Operations This chapter describes the effects of the proposed project on SWP and SWP contractors' operations.

Chapter 7 Environmental Analysis This chapter analyzes the potential impacts of the proposed project on a range of environmental elements. Each section includes an introduction, description of environmental setting, impacts, and mitigation measures to minimize significant adverse impacts.

Chapter 8 Growth-Inducing Impacts As described in CEQA Guideline 15126.2(d), this chapter discusses the ways in which the proposed project could foster economic or population growth, or the construction of additional housing either directly or indirectly. This includes considering the possibility of the proposed project to accommodate growth, remove obstacles to growth, or induce growth and related environmental effects.

Chapter 9 Reliability of Water Supplies and Growth This chapter provides information about whether planners in the SWP service area relied on full Table A amounts in the SWP long-term water supply contracts and whether there is an SWP "paper water" problem that would be ameliorated if Article 18(b) were retained and invoked.

Chapter 10 CEQA and Other Considerations This chapter provides discussions of additional considerations required by CEQA including, a discussion of cumulative impacts, summary of significant unavoidable impacts, and significant irreversible changes to the environment. This chapter also includes a discussion of potential Environmental Justice impacts. While this is not a requirement of CEQA, it has been included, consistent with Department practice for preparing environmental documents.

Chapter 11 Alternatives This chapter includes a description of alternatives to the proposed project that were considered in this EIR. An EIR is required by CEQA to provide adequate information for decision-makers to make a reasonable choice between alternatives based on the environmental aspects of the proposed project and alternatives. The impacts of the alternatives are qualitatively compared to those of the proposed project. This chapter also identifies and discusses the environmentally superior alternative as required by CEQA Guidelines 15126.6(e).

Chapter 12 Climate Change This chapter discusses the evidence of how global climate change could affect water resources in California and what impact this might have on California's economy, public health and environment.

Chapter 13 References This chapter lists all references cited in the EIR.

Chapter 14 EIR Report Preparation This chapter lists report authors, Department staff, and others who provided technical assistance in the preparation and review of the EIR.

Appendices The appendices include documents providing support and documentation of the analysis included in the EIR.

2. STATE WATER PROJECT

2. STATE WATER PROJECT

2.1 INTRODUCTION

Funding for the SWP was authorized by the California Legislature in 1959 and approved by the voters in 1960 through the Burns-Porter Act. The Burns-Porter Act expressly authorized the State of California to enter into contracts for the sale, delivery, or use of water made available by the State Water Resources Development System (California Water Code [CWC] 12937(b)(4)). In return for the State financing, constructing, operating, and maintaining facilities needed to provide water service, the 29 public water agencies contractually agreed to repay all associated SWP capital and operating costs including the $1.75 billion in bonds used to construct the SWP facilities. Construction of the SWP commenced in the 1960s and water was first delivered in 1962 through a portion of the South Bay Aqueduct to Alameda and Santa Clara counties. Large scale water deliveries began late in the 1960s.

Managed by the California Department of Water Resources (Department), the SWP is the largest state-built water storage and conveyance project in the United States. The multi-purpose SWP facilities deliver water supply under long term water supply contracts to 29 public water agencies throughout California. Collectively known as the SWP contractors, the 29 water agencies deliver water directly to agricultural and urban water users or to water wholesalers or retailers. The contractor's role is to take the water at their various points of delivery, use it within their respective service areas, and repay the capital and operations costs of the SWP. Approximately 24 million Californians receive a portion of their drinking water supply from the SWP, and about 750,000 acres of agricultural land, primarily in the San Joaquin Valley, is irrigated with SWP water. For all the contractors, the SWP water supply supplements water used within their service areas from other sources including ground water, local surface water, other imported water supplies, recycled water, and desalinated water.

In addition to operating and managing the SWP, the Department's mission includes managing the water resources of California in cooperation with other agencies to benefit the State's people, and to protect, restore, and enhance the natural and human environments. The Department plans, designs, constructs, and operates the SWP to deliver water, control floods, generate power, and provide recreational opportunities. The Department also provides enhancements for fish and wildlife.

In order to fulfill its mission, the Department has eight goals which include: (1) developing and assessing strategies for managing the State's water resources, including development of the California Water Plan Update; (2) planning, constructing, operating, and maintaining the SWP to achieve maximum flexibility, safety, and reliability; (3) protecting and improving the water resources and dependent ecosystems of statewide significance, including the Sacramento-San Joaquin Bay-Delta Estuary; (4) protecting lives and infrastructure as they relate to dams, floods, droughts, watersheds impacted by fire and disasters, and assisting in other emergencies; (5) providing policy direction and legislative guidance on water and energy issues and educating the public on the importance, hazards, and efficient use of water; (6) supporting local planning and integrated regional water management through technical and financial assistance; (7) performing efficiently all statutory, legal, and fiduciary responsibilities regarding management of State long-term power contracts and servicing of power revenue bonds; and (8) providing professional, cost-effective, and timely services in support of the Department's programs, consistent with governmental regulatory and policy requirements.

2.2 COMPONENTS OF THE SWP

The SWP is a complex system of reservoirs, dams, power plants, pumping plants, pipelines, and aqueducts. Precipitation and watershed runoff is stored in SWP reservoirs and delivered via natural stream channels and SWP aqueducts to water agencies and districts in Southern California, the Central Coast, the San Joaquin Valley, portions of the San Francisco Bay area, and upper Feather River areas. The principal components of the SWP are shown in Figure 2-1.

Three small reservoirs—Lake Davis, Frenchman Lake, and Antelope Lake—are the northernmost SWP facilities. Situated on Feather River tributaries in Plumas County, these lakes are used primarily for recreation. Lake Davis also provides water to Plumas County Flood Control and Water Conservation District (FC&WCD) and local agencies that have water rights agreements with the Department.

Downstream from these three lakes is the Oroville-Thermalito Complex which includes: Lake Oroville and Oroville Dam; Hyatt Powerplant; Thermalito Diversion Dam and Powerplant; the Feather River Fish Hatchery; Thermalito Power Canal; Thermalito Forebay; Thermalito Pumping-Generating Plant; and Thermalito Afterbay.

The Oroville-Thermalito Complex was designed as an efficient water and power system. Lake Oroville has a storage capacity of approximately 3.5 million acre-feet (AF) and it stores winter runoff and spring snowmelt from the Feather River drainage for later downstream release. Power is generated from releases made through Hyatt Powerplant and two other Thermalito power plants. Water stored in the Thermalito Forebay and Afterbay can also be pumped back into the reservoir when feasible for subsequent power generation. A special fish barrier dam was built to lead salmon and steelhead, returning to spawn, into the Feather River Fish Hatchery. Salmon and steelhead raised at the hatchery are transported and released in the Feather and Sacramento rivers, or in the Delta near the San Francisco Bay area.

Releases from Lake Oroville flow down the Feather River then merge with the Sacramento River. The Sacramento River flows into the Sacramento-San Joaquin Delta which is comprised of 738,000 acres of land interlaced with channels that receive runoff from approximately 40 percent of the state's land area.

The Department completed the Barker Slough Pumping Plant in 1988 to divert water for delivery from the northern Delta to Napa and Solano counties through the North Bay Aqueduct. In the southern Delta, the SWP diverts water into Clifton Court Forebay for delivery south of the Delta. From Clifton Court Forebay, the Skinner Fish Facility diverts an average of 15 million fish each year away from the Delta pumps. Two miles downstream from Skinner Fish Facility, the Harvey O. Banks Delta (Banks) Pumping Plant lifts water into the California Aqueduct, which then flows to Bethany Reservoir.

From Bethany Reservoir, the South Bay Pumping Plant lifts water into the South Bay Aqueduct to supply portions of Alameda and Santa Clara counties. The South Bay Aqueduct provided initial deliveries in 1962 and has been fully operational since 1965. South Bay Aqueduct facilities include Lake Del Valle, a regulatory, flood control, and water supply reservoir for the aqueduct, and Patterson Reservoir.

Source: Department of Water Resources, 2005.

PBS&J®

FIGURE **2-1**

Major Components of the State Water Project

The remaining water delivered to Bethany Reservoir continues south in the California Aqueduct. This 444-mile-long main aqueduct conveys water to the primarily agricultural lands of the San Joaquin Valley and the mainly urban regions of Southern California. The first SWP deliveries to San Joaquin Valley contractors began in 1968. The first SWP deliveries to southern California began in 1972.

The California Aqueduct winds along the west side of the San Joaquin Valley. It transports water to O'Neill Forebay. Water in the Forebay can be released to the San Luis Canal or pumped into San Luis Reservoir by the Gianelli Pumping Plant. San Luis Reservoir has a storage capacity of more than two million AF and is jointly owned by the Department and U.S. Bureau of Reclamation (Reclamation). The SWP's share of the reservoir's gross storage is about 1,062,180 AF. The Department generally pumps water through the Gianelli Pumping-Generating Plant into San Luis Reservoir during late fall through early spring for temporary storage until the Department releases the water back into the O'Neill Forebay and the California Aqueduct to meet late spring and summer peaking demands of SWP contractors.

SWP water pumped directly from the Delta and water eventually released from San Luis Reservoir continues to flow south in the San Luis Canal, a portion of the California Aqueduct jointly owned by the Department and Reclamation. The Central Valley Project (CVP) joint ownership ends near Kettleman City, and the SWP portion of the California Aqueduct continues. As the water flows through the San Joaquin Valley, numerous turnouts convey the water to farmlands within the service areas of the SWP and CVP. Along its journey, four pumping plants—Dos Amigos, Buena Vista, Teerink, and Chrisman—lift the water more than 1,000 feet before it reaches the foot of the Tehachapi Mountains.

In the San Joaquin Valley near Kettleman City, Phase I of the Coastal Branch Aqueduct serves agricultural areas west of the California Aqueduct. The Coastal Branch's Phase II extended the conveyance facility to serve municipal and industrial water users in San Luis Obispo and Santa Barbara counties. Phase II became operational in 1997.

The remaining water conveyed by the California Aqueduct is delivered to Southern California, home to about one-half of California's total population. Before this water can be delivered, the water must first cross the Tehachapi Mountains. Pumps at Edmonston Pumping Plant, situated at the foot of the mountains, raise the water 1,926 feet—the highest single lift of any pumping plant in the world. From there, the water enters about eight miles of tunnels and siphons as it flows into Antelope Valley, where the California Aqueduct divides into two branches; the East Branch and the West Branch.

The East Branch carries water through the Tehachapi East Afterbay, Alamo Powerplant, Pearblossom Pumping Plant, and Mojave Siphon Powerplant into Silverwood Lake in the San Bernardino Mountains. From Silverwood Lake, water flows through the San Bernardino Tunnel into Devil Canyon Powerplant. Water continues down the East Branch to Lake Perris, the terminus of the East Branch. Lake Perris lies just east of Riverside, has a capacity of 131,500 AF and serves as a regulatory and emergency water supply facility for the East Branch.

Phase I of the East Branch Extension of the California Aqueduct was completed in 2003 and provides conveyance facilities to deliver SWP water to San Gorgonio Pass Water Agency (WA), and to the eastern portion of the San Bernardino Valley Municipal Water District (MWD) -- which will deliver water to areas such as Yucaipa, Calimesa, Beaumont, Banning, and other communities. The East Branch Extension is comprised of a combination of existing San Bernardino Valley MWD facilities and newly constructed SWP facilities. While the new pipelines were designed for the ultimate conveyance capacity, the installed Phase I pumping capacity is less than one-half the ultimate capacity - enough to meet the immediate foreseeable demand for SWP water. Phase II will bring the extension to its ultimate storage and conveyance capacity with new pipelines, pumping, and storage facilities. Currently, the Department is in the planning stages of Phase II. A feasibility study and a Phase II Project Environmental Impact Report are concurrently being worked on and will take approximately 24 months to complete.

At the bifurcation of the California Aqueduct in Antelope Valley, the West Branch carries water through Oso Pumping Plant, Quail Lake, Lower Quail Canal, and William E. Warne Powerplant into Pyramid Lake in Los Angeles County. From there, water flows through the Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, and Castaic Lake, terminus of the West Branch. Castaic Lake is located north of Santa Clarita, has a capacity of 324,000 AF, and is a regulatory and emergency water supply facility for the West Branch. Castaic Powerplant is operated by the Los Angeles Department of Water and Power.

The energy needed to operate the SWP, the single largest consumer of electrical power in California, comes from a combination of its own hydroelectric facilities, a coal-fired generation plant, and power purchased from other utilities. The coal-fired plant and the SWP's eight hydroelectric power plants, including three pumping-generating plants, produce enough electricity in a normal year to supply about two-thirds of the SWP's necessary operating power.

Tables 2-1 and 2-2 show statistical information for the SWP's primary reservoirs and aqueducts.

TABLE 2-1

PHYSICAL CHARACTERISTICS OF PRIMARY STORAGE FACILITIES

Facility	Gross Capacity (Acre-feet)	Surface Area (Acres)	Shoreline (Miles)
Antelope Lake	22,600	930	15
Frenchman Lake	55,500	1,580	21
Lake Davis	84,400	4,030	32
Lake Oroville	3,537,600	15,800	167
Thermalito Forebay	11,800	630	10
Thermalito Afterbay	57,000	4,300	26
Thermalito Diversion Pool	13,400	320	10
Clifton Court Forebay	31,300	2,180	8
Bethany Reservoir	5,100	180	6
Lake Del Valle	77,100	1,060	16
San Luis Reservoir	2,027,800 (SWP storage 1,062,183)	12,520	65
O'Neill Forebay	56,400 (SWP storage 29,500)	2,700	12
Pyramid Lake	171,200	1,300	21
Elderberry Forebay	32,500	500	7
Castaic Lake	323,700	2,240	29
Silverwood Lake	75,000	980	13
Lake Perris	131,500	2,320	10

Source: California Department of Water Resources, Bulletin 132-02:6, January 2004.

TABLE 2-2

TOTAL MILES OF AQUEDUCTS

Facility	Channel and Reservoir	Canal	Pipeline	Tunnel	Total
North Bay Aqueduct	0.0	0.0	27.4	0.0	27.4
South Bay Aqueduct	0.0	8.4	32.9	1.6	42.9
California Aqueduct					
Delta to O'Neill Forebay	1.4	67.0	0.0	0.0	68.4
O'Neill Forebay to Kettleman City	2.2	103.5	0.0	0.0	105.7
Kettleman City to Edmonston Pumping Plant	0.0	120.9	0.0	0.0	120.9
Edmonston Pumping Plant to Tehachapi Afterbay	0.0	0.2	2.5	7.9	10.6
Tehachapi Afterbay to Lake Perris	2.9	93.4	38.3	3.8	138.4
Subtotal	6.5	385.0	40.8	11.7	444.0
California Aqueduct Branches					
West Branch	9.2	9.1	6.4	7.2	31.9
Coastal Branch	0.0	15.0	97.9	2.7	115.6
East Branch Extension, Phase I	0.0	0.0	13.0	0.0	13.0
Total	15.7	417.5	218.4	23.2	674.8

Source: California Department of Water Resources, Bulletin 132-04, September 2005, page 8.

2.3 SWP OPERATIONS

Operations at Oroville-Thermalito Complex alter seasonal flows in the Feather River by retaining a portion of the winter and spring runoff for release during the summer and fall. Flood control operations begin in mid-September and end in June and help lessen extreme flood peaks down the Feather River.

Water released from Lake Oroville, and other water in the Delta, can be diverted into the North Bay and California Aqueducts through the Barker Slough and Banks Pumping Plants, respectively. State and Federal laws protect water rights, water quality, wetlands, anadromous and native fisheries, migratory birds, and threatened and endangered species in the Delta, which is both an estuary and a navigable waterway. These factors as well as operational factors limit the volume of water that the Department can divert from the Delta.

Once SWP water is pumped from the Delta, it flows down the California Aqueduct which is divided into a series of interconnected pools of water separated by gated check structures. This system of "mini-reservoirs" allows for control of water levels and flow in an aqueduct which is significant in length and minimal in slope.

Each year by the first of October, contractors submit monthly water requests to the Department for the subsequent calendar year. The Department then estimates the amount of water available to the contractors based on reservoir storages and hydrologic conditions and incorporates these monthly delivery requests in order to determine how much supply is available to be allocated for delivery to the contractors. Beginning in late December or January, contractors may submit updated weekly or monthly requests. The Department uses these requests to make water deliveries and adjust SWP operational plans. As winter progresses, the Department relies on updated rainfall and snowpack values to refine its total water supply availability projections, and allocations to contractors are adjusted accordingly.

2.4 SWP DELIVERIES

Hydrologic conditions vary widely within California—from place to place, from season to season, and from year to year. The amount of water available to the SWP fluctuates because of this variability, and because of flood management needs, capacity of SWP storage and conveyance facilities, changing weather-temperature conditions, water quality, and environmental requirements. These are all factors that affect the amount of water that can be delivered annually to SWP contractors.

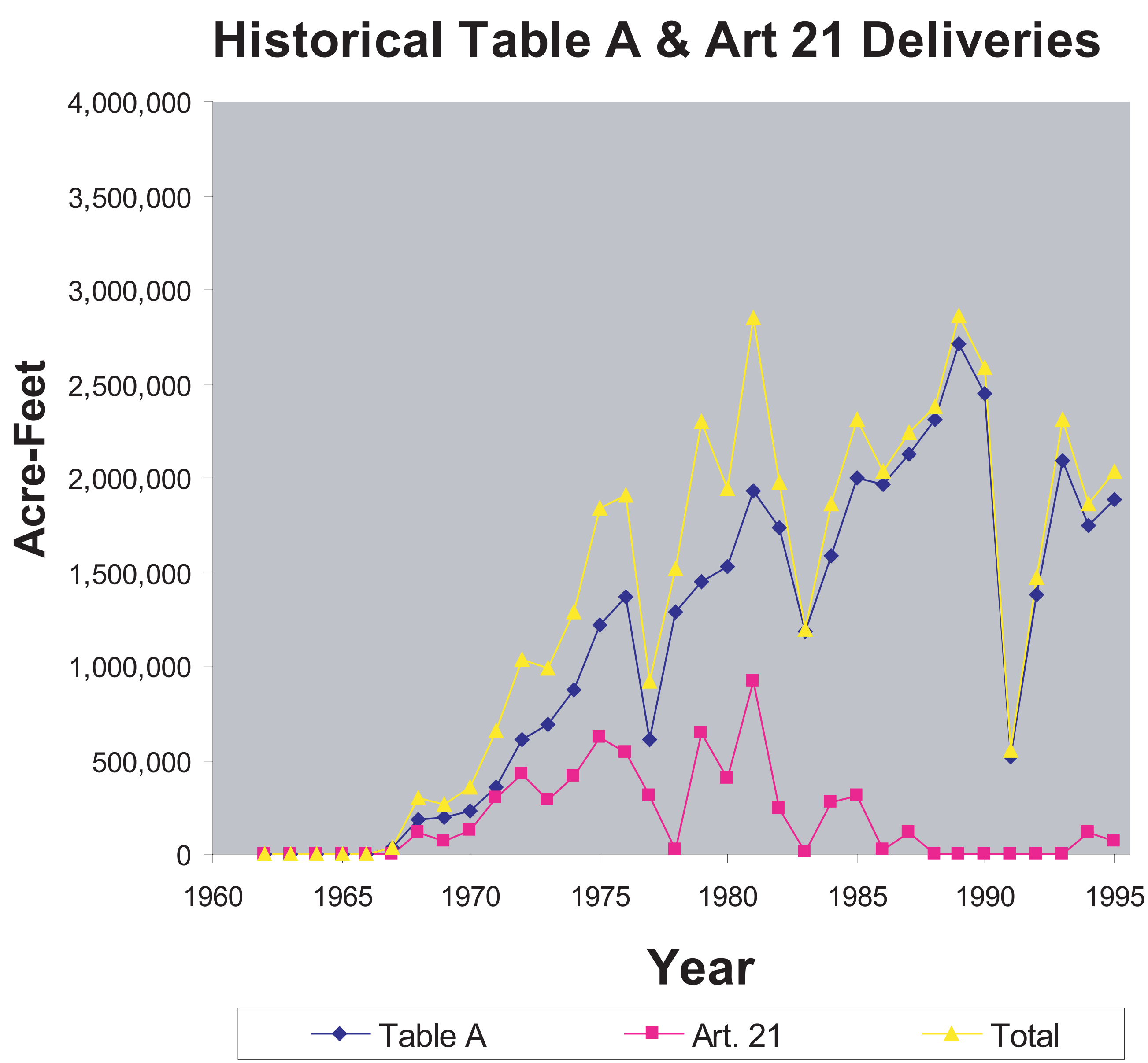
Table 2-3 and Figure 2-2 show SWP water deliveries and other water delivered to SWP contractors annually from 1970 to 1995, the years before the Monterey Amendment was implemented. Figure 2-2 shows a generally rising trend in deliveries that corresponds with increasing water demand in the contractors' service areas. The rising trend in deliveries was interrupted in years when the SWP had insufficient water to meet contractors' requests.

TABLE 2-3

HISTORICAL REQUESTS & DELIVERIES TO SWP CONTRACTORS

Year	Initial Requests (AF)	Final Allocation Percentage (M&I / Ag)	Total Deliveries[c] (AF)	SWP Water deliveries[a] (AF)	Other Water deliveries to SWP Contractors[b] (AF)
1970	322,600	100	390,066	365,841	24,225
1971	375,590	100	669,893	651,921	17,972
1972	594,094	100	1,041,537	1,034,123	7,414
1973	923,954	100	1,007,041	987,804	19,237
1974	1,146,650	100	1,307,291	1,286,528	20,763
1975	1,311,260	100	1,872,509	1,844,675	27,834
1976	1,488,470	100	1,933,221	1,924,687	8,534
1977	1,660,538	90 / 40	944,740	926,126	18,614
1978	1,828,624	100	1,551,058	1,501,844	49,214
1979	1,855,003	100	2,374,503	2,356,726	17,777
1980	1,880,386	100	1,962,139	1,931,166	30,973
1981	1,876,707	100	2,864,748	2,838,590	26,158
1982	2,342,576	100	2,019,920	1,990,695	29,225
1983	2,365,818	100	1,283,607	1,198,493	85,114
1984	1,563,620	100	1,887,185	1,859,636	27,549
1985	1,862,709	100	2,344,491	2,308,430	36,061
1986	2,364,193	100	2,066,373	2,040,206	26,167
1987	2,717,215	100	2,262,257	2,234,993	27,264
1988	2,625,328	100	2,391,916	2,376,373	15,543
1989	2,999,451	100	2,931,169	2,853,747	77,422
1990	3,218,790	100 / 50	2,802,630	2,732,241	70,389
1991	3,484,687	30 / 0	1,074,913	552,634	522,279
1992	3,630,618	45 / 45	1,573,723	1,472,610	101,113
1993	3,846,195	100	2,335,144	2,315,235	19,909
1994	3,841,096	50 / 50	1,959,254	1,861,976	97,278
1995	3,163,780	100	2,062,387	2,031,423	30,964

Notes:
a. Includes Table A, Article 12(d), Article 14(b), Article 21, wet weather water, Carryover water prior to Article 12(e), and Article 12(e).
b. Includes other non-SWP water delivered to SWP contractors.
c. Total water deliveries to SWP contractors.



Source: PB&J, 2006.

FIGURE **2-2**
SWP Water Delivered to Contractors 1970 - 1994

The Table A amounts in most SWP contractors' contracts reached a maximum in the early 1990's. However, many did not request those amounts until the early 2000's. As can be seen in Table 2-3, the SWP has had sufficient water to meet the contractors' requests in most years, but has had to reduce SWP water supplies during individual dry years or extended dry periods. Nonetheless, the Department has been able to make up some of the shortages through water purchases and transfers. In 1982 Legislation was passed which provided a means for the Department to acquire supplemental water supplies, and directed the Department to establish an ongoing program to facilitate voluntary exchange or transfer of water (CWC §480).

SWP contractors also supplement their water supplies through use of local surface or groundwater supplies, conservation techniques/incentives, or by the purchase of supplemental water supplies. Most water users in California live in areas that rely on multiple sources of water supply and local water providers have worked to improve the efficiency of local uses and their water management systems, as well as having drought contingency plans. Since its formulation the SWP was to be a source of supplemental water, not a sole source of water supply for the SWP contractors.

2.5 LONG-TERM WATER SUPPLY CONTRACT WATER SERVICE PROVISIONS PRIOR TO THE MONTEREY AMENDMENT

The Department has a long-term water supply contract with each of the 29 agricultural and municipal and industrial (M&I) water supply agencies. The contractors receive SWP water and retail it to customers or wholesale it to other water agencies. The M&I contractors are located throughout the state, while the agricultural contractors are located primarily in the San Joaquin Valley. The service areas of the contractors are shown in Figure 2-3.

The long-term water supply contracts were originally executed in the 1960's and are substantially the same for each contractor. Contract provisions reflected the Department's expectations at that time with respect to future water demand and the construction schedule of SWP components. The Department and the contractors made many amendments to the contracts to resolve disagreements and address matters that arose over a 30-year period, but most of the contract provisions remained substantially unchanged until the early 1990s.

The long-term water supply contracts outline how the contractors will repay all SWP capital and operating costs in return for the state's financing, constructing, operating, and maintaining the SWP and providing water service. The contracts are complex legal documents with multiple provisions, primarily covering water delivery and repayments.

The water delivery provisions cover a range of issues, including: the Department's obligation to take all reasonable efforts to complete the facilities necessary to deliver the water amounts contracted for in Table A of Article 6 (Article 6(c)); the allocation of supplies made available in excess of Table A supplies (Article 21); the allocation of Table A supplies in times of temporary shortage (Article 18(a)); the potential for reductions in Table A amounts in the event of a permanent shortage (Article 18(b)); and the potential for subsequent increases in Table A amounts if the permanent shortage situation was cured or lessened (Article 18(d)).

These provisions and several other important contract water delivery provisions are described briefly below--- a few of which were further amended by the Monterey Amendment. A long-term water supply contract for one of the contractors, as it was prior to being amended by the Monterey Amendment is contained in Appendix C.

NOTE: THE BOUNDARIES ON THIS MAP ARE ONLY A RENDERING, NOT AN EXACT DELINEATION OF THE STATE WATER PROJECT CONTRACTORS' SERVICE AREAS

Source: Department of Water Resources, "Management of the CA State Water Project", Bulletin 132-04.

PBS&J

FIGURE **2-3**

State Water Project and Water Supply Contractors' Service Areas

2.5.1 Article 6

Charges to SWP contractors include the costs of facilities for the conservation and development of a water supply and the conveyance of such supply to SWP service areas. "Conservation facilities" are those SWP facilities used to develop (or "conserve") water supply, and primarily consist of Oroville and San Luis Reservoirs. Costs for the planning, design, right of way, construction, and operation of the SWP conservation facilities are allocated among the contractors based on their proportionate share of total contractor "Table A amounts." Pursuant to Article 6(a), Table A lists quantities of water which are used as the basis for calculating costs for the storage and development of such supply (referred to as "Table A amounts" pursuant to the Monterey Settlement Agreement).

Table A amounts are also used in allocating among contractors the total SWP water supply that is determined to be available for delivery each year. Under the original contracts, the sum of the maximum Table A amounts of all contractors was not to exceed 4.0 million AF, and was equal to the planned minimum SWP yield of the SWP conservation facilities. This contractual maximum was subsequently increased to 4.23 million AF in 1964. As a result of the Monterey Amendment, in 1996 this contractual maximum was reduced to 4.185 million AF. This number of the contractual limit of total maximum Table A amounts was also referred to in the definition of "minimum SWP yield," which is the dependable annual supply of the SWP that was to be made available to SWP contractors. This yield was also sometimes called "firm yield," which for modeling purposes was based on the maximum amount of water that could be delivered on demand during the 1928-34 drought period taking into consideration certain shortage allocations. However, this planned minimum SWP yield was determined during the formulation of the SWP during the 1950's and 1960's and was based on the assumed amount of water the SWP could deliver upon completion of all anticipated SWP facilities. But all of the originally contemplated facilities have not been built and the existing SWP facilities and operations today are not what was envisioned over 50 years ago (see Chapter 3 for more history of the SWP). In recent years, for operations and planning purposes, the concept of firm yield has been replaced with water delivery reliability curves which show the likelihood of water deliveries by the SWP in any year given the range of historical hydrologic events.

The contractors and their Table A amounts in 1995, prior to execution of the Monterey Amendment, are listed in Table 2-4. The contractors with the largest Table A amounts are Metropolitan Water District of Southern California (MWDSC), a M&I contractor, and Kern County Water Agency (KCWA), primarily an agricultural contractor. Together these two water agencies represent about three-quarters of the total Table A amounts.

Table A amounts in each contractor's SWP long-term water supply contracts ramped up over time until they reached a maximum Table A amount. The contracts were structured to reflect increasing population and water demand, estimated by the Department, and sequential completion of SWP facilities. For most contractors, Table A amounts reached their maximum levels in the early to mid-1990s as shown in Table 2-5. In 1995, the sum of all contractor's Table A amounts was 4,163,066 AF. Currently, the sum of all contractor's maximum Table A amounts is 4,172,786 AF. The difference between this amount and the contractual maximum of 4.185 million AF discussed above is due to a 12,214 AF reduction in Santa Barbara County Flood Control and Water Conservation District's maximum Table A amount in the late 1980's.

Article 6(c) requires the Department to take all reasonable steps to complete the water supply facilities needed to deliver the water amounts contracted for in Table A. This promise of future action was provided because all parties recognized that the initial facilities then being

TABLE 2-4

TABLE A AMOUNTS (1995)

SWP Contractors	Table A Amount (AF)	Type
Butte County	1,200	M&I[1]
Plumas County FC&WCD	1,250	M&I
Yuba City	9,600	M&I
Napa County FC&WCD	9,780	M&I
Solano County WA	34,250	M&I
Alameda Co. FC&WCD, Zone 7	42,000	M&I[2]
Alameda County WD	42,000	M&I[2]
Santa Clara Valley WD	100,000	M&I
Oak Flat WD	5,700	Agricultural
Kings County	4,000	Agricultural
Dudley Ridge WD	57,700	Agricultural
Empire West Side ID	3,000	Agricultural
KCWA	1,153,400	Agricultural[3]
Tulare Lake Basin WSD	118,500	Agricultural
San Luis Obispo Co. FC&WCD	25,000	M&I
Santa Barbara Co. FC&WCD	45,486	M&I
Antelope Valley-East Kern WA	138,400	M&I[4]
Castaic Lake WA	54,200	M&I[5]
Coachella Valley WD	23,100	M&I
Crestline-Lake Arrowhead WA	5,800	M&I
Desert WA	38,100	M&I
Littlerock Creek ID	2,300	M&I[1]
Mojave WA	50,800	M&I
Metropolitan WDSC	2,011,500	M&I
Palmdale WD	17,300	M&I
San Bernardino Valley MWD	102,600	M&I
San Gabriel Valley MWD	28,800	M&I
San Gorgonio Pass WA	17,300	M&I
Ventura County FCD	20,000	M&I
Total	4,163,066	

Notes:
1. Municipal and Industrial
2. These contractors provide small amounts of water to agriculture.
3. Approximately 15 percent of KCWA's Table A amount is classified as municipal and industrial.
4. Approximately 25 percent of Antelope Valley-East Kern Water Agencies SWP water is used by agriculture.
5. 12,700 acre-feet of Castaic Lake WA's Table A amount was acquired from Devils Den Water District in 1992 and is classified as agricultural, but can be delivered for M&I usage.

TABLE 2-5

TABLE A AMOUNTS 1970-1995

Year	Upper Feather River	North Bay	South Bay	San Joaquin Valley	Central Coast	Southern California	Total
1970	700	0	114,200	202,000	0	5,700	322,600
1972	970	0	118,300	413,066	0	209,423	741,759
1974	1,230	0	122,400	460,650	0	597,920	1,182,200
1976	1,990	0	126,500	543,417	0	836,480	1,508,387
1978	1,850	0	130,700	635,900	0	1,049,584	1,818,034
1980	1,810	500	134,800	758,100	1,946	1,317,614	2,214,770
1982	1,970	800	139,200	876,500	5,626	1,550,449	2,574,545
1984	3,630	1,100	143,600	979,211	12,698	1,744,098	2,884,337
1986	4,190	1,400	148,100	1,091,946	28,210	1,983,890	3,257,736
1988	5,060	15,471	152,500	1,246,100	43,722	2,225,482	3,688,335
1990	6,040	28,190	160,900	1,313,450	70,846	2,500,600	4,079,666
1991	11,880	29,590	166,400	1,338,011	70,846	2,510,200	4,126,567
1992	11,920	32,010	171,900	1,342,300	70,846	2,510,200	4,138,816
1993	11,960	34,620	177,400	1,342,300	70,846	2,510,200	4,146,966
1994	12,000	37,215	182,000	1,342,300	70,846	2,510,200	4,154,201
1995	12,050	44,030	184,000	1,342,300	70,846	2,510,200	4,163,066

Source: California Department of Water Resources Bulletin 132-01.

constructed would not be sufficient, by themselves, to meet the contractors' maximum Table A amounts, and that even the supply provided by those initial facilities would decline as upstream, local water needs increased. The Monterey Amendment did not change this provision.

2.5.2 Article 15(a)/Article 41

Pursuant to Article 15(a) of the long-term water supply contracts, the Department has approved the sale or transfer of SWP water by a SWP contractor outside its service area. Additionally, Article 41 provides the Department with the authority to approve the assignment or transfers of any part of the contracts. Prior to the Monterey Amendment, the Department implemented various water management practices through SWP contract amendments, separate agreements, or case-by-case agreements. Those water management programs are discussed below.

Transfers

The Department has approved annual transfers of allocated Table A water to help SWP contractors increase their water management flexibility, especially during dry years. One such program involves a transfer from one SWP contractor to another, for the benefit of a landowner who farms in both contractors' service areas. For example, in 1990, Dudley Ridge WD received 161 AF from KCWA and 200 AF from Tulare Lake Basin Water Storage District (WSD) on behalf of two landowners who farm in both districts. This water management option provided Dudley Ridge WD, which relies solely on SWP supplies due to limited access to groundwater, the ability to supplement its low allocation of SWP water during the drought.

In 1992, the Department approved the permanent transfer of Devil's Den WD's entire 12,700 AF of Table A amount to Castaic Lake WA pursuant to Article 41. Castaic Lake WA purchased approximately 90 percent of the farmland comprising the Devil's Den WD service area. The Department's approval conditioned the Table A amount transferred to remain classified as agricultural Table A amount and to remain subject to Article 18(a) shortage provision dealing with agricultural-use cutbacks. However, Castaic Lake WA's SWP contract amendment allowed it to use the water in its service area for municipal water supply.

Exchanges

In order to achieve flexibility and reliability of both existing and future water supplies to SWP contractors, the Department had approved water exchanges prior to the Monterey Amendment. Exchanges can occur to help contractors re-regulate water supplies, and entail the Department's approval of the SWP operation needed to effect the action; for example, changing the location and timing of water delivery. For example, in 1989 the Department approved a transfer of up to 45,000 AF of KCWA's 1989 allocated Table A water to Westlands Water District, a CVP contractor, to help Westlands WD during a water-short year. Westlands WD was to return a like amount of its CVP water to KCWA during the following 10-year period.

An exchange has been on-going since 1998 between Mojave WA and Solano County WA. In years when Solano County WA has extra water supplies, it transfers a portion of its allocated Table A supply to Mojave WA for direct or in- lieu recharge of the adjudicated groundwater basin within Mojave WA's service area. For every two units of water that is delivered to Mojave WA, the Solano County WA will receive one unit back during a dry year from Mojave WA's supply of Table A water.

Storage Programs Outside Contractor's Service Area

In the late 1980s, the Department began considering requests for storage of a contractor's SWP supplies in groundwater banks outside its service area. In 1988, MWDSC began working on a program with CVP contractor Arvin-Edison WSD to store, through in-lieu and direct recharge means, a portion of MWDSC's SWP water supplies in the groundwater basin underlying Arvin-Edison WSD within Kern County. The benefits of the program were to provide some surface water supplies for about 40 percent of the land formerly irrigated by groundwater, ensuring that the remaining 60 percent of the land could be irrigated from a stabilized groundwater source, reducing groundwater pumping lifts, and providing a water management option for an M&I contractor. Public workshops were held in July 1989 on the program and discussions with the Department and KCWA continued in the early 1990s to resolve local concerns. Deliveries to the program began in 1997.

In 1990, as part of its program to determine the feasibility of operating several local elements of the Kern Water Bank, the Department delivered 150,000 AF from storage in San Luis Reservoir into storage in the Kern County groundwater basin. Under these demonstration programs, the water was delivered according to the terms of five separate agreements between the Department and KCWA and five of KCWA's member units: Semitropic WSD, Buena Vista WSD, Kern Delta WD, Rosedale-Rio Bravo WSD, and Berrenda Mesa WD. The water was recharged mainly through in-lieu (meaning the district used delivered SWP water in place of pumping groundwater, thereby crediting the groundwater that was not pumped as banked surface water), with some water directly recharged to the groundwater basins utilizing existing systems of canals and wells. MWDSC also participated in a groundwater program with KCWA and Semitropic prior to the Monterey Amendment. In 1993, MWDSC began delivering a portion of its SWP supply to Semitropic.

In 1991 the Department implemented two water storage programs in which SWP contractors could store local water supplies in SWP facilities, or could store allocated Table A water in facilities belonging to other SWP contractors. The Spring 1991 Storage Program provided a means for SWP contractors to store in SWP facilities water captured as runoff, pumped from groundwater supplies, or purchased from suppliers in contractors' local areas. Agencies participating in the program included two SWP contractors: Antelope Valley-Eastern Kern WA and San Bernardino Valley MWD. The Department provided to San Bernardino Valley MWD the storage of 3,600 AF of water diverted from the Santa Ana River and Mill Creek into the California Aqueduct, for use later in the year. San Bernardino Valley MWD also stored local water during 1992 and 1993. Antelope Valley-Eastern Kern WA utilized the program by purchasing additional water supplies from Tejon Ranch in the northern part of its service area, which was then introduced into the California Aqueduct for delivery to the southern part of its service area. The Fall 1991 Storage Program entailed the delivery of 200,000 AF of water from San Luis Reservoir to M&I contractors for storage in local reservoirs or groundwater basins. The water was made available from October through December 1991 due to high storage in SWP reservoirs.

Water Purchases

As a means of conserving and making the most beneficial use of available water supplies, the Department has arranged for purchases of water for SWP operations and deliveries to SWP contractors since 1977. In 1991, California began its first statewide water transfer program, the Drought Water Bank. Established through Executive Order by Governor Wilson in February 1991, the bank was administered by the Department. Of the 862,040 AF of water transferred to the 1991 water bank, 167,012 AF was used for environmental protection of the Delta and other environmental activities. Of the remainder, some was purchased on behalf of and delivered to individual contractors, some was for non-SWP water users, and some was retained as part of SWP water supply. Water was purchased from three sources: 1) surplus water in non-SWP surface reservoirs; 2) additional pumping of groundwater; and 3) fallowed agricultural lands. In 1992, the Department purchased almost 200,000 AF of water and approximately 222,000 AF of water in 1994, on behalf of individual SWP contractors and non-SWP water users.

From 1987-1992, the Department also purchased water from Yuba County WA in northern California on behalf of individual SWP contractors, or for augmentation of overall SWP supplies. For example during 1989, the Department purchased 200,000 AF of water from Yuba County WA's New Bullards Bar Reservoir (non-SWP water) on behalf of two SWP contractors, Santa Clara Valley WD and Tualre Lake Basin WSD. The total acquired by each contractor for delivery in 1989 and 1990 was 90,000 AF and 110,000 AF respectively. Of the 200,000 AF purchased, approximately 20 percent was applied to meet Delta water quality standards.

Conveyance of Non-SWP Water

The California Water Code requires the Department to transport water for others in SWP facilities when capacity is available to do so. The Department has conveyed non-SWP water for the SWP contractors in SWP facilities prior to the Monterey Amendment when sufficient capacity in the facilities was available. For example in 1990, a critically dry year, non-SWP water purchased from Yuba County WA was transported to three contractors: Tulare Lake Basin WSD, Santa Clara Valley WD, and Empire West Side Irrigation District (ID). The amounts conveyed using SWP facilities were 31,211 AF, 28,962 AF, and 2,031 AF respectively.

2.5.3 Article 18

The long-term water supply contracts contained provisions specifying how the Department should curtail water to contractors during a temporary shortage of water supply. A temporary water supply shortage was defined in Article 18 as one due to drought or other temporary cause, with the result that such supply was less than the total of all contractors' requests for Table A water for that year.

In the long-term water supply contract, Article 18(a) specified that reductions for agricultural use could not exceed 50 percent in any one year and up to an aggregate limit of 100 percent in any series of seven consecutive years before reducing water deliveries for other purposes. If additional reductions were necessary, Article 18(a) stated that further reductions were to be allocated proportionately among all contractors.

During the 1980's and early 1990's the Department did not always allocate water among the contractors based solely on Table A amounts. For example, some contractors did not yet have conveyance connection to the SWP, and many contractors did not request their full Table A amounts. Further, during this time, there was controversy among the Department, agricultural contractors, and M&I contractors regarding whether water should be allocated among contractors based on contractor requests or their Table A amounts. In the shortage years during this period, the Department reduced deliveries of water pursuant to Article 18(a) deficiency percentages, but did so in several years based on contractor requests and in 1994 (the year the Monterey Agreement was negotiated) based on Table A amounts. Since implementation of the Monterey Amendment, water supply is allocated among all contractors in proportion to each contractor's Table A amount for that year, up to each contractor's request for water, regardless of whether the water is for agricultural or M&I purposes. Therefore, any water supply shortage is now shared proportionately among all contractors.

Article 18(b) specified how the Department could reduce contractors' Table A amounts in the event of a permanent shortage of water supply due to a reduction in the minimum SWP yield, regardless of preventive or remedial actions taken by the Department, including lack of construction of sufficient additional conservation facilities. In the event the Department declared a permanent shortage under Article 18(b), the Department would proportionally reduce Table A amounts so that the sum of the Table A amounts equaled the reduced SWP minimum yield. The effect of an implementation of Article 18(b) would have been to reduce the number of years when agricultural contractors would have to take shortages in advance of urban contractors. It would also have reduced the amount of that shortage in years when Article 18(a) was applied to SWP deliveries. It would not, however, have altered the amount of water that the Department delivered to the contractors in the many years when more than the minimum SWP yield was available in the SWP system. Instead, such water would have been delivered to the contractors under Article 21.

Prior to the Monterey Amendment, Article 18(d) provided a means for the Department, with contractor consent, to revise Table A amounts upward after implementation of Article 18(b), if the Department judged that circumstances justified such a revision.

2.5.4 Article 21

The long-term water supply contracts have provided a means for the Department to offer to SWP contractors an additional water supply pursuant to Article 21. Prior to about 1987, when SWP demands were generally below 2 million acre-feet, a "surplus water" supply was offered first to SWP contractors who could use such a supply for agricultural use or groundwater replenishment, then to other SWP contractors for M&I uses. The contractors could schedule this water (often called "scheduled surplus water") for delivery throughout a year when the total

SWP water supply could fulfill the total of that year's annual Table A and when reservoir storage targets had been met.

The Department has additionally delivered “extra surplus water” (further renamed “unscheduled water”) when all of the following conditions have existed: the SWP's share of San Luis Reservoir is full, or projected to be full in the near term; other SWP reservoirs are full or at their storage targets, or the conveyance capacity to fill these reservoirs is maximized; the Delta is in "excess" conditions (see Chapter 7); Table A deliveries are being fully met; and the Banks Pumping Plant has spare capacity. “Unscheduled water” has been relatively unpredictable and has been as brief as a day or as long as several months, and had priorities similar to “surplus” water.

Shortly after initial execution of the long-term water supply contracts, Article 21 was amended to clarify that “surplus” water was to be offered to SWP contractors for agricultural use or groundwater replenishment, with the provision that "the State shall refuse to deliver such surplus water to any contractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor which would be dependent upon the sustained delivery of water in excess of the contractor's maximum annual entitlement." It was foreseen that once annual Table A amounts (i.e. "entitlement") reached their maximum amounts, the Department could not offer a supply of scheduled surplus water on a reliable basis. In 1974, this provision was placed in section (g) of Article 21, entitled "Restrictions on Deliveries." Additional constraints were added, such as the scheduling of a contractor's approved annual deliveries.

2.5.5 Carryover Water

SWP contractors have had the opportunity to carry over, or retain, a portion of their allocated Table A water in SWP conservation reservoirs from one year into the following year(s), subject to conservation reservoir operations including reservoir levels, filling cycles, and flood operations. Carrying over water allows the contractors to make the most beneficial use of allocated water by not losing such supply at the end of the year, and for contingency planning in case the next year is dry.

Article 12(e) Carryover

From 1977 through 1990, the Department approved annual requests by SWP contractors to carry over a portion of their allocated Table A water in SWP conservation reservoirs on a discretionary basis. This water management practice became the subject of a contract amendment in 1991. Article 12(e) was added to all but one of the long-term water supply contracts and provided contractors the opportunity to carry over Table A water for delivery in the first three months of the following year. Article 12(e) carryover water is limited to Table A water that a contractor scheduled for delivery in October through December which was not delivered due to a scheduled or unscheduled outage in the contractor’s service area, or due to a delay in planned pre-irrigation or groundwater storage activities.

Wet Weather Carryover

Pursuant to long-term water supply contract Article 7 (for South Bay contractors) and Article 45 (for San Joaquin Valley contractors: County of Kings, Empire West Side ID, Oak Flat WD, Tulare Lake Basin WSD), seven SWP contractors could acquire credits of deferred Table A water for future delivery if above-normal supplies of local water reduced their needs for SWP water, termed "wet weather water" by the Department. Subject to the provisions of the contract, the seven contractors could request increased deliveries in later years with wet weather water if there was available SWP water supply and if its delivery did not interfere with the delivery of allocated Table A water to other contractors. Additionally, the sum of a contractor's wet weather water and its annual Table A amount could not exceed its maximum Table A amount. Signers of the Monterey Amendment lost their balances of wet weather water and this contract provision. Although Empire West Side ID did not sign the Monterey Amendment, their maximum Table A amount was reached in the second year of deliveries, and subject to Article 45 provisions could not acquire wet weather credits.

2.5.6 Article 14(b)

Article 14(b) of the long-term water supply contract provides for allocated Table A water not delivered at any time during a year due to a Department discontinuance or reduction of deliveries for the purposes of repair, maintenance, and replacement of any of the SWP facilities, to be delivered at other times during the year or succeeding years. The delayed delivery is conditioned upon the ability of the Department to deliver that water, considering the Table A delivery schedules of all contractors. Under the Monterey Amendment, Article 14(b) was amended to provide for delivery in only one succeeding year, rather than in succeeding years.

2.5.7 Article 12(d)

Article 12(d) of the long-term water supply contracts provided a means for a contractor to take delivery of Table A water in succeeding years, which the Department was unable to deliver as a result of causes beyond its control. In 1977 as a result of the drought, contractors acquired up to 457,000 AF of Table A future delivery credits, which were taken in 1978 and 1979. In the Monterey Amendment, the Department and the contractors agreed to eliminate this provision and any outstanding Article 12(d) future delivery credits.

2.6 SWP FINANCING AND REPAYMENT

2.6.1 Financing

The major source of financing for construction of the SWP has been from two types of bonds: State general obligation bonds and revenue bonds. General obligation bonds are backed by the "full faith and credit" of the State and are normally paid back from general fund revenues. The State has sold approximately $1.58 billion of the $1.75 billion in general obligation bonds authorized by the Burns-Porter Act for the SWP. The Department is repaying the general fund for the principal and interest on those general obligations bonds from revenues it receives from billings to the SWP contractors and other sources.

To supplement general obligation bonds, the Department has sold revenue bonds under the authority of the 1933 Central Valley Project Act. These revenue bonds help finance projects such as power plants that and water facility additions and improvements. The principal and interest on the revenue bonds are paid by the Department from revenues received from SWP contractors and other sources. In addition to bonds, other capital funding sources have included tideland oil revenues (from the leasing of state lands for oil production, primarily off the Long Beach and Santa Barbara coastlines), investment earnings, legislative appropriations for recreation, federal flood control payments, and funds advanced by the SWP contractors.

2.6.2 Repayment

The 29 SWP contractors repay, with interest, about 94 percent of the cost for constructing and operating the SWP conservation facilities. All SWP contractors pay the same unit rate for constructing and operating the SWP conservation facilities, which are used to develop the SWP's water supply and include Lake Oroville, San Luis Reservoir, and a portion of the California Aqueduct from the Sacramento-San Joaquin Delta to San Luis Reservoir. The costs for the development of the conservation facilities are to be repaid by the contractors through the term of the repayment period (2035). Each contractor's annual charge for repayment of these costs is based on that year's unit rate multiplied by that contractor's Table A amount. Each contractor also pays its own "transportation charge," which repays the cost for constructing and operating the aqueduct facilities needed to deliver water to a SWP contractor's service area. Under the transportation charge, the more distant contractors pay a higher charge than those located near the water source in the Sacramento-San Joaquin Delta. In addition to repayment by SWP water contractors, the federal government has paid for a portion of the facilities built by the SWP for flood control.

Since plans to construct the SWP included recreational facilities, those facilities are financed in accordance with several legislative provisions including the Davis-Dolwig Act. The Davis-Dolwig Act declared that providing for the enhancement of fish and wildlife and for recreation in connection with the SWP benefits all the people of California, and that the costs attributable to such enhancement should be paid by them. Likewise, the floodwater storage space in SWP reservoirs is paid by the federal government.

3. HISTORY AND BACKGROUND

3. HISTORY AND BACKGROUND

3.1 BACKGROUND AND OVERVIEW

As described in Chapter 2, the multi-purpose SWP facilities deliver water supply under long-term water supply contracts to 29 public water agencies throughout the state, provide flood control, generate power, provide recreational opportunities, and enhance habitat for fish and wildlife. The original 1960's plan for the SWP was to build storage dams and reservoirs upstream of the Sacramento-San Joaquin Delta that, in conjunction with facilities to transport water across the Delta, could develop sufficient water to deliver a “minimum SWP yield” to all contractors, year-in and year-out. Only during certain few and infrequent critically dry years did the original plan expect deliveries to be less than the combined minimum SWP yield of approximately 4.2 million AF, in which case agricultural contractors would see some supply reductions. During the 1950’s and 1960’s when the SWP was in the formulation stage, the California Department of Water Resources (Department) conducted operations studies to determine drought-period supplies of SWP facilities, utilizing at that time the historical water supply to the Delta for the critical drought period of record, 1928-1934. By projecting future watershed uses and utilizing maximum Table A amounts, the Department determined that reductions to agricultural deliveries would aggregate 100 percent over a seven-year period.

As contractor demand increased, the expectation was that additional facilities would be built to meet the projected demand. SWP development unfolded substantially as planned through the 1960's and early 1970's. Major components of the SWP were built and put into service and the contractors took increasing quantities of water.

Circumstances began to change in the 1970's. Various concerns, including environmental, political and financial, prevented the development of some controversial components of the SWP, including the original plan for additional dams and reservoirs on north coast streams, and a Delta conveyance facility which included a canal (known as the Peripheral Canal) that would convey water around the eastern perimeter of the Sacramento-San Joaquin River Delta to the Banks Pumping Plant. In addition, more stringent environmental standards in the Delta to address the federal Endangered Species Act (FESA) listing of Delta smelt and winter-run Chinook salmon as well as more stringent water quality standards, limited the amount of water that could be diverted at the Banks Pumping Plant and reduced the capability to deliver the maximum water supply for which the SWP conveyance facilities had been designed and constructed to deliver.

Since the mid-1970s, the Department has added or modified conveyance facilities to the SWP (e.g. the Coastal Branch Aqueduct and the California Aqueduct East Branch enlargement and extension), and increased Banks Pumping Plant capacity, but otherwise the SWP’s facilities have remained essentially unchanged.

Through the mid-1980's, declining prices for agricultural commodities and increasing costs, including water costs, made farming uneconomical in parts of the SWP service area. Two member units of the KCWA, the largest of the SWP’s agricultural contractors, indicated that they might not be able to pay their shares of KCWA’s SWP charges after 1986. Some member units of KCWA wanted to permanently reduce their Table A amounts to decrease their payment obligations. The Department and the contractors discussed possible solutions including exchanges of Table A amounts with other agricultural users within the KCWA or permanent transfers to other SWP contractors. Several M&I contractors including Desert WA, Coachella Valley WD, and Castaic Lake WA expressed an interest in acquiring additional Table A amounts. A hearing before the California Water Commission was held in 1987 to discuss Table A transfers, but no action was taken.

Through the 1980's, with rising contractor demands and increased environmental needs, it became more difficult for the SWP to deliver the maximum contract water supplies. In addition, the drought of 1987–1992 sharply reduced SWP water supplies. During 1987, 1988, and 1989, supplies remained low through the early part of the year, and the Department initially applied the shortage provision (Article 18(a)) of the water supply contracts and imposed allocation reductions on deliveries for agricultural use. However, in each of these years, the water supply situation improved and the Department was eventually able to meet all contractors' requests, due to a combination of spring storms, reductions by some contractors of their requests, and the Department's purchase of water from Yuba County WA to supplement SWP water supplies. By November 12, 1987, the Department recognized the need for discussion with the contractors to address the reduction of water supplies and issued Water Service Contractors Council Memorandum No. 1878. In this memorandum, the Department compared the merits of four interpretations to the allocation procedure and then met with the SWP contractors to try to resolve the issue.

In 1990, SWP water supplies in the early part of the year were inadequate to meet contractors' requests and remained that way throughout the year. The Department imposed reductions in contractors' allocations in accordance with the provisions of Article 18(a), reducing allocations to agricultural contractors by 50 percent, before the M&I contractors' deliveries were reduced. In 1991, SWP supplies were extremely low and additional reductions beyond the initial cuts for agricultural contractors were required, with the agricultural contractors allocated no water from the SWP and the M&I contractors allocated 30 percent of their requests. Contractors are contractually required to make payments for water based on annual amounts listed in Table A of their water supply contracts, whether or not they receive water, so agricultural contractors had to make their full SWP payments during the drought even though they received reduced or no SWP water supply. Due to Department water purchases and programs, no SWP contractor went without any water deliveries from the SWP (see Table 2-3). In 1992 the Department reduced allocations to both agricultural and M&I contractors to 45 percent of their requests.

Additionally during this time frame, M&I contractors also recognized that the SWP supplies were not as dependable from year to year as they had expected, and began developing new local water supplies and projects that could more effectively use available SWP water when it was abundant, primarily in wet periods, to place in local groundwater storage. However, opportunities for such projects at that time were beginning to reach their limits within each contractor's service area and M&I contractors were seeking opportunities to store SWP water outside their service area.

The limited supplies available during the drought highlighted the differences between the views of the Department, M&I contractors, and agricultural contractors on interpretation and application of SWP contract shortage provisions. Contractors who suffered large reductions in their water deliveries for agricultural use felt that they were receiving an unfair share of the drought-related allocation reductions partly because all planned components of the SWP had not been completed. Their argument was that if the Department had built all originally planned components of the SWP, the minimum yield would have been greater, and their share of drought-related allocation reductions would be less. In addition, M&I contractors disagreed with the Department's approach to Article 18(a)'s shortage allocations which allocated supply shortages on the basis of contractors' requests (see Chapter 2). The M&I contractors believed that the State should allocate supplies on the basis of Table A amounts; they argued that their interpretation was consistent with the language of the contract. They also felt that since SWP supply facility costs are allocated among contractors on the basis of Table A amounts, the Department should allocate their fair share of any supplies from those facilities based on Table A amounts.

Some agricultural contractors argued that the Department's invocation of Article 18(b) would protect their interests (see Chapter 2 for a description of Article 18(b)). They insisted that the Department must invoke Article 18(b) to eliminate the SWP allocation disparities or face the possibility of judicially mandated Article 18(b) invocation. The M&I contractors argued that Article 18(b) was only applicable after all of the originally planned SWP facilities were built and the SWP could still not achieve its planned minimum yield. In addition, M&I contractors emphasized that invocation of Article 18(b) was unnecessary due to CALFED's likely future supply improvements and other actions that would increase minimum SWP yield. Both the agricultural and M&I contractors threatened lawsuits over this issue.

In order to resolve these disagreements, the Department and representatives of both the agricultural and the M&I contractors, including the Central Coast WA (a joint powers authority representing two contractors, San Luis Obispo County FC&WCD and Santa Barbara County FC&WCD), began mediated negotiations. Soon after negotiations began, the parties determined that the water allocation problem could not be addressed as a single issue. The parties adopted a broader approach to address water allocation and a number of other interrelated issues pertaining to the management and financing of the SWP. The broader issues that the negotiators addressed included development of measures to allow the contractors to more effectively manage the more limited SWP water supplies anticipated to be available to them in the future, development and use of the Kern Water Bank and issues pertaining to restructuring rates.

In 1994, the Department and SWP contractor representatives agreed to a set of 14 principles to modify the long-term water supply contracts. The principles became known as the Monterey Agreement because the final negotiations occurred in Monterey, and were released to the public on December 16, 1994. The principles fell into three general categories that matched the following goals of the negotiations:

Goal 1- Increase reliability of existing water supplies. The agreement called for the Department to adopt new rules to allocate water and allow contractors to turn back allocated water into an annual pool for purchase by other SWP contractors.

Goal 2 - Provide stronger financial management. The agreement satisfied this goal by creating a general operating fund-consistent with utility practices-and, after SWP repayment of the California Water Fund, adjusting contractor billings to eliminate certain excess collections of revenues. The adjusted contractor billings would be accomplished through rate reductions to M&I contractors and would allow creation of a trust fund for agricultural contractors to stabilize payments in water-short years.

Goal 3 - Increase water management flexibility, providing more tools to local water agencies to maximize existing facilities and supplies. To accomplish this goal, the Department would:

- transfer control of the Kern Fan Element property to agricultural contractors,
- provide for permanent sales of Table A amounts to M&I contractors,
- provide more flexibility in using certain reservoirs for local use,
- implement a simpler program for interruptible water supplies,
- provide new administrative rules for transportation of non-SWP water to contractors, and
- provide rules for storing water outside a contractor's service area.

CEQA requires that lead agencies disclose the potential environmental impacts of a proposed project to decision-makers before approving a project. The Department and the SWP contractors who participated in the Monterey negotiations determined that implementation of the Monterey Agreement could potentially cause significant environmental impacts, and therefore, the proposed project should be analyzed in an EIR. The Central Coast WA (CCWA) served as the Lead Agency for CEQA compliance purposes. A program EIR was completed and certified by the CCWA in October of 1995. Following certification of the EIR in 1995, the Department and the contractors incorporated most of the principles into a contract amendment named the Monterey Amendment. All SWP contractors except Plumas County FC&WCD and the Empire West Side ID signed the Monterey Amendment. These two contractors continue to receive SWP water from the Department in accordance with the SWP contracts in effect before the Monterey Amendment.

After completion and certification of the EIR, the Planning and Conservation League (PCL) filed a lawsuit challenging the adequacy of the EIR. It also argued that the Department should be Lead Agency for the preparation and certification of the EIR. The Citizen's Planning Association of Santa Barbara and Plumas County FC&WCD later joined the action as plaintiffs. The trial court ruled that the CCWA improperly served as the Lead Agency, but that the EIR was adequate and the CEQA violation was not prejudicial.

The plaintiffs appealed to the California State Court of Appeal. In September 2000, the court ruled that the Department should have served as Lead Agency and that the EIR was inadequate because it failed to analyze invocation of Article 18(b) of the then-existing SWP contracts as a no-project alternative in *Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892 (PCL v DWR)*. Having ordered the Department to prepare a new EIR, the court found it unnecessary to adjudicate the plaintiffs' other CEQA objections to the EIR. The Court of Appeal remanded the case to the trial court, ordering it to issue a writ of mandate vacating the certification of the 1995 EIR and to retain jurisdiction over the action until the Department, as the CEQA Lead Agency, certifies an EIR in accordance with CEQA standards and procedures, and the Superior Court determines that the EIR meets the substantive requirements of CEQA.

Following the PCL v DWR ruling, the Department, the SWP contractors, and the plaintiffs engaged in settlement negotiations. The parties executed a Settlement Agreement in May 2003 (see Appendix D).

The Settlement Agreement set forth a process for including the plaintiffs and contractors in the development of the new EIR and set forth some specific items that should be included in the content of the new EIR. It also established a process for mediation of CEQA issues raised by either the plaintiffs or contractors and limited the issues that plaintiffs could appeal based on the mediation. The Settlement Agreement also dealt with a number of other issues discussed below.

Environmental documentation had been prepared on a number of Table A transfers before PCL v. DWR determined that the Monterey Agreement EIR was inadequate and required decertification of the EIR. This environmental documentation for the Table A transfers relied upon the Monterey Agreement EIR. There were no challenges within the statutory time period to all of the transfers except a transfer to Castaic Lake WA. At the time of the Settlement Agreement negotiations, the Castaic Lake WA transfer was the subject of litigation in the Los Angeles County Superior Court pending a remand from the District Court of Appeal.[1] The plaintiffs and the contractors had differing opinions on whether this transfer was valid or final.

The Department transferred ownership of the Kern Fan Element property to the KCWA as part of the Monterey Amendment. In 1995, Dudley Ridge WD, KCWA on behalf of Improvement District No. 4, Semitropic WSD, Tejon-Castac WD, Westside Mutual Water Company, and Wheeler Ridge-Maricopa WSD joined to form the Kern Water Bank Authority (KWBA). Subsequently, the KCWA transferred ownership of the property to the KWBA. Plaintiffs were concerned that there might be environmental impacts caused by the transfer of the Kern Fan Element property that had not been identified. They were also concerned that the Kern Fan Element lands could be used or transferred for purposes other than a water bank and wanted to place restrictions on use or transfer of these lands. The contractors wanted assurance that the effectiveness or validity of the Kern Fan Element property transfer would not be challenged.

Plumas County argued that the county's share of the benefits of the SWP was disproportionate with its monetary and environmental costs. It argued that water supplied to Plumas and its shortages should be based on water supply from Lake Davis. It also argued that watershed restoration projects could indirectly result in benefits to the SWP water supply.

Plaintiffs wanted the Department to formalize its process for reviewing transfers of Table A amounts in order to assist the contractors in developing transfer proposals and the public in participating in the review of such transfers. They wanted to make sure that such reviews would include consideration of environmental impacts in the service areas of the seller and buyer, on the SWP and on the Delta and areas of origin. They also wanted to provide for public participation in SWP-wide amendments and contract amendments to transfer entitlements between SWP contractors.

Plaintiffs argued that the use of the term "entitlements" in the SWP contracts was misleading because it implied that the SWP could deliver its full minimum yield. They argued this could lead cities and counties that obtained water from the SWP to overestimate the amount of water available to support urban growth. The plaintiffs' were also concerned that "entitlement" would be misinterpreted to mean that the SWP could and was legally required to deliver full Table A amounts. They also wanted improved dissemination of information on the SWP's delivery reliability.

ENDNOTES

1. Since that time, CLWA has prepared and certified a new EIR on its transfer of 41,000 AF of Table A amount, which became the subject of new litigation brought by PCL and the California Water Impact Network (CWIN) in Los Angeles County Superior Court.

4. PROPOSED PROJECT

4. PROPOSED PROJECT

4.1 INTRODUCTION

The proposed project is the Monterey Amendment and the Settlement Agreement. This chapter outlines the project objectives and describes the provisions of the Monterey Amendment and the Settlement Agreement.

4.2 PROJECT LOCATION

The proposed project is primarily an administrative action and does not have a specific physical location. However, the effects of the administrative action could be felt over large areas of the state. For the purposes of the assessment of impacts, the project area consists of the SWP facilities, the Sacramento-San Joaquin Delta, rivers tributary to the Delta, the SWP service area, the SWP contractor service areas (see Figures 2-1 and 2-3) and any other areas that could be influenced by the proposed project. Site-specific portions of the project include watershed areas of Plumas County, the Lake Davis area of Plumas County, Castaic Lake and Lake Perris, and the Kern Fan area of Kern County. The latter includes areas outside SWP contractor service areas where SWP water could be stored for later use within the service area.

4.3 PROJECT OBJECTIVES

The overall objective is to resolve the underlying issues that led to the Monterey Amendment and implement the Settlement Agreement.

4.3.1 Objectives of the Monterey Amendment

Specific objectives of the Monterey Amendment are to:

- Resolve conflicts and disputes among SWP contractors regarding water allocations and financial responsibilities for SWP operations;
- Restructure and clarify procedures for SWP water allocation and delivery during times of shortage and surplus;
- Reduce financial pressures on agricultural contractors in times of drought and supply reductions;
- Adjust the financial rate structure of the SWP to more closely match revenue needs;
- Facilitate water management practices and water transfers that improve reliability and flexibility of SWP water supplies in conjunction with local supplies;
- Resolve legal and institutional issues related to storage of SWP water in Kern County groundwater basins, and in other areas;

The Monterey Agreement provided in Principle 13 that the proposal was an integrated package. Contractors had to choose to participate in all the provisions of the Agreement or none. In other words, the Monterey Amendment resulted from a package deal of negotiated concessions that required achieving all of the above objectives in order to settle significant disputes among the contractors. Both agricultural and M&I contractors gave up rights or benefits to make the agreement work. Both had to also gain new rights or benefits or there would have been no reason to sign the agreement. The reasons for signing may have been different for each contractor, but each one had to believe that it would benefit from the changes as a whole.

4.3.2 Objectives of the Settlement Agreement

Specific objectives of the Settlement Agreement are to:

- Communicate SWP supply reliability information to SWP contractors and local planning jurisdictions and clarify related SWP contract language;
- Enhance public review of SWP contract amendments and public participation in environmental review;
- Provide assurances regarding finality of certain Table A transfer and transfer of title to the Kern Fan Element land and assurances regarding environmental protection of Kern Fan Element lands.
- Increase SWP watershed enhancement activities in Plumas County and improve Plumas County's access to SWP water.
- provide funding to plaintiffs to implement the Settlement Agreement including watershed restoration projects

While the Settlement Agreement does not have the same language that the Monterey Agreement had with regard to an integrated package, the Settlement Agreement also was a package deal of negotiated concessions that required achieving all of the above objectives in order to settle significant disputes between the parties. Thus to fulfill the intent and purpose of the project, it is essential that all of the above objectives are achieved.

4.4 PROJECT DESCRIPTION – MONTEREY AMENDMENT

The changes to the SWP contracts from the Monterey Amendment can be grouped according to the six basic objectives identified previously. Table 4-1 shows the relationship between individual articles in the Monterey Amendment and the six objectives. These objectives correspond to five elements that modify the long- term SWP water supply contracts. These five areas are listed and discussed below:

- Changes in the procedures for allocation of Table A water and surplus water among the SWP contractors;
- Approval to permanent transfers of 130,000 acre feet and retirement of 45,000 acre-feet of SWP long-term water supply contracts' Table A amounts;
- Transfer of property known as the "Kern Fan Element property" in Kern County;
- Water supply management practices; and
- Restructured rates.

The Monterey Amendment to the long-term water supply contract is included in Appendix C. Article 1 of the contract includes definitions of terms used in the contract.

TABLE 4-1

SUMMARY OF MONTEREY AMENDMENT

Article	Summary	Relationship with Objectives
1(d)	Modifies the definition of "Contractor" to include an assignee.	0
1(k)	Revises the definition of "Minimum SWP Yield" to reduce the SWP's estimated "Minimum SWP Yield" from 4.23 to 4.185 MAF/yr.	1,2
1(hh)	Expands definition of "Water System Facilities" to include a SWP Corporation Yard and SWP Operation Center.	0
1(jj)	Adds definition for "Interruptible water."	0
1(kk)	Adds definition for "Non SWP water."	0
1(ll)	Adds definition for "Monterey Amendment."	0
4	Adds reference to the new Article 55 (and deletes reference to Article 18(b)) as an additional item for consideration of options for continued service.	0
7(a)	Provides the State's approval for amendments of Table A amounts subject to financial feasibility of SWP facilities.	1
12	Changes title to "Priorities, Amounts, Times and Rates of Deliveries."	0
12(a)(2)	Clarifies that Department review and modification of contractor delivery schedules be made consistent with Article 18.	0
12(d)	Deletes provision that provided for delayed delivery of scheduled Table A water in a year or the succeeding year when the State is unable to deliver water as a result of causes beyond its control.	1
12(f)	Adds priorities for delivery of Table A, interruptible, non-SWP; deferred Table A, and Table A water that was stored pursuant to Articles 12(e) and 56.	1,2
14(a)	Expands conditions which justify curtailed deliveries to include outages or reductions in capability of facilities outside of State's control or unusability of SWP water due to an emergency affecting the SWP facilities.	2
14(b)	Limits delivery obligation to a year or the succeeding year in provision that provides for delayed delivery of scheduled water which, under the terms of Article 14(a), the State did not deliver.	2
16(a)	Reduces sum of maximum Table A amounts to 4.185 MAF.	1
18(a)	Clarifies that shortage provisions apply to conditions due to any cause whatsoever instead of only temporary causes.	2
	Revises allocation procedures to be based on each contractor's annual Table A amount with no initial reduction to agricultural contractors when SWP supplies are less than the contractors' requests.	1,2,3
	Specifies that if a contactor is allocated more water than it requested, then the excess water be reallocated among the other contractors.	1,2,3
18(b)	Deletes provision for reducing Table A amounts when there is a threatened permanent shortage of the types specified.	2
18(d) & (e)	Eliminates references to deleted Article 18(b).	0
21	Changes title from Surplus Water to Interruptible Water Service. Eliminates provisions for scheduled "surplus" water and renames "unscheduled water" as "interruptible water." Cancels all water credits owed to contractors pursuant to Article 12(d), wet weather water agreements and Article 14(b) water accumulated prior to 1995. Specifies delivery conditions for interruptible water.	1,2
	Specifies that interruptible water allocation follow procedures set forth in Article 18(a).	1,2
	Confirms that power charges for delivery of interruptible water equal to Table A water.	1,2
22(j)	Confirms that reductions in payments under the new Article 51 do not affect the conservation portion of the water system revenue bond financing costs.	4
24(b)	Provides that the State will not retroactively calculate capital costs for Table A amount transfers or Table A amount changes.	4
24(g)	Confirms that reduction in payments due to Article 51 do not affect the transportation portion of the water system revenue bond financing costs.	4
25(d)(3)	Confirms that off-aqueduct costs will apply to non-SWP water as well as SWP water.	4
50(j)	Confirms that reductions in payments due to Article 51 shall not affect water system revenue bond financing costs.	4

TABLE 4-1

SUMMARY OF MONTEREY AMENDMENT

Article	Summary	Relationship with Objectives
51	Establishes a General Operating Account to provide funds during an emergency or cash flow shortage.	4
	Establishes a State Water Facilities Capital Account to pay capital costs of the State Water Facilities for which neither general obligation bond or revenue bond proceeds are available.	4
	Calculates annual financial needs to determine charge reductions or supplemental billings.	4
	Determines and apportions charge reductions.	4
	Provides for reviews financial requirements.	4
	Establishes an Agricultural Rate Management Trust Fund.	4
52	Specifies that State convey land for proposed Kern Fan Element to KCWA.	6
	Transfers 50 percent of SWP water remaining in storage from the 1990 Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program to KCWA.	6
	Specifies that the State retain remaining 50 percent of SWP water (approximately 42,828.5 acre-feet).	6
	Specifies that any other Kern Water Bank demonstration program water remain as SWP water	6
53	Specifies that agricultural contractors make available up to 130,000 acre-feet of Table A amounts (and related conveyance capacity rights) for permanent transfer from agricultural contractors to urban contractors or non-SWP contractors.	1,3,5
	Specifies that other individual SWP contractors may transfer Table A amounts among themselves in addition to the 130,000 acre-feet.	5
	Specifies that KCWA's agricultural Table A amount permanently decrease by 40,670 acre-feet and Dudley Ridge WD's by 4,330 acre-feet of its Table A amount.	1,3,5
54	Allows specified contractors participating in the repayment of Castaic Lake and Lake Perris to withdraw water in excess of approved SWP deliveries up to specified limits for up to five years from Castaic Lake (MWDSC, Castaic Lake WA, and Ventura County FCD) and Lake Perris (only MWDSC) Withdrawal and replacement delivery schedules subject to Department approval.	5
55	Confirms contractors may use SWP transportation facilities to transport non-SWP water to their service areas and to interim storage outside their service areas for later delivery to their service areas.	5
	Confirms power charges for delivering non-SWP water equal to Table A water.	5
56	Allows contractors to store SWP water outside their service areas for later use within its service area.	5
	Sets no limit on storage of SWP water in groundwater storage facilities and sets limits on storage of SWP water in surface storage facilities.	5
	Makes excess storage capacity in SWP surface conservation facilities available to requesting contractors for as long as capacity is available. Requests be included with preliminary water delivery schedule submitted by contractors pursuant to Article 12(a).	5
	Allocates available storage capacity on the basis of Table A amounts if storage requests exceed available excess storage capacity.	5
	Establishes a Turnback Pool program to allow sale of excess allocated Table A water during a year by contractors to other SWP contractors who do not elect to store SWP water in SWP storage facilities in that year and do not elect to carry over water from the prior year pursuant to Article 12(e).	5
	Clarifies that the article's provisions do not prevent a contractor from participating in bona fide exchanges of SWP water for use outside the contractor's service area if the State consents to the exchange.	5
General	State to administer water supply contracts of contractors that do not sign the Monterey Amendment so that such contractors are not affected adversely or beneficially by the Monterey Amendment of other contractors.	0

TABLE 4-1 SUMMARY OF MONTEREY AMENDMENT		
Article	**Summary**	**Relationship with Objectives**
General	If any part of the Monterey Amendment or if the conveyance of the Kern Fan Element property to KCWA is determined to be invalid or unenforceable, the Monterey Amendments of all contractors and the contract for transferring the Kern Fan Element property from the State to KCWA are of no force and effect.	0

Notes:
Relationship to Objectives
0. Contract language changes not linked to a particular objective (i.e. definitions, references, etc).
1. Resolve conflicts and disputes among SWP contractors regarding water allocations and financial responsibilities for SWP operations.
2. Restructure and clarify procedures for SWP water allocation and delivery during times of shortage and surplus.
3 Reduce financial pressures on agricultural contractors in times of drought and supply reductions.
4. Adjust the financial rate structure of the SWP to more closely match revenue needs.
5. Facilitate water management practices and water transfers that improve reliability and flexibility of SWP water supplies in conjunction with local supplies.
6. Resolve legal and institutional issues related to storage of SWP water in Kern County groundwater basins, and in other areas.

4.4.1 Changes in the Department's Allocation of Table A Water and Article 21 Water

The Monterey Amendment revised the temporary shortage provision in Article 18(a) that specified an initial reduction of supplies for agricultural use when requests for SWP water exceeded the available supply. The revised Article 18(a) specifies that whenever the supply of Table A water is less than the total of all contractors' requests, the available supply of Table A water is allocated among all contractors in proportion to each contractor's annual Table A amount.

The Monterey Amendment eliminated Article 18(b) of the SWP long-term water supply contracts. Article 18(b) addressed permanent water shortages that might occur if the Department was for any reason, including inability to develop sufficient additional conservation facilities, unable to prevent a reduction in the minimum SWP yield of the SWP (4.23 million AF per year). The reason for eliminating Article 18(b) is not described in the Monterey Agreement. However, once the agriculture first shortage provision was eliminated, it would no longer be needed to protect agricultural water users from excessive shortages. With the elimination of the agricultural first shortage provisions, it no longer mattered whether a shortage was a temporary one or a permanent one, since the allocation of the available supply would be the same in either situation.

The Monterey Amendment amended Article 21 by eliminating the category of "surplus water" which was available for scheduled delivery. The amendment to Article 21 also included the elimination of the restriction on Article 21 supply to preclude deliveries for uses that "would tend to encourage the development of an economy … which would be dependent upon the sustained delivery of surplus water." The Monterey Amendment also renamed "unscheduled water" as "interruptible water". The Department now refers to interruptible water as "Article 21 water," which is the term used in this EIR. Article 21 water is similar to the pre-Monterey unscheduled water and is highly unpredictable and unreliable. For signers of the Monterey Amendment, Article 21 water is allocated when the SWP's share of San Luis Reservoir is full, or projected to be full in the near term; other SWP reservoirs are full or at their storage targets, or the conveyance capacity to fill these reservoirs is maximized; the Delta is in "excess" conditions (see Chapter 6); Table A deliveries are being fully met; and the Banks Pumping Plant has spare capacity. It is no longer prioritized for agricultural use or groundwater replenishment; nonetheless, a large part of this water supply is still delivered to the San Joaquin Valley for such purposes.

Prior to the Monterey Amendment, the Department charged the contractors the same power charges for pumping surplus water as it did for pumping Table A water. The revised Article 21 formalized the Department's power charges for pumping Article 21 water. Furthermore, Article 21 together with Paragraph 28 of the Monterey Amendment eliminated: (1) Article 12(d), which provided a later delivery of allocated Table A water which was deferred as a result of causes beyond the State's control, and any Article 21(d) delivery credits; and (2) wet weather water and wet weather credits which some contractors accumulated when local conditions in their respective service area were so wet that their need for SWP water was reduced. A change to Article 14(b) limited the Department's delivery obligation when it did not deliver scheduled Table A water due to an SWP outage to delivery only through the next year based on specified conditions. Article 12(d), 14(b), and wet weather water are discussed in detail in Chapter 2.

The result of these contractual changes is that the Department now allocates Table A and interruptible water among contractors in proportion to annual Table A amounts without consideration of whether the water would be used for M&I or agricultural purposes and without consideration of contractor's actual Table A demand. Agricultural and M&I contractors share any reductions in deliveries or opportunities for Article 21 water in proportion to their annual Table A amounts.

4.4.2 Permanent Transfers and Retirement of Table A Amounts

The Monterey Amendment added Article 53 to the long-term water supply contracts. Article 53 provides that agricultural contractors, namely County of Kings, Dudley Ridge WD, Empire West ID, KCWA, Oak Flat WD, and Tulare Lake WSD, will make available 130,000 acre-feet of Table A amounts and related transportation capacity, for permanent transfer to M&I contractors or non-contractors on a willing buyer and willing seller basis. KCWA is responsible for making available any portion of the 130,000 acre-feet not previously made available under this article by the other agricultural contractors. In addition, Article 53 required KCWA and Dudley Ridge WD to permanently retire a total of 45,000 acre-feet of Table A amount. This Table A amount retirement reduced the amount in the long-term water supply contracts that the sum of the maximum annual Table A amounts of all contractors was not to exceed from 4,230,000 acre-feet to 4,185,000 acre-feet.

4.4.3 Transfer of Kern Fan Element Property in Kern County

In the 1980s, the Department purchased approximately 20,000 acres of land overlying a ground water basin in Kern County for the purpose of developing the property as one part of a larger imported-water groundwater banking project called the Kern Water Bank (KWB). As envisioned, the KWB would consist of a series of "elements," which would be geographically separate banking projects that would be operationally integrated. The largest of these elements, the Kern Fan Element (KFE), for which efforts to develop occurred first, was to be followed by a number of local elements developed with several water districts in Kern County. The Department planned to develop the property it purchased into the KFE of the KWB, and the property is referred to as the KFE property. There were many questions about the feasibility of developing the property as a SWP project and whether required local approval could be obtained, as described in further detail in Appendix E, Section I.A. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately lead to the Department halting feasibility studies and design work on the KWB.

The Monterey Amendment added Article 52 to the long-term water supply contracts. Article 52 required the Department to convey the KFE property including all fixtures to KCWA. In addition, as part of the ongoing development of groundwater banking programs during the 1980s/1990s, the Department had stored SWP water as part of the Berrenda Mesa Demonstration Program and had acquired groundwater for the SWP through the La Hacienda Water Purchase Program. Article 52 also required that one-half of such water in these two programs be relinquished to KCWA. Article 52 also provides that, subject to KCWA approval, other SWP contractors may be provided access to, and use of the property, for groundwater storage and later recovery for delivery to their service areas.

4.4.4 Water Supply Management Practices

Articles 54, 55, and 56 of the Monterey Amendment contain provisions intended to provide more consistency and greater flexibility in SWP contractors' use of existing SWP storage and conveyance facilities and to promote groundwater banking, conjunctive use of local and SWP water sources, and earlier and more efficient use of excess allocated Table A water.

Contractors' use of Castaic Lake and Lake Perris – Flexible Storage

Article 54 provides contractors that were participating in repayment of capital costs of Castaic Lake and Lake Perris the flexibility to withdraw SWP water in amounts from the reservoirs in addition to their allocated SWP water. The MWDSC, Ventura County FC&WCD, and Castaic Lake WA participate in the repayment of capital costs for Castaic Lake and may collectively withdraw up to 160,000 AF from the reservoir. MWDSC, Coachella Valley WD and Desert WA participate in the repayment of capital costs for Lake Perris, but through agreement, MWDSC is the only contractor that can withdraw water from Lake Perris, and it may withdraw up to 65,000 AF from the reservoir. A contractor that withdraws water is required to replace that water within five years after the withdrawal occurs. If it fails to do so, the Department would replace the water in the sixth year, or as soon as possible thereafter, with SWP water otherwise approved for delivery to that contractor. The participating contractors are to cooperate with each other to minimize adverse impacts to each other. The withdrawal and replacement delivery schedules are subject to approval by the Department. Borrowing and replacement of Castaic Lake and Lake Perris water by contractors is referred to as flexible storage.

Transport of non-SWP Water

Article 55 provides contractual terms for the conveyance and delivery of non-SWP water to the contractors' service areas through SWP facilities when sufficient capacity is available. Prior to the Monterey Amendment, the Department had conveyed and delivered non-SWP water for requesting contractors on a number of occasions, as described in Chapter 2. This article specifies details regarding delivery and costs of delivery. Non-SWP water may be conveyed to the contractor's service area, or to a location outside the contractor's service area for storage and later delivery to the contractor's service area. This article clarifies that the power charges for conveying non-SWP water are the same as for conveying Table A water. Article 12(f), which was also added by the Monterey Amendment, sets priorities for the conveyance of both SWP water and non-SWP water.

Storage in SWP facilities and outside Contractors' Service Areas

Prior to Monterey the Department approved storage of water in both SWP facilities and in storage areas outside contractors' service area on a case by case basis (see discussion of this in Chapter 2). Article 56(a) provides that the SWP contractors may store SWP water outside their service area for later use within their service area and specifies details regarding such storage.

Under Article 56(c), contractors may store SWP and non-SWP water in SWP conservation reservoirs, and SWP water in non-SWP surface reservoirs or groundwater banks outside their service areas. Article 56(c) limits the amount of SWP water that can be added to storage each year in surface reservoirs outside contractors' service areas but places no limit on the amounts of water that can be stored in groundwater banks outside contractors' service areas. Storing contractor water in SWP conservation reservoirs is allowed when the storage capacity is not needed by the SWP for SWP purposes. The most likely location of available SWP storage capacity is San Luis Reservoir. Contractors submit requests to the Department to carry over allocated Table A water from one year to the next and the Department allocates available storage among requesting contractors in proportion to their annual Table A amounts, as specified in the article.

As the Department needs the storage space for SWP purposes, the carryover water stored for contractors reverts to SWP supply at the same rate the Department would otherwise have been able to fill that storage.

Turnback Pool

Article 56(d) establishes a program that allows a contractor with more allocated SWP water than it needs in any year to offer its excess Table A water for sale to other contractors or to the Department. Contractors having excess allocated Table A water can turn back water to the SWP turnback pool program early in the year for sale to other SWP contractors for their use, or to the Department for SWP carryover storage for the following year. In return, that contractor is paid a rate equal to a percentage of the Delta water rate. Previously, when a portion of a contractor's allocated Table A water was not taken, it became available, either late that year or the following year, for other SWP purposes including reallocation to other contractors with unmet needs. The turnback pool enables contractors to be partially compensated for unused allocated Table A water purchased by other SWP contractors and increases the likelihood that any excess allocated water would be available to other contractors early enough in the year to be managed and used more efficiently.

4.4.5 Restructured Rates

Article 51 created a General Operating Account and a State Water Facilities Capital Account. The General Operating Account is to provide funds needed to meet obligations under the Burns-Porter Act in the event of emergency or cash flow shortages. Initial deposits into this account came from revenue bond reserves that were no longer required by revenue bond covenants and that would otherwise have been credited to the contractors. The State Water Facilities Capital Account is established to pay capital costs of the State Water Facilities for which neither general obligation bond nor revenue bond proceeds are available.

Each year the Department calculates the annual statement of charges for each SWP contractor and determines the finance needs of the SWP for the following year. The contractors receive a reduction to their charges if the revenues exceed the payments for general obligations bonds, revenue bonds, maintenance, operation, and replacement costs, reimbursement of the California Water Fund, and deposits into the State Water Facilities Capital Account.

Article 51 requires the Department to review the financial requirements of the State Water Resources Development System every five years. The first review was conducted in 2001. Article 51 also establishes an Agricultural Rate Management Trust Fund. The amount of any reduction in charges for agricultural contractors is instead deposited by them into this trust fund. These deposits are then available to these agricultural contractors to help meet their SWP financial obligations in years in which they receive less than their requested annual Table A amounts for that year. In addition, the trust fund will help Tulare Lake Basin WSD meet its financial obligations in years when its irrigable land is flooded.

4.5 PROJECT DESCRIPTION - SETTLEMENT AGREEMENT

Major provisions of the Settlement Agreement can be grouped according to the five basic objectives identified previously. Table 4-2 shows the relationship between individual provisions in the Settlement Agreement and the five objectives. These objectives correspond to six elements as discussed below. The complete Settlement Agreement is contained in Appendix E. In addition to establishing a process for involving plaintiffs and contractors in the development of the new EIR on the Monterey Amendment, the Settlement Agreement provides the following:

- The Department will communicate SWP water reliability information by substituting the term "Table A amount" for "entitlement" in the SWP contracts and by implementing new procedures for disclosure of SWP delivery reliability;
- The Department will provide for better public review of major SWP actions by issuing guidelines on the Department's review of permanent transfers of Table A and issuing principles for a public participation process in negotiations for certain SWP long-term water supply contract amendments, including Table A transfers;
- Certain Table A transfers under the Monterey Amendment are recognized as final.
- Assurances regarding the KFE property transfer are provided including confirmation that title to the KFE property was retained by the Kern Water Bank Authority (KWBA). Restrictions on the use of the KFE lands were included and the Department was required to analyze some operations of the KWBA-developed Kern Water Bank in an independent study;[1]
- Certain measures are implemented pertaining to Plumas, including provisions relating to the Plumas Watershed Forum, funding for watershed restoration and other purposes and amendment of Plumas' SWP contract with respect to access to SWP water;
- The Department will provide funding to the plaintiffs for multiple purposes including watershed restoration;

4.5.1 Communicate SWP water reliability information

Substitution of the Term "Table A Amount" for "Entitlement" in the SWP Contracts

Section VII.B requires the Department to replace the term "entitlement" in the SWP contracts with the term "Table A amount." (see Appendix A to the Settlement Agreement).

New Procedures for Disclosure of SWP Delivery Reliability

Section VII.D requires the Department to prepare a report every two years describing the reliability of SWP water deliveries under a range of hydrologic conditions. The report must be sent to all SWP contractors, city and county planning departments, and all regional and

TABLE 4-2

SUMMARY OF MONTEREY SETTLEMENT AGREEMENT

Article	Summary	Relationship with Objectives
I	Provides definitions of terms used in settlement agreement	0
II	Authorizes on an interim basis the administration and operation of the SWP and Kern Water Bank in accordance with the Monterey Amendment, the Settlement Agreement, and Attachment A Amendments on an interim basis until court order is issued discharging writ of mandate	1,2
III	Describes content of new EIR and procedures for preparing it	0
III D Attachment E	Recognizes that certain permanent Table A transfers already completed under the Monterey Amendment are final	3
III E	Recognizes that the KCWA-Castaic Lake WA 41,000 acre-feet Table A transfer is subject to pending litigation in the Los Angeles County Superior Court	0
III F	Acknowledges that Kern Water Bank is operating under Kern Environmental Permits which were entered into based on an addendum to the Monterey Agreement EIR. The parties agree not to challenge the Addendum and Kern agrees not to rely on the Addendum for new projects. Requires an independent study by the Department regarding the impacts related to the transfer of the KFE property, and the development and operation of the Kern Water Bank	3
IV A & B	Specifies payments to Plumas County and establishes a forum and program to undertake watershed improvements with emphasis on Feather River watershed	4
IV C & D	Limits Plumas County's exposure to cutbacks during SWP shortages and commits the Department to confer with Plumas County regarding potential reoperation of SWP facilities to increase benefits to Plumas County	4
IV E & F	Relates to future relations between the Department and Plumas County and resumption of Plumas County's SWP payments	4
V	Title of KFE lands remains with KWBA. Limits use of KFE lands including prohibiting development of 490 acres that can be developed under HCP	3
VI	Provides plaintiffs with funding	5
VII A	Prevents the Department or contractors from approving any new projects that rely on the 1995 EIR	2
VII B Attachment A	Provides for execution of an amendment to the SWP contracts that defines several terms including "Annual Table A Amounts," "Maximum Annual Table A Amount, and "Minimum SWP Yield", replaces use of the term "entitlement" with "Annual Table A Amount" and requires the Department to prepare and distribute a report of SWP delivery capability every two years. Deletes a specific amount for the Minimum SWP Yield. Amendment adds language to the bottom of Table A explaining that Table A not be interpreted to mean that the State is able to deliver those amounts in all years	1
VII C	Provides for filing settlement agreement with court	0
VII D Attachments B, C, D	Requires the Department to adopt new policies, procedures, and guidelines that clarify procedures for review of SWP contract amendments and establish principles for public participation in SWP contract negotiations	2
VII E, F, G, H, I, J, K, & L	Specifies various legal procedures	0
VIII	Calls for arbitration to establish attorney's fees	0
IX	Specifies procedures for dispute resolution	0
X	Specifies various legal procedures	0

Notes:
Relationship with Objectives
0. Not linked to a particular objective.
1. Communicate SWP supply reliability information to SWP contractors and local planning jurisdictions, and clarify related SWP contract language.
2. Enhance public review of SWP contract amendments and public participation in environmental review.
3. Provide assurances regarding finality of certain Table A transfers and transfer of title to the KFE land and assurances regarding environmental protection of the KFE lands.
4. Increase SWP watershed enhancement activities in Plumas County and improve Plumas County's access to SWP water.
5. Provide funding to plaintiffs to implement the Settlement Agreement including watershed restoration projects.

metropolitan planning departments in the SWP service area. In addition, the Department must prepare guidelines to assist M&I contractors in integrating SWP delivery reliability information into local agencies' urban water management plans (see Appendix B to the Settlement Agreement).

4.5.2 Greater Public Review of Major SWP Actions

Guidelines for the Review of Permanent Table A Transfers

Section VII.D requires the Department to issue guidelines to describe the process for the Department's review of proposed permanent transfers of Table A amounts. The purpose of the guidelines is to help contractors develop transfer proposals and facilitate the Department's review of the transfer proposals, and to assist the public in participating in that review (see Appendix C, Settlement Agreement).

Principles for Public Participation Process in Contract Amendment Negotiations

Section VII.D requires the Department to provide for public review SWP contract amendments and amendments to transfer Table A amounts. It requires public notice and an opportunity to observe negotiations and to comment in each negotiating session (see Appendix D to the Settlement Agreement).

4.5.3 Recognize Certain Permanent Table A Transfers

Certain permanent Table A transfers from KCWA that were completed under the Monterey Amendment are recognized as final permanent Table A transfers in Attachment E of the Settlement Agreement. These transfers of Table A water had occurred after the signing of the Monterey Agreement and before the completion of the Settlement Agreement negotiations and amounted to 70,781-acre feet of Table A transferred. The transfers are listed in Table 6-3. Project-level environmental documentation had been prepared on all the transfers. There were no challenges within the statutory time period to these transfers. Another transfer of 41,000 AF from Wheeler Ridge-Maricopa to Castaic Lake WA in 1999 was challenged within the statutory time period for challenging CEQA cases. At the time of the Settlement Agreement negotiations, the Castaic Lake WA transfer was the subject of pending litigation in the Los Angeles County Superior Court pending a remand from the District Court of Appeal.[2]

4.5.4 Assurances regarding Kern Fan Element Lands

Title and restrictions on use

The Settlement Agreement specifies that the KWBA retains title to the KFE property and that KWBA can operate and administer the KFE lands including the water bank, but the Settlement Agreement places certain restrictions on the uses of the lands. If the KWBA determines that use of the lands as a water bank becomes legally or economically infeasible, and the SWP has no other use for the lands or if the Department and KWBA are unable to agree on terms and conditions for such SWP use, then the KWBA may transfer or develop the lands for another purpose, provided that no unmitigable adverse environmental impacts result from the new use. Any net proceeds of land transfer or development will be used by the KWBA for water management purposes. The KWBA developed a Habitat Conservation Plan (HCP) that specifies how the lands over the water bank must be managed to protect endangered species.

The HCP allows a 490-acre parcel of land to be developed for commercial purposes. The Settlement Agreement prohibits commercial development on the 490-acre parcel.

Independent Study

The Settlement Agreement requires the Department, as part of this EIR, to independently study the impacts of the transfer, development, and operation of the water bank KWBA developed on the KFE property (now known as the Kern Water Bank) in light of the Kern environmental permits that have been issued.

4.5.5 Plumas County Issues

Support for a Watershed Forum and Funding for Plumas County to Pursue Watershed Restoration

Funding of up to $8 million is provided to Plumas County FC&WCD, primarily for watershed improvements for the mutual benefit of Plumas and the SWP in the Feather River watershed, and for other district-related purposes, to be disbursed with input from a watershed forum composed of representatives of Plumas, the Department, and SWP contractors.

Amend Plumas County FC&WCD's SWP Contract with Respect to access to SWP Water

The Department is required to offer Plumas County FC&WCD a contract amendment to its long-term water supply contract which will include the Department's agreement that the allocation of Table A water to Plumas County FC&WCD be determined based on local hydrologic conditions at Lake Davis. The Department will develop strategies for modifying the operations of SWP facilities to provide greater water supply, recreational, and environmental benefits in Plumas County.

4.5.6 Provide Funding to the Plaintiffs for Multiple Purposes Including Watershed Restoration

The Settlement Agreement provides funding of $5.8 million to the plaintiffs for multiple purposes, including watershed restoration projects, follow-up actions arising from the settlement, and technical studies.

4.6 REQUIRED PERMITS AND APPROVALS

No permits or approvals are required for the proposed project. Operation of the SWP is subject to ongoing environmental regulations including for water quality and endangered species protection.

ENDNOTES

1. The Kern Fan Element property and the Kern Water Banks lands, referenced in the Settlement Agreement, are the same real property (see Settlement Agreement, I.R.).

2. Since that time, CLWA has prepared and certified a new EIR on its transfer of 41,000 AF of Table A amount, which became the subject of new litigation brought by PCL and the California Water Impact Network (CWIN) in Los Angeles County Superior Court.

5. METHODS

5. METHODS

5.1 INTRODUCTION

This chapter describes the methods used in the analysis of the proposed project and its alternatives. Topics discussed include:

- Period of analysis;
- Environmental setting and baseline for analysis of proposed project;
- Analytical approach; and
- Analytical methods.

5.2 PERIOD OF ANALYSIS

The California Department of Water Resources (Department) analyzed the effects of the proposed project over a period extending from 1995 until 2020. The Monterey Amendment was executed in 1995 but was not implemented until the following year. The Department chose 1995 as the baseline year for the analysis because it represents conditions just prior to implementation of the Monterey Amendment. The Department chose the year 2020 as the end point for the analysis because many other Department programs and planning processes underway in 2003 were using 2020 as their planning horizon. Use of 2020 as the planning horizon is appropriate for analysis of the Monterey Amendment because it is expected that the SWP contractors will need their maximum Table A amounts before that date. Furthermore, it is expected that the Settlement Agreement will be fully implemented by 2020. Also, use of 2020 as the planning horizon does not require excessive speculation.

5.3 ENVIRONMENTAL SETTING AND BASELINE FOR ANALYSIS OF PROPOSED PROJECT

The environmental setting, the condition without the proposed project, typically serves as the baseline condition against which the environmental effects of the proposed project are compared. CEQA Guidelines, Section 15125 (a), state “An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published or, if no notice of preparation is published, at the time environmental analysis is commenced.” Furthermore, the CEQA Guidelines state “This environmental setting will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant.”

An important use of the baseline conditions is to provide a basis for the decision-making body to decide what action to take after considering the environmental impacts of the action and other factors. In the case of the Monterey Amendment, a decision to continue the current implementation of the Monterey Amendment, continue the current implementation with mitigation measures, or revert to one of the possible no project alternatives requires consideration of the impacts of the proposed project as compared to the appropriate baseline.

When, as with the Monterey Amendment and the Settlement Agreement, the proposed project is the modification of an ongoing operation, in this case the SWP, the baseline will be the continuation of the ongoing, unmodified operation into the future (CEQA Guidelines 15126(e) (3) (A)). Thus, the baseline for the Monterey Plus EIR will be continued operation of the SWP in accordance with the long-term water supply agreements but adjusted to include events that are expected to occur over time that are not related to Monterey Amendment and the Settlement Agreement. The events expected to occur between 1995 and 2020, unrelated to the proposed project, include increased population growth and urban development in California, increased demand for water in the SWP service area and elsewhere and certain Table A transfers. The Table A transfers include transfers from MWDSC to Coachella Valley WD and Desert WA pursuant to the Colorado River Quantitative Settlement Agreement and transfers from Tulare Lake Basin WD to other SWP contractors. Table 5-1 provides a listing of the basic assumptions underlying the baseline and proposed project scenarios.

Use of the baseline for assessment of the proposed project is complicated by the fact that parts of the proposed project were implemented between the time the Monterey Amendment was executed (1995) and the issuance of the NOP for the Monterey Plus EIR (2003). The pre-Monterey Amendment condition no longer exists with respect to SWP operation and with respect to the physical and regulatory environments.

A question arises with respect to the baseline against which the environmental impacts of the proposed project should be judged: should the baseline be 1995 conditions before any parts of the Monterey Amendment were implemented, or should it be 2003 conditions? Both have advantages and disadvantages, but neither is ideal. The use of 2003 conditions as the baseline is conventional practice and technically simple, and it provides a relatively current basis for decisions by the Department on implementation of an alternative.

However, use of the 2003 conditions would not account for the impacts of those elements of the Monterey Amendment that have already been implemented. The use of 1995 conditions as the baseline provides an especially useful basis for analyzing the environmental impacts of the proposed project over the past decade, although it involves the potentially difficult task of characterizing environmental conditions that prevailed almost a decade ago. Consequently, the Department used two time periods to evaluate the proposed project:

- 1995 conditions serve as the baseline for analysis of direct impacts of the elements of the Monterey Amendment that have already been implemented; and
- 2003 conditions serve as the baseline for analysis of direct impacts of the Settlement Agreement and also provide a frame of reference for agency decision-making.

The impacts of the proposed project for the period 1996 through 2003 are part of the historical record. The impacts of the proposed project from 2003 into the future are known through the date of completion of this EIR, but are not known beyond that time and must be projected. The impacts for the two periods are considered individually for most impact categories, and the total change from 1996 to 2020 is evaluated to disclose the full impacts of the proposed project as compared to the 1995 baseline and to enable a determination of the significance of the impacts.

CEQA requires that the impacts of the proposed project be compared to the existing or baseline condition. For this EIR, the baseline is a scenario that begins in 1995 and extends to 2020. The condition that existed in 1995 was adjusted as described above to include events that are expected to occur over time unrelated to the Monterey Amendment or the Settlement Agreement. Alternatives to the proposed project can also be compared to the baseline scenario

TABLE 5-1

ASSUMPTIONS FOR BASELINE AND PROPOSED PROJECT SCENARIOS

Issue	1995	2003		2020	
	Baseline	Baseline	Proposed Project	Baseline	Proposed Project
Level of development and SWP demands	1995	2003	2003	2020	2020
Allocation of SWP water	Per 1995 SWP contract provisions.	Same as 1995 Baseline.	Per Monterey Amendment provisions.	Same as 1995 Baseline.	Same as 2003 Proposed Project.
Table A amount changes and transfers	1995 Table A amounts.	a. Changes as specified in 1995 SWP contracts, and b. Other changes and transfers unrelated to the Monterey Amendment that occurred between 1996 and 2003 (including 22,273 AF of Table A transfers from TLBWSD to various agencies).	a. Same as 2003 Baseline, and b. Those Monterey Amendment transfers that occurred between 1996 and 2003 (114,000 AF from KCWA to various M&I agencies).	a. Same as 2003 Baseline, and b. Other changes and transfers unrelated to the Monterey Amendment that occurred since 2003 or are anticipated to occur by 2020 (including 100,000 AF of Table A transfers from MWDSC to Coachella Valley WD and Desert WA).	a. Same as 2020 Baseline, and b. 130,000 AF Monterey Amendment transfers from KCWA to various M&I agencies (including 114,000 AF that occurred between 1996 and 2003, and the remaining 16,000 AF).
Table A amount retirements	None.	Same as 1995 Baseline.	45,000 AF of Table A amounts retired (40,670 AF by KCWA and 4,330 AF by Dudley Ridge WD).	Same as 1995 Baseline.	Same as 2003 Proposed Project.

TABLE 5-1

ASSUMPTIONS FOR BASELINE AND PROPOSED PROJECT SCENARIOS

Issue	1995	2003		2020	
	Baseline	Baseline	Proposed Project	Baseline	Proposed Project
Water supply management practices	Practices that occurred or were approved under the 1995 SWP contract, including: • Conveyance in SWP facilities of non-SWP water for SWP contractors. • MWD participation in Semitropic Groundwater Banking Program.	Same as 1995 Baseline.	Monterey Amendment provisions for: • Storage outside contractors' service areas, including: o Expanded carryover storage in SWP conservation reservoirs. o Storage in groundwater banking programs. • Turnback Pool. • Transfer of Kern Fan Element property for local development as water bank. • Flexible storage use at terminal reservoirs Castaic Lake and Lake Perris.	Same as 1995 Baseline.	Same as 2003 Proposed Project.

as well as to each other so that the decision-makers and the public can evaluate the comparative merits of the alternatives.

5.4 ANALYTICAL APPROACH AND METHODS

The Department used two basic methods to analyze the effects of the proposed project and its alternatives on SWP operations and deliveries to SWP contractors. The methods were historical data analysis and modeling using CALSIM II. CALSIM II is a planning model developed to simulate SWP and CVP operations in the Central Valley of California.

Because the Monterey Amendment was implemented in 1996, post-Monterey Amendment SWP operations and deliveries to individual contractors in the period 1996 to 2005 are a matter of historical record. Consequently, it is possible to examine Monterey Amendment-induced changes in SWP operations by reviewing the historical record[1]. Monterey Amendment-induced changes in SWP operations were determined by comparing historical deliveries with the Monterey Amendment in effect with deliveries that would likely have been made under the baseline scenario.

Although the historical analysis provides useful information, its value is limited by the fact that the period between 1996 and 2004 or 2005 is representative of only a small portion of the hydrologic record. To evaluate the effects of the Monterey Amendment over a wider range of hydrologic conditions, CALSIM II was used to examine the effects of the Monterey Amendment on total annual deliveries to SWP contractors under 2003 and 2020 conditions. CALSIM II estimates of total annual deliveries were post-processed to estimate deliveries to individual contractors under 2003 and 2020 conditions.

Several studies were made using the two basic analytical methods, historical data analysis and CALSIM II modeling. The studies are listed, together with their purposes, in Table 5-2. The studies themselves are contained in various appendices as shown in Table 5-2.

The goal of Study No. 2, No. 3 No. 4, and No. 5 was the identification and characterization of Monterey Amendment-induced changes in deliveries, which would then result in hydrologic changes (changes in river flow or Delta outflow). The hydrologic changes are the primary factors in determining the environmental impacts of the proposed project and its alternatives on other environmental elements such as terrestrial biology and fisheries resources. The goals of Study No. 6 and No 7 was to estimate the effects of the Monterey Amendment on Joint Point of Diversion (cooperative use of SWP and CVP Delta pumping facilities) and on the Environmental Water Account.

Proposed project-induced changes in SWP operations determined as described above are detailed in Chapter 6. Chapter 7 contains a description of the environmental impacts of the proposed project including its impacts on river flow and Delta outflow. Chapter 11 contains a description of alternatives to the proposed project, including no project alternatives, and a description of the environmental impacts of the alternatives. Most, but not all, of the environmental impacts of the proposed project and its alternatives, stem from proposed project- or alternative-induced changes in SWP operations.

TABLE 5-2

ANALYTICAL STUDIES

Study	Method	Purpose
Study No.1 - Historical Allocation Analysis (Appendix I)	Analysis of historical operations data from 1995-2005	Estimate allocation of Table A water to SWP contractors if Monterey Amendment had not been implemented 1996-2005
Study No. 2 – Historical Operations Analysis (Appendix K)	Analysis of historical operations data from 1996-2004	Estimate effects of most Monterey Amendment provisions on SWP deliveries and Delta pumping 1996-2005
Study No. 3 – Historical Operations Analysis (Appendix K)	Analysis of historical operations data from 1996-2004	Estimate effects of water supply management practices on SWP deliveries and Delta pumping under 2020 conditions
Study No. 4 - Water Allocation Modeling (Appendix F)	CALSIM II and post-processing of CALSIM II output	Estimate deliveries of water to SWP contractors as a result of altered water allocation procedures and transfers and retirements of Table A amounts under 2003 and 2020 conditions
Study No. 5 - River/Delta Flow Analysis (Appendix H)	CALSIM II and spreadsheet analysis	Estimate effects of altered water allocation procedures and transfers and retirements of Table A amount on river flow and Delta outflow under 2003 and 2020 conditions
Study No. 6 - JPOD Analysis (Appendix L)	Historical operations analysis, CALSIM II and spreadsheet analysis	Estimate effects of Monterey Amendment on Joint Point of Diversion (Cooperative use of CVP and SWP Delta pumping facilities).
Study No. 7 – Environmental Water Account Analysis (Appendix M)	Analysis of historical operations from 1996-2004	Estimate effects of Monterey Amendment on Environmental Water Account

5.5 ANALYSIS OF PROPOSED PROJECT ELEMENTS

SWP Allocations, Table A Retirements, and Table A Transfers

Effects on Water Allocations

The altered allocation method and Table A retirements and transfers were analyzed as one combined action. In the historical allocation analysis (Study No. 1), the total amount of Table A water actually allocated in 1996-2005 was tabulated for the proposed project and then adjusted to restore Table A retirements and reverse certain Table A transfers as appropriate to construct the baseline and alternative scenarios. The resulting allocations were then recomputed for each SWP contractor using the actual base amount of Table A water allocated by the Department in each of the historical years, redistributed in accordance with the allocation rules specific to the baseline scenario and each alternative. The difference between the proposed project and baseline scenarios provides an indication of the effects of the altered allocation method and the Table A retirements and transfers on Table A allocations.

The CALSIM II model and post-processing of CALSIM II output (Study No. 4) were used to estimate the effects of the altered allocation method and the Table A retirements and transfers on deliveries to individual contractors under 2003 and 2020 conditions. More information on the CALSIM II model is provided in Section 5.6.

Effects on River Flow and Delta Outflow

The altered allocation procedures, and Table A retirements and transfers cause a change in the proportion of total deliveries to SWP contractors that are made north and south of the Delta. The change in the proportion of deliveries north and south of the Delta could affect flow in the Feather and Sacramento rivers and outflow from the Delta. Changes in flow in the rivers and in Delta outflow could affect water quality and aquatic life. For the period from 2003 to 2020, the changes in river flow and Delta outflow were analyzed in two parallel ways: (1) using the CALSIM II model and analyzing its output; and (2) by tabulating the allocation differences between alternatives in a spreadsheet format and comparing the differences to the total flow in the affected rivers upstream of the Delta.

CALSIM II is a planning model developed to simulate SWP and CVP operations in the Central Valley of California. The model operates on a monthly time step and is typically run using a 73-year period of historical hydrologic record as input data. Other input data reflects certain assumptions regarding water demand, facility size and operating constraints, Delta environmental and flow constraints, and other variables. In this EIR, CALSIM II was initially used to estimate SWP deliveries, river flows, and reservoir storage levels in typical wet, above normal, below normal, dry and critically dry years under conditions prevailing or expected to prevail in 1995, 2003, and 2020.

Actual day-to-day operations of the SWP and CVP depend on continuous collection of, and response to, real-time data. Thus actual daily project operations will differ from the monthly simulations provided by CALSIM II or any other similar model.

Any proposed project-related changes in river flow upstream of the Delta are due to allocation changes and Table A transfers affecting the five SWP contractors located north of the Delta (Plumas County FC&WCD, Butte County, Yuba City, Napa County FC&WCD, and Solano County WA). The pre- and post-Monterey Amendment Table A amounts of these contractors are relatively small and represent less than three percent of the total Table A amounts for the 29 contractors. Thus, proposed project-related changes in deliveries to these contractors would be expected to have only small effects on river flow.

CALSIM II models operations of the SWP and CVP where SWP diversions typically range from two to four million AF and Delta inflows typically range from 10 to 20 million AF. The model is a useful tool for evaluating the effects of operational changes or new facilities on total SWP deliveries but it cannot accurately predict the effects of minor shifts in deliveries to individual contractors and the consequent small changes in river flow. In this case, the changes in river flow are a fraction of one percent of total river flow.

For the reason noted above, the Department decided to use a spreadsheet tabulation analysis rather than CALSIM II to evaluate the effects of the proposed project on river flow (Study No. 5). The spreadsheet tabulation analysis provides a more direct and intuitive basis for comparing the effects of the allocation changes, Table A retirement, and Table A transfers on flow in the Feather and Sacramento rivers. No impacts are computed for the American River in this latter analysis, as there are no SWP service areas in the American River watershed and the allocation changes and Table A transfers and retirements have no direct effect on the operation of the American River. The spreadsheet tabulation analysis shows the differences in diversions upstream of the Delta as a result of the Table A retirements, transfers, and different allocation formulas to be extremely minor in all months of all year types. This is the method used in this EIR to provide the basis for characterizing the impacts of these actions on the potentially affected rivers upstream of the Delta and on Delta inflow for this element of the proposed project and the alternatives.

Kern Fan Element Transfer

Under the proposed project, the Kern Water Bank was developed as a locally owned facility on land transferred from the Department as part of the Monterey Amendment. The creation of the Kern Water Bank increased the total water storage capacity south of the Delta and could affect Delta outflow if the water placed into storage in the Kern Water Bank would otherwise have flowed out of the Delta. Analysis of historical data was used to examine this possibility (Study No. 2).

Under certain no project alternative scenarios, it was assumed that the Department would use the property to develop a state owned water bank that would provide storage for SWP water. The CALSIM II model was used to examine the effects of a state owned water bank in the Kern Fan Element property, with a capacity of 350,000 AF in 2003 and 500,000 AF in 2020 on SWP deliveries (Study No. 4).

Water Supply Management Practices

Article 56 out-of-service-area water storage programs have increased the amount of water the contractors have stored both in groundwater banking programs and as extended carryover in San Luis Reservoir. In addition, the turnback pool established under Article 56 has shifted deliveries among contractors and Article 54 enables flexible storage in Castaic Lake and Lake Perris. These water supply management practices have the potential to increase pumping from the Delta, increase deliveries to the contractors and reduce Delta outflow. Article 54 could also have local effects at Castaic Lake and Lake Perris.

Effects on Delta

Historical operations data from the period 1996 through 2004 were used to evaluate the effects of the water supply management practices and the Table A retirements on Delta pumping (Study No. 2). Monterey Amendment-induced changes in SWP operations were examined by comparing historical deliveries with deliveries that would likely have been made if the Monterey Amendment had not been implemented and then assessing how the delivery changes would have affected storage in San Luis Reservoir and Delta pumping. The potential impact on the Delta was evaluated by determining when (by month and year) additional water was pumped from the Delta at the Banks Pumping Plant compared to the baseline scenario. The estimated effects of the water supply management practices and Table A retirements on Delta outflow were used to determine likely effects on water quality and fisheries. The analysis also used to address whether any other diverters would have been affected by Monterey Amendment-induced changes in Delta pumping.

Future impacts of the water supply management practices were determined by repeating the historical operations study but using assumptions more reflective of future conditions (Study No. 3). In this case, the analysis examined the effects of the water management practices in isolation and did not include the effects of the Table A retirements. The analysis accounted for the increasing water demands of SWP contractors, the probable increase in available groundwater storage south of the Delta and the likely reduction in availability to the contractors of storage other than groundwater storage outside their service areas. Estimates of future pumping from the Delta at the Banks Pumping Plant were made in a similar to the estimates for the period 1996 through 2004.

Effects at Castaic Lake and Lake Perris

Flexible storage in Castaic Lake and Lake Perris could affect Delta outflow but would also have local impacts at the two reservoirs. The proposed project allows those contractors that were participating in the repayment of these reservoirs to withdraw up to about 50 percent of the total volume of water in the reservoirs, subject to Department approval and contractual requirements to replace the water within five years. The analysis of the impacts was conducted in two ways: first, by tabulating actual exercise of flexible storage by the three contractors allowed to access the water, and second by assuming a maximum exercise of the right during potential future drought conditions. The second method provides a worst case analysis of potential impacts at the two reservoirs.

Lake Perris is currently drawn down because of concern about seismic safety of its dam. It is likely to remain drawn down until the seismic safety issues are resolved. For the purposes of this EIR, it was assumed that the issues will be resolved and the operations at the reservoir will return to normal.

5.6 USE OF CALSIM II

The CALSIM II model was used to estimate SWP deliveries under various conditions (see Chapters 6 and 11). It was also used to estimate the effects of the proposed project on storage in Lake Oroville and San Luis Reservoir. The Department determined that it was appropriate to use the model for these purposes. A more detailed discussion of where and how the CALSIM II was used is contained in Section 6.4.1. A report containing the results of CALSIM II simulations and associated post-processing is contained in Appendix F.

There has been considerable discussion in the Monterey Plus EIR Committee meetings about the Department's use of the current SWP and CVP operations model (CALSIM II) for analyzing the effects of the Monterey Amendment. CALSIM II is an important tool used by the Department and other State and federal agencies to study many technical and policy issues related to water supply reliability, environmental management and performance, water demands, economics, hydrology and climate, and regulatory compliance. Several studies currently being conducted by the Department are using, or will use, the CALSIM II model to estimate how new actions, projects, or programs could potentially affect the operations of the SWP and CVP, local and regional hydrology, and SWP and CVP water deliveries.

CALSIM II has received considerable public scrutiny because it is the model selected for assessing water projects of statewide significance and for Central Valley water operations. Since release of *The State Water Project Delivery Reliability Report 2002,* the Department and Reclamation have performed several studies and analyses to advance acceptance and build additional broad support and confidence in the CALSIM II model and modeling studies. An important step in this process was an external peer review of CALSIM II conducted by the CALFED Bay-Delta Program in 2003. The CALFED Science Program's peer review panel published its results in *A Strategic Review of CALSIM II and its Use for Water Planning Management and Operations in Central California* (Strategic Review) in December 2003. (This document is available at: http://science.calwater.ca.gov/pdf/CALSIM_Review.pdf). The Strategic Review discussed strengths and weaknesses of the model. The panel considered a variety of CALSIM II issues and how future model development activities can be managed to assure quality results for current and proposed applications.

The key questions assessed by the review panel were:

- Has the CALFED program adopted an appropriate approach to modeling the CVP/SWP Central Valley system?
- Is the general CALSIM II modeling approach appropriate for predicting the performance of the system and for use in allocation planning, assessing water supply reliabilities, and carrying out operational studies?

The Strategic review's findings included:

- A unique aspect of CALSIM II is the level of cooperation between federal (i.e. Reclamation) and State (Department) interests in its development. This kind of cooperation is rare, and in fact this may be the only such example of such coordination for a system of this scale and complexity. CALSIM II can provide a showcase for other states as to what can be accomplished with federal and State cooperation for river basin management.
- The use of an optimization engine for simulating the hydrology and for making allocation decisions is an appropriate approach and is in fact the approach many serious efforts of this kind are using.
- CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling.

In general, the panel concluded that the current modeling was appropriate and addressed many of the complexities of the CVP/SWP system and its water management decisions. To balance the competing needs of those who require greater detail from the model and those who require less detail, the panel recommended steps to achieve a more comprehensive, modular, and flexible approach in modeling practices and tools. To increase user confidence in model results and to provide a basis for gauging the model's ability to produce absolute predictive results of system behavior, the panel suggested calibration and verification of the model, as well as analyses in sensitivity and uncertainty.

Traditional model calibration and verification process is difficult to apply to a planning model, such as CALSIM II, that simulates operations and water supplies at a fixed level of development. A specially designed study to evaluate performance of CALSIM II under recent historical conditions was conducted to simulate the historical 24 year period of 1975 through 1998. In this study, model parameters such as historical land use, the Delta standards, and water demands were allowed to vary to mimic the historical trend. Results of this study demonstrated quite well the adequacy of CALSIM II. A technical report on the results of this effort was published in November 2003 and is available at:
http://science.calwater.ca.gov/pdf/CalSimII_Simulation.pdf.

In August 2004, the Department and Reclamation jointly responded to the questions, comments, and recommendations of the review panel in a report, *Peer Review Response: A Report by DWR/Reclamation in Reply to the Peer Review of the CALSIM II Model Sponsored by the CALFED Science Program in December 2003 Peer Review Response,* available at http://baydeltaoffice.water.ca.gov/modeling/hydrology/Peer Review Response (August 2004).pdf.
The agencies' report outlined model development plans and the agencies' priorities for improving CALSIM II. The report also highlighted the ongoing and planned efforts to establish trust in and credibility for the model by improving documentation, conducting sensitivity and uncertainty analyses of the model parameters and results, enhancing the level of detail in the geographic representation of the system, and improving hydrologic input and software development.

Many of the elements of model development features outlined in the *Peer Review Response* are in progress and will be implemented in the updated version of the model, CALSIM III. The current version of CALSIM II was used in support of the analyses in this EIR.

In preparing this EIR, a modeling subcommittee was formed early in the planning process to review assumptions that would be input to the model. All documentation and data sets were made available and reviewed by the subcommittee as they were developed and changes were made based on input from the subcommittee. The assumptions used in the model runs for this EIR are shown in Table 5-3.

One criticism of the CALSIM II model is that it overestimates water deliveries to SWP contractors. To minimize the potential for overestimated deliveries in this EIR, the Department reviewed the demand estimates for the SWP's M&I municipal contractors for 1995 and 2003 conditions that are used as input to the CALSIM II model. The demand estimates were revised based on their actual historical SWP deliveries. More information on the estimation of demand is contained in Appendix F.

TABLE 5-3

CALSIM II ASSUMPTIONS

CALSIM II Input			**Assumptions for Level-of-Development Year**
Hydrology	Period of Simulation		73 years (1922-1994)
	Initial Conditions (reservoir storage)		1922
	Land Use Level of Development		Assume that 1995 is equal to 2001 level (2001 Level from California Department of Water Resources (DWR) Bulletin 160-98) and that 2003 level is equal to 2001. 2020 Level from DWR Bulletin 160-98
Demands	North of Delta (except American R.)	CVP	1995 and 2003 based on 2001 land use, limited by full CVP contract. 2020 based on 2020 land use
		SWP—Feather River Service Area	1995 and 2003 based on 2001 land use, 2020 based on 2020 land use. All years limited by full Settlement Contract
		SWP—FVB Cities (Fairfield, Vacaville, and Benicia)	No demand in 1995; contract-specified in 2003 and 2020
		Non-Project	Based on land use
		CVP Refuges	Firm Level 2
	American River Basin	Water rights	2001 for 1995 and 2003, 2020 for 2020
		CVP	2001 for 1995 and 2003, 2020 for 2020
	San Joaquin River Basin	Friant Unit	Regression of historical
		Lower Basin	Fixed annual demands
		Stanislaus River Basin	1997 New Melones Interim Operations Plan
	South of Delta	CVP	Full Contract
		Contra Costa Water District	124 TAF/YR in 1995 & 2003, 158 TAF/YR in 2020
		SWP (w/ North Bay Aqueduct)	Varies based on hydrology for 1995 and 2003; equals sum of Table A amounts for 2020
		SWP Article 21 Demand	Varies based on hydrology for 1995, 2003 and 2020
Facilities	CVP		Existing CVP
	SWP	Existing & new facilities	Existing SWP facilities with Coastal Branch Phase II in operation and without the East Branch Enlargement for 1995 & 2003; 2020 adds East Branch Enlargement
		South Bay Aqueduct	Existing Capacity (300 cfs)
		SWP Kern Fan Element	Kern Fan Element facilities not included
		Banks Pumping Plant	1995 Capacity for 1995, 2003, and 2020
Regulations	Trinity River	Minimum Flow below Lewiston Dam	1995 limit is 340 TAF/Yr, 2003 limit is Interim (369-453 TAF/Yr), and 2020 limit is 369-815 TAF/Yr (Trinity EIS Preferred Alternative)
		Trinity Reservoir End-of-September Minimum Storage	No 1995 limit; 600 TAF as able in 2003 & 2020 (Trinity EIS Preferred Alternative)
	Clear Creek	Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to USFWS and NPS, and USFWS discretionary use of CVPIA 3406(b)(2)
	Upper Sacramento River	Shasta Lake End-of-September Minimum Storage	SWRCB WR 1993 Winter-run Biological Opinion (1900 TAF)
		Minimum Flow below Keswick Dam	Flows for SWRCB WR 90-5 and 1993 Winter-run Biological Opinion temperature control, and USFWS discretionary use of CVPIA 3406(b)(2)
	Feather River	Minimum Flow below Thermalito Diversion Dam	1983 DWR, DFG Agreement (600 CFS)
		Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (1000 – 1700 cfs)

TABLE 5-3

CALSIM II ASSUMPTIONS

CALSIM II Input			Assumptions for Level-of-Development Year
	American River	Minimum Flow below Nimbus Dam	SWRCB D-893 and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Flow at H Street Bridge	SWRCB D-893
	Lower Sacramento River	Minimum Flow near Rio Vista	SWRCB D-1641
	Mokelumne River	Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100 – 325 cfs)
		Minimum Flow below Woodbridge Diver. Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25 – 300 cfs)
	Stanislaus River	Minimum Flow below Goodwin Dam	1987 USBR, DFG agreement, and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Dissolved Oxygen	SWRCB D-1422
	Merced River	Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 CFS, Nov – Mar), and Cowell Agreement
		Minimum Flow at Shaffer Bridge	FERC 2179 (25 – 100 CFS)
	Tuolumne River	Minimum Flow at La Grange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94 – 301 TAF/YR)
	San Joaquin River	Maximum Salinity near Vernalis	SWRCB D-1641
		Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement
	Sacramento River-San Joaquin River Delta	Delta Outflow Index (Flow and Salinity)	SWRCB D-1641
		Delta Cross Channel Gate Operation	SWRCB D-1641
		Delta Exports	SWRCB D-1641, USFWS discretionary use of CVPIA 3406(b)(2) for 1995, 2003, & 2020; 2003 & 2020 add CALFED Fisheries Agencies discretionary use of EWA
Operations Criteria	Upper Sacramento River	Flow Objective for Navigation (Wilkins Slough)	Discretionary 3,250 – 5,000 CFS based on Shasta storage condition
	American River	Folsom Dam Flood Control	Variable 400/670 flood control diagram (without outlet modifications)
		Flow below Nimbus Dam	Discretionary operations criteria corresponding to SWRCB D-893 required minimum flow
		Sacramento Water Forum Mitigation Water	No limits in 1995 & 2003; 2020 uses Sacramento Water Forum standard (up to 47 TAF/YR in dry years)
	Stanislaus R.	Flow below Goodwin Dam	1997 New Melones Interim Operations Plan
	San Joaquin River	Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program
	CVP Water Allocation	CVP Settlement and Exchange	100% (75% in Shasta Critical years)
		CVP Refuges	100% (75% in Shasta Critical years)
		CVP Agriculture	100% - 0% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
		CVP Municipal & Industrial	100% - 50% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
	SWP Water Allocation	Feather River Service Area	Specified by Settlement Contract
		Fairfield, Vacaville, and Benicia	No allocation in 1994, specified by Settlement Contract in 2003 & 2020

TABLE 5-3

CALSIM II ASSUMPTIONS

CALSIM II Input			**Assumptions for Level-of-Development Year**
		South of Delta	Based on SWP supply; varies with EIR alternative
	Delta Pumping	Banks Pumping Plant	6,680 cfs, can increase up to 8,500 cfs Dec. 15-Mar 15 (min. 300cfs)
		Tracy Pumping Plant	1995 & 2003 use 4,200 cfs + deliveries upstream of DMC constriction; 2020 adds CVP-SWP Intertie
	CVP/SWP Coordinated Operations	Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement (FRWP EBMUD and 2/3 of North Bay Aqueduct diversions are considered as Delta Export, 1/3 of the North Bay Aqueduct diversion is considered as In-Basin-Use)
		Sharing of Surplus Flows	1986 Coordinated Operations Agreement
		Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641; use of CVPIA 3406(b)(2) only restricts CVP exports; EWA use restricts CVP and/or SWP as directed by CALFED Fisheries Agencies
		Dedicated CVP Conveyance at Banks	No 1995 or 2003 conveyance; SWP to convey 100,000 af/year of Level 2 refuge water through Banks P.P. (Jul & Aug) in 2020 studies
		North of Delta Accounting Adjustments	No adjustments in 1995 or 2003; in 2020, CVP to provide SWP a maximum of 75,000 AF to meet in-basin requirements through adjustments in COA accounting
		Sharing of Export Capacity for Lesser Priority and Wheeling Related Pumping	Cross Valley Canal wheeling (max of 128 TAF/Yr), CALFED ROD defined Joint-Point-of-Diversion
CVPIA 3406(b) 2)	Allocation		Per May 2003 Dept of Interior Decision: 800 taf/yr, 700 taf/yr in 40-30-30 dry years, and 600 taf/year in 40-30-30 critical years
	Actions		1995 WQCP, Fish flow objectives (Oct-Jan), VAMP (Apr 15- May 15) CVP export restriction, 3000 CFS CVP export limit in May and June (D1485 Striped Bass cont.), Post (May 16-31) VAMP CVP export restriction, Ramping of CVP export (Jun), Upstream Releases (Feb-Sep)
	Accounting Adjustments		Per May 2003 Interior Decision, no limit on responsibility for non-discretionary D1641 requirements with 500 TAF target, no Reset with the Storage metric and no Offset with the Release and Export metrics
CALFED Environmental Water Account	Actions		1995 has none; 2003 and 2020 have export cuts of 50 taf Dec-Feb, VAMP (Apr 15- May 15) export restriction, post (May 16-31) VAMP export restriction, and ramping of export (Jun)
	Assets		1995 has none; 2003 and 2020 have fixed water purchases of 250 TAF/yr, 230 TAF/yr in 40-30-30 dry years, 210 TAF/yr in 40-30-30 critical years. The purchases range from 0 TAF in Wet Years to approximately 153 TAF in Critical Years NOD, and 57 TAF in Critical Years to 250 TAF in Wet Years SOD. Variable assets include the following: used of 50% JPOD export capacity, acquisition of 50% of any CVPIA 3406(b)(2) releases pumped by SWP, flexing of Delta Export/Inflow Ratio (post-processed from CALSIM II results), dedicated 500 CFS pumping capacity at Banks in July to September

TABLE 5-3

CALSIM II ASSUMPTIONS

CALSIM II Input		**Assumptions for Level-of-Development Year**
	Debt Restrictions	1995 has none; for 2003 and 2020 delivery debt is paid back in full upon assessment; storage debt paid is back over time based on asset/action priorities; SOD and NOD debt carryover is allowed; SOD debt carryover is explicitly managed or spilled; NOD debt carryover must be spilled; and SOD and NOD asset carryover is allowed

ENDNOTES

1. Although conditions in 2003 serve as a baseline for analysis in this EIR data from 2004 and 2005 were used in some cases to extend the period of historical record. The longer the historical record the more likely it is that the historical record contains representative hydrologic conditions.

6. EFFECTS OF PROPOSED PROJECT ON SWP AND SWP CONTRACTOR OPERATIONS

6. EFFECTS OF PROPOSED PROJECT ON SWP AND SWP CONTRACTOR OPERATIONS

6.1 INTRODUCTION

The Monterey Amendment and the Settlement Agreement include provisions, many of which result in changes in the allocation of SWP water supplies among contractors and in deliveries to the contractors. This chapter describes the changes in SWP operations that stem from the proposed project and lead to the altered water allocations and deliveries. The changes in operations are part of the proposed project rather than a consequence of it. Operations of the SWP before and after implementation of the proposed project are described in this chapter with emphasis on operation of Lake Oroville, the Banks and North Bay Pumping Plants, and San Luis Reservoir.

6.2 SWP OPERATIONS PRIOR TO IMPLEMENTATION OF THE PROPOSED PROJECT

The SWP is operated to provide water for agricultural, municipal, industrial, recreational and environmental purposes. The California Department of Water Resources (Department) manages the SWP to meet agricultural and municipal contractors' requests for water to the maximum extent possible while meeting all regulatory requirements. The regulatory requirements are described in Chapter 7, Section 7-1. Water is stored in Lake Oroville and released to meet regulatory requirements and to serve four contractors north of the Delta and 24 contractors south of the Delta. The Department also releases water from Lake Oroville to satisfy water rights that predate the Department's water rights. In each of the last five years, about 1,000,000 acre-feet of water has been released from Lake Oroville to satisfy prior water rights. The Department serves one contractor, Plumas County FCWCD, from Lake Davis, upstream of Lake Oroville in the Feather River watershed. Water released from Lake Oroville is pumped from the Delta at the Banks Pumping Plant to serve the south-of-the Delta contractors and at the North Bay Pumping Plant to serve the Napa County and Solano County contractors. In addition, these pumping plants can capture water from unregulated flows entering the Delta for conveyance to contractors.

The amount of water available to the SWP varies widely from year to year depending on hydrologic conditions. Contractors can request water from the SWP in accordance with their contracts, but their requests vary from year to year based on the demand for water in their service areas and the availability of water from other sources. Water demand in all contractors' service areas is met from a number of different water sources. Some contractors have local sources of surface and groundwater and other sources of imported water. A contractor's need for SWP water in a particular year depends on the cost and availability of water from other sources. For example, in years when large amounts of water are available from the Owens and Colorado rivers, MWDSC's demand for SWP water may be reduced. The Department's ability to meet contractors' requests for water is limited not only by hydrology, but also by the capacity of the SWP's storage and conveyance facilities, agreements with other agencies, water rights and, State and federal environmental laws and regulations.

6.2.1 Operation of SWP Storage and Conveyance Facilities

Most of the SWP's water supply is obtained from Lake Oroville, north of the Delta, and from unregulated Delta inflow whereas about 97 percent of the demand for SWP water is located south of the Delta. The Department's ability to convey water from Lake Oroville, to contractors south of the Delta is constrained by the physical characteristics of the Delta, environmental regulations and the capacity and operational constraints of SWP storage and conveyance facilities.

Within these constraints, the SWP is operated to optimize the capture of water in the Delta, maximize the usable supply released to the Delta from Oroville storage, and maximize the intake allotment of Clifton Court Forebay at the maximum permitted rate as much of the time as possible. The diversion of water into Clifton Court Forebay for pumping at the Banks Pumping Plant is controlled by SWRCB D-1641 and permits issued by the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act. This diversion rate is normally restricted to 6,680 cfs as a three-day average inflow to Clifton Court Forebay, although at times of high San Joaquin River flows, one-third of the flow in that river at Vernalis may be pumped in addition. Additional information on the environmental regulations that apply to the SWP's Delta operations is contained in Section 7.1.

The Clifton Court Forebay radial gates are operated at certain times to protect water levels in the south Delta area for the benefit of local agricultural interests. At these times, the radial gates controlling inflow to the forebay may be open during any period of the tidal cycle with the exception of the two hours before and after the low-low tide and the hours leading up to the high-high tide each day.

The Banks Pumping Plant is operated to minimize the impact to power loads on the California electrical grid to the extent practical, using Clifton Court Forebay as a holding reservoir to allow that flexibility. Generally, more pump units are operated during off-peak energy demand periods and fewer during peak periods. Because the installed capacity of the pumping plant is 10,300 cfs, the plant can be operated to reduce power grid impacts, by running all available pumps at night and a reduced number during the higher energy demand hours, even when Clifton Court Forebay is admitting the maximum permitted inflow.

Typically, the Department pumps all the water it can at the Banks Pumping Plant, as limited by supply availability and regulatory and system capacity constraints. At times, however, when San Luis Reservoir is full, pumping at Banks is reduced to only that amount needed to meet contractors' total current demand, even though additional supply is available in the Delta. Under these conditions, Banks Pumping Plant operations are "demand limited".

San Luis Reservoir is the Department's primary storage facility south of the Delta. San Luis Reservoir is a joint SWP and CVP facility in which storage is shared about equally. The SWP's share is used to store water pumped from the Delta at the Banks Pumping Plant, generally in the winter and spring, that exceeds contractors' current demands. Water is released from San Luis Reservoir to the California Aqueduct, generally in the late spring, summer and fall, when pumping at Banks is insufficient to meet contractors' peak demands.

The Department attempts to fill its share of San Luis Reservoir as early in the water year (which begins October 1 and ends September 30) as it can. The reservoir is generally filled in the winter and spring, possibly as early as January, or even earlier in some years, but more often in February, March, or April. Once the SWP's share of San Luis Reservoir is full, and other SWP storage facilities south of the Delta are full or at their storage targets, the Department generally announces the availability of additional water, on a temporary and interruptible basis, under Article 21 of the long term water supply contracts. Contractors may request delivery of Article 21 water if they can put it to direct beneficial use or store it for future use in their service areas.

During the summer, the Department releases water from Lake Oroville to supplement Delta inflow and allow the Banks Pumping Plant to export the stored Oroville water to help meet demand. These releases are scheduled to maximize export capability and gain maximum benefit from the stored water while meeting in-stream fish flow requirements, temperature requirements, Delta water quality, and all other applicable standards in the Feather River and the Delta.

As San Luis Reservoir is drawn down to meet demands, it usually reaches its low point in late August or early September. From September through mid-October, demand for deliveries usually drops falling below Banks Pumping Plant diversions from the Delta; diversions above that demand are then used to begin refilling San Luis Reservoir, reversing its spring and summer drawdown. From mid-October until the first major storms in late fall or winter unregulated flow continues to decline and releases from Lake Oroville are restricted due to flow stability agreements with CDFG. This results in export rates at Banks that are somewhat less than demand, typically causing a second seasonal decrease in the SWP's share of the storage in San Luis Reservoir. Once the fall and winter storms increase runoff into the Delta, Banks can increase its pumping rate and eventually fill the SWP's share of San Luis Reservoir.

Once the south-of-Delta SWP storage reservoirs are full, the contractors are taking all the water they can accept (both Table A and Article 21 water), and Banks Pumping Plant is not being used to convey non-Project water, then the amount of water taken into Clifton Court Forebay may be cut back to just balance south of Delta SWP deliveries. At this time, Delta outflow increases by the amount of the intake decrease at Clifton Court Forebay.

The Department must balance storage between Lake Oroville and San Luis Reservoirs carefully to meet flood control requirements, Delta water quality and flow requirements, and optimize the supplies to its contractors consistent with all environmental constraints. Lake Oroville may be operated to move water through the Delta to San Luis Reservoir via the Banks Pumping Plant under different schedules depending on Delta conditions, reservoir storage volumes, and storage targets. Predicting those operational differences for an EIR is not practical, as the decisions reflect operator judgment based on many real-time factors as to when to move water from Lake Oroville to San Luis Reservoir and other south-of-Delta SWP reservoirs. Even if it were possible to predict the differences, it would likely make little or no difference in the total amount of water moved through Banks Pumping Plant in a year, and would likely make no difference to allocations of the water to the contractors.

6.2.2 Coordinated Operation of the SWP and CVP

The SWP and CVP both divert large volumes of water from the Delta and must comply with applicable environmental regulations including Delta water quality standards. Coordinated operations help the two water projects meet consumptive and environmental water needs more efficiently. Coordinated operations in the 1970s and early 1980s were accomplished by annual agreements between the Department and Reclamation. In 1986, the two agencies executed the Coordinated Operating Agreement (COA), which specifies how the two parties would operate their facilities to meet their customers' water demands and Delta water quality standards and other environmental regulations without adversely affecting each other. The COA specifies two conditions for operational purposes: balanced conditions and excess conditions. Balanced conditions occur when releases from upstream reservoirs and unregulated flow equal the water supply needed to meet Sacramento Valley in-basin uses and exports from the Delta. Excess conditions occur when releases from upstream reservoirs and unregulated flow exceed the water supply needed to meet Sacramento Valley in-basin uses and exports from the Delta. During balanced conditions, the SWP and CVP coordinate their operations in a prescribed manner. During excess conditions, the SWP and CVP still coordinate their operations for flood control and other purposes, but their operations are not prescribed by the COA.

The CVP and SWP have historically shared their Delta export pumping facilities when it is advantageous to do so. Sharing of the pumping facilities can help both projects deliver water to their contractors when demand is high or some facilities are out of service in emergencies or during maintenance. The sharing of facilities is referred to as the Joint Point of Diversion (JPOD). In 1978, the Department agreed to, and the SWRCB permitted, the CVP to use the SWP's Banks Pumping Plant capacity to divert and export up to 195,000 AF annually from the Delta to replace pumping capacity lost at the CVP's Tracy Pumping Plant (now known as the Jones Pumping Plant). Pumping capacity was lost as a result of restrictions contained in the SWRCB's Decision 1485. In 1986, Reclamation and the Department formally agreed that "either party may make use of its facilities available to the other party for pumping and conveyance of water by written agreement".

6.2.3 Allocation and Delivery of SWP Supplies

The following narrative describes the practices of the Department in determining the overall amount of Table A water that can be allocated and the allocation process itself. There are many variables that control how much water the SWP can capture and provide to its contractors for beneficial use. An understanding of the allocation process and the way it is implemented is helpful to understanding the analysis in this document.

The allocations are developed from analysis of a broad range of variables that include:

- Volume of water stored in Lake Oroville,
- Flood operation restrictions at Lake Oroville,
- End-of-water-year (September 30) target for water stored in Lake Oroville,
- Volume of water stored in San Luis Reservoir,
- Minimum target (low-point) for water stored in San Luis Reservoir,
- Snow survey results,
- Forecasted runoff,
- Feather River flow and temperature requirements for fish habitat,
- Feather River service area delivery obligations,
- Feather River flow levels to support direct diverters,
- Expected depletions in the Sacramento River basin,
- Expected Delta conditions,
- Precipitation and streamflow conditions since the last snow surveys and forecasts,
- Contractor delivery requests for water, and

- Other SWP uses (i.e. recreation, fish and wildlife purposes, operational purposes, and operational losses).

From these and other variables, the Department estimates the total Table A water supply available to allocate to contractors and meet the SWP's needs. The Department then enters the water supply, contractor requests, and Table A amounts into a spreadsheet and computes the allocation percentage that would be provided by the available water supply for the calendar year. The allocation percentage was computed based on requests for Table A water through 1993 and based on Table A amounts thereafter. (See Chapter 2 for a more complete discussion of the Department's past practices with respect to allocations and the controversies surrounding them.)

Department management then makes the final decision on the initial percentage of Table A amounts to allocate to the contractors. The decision is made, and announced in a press release followed by a Notice to Contractors. (A past practice was to issue a letter to all contractors, followed by a Water Service Contractors' Council memorandum.) This process is repeated several times each year as necessary to update allocations to match current hydrologic conditions.

By October 1, (the beginning of the water year), the contractors submit initial water delivery schedules (i.e., requests) for monthly Table A water deliveries for the following calendar year. The initial allocation announcement is made by December 1 of each year. The allocation of water is made with a conservative assumption of future precipitation, and generally in graduated steps, carefully avoiding over-allocating water before the hydrologic conditions are well defined for the year. The Department might allocate as little as 10 percent of requested supply as was the case in December 1993. As storms move in off the Pacific and new snow surveys and runoff assessments occur, the allocations are increased accordingly. Generally the last allocation is made by mid-April or mid-May, although in 1991, allocations were increased from 20 percent to 30 percent on October 4.

Beginning in late December, the contractors may submit updated weekly and monthly delivery schedules to the Department. The Department uses these updated requests and, after accumulating any new information on hydrologic conditions, may revise its estimates of probable deliveries, update allocations, schedule actual weekly water deliveries and adjust SWP operations. If the Department has more water available than is needed to satisfy all of the contractors' requests for Table A water, the SWP's needs and regulatory requirements, additional water is made available to the contractors. Prior to the Monterey Amendment, the Department made two types of additional water available under Article 21 of the long-term water supply contracts. Article 21 water that was called "scheduled surplus water" was made available to the contractors when the amount of water predicted to be available in SWP storage reservoirs and from unregulated Delta flow exceeded Table A requests for the year. In that case, the Department offered scheduled surplus water to contractors and approved deliveries through the year that did not interfere with Table A deliveries. Article 21 water that was called "unscheduled water" was in excess of the SWP's immediate needs and was typically offered to contractors on a short-term (daily or weekly) basis. Delivery of unscheduled water could be discontinued on short notice. For both types of Article 21 water, use for agricultural purposes and for groundwater recharge had priority over M&I use. Article 21(g) stated that scheduled surplus water would not be delivered if it encouraged development of an economy dependent on surplus water.

For example, in October 1985, the contractors requested 2.36 million acre-feet (AF) of Table A water for delivery in 1986. In December 1985, as a wet winter was beginning, the Department approved an allocation of 100 percent for M&I contractors and about 95 percent for agricultural contractors. In February 1986, the allocation for agricultural contractors was increased to 100 percent and the availability of surplus water was announced. Ultimately, the Department delivered about 2 million AF of Table A water and 37,000 AF of surplus water to contractors in 1986.

In drier years, the Department may not have sufficient water to satisfy the requests of the contractors and meet the SWP's other obligations and needs. The shortage provision of Article 18(a) of the long-term water supply contracts specifies how water should be allocated to contractors during shortages. Prior to the Monterey Amendment, Article 18(a) required that deliveries to the agricultural contractors be reduced before the M&I contractors were subject to any reduction in deliveries.

Table 6-1 shows Table A amounts, contractors' initial requests for Table A water and delivered Table A water, scheduled surplus water and unscheduled surplus water for each year from 1980 to 1995. It also shows the percentage of the requests for urban and agricultural water that the Department was able to meet each year. From 1980 through 1989, the Department was able to meet 100 percent of the contractors' requests for Table A water.

Several dry years occurred in the early 1990s and the Department was unable to meet all contractors' requests for Table A water. In 1990, the Department allocated 100 percent of the water requested by M&I contractors but cut allocations to agricultural contractors to 50 percent of their requests. In 1991, a critically dry year, the Department allocated 30 percent of the water requested by M&I contractors but allocated no water to the agricultural contractors. In the following years, 1992, 1993 and 1994, the Department allocated 45 percent, 100 percent and 50 percent of their requests to both M&I and agricultural contractors, respectively. M&I and agricultural contractors were subject to the same proportional cutbacks in 1992 and 1994 because the cutbacks in deliveries to agricultural contractors allowable under Article 18(a) (100 percent in a seven-year period) had been exhausted in 1990 and 1991.

Although not a policy, the general practice of the Department has been to allocate Table A water in five percent increments as it announces its decisions. An exception to this practice occurred in late 1989, when the Department initially approved a 72 percent allocation for agricultural users for 1990. Another exception occurred in 2001, when a 33 percent allocation was announced on May 4, increased to 35 percent on May 17, and then finally set at 39 percent on August 16, 2001. Other minor exceptions to the practice occurred in 1986, 1987 and 1994.

The practice of allocating water in five percent increments is reflective of the relative imprecision inherent in projecting water conditions and customer demands months in advance. Weather conditions and contractor demand both involve substantial uncertainty. For example, weather conditions may cause some contractors, notably MWDSC, to eventually schedule delivery of less water than originally requested. A cooler summer and wetter spring are primary reasons that MWDSC may require a lesser supply in some years than the amount it forecasts when it submits its delivery request to the Department in the prior October. Similarly, southern Central Valley agricultural contractor demands may be reduced by a wet spring.

San Luis Reservoir often contains much more water at the low point in August or September than the earlier forecasts, but occasionally is drawn down to or even below the targeted 42,000 AF low point, which represents the SWP share of "dead pool" storage. Under some conditions,

TABLE 6-1

ALLOCATIONS AND DELIVERIES OF TABLE A AND ARTICLE 21 WATER (1980—1995)

Year	Total Table A Amounts AF	Initial Table A Requests AF	Final Table A Allocations AF	Table A Deliveries AF	Article 21 Water Delivered AF			Final Allocation %	
					Unscheduled	Surplus	Total	M & I	Ag
1980	2,214,770	1,880,386	1,880,386	1,529,749	72,457	332,100	404,557	100	100
1981	2,392,468	1,876,707	1,876,707	1,909,562	275,045	633,383	908,428	100	100
1982	2,574,545	2,342,576	2,342,576	1,750,024	168,151	46,983	215,873	100	100
1983	2,701,164	2,365,818	2,365,818	1,184,869	0	13,019	13,019	100	100
1984	2,884,337	1,563,620	1,563,620	1,588,619	0	262,917	262,917	100	100
1985	3,055,846	1,862,709	1,862,709	1,995,453	0	307,672	307,672	100	100
1986	3,257,736	2,364,193	2,364,193	1,995,636	22,034	14,586	36,620	100	100
1987	3,484,115	2,717,215	2,337,715	2,130,086	114,907	0	114,907	100	100
1988	3,688,335	2,625,328	2,595,120	2,385,122	0	0	0	100	100
1989	3,958,190	2,999,451	2,999,451	2,853,747	0	0	0	100	100
1990	4,079,666	3,218,790	2,469,405	2,582,151	90	0	90	100	50
1991	4,126,567	3,484,687	671,711	549,113	3,521	0	3,521	30	0
1992	4,138,816	3,630,618	1,634,000	1,471,454	1,156	0	1,156	45	45
1993	4,146,966	3,846,195	3,846,195	2,315,235	0	0	0	100	100
1994	4,154,201	3,841,096	1,918,622	1,749,351	112,625	0	112,625	50	50
1995	4,163,066	3,163,780	3,163,780	1,967,093	64,330	0	64,330	100	100

Source: California Department of Water Resources Bulletin 132-05 and California Department of Water Resources files.

such as occurred in 1981, 1982, and 1990, the state share of San Luis Reservoir may be drawn below the target. Actual state share storage in San Luis Reservoir was 5,555 AF at December 31, 1990. (Total water storage, including CVP supplies in San Luis Reservoir, was higher than the total dead pool level of 80,000 AF.) In contrast, the Department set a target for low point storage in San Luis Reservoir at 100,000 AF in 1993. The actual summer low point in 1993 was 723,206 AF.

Thus in 1993, a wet year, low point storage exceeded the target by over 600,000 AF. In 1990, a drought year, the low point storage was short of the target by nearly 100,000 AF. This, and the previous example, illustrates the imprecision of forecasting at the beginning of the year, before the hydrologic conditions are known, and before real contractor demands are known, even though the Department adjusts allocations as information on hydrologic conditions and water demand improves as the year progresses. Because the Department makes its supply projections cautiously, not wishing to overestimate likely water availability, and the contractors make their delivery requests cautiously, not wishing to underestimate demand, the potential for variations between projections and actual events, especially under wet hydrologic conditions, is considerable.

6.2.4 Operations and Activities During Droughts

During a drought the Department makes the most beneficial use of available water to the SWP by utilizing drought-related activities and modifying operations. It considers the variables listed previously with an emphasis on the following:

- Managing available supplies;
- Determining acceptable amounts of water to be retained in storage to be carried over (targeted) for use in following years;
- Ensuring water supplies to meet following-year Delta requirements;
- Ensuring water quality to contractors;
- Supplementing water supplies through transfers, exchanges, and purchases; and
- Encouraging carryover programs to allow contractors' more flexibility in the management of available supplies.

6.2.4.1 Water Quality

Water quality in the Delta depends primarily on a balance between downstream freshwater flows and saltwater tidal incursions. The Department monitors water quality through an automated network of continually operating recorders, laboratory analyses of field samples collected at weekly, quarterly, monthly, or annual intervals and long-range modeling activities. Additionally, the Department conducts special studies to investigate water quality at potential problem sites or as a result of unique events.

During periods of low river flows from the Sacramento and San Joaquin rivers, water is released from both SWP and CVP reservoirs to meet Delta standards. In addition, both the CVP and SWP can reduce exports from the Delta, increase releases, and open or close the Delta Cross Channel (to help regulate direction of water passing into the Delta), to improve water quality in the Delta. For example, in 1991 when exceptionally high tides and strong westerly winds, high consumptive use in the Delta, and physical failures at the Suisun Marsh salinity control gates combined to cause chloride levels to rise unacceptably at the Contra Costa Water District intake in the western Delta, both the SWP and CVP curtailed exports to try to improve water quality.

In addition to Delta operations, SWP reservoirs can be operated to improve stream flows and water quality during droughts. During an extended drought when reservoir levels are low, a top priority at Lake Oroville is meeting water temperature requirements for fish downstream of the dam while balancing power generation through the Hyatt Powerplant.

In order to improve water quality to South Bay contractors, the Department in 1988 made releases from Lake Del Valle during the summer in order to blend Del Valle water with Delta water to reduce chloride levels in the South Bay Aqueduct water. Typically, Lake Del Valle reservoir levels are maintained at a constant elevation for recreation from Memorial Day through Labor Day.

6.2.4.2 Transfers

In 1982, because of increasing environmental concerns and costs of developing large-scale water projects, California adopted a statewide policy of encouraging voluntary transfers between agencies throughout the state (CWC §109). Enabling legislation provided a means for the Department to acquire supplemental water supplies, especially during a drought, and directed the Department to establish an ongoing program to facilitate voluntary exchange or transfer of water (CWC § 480).

During the 1987 through 1992 drought, the Department established a drought information center and drought water banks. The purpose of the drought water bank was to provide supplies to entities with a critical need for water during droughts. Water for the banks was obtained from surplus water in non-SWP surface reservoirs, groundwater and water saved as a result of fallowing agricultural lands. During the drought, the Department purchased considerable amounts of water from Yuba County Water Agency and other agencies in northern California on behalf of individual SWP contractors, or for augmentation of overall SWP supplies. The Department also approved transfers of Table A water from both M&I and agricultural contractors to agricultural contractors whose only source of water was SWP water, or whose permanent crops (trees and vines) were in water-deficient areas.

6.2.4.3 Carryover Storage in San Luis Reservoir

Prior to 1990, the long-term water supply contracts contained no provision for contractors to carry over allocated Table A water in SWP reservoirs from one year to the next (although Articles 12(d) and Article 14(b) “make-up” water offered credits of water). During the spring and fall of 1988, insufficient rainfall induced fears of a continued drought and deficiencies on agricultural requests. The Department informed the contractors of its willingness to consider requests to carry over 1988 Table A water for two purposes: (1) for agricultural contractors to use for pre-irrigation during January, February, and March 1989; and (2) for all contractors to replace water that could not be delivered during the fall of 1988 because of outages within the contractors’ distribution systems. The contractors were informed that carryover water could not affect the delivery of Table A water to other SWP contractors. By summer 1991, most contractors had signed contract amendments to provide for Article 12(e) carryover. Often no water was carried over in San Luis Reservoir pursuant to Article 12(e) and when it was, the amounts were usually small. Prior to 1994, the maximum total amount of water carried over pursuant to Article 12(e) was 25,000 AF.

6.2.5 Storage of SWP Water by Contractors

Contractors may store SWP water within their service areas for later use. For example, in a wet year, a contractor might take more SWP water than it needs in that year to meet current demand, placing the balance in storage for future use. The ability to store SWP water enables contractors to increase the overall reliability of their water supplies. Some contractors are able to store SWP water in groundwater basins within their service areas, for example KCWA and Mojave WA. Other contractors have built surface storage facilities within their service areas to increase their ability to take SWP water when it is available. Diamond Valley Reservoir in MWDSC's service area, approved prior to the Monterey Amendment but completed afterwards, and Anderson Reservoir in Santa Clara Valley WD's service area are examples of reservoirs used to store SWP water.

Prior to the Monterey Amendment, the SWP contracts did not prohibit storage of SWP water outside contractors' service areas but it was not common. Starting in the mid- to late-1980s, some contractors became interested in storing SWP water outside their service areas. This may have been due to increasing water demand, fewer opportunities to store SWP water within contractors' service areas and concerns about delivery reliability in dry years. Delivery reliability in dry years would be improved by additional SWP storage but there was growing recognition that none was likely to be constructed any time soon.

In the early 1990s, Semitropic WSD developed a groundwater bank with a capacity of one million AF. MWDSC acquired about one-third of the capacity of the water bank. In 1993, the Department and MWDSC negotiated an agreement for temporary storage of a portion of MWDSC's SWP water in the Semitropic WSD's water bank. In 1994, the two agencies signed an agreement permitting long-term storage of a portion of MWDSC's SWP water in the water bank. Other similar storage programs were being discussed prior to the Monterey Amendment as described in Chapter 2.

6.2.6 Table A Transfers

Prior to the Monterey Amendment, SWP water was occasionally transferred from one contractor to another. SWP contractors transferred water from one contractor to another to increase their water management flexibility and help meet the needs of their customers. Transfers were arranged by the contractors but were subject to approval by the Department. The transfers were temporary in nature and were approved and implemented by the Department on a case-by-case basis.

Prior to the Monterey Amendment, Department approval had been sought for only one permanent transfer of Table A amount. In 1991, the Department approved the transfer of Devil's Den Water District's entire Table A amount of 12,700 AF to Castaic Lake WA. Several other agricultural contractors were interested in selling Table A amounts and several M&I contractors were interested in acquiring Table A amounts, but no transfers other than the transfers between Devil's Den WD and Castaic Lake WA had been executed prior to the Monterey Amendment.

6.2.7 Conveyance of Non-project Water

In accordance with the California Water Code, the Department is required to convey non-SWP water in SWP facilities when capacity to do so is available and conveyance of non-SWP water does not interfere with SWP operations. This obligation was in effect prior to the Monterey

TABLE 6-2

CONVEYANCE OF NON-PROJECT WATER FOR SWP CONTRACTORS (1987-2005)

Year	From	To	Delivery (AF)
2005	Westlands WD	KCWA	11,284
2005	USBR (CVP Art. 215)	DRWD	576
2004-2005	CVP Contractors	KCWA	21,508
2004	Brown's Valley ID	Santa Clara Valley WD	3,100
2003	Brown's Valley ID	Santa Clara Valley WD	3,100
2003	Byron Bethany ID	Zone 7	1,000
2002	Lower Tule River ID (CVP)	Tulare Lake Basin WSD	10,956
2002	Kern-Tulare/Rag Gulch (CVP)	KCWA	39,975
2002	Byron Bethany ID	Zone 7	2,000
2001	Byron Bethany ID	Zone 7	3,997
2000	Natomas Central Mutual Water Co.	MWDSC	900
2000	Byron Bethany ID	Zone 7	1,000
1999	Byron Bethany ID	Zone 7	2,000
1998	Tulare Lake Basin WSD (Kern River Water)	MWDSC	1,000
1998	Byron Bethany ID	Zone 7	2,000
1997	Natomas Central Mutual Water Co.	Mojave WA	1,600
1997	Byron Bethany ID	Zone 7	667
1996	Byron Bethany ID	Zone 7	667
1995	Byron Bethany ID	Zone 7	667
1994	Byron Bethany ID	Zone 7	2,000
1993	Alhambra Pacific Joint Venture	Solano	600
1992	Glenn-Colusa ID	Solano	38
1992	Glenn-Colusa ID	Napa	116
1991	Yuba County	Napa	7,390
1991	Yuba County	SCVWD	25,589
1991	Placer County	SCVWD	13,714
1990	Yuba County	Empire	2,031
1990	Yuba County	Tulare Lake Basin	31,211
1989	Yuba County	SCVWD	17,085
1989	Yuba County	Tulare Lake Basin	53,501
1989	Yuba County	Empire	812
1989	Yuba County	Napa	3,958
1988	USBR	Napa	1,646
1987	USBR	Napa	7,693

Note: Table does not include water purchased by California Department of Water Resources.

Amendment and was not affected by it. Table 6-2 shows conveyance of non-SWP water by the Department from 1987 through 2005. From 1996 through 2005, the Department conveyed an average of about 6,000 AF per year of non-SWP water.

6.3 CHANGES IN SWP OPERATIONS SINCE 1995 UNRELATED TO THE PROPOSED PROJECT

Several aspects of the SWP operations have changed since 1995. Some of these are a direct result of the Monterey Amendment, and are addressed in subsequent sections. Others are a result of factors unrelated to the Monterey Amendment. They include increased water demand since 1995, application of the federal Endangered Species Act to certain fish species in the

Delta, the implementation of the CALFED Bay-Delta Program, and the implementation of the Environmental Water Account (EWA) in 2000, as part of the CALFED Program.

6.3.1 Increased SWP Demand

Since 1995, water demands have increased in many contractors' service areas. This demand increase affects the operation of the SWP. The increased demand is independent of the changes that are a part of the proposed project.

As noted above, there are times (primarily in wetter periods) when Banks Pumping Plant operations are demand-limited, and the Department is able to pump enough water from the Delta to fill San Luis Reservoir and meet all contractor demands without maximizing its pumping capability at Banks. But demand-limited conditions have been much less likely to occur in recent years because the contractors request all, or nearly all, of their Table A amounts every year. Since about 1999, Banks operations have been more often supply-limited. Under supply-limited conditions, Banks Pumping Plant is operated at its maximum permitted capacity in order to maximize the volume of water captured, subject to the limitations of water quality, Delta standards, and a host of other variables, until all needs are satisfied and all SWP storage facilities south of the Delta are full or at their storage targets. As a consequence of the increase in requests for Table A water, and relatively dry hydrologic condition since 2000, there were fewer times when Delta pumping was reduced than formerly.

6.3.2 CALFED Bay-Delta Program and the Environmental Water Account

In 1994, the CALFED Bay-Delta Program was formed to address long-standing and unresolved conflicts over water use in the Sacramento-San Joaquin Delta. It is a collaborative program of 23 federal and state agencies. Its goal is to restore the ecological health of the Delta while ensuring an adequate supply for Delta water users including the SWP and CVP.

Several fish species in the Delta are listed as threatened or endangered pursuant to the FESA. The federal agencies responsible for administering the act, USFWS and NMFS, have determined that, at certain times of the year, diversion of water from the Delta by the SWP and CVP could harm listed fish species. The USFWS and the NMFS have the authority to require a cessation or curtailment of pumping at times when they believe continued pumping would jeopardize endangered fish species. Curtailments of pumping occurred at times in May and June of 1996, 1997, 1999, and 2000.

During Phase I of the CALFED Program, a range of alternatives for achieving long-term solutions to the problems of the Delta was developed. In Phase II, a programmatic EIS/EIR was prepared on the CALFED Program. The preferred alternative, identified in the CALFED Record of Decision, which was published in 2000, is being implemented in Phase III of the CALFED Program. One of the CALFED program actions being implemented to address water supply reliability in the context of endangered species issues is the EWA.

The purpose of the EWA is to enable diversion of water by the SWP and CVP from the Delta to be reduced at times when at-risk fish species may be harmed or killed while preventing the uncompensated loss of water to SWP and CVP contractors. The EWA facilitates a reduction in Delta diversions at times when the species of concern are most at risk. These pumping curtailments are called “fish actions.”

The EWA replaces any water lost to the SWP and CVP due to curtailment of pumping by purchase of supplies from willing sellers and by taking advantage of regulatory flexibility and certain SWP operational assets. The EWA acquires water from willing sellers by transfers of water from non-SWP reservoirs, by purchase of previously banked groundwater and by transfers of surface water made available by groundwater substitution. The EWA can also purchase water made available by the idling of crop land or by the substitution of high water use crops with lower water use crops, but this has not yet been done.

The EWA can gain operational assets by relaxing the export/Delta inflow (E/I) ratio at times to increase Banks pumping; by pumping of certain environmental water released to the Delta after it has served its other purposes; and by temporary use of available storage in SWP and CVP reservoirs. The EWA can also use 500 cfs of the capacity at the Banks Pumping Plant above the 6,680 cfs intake rate from July 1 through September 30 each year to move purchased EWA transfer water through the Delta or gain unappropriated water if the Delta is in excess conditions. The replacement water is then delivered to the CVP and SWP at the O'Neill Forebay of San Luis Reservoir.

Five agencies administer the EWA. They are the Department and Reclamation (the agencies that operate the SWP and the CVP) the USFWS, the NMFS and the CDFG, (the agencies responsible for protecting and managing the Delta's natural resources). The Department and Reclamation are called the Project Agencies; the others are called the Management Agencies. The EWA began operation in late 2000.

The operation of the EWA does not change any deliveries to SWP or CVP contractors, but it does change certain aspects of SWP operations. As part of the EWA adaptive management process described above, the SWP is permitted to pump an additional 500 cfs from July 1 to September 30, making the summer limit effectively 7,180 cfs rather than 6,680 cfs. Thus, due to fish actions, less water may be moved through the Delta in December through June and more water may be pumped in July through September.

Because the EWA Program supports pumping curtailments (fish actions) between December and June, and repays the water primarily in the summer months, the water levels in San Luis Reservoir are generally lower with EWA operations than without during parts of the year. The amount of pumping curtailments at Banks that are not yet repaid is termed EWA debt. The amount of water stored in San Luis Reservoir is tracked in two ways: actual and base case. The base case is the storage level in the reservoir that would have occurred if there were no EWA debt to the SWP. The actual level is lower than the base case by the amount of EWA debt.

San Luis Reservoir operations with the EWA in operation occur as follows. The Department attempts to fill San Luis Reservoir as early in the year as it can. Once it is full in the base case (full except for EWA debt), other SWP storage facilities south of the Delta are full or conveyance capacity to fill these reservoirs is maximized, and conditions are such that exports are projected to exceed demand, the Department typically announces the availability of additional water under Article 21 of the water supply contracts. Contractors may request delivery of the additional water if they can put it to direct beneficial use or place it in storage. If the contractors' Table A and Article 21 water deliveries are being satisfied, and the permitted maximum intake capacity at Clifton Court Forebay exceeds those demands, the EWA may use that added pumping capacity to repay any debt it might have to the SWP in San Luis Reservoir. Otherwise EWA repays the debt later in the year with purchased water or operational assets, or may carry some debt to the SWP into a future year.

Once the EWA debt is repaid, the south-of-Delta SWP storage reservoirs are full or at their storage targets, the contractors are taking all the water they can accept (both Table A and Article 21), and Banks is not being used to convey non-SWP water, then the amount of water taken into Clifton Court Forebay may be cut back to just balance south-of-Delta SWP deliveries. At this time, Delta outflow increases by the amount of the intake decrease at Clifton Court Forebay and pumping at the Banks Pumping Plant is decreased by a like amount. Under current demand conditions, this change generally occurs only during wet winters, and usually ends by the start of VAMP, which generally begins April 15, but occasionally begins later (May 1 in 2005 and 2006).

The result of this aspect of EWA operations is to reduce the amount of time when all SWP reservoirs south of the Delta are full or at their storage targets, all SWP demands are being met, and Banks pumping can be reduced. Banks pumping would generally not be reduced until the EWA debt has been repaid and SWP storage in San Luis Reservoir is physically full.

6.3.3 Vernalis Adaptive Management Program

During April, the Vernalis Adaptive Management Program (VAMP) takes effect. The VAMP is an experimental/management program designed to protect juvenile Chinook salmon migrating down the San Joaquin River and through the Delta. The program involves the release of water from reservoirs on the San Joaquin River and the curtailment of pumping by the SWP and CVP. Around the time the SWP and CVP reduce their export pumping for the VAMP, water demands from both agricultural and M&I contractors are increasing, and if still available, delivery of Article 21 water is usually discontinued. Water is released from San Luis Reservoir to the California Aqueduct as needed to meet contractors' demands for Table A water that exceed allowable Delta pumping.

By late May, after VAMP and its "shoulders" (the ramping down of pumping before VAMP and ramping back up of pumping after VAMP), Delta pumping at the Banks Pumping Plant can be increased depending on Delta inflow and Delta standards. By late May, demands usually exceed the restored pumping rate at Banks, and continued releases from San Luis Reservoir are needed to meet contractor demands for Table A water.

6.3.4 Water Rights Decision 1641 and Joint Point of Diversion

The SWRCB's issued Water Rights Decision 1641 in 1999 and revised it in two water rights orders in 2000 and 2001. Revised D-1641 requires Reclamation and the Department to continue to meet certain water quality and flow objectives in the Delta. The SWRCB's actions are described in detail in Chapter 7, Section 7.1.

D-1641 also authorizes the Department to divert up to 4,600 cfs at the CVP's Jones Pumping Plant subject to approval by Reclamation if certain conditions are met. Reclamation may divert water at the Banks Pumping Plant in accordance with similar provisions. Per D-1641, use of JPOD is allowed only when fish and wildlife and other legal users of water are protected from harm.

6.4 SWP OPERATIONS UNDER THE PROPOSED PROJECT

The Monterey Amendment made numerous changes to the long-term water supply contracts between the Department and the SWP contractors. Some of the changes affected the operations of the SWP whereas others were administrative changes that had no effect on SWP operations. Table 6-3 lists the articles in the SWP contracts that were amended, deleted or added as part of the Monterey Amendment and indicates whether they have the potential to change SWP operations. If an article could cause changes in the way SWP water is stored or conveyed then it was assumed that it could have the potential to produce a change in SWP or contractor operations, which might in turn have environmental effects.

The contractual changes with the greatest potential for effects on SWP operations are those that altered water allocation procedures in times of shortage and surplus, enabled transfers and retirements of Table A amounts, and provided for the use of various water supply management practices.

6.4.1 Analytical Methods

Two analytical methods were used to examine the effects of the Monterey Amendment on SWP and SWP contractor operations: analysis of historical data and CALSIM II model simulation and post-processing of CALSIM II output. Several studies were conducted using analysis of historical data (Study Nos. 1, 2 and 3) and CALSIM II (Study Nos. 4 and 5). The studies are listed in Table 5-2 and are contained in Appendices F, H, I and K.

To characterize the effects of the proposed project between 1996 and 2003, three historical analyses were performed. One historical analysis (Study No. 1) examined the effects of the Table A transfers and retirements and the altered water allocation procedures on Table A allocations. A second analysis examined the changes in historical SWP operations between 1996 and 2003 attributable to the combined effects of the water supply management practices and the Table A retirements (Study No. 2). Study No. 2 took account of the effects of Article 52, the transfer of the Kern Fan Element property from state to local ownership, and the subsequent development of the Kern Water Bank. The Kern Water Bank represents new south of delta storage that would not be available under the baseline scenario and thus could potentially increase deliveries and Delta diversions. In fact, a survey of users of the Kern Water Bank indicated that between 1996 and 2004 and in the absence of the Kern Water Bank, the users of the bank would have placed the available SWP water in other storage available to them. Consequently, Article 52 of the Monterey Amendment did not have any effect on deliveries or Delta diversions between 1996 and 2004.

A third historical analysis was used to examine possible future effects of the water supply management practices on SWP operations (Study No. 3). Study No. 3 is similar to Study No. 2 in that it uses historical data from 1996 to 2004, but it uses different assumptions with respect to the availability of in-service area storage and out-of-service area storage.

Although the historical analyses provide useful information, its value is limited by the fact that the period from 1996 through 2005 (inclusive) is representative of only a small portion of the hydrologic record. The CALSIM II model simulates SWP operations over a longer period of hydrologic record. For this EIR, it was used to estimate the total annual SWP water supplies that would be available under a wider range of hydrologic conditions under conditions prevailing or projected to prevail in 1995, 2003, and 2020. CALSIM II estimates of total annual deliveries were post-processed to estimate deliveries to individual contractors with the results shown as

TABLE 6-3

POTENTIAL EFFECTS OF MONTEREY AMENDMENT ON SWP OPERATIONS

Amended, Deleted, or Added Article	Summary	Potential Change in SWP or Contractor Operations	Notes
1(d)	Definition change for "Contractor"	No	
1(k)	Reduces SWP's minimum project yield from 4.23 to 4.185 MAF/yr	No	a
1(hh)	Definition change for "Water System Facilities"	No	
1(jj)	Definition added for "Interruptible water"	No	
1(kk)	Definition added for "Non-SWP water"	No	
1(ll)	Definition added for "Monterey Amendment"	No	
4	Revises options for continued service	No	
7(a)	Revises procedures for requesting changes in Table A amounts	No	
12	Title change for Article 12	No	
12(a)(2)	Makes Department review and modification of contractor delivery schedules consistent with Article 18	No	
12(d)	Deleted	No	
12(f)	Added to clarify priorities for delivery of water	Yes	
14(a)	Expands conditions under which the Department can curtail deliveries to include outages or reductions in capability of facilities outside of State's control	No	
14(b)	Clarifies conditions for subsequent delivery of water not delivered due to curtailments covered in 14(a)	No	
16(a)	Reduces sum of maximum Table A amounts to 4.185 MAF to be consistent with 1(k)	Yes	
18(a)	Revises allocation procedures in shortages	Yes	
18(b)	Deletes provision for reducing Table A amounts when there is a threatened permanent water shortage as defined in provision	Yes	b
18(d)(e)	Eliminates references to Article 18(b)	No	
21(a) through (j)	Eliminates provisions for scheduled "surplus" water, renames "unscheduled water" as "interruptible water and sets terms for delivery of "interruptible water". Eliminates some restrictions on use of "surplus" water.	Yes	
22(j)	Clarifies financial obligations with regards to "the conservation portion of the water system revenue bond financing costs" as they relate to new Article 51	No	
24(b)	Refines definition of financial obligation with regards to aqueduct capital costs	No	
24(g)	Clarifies financial obligations with regards to the "capital cost component of the Transportation Charge" as they relate to new Article 51	No	
25(d)(3)	Clarifies method used to allocate power costs	No	
50(j)	Added to clarify the obligations related to bond financing under Article 50 and unaffected by new Article 51	No	
51	Added to specify numerous financial adjustments	No	
52	Added to transfer state-owned land in the Kern Fan Element to KCWA	Yes	c
53	Added to allow for accelerated administrative approval of voluntary permanent transfer up to 130,000 AF from Agricultural Contractors. Also provides for retirement of 45,000 AF of Table A between KCWA and DRWD	Yes	
54	Added to allow flexible storage at Castaic Lake and Lake Perris	Yes	
55	Added to clarify process and charges associated with the transportation of non-SWP water for contractors	No	
56	Added to encourage cooperation among the contractors to develop groundwater storage programs and to govern storage of Project Water outside contractor service areas. Also established a process for contractors to sell their SWP water via a turnback pool	Yes	

Notes:
a. Affects SWP as it relates to total Table A amounts in article 16(a).
b. Will analyze potential effects of invoking Article 18(b) in No Project Alternatives 1 and 2.
c. Virtually eliminates the possibility that a state-owned groundwater bank on the Kern Fan Element property would be developed as part of the SWP.

averages of deliveries in wet, above normal, below normal, dry and critically dry years (Study No. 4). The CALSIM estimates do not include the effects of the water supply management practices.

The CALSIM II model uses historical hydrological data from a 73-year period of record and other data to simulate river flow in the Sacramento and San Joaquin valleys, flow in the Delta and the operations of the SWP and CVP. It is an analytical tool that is best used to evaluate alternative projects or decisions. It does not forecast actual operations of the SWP or CVP. Actual day-to-day operations of the SWP and CVP depend on continuous collection of, and response to, real-time data. Actual operations are more complex than can be simulated by CALSIM II or any other mathematical simulation model.

As noted earlier, the Department usually allocates water in five-percent increments. A five percent allocation increase provides about 200,000 AF of water for the SWP contractors. A one percent allocation provides about 40,000 AF of Table A. The CALSIM II model allocates a computed number of acre feet of water based on its internal formulas in amounts that are not even whole percentages of the total contract Table A. Thus, it is important to note that the degree of precision of the total annual allocations in the CALSIM II model output exceeds the real-world practices of the Department in determining overall allocations.

It is also important to note that the CALSIM II post-processing spreadsheets distribute the precise CALSIM-determined SWP allocations to the individual contractors for each year. In real world practice, the differences between the CALSIM II estimates and the five percent (or one percent) Department allocations would be carried over as a difference between the target year-end reservoir storage and actual year-end storage, and could increase or decrease allocations in the subsequent year.

None of the individual analytical studies described above, and in Chapter 5, fully characterize the effects of the proposed project on SWP operations and the environment. But used together, as described in the following sections of this chapter, they provide a comprehensive evaluation of the effects of the proposed project.

6.4.2 Changes in Allocations and Deliveries to Contractors Induced by Permanent Transfers and Retirements of Table A Amounts and Altered Allocation Procedures

Each year, the Department determines the total amount of water available for delivery to the contractors. Several provisions of the Monterey Amendment affect how this total supply is allocated among the individual contractors. The allocations identify how much water each contractor has available to it for delivery that year. The altered allocation procedures of Articles 18 and 21 change how water is allocated between agricultural and M&I contractors. In addition, Article 53 of the Monterey Amendment provides for permanent transfers and retirements of Table A amounts. Agricultural contractors would permanently retire 45,000 AF of Table A amount and permanently transfer up to 130,000 AF of Table A amount to M&I contractors.

Between 1996 and 2003, 45,000 AF of Table A amount was permanently retired and 114,000 AF of Table A amount was transferred from agricultural to M&I contractors pursuant to the Monterey Amendment. Included in the 114,000 AF is a 41,000 AF transfer from Wheeler Ridge-Maricopa Water Service District, a KCWA member agency, to Castaic Lake WA. This transfer is currently the subject of litigation.[1] It is included in this analysis because the Department is currently operating under the amendments that authorized the transfer; that is. water associated with the transferred Table A amount is allocated to Castaic Lake WA and the costs associated with that Table A amount are billed to and paid by Castaic Lake WA. The agencies that retired or transferred Table A amounts pursuant to the Monterey Amendment between 1996 and 2003 and those that received the transfers are listed in Table 6-4.

Additional Monterey Amendment-related Table A transfers have occurred or are expected between 2003 and 2020. They are shown in Table 6-5. Of the 130,000 AF of Table A transfer provided for by Article 53 of the Monterey Amendment, 114,000 AF was transferred between 1996 and 2003. The remaining 16,000 AF is expected to be transferred from KCWA to Coachella Valley WD and Desert WA. Coachella Valley WD and Desert WA would receive 12,000 AF and 4,000 AF of Table A amount, respectively. These transfers would make up the balance of the 130,000 AF of Table A transfer provided for by the Monterey Amendment.[2]

From 1996 through 2003, several other permanent transfers of Table A amount totaling 22,273 AF occurred under Article 41, a provision of the long-term water supply contracts that was in place prior to the Monterey Amendment. The source of all the transfers was Tulare Lake Basin WSD. The transfers are listed in Table 6-4 and were not a consequence of the Monterey Amendment. In the analysis that follows, the transfers were assumed to occur under all scenarios examined in this EIR (baseline, proposed project and alternatives to the proposed project) because they would likely have occurred whether or not the Monterey Amendment had been executed.

Two other transfers occurred in 2005. MWDSC transferred 88,100 AF of Table A amount to Coachella WA and 11,900 AF of Table A amount to Desert WA. These transfers were a result of the Quantification Settlement Agreement, an agreement on how water from the Colorado River will be shared. These transfers are also unrelated to the Monterey Amendment and were assumed to occur under all scenarios examined in this EIR (baseline, proposed project and alternatives to the proposed project).

Table 6-6 shows Table A amounts in 1995 before implementation of the Monterey Amendment and Table A amounts in 2003 and 2020. Under the baseline scenario the total Table A amount would have increased from its 1995 value of 4,163,066 AF to 4,171,926 AF in 2003 and 4,217,686 AF in 2020 in accordance with the pre-Monterey Amendment SWP contracts. The transfers of Table A amount from Tulare Lake Basin WSD to other contractors shown in Table 6-4 are assumed to occur between 1995 and 2003 and the Quantification Settlement Agreement transfers from MWDSC to Coachella WA and Desert WA are assumed to occur between 2003 and 2020.

Table A amounts for the proposed project in 2003 and 2020 are also shown in Table 6-6. The total Table A amounts for the proposed project in 2003 and 2020 are lower than those under the baseline scenario by 45,000 AF, the amount of Table A retired in accordance with the Monterey Amendment. They also reflect the effect of the Table A transfers shown in Tables 6-4 and 6-5.

In addition to providing for transfers and retirements of Table A amounts, the Monterey Amendment altered the procedures for allocating SWP water in times of shortage and surplus. The Monterey Amendment amends the temporary shortage provisions of Article 18(a) of the long-term water supply contracts which specifies how water should be allocated to the contractors during annual water shortages. Prior to the Monterey Amendment, Article 18(a) required that deliveries to agricultural contractors be curtailed in years of shortage before M&I contractors suffered any cutbacks and Article 21 gave delivery priority to agricultural contractors when surplus water was available. Amended Articles 18(a) and 21 require shortages and surpluses to be shared among all contractors in proportion to their Table A amounts.

TABLE 6-4

TABLE A TRANSFERS AND RETIREMENTS 1996-2003

Transferring/Retiring Contractor	Transaction Type	Purchasing Contractor	Quantity (AF)	Notes
Kern County Water Agency	Retirement	NA	40,670	a
Dudley Ridge Water District	Retirement	NA	4,330	a
Kern County Water Agency	Transfer	Palmdale Water District	4,000	a
Kern County Water Agency	Transfer	Napa County Flood Control and Water Conservation District	4,025	a
Kern County Water Agency	Transfer	Solano County Water Agency	5,756	a
Kern County Water Agency	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	10,000	a
Kern County Water Agency	Transfer	Mojave Water Agency	25,000	a
Kern County Water Agency	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	7,000	a
Kern County Water Agency	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	15,000	a
Kern County Water Agency	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	2,219	a
Kern County Water Agency	Transfer	Castaic Lake Water District	41,000	a, b
Tulare Lake Basin Water Service District	Transfer	Antelope Valley – East Kern Water Agency	3,000	c
Tulare Lake Basin Water Service District	Transfer	Dudley Ridge Water District	3,973	c
Tulare Lake Basin Water Service District	Transfer	Alameda County Flood Control and Water Conservation District, Zone 7	400	c
Tulare Lake Basin Water Service District	Transfer	County of Kings	5,000	c
Tulare Lake Basin Water Service District	Transfer	Coachella Valley Water District	9,900	c

Notes:
a. Retirements and transfers included in the 45,000 acre-foot retirement and 130,000 AF transfer provided for in the Monterey Amendment.
b. Pending resolution of a legal challenge.
c. Transfers unrelated to the Monterey Amendment and included in the baseline scenario.
Source: California Department of Water Resources.

TABLE 6-5

EXPECTED TABLE A TRANSFERS AND RETIREMENTS 2003-2020

Transferring/Retiring Contractor	Purchasing Contractor	Quantity (AF)	Notes
Kern County Water Agency	Coachella Valley Water District	12,000	a
Kern County Water Agency	Desert Water Agency	4,000	a
Metropolitan Water District of Southern California	Coachella Valley Water District	88,100	b
Metropolitan Water District of Southern California	Desert Water Agency	11,900	b

Notes:
a. Transfers included in the 130,000 AF transfer provided for in the Monterey Amendment.
b. Transfers unrelated to the Monterey Amendment and included in the baseline scenario.
Source: California Department of Water Resources.

TABLE 6-6

TABLE A AMOUNTS IN 2003 AND 2020 UNDER BASELINE SCENARIO AND WITH PROPOSED PROJECT (AF)

SWP Contractors	1995	2003		2020	
		Baseline	Proposed Project	Baseline	Proposed Project
County of Butte	1,200	3,500	3,500	27,500	27,500
Plumas County FC&WCD	1,250	1,690	1,690	2,700	2,700
City of Yuba City	9,600	9,600	9,600	9,600	9,600
Napa County FC&WCD	9,780	17,450	21,475	24,900	28,925
Solano County WA	34,250	41,000	46,756	42,000	47,756
Alameda Co. FC&WCD, Zone 7	42,000	46,400	80,619	46,400	80,619
Alameda County WD	42,000	42,000	42,000	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	5,700
County of Kings	4,000	9,000	9,000	9,000	9,000
Dudley Ridge WD	57,700	61,673	57,343	61,673	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	3,000
KCWA (Ag)	1,018,800	1,018,800	864,130	1,018,800	848,130
KCWA (Muni)	134,600	134,600	134,600	134,600	134,600
Tulare Lake Basin WSD	118,500	96,227	96,227	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	45,486
Antelope Valley-East Kern WA	138,400	141,400	141,400	141,400	141,400
Castaic Lake WA (Ag)	12,700	12,700	12,700	12,700	12,700
Castaic Lake WA (Muni)	41,500	41,500	82,500	41,500	82,500
Coachella Valley WD	23,100	33,000	33,000	121,100	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	5,800
Desert WA	38,100	38,100	38,100	50,000	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	2,300
Mojave WA	50,800	50,800	75,800	50,800	75,800
Metropolitan WDSC	2,011,500	2,011,500	2,011,500	1,911,500	1,911,500
Palmdale WD	17,300	17,300	21,300	17,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	28,800
San Gorgonio Pass WA	17,300	5,000	5,000	17,300	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	20,000
Total	4,163066	4,171,926	4,126,926	4,217,686	4,172,686

6.4.2.1 Analysis Using Historical Data

Allocations from 1996 through 2005

The effects of the Table A transfers and retirements and the altered water allocation procedures on allocations of SWP water were analyzed using historical data for the period 1996 through 2005. Because the Monterey Amendment was implemented in 1996, post-Monterey Amendment SWP allocations to individual contractors in the period 1996 through 2005 are a matter of historical record. The Department conducted a study (Study No. 1) that compared the actual Table A allocations to individual contractors that occurred between 1996 and 2005 to the Table A allocations that the Department calculates it would have made in that period under the baseline scenario. Under the baseline scenario, water demand would increase but none of the provisions of the Monterey Amendment would be implemented. For a description of the analytical method and complete results of Study No. 1, see Chapter 5 and Appendix I.

Table 6-1 shows historical SWP allocations and deliveries from 1980 to 1995, prior to implementation of the proposed project. During the ten-year period preceding implementation of the proposed project, allocations of Table A water averaged 2,400 TAF, ranging from 672 TAF in 1991 (a critically dry year that was the fifth year in an extended drought) to 3,846 TAF in 1993 (an above normal year). During the same period, deliveries of SWP water averaged 2,033 TAF (2,000 TAF of Table A and 33 TAF of Article 21 water) with the maximum delivery of 2,854 TAF occurring in 1989. As discussed previously, individual contractors may not take delivery of all the water allocated to them for a number of reasons such as lower than projected demand in their service area or greater than projected availability of water from local sources.

Table 6-7 shows historical allocations and deliveries following implementation of the proposed project. From 1996 through 2005, after implementation of most elements of the proposed project, allocations of Table A water averaged 3,010 TAF, ranging from 1,608 TAF in 2001 (a dry year) to 3,714 TAF in 2003 (a normal year). During the same period, deliveries averaged 2,658 TAF (2,495 of Table A and 163 TAF of Article 21 water). The maximum delivery during the period 1996 through 2005 was 3,559 TAF in 2005.

TABLE 6-7

DELIVERIES OF TABLE A AND ARTICLE 21 WATER (1996-2005)

Year	Total Table A Amounts AF	Initial Table A Requests AF	Final Table A Approvals AF	Table A Deliveries AF	Article 21 Water Delivered AF	Final Allocation %	
						M&I	Ag
1996	4,111,341	2,676,467	2,701,707	2,514,825	28,647	100	100
1997	4,084,866	2,976,606	2,977,246	2,325,775	21,432	100	100
1998	4,086,021	3,335,367	3,191,045	1,725,519	20,288	100	100
1999	4,119,646	3,147,569	3,214,259	2,738,891	158,070	100	100
2000	4,121,631	3,617,267	3,406,083	3,200,677	308,785	90	90
2001	4,124,136	4,124,136	1,607,570	1,546,742	43,435	39	39
2002	4,125,031	3,913,698	2,887,014	2,573,030	37,165	70	70
2003	4,126,926	4,126,926	3,714,233	2,901,041	59,828	90	90
2004	4,127,061	4,128,811	2,683,727	2,599,536	218,496	65	65
2005	4,125,686	4,127,986	3,713,117	2,828,406	731,083	90	90

Source: California Department of Water Resources.

Comparison of the ten-year periods preceding and following implementation of the proposed project shows a rising trend in both allocations of Table A water and total deliveries. The rising trend is attributable to more favorable hydrology between 1996 and 2005 than between 1986 and 1995, increased water demand in the M&I contractors' service areas and facilities improvements that gave some contractors better access to SWP water.

Several provisions of the Monterey Amendment affected allocations to individual contractors after 1995 but the provisions with the greatest effect were those that altered the water allocation method (Article 18(a)) and called for transfers of Table A amount from M&I to agricultural contractors (Article 53). For example, in 2000, all contractors were allocated 90 percent of their Table A amounts. If the Monterey Amendment had not been in place the agricultural and M&I contractors would have been allocated 79 percent and 100 percent of their Table A amounts, respectively. Similarly, in 2001, all contractors were allocated 39 percent of their Table A amounts. If the Monterey Amendment had not been in place the agricultural and M&I contractors would have been allocated 3 percent and 53 percent of their Table A amounts, respectively.

Tables 6-8 and 6-9 show the effects of the Table A transfers and altered water allocation procedures on the M&I and agricultural contractors as groups between 1996 and 2005. The Table A allocations for the proposed project are the actual allocations that occurred between 1996 and 2005 because the proposed project was being implemented in those years. The Table A allocations for the baseline scenario represent the Table A allocations that would have occurred if the Monterey Amendment had not been implemented. They were estimated by applying pre-Monterey Amendment allocation procedures to the contractors' Table A amounts and requests. As noted above, Table A allocations are not the same as Table A deliveries. The Department makes Table A allocations based on hydrologic conditions and the amount of water in storage in SWP reservoirs. Contractors may not take delivery of all the water allocated to them.

TABLE 6-8

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS TO M&I CONTRACTORS

Year	Water Year Type[a]	Baseline Scenario (AF)	Proposed Project (AF)	Difference (AF)	Percent Change
1996	W	2,931,611	2,931,611	0	0%
1997	W	2,909,466	2,909,466	0	0%
1998	W	2,910,621	2,910,621	0	0%
1999	W	2,063,859	2,063,859	0	0%
2000	AN	2,394,920	2,394,920	0	0%
2001	D	1,562,830	1,150,007	-412,853	-26%
2002	D	2,241,720	2,064,742	-176,978	-8%
2003	AN	2,623,456	2,652,015	28,559	1%
2004	BN	1,890,183	1,919,717	29,534	2%
2005	AN	2,625,755	2,655,257	29,503	1%
Total		**24,154,420**	**23,652,215**	**-502,205**	**-2%**

Notes:
AN= Above Normal D = Dry BN = Below Normal W = Wet

a. The Department classifies water year types as wet (W), above normal (AN), below normal (BN), dry (D), and critically dry (CD), based on flow in the Sacramento and San Joaquin rivers.
Source: California Department of Water Resources.

TABLE 6-9

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS TO AGRICULTURAL CONTRACTORS

Year	Water Year Type[a]	Baseline Scenario (AF)	Proposed Project (AF)	Difference (AF)	Percent Change
1996	W	1,224,730	1,179,730	-45,000	-4%
1997	W	1,220,400	1,175,400	-45,000	-4%
1998	W	1,220,400	1,175,400	-45,000	-4%
1999	W	1,147,176	1,175,400	28,224	2%
2000	AN	1,023,932	1,057,860	44,928	4%
2001	D	36,679	459,271	422,593	1152%
2002	D	648,200	824,333	176,133	27%
2003	AN	1,090,810	1,062,251	-28,559	-3%
2004	BN	781,056	764,010	-17,046	-2%
2005	AN	1,086,156	1,057,860	-28,296	-3%
Total		9,468,539	9,931,516	462,977	5%

Note:
AN= Above Normal D = Dry BN = Below Normal W = Wet

a. The Department classifies water year types as wet (W), above normal (AN), below normal (BN), dry (D), and critically dry (CD), based on flow in the Sacramento and San Joaquin rivers.
Source: California Department of Water Resources.

As shown in Table 6-8, in most years, the M&I contractors' total Table A allocation was similar with the proposed project and under the baseline scenario. However, in dry years (2001 and 2002) the M&I contractors' total Table A allocation with the proposed project was considerably less than it would have been under the baseline scenario. For the ten-year period, the M&I contractors' total Table A allocation was about 500,000 AF (or about two percent) less than it would have been under the baseline scenario.

As shown in Table 6-9, in most years, the agricultural contractors' total Table A allocations with the proposed project and under the baseline scenario were within 10 percent of each other. However, in two dry years (2001 and 2002), the agricultural contractors' total Table A allocation with the proposed project was considerably more than it would have been under the baseline scenario. For the 10-year period, the agricultural contractors' Table A allocation was about 450,000 AF (or five percent) more than it would have been under the baseline scenario.

The effects of the Table A transfers and retirements and altered water allocation procedures on individual M&I and agricultural contractors between 1996 and 2005 varied. The effects differ for the following four groups of contractors:

- M&I contractors that did not participate in a Monterey Amendment-related transfer or retirement of Table A amount;
- M&I contractors that did participate in a Monterey Amendment-related transfer or retirement of Table A amount;
- Agricultural contractors that did not participate in a Monterey Amendment-related transfer or retirement of Table A amount; and
- Agricultural contractors that did participate in a Monterey Amendment-related transfer or retirement of Table A amount.

Table 6-10 shows the effects of the Table A transfers and retirements and altered water allocation procedures on Santa Clara Valley WD, Santa Barbara County FC&WCD and MWDSC. These three contractors are examples of M&I contractors that did not participate in a Monterey Amendment related transfer or retirement of Table A amount. In most years, the Table A allocations for M&I contractors in this group were similar with the proposed project and under the baseline scenario. However, in dry years (2001 and 2002) the Table A allocations for M&I contractors in this group with the proposed project were less than they would have been under the baseline scenario. For M&I contractors in this group, Table A allocations were reduced by about two or three percent over the ten-year period from 1996 through 2005 with the proposed project compared to the baseline scenario. The reason for the reduction in Table A allocations for M&I contractors in this group is that the altered water allocation procedure that is a part of the proposed project subjected these contractors to greater cuts in dry years than would have occurred under the baseline scenario.

Table 6-11 shows the effects of the Table A transfers and retirements and altered water allocation procedures on Solano County WA, Alameda County, Zone 7, and Mojave WA. These three contractors are examples of M&I contractors that participated in a Monterey Amendment-related transfer of Table A amount. M&I contractors in this group received greater Table A allocations in most or all years with the proposed project than under the baseline scenario. Some M&I contractors in this group (Solano County WA, for example) received greater Table A allocations with the proposed project than under the baseline scenario in all but dry years because the Table A transfers that are a part of the proposed project increased their individual Table A amounts. This is because the allocation-decreasing effects of the altered allocation procedures were insufficient to offset the allocation-increasing effects of the Table A transfers in all years. However, in dry years the allocation-increasing effects of the Table A transfers were more than offset by the allocation-decreasing effects of the altered water allocation procedure.

The other two contractors in this group received greater Table A allocations with the proposed project than they would have under the baseline scenario every year from 1996 through 2005.

Table 6-12 shows the effects of the Table A transfers and retirements and altered water allocation procedures on County of Kings and Oak Flat WD. These two contractors did not participate in a Monterey Amendment-related transfer or retirement of Table A amount. Agricultural contractors in this group experienced an increase in their Table A allocations in many years between 1996 and 2005 compared to the baseline scenario. The increases in Table A allocations in many years were small and attributable to the retirement of 45,000 AF of Table A amount that is part of the Monterey Amendment. The retirement of 45,000 AF of Table A amount increased each contractor's share of the total Table A amount by about one percent with a consequent effect on its Table A allocations. For example, prior to the Monterey Amendment, Oak Flat WD's Table A amount of 5,700 AF represented 0.1372 percent of the total Table A amount. After the Monterey Amendment, it represented 0.1387 percent of the total Table A amount. In 2001 and 2002, two dry years, agricultural contractors in this group received a substantial increase in their allocations because of the altered allocation procedures that eliminated agriculture-first allocation cuts. In 2001, for example, agricultural contractors in this group received Table A allocations about twelve times greater than they would have under the baseline scenario.

TABLE 6-10

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS FOR SELECTED M&I CONTRACTORS THAT DID NOT PARTICIPATE IN A MONTEREY AMENDMENT-RELATED TABLE A TRANSFER

Contractor	Year	Baseline Table A Allocation (AF)	Proposed Project Table A Allocation (AF)	Change in Table A Allocation	
				AF	Percent
Santa Clara Valley WD	1996	100,000	100,000	0	0%
	1997	100,000	100,000	0	0%
	1998	100,000	100,000	0	0%
	1999	100,000	100,000	0	0%
	2000	100,000	100,000	0	0%
	2001	53,000	39,000	-14,000	-26%
	2002	76,000	70,000	-6,000	-8%
	2003	88,885	89,852	968	1%
	2004	64,000	65,000	1,000	2%
	2005	89,000	90,000	1,000	1%
	Total	871,596	843,960	-17,032	-2%
Santa Barbara FC&WCD	1996	45,486	45,486	0	0%
	1997	38,986	38,986	0	0%
	1998	38,986	38,986	0	0%
	1999	45,486	45,486	0	0%
	2000	45,486	45,486	0	-0%
	2001	24,108	17,740	-6,368	-26%
	2002	34,569	31,840	-2,729	-8%
	2003	40,430	40,870	440	1%
	2004	29,111	29,566	455	2%
	2005	40,483	40,937	455	1%
	Total	383,454	370,884	-7,747	-2%
MWDSC	1996	2,011,500	2,011,500	0	0%
	1997	2,011,500	2,011,500	0	0%
	1998	2,011,500	2,011,500	0	0%
	1999	1,180,000	1,180,000	0	0%
	2000	1,507,136	1,507,136	0	0%
	2001	1,066,095	784,485	-281,610	-26%
	2002	1,528,740	1,408,050	-120,690	-8%
	2003	1,787,916	1,807,380	19,463	1%
	2004	1,287,360	1,307,475	20,115	1%
	2005	1,701,235	1,720,350	9,115	1%
	Total	16,092,982	15,749,375	-343,607	-2%

Source: California Department of Water Resources.

TABLE 6-11

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS FOR SELECTED M&I CONTRACTORS THAT PARTICIPATED IN A MONTEREY AMENDMENT-RELATED TABLE A TRANSFER

Contractor	Year	Baseline Table A Allocation (AF)	Proposed Project Table A Allocation (AF)	Change in Table A Allocation	
				AF	Percent
Solano County WA	1996	37,800	37,800	0	0%
	1997	38,250	38,250	0	0%
	1998	38,710	38,710	0	0%
	1999	39,170	39,170	0	0%
	2000	39,620	39,620	0	0%
	2001	21,242	17,876	-3,366	-16%
	2002	30,810	32,407	1,597	5%
	2003	36,443	42,011	5,569	15%
	2004	26,528	30,684	4,156	16%
	2005	36,935	42,530	5,595	15%
	Total	345,509	359,059	13,550	4%
Alameda FC&WCD, Zone 7	1996	44,000	44,000	0	0%
	1997	46,000	46,000	0	0%
	1998	46,000	46,000	0	0%
	1999	46,000	46,000	0	0%
	2000	46,000	65,800	19,800	43%
	2001	24,380	31,286	6,905	28%
	2002	35,172	56,153	20,981	60%
	2003	40,887	72,079	31,192	76%
	2004	29,696	52,402	22,706	76%
	2005	41,296	72,557	31,261	76%
	Total	399,431	532,277	132,846	33%
Mojave	1996	50,800	50,800	0	0%
	1997	50,800	50,800	0	0%
	1998	50,800	75,800	25,000	49%
	1999	20,000	45,000	25,000	125%
	2000	20,000	42,500	22,500	113%
	2001	26,924	29,562	2,538	10%
	2002	38,608	53,060	14,452	37%
	2003	45,153	68,108	22,955	51%
	2004	32,512	49,270	16,758	52%
	2005	45,212	68,220	23,008	51%
	Total	380,809	533,120	152,311	40%

Source: California Department of Water Resources.

TABLE 6-12

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS FOR SELECTED AGRICULTURAL CONTRACTORS THAT DID NOT PARTICIPATE IN A MONTEREY AMENDMENT-RELATED TABLE A TRANSFER

Contractor	Year	Baseline Table A Allocation (AF)	Proposed Project Table A Allocation (AF)	Change in Table A Allocation	
				AF	Percent
County of Kings	1996	4,000	4,000	0	0%
	1997	4,000	4,000	0	0%
	1998	3,320	3,600	280	0%
	1999	120	1,560	1,440	8%
	2000	2,120	2,800	680	14%
	2001	8,000	8,087	87	1,120%
	2002	5,760	5,850	90	33%
	2003	8,010	8,100	90	1%
	2004	5,700	5,700	0	1%
	2005	5,700	5,700	0	1%
	Total	46,730	49,397	2,667	9%
Oak Flat WD	1996	5,700	5,700	0	0%
	1997	5,700	5,700	0	0%
	1998	5,700	5,700	0	0%
	1999	5,338	5,700	342	6%
	2000	4,731	5,130	399	8%
	2001	171	2,223	2,052	1,200%
	2002	3,021	3,990	969	32%
	2003	5,066	5,122	55	1%
	2004	3,648	3,705	57	2%
	2005	5,073	5,130	57	1%
	Total	44,168	48,100	3,931	9%
Tulare Lake Basin WSD	1996	118,500	118,500	0	0%
	1997	118,500	118,500	0	0%
	1998	118,500	118,500	0	0%
	1999	111,390	118,500	7,110	6%
	2000	98,355	106,650	8,295	8%
	2001	3,555	46,215	42,660	1,200%
	2002	59,109	78,069	18,960	32%
	2003	98,775	99,850	1,075	1%
	2004	61,585	62,548	962	2%
	2005	85,642	86,604	962	1%
	Total	873,912	953,936	80,024	9%

Source: California Department of Water Resources.

Table 6-13 shows the effects of the Table A transfers and retirements and altered water allocation procedures on the only agricultural contractor that participated in a Monterey Amendment-related transfer of Table A amount, KCWA. KCWA experienced a reduction in its Table A allocation compared to the baseline scenario in every year between 1996 and 2005 except 2001 and 2002. The reduction resulted from KCWA's Monterey Amendment-related transfer of 114,000 AF of Table A amount to M&I contractors and its retirement of 40,670 AF of the total 45,000 AF of Table A amount that was retired, both of which reduced KCWA's share of the total Table A amount. In the dry years 2001 and 2002, the reduction in Table A amount attributable to the Table A transfers and retirements was more than offset by the effects of the altered water allocation procedures. Prior to the Monterey Amendment, KCWA would have been allocated very little or no water in 2001. With the Monterey Amendment in place, its allocation in that year was increased substantially compared to the baseline scenario.

TABLE 6-13

EFFECTS OF PROPOSED PROJECT ON TABLE A ALLOCATIONS FOR AGRICULTURAL CONTRACTORS THAT PARTICIPATED IN A MONTEREY AMENDMENT-RELATED TABLE A TRANSFER

Contractor	Year	Baseline Table A Allocation (AF)	Proposed Project Table A Allocation (AF)	Change in Table A Allocation	
				AF	Percent
KCWA	1996	1,157,730	1,117,060	-40,670	-4%
	1997	1,153,400	1,112,730	-40,670	-4%
	1998	1,153,400	1,087,730	-65,670	-6%
	1999	1,092,272	1,087,730	-4,542	0%
	2000	980,204	932,117	-48,087	-5%
	2001	101,969	390,370	288,402	283%
	2002	643,436	700,664	57,228	9%
	2003	1,027,169	899,376	-127,793	-12%
	2004	738,176	649,175	-89,002	-12%
	2005	1,026,526	898,857	-127,669	-12%
	Total	9,074,281	8,875,809	-198,473	-2%

Source: California Department of Water Resources.

Future Allocations

Future SWP allocations cannot be predicted using historical analysis. However, because most of the provisions of the Monterey Amendment were implemented between 1996 and 2003, trends in allocations determined from historical analysis provide insight into future allocations baring catastrophic events.

6.4.2.2 Analysis Using CALSIM II

The CALSIM II model is a planning tool that uses historical data from a 73-year period of record and other data to simulate operations of the SWP and CVP. In Study No. 4, the CALSIM II model was used to estimate total annual deliveries of SWP water available in different year types under 2003 and 2020 conditions. CALSIM II model output of total deliveries was then post-processed to allocate these supplies to individual contractors in accordance with the allocation rules that apply to the baseline and proposed project scenarios. For a description of the analytical method and complete results of Study No. 4, see Chapter 5 and Appendix F.

The CALSIM II model is demand-driven; that is, a certain demand for SWP water is input to the model and the model then tries to meet as high a proportion as possible of the demand each year taking account of hydrologic conditions, environmental regulations, and the physical characteristics of the California water system. Demand for water in California increased from 1995 to 2003 and increases are expected to continue in the future even with the levels of aggressive water conservation assumed in the latest update to the California Water Plan. Individual contractors' demands for SWP water in 2003 and 2020 were estimated and used as input to the model. The assumptions made to estimate contractors' demands are described in Appendix F.

Separate CALSIM II model runs were made for the baseline and proposed project scenarios to reflect the differences in water demand for individual contractors related to the Table A retirements and transfers. For example, the demands of the two agricultural contractors that retired Table A amounts, and so for the SWP as a whole, are lower by 45,000 AF under the proposed project scenario as compared to the baseline. Similarly, the demands of agricultural contractors that transferred Table A amounts are lower by the amount transferred under the proposed project scenario. However, under 2003 conditions, it was assumed that those M&I contractors that received Table A transfers do not yet have a demand for the water in every year. Consequently, the difference in total SWP demand under the proposed project scenario compared to the baseline is something greater than the 45,000 AF of retired Table A amount. But this transfer-related reduction in demand is a temporary phenomenon. It was assumed that by 2020 the demands for these M&I contractors would increase to their full Table A amounts.

Deliveries to individual contractors with the proposed project and under the baseline scenario were estimated over the 73-year period of hydrologic record with averages calculated for wet, above normal, below normal, dry, and critically dry years. The following paragraphs describe the effects of the proposed project relative to the baseline scenario in average wet and critically dry years because the effects of the proposed project are most apparent in these hydrologic year types. Estimated deliveries in all hydrologic year types are contained in Appendix F. Annual average deliveries over the 73-year period of record were also calculated.

In the following section, Table A deliveries and total deliveries, including both Table A and Article 21 water deliveries, are discussed separately for two reasons; Table A water is the contractors' primary SWP supply, and the estimates of Table A deliveries are more accurate than those for Article 21 deliveries. Many contractors include only Table A deliveries in their future water supply planning because they are uncertain that they will be able to take advantage of Article 21 water. The availability, and if available, the timing of availability, of Article 21 water is uncertain. To take advantage of Article 21, a contractor must be able to use it or store it at the time it is available. Thus, for many contractors, Monterey Amendment-induced changes in Table A deliveries are of more importance than Monterey Amendment-induced changes in total deliveries.

As noted earlier, CALSIM II is demand driven. For the CALSIM studies for this EIR, contractor demands for Table A water were refined based on recent deliveries and discussions with some contractors. Consequently, contractors are very likely to be able to use the Table A deliveries estimated by the model, and thus the delivery estimates should have good accuracy. No similar refinement of demands for Article 21 water occurred and as a result, the estimates of deliveries of Article 21 water to individual contractors are much less accurate than the estimates of deliveries of Table A water.

The water supply management practices that are part of the Monterey Amendment may alter how much of a contractor's allocated SWP supply it is able to accept. But a contractor's use of the various water supply management practices is often dependent on local conditions unrelated to the SWP. For this reason, the CALSIM II model does not simulated the water supply management practices and consequently their effects are not reflected in the estimates of deliveries to individual contractors discussed below and contained in Tables 6-14 through 6-25. The effects of the water supply management practices are described in Section 6.4.3.

Table A Deliveries under 2003 Conditions

Table 6-14 shows estimated average Table A deliveries to individual contractors under 2003 conditions in *wet years* with the proposed project and under the baseline scenario. In wet years, the average of total Table A deliveries would decrease by 3 percent compared to the baseline scenario due to the Table A retirement and the Table A transfers to M&I contractors that do not yet have full demand for Table A water. Collectively, average Table A deliveries to

TABLE 6-14

ESTIMATED AVERAGE WET YEAR TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

	Baseline Scenario			Proposed Project			Table A Difference	
SWP Contractors	**Table A**	**Article 21**	**Total**	**Table A**	**Article 21**	**Total**	**TAF/yr**	**%**
Napa County FC&WCD	6.8	2.1	8.9	6.8	3.1	9.9	0	0
Solano County WA	37.7	2.3	40	37.7	4.2	41.9	0	0
Alameda Co. FC&WCD, Zone 7	46.4	2.4	48.8	66.5	4.3	70.8	20.1	43
Alameda County WD	35.2	2.9	38.1	35.2	4.1	39.3	0	0
Santa Clara Valley WD	84.7	10.6	95.3	84.7	13.4	98.1	0	0
Oak Flat WD	5.3	0	5.3	5.3	0	5.3	0	0
County of Kings	8.6	0	8.6	8.4	0	8.4	-0.2	-2
Dudley Ridge WD	57.0	4.3	61.3	53.4	4.3	57.7	-3.6	-6
Empire West Side ID	2.8	3.3	6.1	2.8	1.9	4.7	0	0
KCWA (Ag)	938.5	200.3	1138.8	805.0	152.0	957	-133.5	-14
KCWA (Muni)	134.6	0	134.6	134.6	0	134.6	0	0
Tulare Lake Basin WSD	87.3	53.9	141.2	89.6	31.9	121.5	2.3	3
San Luis Obispo Co. FC&WCD	4.4	0	4.4	4.4	0	4.4	0	0
Santa Barbara Co. FC&WCD	26.3	0	26.3	26.3	0	26.3	0	0
Antelope Valley-East Kern WA	64.9	3.5	68.4	64.9	4.5	69.4	0	0
Castaic Lake WA (Ag)	11.7	0	11.7	11.8	0	11.8	0.1	1
Castaic Lake WA (Muni)	41.5	2.3	43.8	68.6	4.4	73	27.1	65
Coachella Valley WD	19.3	6.3	25.6	19.3	4.6	23.9	0	0
Crestline-Lake Arrowhead WA	1.9	0	1.9	1.9	0	1.9	0	0
Desert WA	31.2	14.3	45.5	31.2	11.1	42.3	0	0
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	13.2	0	13.2	13.2	0	13.2	0	0
Metropolitan WDSC	1272.5	215.1	1487.6	1272.5	304.8	1577.3	0	0
Palmdale WD	14.9	0	14.9	14.9	0	14.9	0	0
San Bernardino Valley MWD	69.8	0	69.8	69.8	0	69.8	0	0
San Gabriel Valley MWD	18.1	0	18.1	18.1	0	18.1	0	0
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	5.0	0	5.0	5.0	0	5.0	0	0
Total All Contractors	3,039.7	523.5	3563.2	2,952.0	548.5	3,500.5	-87.7	-3
Total Agricultural Contractors	1,111.2	261.8	1373.0	976.3	190.0	1,166.3	-134.9	-12
Total Municipal Contractors	1,928.4	261.7	2190.1	1975.7	358.5	2,334.2	47.3	2

TABLE 6-15

ESTIMATED AVERAGE CRITICALLY DRY YEAR TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Table A Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	4.7	0.2	4.9	4.4	0.4	4.8	-0.3	-6
Solano County WA	17.8	0.3	18.1	19.3	0.5	19.8	1.5	8
Alameda Co. FC&WCD, Zone 7	19.9	0.3	20.2	30.5	0.5	31	10.6	53
Alameda County WD	16.8	0.3	17.1	16.0	0.5	16.5	-0.8	-5
Santa Clara Valley WD	40.1	1.2	41.3	38.3	1.8	40.1	-1.8	-4
Oak Flat WD	1.6	0	1.6	2.1	0	2.1	0.5	31
County of Kings	2.5	0	2.5	3.3	0	3.3	0.8	32
Dudley Ridge WD	17.5	0.5	18.0	21.3	0.5	21.8	3.8	22
Empire West Side ID	0.9	0.4	1.3	1.1	0.3	1.4	0.2	22
KCWA (Ag)	289.9	21.8	311.7	321.0	22.2	343.2	31.1	11
KCWA (Muni)	57.8	0	57.8	55.3	0	55.3	-2.5	-4
Tulare Lake Basin WSD	27.4	5.8	33.2	35.7	5.3	41	8.3	30
San Luis Obispo Co. FC&WCD	3.5	0	3.5	3.3	0	3.3	-0.2	-6
Santa Barbara Co. FC&WCD	19.5	0	19.5	18.4	0	18.4	-1.1	-6
Antelope Valley-East Kern WA	46.0	0.4	46.4	44.2	0.5	44.7	-1.8	-4
Castaic Lake WA (Ag)	3.6	0	3.6	4.7	0	4.7	1.1	31
Castaic Lake WA (Muni)	17.8	0.3	18.1	31.4	0.5	31.9	13.6	76
Coachella Valley WD	9.2	0.7	9.9	11.1	0.9	12	1.9	21
Crestline-Lake Arrowhead WA	1.7	0	1.7	1.6	0	1.6	-0.1	-6
Desert WA	15.1	1.5	16.6	14.4	1.9	16.3	-0.7	-5
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	12.2	0	12.2	12.3	0	12.3	0.1	1
Metropolitan WDSC	771.5	34.9	806.4	733.9	44.4	778.3	-37.6	-5
Palmdale WD	7.0	0	7.0	7.6	0	7.6	0.6	9
San Bernardino Valley MWD	38.1	0	38.1	36.2	0	36.2	-1.8	-5
San Gabriel Valley MWD	10.4	0	10.4	9.9	0	9.9	-0.5	-5
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	4.6	0	4.6	4.6	0	4.6	0	0
Total All Contractors	1,457.3	68.6	1,525.9	1,481.9	80.1	1,562	24.6	2
Total Agricultural Contractors	343.5	28.5	372	389.3	28.2	417.5	45.8	13
Total Municipal Contractors	1,113.9	40.1	1,154.0	1,092.6	51.9	1,144.5	-21.3	-2

TABLE 6-16

ESTIMATED AVERAGE ANNUAL TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Table A Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	6.5	1.0	7.5	6.4	1.7	8.1	-0.1	-2
Solano County WA	34.2	1.0	35.2	34.3	2.1	36.4	0.1	0
Alameda Co. FC&WCD, Zone 7	41.1	1.1	42.2	59.3	2.2	61.5	18.2	44
Alameda County WD	31.9	1.4	33.3	31.3	2.1	33.4	-0.6	-2
Santa Clara Valley WD	76.6	5.1	81.6	75.3	7.1	82.4	-1.3	-2
Oak Flat WD	4.4	0	4.4	4.7	0.0	4.7	0.3	7
County of Kings	7.0	0	7.0	7.3	0.0	7.3	0.3	4
Dudley Ridge WD	47.2	2.2	49.4	46.8	2.2	49	0.4	-8
Empire West Side ID	2.3	1.6	3.9	2.4	1.0	3.4	0.1	4
KCWA (Ag)	778.3	101.2	879.5	705.7	81.8	787.5	-72.6	-9
KCWA (Muni)	119.4	0	119.4	117.8	0	117.8	-1.6	-1
Tulare Lake Basin WSD	73.0	26.7	99.7	78.6	16.7	95.3	5.6	8
San Luis Obispo Co. FC&WCD	4.3	0	4.3	4.2	0	4.2	-0.1	-2
Santa Barbara Co. FC&WCD	25.2	0	25.2	24.9	0	24.9	-0.3	-1
Antelope Valley-East Kern WA	61.8	1.7	63.5	61.3	2.3	63.6	-0.5	-1
Castaic Lake WA (Ag)	9.7	0	9.7	10.4	0	10.4	0.7	7
Castaic Lake WA (Muni)	36.8	1.0	37.8	61.1	2.2	63.3	24.5	67
Coachella Valley WD	17.5	3.0	20.5	17.8	2.7	20.5	0.3	2
Crestline-Lake Arrowhead WA	1.9	0	1.9	1.8	0	1.8	-0.1	-5
Desert WA	28.3	6.9	35.2	27.8	5.9	33.7	-0.5	-2
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	13.0	0	13.0	13.0	0	13.0	0	0
Metropolitan WDSC	1310.1	119.8	1429.9	1284.6	164.0	1448.6	-25.5	-2
Palmdale WD	13.5	0	13.5	13.5	0	13.5	0	0
San Bernardino Valley MWD	64.4	0	64.4	63.5	0	63.5	-0.9	-1
San Gabriel Valley MWD	16.8	0	16.8	16.6	0	16.6	-0.2	-1
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	4.9	0	4.9	4.9	0	4.9	0	0
Total All Contractors	2,830.1	273.8	3,103.9	2,775.7	294.0	3,069.7	-54.4	-2
Total Agricultural Contractors	921.8	131.7	1,053.5	855.9	101.6	957.5	-65.9	-7
Total Municipal Contractors	1,908.3	142.0	2050.3	1,919.7	192.3	2112	11.4	1

TABLE 6-17

ESTIMATED AVERAGE WET YEAR TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	6.8	2.1	8.9	6.8	3.1	9.9	2	11
Solano County WA	37.7	2.3	40	37.7	4.2	41.9	1.9	5
Alameda Co. FC&WCD, Zone 7	46.4	2.4	48.8	66.5	4.3	70.8	22	45
Alameda County WD	35.2	2.9	38.1	35.2	4.1	39.3	1.2	3
Santa Clara Valley WD	84.7	10.6	95.3	84.7	13.4	98.1	2.8	3
Oak Flat WD	5.3	0	5.3	5.3	0	5.3	0	0
County of Kings	8.6	0	8.6	8.4	0	8.4	-.2	-2
Dudley Ridge WD	57.0	4.3	61.3	53.4	4.3	57.7	-3.6	-6
Empire West Side ID	2.8	3.3	6.1	2.8	1.9	4.7	-1.4	-23
KCWA (Ag)	938.5	200.3	1138.8	805.0	152.0	957	-181.8	-16
KCWA (Muni)	134.6	0	134.6	134.6	0	134.6	0	0
Tulare Lake Basin WSD	87.3	53.9	141.2	89.6	31.9	121.5	-19.7	-14
San Luis Obispo Co. FC&WCD	4.4	0	4.4	4.4	0	4.4	0	0
Santa Barbara Co. FC&WCD	26.3	0	26.3	26.3	0	26.3	0	0
Antelope Valley-East Kern WA	64.9	3.5	68.4	64.9	4.5	69.4	1	1
Castaic Lake WA (Ag)	11.7	0	11.7	11.8	0	11.8	0.1	1
Castaic Lake WA (Muni)	41.5	2.3	43.8	68.6	4.4	73	29.2	67
Coachella Valley WD	19.3	6.3	25.6	19.3	4.6	23.9	-1.7	-7
Crestline-Lake Arrowhead WA	1.9	0	1.9	1.9	0	1.9	0	0
Desert WA	31.2	14.3	45.5	31.2	11.1	42.3	-3.2	-7
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	13.2	0	13.2	13.2	0	13.2	0	0
Metropolitan WDSC	1272.5	215.1	1487.6	1272.5	304.8	1577.3	89.7	6
Palmdale WD	14.9	0	14.9	14.9	0	14.9	0	0
San Bernardino Valley MWD	69.8	0	69.8	69.8	0	69.8	0	0
San Gabriel Valley MWD	18.1	0	18.1	18.1	0	18.1	0	0
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	5.0	0	5.0	5.0	0	5.0	0	0
Total All Contractors	3,039.7	523.5	3563.2	2,952.0	548.5	3,500.5	-62.7	-2
Total Agricultural Contractors	1,111.2	261.8	1373.0	976.3	190.0	1,166.3	-206.7	-15
Total Municipal Contractors	1,928.4	261.7	2190.1	1975.7	358.5	2,334.2	144.1	7

TABLE 6-18

ESTIMATED AVERAGE CRITICALLY DRY YEAR TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	4.7	0.2	4.9	4.4	0.4	4.8	-0.1	-2
Solano County WA	17.8	0.3	18.1	19.3	0.5	19.8	1.7	9
Alameda Co. FC&WCD, Zone 7	19.9	0.3	20.2	30.5	0.5	31	10.8	53
Alameda County WD	16.8	0.3	17.1	16.0	0.5	16.5	-0.6	-4
Santa Clara Valley WD	40.1	1.2	41.3	38.3	1.8	40.1	-1.2	-3
Oak Flat WD	1.6	0	1.6	2.1	0	2.1	0.5	31
County of Kings	2.5	0	2.5	3.3	0	3.3	0.8	32
Dudley Ridge WD	17.5	0.5	18.0	21.3	0.5	21.8	3.8	21
Empire West Side ID	0.9	0.4	1.3	1.1	0.3	1.4	0.1	8
KCWA (Ag)	289.9	21.8	311.7	321.0	22.2	343.2	31.5	10
KCWA (Muni)	57.8	0	57.8	55.3	0	55.3	-2.5	-4
Tulare Lake Basin WSD	27.4	5.8	33.2	35.7	5.3	41	7.8	23
San Luis Obispo Co. FC&WCD	3.5	0	3.5	3.3	0	3.3	-0.2	-6
Santa Barbara Co. FC&WCD	19.5	0	19.5	18.4	0	18.4	-1.1	-6
Antelope Valley-East Kern WA	46.0	0.4	46.4	44.2	0.5	44.7	-1.7	-4
Castaic Lake WA (Ag)	3.6	0	3.6	4.7	0	4.7	1.1	31
Castaic Lake WA (Muni)	17.8	0.3	18.1	31.4	0.5	31.9	13.8	76
Coachella Valley WD	9.2	0.7	9.9	11.1	0.9	12	2.1	21
Crestline-Lake Arrowhead WA	1.7	0	1.7	1.6	0	1.6	-0.1	-6
Desert WA	15.1	1.5	16.6	14.4	1.9	16.3	-0.3	-2
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	12.2	0	12.2	12.3	0	12.3	0.1	1
Metropolitan WDSC	771.5	34.9	806.4	733.9	44.4	778.3	-28.1	-3
Palmdale WD	7.0	0	7.0	7.6	0	7.6	0.4	6
San Bernardino Valley MWD	38.1	0	38.1	36.2	0	36.2	-1.9	-5
San Gabriel Valley MWD	10.4	0	10.4	9.9	0	9.9	-0.5	-5
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	4.6	0	4.6	4.6	0	4.6	0	0
Total All Contractors	1,457.3	68.6	1,525.9	1,481.9	80.1	1,562	36.1	2
Total Agricultural Contractors	343.5	28.5	372	389.3	28.2	417.5	45.5	12
Total Municipal Contractors	1,113.9	40.1	1,154.0	1,092.6	51.9	1,144.5	-9.5	-1

TABLE 6-19

ESTIMATED AVERAGE ANNUAL TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	6.5	1.0	7.5	6.4	1.7	8.1	0.6	8
Solano County WA	34.2	1.0	35.2	34.3	2.1	36.4	1.2	3
Alameda Co. FC&WCD, Zone 7	41.1	1.1	42.2	59.3	2.2	61.5	19.3	46
Alameda County WD	31.9	1.4	33.3	31.3	2.1	33.4	0.1	0
Santa Clara Valley WD	76.6	5.1	81.6	75.3	7.1	82.4	0.8	1
Oak Flat WD	4.4	0	4.4	4.7	0.0	4.7	0.3	7
County of Kings	7.0	0	7.0	7.3	0.0	7.3	0.3	4
Dudley Ridge WD	47.2	2.2	49.4	46.8	2.2	49	-0.4	-1
Empire West Side ID	2.3	1.6	3.9	2.4	1.0	3.4	-0.5	-13
KCWA (Ag)	778.3	101.2	879.5	705.7	81.8	787.5	-92	-10
KCWA (Muni)	119.4	0	119.4	117.8	0	117.8	-1.6	-1
Tulare Lake Basin WSD	73.0	26.7	99.7	78.6	16.7	95.3	-4.4	-4
San Luis Obispo Co. FC&WCD	4.3	0	4.3	4.2	0	4.2	-0.1	-2
Santa Barbara Co. FC&WCD	25.2	0	25.2	24.9	0	24.9	-0.3	-1
Antelope Valley-East Kern WA	61.8	1.7	63.5	61.3	2.3	63.6	0.1	0
Castaic Lake WA (Ag)	9.7	0	9.7	10.4	0	10.4	0.7	7
Castaic Lake WA (Muni)	36.8	1.0	37.8	61.1	2.2	63.3	25.5	67
Coachella Valley WD	17.5	3.0	20.5	17.8	2.7	20.5	0	0
Crestline-Lake Arrowhead WA	1.9	0	1.9	1.8	0	1.8	-0.1	-5
Desert WA	28.3	6.9	35.2	27.8	5.9	33.7	-1.5	-4
Littlerock Creek ID	0	0	0	0	0	0	0	0
Mojave WA	13.0	0	13.0	13.0	0	13.0	0	0
Metropolitan WDSC	1310.1	119.8	1429.9	1284.6	164.0	1448.6	18.7	0
Palmdale WD	13.5	0	13.5	13.5	0	13.5	0	0
San Bernardino Valley MWD	64.4	0	64.4	63.5	0	63.5	-0.9	-1
San Gabriel Valley MWD	16.8	0	16.8	16.6	0	16.6	-0.2	-1
San Gorgonio Pass WA	0.1	0	0.1	0.1	0	0.1	0	0
Ventura County FCD	4.9	0	4.9	4.9	0	4.9	0	0
Total All Contractors	2,830.1	273.8	3,103.9	2,775.7	294.0	3,069.7	-34.2	-1
Total Agricultural Contractors	921.8	131.7	1,053.5	855.9	101.6	957.5	-96.0	-11
Total Municipal Contractors	1,908.3	142.0	2050.3	1,919.7	192.3	2112	61.7	3

TABLE 6-20

ESTIMATED AVERAGE WET YEAR TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Table A Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	24.4	0.1	24.5	28.1	1.5	29.6	3.7	15
Solano County WA	41.2	0.1	41.3	46.4	1.6	48.0	5.2	13
Alameda Co. FC&WCD, Zone 7	45.5	0.3	45.8	78.2	1.7	79.9	32.7	72
Alameda County WD	41.2	0.7	41.9	40.8	1.6	42.4	-0.4	-1
Santa Clara Valley WD	98.2	2.1	100.3	97.1	5.6	102.7	-1.1	-1
Oak Flat WD	5.1	0	5.1	5.3	0	5.3	0.2	4
County of Kings	8.3	0	8.3	8.3	0	8.3	0	0
Dudley Ridge WD	55.8	1.8	57.6	53.0	1.7	54.7	-2.8	-5
Empire West Side ID	2.7	1.2	3.9	2.8	0.3	3.1	0.1	4
KCWA (Ag)	919.7	79.4	999.1	784.5	59.9	844.4	-135.2	15
KCWA (Muni)	132.1	0	132.1	130.6	0	130.6	-1.5	-1
Tulare Lake Basin WSD	85.9	19.6	105.5	89	6.4	95.4	3.1	4
San Luis Obispo Co. FC&WCD	24.5	0	24.5	24.3	0	24.3	-0.2	-1
Santa Barbara Co. FC&WCD	44.6	0	44.6	44.1	0	44.1	-0.6	-1
Antelope Valley-East Kern WA	138.7	1.0	139.7	137.2	1.8	139.0	-1.5	-1
Castaic Lake WA (Ag)	11.5	0	11.5	11.7	0	11.7	0.2	2
Castaic Lake WA (Muni)	40.7	0.1	40.8	80.1	1.7	81.8	39.4	97
Coachella Valley WD	118.5	1.9	120.4	129.2	3.4	132.6	10.7	9
Crestline-Lake Arrowhead WA	5.7	0	5.7	5.6	0	5.6	-0.1	-2
Desert WA	49.1	3.6	52.7	52.4	3.6	56.0	3.3	7
Littlerock Creek ID	2.3	0	2.3	2.2	0	2.2	-0.1	-4
Mojave WA	49.9	0	49.9	73.6	0	73.6	23.7	47
Metropolitan WDSC	1,876.3	80.4	1,956.7	1,855.2	100.3	1,955.5	-21.1	-1
Palmdale WD	17.0	0	17.0	20.7	0	20.7	3.7	22
San Bernardino Valley MWD	100.7	0	100.7	99.6	0	99.6	-1.1	-1
San Gabriel Valley MWD	28.3	0	28.3	28.0	0	28.0	-0.3	-1
San Gorgonio Pass WA	17.0	0	17.0	16.8	0	16.8	-0.2	-1
Ventura County FCD	19.6	0	19.6	19.4	0	19.4	-0.2	-1
Total All Contractors	4,004.6	192.3	4,196.9	3,964.1	190.9	4,155.0	-40.5	-1
Total Agricultural Contractors	1,089.1	102.0	1,191.9	954.6	68.2	1,022.8	-134.5	-12
Total Municipal Contractors	2,915.5	90.4	3,005.9	3,009.5	122.7	3,132.2	94	3

TABLE 6-21

ESTIMATED AVERAGE CRITICALLY DRY YEAR TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

	Baseline Scenario			Proposed Project			Table A Difference	
SWP Contractors	**Table A**	**Article 21**	**Total**	**Table A**	**Article 21**	**Total**	**TAF/yr**	**%**
Napa County FC&WCD	8.9	0.4	10.2	9.4	0.5	9.9	0.5	6
Solano County WA	15.0	0.4	15.4	15.5	0.5	16.0	0.5	3
Alameda Co. FC&WCD, Zone 7	16.5	0.5	17.0	26.2	0.5	26.7	9.7	59
Alameda County WD	15.0	0.5	15.5	13.6	0.5	14.1	-1.4	-9
Santa Clara Valley WD	35.7	1.8	37.5	32.4	1.8	33.2	-3.3	-9
Oak Flat WD	1.3	0	1.3	1.8	0	1.8	0.5	38
County of Kings	2.0	0	2.0	2.9	0	2.9	0.9	45
Dudley Ridge WD	13.8	0.5	14.3	18.6	0.5	19.1	4.8	35
Empire West Side ID	0.7	0.5	1.2	1.0	0.4	1.4	0.3	43
KCWA (Ag)	228.6	22.7	251.3	275.2	22.7	297.9	46.6	20
KCWA (Muni)	48.1	0	48.1	43.7	0	43.7	-4.4	-9
Tulare Lake Basin WSD	21.6	6.8	28.4	31.9	6.5	38.4	10.3	48
San Luis Obispo Co. FC&WCD	8.9	0	8.9	8.1	0	8.1	-0.8	-9
Santa Barbara Co. FC&WCD	16.2	0	16.2	14.8	0	14.8	-1.4	-9
Antelope Valley-East Kern WA	50.1	0.5	50.6	45.9	0.5	46.4	-4.2	-8
Castaic Lake WA (Ag)	2.8	0	2.8	4.1	0	4.1	1.3	46
Castaic Lake WA (Muni)	14.8	0.4	15.2	26.8	0.5	27.3	12	81
Coachella Valley WD	41.9	0.9	42.8	43.2	0.9	44.1	1.3	3
Crestline-Lake Arrowhead WA	2.1	0	2.1	1.9	0	1.9	-0.2	-10
Desert WA	17.9	2.1	20.0	17.5	2.3	19.8	-0.4	-2
Littlerock Creek ID	0.8	0	0.8	0.7	0	0.7	-0.1	-13
Mojave WA	18.1	0	18.1	24.6	0	24.6	6.5	36
Metropolitan WDSC	682.8	45.4	728.2	620.2	45.5	665.7	-62.6	-9
Palmdale WD	6.2	0	6.2	6.9	0	6.9	0.7	11
San Bernardino Valley MWD	36.6	0	36.6	33.3	0	33.3	-3.3	-9
San Gabriel Valley MWD	10.3	0	10.3	9.3	0	9.3	-1	-10
San Gorgonio Pass WA	6.2	0	6.2	5.6	0	5.6	-0.6	-10
Ventura County FCD	7.1	0	7.1	6.5	0	6.5	-0.6	-8
Total All Contractors	1,330.2	83.2	1,413.4	1,341.0	83.2	1,424.2	10.8	1
Total Agricultural Contractors	270.8	30.5	301.3	334.9	30.0	364.9	64.1	24
Total Municipal Contractors	1,059.4	52.8	1,112.2	1,006.1	53.2	1,059.3	-53.3	-5

TABLE 6-22

ESTIMATED AVERAGE ANNUAL TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Table A Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	20.1	0.1	20.2	22.5	0.9	23.4	2.4	12
Solano County WA	33.9	0.2	34.1	37.1	1.0	38.1	3.2	9
Alameda Co. FC&WCD, Zone 7	37.5	0.3	37.8	62.6	1.0	63.6	25.1	67
Alameda County WD	33.9	0.5	34.4	32.6	0.9	33.5	-1.3	-4
Santa Clara Valley WD	80.8	1.5	82.3	77.7	3.3	81.0	-3.1	-4
Oak Flat WD	3.8	0.0	3.8	4.3	0.0	4.3	0.5	13
County of Kings	6.1	0.0	6.1	6.8	0.0	6.8	0.7	11
Dudley Ridge WD	41.2	1.1	42.3	43.4	1.0	44.4	2.2	5
Empire West Side ID	2.0	0.7	2.7	2.3	0.2	2.5	0.2	7
KCWA (Ag)	679.0	48.1	727.1	642.2	36.1	678.3	-36.8	-5
KCWA (Muni)	108.8	0.0	108.8	104.5	0.0	104.5	-4.3	-4
Tulare Lake Basin WSD	63.7	11.8	75.5	72.9	4.9	77.8	9.2	14
San Luis Obispo Co. FC&WCD	20.2	0.0	20.2	19.4	0.0	19.4	-0.8	-4
Santa Barbara Co. FC&WCD	36.8	0.0	36.8	35.3	0.0	35.3	-1.5	-4
Antelope Valley-East Kern WA	113.9	0.7	114.6	109.8	1.0	110.8	-4.1	-4
Castaic Lake WA (Ag)	8.5	0.0	8.5	9.6	0.0	9.6	1.1	13
Castaic Lake WA (Muni)	33.5	0.2	33.7	64.1	1.0	65.1	30.6	91
Coachella Valley WD	96.7	1.3	98.0	103.4	2.0	105.4	6.7	7
Crestline-Lake Arrowhead WA	4.7	0.0	4.7	4.5	0.0	4.5	-0.2	-4
Desert WA	40.4	5.7	46.1	41.9	2.4	44.3	1.5	4
Littlerock Creek ID	1.9	0.0	1.9	1.8	0.0	1.8	-0.1	-5
Mojave WA	41.1	0.0	41.1	58.9	0.0	58.9	17.8	43
Metropolitan WDSC	1545.0	52.1	1597.1	1483.3	62.9	1546.2	-61.7	-4
Palmdale WD	14.0	0.0	14.0	16.5	0.0	16.5	2.5	18
San Bernardino Valley MWD	82.9	0.0	82.9	79.7	0.0	79.7	-3.2	-4
San Gabriel Valley MWD	23.3	0.0	23.3	22.4	0.0	22.4	-0.9	-4
San Gorgonio Pass WA	14.0	0.0	14.0	13.4	0.0	13.4	-0.6	-4
Ventura County FCD	16.2	0.0	16.2	15.5	0.0	15.7	-0.7	-4
Total All Contractors	3,203.8	120.8	3324.6	3,189.3	118.7	3,308.0	-14.5	0
Total Agricultural Contractors	804.3	61.6	865.9	781.5	42.2	823.7	-22.8	-3
Total Municipal Contractors	2,399.5	59.2	2,458.7	2,407.8	76.5	2,484.3	8.3	0

TABLE 6-23

ESTIMATED AVERAGE WET YEAR TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	24.4	0.1	24.5	28.1	1.5	29.6	5.1	21
Solano County WA	41.2	0.1	41.3	46.4	1.6	48.0	6.7	16
Alameda Co. FC&WCD, Zone 7	45.5	0.3	45.8	78.2	1.7	79.9	34.1	74
Alameda County WD	41.2	0.7	41.9	40.8	1.6	42.4	0.5	1
Santa Clara Valley WD	98.2	2.1	100.3	97.1	5.6	102.7	2.4	2
Oak Flat WD	5.1	0	5.1	5.3	0	5.3	0.2	4
County of Kings	8.3	0	8.3	8.3	0	8.3	0	0
Dudley Ridge WD	55.8	1.8	57.6	53.0	1.7	54.7	-2.9	5
Empire West Side ID	2.7	1.2	3.9	2.8	0.2	3.0	-0.9	-23
KCWA (Ag)	919.7	79.4	999.1	784.5	59.9	844.4	-154.7	-15
KCWA (Muni)	132.1	0	132.1	130.6	0	130.6	-1.5	-1
Tulare Lake Basin WSD	85.9	19.6	105.5	89	6.4	95.4	-10.1	-10
San Luis Obispo Co. FC&WCD	24.5	0	24.5	24.3	0	24.3	-0.2	-1
Santa Barbara Co. FC&WCD	44.6	0	44.6	44.1	0	44.1	-0.5	-1
Antelope Valley-East Kern WA	138.7	1.0	139.7	137.2	1.8	139.0	-0.7	-1
Castaic Lake WA (Ag)	11.5	0	11.5	11.7	0	11.7	0.2	2
Castaic Lake WA (Muni)	40.7	0.1	40.8	80.1	1.7	81.8	41.0	100
Coachella Valley WD	118.5	1.9	120.4	129.2	3.4	132.6	12.2	10
Crestline-Lake Arrowhead WA	5.7	0	5.7	5.6	0	5.6	-0.1	-2
Desert WA	49.1	3.6	52.7	52.4	3.6	56.0	3.3	6
Littlerock Creek ID	2.3	0	2.3	2.2	0	2.2	-0.1	-4
Mojave WA	49.9	0	49.9	73.6	0	73.6	23.7	47
Metropolitan WDSC	1,876.3	80.4	1,956.7	1,855.2	100.3	1,955.5	-1.2	0
Palmdale WD	17.0	0	17.0	20.7	0	20.7	3.7	22
San Bernardino Valley MWD	100.7	0	100.7	99.6	0	99.6	-1.1	-1
San Gabriel Valley MWD	28.3	0	28.3	28.0	0	28.0	-0.7	-2
San Gorgonio Pass WA	17.0	0	17.0	16.8	0	16.8	-0.2	-1
Ventura County FCD	19.6	0	19.6	19.4	0	19.4	-0.2	-1
Total All Contractors	4,004.6	192.3	4,196.9	3,964.1	190.9	4155.0	-41.9	-1
Total Agricultural Contractors	1,089.1	102.0	1,191.1	954.6	68.2	1,022.8	-168.3	-14
Total Municipal Contractors	2,915.5	90.4	3005.9	3,009.5	122.7	3,132.2	126.3	4

TABLE 6-24

ESTIMATED AVERAGE CRITICALLY DRY YEAR TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	8.9	0.4	10.2	9.4	0.5	9.9	0.5	5
Solano County WA	15.0	0.4	15.4	15.5	0.5	16.0	0.5	3
Alameda Co. FC&WCD, Zone 7	16.5	0.5	17.0	26.2	0.5	26.7	9.7	57
Alameda County WD	15.0	0.5	15.5	13.6	0.5	14.1	-1.4	-9
Santa Clara Valley WD	35.7	1.8	37.5	32.4	1.8	33.2	-4.3	-11
Oak Flat WD	1.3	0	1.3	1.8	0	1.8	0.5	38
County of Kings	2.0	0	2.0	2.9	0	2.9	0.9	45
Dudley Ridge WD	13.8	0.5	14.3	18.6	0.5	19.1	4.8	34
Empire West Side ID	0.7	0.5	1.2	1.0	0.4	1.4	0.2	17
KCWA (Ag)	228.6	22.7	251.3	275.2	22.7	297.9	46.6	19
KCWA (Muni)	48.1	0	48.1	43.7	0	43.7	-4.4	-9
Tulare Lake Basin WSD	21.6	6.8	28.4	31.9	6.5	38.4	10	35
San Luis Obispo Co. FC&WCD	8.9	0	8.9	8.1	0	8.1	0.8	-9
Santa Barbara Co. FC&WCD	16.2	0	16.2	14.8	0	14.8	-1.4	-9
Antelope Valley-East Kern WA	50.1	0.5	50.6	45.9	0.5	46.4	-4.2	-8
Castaic Lake WA (Ag)	2.8	0	2.8	4.1	0	4.1	1.3	46
Castaic Lake WA (Muni)	14.8	0.4	15.2	26.8	0.5	27.3	12.1	80
Coachella Valley WD	41.9	0.9	42.8	43.2	0.9	44.1	1.3	3
Crestline-Lake Arrowhead WA	2.1	0	2.1	1.9	0	1.9	-0.2	-10
Desert WA	17.9	2.1	20.0	17.5	2.3	19.8	-0.2	-1
Littlerock Creek ID	0.8	0	0.8	0.7	0	0.7	-0.1	-13
Mojave WA	18.1	0	18.1	24.6	0	24.6	6.5	36
Metropolitan WDSC	682.8	45.4	728.2	620.2	45.5	665.7	-62.5	-9
Palmdale WD	6.2	0	6.2	6.9	0	6.9	0.7	11
San Bernardino Valley MWD	36.6	0	36.6	33.3	0	33.3	-3.3	-9
San Gabriel Valley MWD	10.3	0	10.3	9.3	0	9.3	-01.0	-10
San Gorgonio Pass WA	6.2	0	6.2	5.6	0	5.6	-0.6	-10
Ventura County FCD	7.1	0	7.1	6.5	0	6.5	-0.6	-8
Total All Contractors	1,330.2	83.2	1,413.4	1,341.0	83.2	1,424.2	10.8	1
Total Agricultural Contractors	270.8	30.5	301.3	334.9	30.0	364.9	63.6	21
Total Municipal Contractors	1,059.4	52.8	1,112.2	1,006.1	53.2	1,059.3	-52.9	-5

TABLE 6-25

ESTIMATED AVERAGE ANNUAL TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND THE PROPOSED PROJECT

SWP Contractors	Baseline Scenario			Proposed Project			Total Difference	
	Table A	Article 21	Total	Table A	Article 21	Total	TAF/yr	%
Napa County FC&WCD	20.1	0.1	20.2	22.5	0.9	23.4	3.2	16
Solano County WA	33.9	0.2	34.1	37.1	1.0	38.1	4.0	12
Alameda Co. FC&WCD, Zone 7	37.5	0.3	37.8	62.6	1.0	63.6	25.8	68
Alameda County WD	33.9	0.5	34.4	32.6	0.9	33.5	-0.9	-2
Santa Clara Valley WD	80.8	1.5	82.3	77.7	3.3	81.0	-1.3	3
Oak Flat WD	3.8	0.0	3.8	4.3	0.0	4.3	0.5	13
County of Kings	6.1	0.0	6.1	6.8	0.0	6.8	0.7	11
Dudley Ridge WD	41.2	1.1	42.3	43.4	1.0	44.4	2.1	5
Empire West Side ID	2.0	0.7	2.7	2.3	0.2	2.5	-0.2	-4
KCWA (Ag)	679.0	48.1	727.1	642.2	36.1	678.3	-48.8	-7
KCWA (Muni)	108.8	0.0	108.8	104.5	0.0	104.5	-4.3	-4
Tulare Lake Basin WSD	63.7	11.8	75.5	72.9	4.9	77.8	2.3	3
San Luis Obispo Co. FC&WCD	20.2	0.0	20.2	19.4	0.0	19.4	-0.8	-4
Santa Barbara Co. FC&WCD	36.8	0.0	36.8	35.3	0.0	35.3	-1.5	-4
Antelope Valley-East Kern WA	113.9	0.7	114.6	109.8	1.0	110.8	-3.8	-3
Castaic Lake WA (Ag)	8.5	0.0	8.5	9.6	0.0	9.6	1.1	13
Castaic Lake WA (Muni)	33.5	0.2	33.7	64.1	1.0	65.1	31.4	93
Coachella Valley WD	96.7	1.3	98.0	103.4	2.0	105.4	7.4	8
Crestline-Lake Arrowhead WA	4.7	0.0	4.7	4.5	0.0	4.5	-0.2	-4
Desert WA	40.4	5.7	46.1	41.9	2.4	44.3	-1.8	-4
Littlerock Creek ID	1.9	0.0	1.9	1.8	0.0	1.8	-0.1	-5
Mojave WA	41.1	0.0	41.1	58.9	0.0	58.9	17.8	43
Metropolitan WDSC	1545.0	52.1	1597.1	1483.3	62.9	1546.2	-50.9	-3
Palmdale WD	14.0	0.0	14.0	16.5	0.0	16.5	2.5	18
San Bernardino Valley MWD	82.9	0.0	82.9	79.7	0.0	79.7	-3.2	-4
San Gabriel Valley MWD	23.3	0.0	23.3	22.4	0.0	22.4	-0.9	-4
San Gorgonio Pass WA	14.0	0.0	14.0	13.4	0.0	13.4	-0.6	-4
Ventura County FCD	16.2	0.0	16.2	15.5	0.0	15.7	-0.5	-3
Total All Contractors	3,203.8	120.8	3,324.6	3,189.3	118.7	3,308.0	-16.6	0
Total Agricultural Contractors	804.3	61.6	865.9	781.5	42.2	823.7	-42.2	-5
Total Municipal Contractors	2,399.5	59.2	2,458.7	2,407.8	76.5	2,484.3	25.6	1

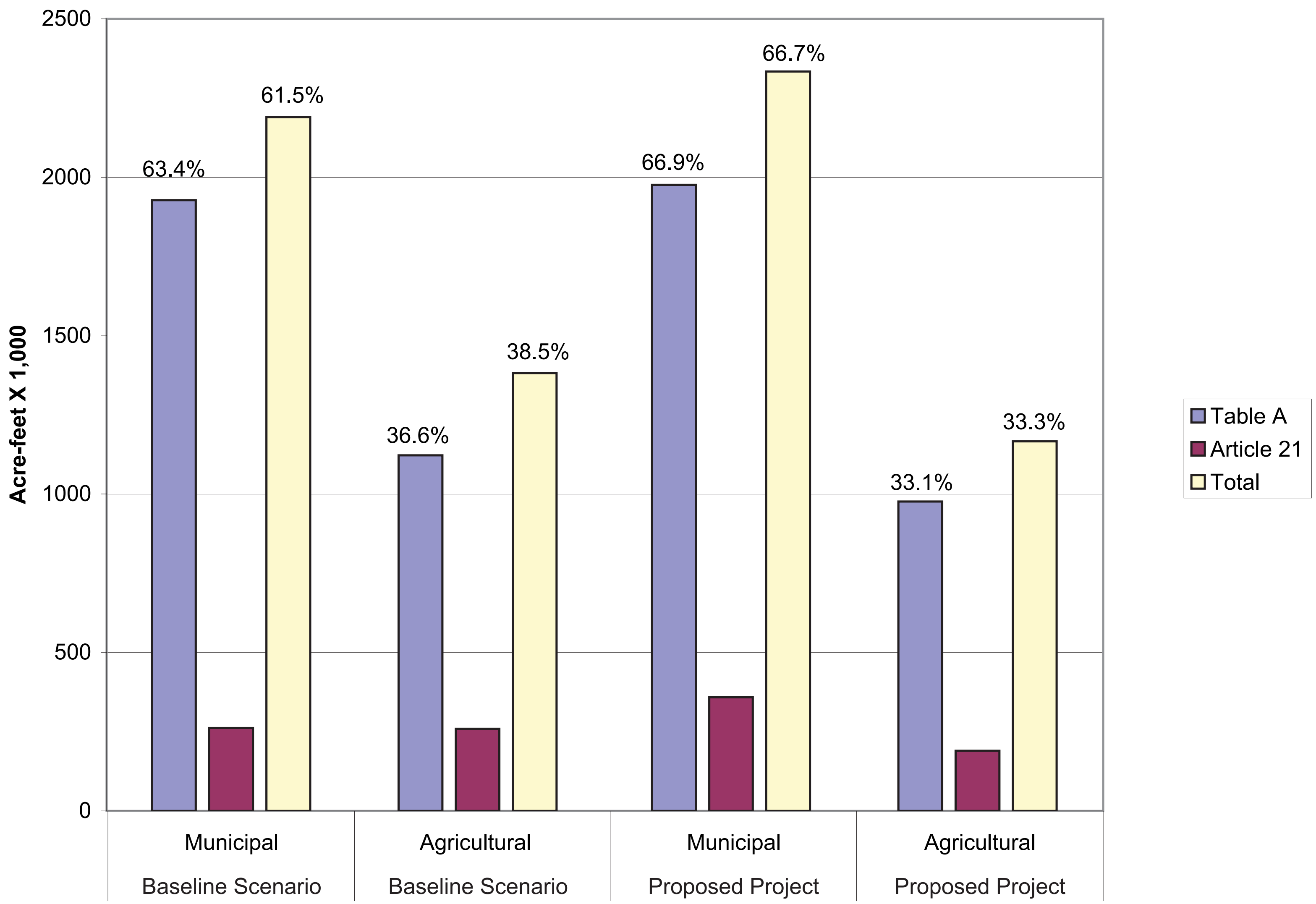
agricultural contractors in wet years would decrease by 12 percent and deliveries to M&I contractors would increase by two percent relative to the baseline scenario. As shown in Figure 6-1, the agricultural contractors' share of total Table A deliveries in wet years would decrease from 36.6 percent under the baseline scenario to 33.1 percent with the proposed project. The M&I contractors' share would increase from 63.4 percent to 66.9 percent. Deliveries to M&I contractors in wet years would increase because their share of the total Table A amount would increase as a result of Table A transfers. Agricultural contractors' deliveries in wet years would decrease because their share of the total Table A amount would decrease.

Table A deliveries to most individual contractors in wet years would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to large decreases in wet year deliveries include KCWA (-14 percent) and Dudley Ridge WD (-6 percent) resulting from Table A retirements and, for KCWA, also from Table A transfers to M&I contractors. M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (43 percent) and Castaic Lake WA (51 percent), resulting primarily from Table A transfers from KCWA.

Table 6-15 shows estimated average Table A deliveries to individual contractors under 2003 conditions in *critically dry years* with the proposed project and under the baseline scenario. In critically dry years, the average of total Table A deliveries would increase by 2 percent compared to the baseline scenario. This is because reductions in Table A deliveries with the proposed project in wet and average years would cause water to accumulate in SWP reservoirs enabling increased deliveries in critically dry years. Collectively, average Table A deliveries to agricultural contractors in critically dry years would increase by 13 percent and deliveries to M&I contractors would decrease by two percent relative to the baseline scenario. As shown in Figure 6-2, the agricultural contractors' share of total Table A deliveries in critically dry years would increase from 23.6 percent under the baseline scenario to 26.3 percent with the proposed project. The M&I contractors' share would decrease from 76.4 percent to 73.7 percent. Deliveries to agricultural contractors would increase because they would no longer be subject to the agriculture-first cuts in very dry periods. Their increase in critically dry year deliveries as a result of the altered allocation procedures under Article 18 would more than offset the effects of the decrease in their share of the total Table A amount as a results of Table A transfers and retirements.

Agricultural contractors would be subject to increases in critically dry year Table A deliveries of between 11 and 32 percent. M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+53 percent), Castaic Lake WA (+68 percent) and Coachella Valley WD (+21 percent). Several M&I contractors that did not receive transfers of Table A amount would be subject to decreases in Table A deliveries of about 5 percent including San Luis Obispo County FC&WCD, Santa Barbara County FC&WCD, Antelope Valley-East Kern WA, Crestline-Lake Arrowhead WA, San Bernardino Valley MWD, San Gabriel Valley MWD and MWDSC.

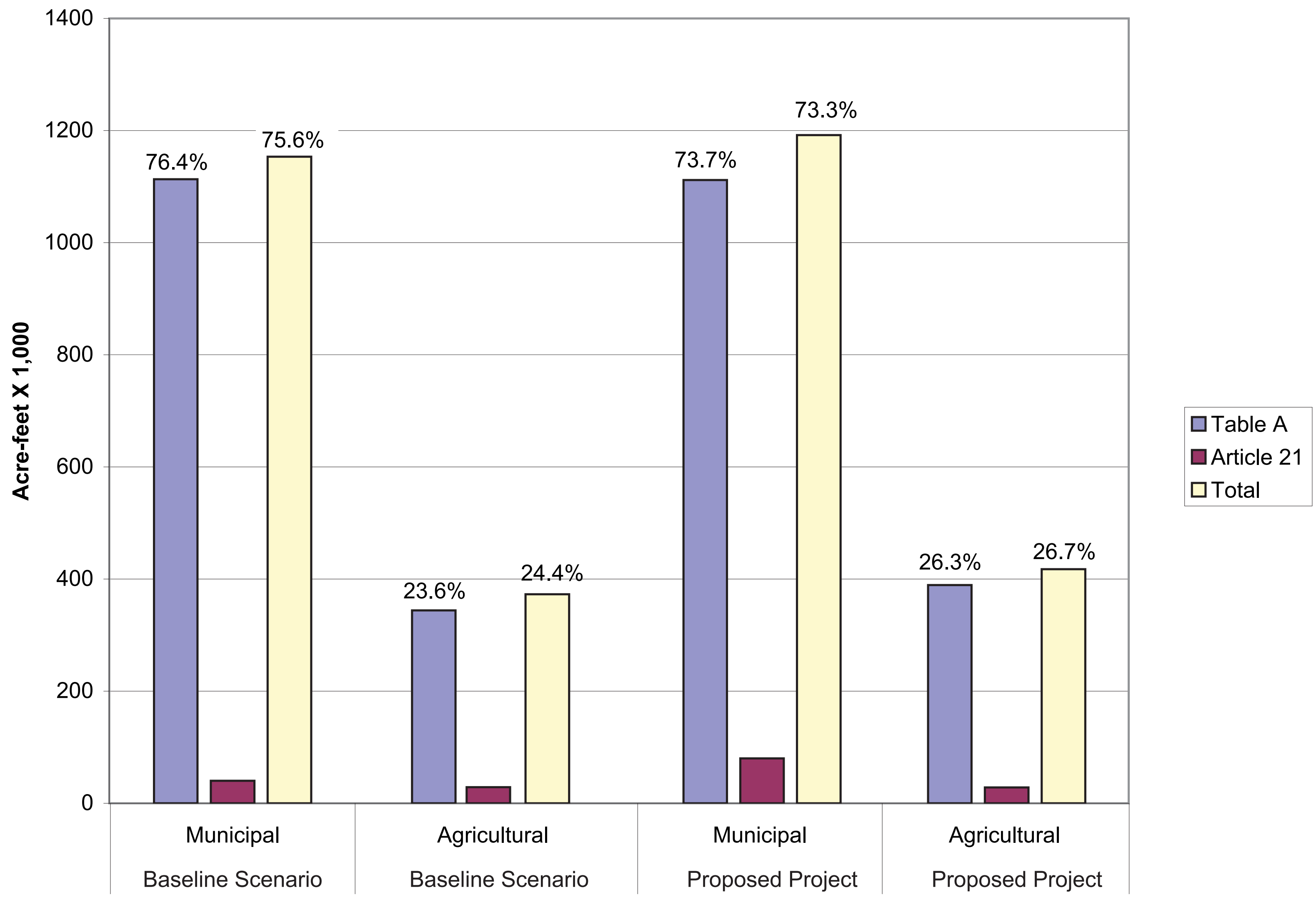
Table 6-16 shows estimated *average annual* Table A deliveries to individual contractors under 2003 conditions with the proposed project and under the baseline scenario. The average annual deliveries are the average deliveries over the 73-year period of record between 1922 and 1994. The average annual of total Table A deliveries would decrease by 2 percent compared to the baseline scenario due to the Table A retirement and the Table A transfers to M&I contractors that do not yet have a full demand for Table a water. Collectively, average annual Table A deliveries to agricultural contractors would decrease by seven percent and



Source: PBSJ, 2007.

FIGURE **6-1**

Average Wet Year Deliveries 2003 Conditions



Source: PBS&J, 2007.

FIGURE **6-2**
Average Critical Year Deliveries 2003 Conditions

deliveries to M&I contractors would increase by one percent relative to the baseline scenario. As shown in Figure 6-3, the agricultural contractors' share of total Table A deliveries would decrease from an average of 32.6 percent under the baseline scenario to 30.8 percent with the proposed project. The M&I contractors' share would increase from an average of 67.4 percent to 69.2 percent.

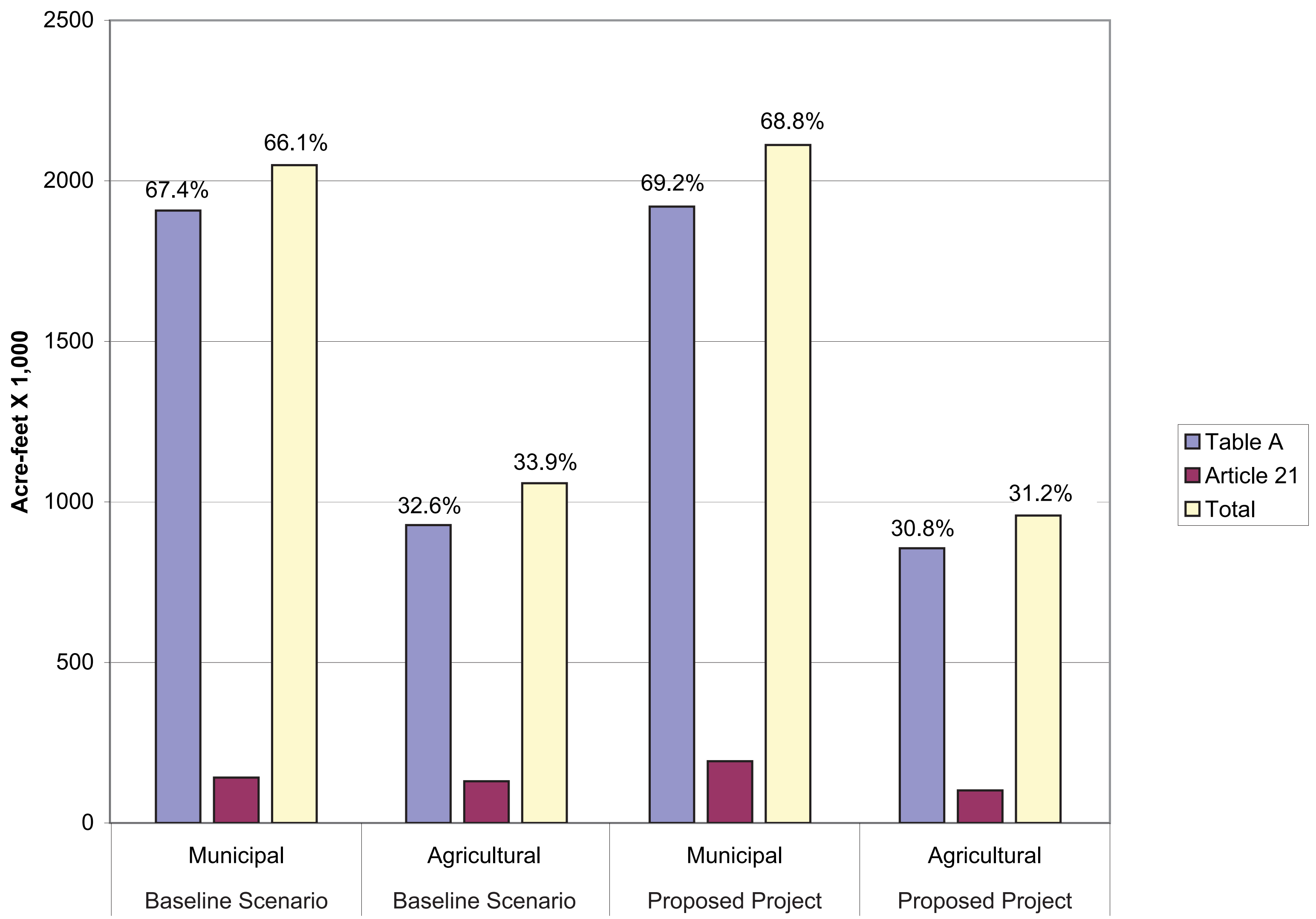
Average annual Table A deliveries to most individual contractors would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to large decreases in annual average deliveries include KCWA (-9 percent) and Dudley Ridge WD (-8 percent). M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+44 percent) and Castaic Lake WA (+54 percent).

Total Deliveries under 2003 Conditions

Table 6-17 shows estimated average Table A and Article 21 deliveries to individual contractors under 2003 conditions in *wet years* with the proposed project and under the baseline scenario. In wet years, the average of total Table A and Article 21 deliveries would decrease by 2 percent compared to the baseline scenario. Collectively, average deliveries to agricultural contractors in wet years would decrease by 15 percent and deliveries to M&I contractors would increase by 7 percent relative to the baseline scenario. As shown in Figure 6-1, the agricultural contractors' share of total deliveries in wet years would decrease from 38.5 percent under the baseline scenario to 33.3 percent with the proposed project. The M&I contractors' share would increase from 61.5 percent to 66.7 percent. Deliveries to M&I contractors in wet years would increase because their share of the total Table A amount would increase as a result of Table A transfers and because they would receive more Article 21 water in wet years under the altered allocation procedures. Agricultural contractors deliveries in wet years would decrease because their share of the total Table A amount would decrease and they would no longer have preferential access to Article 21 water.

Deliveries to most individual contractors in wet years would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to large decreases in wet year deliveries include Empire West Side ID (-23 percent), KCWA (-16 percent) and Tulare Lake Basin WSD (-14 percent). M&I contractors subject to large increases in deliveries include Napa County FC&WCD (11 percent), Alameda County, Zone 7 (45 percent) and Castaic Lake WA (53 percent).

Table 6-18 shows estimated average Table A and Article 21 deliveries to individual contractors under 2003 conditions in *critically dry years* with the proposed project and under the baseline scenario. In critically dry years, the average of total Table A and Article 21 deliveries would increase by 2 percent compared to the baseline scenario. Collectively, average deliveries to agricultural contractors in critically dry years would increase by 12 percent and deliveries to M&I contractors would decrease by 1 percent relative to the baseline scenario. As shown in Figure 6-2, the agricultural contractors' share of total deliveries in critically dry years would increase from 24.4 percent under the baseline scenario to 26.7 percent with the proposed project. The M&I contractors' share would decrease from 75.6 percent to 73.3 percent. Deliveries to agricultural contractors would increase because they would no longer be subject to the agriculture-first cuts in very dry periods. Their increase in critically dry year deliveries as a result of the altered allocation procedures under Article 18 would more than offset the effects of the decrease in their share of the total Table A amount as a results of Table A transfers and retirements.



Source: PBS&J, 2007.

PBS&J®

FIGURE **6-3**

Average Annual Deliveries 2003 Conditions

Agricultural contractors would be subject to increases in critically dry year deliveries of between 8 and 31 percent. M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+53 percent), Castaic Lake WA (+69 percent) and Coachella Valley WD (+21 percent). M&I contractors that did not receive transfers of Table A amounts would be subject to decreases in deliveries of 2 to 6 percent including Alameda County WD, Santa Clara Valley WD, San Luis Obispo County FC&WCD, Santa Barbara County FC&WCD, Antelope Valley-East Kern WA, Crestline-Lake Arrowhead WA, Desert WA, San Bernardino Valley MWD, San Gabriel Valley MWD and MWDSC.

Table 6-19 shows estimated *average annual* Table A and Article 21 deliveries to individual contractors under 2003 conditions with the proposed project and under the baseline scenario. The average annual deliveries are the average deliveries over the 73-year period of record between 1922 and 1994. The annual average of total Table A and Article 21 deliveries would decrease by 1 percent compared to the baseline scenario. Collectively, average annual deliveries to agricultural contractors would decrease by 11 percent and deliveries to M&I contractors would increase by 3 percent relative to the baseline scenario. As shown in Figure 6-3, the agricultural contractors' share of total deliveries would decrease from an average of 33.9 percent under the baseline scenario to 31.2 percent with the proposed project. The M&I contractors' share would increase from an average of 66.1 percent to 68.8 percent.

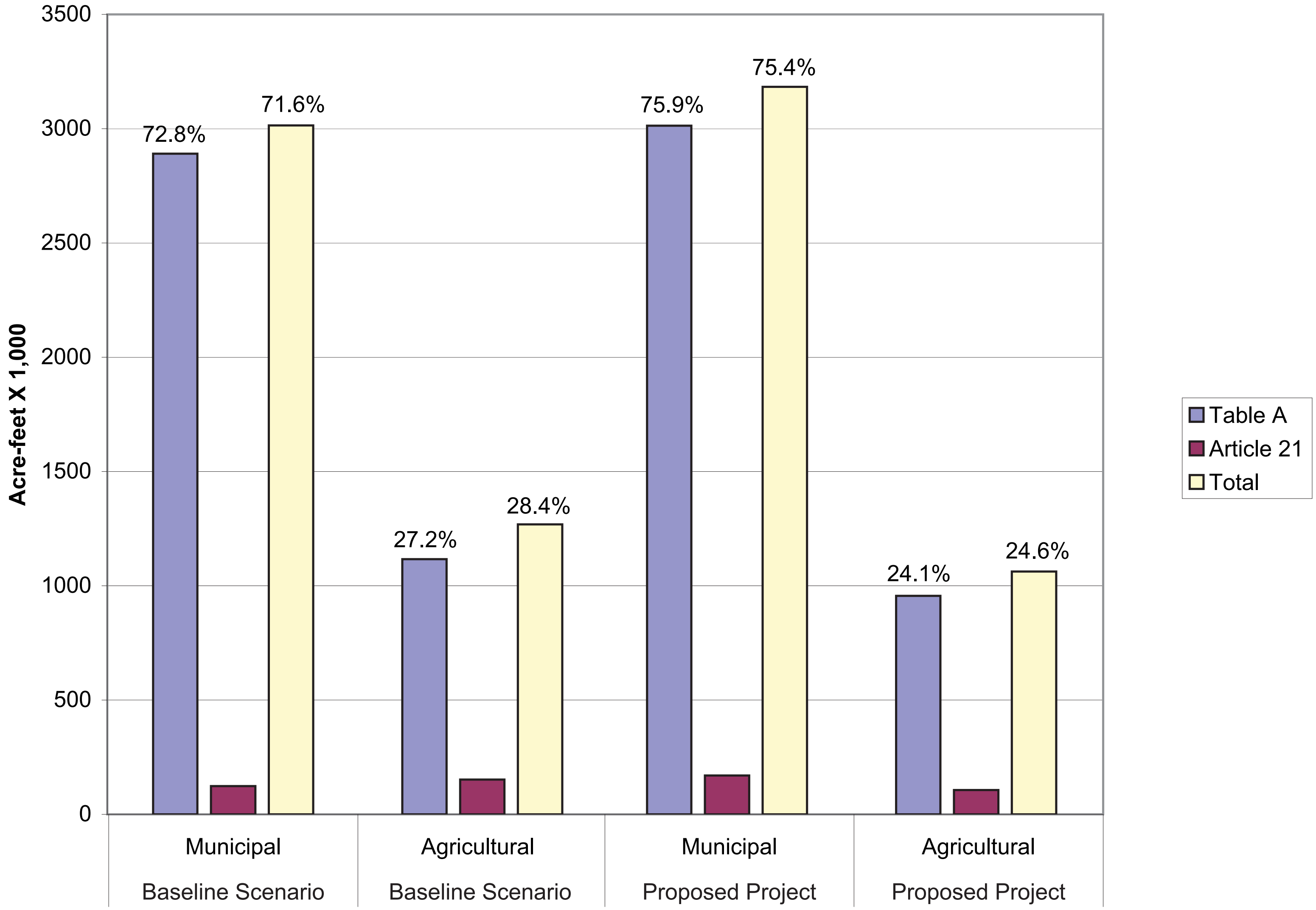
Average annual deliveries to most individual contractors would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to large decreases in annual average deliveries include Empire West Side ID (-13 percent) and KCWA (-10 percent). M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+46 percent) and Castaic Lake WA (+55 percent).

Table A Deliveries under 2020 Conditions

Table 6-20 shows estimated average Table A deliveries to individual contractors under 2020 conditions in *wet years* with the proposed project and under the baseline scenario. In wet years, the average of total Table A deliveries would decrease by 1 percent compared to the baseline scenario due to the Table A retirement. Collectively, average Table A deliveries to agricultural contractors in wet years would decrease by 12 percent and deliveries to M&I contractors would increase by 3 percent relative to the baseline scenario. As shown in Figure 6-4, the agricultural contractors' share of total deliveries in wet years would decrease from 27.2 percent under the baseline scenario to 24.1 percent with the proposed project. The M&I contractors' share would increase from 72.8 percent to 75.9 percent. Deliveries to M&I contractors would increase because their share of the total Table A amount would increase as a result of Table A transfers.

Table A deliveries to a little more than half of the individual contractors in wet years would change by less than 5 percent relative to the baseline scenario. The only agricultural contractor subject to a large decrease in wet year deliveries would be KCWA (-15 percent). M&I contractors subject to large increases in deliveries include Napa County FC&WCD (+15 percent), Solano County WA (+13 percent), Alameda County, Zone 7 (+72 percent), Castaic Lake WA (+76 percent), Mojave (+47 percent) and Palmdale WD (+22 percent). All are recipients of Table A transfers.

Table 6-21 shows estimated average Table A deliveries to individual contractors under 2020 conditions in *critically dry years* with the proposed project and under the baseline scenario. In critically dry years, the average of total Table A deliveries would increase by 1 percent



Source: PBS&J 2007.

FIGURE **6-4**
Average Wet Year Deliveries 2020 Conditions

compared to the baseline scenario. This is because the retirement of Table A amount with the proposed project, and the consequent reduction in Table A deliveries in wet and average years, would cause water to accumulate in SWP reservoirs enabling increased deliveries in critically dry years. Collectively, average Table A deliveries to agricultural contractors in critically dry years would increase by 24 percent and deliveries to M&I contractors would decrease by 5 percent relative to the baseline scenario. As shown in Figure 6-5, the agricultural contractors' share of total Table A deliveries in critically dry years would increase from 20.4 percent under the baseline scenario to 25 percent with the proposed project. The M&I contractors' share would decrease from 79.6 percent to 75 percent. Table A deliveries to agricultural contractors would increase because they would no longer be subject to the agriculture-first cuts in very dry periods. Their increase in critically dry year deliveries as a result of the altered allocation procedures under Article 18 would more than offset the effects of the decrease in their share of the total Table A amount as a results of Table A transfers.

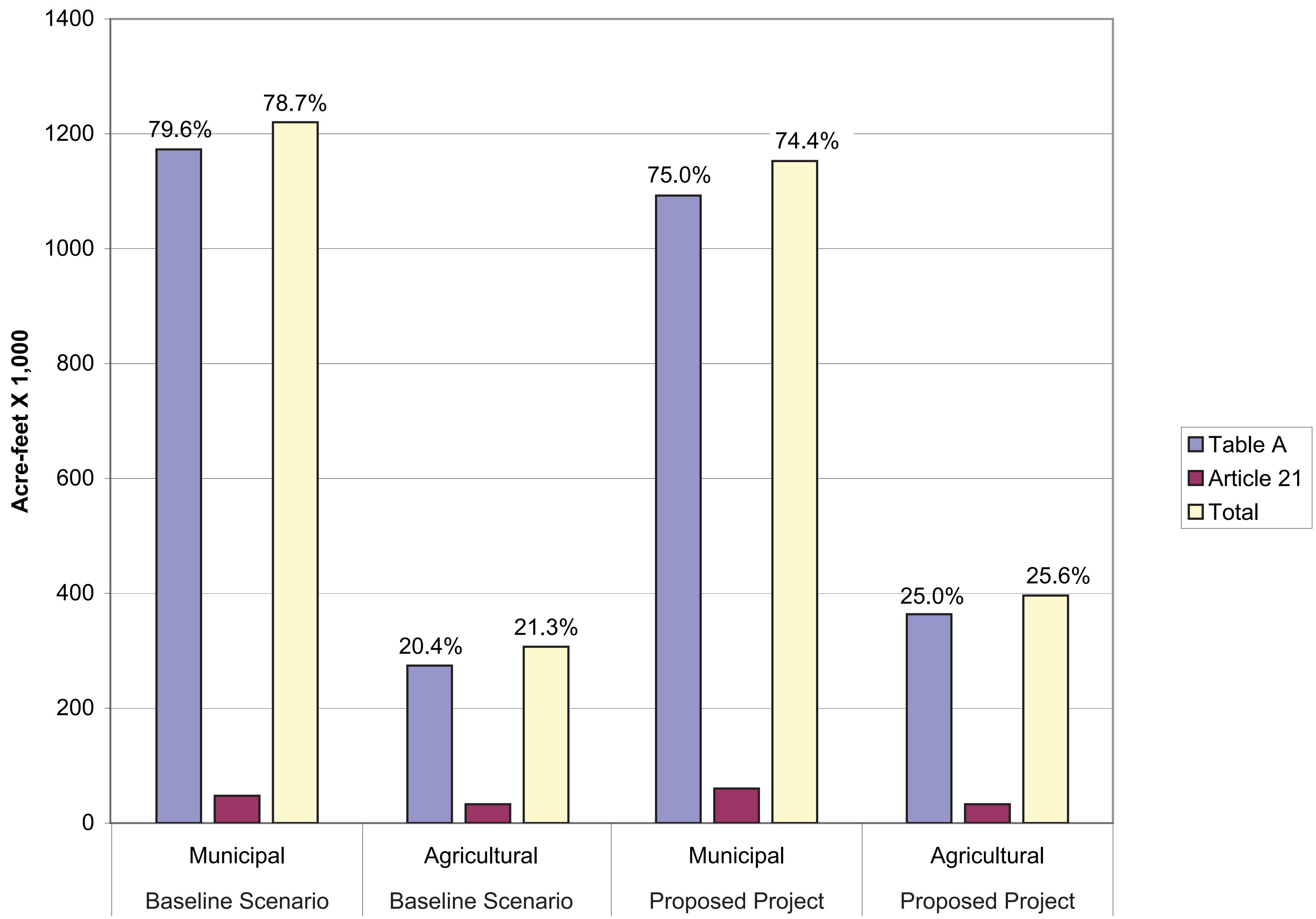
Agricultural contractors would be subject to increases in critically dry year Table A deliveries of between 20 and 48 percent. Many M&I contractors would be subject to decreases in Table A deliveries of about 10 percent. They include Alameda County WD (-9 percent), Santa Clara Valley WD (-9 percent), San Luis Obispo County FC&WCD (-9 percent), Santa Barbara County FC&WCD (-9 percent), Antelope Valley-East Kern WA (-8 percent), Crestline-Lake Arrowhead WA (-10 percent), Littlerock Creek ID (-13 percent), MWDSC (-9 percent), San Bernardino Valley MWD (-9 percent), San Gabriel Valley MWD (-10 percent), San Gorgonio Pass WA (-10 percent) and Ventura County FCD (-8 percent). These contractors would be subject to decreased critically dry year Table A deliveries because their reduced deliveries as a result of the altered allocation procedures would not be offset by receipt of a Table A transfer. Several M&I contractors that would receive Table A transfers would be subject to increased deliveries in critically dry years. They include Alameda County, Zone 7 (+59 percent), Castaic Lake WA (+76 percent) and Mojave WA (+36 percent).

Table 6-22 shows estimated *average annual* Table A deliveries to individual contractors under 2020 conditions with the proposed project and under the baseline scenario. The average annual deliveries are the average deliveries over the 73 years of record between 1922 and 1994. The annual average of total Table A deliveries would decrease by less than 1 percent compared to the baseline scenario due to the Table A retirement. Collectively, average annual deliveries to agricultural contractors would decrease by three percent and deliveries to M&I contractors would remain about the same relative to the baseline scenario. As shown in Figure 6-6, the agricultural contractors' share of total deliveries in average years would decrease from 25.1 percent under the baseline scenario to 24.5 percent with the proposed project. The M&I contractors' share would increase from 74.9 percent to 75.5 percent.

Average annual Table A deliveries to about half the individual contractors would change by less than five percent relative to the baseline scenario. The smaller agricultural contractors would experience increases in deliveries of 5 to 15 percent but the largest agricultural contractor, KCWA, would experience a reduction in deliveries of 5 percent. M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+67 percent), Castaic Lake WA (+75 percent), Mojave WA (+43 percent) and Palmdale WD (+18 percent). All are recipients of Table A transfers.

<u>Total Deliveries under 2020 Conditions</u>

Table 6-23 shows estimated average Table A and Article 21 deliveries to individual contractors under 2020 conditions in *wet years* with the proposed project and under the baseline scenario.



Source: PBSJ, 2007.

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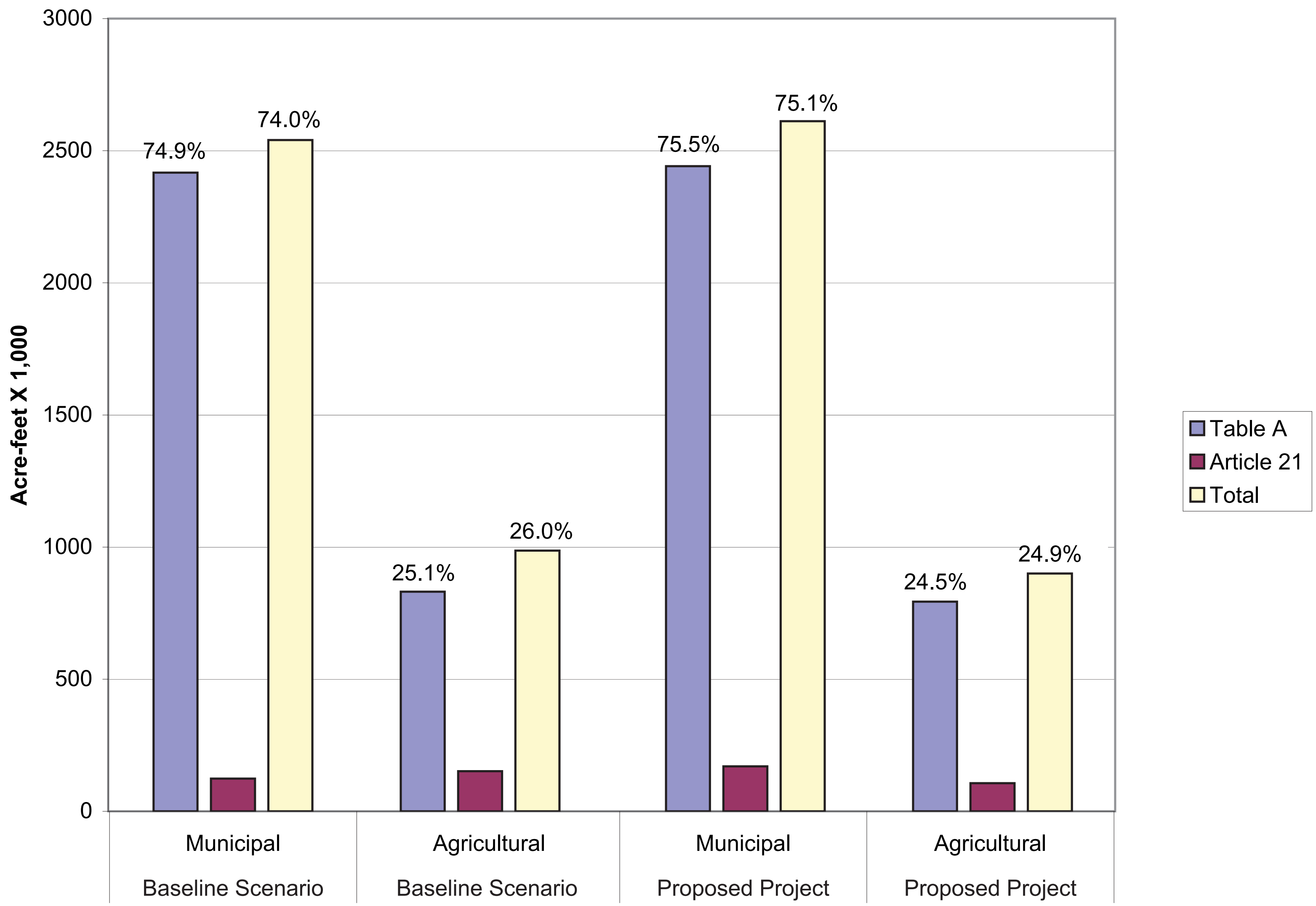
FIGURE **6-5**

Average Critical Year Deliveries 2020 Conditions



Source: PBSJ, 2006.

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FIGURE **6-6**

Average Annual Deliveries 2020 Conditions

In wet years, the average of total Table A and Article 21 deliveries would decrease by 1 percent compared to the baseline scenario. Collectively, average deliveries to agricultural contractors in wet years would decrease by 14 percent and deliveries to M&I contractors would increase by 4 percent relative to the baseline scenario. As shown in Figure 6-4, the agricultural contractors' share of total deliveries in wet years would decrease from 28.4 percent under the baseline scenario to 24.6 percent with the proposed project. The M&I contractors' share would increase from 71.6 percent to 75.4 percent. Deliveries to M&I contractors would increase because their share of the total Table A amount would increase as a result of Table A transfers and because they would receive more Article 21 water under the altered allocation procedures in Article 18 and 21.

Deliveries to a little more than half of the individual contractors in *wet years* would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to large decreases in wet year deliveries include Empire West Side ID (-21 percent), KCWA (-15 percent) and Tulare Lake Basin WSD (-10 percent). M&I contractors subject to large increases in deliveries include Napa County FC&WCD (+21 percent), Solano County WA (+16 percent), Alameda County, Zone 7 (+74 percent), Castaic Lake WA (+100 percent), Coachella Valley WD (+10 percent), Mojave WA (+47 percent) and Palmdale WD (+22 percent). All are recipients of Table A transfers.

Table 6-24 shows estimated average Table A and Article 21 deliveries to individual contractors under 2020 conditions in *critically dry years* with the proposed project and under the baseline scenario. In critically dry years, the average of total Table A and Article 21 deliveries would increase by 1 percent compared to the baseline scenario. Collectively, average deliveries to agricultural contractors in wet years would increase by 21 percent and deliveries to M&I contractors would decrease by 5 percent relative to the baseline scenario. As shown in Figure 6-5, the agricultural contractors' share of total deliveries in critically dry years would increase from 21.3 percent under the baseline scenario to 25.6 percent with the proposed project. The M&I contractors' share would decrease from 78.7 percent to 74.4 percent. Deliveries to agricultural contractors would increase because they would no longer be subject to the agriculture-first cuts in very dry periods. Their increase in critically dry year deliveries as a result of the altered allocation procedures under Article 18 would more than offset the effects of the decrease in their share of the total Table A amount as a results of Table A transfers.

All agricultural contractors would be subject to increases in critically dry year deliveries. Contractors experiencing the greatest increases include Oak Flat WD (+38 percent), Dudley Ridge WD (+34 percent), KCWA (+18 percent) and Tulare Lake Basin WSD (+35 percent). Many M&I contractors would be subject to decreases in deliveries of about 10 percent. They include Alameda County WD (-9 percent), Santa Clara Valley WD (-11 percent), San Luis Obispo County FC&WCD (-9 percent), Santa Barbara County FC&WCD (-9 percent), Antelope Valley-East Kern WA (-8 percent), Crestline-Lake Arrowhead WA (-10 percent), Littlerock Creek ID (-13 percent), MWDSC (-9 percent), San Bernardino Valley MWD (-9 percent), San Gabriel Valley MWD (-10 percent), San Gorgonio Pass WA (-10 percent) and Ventura County FCD (-8 percent). These contractors would be subject to decreased critically dry year deliveries because their reduced deliveries as a result of the altered allocation procedures would not be offset by receipt of a Table A transfer. Several M&I contractors that would receive Table A transfers would be subject to increased deliveries in critically dry years. They include Napa County FCWCD (5 percent), Solano County WA (3 percent), Alameda County, Zone 7 (+57 percent), Castaic Lake WA (+80 percent), Mojave WA (+36 percent) and Palmdale WD (11 percent).

Table 6-25 shows estimated *average annual* Table A and Article 21 deliveries to individual contractors under 2020 conditions with the proposed project and under the baseline scenario. The average annual deliveries are the average deliveries over the 73 years of record between 1922 and 1994. The annual average of total Table A and Article 21 deliveries would decrease by less than 1 percent compared to the baseline scenario. Collectively, average annual deliveries to agricultural contractors would decrease by 5 percent and deliveries to M&I contractors would increase by 1 percent relative to the baseline scenario. As shown in Figure 6-6, the agricultural contractors' share of total deliveries in average years would decrease from 26.0 percent under the baseline scenario to 24.9 percent with the proposed project. The M&I contractors' share would increase from 74.0 percent to 75.1 percent.

Average annual deliveries to about half the individual contractors would change by less than 5 percent relative to the baseline scenario. Agricultural contractors subject to decreases in annual average deliveries include Empire West Side ID (-4 percent) and KCWA (-7 percent). The other agricultural contractors would experience increases in average annual deliveries. M&I contractors subject to large increases in deliveries include Alameda County, Zone 7 (+68 percent), Castaic Lake WA (+77 percent), Mojave WA (+43 percent) and Palmdale WD (+18 percent). All are recipients of Table A transfers.

Comparison Between CALSIM II Simulation and the Historical Allocation Analysis

No exact comparison can be made between the results of CALSIM II simulations (Study No.4) and the historical allocation analysis (Study No.1) because the former uses a 73-year period of hydrologic record while the latter uses data from a ten-year period. The ten-year period of record is not as representative of long-term hydrologic conditions as the 73-year period of record. Also, the CALSIM II simulations estimate Table A deliveries, whereas the historical allocation analysis calculates Table A allocations. However, comparison of actual Table A allocations to contractors between 1996 and 2005 (Tables 6-10, 6-11, 6-12 and 6-13) with CALSIM II simulations of average annual Table A deliveries (Tables 6-16 and 6-22) reveals similar patterns. Contractors that received increased Table A allocations as a result of the proposed project (historical analysis – Study No. 1) also received increased Table A deliveries (CALSIM II simulations - Study No. 4).

6.4.3 Changes in SWP Operations and Deliveries Induced Primarily by Water Supply Management Practices

The Monterey Amendment contains several provisions, other than the altered water allocation procedures and the transfers and retirements of Table A amounts, that affect deliveries to contractors. Article 54 of the Monterey Amendment permits certain contractors to borrow water from Castaic Lake and Lake Perris in addition to their allocated SWP supplies and describes the rules governing the borrowing and replacement of water by these contractors. Article 56 of the Monterey Amendment allows contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or storage in surface water reservoirs owned by the SWP or others. Another provision of Article 56 establishes a turnback pool for annual transfers of Table A water among contractors.

Article 55 clarifies the terms and conditions for conveyance of non-SWP water using SWP facilities but has no effect on deliveries of SWP water. Because the Department is required by the California Water Code to transport water for others in SWP facilities when capacity is available to do so, this provision neither increases nor decreases the contractors' ability to convey non-SWP water using SWP facilities. Because Article 55 has no effect on SWP deliveries or the use of SWP facilities to deliver non-SWP water it would have no environmental effects and is consequently not analyzed in the following section.

The water supply management practices alter SWP operations and deliveries to contractors but they are not simulated by the CALSIM II model. Consequently, their effects are not reflected in the delivery estimates contained in Tables 6-14 through, 6-25. The changes in SWP operations and deliveries to contractors induced by the water supply management practices were characterized by examining historical data for the period 1996 to 2004. The changes in SWP operations and deliveries contractors induced by the water supply management practices between 1996 and 2004 offer insight into and enable projection of likely future operational changes.

One of the historical operations analyses for the period 1996 to 2004 (Study No. 2) examined the effects of the water supply management practices in combination with most of the other provisions of the Monterey Amendment, including the Table A retirements provided for by Article 53, on SWP deliveries. Like the water supply management practices the Table A retirements affect SWP deliveries. The permanent Table A retirements provided for under Article 53 result in lower deliveries to agricultural contractors that retired Table A amount and to lower overall SWP deliveries. The altered water allocation procedures were not accounted for in the analysis for two reasons. First, it is difficult to do so without making difficult-to-supports assumptions. Second, the altered allocation procedures provided for by Articles 18 and 21 result primarily in a shift in deliveries from one contractor to another and do not affect total deliveries they were not accounted for in the historical operations analysis. The permanent transfers of Table A amounts provided for in Article 53 may result in a temporary reduction in deliveries because the immediate water demands of some of the M&I contractors receiving transfers are less than those of the agricultural contractors that were the source of the transfers. Some M&I contractors acquired Table A amount to meet future water demands and to improve dry year supply. By 2020, these M&I contractors are expected to need their full Table A amounts and therefore the transfers would have little or no effect on total deliveries by that time.

The second historical operations analysis was used to determine the effects of the water supply management practices in the future (Study No. 3). It used data from the period 1996 to 2004 and examined the effects of the water supply management practices on SWP deliveries in isolation.

Deliveries Between 1996 and 2003

<u>Changes in SWP Operations and Deliveries Induced by Water Supply Management Practices</u>

Prior to the 1990s, the contractors had little interest in storing SWP water outside their service areas because there was no need to do so; water demands were lower than they are currently and water supplies were generally adequate. In the early 1990s, contractors' interest in the concept grew as the balance between demand and supply became less favorable in a series of dry years. Article 12(e) was added to most contractors' long term water supply contracts in 1991. Article 12(e) allowed contractors to store water outside their service areas by carrying over Table A water in San Luis Reservoir from one year to the next under certain conditions. But Department approval for out-of-service area storage in groundwater basins or surface water reservoirs other than San Luis Reservoir had to be obtained on a case-by-case basis. Only one contractor, MWDSC, had obtained Department approval for an out-of-service area storage, in this case in a groundwater basin, prior to the Monterey Amendment. Article 56 of the Monterey

Amendment provided for storage of SWP water outside contractors' service areas for later use within their service areas.

Groundwater storage

Opportunities for storage outside contractors' service areas were greatest in Kern County where geological characteristics are suitable for the creation and operation of groundwater banks. Also, the groundwater bodies underlying the southern San Joaquin Valley portion of Kern County have been historically overdrafted. Banking of water from outside Kern County could help to reduce groundwater extraction and overdrafting.

The creation of groundwater banks in Kern County in which contractors could store SWP water increases the amount of south of Delta storage available to the SWP and its contractors. An increase in south of Delta storage has the potential to increase average SWP deliveries and deliveries to certain of its contractors. The increase in average deliveries would occur because new groundwater banks provide a new place to store SWP water south of the Delta in wetter years when large volumes of water are available in the Delta.

As noted earlier, Semitropic WSD, a KCWA member agency, developed an in-lieu water bank in Kern County with a capacity of one million AF in the early 1990s. MWDSC acquired rights to about a one-third share of the capacity of the water bank and received the Department's permission to store water there prior to the Monterey Amendment. Although other contractors were considering participation in this and other similar groundwater banking programs, MWDSC was the first contractor to request Department approval to do so and the only contractor to receive approval prior to the Monterey Amendment. Because MWDSC had received the Department's approval of storage in Semitropic Water Storage District's groundwater bank before the Monterey Amendment was executed it is included in the baseline scenario.

From 1996 through 2003, six contractors delivered a total of 1,092,647 AF of SWP water for storage in groundwater banks outside their service areas. Pursuant to its pre-Monterey Amendment acquisition of rights to store water in Semitropic WSD's groundwater bank, and the Department's approval of the arrangement, MWDSC delivered 406,290 acre-feet of SWP water for storage there. Thus, 686,357 AF more water was delivered for storage in groundwater banks with the proposed project than would have been delivered for storage under the baseline scenario. When the contractors withdraw the additional water from the groundwater banks it would add to their deliveries of SWP water in the year they make the withdrawal. The amounts of water delivered to storage in groundwater banks outside their service areas by individual contractors from 1996 through 2003, excluding storage by MWDSC in the Semitropic WSD's bank, are shown in Table 6-26.

If the 686,357 AF of SWP water had not been placed in groundwater storage outside the contractors' service areas it might have been stored or used by contractors within their service areas, stored by the Department or allowed to remain in the Delta. Any water that would have remained in the Delta under the baseline scenario but which was diverted from the Delta with the proposed project in place would represent additional SWP water that the contractors would not otherwise have had available to them.

Extended Carryover in San Luis Reservoir

Article 12(e) of the long-term water supply contracts allows contractors to carryover Table A water from one year to next under certain conditions. The water is temporarily stored or carried over in SWP reservoirs, primarily San Luis Reservoir. Article 56 of the Monterey Amendment

TABLE 6-26

SWP WATER DELIVERED TO STORAGE AND RECOVERED FROM GROUNDWATER BASINS OUTSIDE CONTRACTORS' SERVICE AREAS (AF)

Year Type[a]	Water Delivered to Storage[b] 1996 W	1997 W	1998 W	1999 W	2000 AN	2001 D	2002 D	2003 AN	Total	Water Recovered Through 2003	Balance in Storage[c] 2003
MWDSC[d]	0	1,486	29,734	62,162	149,731	0	0	60,765	303,878	33,180	270,698
Alameda Co. FC&WCD, Zone 7	0	0	1,970	22,910	23,940	5,000	13,484	6,500	73,804	1,807	71,997
Alameda County WD	6,200	10,000	3,780	16,100	13,380	0	2,083	18,800	70,343	0	70,343
Santa Clara Valley WD	45,000	35,000	23,800	30,000	23,730	0	3,311	33,000	193,841	30,000	163,841
Dudley Ridge WD	4,131	5,342	5,925	1,321	953	1,733	736	350	20,491	4,954	15,537
Castaic Lake WA	0	0	0	0	0	0	24,000	0	24,000	0	24,000
Totals	55,331	51,828	65,209	132,493	211,734	6,733	43,614	119,415	686,357	69,941	616,416

Notes:

a. Based on Sacramento Valley water year types as wet (W), above normal (AN), below normal (BN), dry (D), and critically dry (CD), in accordance with SWRCB D-1641.

b. All water delivered to storage and recovered from groundwater basins in Kern County.

c. The storage balances shown here overstate the amount of water available for recovery by the storing contractor because they do not account for losses within the groundwater basin. Losses differ by storage program but are typically of the order of 10 percent so about 90 percent of the water delivered to storage is available for recovery.

d. Deliveries by MWDSC to the Semitropic WSD groundwater banking program are excluded from these deliveries because MWDSC's participation in the program predated the Monterey Amendment.

Source: California Department of Water Resources.

expanded the circumstances under which contractors could carry over or temporarily store water in San Luis Reservoir. However, contractors must take delivery of carryover water before storage space in San Luis Reservoir is needed by the SWP. Any carryover water remaining in the reservoir when the SWP needs the storage capacity reverts to the SWP.

From 1996 through 2004, contractors requested about 1,680,000 AF of water be placed in extended carryover storage and took delivery of approximately 1,280,000 AF. About 400,000 AF of the carryover water reverted to the SWP. Under the baseline scenario, no Table A water would have been placed in Article 56 extended carryover storage.

Some contractors use extended carryover to improve their SWP water supply during dry years. If a contractor has more Table A water in a given year (Year 1) than it needs it may choose to store some or all of the excess in San Luis Reservoir. If the following year (Year 2) is dry, the contractor is able to supplement its reduced SWP allocation with SWP water carried over from the previous year (Year 1). If Year 2 is wet, the contractor typically uses the SWP water carried over from Year 1 early in the year to prevent it reverting to the SWP. This reduces the contractor's need for SWP water in Year 2, increasing the chance it will be able to carry over some of its Year 2 SWP allocation in San Luis Reservoir for use in Year 3. Extended carryover affects deliveries to individual contractors. Prior to the Monterey Amendment, in a year (Year 1) when a contractor did not need its full, allocated Table A amount, the water it did not take reverted to the SWP. The SWP either allocated the water to other contractors in Year 1 or carried it over in San Luis Reservoir for allocation to contractors in the following year (Year 2). The Monterey Amendment enabled a contractor to defer delivery of part of its Year 1 SWP allocation so that it could use it in Year 2. Routine use of carryover storage enables a contractor to slightly increase its share of SWP water at the expense of contractors that do not carry over SWP water from one year to the next.

Extended carryover in San Luis Reservoir could increase total deliveries of SWP water if any of the water placed in carryover storage in a year when the storing contractors had more water than they needed would otherwise have flowed out of the Delta. It would not increase total deliveries of SWP water if the water placed in carryover storage would have been reallocated and used by other contractors or used to increase storage in SWP facilities.

Turnback pool

Contractors have often requested more Table A water than they ultimately needed for several reasons. By October 1, when the initial requests are made for the following calendar year, contractors cannot know how weather will affect demand for water in their service areas, how much local water supply will be available, or how much water will be allocated to them by the SWP. A reasonable strategy for a contractor is to estimate the range of likely water demand and then request a Table A amount sufficient to meet demand at the high end of the range. Although this is prudent practice for an individual contractor it does not optimize benefits for the SWP as a whole. If a contractor discovers in the spring that it needs only a portion of its requested Table A water, it may be too late for another contractor or the Department to put the unneeded water to use. The turnback pool was created to provide a financial incentive to a contractor that does not need all of its requested Table A water to turn that water back for sale to another contractor or the Department early enough in the year for it to be put to use.

From 1996 through 2004, numerous contractors and the Department used the turnback pool to buy and sell Table A water. The turnback pool was used to transfer 1,285,318 AF of Table A water between 1996 and 2004, including 289,222 AF purchased by the Department and 9996,096 AF purchased by contractors. The water purchased by the Department remained in storage for use in a subsequent year. Of the water purchased by contractors, 922,697 AF was actually delivered. If this amount of Table A water had not been delivered to contractors via the turnback pool, it might have been used by the contractor it was originally allocated to, allocated to another contractor, stored by the Department in Lake Oroville or San Luis Reservoir, or it might have flowed out of the Delta. Any water that would have flowed out of the Delta under the baseline scenario but which was diverted from the Delta with the proposed project in place would represent additional SWP water that the contractors would not have had available to them. When the contractors purchased water through the turnback pool that would otherwise have flowed out of the Delta it would add to their deliveries of SWP water.

Flexible storage in Castaic Lake and Lake Perris

Castaic Lake (gross capacity 323,700 AF) and Lake Perris (gross capacity 131,500 AF) are located respectively at the termini of the West and East branches of the California Aqueduct. Their purpose is to meet peak demands for water and to provide emergency storage. The Department uses the reservoirs to meet peak summertime water demand in southern California when the California Aqueduct is operating at its maximum capacity. When the California Aqueduct is out of service in emergencies, or when it is closed or is subject to flow reductions for maintenance, the Department can supply some contractors with water from Castaic Lake and Lake Perris. The Department refills the reservoir when water and energy conditions are favorable.

The Department also uses the reservoirs to reduce its electrical power costs. The cost of electrical power reaches its seasonal maximum on hot summer days. By supplying water to some contractors from the reservoirs at such times rather than purchasing power at peak rates to pump water from the California Aqueduct, the Department is able to reduce its power costs.

Article 54 of the Monterey Amendment provides that the three contractors that can obtain water from Castaic Lake and Lake Perris may borrow water from the reservoirs provided the borrowing contractor replaces the water within five years. This is referred to as the flexible storage provision. MWDSC is the only contractor that can withdraw water from Lake Perris. See Chapter 4, Section 4.4.4 for further discussion of the flexible storage provision. The borrowing and replacement of water that occurred between 1996 and 2003 is shown in Table 6-27.

For a variety of reasons, including recent wetter than normal hydrology, the Department has been able to reduce its summer drawdown of Castaic Lake and Lake Perris compared to pre-Monterey Amendment conditions. The higher water level enables the Department to accommodate possible borrowing of water by contractors under the flexible storage provision without compromising the other purposes of the reservoirs; that is, meeting peak demands, providing water in emergencies and during maintenance and increasing the efficiency of energy use.

When water has been borrowed from the reservoirs, the Department has often refilled the reservoirs, as water and off-peak energy become available to it, before the contractors wished to replace the water they had borrowed. If the reservoirs were full by the time the contractors wished to replace the water, the Department credited the contractors with the replacement water and that water became part of the SWP's supply.

The flexible storage provision enables some contractors to temporarily increase the amount of water they obtain from the SWP. A contractor using the provision can obtain its allocation of SWP water under all other provisions of its SWP contract plus the water borrowed from Castaic

TABLE 6-27

USE OF FLEXIBLE STORAGE 1996-2003

Borrower	Reservoir	Purpose	Amount AF	Withdrawal Date	Replacement Date
Castaic Lake WA	Castaic	Water quality improvement	1,256	November-December, 1996	November-December, 1997
Castaic Lake WA	Castaic	Water quality improvement	2,589	November-December, 2000	December, 2001
MWDSC	Castaic	Environmental Water Account	50,000	March-April, 2001	March-July, 2002 and October-November, 2002
MWDSC	Castaic	Cost savings to MWDSC	14,300	December, 2001	November-December, 2002
Castaic Lake WA	Castaic	Water quality improvement	395	December, 2002	January, 2006
MWDSC	Castaic	Water quality improvement during facility outage	77,804	Jan-Feb 2003	Feb-Apr 2003
MWDSC	Perris	Water quality improvement	8,181	Mar-May 2000	Jun 2000 and Mar 2001
MWDSC	Perris	Cost savings to MWDSC	10,692	Dec 2001	May-Jul 2002 and Nov-Dec 2002
MWDSC	Perris	Water quality improvement during facility outage	17,993	Jan-Feb 2003	Feb-Apr 2003

Sources: MWDSC, California Department Of Water Resources.

Lake or Lake Perris. The effects of flexible storage on SWP deliveries depend on how the water is replaced. It might be paid back by the contractor increasing its use of one of its other water sources and taking less SWP water than its full allocation under the other provisions of the SWP contracts. If this were the case, then flexible storage would have no effect on the total deliveries of water by the SWP. Alternatively, a contractor might pay it back by requesting a greater proportion of its Table A amount or more Article 21 water than it otherwise would request. In this case, if Table A allocations were less than 100 percent or the Article 21 supply available was less than demand for it, the increase in deliveries to that contractor would be offset by reduced allocations to other contractors with no effect on total deliveries of SWP. The repayment of water would only affect total deliveries of SWP water if it occurred when Table A allocations were 100 percent or Article 21 water was available in excess of demand for it. That is, when Delta pumping was cut back because all other demands for SWP water were being met and all SWP storage reservoirs were full or at their storage targets. If repayment occurred under these conditions it could increase total deliveries of SWP water and decrease total Delta outflow.

Summary of Effects of Water Supply Management Practices and Table A Retirements

The historical operations analysis (Study No. 2) estimated the effects of nearly all the provisions of the Monterey Amendment with the potential to affect SWP operations and deliveries, namely the water supply management practices and the Table A retirements. As noted earlier, the effects of the altered allocation procedures are not included because they have a negligible effect on deliveries. The effects of the Table A transfers are not included because they are difficult to estimate accurately. The effects of the transfer of the Kern Fan Element property from state to local ownership are included but were determined to be inconsequential between 1996 and 2004. The results of the analysis are summarized below; detailed results are contained in Appendix K.

In the historical operations analysis, contractor deliveries between 1996 and 2004 under each provision of the Monterey Amendment were reviewed and an assessment made of whether these deliveries would or would not have occurred under the baseline scenario. To construct the baseline scenario, it was assumed that water associated with the retired Table A amount would have been delivered but that none of the deliveries stemming from the water supply management practices would have been made with the exception of deliveries to out-of-service area storage. Deliveries to out-of-service area were examined to determine whether the contractors delivering water to out-of-service area storage would otherwise have delivered some or all of the water to other storage facilities available to them. The determination was based on a telephone survey of contractors conducted by the Department. The net change in deliveries was then reflected in changes in storage in San Luis Reservoir. If the result were to be an increase in storage in San Luis Reservoir, then the Department would allocate more Table A water to the contractors and would make Article 21 water available earlier than it did with the proposed project. The additional amount of water that would be made available to the contractors under the baseline scenario was estimated taking account of the limits to the contractors' demands for SWP water. Once the SWP's share of storage in San Luis Reservoir was full and all contractors' demands were met, it was assumed that diversions at the Banks Pumping Plant would be reduced.

The historical operations analysis showed that the Monterey Amendment resulted in an increase in deliveries of 44,000 acre-feet during the period from 1996 to 2004 compared to the baseline scenario. The estimated increase in deliveries and the corresponding increase in total diversions at the Banks Pumping Plant occurred in six months of the nine-year period (108 months), typically in the wetter months of wet years.

As noted earlier, the historical operations analysis did not include the effects of the permanent Table A transfers, which probably would have decreased deliveries in some years between 1996 and 2003. This is because some of the M&I contractors receiving the transfers had less immediate use for the water than the agricultural contractors that transferred Table A amounts. Thus, the actual increase in deliveries was probably less than 44,000 AF between 1996 and 2004.

The difference between deliveries with the proposed project and under the baseline scenario between 1996 and 2004 was small primarily because the contractors that took advantage of the provision of the Monterey Amendment that enabled out-of-service area storage had other storage available to them in that time period. They placed water in storage outside their service areas in order to diversify their water sources rather than to increase their total amount of water in storage.

Future Deliveries

<u>Changes in SWP operations expected to be induced by water supply management practices</u>

Groundwater Storage

As described earlier, between 1996 and 2003, six contractors delivered 686,357 AF more SWP water for groundwater storage outside their service areas than they would have under the baseline scenario. By creating a reserve of SWP water stored outside their service areas, which could be used during dry periods, these contractors increased the reliability of their SWP water supplies. It is expected that between 2003 and 2020 these and other contractors would place SWP water into groundwater storage outside their service areas when it is available to them and would recover it from storage as needed.

The advantages of groundwater storage outside contractors' service areas are likely to grow in the future as water demand increases in the M&I contractors' service areas and shortages become more frequent. However, opportunities to place SWP water in groundwater storage outside contractors' service areas are likely to be less frequent in the future than they were between 1996 and 2003. There are two reasons for this conclusion. The period between 1996 and 2003 was wetter than average and included four wet years, two above normal years and two dry years. As a result, more SWP water in excess of contractors' immediate needs was available than there would be in a more typical sequence of hydrologic years. The second reason is that as demand grows in the M&I contractors' service areas they will need more of their SWP water to meet their immediate needs and less will be available to place in storage.

Extended carryover in San Luis Reservoir

Between 1996 and 2004, contractors placed about 1,680,000 AF of water in extended carryover storage. The use of extended carryover storage enables contractors to increase their supplies of SWP water in dry years. Because use of extended carryover storage is a strategy that offers advantages, particularly to contractors with no or limited access to groundwater supplies, it is expected that it would be increasingly used in the future.

As noted earlier, extended carryover in San Luis Reservoir could increase total deliveries of SWP water if any of the water placed in carryover storage in a year when the storing contractors had more water than they needed would otherwise have flowed out of the Delta. It would not increase total deliveries of SWP water if the water placed in carryover storage would have been reallocated and used by other contractors or used to increase storage in SWP facilities.

Turnback pool

Between 1996 and 2004, numerous contractors and the Department took advantage of the turnback pool to buy and sell Table A water but use of the turnback pool began to decline toward the end of the period. The decline is attributable to M&I contractors needing more of their Table A water for their own use and their use of other methods to manage their SWP supplies. The decline in use of the turnback pool is expected to continue in the future as demand increases still further in the M&I contractors' service areas and the M&I contractors need more of their SWP water for their own use. By 2020, when all contractors are expected to need their full Table A amounts, it is expected that little or no water would be bought or sold via the turnback pool.

Flexible Storage in Castaic Lake and Lake Perris

Two contractors, MWDSC and Castaic Lake WA, borrowed water from Castaic Lake pursuant to Article 54 between 1996 and 2003. MWDSC also borrowed water from Lake Perris. It is expected that the three contractors that are able to borrow water from the terminal reservoirs pursuant to Article 54 would do so in the future. MWDSC provided an estimate of its future use of flexible storage, which is shown in Table 6-28. Future borrowing may draw down the two reservoirs to a greater extent than occurred between 1996 and 2003, a relatively wet period.

As noted earlier, the effects of flexible storage depend on how borrowed water is replaced. It might be replaced by the contractor increasing its use of one of its other water sources and

TABLE 6-28

EXPECTED FUTURE USE OF FLEXIBLE STORAGE BY MWDSC

Purposes for Use	Estimated Amount of Withdrawal	Estimated Duration of Withdrawal	Estimated Frequency of Occurrence
Supply source shift for:			
	Castaic: up to 100,000 AF		
Environmental Water Account		Less than 1 year to 2 years	Once every 1 to 3 years
Water quality benefit	Perris: up to 40,000 AF		
Operational flexibility			
Cost savings to MWDSC			
Provide supply for:	Castaic: up to 100,000 AF		
Environmental Water Account		Less than 1 year to 2 years	Once every 3 to 5 years
Exchange	Perris: up to 40,000 AF		
Make up shortage during:			
	Castaic: up to 153,940 AF		
Emergency		1 to 5 years	Once every 7 to 10 years
System outage	Perris: up to 65,000 AF		
Single critically dry year			
Multi-year drought			

Source: MWDSC.

taking less SWP water than its full allocation under the other provisions of the SWP contracts. If this were to be the case, then flexible storage would have no effect on the total deliveries of water by the SWP. Alternatively, a contractor might pay it back by requesting a greater proportion of its Table A amount or more Article 21 water than it otherwise would request. In this case, if Table A allocations are less than 100 percent and more Article 21 water was available in excess of demand, the increase in Table A delivery to that contractor would be offset by reduced allocations to other contractors with no effect on total deliveries of SWP water. The repayment of water would only affect total deliveries of SWP water if it occurred when Table A allocations were 100 percent or Article 21 water was available in excess of demand for it. That is, if Delta pumping was cut back because all other demands for SWP water were being met and all SWP storage facilities were full or at its storage targets. Under these conditions, repayment would increase total deliveries of SWP water.

If the contractors borrowed the maximum amounts of water permitted under Article 54, 160,000 AF would be borrowed from Castaic Lake and 65,000 AF would be borrowed from Lake Perris, in each case about half the maximum capacity of the reservoir. The reservoirs could remain drawn down for a maximum of five years. Although this “worst-case” condition could occur, it is unlikely because it is in the interests of the Department, and the contractors that receive water from the two reservoirs, that borrowed water be replaced as soon as practicable. The terminal reservoirs fulfill their function best when they are kept full or close to full.

With the flexible storage provision in place, the Department would continue to operate Castiac Lake and Lake Perris as it has done historically. The functions of the reservoirs would remain the same. Depending on future conditions, the Department may be able to continue the practice of reducing annual summer drawdown of the reservoirs compared to pre-Monterey Amendment conditions.

In June 2001, the Department, MWDSC, the California Department of Parks and Recreation, the CDFG and the California Department of Boating and Waterways signed a memorandum of understanding regarding development of operations guidelines for Lake Perris. The purpose of the operations guidelines was to optimize benefits for recreation, fish and wildlife, water supply and water quality. The Department and MWDSC agreed to fill or refill and maintain the lake at a minimum elevation of 1,584 feet during the summer for recreational use and boat ramp access. Elevation changes would be minimized from mid-March to the beginning of May to protect fish spawning. In 2005, the memorandum of agreement was amended in recognition of the potential for liquefaction at the Perris Dam foundation. The parties agreed that Lake Perris would be operated between elevation 1,558 feet and 1,563 feet year round but could be lowered an additional five feet between Labor Day and Memorial Day if necessary in the event of a water shortage, a SWP outage or other unusual circumstances.

<u>Summary of Effects of Water Management Practices</u>

To estimate the effects of the water management practices in the future, the Department used historical data from 1996 through 2004 in a historical operations analysis (Study No. 3) similar to the one described earlier (Study No. 2). There are two differences between Study No. 3 and Study No. 2. Study No. 2 included the Table A retirements; Study No. 3 did not. Also, Study No. 3 includes different assumptions with respect to the availability of storage to contractors after 2004. In Study No. 2, it was assumed that if a contractor that delivered SWP water to storage outside the contractor's service area with the proposed project had other storage options available to it then it would have delivered the water to its alternative storage programs under the baseline scenario. Study No. 2, which was partly based on a survey of contractors, determined that most of the contractors taking advantage of storage outside their service areas from 1996 through 2004 had capacity in other storage programs available to them. Consequently, it was estimated that deliveries to storage were similar with the proposed project and under the baseline scenario. At some point in the future, however, capacity in the other storage programs would be exhausted and storage outside contractors' service areas would be the contractors' only storage option. In Study No. 3, it was assumed that the alternative storage programs available to the contractors from 1996 through 2004 are full and that any SWP water delivered to storage outside contractors' service areas with the proposed project represents deliveries that would not take place under the baseline scenario.

Study No. 3 showed that, with the assumptions described above, the water supply management practices would have resulted in an increase in SWP deliveries of 449,000 AF over the nine-year period from 1996 through 2004, or an average of 50,000 AF per year. The increases would have occurred in 11 months of the nine-year (108-month period). Assuming hydrologic conditions in the future are similar to those that occurred from 1996 through 2004, then the water supply management practices would increase SWP deliveries by an average of 50,000 AF in the future. This may overstate the effects of the water management practices because overall hydrologic conditions during the period 1996 through 2004 were wetter than average and the availability of SWP water in excess of contractors immediate needs was greater than it is likely to be in the future.

6.4.4 Transfer of the Kern Fan Element and SWP Operations

In 1988, the Department purchased approximately 20,000 acres of land in Kern County with the intention of constructing one element of a larger groundwater bank that would be a part of the SWP storage/conveyance system. This element became known as the Kern Fan Element and the land was referred to as the Kern Fan Element property. Transfer of the land to KCWA as part of the Monterey Amendment eliminated the possibility that a state-owned groundwater bank would be developed on the Kern Fan Element property. If the Department had retained ownership to the property it may have built a groundwater bank as part of the SWP. This possibility is described and analyzed in Chapter 11.

6.4.5 Summary of Monterey-Amendment-Induced Changes on SWP Operations and Deliveries

The Table A transfers and retirements and altered water allocation procedures that are a part of the Monterey Amendment would have a small effect on average annual total SWP deliveries (Study No. 4). They would result in a one-percent decrease in average annual total SWP deliveries (Table A + Article 21) under 2003 conditions (Table 6-19) and about a 0.5 percent decrease by 2020 (Table 6-25). The decrease under 2003 conditions is due to the retirement of 45,000 AF of Table A amount and the fact that some M&I contractors receiving Table A transfers had less immediate need for water than the agricultural contractors that made the transfers. The decrease under 2020 conditions is solely due to the retirement of 45,000 AF of Table A amount.

The Table A transfers and retirements and altered water allocation procedures would have a greater effect on the proportional delivery of SWP water to agricultural and M&I contractors as groups. On an average annual basis with the proposed project in place, Table A deliveries to agricultural contractors under 2020 conditions would decrease by about three percent relative to the baseline scenario. Deliveries to M&I contractors would be about the same as they are under the baseline scenario. On an average annual basis with the proposed project in place, total SWP deliveries of Table A and Article 21 water to agricultural contractors under 2020 conditions would decrease by about five percent relative to the baseline scenario. Deliveries to M&I contractors would increase by about one percent. Agricultural contractors would increase their share of Table A and total SWP deliveries in critically dry years compared to the baseline scenario. Municipal contractors would increase their share of Table A and total SWP deliveries in wet years compared the baseline scenario.

The Table A transfers and retirements and altered water allocation procedures would affect deliveries to individual contractors. M&I contractors that received a transfer of Table A amount would increase their average annual deliveries substantially. M&I contractors that did not receive a Table A transfer would experience a slight decline in their average annual deliveries. KCWA would experience a reduction in average annual deliveries because it retired and transferred a substantial Table A amount.

Some of the water supply management practices that are a part of the Monterey Amendment would affect deliveries of SWP water. Between 1996 and 2003, the Department, in its historical operations analysis (Study No. 2), estimated that the water supply management practices and the Table A retirements analyzed together increased total deliveries of SWP water by 44,000 AF or about 0.2 percent compared to the baseline scenario. Because the analysis did not account for the Table A transfers it probably overstates the increase in deliveries. Overall, the Monterey Amendment probably had little effect on deliveries between 1996 and 2003.

In the future, it is estimated that the water supply management practices would increase average annual deliveries of SWP water by 50,000 AF per year. The estimate was made by reanalyzing historical data from 1996 to 2004 but using different assumptions with respect to storage available to the contractors (Study No. 3). In the period 1996 to 2004, it was determined that most of the contractors taking advantage of storage outside their service areas had capacity in other storage programs available to them. Consequently, it was estimated that deliveries to storage were similar with the proposed project and under the baseline scenario. In the future, it is expected that the other storage programs would fill and that storage outside contractors' storage areas was assumed to be the contractors' only storage option. The estimate is conservative, that is, it probably overstates the actual increase in deliveries attributable to the Monterey Amendment for several reasons. The estimate was based on 1996 through 2004 hydrology which was a wetter than usual. Also, the estimate does not account for the reduction in deliveries that would occur in some years as a result of the Table A retirements. In years when Table A allocations are less than 100%, the retirements would have no effect on deliveries but in years when Table A allocations are 100% there may be a reduction in deliveries. Finally, as demand increases in contractors' service areas, the contractors will need their SWP water to meet immediate needs, making less SWP water available for storage outside-their service areas.

6.5 POST SETTLEMENT AGREEMENT SWP OPERATIONS

Table 6-29 lists and summarizes the provisions of the Settlement Agreement entered into in *Planning and Conservation League et al vs. California Department of Water Resources*. The Settlement Agreement alters how the Department administers the long-term water supply contracts and provides information to the public on SWP operations. It does not affect how the Department operates the SWP except in Plumas County. The Settlement Agreement reduces Plumas County's exposure to cutbacks in SWP supplies during droughts; however, the amounts of water involved are so small that the changes would have no operational effect on the rest of the SWP. (Plumas County's Table A amount in 2020 is less than 0.1 percent of the total Table A amount.)

TABLE 6-29

POTENTIAL EFFECTS OF SETTLEMENT AGREEMENT ON SWP OPERATIONS

Article	Summary	Potential Change in SWP or Contractor Operations
I	Provides definitions of terms used in settlement agreement	No
II	Allows the Department to operate in accordance with the Monterey Amendment on an interim basis until court order is issued discharging writ of mandate	No
III	Describes content of new EIR and procedures for preparing it	No
IV A & B	Specifies payments to Plumas County and establishes a forum and program to undertake watershed improvements with emphasis on Feather River watershed	No
IV C & D	Changes SWP deliveries to Plumas County in water shortages and commits the Department to confer with Plumas County regarding reoperation of SWP facilities to increase benefits to Plumas County	Yes
IV E & F	Relates to future relations between the Department and Plumas County and resumption of Plumas County's SWP payments	No
V	Limits use of Kern Fan Element lands including prohibiting development of 490 acres that can be developed under HCP	No
VI	Provides plaintiffs with funding	No
VII A	Prevents the Department or contractors from approving any new project based on 1995 EIR	No
VII B	Provides for execution of an amendment to the SWP contracts that redefines several terms including "Annual Table A Amounts," eliminates use of the term "entitlement" and requires the Department to prepare and distribute a report of SWP delivery capability every two years	No
VII C	Provides for filing settlement agreement with court	No
VII D	Requires the Department to adopt new policies, procedures, and guidelines that clarify procedures for review of SWP contract amendments and establish principles for public participation in SWP contract negotiations	No
VII D, E, F, G, H, I, J, K, & L	Specifies various legal procedures	No
VIII	Calls for arbitration to establish attorney's fees	No
IX	Specifies procedures for dispute resolution	No
X	Specifies various legal procedures	No

ENDNOTES

1 After the transfer took place the adequacy of the CEQA compliance documents for the transfer were challenged. Castaic Lake WA prepared and certified a new EIR on the transfer, which became the subject of new litigation brought by PCL and the California water Impact Network in Los Angeles Superior Court.

2 The transfers from KCWA to Coachella Valley WD and Desert WA were executed in September, 2007. When this EIR is certified the Department may designate them as Monterey Amendment transfers.

7. ENVIRONMENTAL ANALYSIS

7.0 INTRODUCTION TO THE ANALYSIS

7.0 INTRODUCTION TO THE ANALYSIS

7.0.1 SCOPE OF THE EIR ANALYSIS

The Environmental Analysis chapter of this EIR presents the environmental and regulatory setting, impacts, and mitigation measures for each of the following technical issue areas (Sections 7.1 through 7.16):

- 7.1 Surface Water Hydrology, Water Quality, and Water Supply
- 7.2 Groundwater Hydrology and Quality
- 7.3 Fisheries Resources
- 7.4 Terrestrial Biological Resources
- 7.5 Visual Resources
- 7.6 Agricultural Resources
- 7.7 Air Quality
- 7.8 Geology, Soils, and Mineral Resources
- 7.9 Recreation
- 7.10 Land Use and Planning
- 7.11 Hazards and Hazardous Materials
- 7.12 Noise
- 7.13 Cultural and Paleontological Resources
- 7.14 Public Services and Utilities
- 7.15 Traffic and Transportation
- 7.16 Energy

7.0.2 SECTION FORMAT

Each section contains: (1) a description of the proposed project elements that have the potential to affect the technical issue area under discussion; (2) methods of analysis; (3) standards of significance used to evaluate the significance of project impacts; (4) physical setting; (5) regulatory setting; and (6) impacts and mitigation measures. The physical and regulatory setting provides a point of reference for assessing the environmental impacts of the proposed project. Setting information is presented for 1995 (the year prior to implementation of any part of the Monterey Amendment) and 2003 (the year the NOP for this EIR was published). Only changes in the 1995 physical and regulatory setting are described in the 2003 setting. This includes setting information for elements of the Settlement Agreement.

The setting discussion is followed by an impacts and mitigation discussion. The impact and mitigation portion of each section includes statements of potential impact, which are prefaced by a number in **bold-faced** type. An explanation of each potential impact and a discussion of the analysis and conclusion reached regarding its significance follow each impact statement. All mitigation measures pertinent to each individual impact are presented following the impact. The degree to which the identified mitigation measure(s) would reduce the impact is also described.

An example of the impacts and mitigation format is shown below.

7.X-X Statement of potential impact for the proposed project in bold type.

Two time periods are evaluated for each impact: Impacts that occurred between 1995 and 2003 (based on 1995 and 2003 conditions) that are discussed under the **1995 – 2003** header; and future impacts that are anticipated to occur between 2003 and 2020 (based on 2003 and 2020 conditions) that are discussed under the **Future Impacts** header.

The discussion of impacts for the proposed project is presented in paragraph form, and a determination of the impact's significance for each time period is presented in ***bold italic** type*.

<u>Mitigation Measures</u>

The mitigation measures are preceded by a statement declaring the ***level of significance*** after implementing the mitigations.

7.X-X *Statement of what, if any, mitigation measures are required.*

The mitigation measures are followed by a discussion of how the proposed measure mitigates the identified impact and to what level of significance.

7.0.3 TERMINOLOGY

This Draft EIR uses the following terminology to describe environmental effects of the proposed project in Chapter 7:

- **Standards of Significance:** A set of criteria used by the lead agency to determine at what level or "threshold" an impact would be considered significant. Standards of Significance used in this EIR include those discussed in the CEQA Guidelines; criteria based on factual or scientific information; criteria based on regulatory standards of local, State, and federal agencies; and criteria adopted by the California Department of Water Resources. In determining the level of significance, the analysis assumes that the proposed project would comply with relevant federal, State, and local regulations and ordinances.
- **Less Than Significant Impact:** A project impact is considered less-than-significant when it does not reach the standard of significance and would therefore cause no substantial change in the environment (no mitigation required).
- **Potentially Significant Impact:** A potentially significant impact is an environmental effect that may result in a substantial adverse change in the environment; however, additional information is needed regarding the extent of the impact to make the determination of significance. For CEQA purposes, a potentially significant impact is treated as if it were a significant impact. Mitigation measures and/or project alternatives are identified to reduce these effects to the environment where feasible.
- **Significant Impact:** A project impact is considered significant if it would result in a substantial adverse change in the physical conditions of the environment. Significant

impacts are identified by the evaluation of project effects in the context of specified significance criteria. Mitigation measures and/or project alternatives are identified to reduce these effects to the environment where feasible.

- **Significant and Unavoidable Impact:** A project impact is considered significant and unavoidable if it would result in a substantial adverse change in the environment that cannot be feasibly avoided or mitigated to a less-than-significant level if the project is implemented. Findings of Overriding Considerations must be adopted if impacts cannot be mitigated.
- **Cumulative Impacts:** According to CEQA, "cumulative impacts refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts" (CEQA Guidelines, Section 15355). CEQA requires that cumulative impacts be discussed when the "project's incremental effect is cumulatively considerable" (CEQA Guidelines, Section 15130 (a)).
- **Mitigation Measures:** The CEQA Guidelines (Section 15370) define mitigation as:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action;
(b) Minimizing impacts by limiting the degree of magnitude of the action and its implementation;
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
(e) Compensating for the impact by replacing or providing substitute resources or environments.

7.1 SURFACE WATER HYDROLOGY, WATER QUALITY, AND WATER SUPPLY

7.1 SURFACE WATER HYDROLOGY, WATER QUALITY, AND WATER SUPPLY

7.1.1 INTRODUCTION

7.1.1.1 Content

This section describes the potential effects of the proposed project on surface water hydrology, water quality and water supply. The proposed project could potentially affect natural surface waterways including the Feather, Sacramento, American and San Joaquin rivers, the Sacramento-San Joaquin Delta and small streams in Plumas and Kern County. It could potentially affect man-made surface waterways and reservoirs including the North Bay Aqueduct, California Aqueduct, South Bay Aqueduct, Coastal Aqueduct, Lake Oroville, San Luis Reservoir, Castaic Lake, Lake Perris and Lake Davis, all components of the SWP. The proposed project could also affect the water supplies of agencies other than the Department and the SWP contractors.

Chapter 6 describes the changes in SWP and SWP contractor operations that are attributable to the Monterey Amendment and the Settlement Agreement. Some of the operational changes attributable to the proposed project could have effects on surface water hydrology, water quality and the water supplies of agencies other than the Department and the SWP contractors. The potential effects of Monterey Amendment and Settlement Agreement-induced operational changes on surface water hydrology, water quality, and the water supply of entities other than the SWP and the SWP contractors, are the focus of this section.

A provision of the Monterey Amendment allowed the transfer of ownership of property in Kern County from the SWP to local water agencies. Subsequent development of a water bank on the property involved construction activities.

A provision of the Settlement Agreement provides SWP funding for watershed improvement projects in Plumas County that could include construction activities. Both of these provisions could have short-term effects on hydrology and water quality in the vicinity of the construction sites. The effects of the provisions are described in this section. Elements of the proposed project that could potentially affect surface water hydrology, water quality and water supply are listed in Table 7.1-1.

7.1.1.2 Analytical Method

Three methods were used to examine the effects of the proposed project on surface water hydrology, water quality and the water supply of entities other than the SWP and its contractors: CALSIM II simulations and post-processing of CALSIM simulations, analysis of historical data and extrapolation from historical data. The CALSIM II model directly simulates the effects of the Table A transfers and retirements and a post-processing spreadsheet analysis of CALSIM II output enables determination of the effects of the altered water allocation procedures. CALSIM II does not simulate the water supply management practices. CALSIM II was also used to assist in the analysis of the impact on CVP use of JPOD.

TABLE 7.1-1

IMPACTS OF THE PROPOSED PROJECT ELEMENTS ON HYDROLOGY AND WATER QUALITY

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Flow and water quality in rivers and Delta, water levels in reservoirs, availability and quality of water for other water users	7.1-1, 7.1-2, 7.1-3, 7.1-4, 7.1-5, 7.1-6, 7.1-7, and 7.1-8.
Permanent Table A transfers and retirements	Flow and water quality in rivers and Delta, water levels in reservoirs, availability and quality of water for other water users	7.1-1, 7.1-2, 7.1-3, 7.1-4, 7.1-5, 7.1-6, 7.1-7, and 7.1-8.
Transfer of Kern Fan Element lands	NA	NA
Water supply management practices	Flow in Delta, water levels in reservoirs, groundwater levels, availability and quality of water for other water users	7.1-1, 7.1-2, 7.1-3, 7.1-4, 7.1-5, 7.1-6, 7.1-7, and 7.1-8.
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guidelines on public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	NA
Watershed forum and restoration in Plumas County	Water Quality in Plumas County streams	7.1-9
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

The assumptions made in the CALSIM II studies are discussed in Chapter 5 and described in detail in Appendix F. The CALSIM II model uses historical hydrological data from a 73-year period of record and other data to simulate operations of the SWP and CVP and river flows in the Sacramento and San Joaquin Valleys. It is an analytical planning tool that uses and predicts monthly data and does not forecast actual day-to-day operations of the SWP or CVP. Actual day-to-day operations of the SWP and CVP depend on continuous collection of, and response to, real-time data. Actual daily operations are more complex than can be simulated by CALSIM II or any other similar model.

CALSIM II was used to estimate the amount of water available for allocation to the SWP contractors in different hydrologic year types. The total amount of water available each year was then allocated to the contractors in accordance with pre-Monterey Amendment allocation procedures (baseline scenario) and post-Monterey Amendment allocation procedures (proposed project). Using an Excel spreadsheet, Monterey Amendment-induced changes in deliveries to individual contractors have the potential to alter flow in the Feather and Sacramento rivers and outflow from the Delta. The effects of the Table A transfers and retirements and the altered water allocation procedures on river flow and Delta outflow were determined by simple calculation using a spreadsheet analysis that incorporated CALSIM II-generated river flow and Delta inflow data.

None of the Monterey Amendment water supply management practices has the potential to affect flow in the Feather and Sacramento rivers. The effects of the water supply management practices on the Delta in the period 1996 to 2003 were determined by analysis of historical data. The effects of the water supply management practices between 2003 and 2020 were estimated by extrapolation based on the known effects of the practices between 1996 and the present.

Some of the effects of the proposed project on water quality were estimated based on flow/water quality and groundwater level/water quality relationships. Others were estimated based on known effects of construction activities on water quality.

7.1.1.3 Standards of Significance

An impact would be judged to be potentially significant if it:

- reduces stream flow in any natural water body sufficiently to substantially impair designated beneficial uses or violate water quality objectives;
- reduces reservoir levels or storage sufficiently to substantially impair designated beneficial uses or violate water quality objectives;
- reduces the quality of an agency's SWP water supply or another agency's Delta water supply such that it is more difficult to treat to meet applicable federal or state drinking water standards for finished water or to maintain existing finished water quality, or
- reduces substantially the availability of water to water supply agencies other than the Department and the SWP contractors.

7.1.2 ENVIRONMENTAL SETTING

The environmental setting section is divided into four subsections. The first subsection describes the physical setting in 1995, the year before the Monterey Amendment was implemented. The second subsection describes the changes in the physical setting that occurred between 1996 and 2003. The third subsection describes the regulatory setting in 1995. The fourth subsection describes changes in the regulatory setting that occurred between 1996 and 2003.

7.1.2.1 Physical Setting in 1995

This section describes those water bodies that could potentially be affected by the proposed project. Flows and water quality in the Feather, Sacramento, American and San Joaquin rivers, the Sacramento-San Joaquin Delta and San Francisco Bay could be affected by the proposed project. Water levels and water quality in Lake Davis, Lake Oroville, San Luis Reservoir, Castaic Lake, and Lake Perris could be affected by the proposed project. Water quality in Plumas and Kern County streams could be affected by proposed project-induced construction activities in those counties.

The primary elements of the proposed project do not involve the discharge of pollutants into water bodies and hence have a limited potential to affect water quality. Some elements of the proposed project would result in the construction of new facilities, for example, percolation basins in Kern County and watershed restoration projects in Plumas County. These projects could result in some discharge of pollutants, primarily suspended solids, to surface water bodies during the construction period. Standard construction mitigation measures usually make the impacts on surface water quality negligible.

Proposed project-related changes in water quality stem mainly from changes in flow in streams and changes in water levels in reservoirs. Accordingly, the water quality data presented in this chapter is limited to those water quality characteristics that could be altered by the proposed project or that are needed to provide a general understanding of potentially affected water bodies.

Surface Waters

The following section contains descriptions of surface waters that may have been affected by the proposed project between 1996 and 2003 and could be affected by it in the future.

Feather River, Lake Davis and Lake Oroville

The Feather River in north-central California is the largest tributary of the Sacramento River below Shasta Dam. It drains an area of about 6,000 square miles. Three small reservoirs in Plumas County, Lake Davis, Frenchman Lake and Antelope Lake, are located on Feather River tributaries and are the northernmost SWP facilities. These reservoirs are used primarily for recreation but they also provide water supply to local agencies. Plumas County FC&WCD, a SWP contractor, obtains its water supplies from Lake Davis. Lake Davis is located about six miles northwest of the city of Portola. It has a maximum capacity of 84,400 AF, a surface area of approximately 6.25 square miles, and a 32-mile long shoreline at capacity.[1]

Flow in the lower Feather River is controlled mainly by releases from the SWP's Lake Oroville, the second largest reservoir in the Sacramento River watershed. Oroville Dam, which impounds Lake Oroville, was completed in 1968. Lake Oroville has a maximum capacity of 3,537,600 AF, a surface area of about 25 square miles, and a 167-mile long shoreline at capacity.[2]

Discharge in the lower Feather River at Nicolaus between 1956 and 1982 averaged 8,428 cubic feet per second (cfs) (6.1 million AFY).[3] Nicolaus is about ten miles upstream of the Feather River's confluence with the Sacramento River.

Mean monthly stream flows at Nicolaus for the period 1956 through 1982 are shown in Table 7.1-2. Stream flow is at its seasonal maximum in the winter and early spring and at its minimum in the summer and fall. The largest mean monthly flow of 15,957 cfs occurred in February. The smallest mean monthly flow of 3,220 cfs occurred in July. Lake Oroville reduces winter and early spring flows in the lower Feather River below estimated unimpaired flows, and increases its late spring, summer and fall flows above estimated unimpaired flows. Unimpaired flow is the flow that would occur in a stream with current land use in the watershed and the current stream channel configuration if there were no reservoirs or diversions.

Lake Oroville and Lake Davis impound high quality water that originates as runoff and snowmelt from primarily rural watersheds. Water quality characteristics for Lake Oroville are shown in Table 7.1-3. Water quality in the lower Feather River is also good. Water quality data for the Feather River at Nicolaus are shown in Table 7.1-4. Dissolved oxygen content is generally high and total organic carbon and electrical conductivity levels are low.

Sacramento River

The Sacramento River is the largest river in California. It drains a basin with an area of about 27,000 square miles and discharges to the Sacramento-San Joaquin Delta. Lake Shasta, a part

TABLE 7.1-2

MEAN MONTHLY STREAM FLOWS AT SELECTED LOCATIONS ON WATERWAYS POTENTIALLY AFFECTED BY PROPOSED PROJECT (CUBIC FEET PER SECOND)

Location	Feather River at Nicolaus[a]	Sacramento River at Knights Landing	Sacramento River at Freeport	American River at Fair Oaks	San Joaquin River at Vernalis	Delta Freshwater Outflow[d]
Period	1/1956-12/1982[b]	1/1956-12/1980[c]	1/1956-12/1995	1/1956-12/1995	1/1956-12/1995	1/1956-12/1995
January	15,453	16,280	33,331	5,006	5,451	52,371
February	15,957	18,920	38,718	5,227	6,400	60,899
March	12,887	16,358	37,028	5,200	7,017	54,812
April	13,328	12,147	28,552	4,224	6,892	37,371
May	9,167	10,412	22,999	4,158	6,444	25,563
June	5,255	8,175	17,329	3,727	5,046	15,398
July	3,220	7,907	15,102	3,692	2,472	7,984
August	3,414	8,330	14,884	2,787	1,560	6,568
September	3,700	8,918	15,409	2,270	2,047	10,337
October	4,032	7,939	13,005	1,918	2,605	10,957
November	5,097	9,796	16,750	2,445	2,458	17,028
December	9,634	13,106	25,318	3,502	3,381	30,905

Notes:
a. Data for all sites except Delta Outflow downloaded from USGS (http://waterdata.usgs.gov/nwis/sw).
b. Feather River at Nicolaus gage (11425000) removed from service in Sep. 1983.
c. Sacramento River at Knights Landing gage (11391000) removed from service in Mar. 1981.
d. Delta freshwater outflow calculated from Dayflow data downloaded from Interagency Ecological Program (http://www.iep.ca.gov/dayflow/output/index.html).
Source: US Geological Survey and California Department of Water Resources.

TABLE 7.1-3

WATER QUALITY CHARACTERISTICS – STATE WATER PROJECT RESERVOIRS POTENTIALLY AFFECTED BY PROPOSED PROJECT

Characteristic		Lake Oroville	San Luis Reservoir	Castaic Lake	Lake Perris
pH (standard units)	Mean	-	7.7	8.3	8.2
	Range	6.8 – 7.4	7.2 – 8.6	7.4 – 9.1	7.4 – 8.9
Turbidity (NTU)	Mean	-	3	2	1
	Range	0.58 – 25	1 – 12	<1 – 3	<1 – 8
Total Organic Carbon (mg/L)	Mean		2.7	4.0	-
	Range		2.0 – 4.1	2.5 – 7.7	3.0 – 1.8
Total Dissolved Solids (mg/L)	Mean		248	285	310
	Range		194 – 295	223 – 381	260 – 775
Electrical Conductivity (μS/cm)	Mean	-	448	535	591
	Range	31 – 85	363 – 501	479 – 627	483 – 712
Chloride (mg/L)	Mean		-	46	89
	Range		-	41 – 54	65 – 121
Dissolved Oxygen (mg/L)	Mean	-	-	-	-
	Range	7.8 – 12	-	-	-

Notes:
Sampling periods vary. Lake Perris and Castaic Lake, February 1996 through January 2007; Lake Oroville, January 1992 through May 1997; San Luis Reservoir, January 1996 through December 1999.
Source: California Department of Water Resources and US Bureau of Reclamation, Draft Environmental Water Account EIR/EIS, 2003.

TABLE 7.1-4

WATER QUALITY CHARACTERISTICS – RIVERS AND STREAMS POTENTIALLY AFFECTED BY PROPOSED PROJECT

Characteristic		Sacramento River at Red Bluff	Sacramento River at Freeport	Feather River near Nicolaus	Lower American River	San Joaquin River near Vernalis
pH (standard units)	Mean	7.8	7.7	7.7	7.4	8.2
	Range	7.4 – 8.1	7.0 – 8.1	7.4 – 8.4	7.0 – 7.7	7.0 – 9.0
Turbidity (NTU)	Mean	39	54	36.5	13.9	77
	Range	3 – 355	12 – 368	8 – 123	2 – 116	45 – 180
Total Organic Carbon (mg/L)	Mean	1.55	1.7	1.7	1.7	10.1
	Range	0.9 – 3.2	0.3 – 3.7	1.2 – 3.2	1.1 – 6.4	7.0 – 17
Dissolved Oxygen (mg/L)	Mean	10.7	9.7	10.1	-	9.6
	Range	8.2 – 12.1	6.5 – 12.2	9.0 – 15.7	8.2 – 12.8	7.3 – 12.9
Electrical Conductivity	Mean	117	124	85	-	320
(µS/cm)	Range	104 – 145	51 – 166	56 – 122	-	-

Source: California Department of Water Resources and US Bureau of Reclamation, Draft Water Account EIR/EIS, 2003.

of the CVP, is the largest reservoir in the Sacramento River basin. Located just north of the city of Redding, it is impounded by Shasta Dam, which was completed in 1946. Lake Shasta, Lake Oroville and reservoirs on other Sacramento River tributaries are used to regulate flows. Flow in the Sacramento River at Knight's Landing between 1956 and 1980 averaged 11,524 cfs (8.1 million AFY).[4] Knight's Landing is located upstream of the Sacramento River's confluence with the Feather River. Flow in the Sacramento River at Freeport between 1956 and 1995 averaged 23,202 cfs (16.8 million AFY).[5] Freeport is located about eight miles south of Sacramento.

Mean monthly stream flows at Knight's Landing and Freeport are shown in Table 7.1-2. Sacramento River discharge is typically at its seasonal minimum in the fall and early winter. Discharge increases as the rainy season begins and usually reaches its seasonal maximum in the late winter or early spring. The largest mean monthly flow of 38,718 cfs at Freeport occurred in February. The smallest mean monthly flow of 13,005 cfs at that location occurred in October. The river's many upstream reservoirs reduce its late winter and early spring flows below estimated unimpaired flows and increase its late spring, summer and fall flows above estimated unimpaired flows.

Water quality data for the Sacramento River at Bend Bridge, near Red Bluff, and at Freeport are shown in Table 7.1-4. Dissolved oxygen content is generally high, close to saturation, and total organic carbon and electrical conductivity levels are low at both locations. There is a deterioration in water quality in a downstream direction primarily as a result of runoff and irrigation return flows from agricultural lands and runoff and wastewater treatment plant discharges from urban and suburban areas.

American River

The American River drains a basin with an area of about 2,000 square miles and discharges to the Sacramento River at Sacramento. Flow in the river is controlled by releases from Folsom Lake, a part of the CVP. Flow in the American River at the Fair Oaks gauge between 1956 and 1995 averaged 3,679 cfs (2.7 million AFY).[6] The Fair Oaks gauge is about 22 miles upstream of the confluence of the American River with the Sacramento River. Mean monthly stream flows at Fair Oaks are shown in Table 7.1-2. The highest flows occurred in January though March and the lowest in September through November. The largest mean monthly flow of 5,227 cfs occurred in February. The smallest mean monthly flow of 1,918 cfs occurred in October.

Water quality data for the lower American River are shown in Table 7.1-4. Dissolved oxygen content is generally high, close to saturation, and total organic carbon and electrical conductivity levels are low.

San Joaquin River

The San Joaquin River drains a basin with an area of about 13,500 square miles and discharges to the Sacramento-San Joaquin Delta. Flow in the river is controlled by releases from Millerton Lake on the main stem of the river and from New Don Pedro, New Melones, and other reservoirs on the San Joaquin's tributaries. Millerton Lake is impounded by Friant Dam which was completed in 1942. Flow in the San Joaquin River at Vernalis between 1956 and 1995 averaged 4,314 cfs (3.1 million AFY).[7] Mean monthly stream flows at Vernalis are shown in Table 7.1-2. The highest flows occur in February though May and the lowest in August and September. The largest mean monthly flow of 7,017 cfs occurred in March. The smallest mean monthly flow of 1,560 cfs occurred in August. There are no minimum flow requirements below Friant Dam and the San Joaquin River is essentially dry between Gravelly Ford and the Mendota Pool, except when flood releases are being made.

Water quality data for the San Joaquin River at Vernalis are shown in Table 7.1-4. Total dissolved solids and total organic carbon content are high for natural waters and considerably higher than for water entering the Delta from the Sacramento River. The primary causes of degraded water quality in the San Joaquin River are flow depletion as a result of upstream diversions on the mainstem of the river and its tributaries, the unsolved agricultural drainage problems in the San Joaquin Valley and municipal wastewater discharges. Water pumped from the Delta and exported to the San Joaquin Valley for crop irrigation contains dissolved mineral salts. Most of the water applied to crops is used by the crops or evaporates, but almost all of the salts remain in the valley. They either accumulate in the soil and groundwater or are discharged to the San Joaquin River in agricultural drainage or return water. Because the San Joaquin River discharges to the Delta some of the salts return to the vicinity of the pumps, are exported back to the valley and return again to the San Joaquin River. Until a solution is found to the San Joaquin Valley's agricultural drainage problem, salt will continue to recycle in the valley with adverse consequences for San Joaquin River water quality.

Sacramento-San Joaquin Delta

The Sacramento-San Joaquin Delta, shown in Figure 7.1-1, is a 600 square mile area of channels and islands at the confluence of the Sacramento and San Joaquin rivers. Freshwater, draining from a 41,300 square-mile watershed, enters the Delta from the Sacramento and San Joaquin rivers and several smaller streams.

About 21 million AF of water reach the Delta annually, but actual inflow varies widely from year to year and within the year. In 1977, a year of extraordinary drought, Delta inflow totaled 5.9 million AF. In 1983, an exceptionally wet year, Delta inflow was about 70 million AF. On a seasonal basis, average monthly flow into the Delta varies by more than a factor of 10 between the highest month in the winter or spring and the lowest month in the fall.[8] The Sacramento River contributes an average of 77 percent of the inflow to the Delta, the San Joaquin River contributes about 15 percent of the inflow, and Mokelumne, Consumnes, and Calaveras rivers contribute the remainder.[9]

Source: Department of Water Resources, October 2004.

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FIGURE **7.1-1**

Sacramento-San Joaquin Delta

Most of the Delta islands are used to grow crops. Delta farmers divert water directly from the Delta channels to irrigate their land. A portion of the diverted water is returned to the Delta channels as agricultural drainage or return water. The average annual net diversion of water for irrigation within the Delta is estimated to be 960,000 AF.[10]

California's two largest water systems, the CVP and SWP, also divert water from the Delta. The CVP diverts water from Old River in the south Delta at the Tracy Pumping Plant and delivers it to CVP contractors via the Delta-Mendota Canal. CVP diversions at the Tracy Pumping Plant average about 1.7 million AFY. In addition, Contra Costa WD, a CVP contractor, diverts its water from Old River and Rock Slough in the south Delta and Mallard Slough in the west Delta. On average, Contra Costa WD diverts 190,000 AFY from the Delta.[11]

The SWP diverts water from Old River at the Banks Pumping Plant and delivers it to SWP contractors via the California Aqueduct and the South Bay Aqueduct. The SWP diverts smaller amounts of water from Barker Slough in the north Delta to serve two SWP contractors, Napa County FC&WCD and Solano County WA. Between 1980 and 1994, the SWP diverted an average of about two million AFY from the Delta.

The Delta is a tidal region. Every 12.4 hours, the tides cause water to move in and out of the Delta. Most of the time, tides cause a five- to eight-mile back and forth movement of water in the western part of the Delta. The average tidal flow into the Delta on the flood tide and out of the Delta on the ebb tide is about 170,000 cfs.[12] The movement of freshwater through the Delta is superimposed on the tidal flows. Typical freshwater flows are much smaller than tidal flows. The average Delta freshwater outflow for the period 1956 to 1995 was only about 27,500 cfs.[13] Thus, total flow into the Delta from Suisun Bay on the flood tide was 142,500 cfs when Delta outflow was at its average value. Similarly, net flow out of the Delta to Suisun Bay on the ebb tide was 197,500 cfs when Delta outflow was at its average value.

Delta freshwater outflow, commonly referred to simply as Delta outflow, is roughly equal to Delta inflow less diversions for export and net in-Delta water diversions. Like Delta inflow, Delta outflow varies widely from month to month and from year to year. Between 1956 and 1995, Delta outflow averaged 19.9 million AF. The greatest annual Delta outflow in the period was 35.7 million AF in 1983. The smallest Delta outflow in the period was 2.6 million AF in 1977.[14] Average monthly Delta outflow for the same period is shown in Table 7.1-2. The greatest Delta outflow typically occurs in January, February and March, when surface runoff is high and demand for irrigation water is low. The smallest Delta outflow typically occurs in the period July through October. The largest mean monthly Delta outflow of 60,899 cfs occurred in February. The smallest mean monthly Delta outflow of 6,568 cfs occurred in August.

In general, the SWP and CVP pump as much water as they can from the Delta. Their ability to pump water is limited by three factors, the capacity of their facilities (pumping plants, aqueducts and storage reservoirs), the need to maintain compliance with environmental standards, and the availability of water. In the winter and spring, fisheries-related environmental standards usually limit pumping. In summer and early fall, water quality-related environmental standards usually limit pumping. Typically, the CVP and SWP can pump larger amounts of water from the Delta in high flow winter and spring months than they can in low flow summer and fall months.

The proportion of Delta inflow that is diverted by the CVP and SWP varies from year to year. Before 1960, no more than 10 percent of annual Delta inflow was diverted from the Delta. The proportion of annual Delta inflow that was diverted increased in the 1960s, 1970s, and 1980s as SWP operations began and SWP contractors' water demands increased. The maximum proportions of annual Delta inflow diverted in the 1960s, 1970s and 1980s were 16 percent, 39 percent and 51 percent, respectively. Proportional diversions of annual Delta inflow reached a maximum value of 54 percent in the drought year of 1990.[15] The flow objectives contained in the 1995 Bay-Delta Water Quality Control Plan (WQCP) limit diversion by the SWP and CVP to 35 percent of total Delta inflow between February and June and to 65 percent of total Delta inflow between July and January.[16]

Diversion of water by the SWP, CVP and others in the south Delta, and upstream depletion of San Joaquin River flows, affects the pattern of flow in the Delta channels. Historically, net flow in the Delta channels was toward Suisun Bay. Now, because freshwater inflow to the south Delta from the San Joaquin River is small compared to the diversions at the Banks and Tracy Pumping Plants, net flow in many south Delta channels reverses during summer and fall. Flow in the lower San Joaquin River and the south Delta channels is directed upstream toward the pumping plants rather than downstream toward Suisun Bay.[17]

Water quality in the Delta is governed by the Delta's complex hydrodynamics. Freshwater enters the Delta from its tributary rivers. Saline water enters the Delta from Suisun Bay, the northern reach of the San Francisco Bay estuary, with the tides. When freshwater flow through the Delta is great, saline water is repelled and the waters of the Delta exhibit little salinity. When freshwater flow is small, tidal flow enables saline water to penetrate into the Delta. Under these circumstances, water quality in some parts of the Delta becomes brackish and unsuitable or less suitable for use as a source of potable and irrigation water.

The development of the water resources of the Sacramento and San Joaquin River watersheds has altered the magnitude and timing of Delta inflow, which in turn affects water quality in the Delta. Construction of reservoirs on rivers tributary to the Delta has led to the capture of winter and spring runoff. Some of the runoff is diverted for municipal and agricultural purposes and never reaches the Delta. The rest of the runoff is released from reservoirs for electric power generation and diversion within the Delta. Diversion and storage of water reduces peak wintertime Delta inflow and increases Delta inflow in the summer and early fall compared to conditions in the 1920s and 1930s. As a result, Delta waters can be less saline in the summer months than they were before construction of the reservoirs.

The reversal of flow in the lower San Joaquin River and many south Delta channels as a result of water diversions by the SWP and CVP also affects water quality. Flow reversal has both beneficial and adverse effects on water quality in the South Delta. Flow reversal causes high quality Sacramento River water to penetrate into the South Delta and dilute lower quality water from the San Joaquin River but it also enables saline water from Suisun Bay to move upriver. Flow reversal also slows the movement of San Joaquin River water toward Suisun Bay, which can reduce the dissolved oxygen content of river water during the warmer summer months. Dissolved oxygen levels in this reach of the river are already low in the summer months as a result of higher water temperature and the oxygen-depleting effects of municipal, industrial and agricultural wastewater discharges.

Water quality in the Delta has also been affected by land use changes in the watersheds of rivers tributary to the Delta. Use of the land for agricultural and urban purposes has increased the discharge of water pollutants to rivers upstream of the Delta. Discharges and runoff from agricultural and urban areas contain dissolved minerals and organic compounds, suspended solids, plant nutrients and low concentrations of toxic substances, including metals and pesticides. Although all municipal wastewaters are treated before discharge some metals and synthetic organic compounds are not removed in conventional wastewater treatment plants.

Table 7.1-5 shows water quality characteristics at selected locations in the Delta. In general, water quality in the Delta declines in a southerly and westerly direction. This is illustrated by the pattern of chloride concentrations. The chloride content of Sacramento River water, entering the Delta from the north, is low. Chloride, a constituent of seawater, enters the Delta from the west. Chloride concentration at the Banks Pumping Plant is higher than in the Sacramento River because low-chloride Sacramento River water has mixed with saline water entering from Suisun Bay.

TABLE 7.1-5

WATER QUALITY CHARACTERISTICS AT SELECTED STATIONS WITHIN THE DELTA

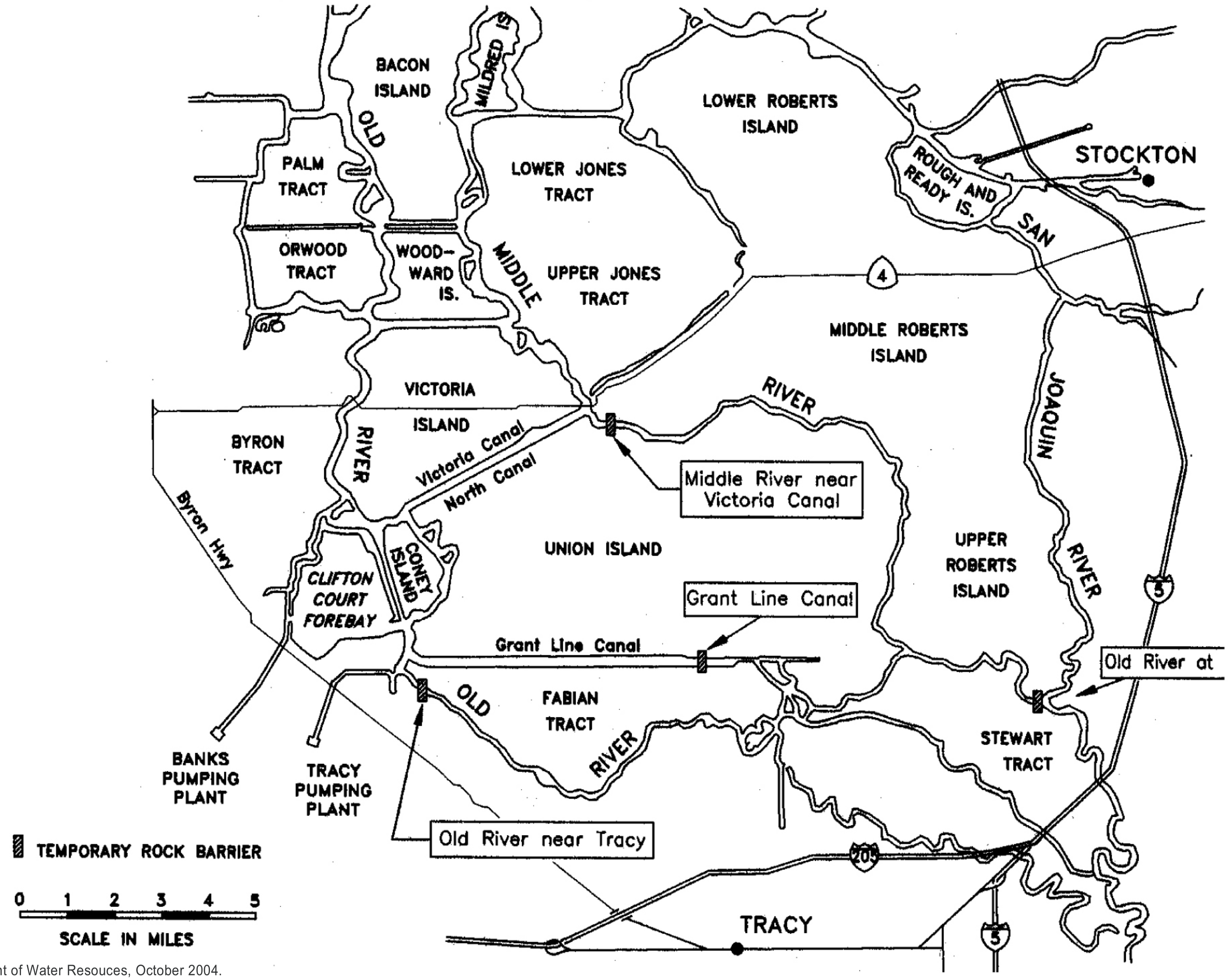
Location	Sacramento River at Green's Landing	North Bay Aqueduct at Barker Slough	Banks Pumping Plant	Contra Costa Intake at Rock Slough	San Joaquin River at Vernalis
Mean TDS (mg/L)	100	192	258	305	459
Mean Electrical Conductivity (µS/cm)	160	332	482	553	749
Mean Bromide, Dissolved (mg/L)	0.018	0.015	0.269	0.455	0.313
Mean DOC (mg/L)	2.5	5.3	3.7	3.4	3.9
Mean Chloride, Dissolved (mg/L)	6.8	26	81	109	102

Notes:
mg/L = milligram per liter.
µS/cm = microsiemen per centimeter.
Sampling period varies, depending on location and constituent, but generally is between 1990 and 1998.
Source: CALFED 2000a.

Water quality constituents in Delta waters that are of greatest concern to municipal water supply agencies are total dissolved solids (salinity), bromide and total organic carbon content. Elevated salinity levels in municipal water supplies may make it unpalatable to users, injurious to piping and plumbing fixtures and unsuitable for groundwater recharge and some industrial purposes. It may also prevent or make wastewater reclamation and reuse more difficult. Farmers are also concerned about salinity because elevated salinity levels may make water unsuitable for irrigating certain salt-sensitive crops and may accelerate the build up of salts in soil.

Organic carbon compounds are present in water in the form of microscopic plants and animals and the products of bacterial degradation of plant and animal material. Total organic carbon levels rise in the Delta in the winter and spring primarily as a result of surface runoff. Organic carbon reacts with agents used to disinfect drinking water to form a group of chemicals called disinfection byproducts. Disinfection byproducts are known to cause cancer and are regulated under the Safe Drinking Water Act (SDWA). Bromide also reacts with organic matter and disinfection agents to form disinfection byproducts. Saline water from San Francisco Bay is the main source of bromide in the Delta.

Since 1990, the Department has installed temporary barriers in the Grant Line Canal, Middle River and Old River to improve water quality and conditions for migrating salmon. The Department installs the barriers in the spring and removes them in the fall. The Department is planning to replace the temporary barriers with permanent gates. The locations of the temporary barriers are shown in Figure 7.1-2. The temporary barriers on the Grant Line Canal, Middle River near the Victoria Canal and Old River near Tracy maintain water levels for irrigation in the south Delta channels. The barrier on Old River at Stewart Tract improves the



Source: Department of Water Resouces, October 2004.

FIGURE **7.1-2**
South Delta Temporary Barriers Locations

dissolved oxygen content of San Joaquin River waters and conditions for downstream migrating juvenile Chinook salmon (smolts) in the spring and upstream migrating adults in the fall.[18]

San Francisco Bay Estuary

The Delta discharges to Suisun Bay. From Suisun Bay, water flows through Carquinez Strait into San Pablo Bay, south into San Francisco Bay and through the Golden Gate to the Pacific Ocean.

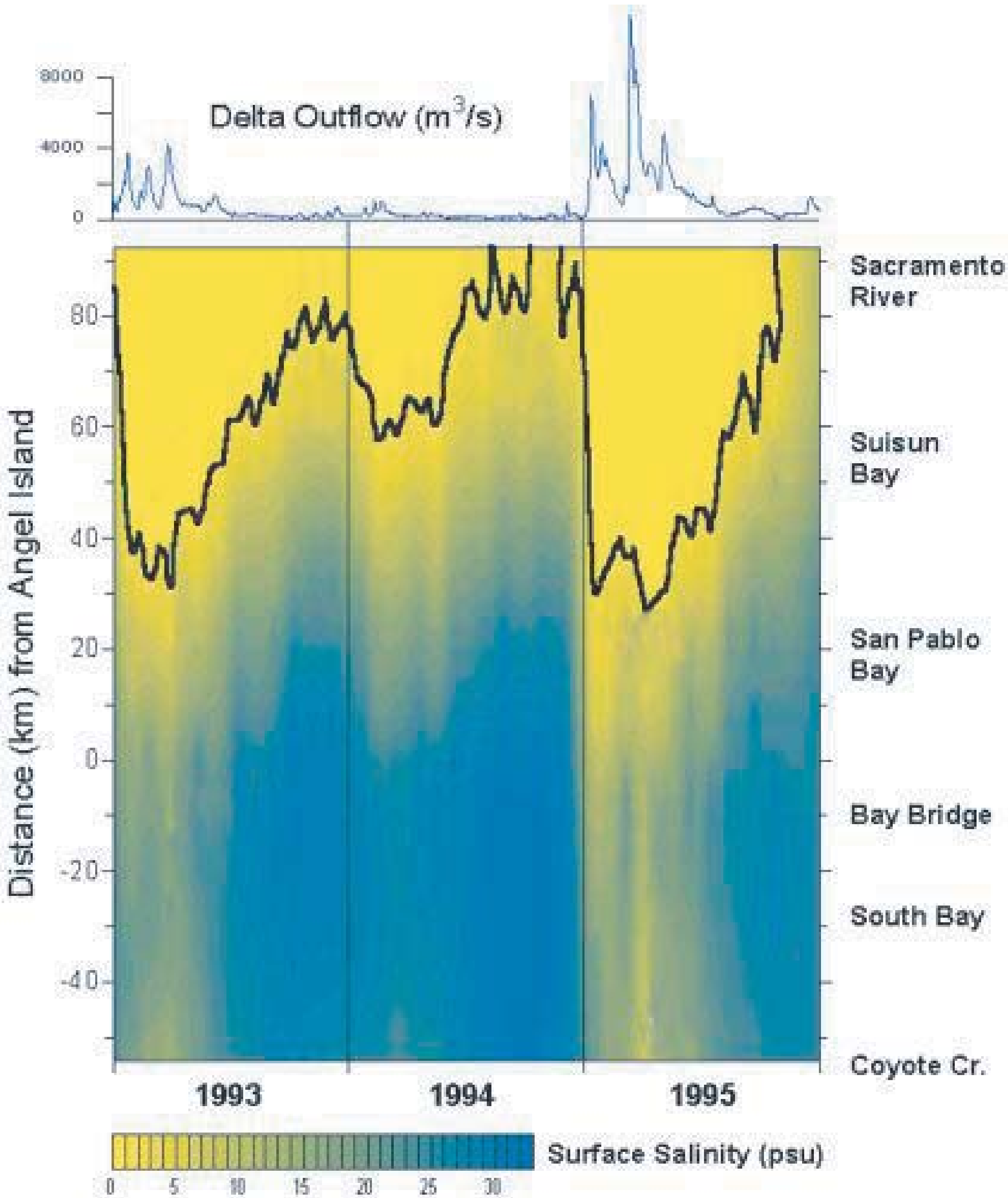
Construction of reservoirs and diversion of water for agricultural and municipal use in the Sacramento and San Joaquin watersheds and land use changes in the Central Valley have altered the volume and timing of freshwater flow into the San Francisco Bay Estuary. It has been estimated that upstream diversion has reduced Delta inflow by about nine million AFY. Additional water is diverted in the Delta for use there and for export. Diversion for export has increased gradually from less than 10 percent of Delta inflow in the 1950s to as high as 54 percent in the drought year of 1990.[19]

Although there is disagreement among experts on the extent of the historical changes in freshwater flow into the San Francisco Bay Estuary, the prevalent view among water planners and the scientific community is that because diversions have increased over the last 80 years, the volume of Delta outflow has decreased. Some scientists have put forward the view that the average annual volume of freshwater flowing to the San Francisco Bay Estuary has remained fairly constant since the 1920s because hydrologic and land use changes that have occurred have offset the increased diversions. Increasing diversion of water from rivers in the Central Valley and the Delta for agricultural and municipal purposes has decreased Delta outflow. But the draining of the extensive historical Central Valley wetlands and the confinement of rivers in channels probably has increased surface runoff, as has an apparent increase in precipitation. Although there is disagreement over whether the increases and decreases offset each other there is agreement that the timing of freshwater flow to the estuary has changed.[20]

Freshwater inflow is the primary determinant of water quality in the San Francisco Bay Estuary. Without freshwater flow into the San Francisco Bay Estuary its waters would be saline and similar in quality to the near-shore Pacific Ocean. The primary source of freshwater flow into the bay is outflow from the Delta, but local runoff and municipal wastewater treatment plants also contribute low-salinity water.

The U.S. Geological Survey (USGS) has studied the effects of different Delta freshwater outflow rates on salinity in the San Francisco Bay Estuary. Figure 7.1-3 shows salinity along a transect drawn through the San Francisco Bay Estuary from the Sacramento River in the north to Coyote Creek in the south for 1993, 1994 and 1995.[21] Salinity varies from about 100 mg/L at the Sacramento River to 33,000 mg/L in central and southern portions of San Francisco Bay. The thick solid line shows the changing location of the 2,000 mg/L surface isohaline. An isohaline is a line drawn on a map connecting places with an equal water salinity. The location of the 2,000 mg/L-isohaline, often referred to as "X2", has been shown to be important for some fish species (see Section 7.3 for a complete discussion of this topic).

In the spring of 1993, when Delta outflow was high, X2 was located at the western end of Suisun Bay in Carquinez Strait. As Delta outflow declined in the summer and fall, X2 moved upstream into the Delta. Because 1994 was a dry year, X2 remained in the Delta for most of the year. In the spring of 1995, a wet year, X2 was pushed out of the Delta and into eastern San Pablo Bay.



Source: http://sfbay.wr.usgs.gov/access/wqdata/yearsdata/charts/sal9395nojava.html.

PBS&J

FIGURE **7.1-3**

Salinity in San Francisco Bay

While water quality in the northern portion of the San Francisco Bay estuary, north of the San Francisco-Oakland Bay Bridge, is clearly and strongly influenced by Delta outflow the effect of Delta outflow on water quality in the estuary south of the Bay Bridge is more muted. Incursions of low-salinity water into the bay south of the Bay Bridge are relatively rare and it is difficult to distinguish the effect of large Delta outflows from those of local runoff because they often occur simultaneously. However, modeling by the USGS has shown that Delta outflow is the most important influence on salinity in the estuary as far south as the San Mateo Bridge.[22]

California Aqueduct and San Luis Reservoir

Water is pumped into the California Aqueduct at the Banks Pumping Plant in the south Delta. Water quality in the aqueduct reflects that of the Delta and varies seasonally. The mean total dissolved solids content of samples taken at the Banks Pumping Plant between 1996 and 1999 was 195 mg/L. The maximum and minimum values recorded in that period were 388 mg/L and 116 mg/L, respectively. The lowest values occur between January and July and the highest between August and December.[23]

San Luis Reservoir is the SWP's primary water storage facility south of the Delta. The Department and the U.S. Bureau of Reclamation (Reclamation) share storage capacity in the reservoir roughly equally. Water from the Delta is delivered to San Luis Reservoir via the California Aqueduct and the Delta-Mendota Canal. A negligible amount of runoff is captured in San Luis Reservoir and so water quality in the reservoir reflects that of the Delta.

Water quality data for San Luis Reservoir are shown in Table 7.1-3. Water quality in the reservoir reflects the quality of Delta waters at the time it is diverted from the Delta and conveyed to the reservoir. Total dissolved solids and total organic carbon concentrations are considerably higher in San Luis Reservoir than in Lake Oroville. Currently, water quality problems constrain the usability of San Luis Reservoir when the reservoir storage is less than 300,000 AF of water. In late summer, when water levels in San Luis Reservoir drop below about 369 feet above sea level, which corresponds with storage of 300,000 AF of water, excessive growth of algae degrades water quality. Algae can be drawn into the intake for the San Felipe Division of the CVP, which serves Santa Clara Valley WD and several smaller CVP contractors.[24] Algae in raw water makes it difficult for municipal water supply agencies to treat water and avoid taste and odor problems. Irrigation districts may be adversely affected because algae can block the emitters in drip irrigation systems. The quality problems that occur when storage in San Luis Reservoir is less than 300,000 AF of water do not affect the SWP or its contractors, other than Santa Clara Valley WD.[25]

The Department and Reclamation cooperate to try to maintain the low point above 300,000 AF, but maintaining that level decreases operational flexibility and may not be possible as water demand increases and limitations on pumping from the Delta become more restrictive. The Department, Reclamation, and Santa Clara Valley WD are currently exploring alternatives that would allow the SWP and CVP to drawdown San Luis Reservoir without adversely affecting the San Felipe Division and its contractors.

Castaic Lake and Lake Perris

Castaic Lake and Lake Perris are located respectively at the termini of the West and East branches of the California Aqueduct. Castaic Lake was completed in 1972 and is located about 45 miles northwest of Los Angeles and about two miles north of the community of Castaic. The lake has a maximum capacity of 323,700 AF at a water surface elevation of 1,515 feet above sea level. It has a surface area of 3.5 square-miles and 29 miles of shoreline at capacity.[26] Water levels typically reach a high point in March and a low point in October. Table 7.1-6 shows historical average monthly water surface elevations for Castaic Lake for the period 1974 though 1995.

TABLE 7.1-6

AVERAGE MONTHLY SURFACE ELEVATIONS – CASTAIC LAKE AND LAKE PERRIS (FEET ABOVE MEAN SEA LEVEL)

Month	Castaic Lake		Lake Perris	
	1974-1994	1995-2003	1974-1994	1995-2003
January	1475.0	1487.7	1582.3	1583.1
February	1483.9	1487.5	1584.6	1582.5
March	1490.5	1493.7	1585.0	1583.8
April	1489.6	1503.3	1584.3	1584.3
May	1484.7	1505.9	1582.9	1584.6
June	1478.0	1506.7	1580.3	1585.0
July	1473.0	1503.7	1577.4	1585.0
August	1465.7	1500.7	1575.4	1585.0
September	1463.4	1499.2	1575.4	1584.4
October	1457.9	1495.5	1575.8	1584.4
November	1460.9	1492.9	1577.7	1584.3
December	1469.5	1495.4	1580.2	1583.6

Source: California Department of Water Resources.

Lake Perris is located adjacent to the City of Moreno Valley. It has a maximum capacity of 131,500 AF at a water surface elevation of 1,588 feet above sea level. It has a surface area of 3.6 square miles and a ten-mile long shoreline at capacity.[27] Water surface elevations typically reach a high point in March and a low point in August or September. Table 7.1-6 shows historical average monthly water surface elevations for Lake Perris for the period 1974 though 1995.

Castaic Lake and Lake Perris are filled with water from the California Aqueduct but the former also receives some runoff from its local watershed. Water quality data for the two reservoirs are shown in Table 7.1-3. Water quality in the two reservoirs primarily reflects the quality of Delta waters, but it is also influenced by local factors. Although most organic compounds are at concentrations below detection limits in both reservoirs, a few synthetic compounds such as methyl tertiary-butyl ether (MTBE) are detected occasionally in Castaic Lake probably as a result of local runoff. Water quality in Lake Perris deteriorates at times because it remains in storage for relatively long periods of time allowing degradation by evaporation and high recreational use.

Kern County Streams

The Kern River is the primary surface water feature in Kern County. It rises in the southern Sierra Nevada and flows westward into the San Joaquin Valley. The valley is arid, typically receiving five inches of rainfall over the valley floor and nine to thirteen inches in the foothills.[28] Because of low rainfall, permeable surface soils and little topographic relief, little surface runoff occurs on the valley floor and there is a limited network of natural surface drainage channels. The few natural streams are ephemeral. The most prominent surface water features are man-made irrigation canals.

Water Supplies

Water supply agencies, other than the Department and the SWP contractors, which could be affected by the proposed project, include the Feather River water rights contractors and CVP contractors.

Feather River Water Rights Contractors

The Feather River water rights contractors are agricultural water agencies with water rights to Feather River water that predate the Department's water rights. The Department negotiated settlement agreements with these water agencies to address the effects of constructing Oroville Dam upstream of their historical points of diversion from the Feather River. The Department provides releases from Oroville Dam to satisfy the terms of the settlement agreements.

Central Valley Project and its Contractors

The CVP is California's largest water project. The CVP is a system of reservoirs, power plants, pumping plants, and canals operated by Reclamation. On average, the CVP delivers 5.6 million acre feet of water for agricultural and municipal use, about twice as much as the SWP.

North of the Delta, the CVP operates reservoirs on the Trinity, Sacramento and American rivers. Water from the Trinity River, which flows to the Klamath River and to the Pacific Ocean near the California/Oregon border, is diverted into Shasta Lake, the largest CVP reservoir on the Sacramento River with a capacity of 4.5 million AF. Water from Shasta Lake and Folsom Lake on the American River is released to the Sacramento River and flows downstream to the Delta. Water is diverted from the south Delta at the CVP's Tracy Pumping Plant and conveyed southward to the CVP's contractors on the western side of the San Joaquin Valley via the Delta-Mendota Canal. The CVP's diversions at the Tracy Pumping Plant average about 1.7 million AFY. Smaller amounts of CVP water, an average of about 150,000 AF, are diverted at the SWP's Banks Pumping Plant and conveyed southward in the California Aqueduct to the O'Neill Forebay (see Chapter 6 for a discussion of shared use of Delta pumping plants by the SWP and CVP). From the O'Neill Forebay, water continues southward to CVP contractors or is pumped into San Luis Reservoir, a joint use facility of the CVP and SWP.

Reclamation supplies water to CVP contractors on the eastern side of the San Joaquin Valley from Millerton Reservoir on the San Joaquin River and several other reservoirs on tributaries of the San Joaquin. Contra Costa County Water District, a CVP contractor, diverts its CVP water directly from the Delta. It diverts an annual average of about 190,000 AF of water from the Delta.

7.1.2.2 Changes in Physical Setting between 1996 and 2003

No major storage facilities with the potential to alter flows in rivers or the Delta were added to the SWP between 1996 and 2003. Some improvements and additions were made to the SWP conveyance system including completion of the Coastal Branch of the California Aqueduct in 1997. Some SWP contractors made improvements to their water systems between 1996 and 2003 to take better advantage of their SWP supplies including the completion of Diamond Valley Reservoir, a pre-Monterey Amendment project of MWDSC. The improvements may have affected flow in rivers and Delta outflow.

No major storage facilities with the potential to alter flows in rivers or the Delta were added to the CVP between 1996 and 2003. Contra Costa WD, a CVP contractor, completed Los Vaqueros Reservoir and the Old River Intake and Pipeline in 1998. The reservoir has a capacity of 100,000 AF. It is filled with water from the Delta when water quality is good. Water from the reservoir is blended with water diverted directly from the Delta during dry periods when water quality deteriorates. The reservoir also serves as emergency storage.[29] The reservoir altered the timing of Contra Costa WD's diversions from the Delta, increasing diversions in wet periods and reducing them in dry periods.

Flows in the Delta and San Joaquin River between 1996 and 2003 were affected by a number of regulatory actions under existing laws, changes in regulations and the responses of water users to the regulatory actions and changes. The regulatory changes that affected flows are described in Section 7.1.2.4. They were also affected by growing water demand in the SWP service area and a consequent increase in water diversion by the SWP.

At certain times of the year, diversion of water from the Delta by the SWP and CVP could harm fish species listed as threatened and endangered under the federal Endangered Species Act. The federal agencies responsible for administering the act, U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), ordered pumping curtailments at times in May and June of 1996, 1997, 1999 and 2000 to reduce harm to the listed fish species. The effect was to increase Delta outflow at times in May and June when threatened and endangered species were present near the pumps.

Beginning in late 2000, the Environmental Water Account (EWA) became operational as a consequence of the CALFED Bay-Delta Program. The purpose of the EWA is to enable the diversion of water by the SWP and CVP from the Delta to be reduced at times when at-risk fish species may be harmed or killed while preventing the uncompensated loss of water to SWP and CVP contractors. The EWA then acquires water from willing sellers by transfers of water from reservoirs, surface water made available by groundwater substitution, or purchase of previously banked groundwater to repay the pumping curtailments. The EWA also obtains water by use of certain operational assets (including shared use of Banks Pumping Plant during the July to September period). The EWA can also acquire water by agreements with water agencies wherein farmers temporarily remove land from agricultural production but this technique has not yet been used. The replacement water is then delivered to the O'Neill Forebay of San Luis Reservoir to ensure that no SWP or CVP users suffer any reduced deliveries as a result of fisheries-related restrictions on Delta pumping by the SWP and CVP.

The operation of the EWA may have resulted in higher Delta outflow at times of the year when water that was acquired from agencies north of the Delta was released for diversion at the SWP and CVP pumps.[30] Because the characteristics of the Delta prevent efficient delivery of water from north of the Delta to the SWP and CVP pumps, extra water, referred to as carriage water, sometimes has to be released to maintain compliance with Delta water quality and flow standards. The amount of carriage water needed to transfer water across the Delta to the pumps depends on conditions in the Delta at the time of the transfer. It typically represents about 20 percent of the amount transferred; that is, to deliver 10,000 AF of water to the pumps, 12,500 AF must be released north of the Delta. The extra 2,500 AF is carriage water and contributes to Delta outflow.

Increases in Delta outflow occurred during fisheries-related pumping curtailments that occurred from December through June between 2000 and 2003. They also occurred between July and

October when water acquired for the EWA was transferred across the Delta. The primary increases in Delta outflow occurred during the pumping curtailments.

Plumas County streams could be affected by the Settlement Agreement, which was executed in 2003. Almost all streams in Plumas County drain to the Feather River. Although the North, Middle and South Forks of the Feather River have been developed for hydropower and water supply, most of the smaller streams in the county are undeveloped. Any stream in Plumas County could potentially be affected by the watershed restoration elements of the Settlement Agreement. Restoration projects are planned for Jordan, Last Chance and Hosselkus Creeks, all of which are tributary to the North Fork Feather River.

7.1.2.3 Regulatory Setting in 1995

Many federal and state laws and regulations have been promulgated to protect California's lakes, rivers, groundwater aquifers, estuaries and coastal waters. The most relevant to the Monterey Plus EIR are summarized briefly below.

Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became known as the Clean Water Act (CWA). The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S. It gave the U.S Environmental Protection Agency (EPA) the authority to set ambient water quality standards for surface waters and set standards for municipal and industrial wastewater discharges. The CWA made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained.

Section 303(d) of the CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The list includes waters that do not meet water quality standards for the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water segments on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality. Many water bodies in the Monterey Plus EIR area of analysis are listed as water quality limited (impaired) for one or more of the constituents of concern. The lists of impaired water bodies are prepared every two years.

Safe Drinking Water Act

The federal Safe Drinking Water Act (SDWA), enacted in 1974, and significantly amended in 1986, was established to protect the public health and quality of drinking water in the United States. The law addresses all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA directed the EPA to set national standards for drinking water quality. It required the EPA to set maximum contaminant levels (MCLs) for a wide variety of potential drinking water pollutants. The owners or operators of public water systems are required to comply with primary (health-related) MCLs and encouraged to comply with secondary (nuisance- or aesthetics-related) MCLs. The 1986 amendments to the SDWA directed the EPA to expand its list of MCLs.

SDWA drinking water standards apply to treated water as it is served to consumers. All surface waters require some form of treatment in order to meet drinking water standards. The degree of treatment needed depends on the quality of the raw water. The highest quality raw surface waters need only to be disinfected before being served to consumers. More typically, raw water is treated in a conventional water treatment plant that includes sedimentation, filtration and disinfection processes. Although it is technically possible to treat virtually any raw water so that it will meet drinking water standards, it is usually not practical to do so. Municipal water suppliers prefer raw water sources of high quality because their use minimizes risk to public health and the cost and complexity of treatment needed to meet SDWA drinking water standards.

Almost all SWP water is diverted from the Delta. Some constituents of Delta water are of particular concern to municipal contractors because they are either not removed or only partially removed by commonly used water treatment processes. They include total dissolved solids, chlorides, bromides, and organic compounds. These substances can be removed from raw water by advanced water treatment processes but to do so substantially increases the cost of water treatment.

Elevated total dissolved solids or chloride concentrations in drinking water can adversely affect its taste. Secondary MCLs for total dissolved solids and chloride are 500 mg/L and 250 mg/L respectively.[31] Bromide and total organic carbon concentrations are of concern because bromides and organic compounds react with disinfecting agents to form various chemical compounds that can harm human health at low concentrations. These compounds are referred to as disinfection byproducts and include trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform), haloacetic acids (mono-, di-, and trichloroacetic acid, mono- and dibromoacetic acid), chlorite and bromate. The primary MCLs for total trihalomethanes, total haloacetic acids, chlorite and bromate are 0.08, 0.06, 1 and 0.01 mg/L, respectively.[32] Elevated total organic carbon concentrations can also affect the taste and odor of treated water.

Porter-Cologne Act

Responding to public concern in California, state legislators enacted a law designed to curb water pollution several years before passage of the Federal Water Pollution Control Act Amendments. The Porter-Cologne Act of 1969 established regional water quality control boards and gave them defined responsibilities for water quality management.

The Porter-Cologne Act requires the regional water quality control boards to prepare regional WQCPs, often referred to as basin plans. The WQCPs must identify present and future beneficial uses of California's waters and establish water quality objectives that will protect those uses. California's beneficial use designations and water quality objectives are the functional equivalent of the federal ambient water quality standards. After passage of the Federal Water Pollution Control Act Amendments, California's water quality objectives served as federal water quality standards, upon review and approval by the EPA.

The State Water Resources Control Board (SWRCB) prepares and adopts the Bay-Delta WQCP. WQCPs for other parts of the state are adopted and amended by the regional water quality control boards but do not become effective until adopted by the SWRCB. All WQCPs are subject to CEQA review. Adoption or revision of surface water objective/standards is subject to the approval of the EPA. The regional WQCPs complement statewide WQCPs adopted by the SWRCB, such as the WQCP for Temperature Control and the WQCP for Ocean Waters.

Several WQCPs govern management of surface and ground waters that could be affected by the proposed project. The Central Valley WQCP covers the Sacramento and San Joaquin River basins, including an area bounded on the east by the crests of the Sierra Nevada and Cascade Range and on the west by the Coast Range and Klamath Mountains. The Tulare Lake WQCP covers the watershed in the southern San Joaquin Valley that drains to the Tulare Lake bed, including the Kings, Kaweah, Tule and Kern rivers. The San Francisco Bay/Delta WQCP covers those portions of Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano and Sonoma counties that drain to the San Francisco Bay estuary, including the Delta. The Los Angeles and Santa Ana River WQCPs cover coastal southern California.

Each WQCP identifies existing and potential beneficial uses of surface waters and establishes water quality objectives within its part of California. Existing and potential beneficial uses of surface waters that could be affected by the proposed project are shown in Table 7.1-7. Surface waters in the WQCP areas are in compliance with objectives except for those waters on the SWRCB's list of impaired water bodies, the CWA Section 303(d) list, and shown in Table 7.1-8.

Delta Standards

The San Francisco Bay/Sacramento-San Joaquin Delta Estuary is one of the most important aquatic ecosystems in the United States, providing habitat for hundreds of plant, animal and fish species. It also provides drinking water for two-thirds of California's people and irrigation water for over seven million acres of farmland.

The San Francisco Region WQCP, published in the early 1970s, designated beneficial uses and water quality objectives for both San Francisco Bay and the Delta. In 1978, a WQCP for the Sacramento-San Joaquin Delta and Suisun Marsh was published. In 1991, a WQCP for salinity in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary was published. When the Monterey Agreement was signed in December 1994, the beneficial uses and water quality objectives contained in the 1978 and 1991 WQCPs were in effect. In May 1995, prior to implementation of the Monterey Amendment, the SWRCB adopted a new WQCP for San Francisco Bay and the Delta that superseded both the 1978 and 1991 plans.[33]

<u>Water Quality and Flow Objectives</u>

The Bay/Delta WQCP contained beneficial use designations and new water quality and flow objectives for the Delta and the lower Sacramento and San Joaquin rivers. Existing and potential beneficial uses are shown in Table 7.1-7. Separate objectives were established for municipal and industrial water use, agricultural water use, and protection of fish and wildlife. Objectives for the Delta include both numerical objectives and narrative objectives. Numerical objectives specify that the concentration of a certain constituent must not exceed or be less than a certain numerical value. For example, chloride content of Delta waters at the Banks Pumping Plant must not exceed 250 mg/L year round and Delta outflow must not be less than a specified value in individual months of different hydrologic year types. Narrative objectives state a desired outcome, for example, protection of migratory fish. These objectives must be met at the locations shown in Figure 7.1-1.

TABLE 7.1-7

DESIGNATED EXISTING AND POTENTIAL BENEFICIAL USES FOR POTENTIALLY AFFECTED SURFACE WATERS

Beneficial Use Designation	Lake Davis	Lower Sacramento River	Lake Oroville	Lower Feather River	Sacramento – San Joaquin Delta	San Francisco Bay	Lower San Joaquin River	California Aqueduct	San Luis Reservoir	Castaic Lake	Lake Perris
Municipal and Domestic Supply		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Agricultural Supply		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stock Watering		✓					✓	✓	✓		
Industrial Process					✓	✓	✓	✓		✓	✓
Industrial Service Supply					✓	✓		✓	✓	✓	✓
Groundwater Recharge					✓	✓				✓	✓
Power Generation			✓				✓	✓	✓	✓	
Water Contact Recreation	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Non-contact Water Recreation	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Warm Freshwater Habitat	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Cold Freshwater Habitat	✓	✓	✓	✓	✓	✓				✓	✓
Fish Migration		✓		✓	✓	✓	✓				
Fish Spawning Habitat	✓	✓	✓	✓	✓	✓	✓			✓	
Navigation		✓			✓	✓					
Wildlife Habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Estuarine Habitat					✓	✓					
Preservation of Rare and Endangered Species					✓	✓				✓	
Shellfish Harvesting					✓	✓					
Commercial and Sport Fishing					✓	✓					

Sources: Lake Davis, Lower Sacramento River, Lake Oroville, Lower Feather River, Lower San Joaquin River, California Aqueduct and San Luis Reservoir; Water Quality Control Plan for Sacramento River and San Joaquin River Basins, September 1998.
Sacramento-San Joaquin Delta and San Francisco Bay; Water Quality Control Plan for San Francisco Bay/Sacramento-San Joaquin Delta Estuary, May 1995.
Lake Perris; Water Quality Control Plan for Santa Ana River Basin, January 1995.

TABLE 7.1-8

IMPAIRED SURFACE WATER BODIES

Location	Impairment
Delta waterways, eastern portion	Pesticides
Delta waterways, Stockton Ship Canal	Organic/Enrichment/Low dissolved oxygen, pesticides
Delta waterways, western portion	Electrical/conductivity, pesticides
Middle River	Low dissolved oxygen
Old River	Low dissolved oxygen
Salt Slough	Electrical/conductivity, pesticides, unknown toxicity
San Joaquin River	Electrical, conductivity, boron, pesticides, unknown toxicity
Feather River, Lake Oroville to Sacramento River	Pesticides
Sacramento River, Keswick Dam to Knights Landing	Unknown toxicity, pesticides
Sacramento River, Knights Landing to Delta	Pesticides, unknown toxicity
Suisun Bay, San Francisco Bay, San Pablo Bay	Pesticides
Source: www.waterbodies.ca.gov/tmdl/303_dlists.html, accessed September 18, 2005.	

Table 7.1-9 shows the numerical objectives for municipal and industrial beneficial uses. The numerical municipal and industrial objectives are expressed in terms of chloride content. Chloride is abundant in seawater, typically found at a concentration of about 19,000 mg/L. The chloride content of waters in the upper reaches of rivers is typically less than 10 mg/L. Chloride content is important to municipal and industrial water users because it provides a measure of

salinity or total dissolved solids content. Water with high chloride content also has high total dissolved solids content. Water with high total dissolved solids content is unpalatable as drinking water and can damage plumbing fixtures. It may also be unsuitable for some industrial purposes, groundwater recharge programs and wastewater reclamation and reuse programs. Removal of total dissolved solids from raw water is difficult and expensive.

The municipal and industrial objectives require that chloride content at all municipal water supply intakes not exceed 250 mg/L at any time. The objectives also specify the number of days each year that the chloride content must not exceed 150 mg/L at either of two municipal water supply intakes in the western Delta. The number of days each year that the 150 mg/L chloride standard in the western Delta must be met depends on the hydrologic year type; compliance is required for fewer days in dry years than in wet years.

Table 7.1-10 shows the numerical objectives for agricultural beneficial uses. The numerical agricultural objectives are expressed in terms of electrical conductivity. Electrical conductivity provides an indicator of salinity or total dissolved solids content. Salinity is important to farmers because irrigation water with a high total dissolved solids content is unsuitable for growing many crops and can lead to salt buildup in soils. The objectives require that the electrical conductivity of waters at various locations in the Delta not exceed certain values during certain periods of time. The objectives for electrical conductivity at western and interior Delta locations vary depending on hydrologic year type.

Table 7.1-11 shows the numerical objectives for fish and wildlife beneficial uses. The numerical fish and wildlife water quality objectives are expressed in terms of dissolved oxygen content, electrical conductivity, the location of X2, the 2,000 mg/L isohaline, and flows in the Delta and the Sacramento and San Joaquin rivers. The dissolved oxygen objective of 6.0 mg/L for September, October and November in the lower San Joaquin River between Stockton and Turner Cut was set to protect fall-run Chinook salmon. In addition, the Central Valley WQCP

TABLE 7.1-9

SACRAMENTO-SAN JOAQUIN DELTA -WATER QUALITY OBJECTIVES FOR MUNICIPAL AND INDUSTRIAL BENEFICIAL USES

Compliance Location	Interagency Station Number (RKI[1])	Parameter	Description (Unit)	Water Year Type[2]	Time Period	Value
Contra Costa Canal at Pumping Plant #1 -or- San Joaquin River at Antioch Water Works Intake	C-5 (CHCCC06) D-12 (near) (RSAN007)	Chloride (Cl)	Maximum mean daily 150 mg/l Cl for at least the number of days shown during the Calendar Year. Must be provided in intervals of not less than two weeks duration. (Percentage of Calendar Year shown in parenthesis)	W AN BN D C		No. of days each Calendar Year ≤150 mg/l Cl 240 (66%) 190 (52%) 175 (48%) 165 (45%) 155 (42%)
Contra Costa Canal at Pumping Plant #1 -and-	C-5 (CHCCC06)	Chloride (Cl)	Maximum mean daily (mg/l)	All	Oct-Sep	250
West Canal at mouth of Clifton Court Forebay -and-	C-9 (CHWSTO)					
Delta-Mendota Canal at Tracy Pumping Plant -and-	DMC-1 (CHDMC004)					
Barker Slough at North Bay Aqueduct Intake -and-	--- (SLSAR3)					
Cache Slough at City of Vallejo Intake[3]	C-19 (SLCCH16)					

Notes:
1. River Kilometer Index station number.
2. The Sacramento Valley 40-30-30 water year hydrologic classification index applies for determinations of water year type. W=wet, AN=above normal, BN=below normal, D=dry, and C=critically dry.
3. The Cache Slough objective to be effective only when water is being diverted from this location.

Source: State Water Resources Control Board, *Water Quality Control Plan for San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, 1995.

TABLE 7.1-10

SACRAMENTO-SAN JOAQUIN DELTA–WATER QUALITY OBJECTIVES FOR AGRICULTURAL BENEFICIAL USES

Compliance Location	Interagency Station Number (RKI[1])	Parameter	Description (Unit)[2]	Water Year Type[3]	Time Period	Value
WESTERN DELTA						
Sacramento River at Emmaton	D-22 (RSAC092)	Electrical Conductivity (EC)	Maximum 14-day running average of mean daily EC (mmhos/cm)	W AN BN D C	0.45 EC April 1 to date shown Aug 15 Jul 1 Jun 20 Jun 15 ---	EC from date shown to Aug 15[4] 0.63 1.14 1.67 2.78
San Joaquin River at Jersey Point	D-15 (RSAN018)	Electrical Conductivity (EC)	Maximum 14-day running average of mean daily EC (mmhos/cm)	W AN BN D C	0.45 EC April 1 to date shown Aug 15 Aug 15 Jun 20 Jun 15 ---	EC from date shown to Aug 15[4] 0.74 1.35 2.20
INTERIOR DELTA						
South Fork Mokelumne River at Terminous	C-13 (RSMKL08)	Electrical Conductivity (EC)	Maximum 14-day running average of mean daily EC (mmhos/cm)	W AN BN D C	0.45 EC April 1 to date shown Aug 15 Aug 15 Aug 15 Aug 15 ---	EC from date shown to Aug 15[4] 0.54
San Joaquin River at San Andreas Landing	C-4 (RSAN032)	Electrical Conductivity (EC)	Maximum 14-day running average of mean daily EC (mmhos/cm)	W AN BN D C	0.45 EC April 1 to date shown Aug 15 Aug 15 Aug 15 Jun 25 ---	EC from date shown to Aug 15[4] 0.58 0.87
SOUTHERN DELTA						
San Joaquin River at Airport Way Bridge, Vernalis -and-	C-10 (RSAN112)	Electrical Conductivity (EC)	Maximum 30-day running average of mean daily EC (mmhos/cm)	All	Apr-Aug Sep-Mar	0.7 1.0
San Joaquin River at Brandt Bridge site[5] -and-	C-6 (RSAN073)					
Old River near Middle River[5] -and-	C-8 (ROLD69)					
Old River at Tracy Road Bridge[5]	P-12 (ROLD59)					
Export Area						
West Canal at mouth of Clifton Court Forebay -and-	C-9 (CHWSTO)	Electrical Conductivity (EC)	Maximum monthly average of mean daily EC (mmhos/cm)	All	Oct-Sep	1.0

TABLE 7.1-10

SACRAMENTO-SAN JOAQUIN DELTA–WATER QUALITY OBJECTIVES FOR AGRICULTURAL BENEFICIAL USES

Compliance Location	Interagency Station Number (RKI[1])	Parameter	Description (Unit)[2]	Water Year Type[3]	Time Period	Value
Delta-Mendota Canal at Tracy Pumping Plant	DMC-1 (CHDMC004)					

Notes:
1. River Kilometer Index station number.
2. Determination of compliance with an objective expressed as a running average begins on the last day of the averaging period. The averaging period commences with the first day of the time period for the applicable objective. If the objective is not met on the last day of the averaging period, all days in the averaging period are considered out of compliance.
3. The Sacramento Valley 40-30-30 water year hydrologic classification index applies for determination of water year type.
4. When no date is shown, EC limit continues from April 1.
5. The 0.7 EC objective becomes effective on April 1, 2005. The California Department of Water Resources and the USBR shall meet 1.0 EC at these stations year round until April 1, 2005. The 0.7 EC objective is replaced by the 1.0 EC objective from April through August after April 1, 2005 if permanent barriers are constructed, or equivalent measures are implemented, in the southern Delta and an operations plan that reasonably protects southern Delta agriculture is prepared by the California Department of Water Resources and the USBR and approved by the Executive Director of the SWRCB. The SWRCB will review the salinity objectives for the southern Delta in the next review of the Bay-Delta objectives following construction of the barriers.

Source: State Water Resources Control Board, *Water Quality Control Plan for San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, 1995.

TABLE 7.1-11

SACRAMENTO-SAN JOAQUIN DELTA-WATER QUALITY OBJECTIVES FOR FISH AND WILDLIFE BENEFICIAL USES

Compliance Location	Interagency Station Number (RKI[1])	Parameter	Description (Unit)[2]	Water Year Type[3]	Time Period	Value
San Joaquin River Salinity						
San Joaquin River at and between Jersey Point and Prisoners Point [4]	D-15 (RSAN018) and D-29 (RSAN038)	Electrical Conductivity (EC)	Maximum 14-day running average of mean daily EC (mmhos/cm)	W,AN,BN,D	Apr -May	0.44 [6]
Eastern Suisun Marsh Salinity						
Sacramento River at Collinsville -and- Montezuma Slough at National Steel -and- Montezuma Slough near Beldon Landing	C-2 (RSAC081) S-64 (SLMZU25) S-49 (SLMZU11)	Electrical Conductivity (EC)	Maximum monthly average of both daily high tide EC values (mmhos/cm), or demonstrate that equivalent or better protection will be provided at the location	All	Oct Nov-Dec Jan Feb-Mar Apr-May	19.0 15.5 12.5 8.0 11.0
Western Suisun Marsh Salinity						
Chadbourne Slough at Sunrise Duck Club -and- Suisun Slough, 300 feet south of Volanti Slough -and- Cordella Slough at Ibis Club -and- Goodyear Slough at Morrow Island -and- Water supply intakes for waterfowl management areas on Van Sickle and Chipps islands	S-21[7] (SLCBN1) S-42 [8] (SLSUS12) S-97 [8] (SLCRD06) S-35 [8] SLGYR09) No locations specified	Electrical Conductivity (EC)	Maximum monthly average of both daily high tide EC values (mmhos/cm), or demonstrate that equivalent or better protection will be provided at the location	All but deficiency period Deficiency period [9]	Oct Nov Dec Jan Feb-Mar Apr-May Oct Nov Dec-Mar Apr May	19.0 16.5 15.5 12.5 8.0 11.0 19.0 16.5 15.6 14.0 12.5

TABLE 7.1-11

SACRAMENTO-SAN JOAQUIN DELTA-WATER QUALITY OBJECTIVES FOR FISH AND WILDLIFE BENEFICIAL USES

Compliance Location	Interagency Station Number (RKI[1])	Parameter	Description (Unit)[2]	Water Year Type[3]	Time Period	Value
Delta Outflow						
		Net Delta outflow index (NDOI) [11]	Minimum monthly average [12] NDOI (cfs)	All	Jan	4,500 [13]
				All	Feb-Jun	[14]
				W,AN	Jul	8,000
				BN		6,500
				D		5,000
				C		4,000
				W,AN,BN	Aug	4,000
				D		3,500
				C		3,000
				All	Sep	3,000
				W,AN,BN,D	Oct	4,000
				C		3,000
				W,AN,BN,D	Nov-Dec	4,500
				C		3,500
River Flows						
Sacramento River at Rio Vista	D-24 (RSAC101)	Flow rate	Minimum monthly average [15] flow rate (cfs)	All	Sep	3,000
				W,AN,BN,D	Oct	4,000
				C		3,000
				W,AN,BN,D	Nov-Dec	4,500
				C		3,500
San Joaquin River at Airport Way Bridge, Vernalis	C-10 (RSAN112)	Flow rate	Minimum monthly average [16] flow rate (cfs) [17]	W,AN	Feb-Apr 14 and May 16-Jun	2,130 or 3,420
				BN,D		1,420 or 2,280
				C		710 or 1,140
				W	Apr 15-May 15 [18]	7,330 or 8,620
				AN		5,730 or 7,020
				BN		4,620 or 5,480
				D		4,020 or 4,880
				C		3,110 or 3,540
				All	Oct	1,000 [19]
Export Limits						
		Combined export rate [20]	Maximum 3-day running average (cfs)	All	Apr 15-May 15 [17]	[22]
			Maximum percent of Delta inflow diverted [23] [24]	All	Feb-Jun	35% Delta inflow [25]
				All	July-Jan	65% Delta inflow
Delta Cross Channel Gates Closure						
Delta Cross Channel at Walnut Grove	----	Closure of gates	Closed gates	All	Nov-Jan	[26]
					Feb-May 20	---
					May 21-Jun 15	[27]
Dissolved Oxygen						
San Joaquin River between Turner Cut and Stockton	(RSAN050-RSAN061)	Dissolved Oxygen (DO)	Minimum DO (mg/l)	All	Sep-Nov	6.0 [4]

TABLE 7.1-11 SACRAMENTO-SAN JOAQUIN DELTA-WATER QUALITY OBJECTIVES FOR FISH AND WILDLIFE BENEFICIAL USES						
Compliance Location	**Interagency Station Number (RKI[1])**	**Parameter**	**Description (Unit)[2]**	**Water Year Type[3]**	**Time Period**	**Value**
SALMON PROTECTION						
----	----	----	Narrative	Water quality conditions shall be maintained together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967-1991, consistent with the provisions of State and federal law.		
Source: State Water Resources Control Board, *Water Quality Control Plan for San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, 1995. Please see this document for notes in this table shown in brackets.						

includes the requirement that dissolved oxygen concentrations anywhere in the Delta must not be less than 5.0 mg/L.[34]

Salinity in the Delta and the location of the freshwater/brackish water interface referred to as X2 affect the abundance and health of some fish species and other aquatic life. In addition to the numerical electrical conductivity objectives for fish and wildlife for the lower San Joaquin River and for Suisun Marsh, there is also an estuarine habitat protection objective that X2 be maintained at the water surface at Collinsville, Chipps Island or Port Chicago. The location of X2 depends primarily on tidal action and Delta outflow and is influenced by upstream reservoir operations and pumping from the Delta. The objective for X2 applies from the beginning of February to the end of June.

The fish and wildlife objectives include flow objectives designed to protect fish and wildlife. They require minimum Delta outflows, minimum flows in the San Joaquin and Sacramento rivers, limits on exports by the SWP and CVP and requirements with respect to closure of the gates in the Delta Cross Channel.

<u>Water Rights Decisions</u>

The SWRCB is responsible for issuing and administering water rights permits in California. In 1978, the SWRCB adopted Water Rights Decision 1485 (D-1485) which established minimum flows in the Delta and limited exports of water by the SWP and CVP. The purpose of D-1485 was to ensure compliance with then current water quality objectives. D-1485 superseded all earlier water rights decisions for SWP and CVP operations in the Delta. Various interests filed lawsuits challenging D-1485. In 1986, the appeal court affirmed the SWRCB's broad authority and obligation to establish water quality objectives and set water rights permit terms that provide reasonable protection to the beneficial uses of Delta waters (Racanelli Decision).[35] In 1987, the SWRCB began hearings to adopt new Delta objectives and a new water rights decision. The SWRCB adopted new water quality and flow objectives in 1995 as part of the 1995 Bay-Delta WQCP but a new water rights decision (D-1641) implementing the 1995 WQCP was not issued until 2000. In the absence of the new water rights decision, the SWP and CVP were voluntarily operated to meet the new objectives, beginning in December 1995.

Water Quality Objectives for Surface Waters Other than the Delta

Because the primary elements of the proposed project do not involve discharge of pollutants the only proposed project-related changes in lake or river water quality are those associated with changes in flow in surface streams or changes in water levels in lakes and reservoirs. Water quality characteristics that are flow-related and could be affected by the proposed project include water temperature, salinity and turbidity.

Two beneficial uses relate to water temperature, cold freshwater habitat (COLD) and warm freshwater habitat (WARM). All the natural water bodies that could be affected by the proposed project are designated for both COLD and WARM beneficial uses. The Central Valley WQCP contains the following objective for COLD and WARM: at no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5 degrees F. above natural receiving water temperature. The WQCP contains a specific temperature objective for the Sacramento River. Water temperatures between Shasta Dam and Hamilton City must not exceed 56 degrees F. and water temperatures between Hamilton City and the I Street Bridge in Sacramento must not exceed 68 degrees F. during periods when temperature increases will be detrimental to the fishery.[36]

Minimum Stream Flow Requirements

Minimum flow requirements have been established for some river reaches. Some minimum flow requirements are permit conditions imposed on hydropower facilities by the Federal Energy Regulatory Commission (FERC). Minimum flows below Lake Oroville on the Feather River were established by FERC based on an agreement made in 1983 between the Department and the California Department of Fish and Game. Flows in the Feather River are governed by releases from Thermalito Afterbay, which is part of the Department's Oroville facilities. Minimum flow requirements in the Feather River below the outlet from Thermalito Afterbay in non-critically dry years are 1,700 cfs from October through March and 1,000 cfs for the rest of the year. Minimum flow requirements in critically dry years are 1,200 cfs from October through February and 1,000 cfs for the rest of the year.[37]

Hydropower facilities at the federally owned Shasta Dam on the Sacramento River are not regulated by FERC. Minimum flows in the river below Keswick Dam are established in a memorandum of agreement between the Reclamation and the California Department of Fish and Game executed in 1960 and SWRCB Order 90-50. Keswick Dam forms the afterbay for Shasta Lake. Minimum flow requirements in critically dry years are 2,000 cfs from December through February, 2,300 cfs in March through August and 2,800 cfs in September through November. In other year types, the requirements are 3,250 cfs from September through February and 2,300 cfs from March through August.[38]

Minimum flow requirements for the American River below the CVP's Folsom Dam are established in the SWRCB's Water Rights Decision 893 (D-893). D-893 states that releases below Nimbus Dam should not fall below 250 cfs between January and September or below 500 cfs at other times. Nimbus Dam forms the afterbay of Folsom Reservoir. However, D-893 requirements are rarely the controlling factor for the CVP's releases at Nimbus Dam. Other factors cause the CVP to release more water than is required by D-893 most of the time.[39]

No minimum releases for environmental purposes have been formally established for Friant Dam on the San Joaquin River. Reclamation releases 35 to 230 cfs to support riparian water rights between the dam and Gravelly Ford. A minimum flow of five cfs is required at Gravelly

Ford in the irrigation season to support water rights holders between Gravelly Ford and the Mendota Pool.[40]

SWP Contract Water Quality Objectives

Article 19 of the long-term water supply contracts includes quality objectives for SWP water. The article states that the Department shall take all reasonable measures to make available at all delivery points water that does not contain constituents in concentrations greater than those shown in Table 7.1-12.

TABLE 7.1-12

WATER QUALITY OBJECTIVES[a] FOR THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Constituent	Unit	Monthly Average	Average for any 10-year Period	Maximum
Total dissolved solids	ppm	440	220	-
Total hardness	ppm	180	110	-
Chlorides	ppm	110	55	-
Sulfates	ppm	110	20	-
Sodium percentage	%	50	40	-
Fluoride	ppm	-	-	1.5
Lead	ppm	-	-	0.1
Selenium	ppm	-	-	0.05
Hexavalent Chromium	ppm	-	-	0.05
Arsenic	ppm	-	-	0.05
Iron and Manganese together	ppm	-	-	0.3
Magnesium	ppm	-	-	125
Copper	ppm	-	-	3
Zinc	ppm	-	-	15
Phenol	ppm	-	-	0.001

Note:
a. Water quality objectives from long-term water supply contract between the department and MWDSC. Water quality objectives are the same for all contractors.

Non-Project Water Acceptance Criteria

If SWP capacity is available, non-SWP water, referred to as “non-project” water, may be introduced into SWP conveyance facilities and conveyed to SWP contractors or others provided it does not adversely effect SWP operations, deliveries or facilities. The quality of the non-SWP water must also be acceptable to the Department. The Department delivered non-SWP water to contractors prior to the Monterey Amendment in accordance with Water Code Section 1810. Article 55 of the Monterey Amendment clarifies some of the administrative arrangements for conveyance of non-SWP water including the costs of conveyance and scheduling of deliveries.

Non-SWP water may be delivered to the Delta and diverted at the Banks Pumping Plant or it may be introduced into the California Aqueduct from a ground or surface water source. Non-SWP water available at the Delta has the same quality characteristics as SWP water. Water introduced into the aqueduct from another source may differ in quality to SWP water in the aqueduct. The Department has developed acceptance criteria for the quality of non-SWP water that may be introduced into the California Aqueduct. The purpose of the criteria is to protect SWP water quality. In considering requests to convey non-SWP water in SWP facilities the

Department takes account of potential impacts on SWP water quality, the SWP contractors' water treatment processes and overall benefits to the SWP.

7.1.2.4 Changes in Regulatory Setting between 1996 and 2003

Clean Water Act

As noted above, Section 303(d) of the CWA requires states to prepare lists of impaired surface water bodies every two years. The most recent list for California was published in 2002. Many surface water bodies in the area potentially affected by the proposed project are listed as impaired with respect to various characteristics. However, many water bodies are listed for characteristics that would not be affected by the proposed project. For example, the Sacramento River and many of its tributaries are listed for mercury and other heavy metals. These contaminants are associated with past mineral extraction and would not be affected by the proposed project. Table 7.1-8 shows surface water bodies listed as impaired for substances that could be affected by the proposed project. Most rivers and streams in the lowland portions of the Sacramento and San Joaquin Valleys are listed as impaired by pesticides, as are Suisun Bay, San Pablo Bay and San Francisco Bay. The San Joaquin River and southern and western portions of the Delta are also listed for electrical conductivity and in some cases for dissolved oxygen.

Porter-Cologne Act

Several WQCPs were updated between 1996 and 2003. In most cases, the designated beneficial uses changed very little. The beneficial uses shown in Table 7.1-7 were current in 2003.

Delta Standards

<u>Water Quality and Flow Objectives</u>

The WQCP for San Francisco Bay and the Delta published in 1995 included water quality and flow objectives for the Delta. A draft EIR on the WQCP was published in 1997.[41] In the draft EIR on the WQCP, the SWRCB acknowledged that the flow objectives can only be achieved by limiting diversions of water in the Sacramento and San Joaquin watersheds and within the Delta itself. The draft EIR noted that the SWRCB intended to implement the objectives, to the extent feasible, through amendments to the water rights permits of water rights holders in the Central Valley. However, the draft EIR also noted that some of the objectives cannot reasonably be achieved through changes to water rights permits exclusively. Water quality and the health of aquatic resources in the Delta and San Francisco Bay are dependent on many factors outside the regulatory authority of the SWRCB. Other factors outside the control of the SWRCB that could affect water quality and the health of aquatic resources of the Delta and San Francisco Bay include salt build up in the San Joaquin Valley, the introduction of non-native aquatic species, legal and illegal commercial and sport fishing and degradation of upstream spawning habitat for fish that migrate through the Bay and Delta.

In the years following publication of the WQCP, most of the objectives of the WQCP were implemented through biological opinions issued by the USFWS and the NMFS pursuant to the Endangered Species Act and through D-1485 and SWRCB Orders WR 95-6 and WR 98-9. Under the biological opinions, D-1485, WR 95-6 and WR 98-9, responsibility for meeting most of the objectives was assigned to the SWP and the CVP.[42]

In 1997, the SWRCB began examining long-term alternatives that would enable compliance with the flow objectives. Water rights proceedings to determine responsibility for meeting the objectives in the 1995 WQCP began in 1998. The water rights proceedings were to be conducted in eight phases. The SWRCB's policy in the water rights proceedings was to encourage water agencies to resolve among themselves the responsibilities for meeting the objectives in the 1995 WQCP and to bring their proposals to the SWRCB for approval. In 1999, the SWRCB published a final EIR on the WQCP, which presented the environmental effects of a range of alternatives but did not identify a preferred alternative.[43]

Water Rights Decisions

Phase 1 through 7 of Bay-Delta water rights proceedings resulted in the SWRCB issuing Water Rights Decision D-1641 in late 1999. The SWRCB revised D-1641 in early 2000 by issuance of Order WR 2000-02, and again in 2001 by issuance of Order WR 2001-05. D-1641 and Order WR 2001-05 contain the water rights requirements to implement the flow objectives for the Delta. D-1641 includes both long-term and temporary requirements.[44]

In D-1641 and in Order WR 2001-05, the SWRCB assigned responsibilities, for specified periods, to water rights holders including Reclamation and the Department in certain watersheds tributary to the Delta. The SWRCB accepted with modifications the proposals made by some water agencies and groups of water agencies with respect to their responsibilities for meeting flow objectives in the Delta. The responsibilities of various parties, including water users in the Sacramento, San Joaquin, Mokelumne, Calaveras and Cosumnes River watersheds were defined in D-1641. These responsibilities require that the water users in these watersheds will contribute specified amounts of water to protect water quality, and that the Department and/or Reclamation will ensure that the objectives are met in the Delta.[45]

Phase 8 of the water rights proceedings would have ultimately determined the responsibilities of the Sacramento Valley water rights holders for meeting the objectives in the 1995 WQCP. The SWRCB's Order WR 2001-05 stayed Phase 8 of the water rights proceedings and required Reclamation and the Department to continue to meet certain objectives in the 1995 WQCP until adoption of another decision assigning responsibility for meeting the objectives. During 2002, Reclamation, the Department, Sacramento Valley upstream water users and certain downstream users negotiated a settlement in lieu of continuing Phase 8 of the water rights proceedings. Beginning in December 2002, the parties to the negotiations executed the Sacramento Valley Water Management Agreement or Short-Term Settlement Agreement. The agreement establishes a planning process for actions that would help meet objectives in the Delta.

Vernalis Adaptive Management Plan

Shortly after the Bay-Delta WQCP was published, an association of users of San Joaquin River water filed suit against the SWRCB, challenging the flow objectives in the WQCP. The association claimed that the flow objectives were based on an inadequate understanding of the relationship between flow and salmon survival. In an effort to settle the issue out of court, the San Joaquin River interests collaborated with other water users, environmental groups and government agencies to develop an alternative, which would provide an equivalent level of fisheries protection to that provided by the Bay-Delta WQCP. The result was the San Joaquin River Agreement, of which the Vernalis Adaptive Management Program (VAMP) was a key component.[46]

The VAMP is an experimental/management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Delta. The San Joaquin River Agreement, including the VAMP, was submitted to the SWRCB as a proposal. It was accepted by the SWRCB and made a part of D-1641.

The VAMP provides for a 31-day pulse flow in the San Joaquin River at Vernalis together with a reduction in SWP and CVP exports from the south Delta.[47] The pulse usually occurs from mid-April to mid-May but its timing may be adjusted based on hydrology and fisheries conditions. The effects of different flow rates in the lower San Joaquin River and different SWP and CVP export rates on juvenile and smolt Chinook salmon survival are being studied as part of the VAMP.

CALFED Bay-Delta Program and the Environmental Water Account

In 1994, the CALFED Bay-Delta Program was initiated to address long-standing and unresolved conflicts over water use in the Sacramento-San Joaquin Delta. It is a collaborative program of 23 federal and State agencies. Its goal is to restore the ecological health of the Delta while ensuring an adequate supply for Delta water users including the SWP and CVP.

During Phase I of the CALFED Program, a range of alternatives for achieving long-term solutions to the problems of the Delta was developed. In Phase II, a programmatic EIS/EIR was prepared on the CALFED Program. The preferred alternative, identified in the CALFED Record of Decision, which was published in 2000, is being implemented in Phase III of the CALFED Program.[48] One of the project-level actions being implemented as part of the CALFED Program is the EWA.

The purpose of the EWA is to enable diversion of water by the SWP and CVP to be reduced at times when at-risk fish species may be harmed while preventing the uncompensated loss of water to SWP and CVP contractors. The EWA then replaces any water loss due to curtailment of pumping by purchase of surface or groundwater supplies from willing sellers and by taking advantage of regulatory flexibility and certain SWP operational assets. The Delta export/inflow ratio may be increased at times when fish abundance in the vicinity of the Delta pumping plants is low and temporary use can be made of available storage in SWP and CVP reservoirs. Also, the Banks Pumping Plant can pump an additional 500 cfs between July and September and the EWA can capture certain upstream environmental releases in the Delta. Five agencies administer the EWA. They are the Department, and Reclamation, the agencies that operate the SWP and the CVP, and the USFWS, the NMFS and the California Department of Fish and Game, the agencies responsible for protecting and managing the Delta's natural resources. The Department and Reclamation are called the Project Agencies; the others are called the Management Agencies. The EWA began operation in late 2000.[49] A more detailed description of the EWA is contained in Chapter 6.

7.1.3 IMPACTS AND MITIGATION MEASURES

7.1-1 The proposed project could potentially change stream flow in the Feather, Sacramento, American and San Joaquin rivers and could potentially change outflow from the Delta to San Francisco Bay.

1996 — 2003

This section describes the impacts of the proposed project in relation to the baseline scenario. Under the baseline scenario, water demand would increase in the contractors' service areas but none of the provisions of the Monterey Amendment or the Settlement Agreement would be implemented (see Chapter 5 for a full description of the baseline scenario).

Several provisions of the Monterey Amendment have the potential to affect stream flow in natural waterways under 2003 conditions. The provisions that altered water allocation procedures and provided for the retirement and transfer of Table A amounts could affect flow in the Feather and Sacramento rivers, Delta inflow and Delta diversions. The provisions that enable the use of the water supply management practices could affect Delta diversions. Because Delta outflow is dependent on both Delta inflow and Delta diversions it can be affected by all of these provisions.

<u>Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations</u>

The SWP makes deliveries to its contractors, other than those in Plumas and Butte counties, by diverting water from the Feather and Sacramento rivers and the Delta, and when flow is insufficient, by releasing water from Lake Oroville. Plumas County FC&WCD obtains its SWP water from Lake Davis, an SWP reservoir on a Feather River tributary upstream of Lake Oroville. The county of Butte obtains its SWP water directly from Lake Oroville. Water released from Lake Oroville flows down the Feather River to Yuba City's diversion point and down the Feather and Sacramento rivers to diversion points at the North Bay Aqueduct and at the Banks Pumping Plant. Solano County WA and Napa County FC&WCD obtain their SWP water from the North Bay Aqueduct.

Changes to flow in the Feather and Sacramento rivers and the Delta would occur if the retirements and transfers of Table A amounts and altered water allocation procedures changed the total amount of water delivered or the proportion of SWP deliveries made north and south of the Delta. The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on SWP deliveries to individual contractors under 2003 conditions as described in Chapter 6. Under the baseline scenario, an estimated annual average of 43,600 AF, or 1.4 percent of total average annual SWP deliveries (3,104,800 AF), would be delivered to contractors north of the Delta. With the proposed project, an estimated annual average of 45,400 AF or 1.48 percent of total average annual SWP deliveries (3,070,600 AF), would be delivered north of the Delta. The small increase in the amount and proportion of SWP water delivered north of the Delta would be expected to result in small changes in flow in the Feather and Sacramento rivers and in Delta inflow but no change in flow in the San Joaquin and American rivers.

The Department developed quantitative estimates of changes in annual and monthly flow in the Feather and Sacramento rivers attributable to the retirements and transfers of Table A amounts and altered water allocation procedures under 2003 conditions by post-processing CALSIM II output on baseline river flows in a spreadsheet (Study No. 5 in Appendix H). Estimates were made of average annual flows in wet, above normal, below normal, dry and critically dry years for the baseline scenario and the proposed project. Average annual flows under the two scenarios were very similar. Differences in average annual flows between the proposed project and the baseline scenario were less than 0.15 percent of annual flows under the baseline scenario, an amount that is essentially immeasurable.

The Department also made estimates of average monthly flows in the Feather and Sacramento rivers in different hydrologic year types for the proposed project and the baseline scenario. This was done by estimating monthly deliveries to contractors based on typical seasonal delivery patterns and then estimating the effects of the monthly deliveries on river flows. Average monthly flows under the two scenarios were very similar. Differences in average monthly flows between the proposed project and the baseline scenario were less than 0.15 percent of monthly flows under the baseline scenario, an amount that is essentially immeasurable.

As indicated above, the Table A transfers and retirements and the altered allocation procedures would result in an estimated 1,800 AF increase in annual average deliveries north of the Delta with the proposed project compared to the baseline scenario under 2003 conditions. The small increase in deliveries north of the Delta attributable to the proposed project would reduce Delta inflow and could occasionally reduce the need for carriage water, which could result in a slight reduction in Delta outflow at times when Delta outflow exceeds that required by D-1641.

Analysis of Effects of Most Provisions of the Monterey Amendment using Historical Data

The Monterey Amendment contains several provisions, other than the altered water allocation procedures and the transfers and retirement of Table A amounts, that have the potential to affect flows in the Feather, Sacramento, American and San Joaquin rivers and the Delta. They include Article 52, and Articles 54 and 56, that provide for the water supply management practices. Article 52 transfers ownership of lands in the Kern Fan Element from the state to KCWA, which enabled local development of the Kern Water Bank. Article 54 of the Monterey Amendment allows certain contractors to borrow water from Castaic Lake and Lake Perris up to specified maximum amounts provided they replace the water within five years. Article 56 of the Monterey Amendment allows contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or storage in surface water reservoirs owned by the SWP or others. Another provision of Article 56 establishes an annual turnback pool.

Because the Article 52, 54 and 56 provisions apply to SWP operations south of the Delta they would not affect flow in the Feather, Sacramento, American and San Joaquin rivers. But they could affect Delta outflow.

CALSIM II does not model Articles 52, 54 and 56, and so the analysis described in the previous section, which uses CALSIM II, does not fully characterize the effects of all the provisions of the Monterey Amendment in combination. This does not affect the analysis of the effects of the proposed project on flow in the Sacramento and Feather rivers because, as noted above, Articles 52, 54 and 56 only affect SWP operations south of the Delta. But they could affect Delta outflow and so an additional analysis using data from 1996 through 2004, was necessary to examine the effects of the Article 52, 54 and 56 provisions on Delta outflow. The Department's historical operations analysis examined the combined effects of the Article 52 provisions, the water supply management practices (Articles 54 and 56) and the Table A retirements on SWP deliveries, Delta diversions at the Banks Pumping Plant, and Delta outflow (Study No. 2). The historical operations analysis is described in more detail in Chapter 6 and is contained in its entirety in Appendix K.

The Monterey Amendment would only have an effect on Delta outflow if the SWP water delivered, stored or transferred pursuant to its provisions would otherwise flow out of the Delta. Water would otherwise have flowed out of the Delta only when the availability of water in the

Delta exceeds total demand for SWP water. As discussed in Chapter 6, the Department diverts water at the Banks Pumping Plant at the maximum rate it can while maintaining compliance with Delta water quality objectives and other environmental standards. The diversion rate is only reduced below the maximum rate consistent with compliance with environmental standards when water availability in the Delta exceeds the total demand for SWP water. Under this condition, the contractors have all the SWP water they can use or store, San Luis Reservoir and all other SWP reservoirs south of the Delta are full, and all EWA debt has been repaid.

The Department determined that the Article 52, 54 and 56 provisions in combination with the Table A retirements enabled increased pumping in a few months between 1996 and 2004.[50] Increased pumping was infrequent because between 1996 and 2004 there were only a few months when the contractors had all the SWP water they could use or store, all SWP reservoirs south of the Delta were full, and all EWA debt was repaid. The Department estimates that between 1996 and 2004, the Articles 52, 54 and 56 provisions and the Table A retirements enabled the SWP to pump about 44,000 AF more water at the Banks Pumping Plant than it would have under the baseline scenario. Thus, between 1996 and 2004, the Article 52, 54 and 56 provisions and the Table A retirements reduced Delta outflow by 44,000 AF.

The reductions in Delta outflow occurred four times; January 13, 1998, February 24 through March 31 of 1999, February 22 through March 31 of 2000, and March 23 though March 30 of 2004. Table 7.1-13 shows the reductions in each month and the percentage of Delta outflow that they represented. The reductions typically occurred when monthly Delta outflow was in excess of 1,000,000 AF and the percentage reductions in monthly flows attributable to the proposed project ranged up to 0.8 percent. Additional information on daily reductions in Delta outflow are provided in Section 7.3, Fisheries Resources.

TABLE 7.1-13

ESTIMATED EFFECTS OF MONTEREY AMENDMENT ON DELTA OUTFLOW

Year	Month	Change in Pumping at Banks AF	Delta Outflow		
			Baseline AF	Proposed Project AF	% Difference
1998	January	1,000	4,400,140	4,399,140	0.02
1999	February	1,000	5,488,283	5,487,283	0.02
1999	March	2,000	4,251,137	4,249,137	0.05
2000	February	10,000	5,422,226	5,412,226	0.18
2000	March	4,000	5,404,323	5,400,323	0.07
2004	March	26,000	3,475,039	3,459,039	0.80

Under the baseline scenario, more spare capacity would have been available at the Banks Pumping Plant than it was with the Article 52, 54 and 56 provisions and the table A retirements in effect. The operations of the SWP and the CVP in the Delta are coordinated and at times the CVP uses spare capacity at the Banks Pumping Plant to divert water from the Delta and deliver it to storage or to CVP contractors. However, the Department has determined that it is unlikely that the CVP would have used the capacity at the Banks Pumping Plant that would have been available to the CVP under the baseline scenario to divert water from the Delta between 1996 and 2004 (see Impact 7.1-7). Thus, 44,000 AF more water would have been pumped from the Delta between 1996 and 2004 with the proposed project than under the baseline scenario.

Summary of Effects of Proposed Project on Stream Flow and Delta Outflow

The retirements and transfers of Table A amounts and the altered allocation procedures that are part of the Monterey Amendment would have very little effect on average or monthly flows in the Feather and Sacramento rivers or Delta outflow compared to the baseline scenario under 2003 conditions.

There are minimum in-stream flow requirements for the Sacramento River below Shasta Dam and for the Feather River below Oroville Dam. The proposed project does not effect the dam operator's obligations with respect to minimum flows. Minimum flow requirements would be the same with the proposed project and under the baseline scenario.

Some of the water supply management practices that are a part of the proposed project affected Delta outflow between 1996 and 2004. Several of the water supply management practices in combination with the Table A retirements resulted in an estimated reduction in Delta outflow of 44,000 AF between 1996 and 2004. The estimated reduction represents about 0.03 percent of total outflow in that period.

Most of the time, the SWP diverts water from the Delta at the Banks Pumping Plant at the maximum possible rate consistent with compliance with Delta water quality standards. From time-to-time, in the wetter months of wet years, water is available in the Delta in amounts in excess of that needed to meet Delta environmental standards and the needs of the SWP and its contractors. That is, all the SWP reservoirs south of Delta are full, all contractors' water needs have been met and EWA debt in San Luis Reservoir has been repaid. It is only at such times, that the water supply management practices of the Monterey Amendment could enable pumping of water that would have contributed to Delta outflow under the baseline scenario. Between 1996 and 2004, these conditions occurred in January 1998, February and March 1999, February and March 2000, and March 2004. Because the late 1990s and 2000 were a series of wet and above normal years the effects of the water supply management practices were felt more frequently than they would have been in a more typical sequence of hydrologic years.

No significance findings were made with respect to the impacts of the proposed project on river flow or Delta outflow. Significance findings are made later in this EIR with respect to the impacts on water quality and biological resources produced by changes in river flow and Delta outflow that are a consequence of the proposed project.

Future Impacts

This section describes the impacts of the proposed project in relation to the baseline scenario. The baseline scenario represents a scenario that might have developed between 2003 and 2020 if the Monterey Amendment had not been implemented. Under the baseline scenario, water demand would increase in the contractors' service areas but none of the provisions of the Monterey Amendment or the Settlement Agreement would be implemented (see Chapter 5 for a full description of the baseline scenario).

Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change the quantities of SWP water delivered to individual contractors in 2020 as described in Chapter 6. The changes in deliveries could affect flows in the Feather and Sacramento rivers and Delta outflow.

Changes to flow in the Feather and Sacramento rivers and the Delta would occur if the retirements and transfers of Table A amounts and altered water allocation procedures changed the proportion of SWP deliveries made north and south of the Delta. The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on average annual SWP deliveries to individual contractors under 2020 conditions as described in Chapter 6. Under the baseline scenario, an estimated annual average of 71.4 TAF, or 2.2 percent of total average annual SWP deliveries (3,251.7 TAF), would be delivered to contractors north of the Delta. With the proposed project, an estimated annual average of 78.8 TAF or 2.37 percent of total average annual SWP deliveries (3,325.3 TAF), would be delivered north of the Delta. The small increase in the proportions of SWP water delivered north of the Delta would be expected to result in small changes in flow in the Feather and Sacramento rivers and in Delta outflow but no change in flow in the San Joaquin and American rivers.

The Department developed quantitative estimates of changes in flow in the Feather and Sacramento rivers attributable to the retirements and transfers of Table A amounts and altered water allocation procedures under 2020 conditions as described in Appendix H. Estimates were made of average annual flows in wet, above normal, below normal, dry and critically dry years for the baseline scenario and the proposed project. Average flows under the two scenarios were very similar. Differences between the proposed project and the baseline scenario were less than 0.15 percent of flows under the baseline scenario, an amount that is essentially immeasurable.

The Department also made estimates of average monthly flows in the Feather and Sacramento rivers in different hydrologic year types for the proposed project and the baseline scenario. Average monthly flows under the two scenarios were very similar. Differences between the proposed project and the baseline scenario were less than 0.15 percent of monthly flows under the baseline scenario, an amount that is essentially immeasurable.

Total deliveries to the SWP contractors with the proposed project and under the baseline scenario under 2020 conditions would be very similar. Consequently, the effects of slightly altered proportional deliveries north and south of the Delta on Delta outflow would be minimal. The small increase in deliveries north of the Delta attributable to the proposed project could reduce the need for carriage water, which could result in slight reduction in Delta outflow at times when Delta outflow exceeds that required by D-1641.

Analysis of Effects of Water Supply Management Practices Using Historical Data

Contractors took advantage of the water supply management practices that are part of the Monterey Amendment to increase their deliveries of SWP water between 1996 and 2003 with a consequent effect on Delta pumping and Delta outflow. They would be expected to continue to employ all or most of them in the future.

As noted earlier, groundwater storage outside contractors' service areas, extended carryover storage and the turnback pool could have an effect on Delta outflow if the SWP water stored or transferred using these water supply management practices would otherwise flow out of the Delta. The effect on Delta outflow would only occur when the availability of water in the Delta exceeds total demand for SWP water; that is, when contractors have all the SWP water they can use or store, San Luis Reservoir and all other SWP reservoirs south of the Delta are full, and all EWA debt has been repaid.

The Department analyzed the historical record to determine whether storage outside contractors' service areas, extended carryover storage, the turnback pool and flexible storage in Castaic Lake and Lake Perris would be likely to enable increased pumping at the Banks Pumping Plant in the future compared to the baseline scenario (Study No. 3). Historical information from the period 1996 through 2004 was used in Study No. 3 but different assumptions were made with respect to the groundwater storage (See Chapter 6 for more information). The Department determined that the Article 54 and 56 provisions would enable the SWP to pump about 449,000 AF more water at the Banks Pumping Plant in the future with the proposed project than it would have under the baseline scenario. Thus, from 1996 through 2004, a nine year period the water supply management practices reduced Delta outflow by 449,000 AF, or an average of 50,000 AF per year. Reductions would occur 11 times in the nine year period and typically occur when monthly Delta outflow is in excess of 1,000,000 AF. Additional information on daily reductions in Delta outflow are provided in Section 7.3, Fisheries Resources.

The estimate of a future average annual 50,000 AF reduction in Delta outflow as a result of the proposed project is a conservative one because in the future the conditions that allowed increased pumping at Banks Pumping Plant as a result of water supply management practices are likely to become even more infrequent than they were between 1996 and 2004. However, as demand increases the advantages provided by the water supply management practices would increase their attractiveness to contractors so it was assumed that future Delta outflow reductions would be the same as those that would have occurred in the past with the groundwater storage assumptions in Study No. 3.

Summary of Effects of Proposed Project on Stream Flow and Delta Outflow

The retirements and transfers of Table A amounts and the altered allocation procedures that are part of the Monterey Amendment would have very little effect on average or monthly flows in the Feather and Sacramento rivers or Delta outflow compared to the baseline scenario under 2020 conditions.

There are minimum in-stream flow requirements for the Sacramento River below Shasta Dam and for the Feather River below Oroville Dam. The proposed project does not affect the dam operator's obligations with respect to minimum flows. Minimum flow requirements would be the same with the proposed project and under the baseline scenario.

Some of the water supply management practices that are a part of the proposed project affected Delta outflow between 1996 and 2004. The same water supply management practices are expected to reduce Delta outflow in the future by about 50,000 AF per year. The reduction would represent about 0.35 percent of average annual Delta outflow.

The Bay-Delta WQCP contains minimum requirements for Delta outflow. The proposed project does not effect the obligations of those that divert water from the Delta with respect to the minimum requirements established in D-1641. Delta outflow requirements would be the same with the proposed project and under the baseline scenario.

No significance findings were made with respect to the impacts of the proposed project on river flow or Delta outflow under 2020 conditions. Significance findings are made later in this EIR with respect to the impacts on water quality and biological resources produced by changes in river flow and Delta that are a consequence of the proposed project.

7.1-2 The proposed project could potentially change ambient water quality in the Feather, Sacramento, American and San Joaquin rivers.

1996 — 2003

Water quality in the rivers varies seasonally and is dependent on discharge. If the proposed project substantially altered discharge in the Feather, Sacramento, American and San Joaquin rivers it could also affect water quality. Stream flow changes would not be expected to affect the concentration of particulate matter, dissolved minerals or dissolved organic substances in river water. Precipitation contains small amounts of dissolved minerals. Concentrations of dissolved substances in river water increase in a downstream direction as surface runoff, infiltrating groundwater and municipal and agricultural wastewater discharges add dissolved minerals and organic substances. Because the proposed project does not involve any change in mass emission of dissolved substances to the Feather, Sacramento, American and San Joaquin rivers it would not change ambient concentrations of these substances. Concentrations of particulate matter in river water, measured as turbidity, increase in storms as precipitation washes soil from the land surface and flood flows erode the beds and banks of rivers. Flow changes in the range attributable to the proposed project would have a negligible effect on turbidity.

The only water quality characteristic of importance that could be affected by flow changes attributable to the proposed project is water temperature. Water temperature in flowing streams depends on flow, the source of the water, air temperature and solar radiation. In managed streams such as the Feather, Sacramento, American and San Joaquin, water temperature is often strongly influenced by the release of cool water from reservoirs.

As described above under Impact 7.1-1, the Table A transfers and retirements and the altered water allocation procedures that are part of the proposed project would have no effect on flow in the American and San Joaquin rivers. These elements of the proposed project would alter flow in the Feather and Sacramento rivers by less than 0.15 percent compared to the baseline scenario. Studies undertaken as part of the EWA EIS/EIR examined the effects of flow changes on water temperature in the Feather and Sacramento River. The studies indicate that flow changes of 0.15 percent or less are insufficient to have an effect on water temperature. As a result, it was concluded that the Table A transfers and retirements and the altered water allocation procedures that are a part of the proposed project would have no effect on water temperature in the Feather and Sacramento rivers.

As described under Impact 7.1-1, several of the water supply management practices that are a part of the proposed project affected Delta outflow in some months between 1996 and 2004 but none affected flow in the Sacramento, Feather, American or San Joaquin rivers. Therefore, none of the water supply management practices affected water quality in the rivers. The proposed project had a ***less-than-significant impact*** on water quality in the Feather, Sacramento, American and San Joaquin rivers between 1996 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

For reasons noted above, the only water quality characteristic of importance that could be affected by flow changes attributable to the proposed project is water temperature. The proposed project would have no measurable effect on flow in the Feather, Sacramento, American and San Joaquin rivers in 2020 relative to the baseline scenario. Therefore, it would have a ***less-than-significant impact*** on water quality including water temperature in 2020 compared to the baseline scenario.

Mitigation Measures

None required.

7.1-3 The proposed project could potentially change water quality in the Delta and the San Francisco Bay Estuary.

1996 — 2003

Water quality in the Delta varies seasonally and is primarily dependent on Delta inflow and the rate of water diversions from the Delta. Water quality in the San Francisco Bay Estuary depends on Delta outflow. If the proposed project substantially altered Delta inflow or the rate of diversion from the Delta it could also affect Delta water quality. If the proposed project substantially altered Delta outflow it could affect water quality in the San Francisco Bay Estuary.

As described above under Impact 7.1-1, the Table A transfers and retirements and the altered water allocation procedures that are a part of the proposed project would have a negligible effect on inflow to the Delta under 2003 conditions. The Table A transfers and retirements and altered allocation methods would result in a less than 0.15 percent change in annual and monthly flow into the Delta from the Feather and Sacramento rivers and no change in flow from the San Joaquin and American rivers. Total deliveries to the SWP contractors with the proposed project and under the baseline scenario under 2003 conditions would be very similar. Consequently, the effects of slightly altered proportional deliveries north and south of the Delta on diversions from the Delta and Delta outflow would be minimal.

The CALSIM II model was used to examine the effects of Table A transfers and retirements and the altered allocation on the average annual value of various Delta parameters under 2003 conditions. The results of the analysis are shown in Table 7.1-14. The estimates include the effects of the Table A transfers and retirements and the altered water allocation procedures but not the water supply management practices. An important parameter with respect to water quality is the average position of X2, the 2,000 mg/L isohaline. The position of X2 is measured as the distance in kilometers from the Golden Gate. As shown in Table 7.1-14, the Table A transfers and retirements and the altered water allocation procedures that are a part of the proposed project would have no effect on the average location of X2 in most hydrologic year types compared to the baseline scenario. In wet years, it would shift the position of X2 by 0.1 kilometers toward the Golden Gate.

The Monterey Amendment enables the use of certain water supply management practices that would not occur under the baseline scenario. Some of the water supply management practices resulted in an increase in the amount of water diverted from the Delta by the SWP between 1996 and 2004 under certain conditions as described under Impact 7.1-1. These conditions can occur when all SWP storage south of the Delta is full, all contractors' SWP water needs have

TABLE 7.1-14

AVERAGE ANNUAL DELTA PARAMETERS UNDER 2003 CONDITIONS ESTIMATED USING CALSIM II[a]

	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I Ratio
1995						
All Years	14,435.0	5,551.4	2,945.0	87.3	75.8	0.36
Wet Years	27,790.3	6,801.7	3,628.8	96.7	68.9	0.31
Above Normal Years	16,903.8	6,609.0	3,364.8	144.1	73.6	0.37
Below Normal Years	9,858.7	5,466.6	3,104.2	85.9	76.9	0.40
Dry Years	6,653.3	4,593.3	2,673.2	81.0	79.9	0.42
Critical Years	4,720.6	3,858.4	1,575.3	33.2	82.6	0.34
2003 Baseline						
All Years	14,656.6	5,609.0	3,000.2	147.7	75.6	0.35
Wet Years	28,007.7	6,821.2	3,592.9	186.0	68.9	0.30
Above Normal Years	17,153.2	6,778.5	3,436.5	181.6	73.5	0.36
Below Normal Years	9,687.8	5,441.9	3,240.0	179.7	77.0	0.40
Dry Years	6,375.0	4,577.5	2,712.8	123.6	79.9	0.40
Critical Years	4,751.7	3,958.3	1,647.7	43.3	82.5	0.32
2003 Proposed Project						
All Years	14,699.0	5,603.6	2,959.5	142.3	75.6	0.35
Wet Years	28,068.5	6,819.1	3,542.9	178.4	68.8	0.30
Above Normal Years	17,186.4	6,769.4	3,389.3	177.0	73.5	0.35
Below Normal Years	9,742.0	5,425.2	3,188.2	172.7	77.0	0.40
Dry Years	6,413.0	4,578.0	2,675.4	120.3	79.9	0.40
Critical Years	4,759.9	3,956.1	1,638.5	40.1	82.5	0.32

Note:
a. Includes effects of Table A transfers and retirements and altered water allocation procedures. Does not include effects of water supply management practices.

been met, EWA debt in San Luis Reservoir has been paid and unused pumping capacity is available at Banks Pumping Plant.

The Monterey Amendment enables the use of certain water supply management practices that would not occur under the baseline scenario. Some of the water supply management practices resulted in an increase in the amount of water diverted from the Delta by the SWP between 1996 and 2004 under certain conditions as described under Impact 7.1-1. These conditions can occur when all SWP storage south of the Delta is full, all contractors' SWP water needs have been met, EWA debt in San Luis Reservoir has been paid and unused pumping capacity is available at Banks Pumping Plant.

Under the proposed project, an estimated 44,000 additional AF of water was pumped from the Delta between 1996 and 2004 than under the baseline scenario. Most of the increased pumping under the proposed project occurred in the wet months of wet years. Increased pumping as a result of the water supply management practices would be expected to shift the position of X2 upstream by a small but undetermined amount in the wet winter months when the extra pumping occurred. The average monthly position of X2 varies seasonally and is at its most downstream location in the late fall and winter when any effects of increased pumping would be felt. The position of X2 in the wet months of wet years is typically between the Benicia Bridge and the eastern end of San Pablo Bay.

Although the proposed project would shift the position of X2 slightly, it would not alter the SWP's and CVP's obligations to meet standards for the location of X2 within the Delta at certain seasons and under different hydrologic conditions. Movement of X2 as a result of the proposed project could alter water salinity at some locations in Suisun Bay and the Delta slightly compared to the baseline scenario but the changes would be too small to be measurable or to affect beneficial uses.

Freshwater inflow from the Delta is the primary determinant of water quality in the San Francisco Bay Estuary. The small differences between Delta outflow under the proposed project and the baseline scenario that result from the retirements and transfers of Table A amounts and the altered water allocation procedures would have little effect on water quality in the estuary. The decrease in Delta outflow in the wet winter months when the water supply management practices enabled extra pumping would prevent X2 from moving as far into the San Francisco Bay Estuary as it would have under the baseline scenario. As noted above, any change, in location of X2 attributable to this increased pumping would occur when monthly average X2 is at its seasonally most downstream location.

The proposed project had a ***less-than-significant impact*** on water quality in the Sacramento-San Joaquin Delta and the San Francisco Bay Estuary between 1996 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

Water quality in the Delta varies seasonally and is primarily dependent on Delta inflow and the rate of water diversions from the Delta. Water quality in the San Francisco Bay Estuary depends on Delta outflow. If the proposed project substantially altered Delta inflow or the rate of diversion from the Delta it could also affect Delta water quality. If the proposed project substantially altered Delta outflow it could affect water quality in the San Francisco Bay Estuary.

As described above under Impact 7.1-1, the Table A transfers and retirements and the altered water allocation procedures that are a part of the proposed project would have a negligible effect on inflow to the Delta under 2020 conditions. Diversion of water from the Delta could be affected by the Table A transfers and retirements, the altered water allocation procedures and by the water supply management practices.

The CALSIM II model was used to estimate the value of various Delta parameters under 2020 conditions. The estimates are shown in Table 7.1-15. The estimates account for the Table A transfers and retirements and the altered water allocation procedures but not the new water supply management practices. An important parameter with respect to water quality is the average position of X2, the 2,000 mg/L isohaline. As shown in Table 7.1-15, the Table A transfers and retirements and the altered water allocation procedures that are a part of the proposed project would have no effect on the average location of X2 in most hydrologic year types compared to the baseline scenario. In dry years, it would shift the position of X2 by 0.1 kilometers toward the Golden Gate.

TABLE 7.1-15

AVERAGE ANNUAL DELIVERIES TO FEATHER RIVER WATER RIGHTS CONTRACTORS ESTIMATED USING CALSIM II (TAF/Year)

Scenario	Demand	Delivery					
		All Years	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
1995 Baseline	796.0	762.1	787.3	792.4	788.5	794.0	619.7
2003 Baseline	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 Proposed Project	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2020 Baseline	796.0	760.0	783.9	789.5	786.8	793.0	618.7
2020 Proposed Project	796.0	760.0	783.9	789.5	786.8	793.0	618.7

The Monterey Amendment enables the use of certain water supply management practices that would not occur under the baseline scenario. As described under Impact 7.1-1, the water supply management practices could reduce Delta outflow by an average of 50,000 AF per year in the future. The reductions in outflow would occur in some wet months of wet years at the time when Delta outflow is at its seasonal maximum. The changes in flow would be small and would have a ***less-than-significant impact*** on water quality in the Delta or the San Francisco Bay Estuary in 2020, relative to the baseline scenario.

Mitigation Measures

None required.

7.1-4 The proposed project could potentially change water levels and water quality in Lake Oroville, San Luis Reservoir, Castaic Lake and Lake Perris.

1996 — 2003

Lake Oroville

The proposed project would not change the Department's operating objectives for Lake Oroville but water storage and water surface elevations in Lake Oroville would be affected by the Table A transfers and retirements and the altered water allocation procedures. Water storage and water surface elevations in Oroville Reservoir would not be affected by the water supply management practices.

The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in Lake Oroville under 2003 conditions. Average annual storage in Lake Oroville with the Table A transfers and retirements and the altered water allocation procedures under 2003 conditions would be about 34,000 AF greater than under the baseline scenario (an increase of about 1.5 percent). An average annual increase in storage of this amount would not raise the water surface elevation by more than a foot or two.

The primary influences on water quality in Lake Oroville are conditions in the watershed from which it originates. Some minor changes in water quality, for example total dissolved solids, plant nutrient and total organic carbon content, typically occur as a result of physical, chemical and biological processes in the reservoir. Water temperature typically increases in the upper 75 feet of the water column in reservoirs in the Sierra Nevada in the summer. The changes in storage and water level attributable to the proposed project that occurred between 1996 and 2003 were too small to affect these processes. Water quality in Lake Oroville with the proposed project was probably the same as under the baseline scenario. The proposed project had no affect on the reservoir's ability to support its designated beneficial uses.

San Luis Reservoir

The proposed project would not change the Department's operating objectives with respect to San Luis Reservoir but it could affect water storage and water surface elevations in the reservoir. Water storage in the reservoir could be affected by the Table A transfers and retirements, the altered water allocation procedures and the water supply management practices.

The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in San Luis Reservoir under 2003 conditions. Average annual storage in the SWP's share of San Luis Reservoir with the Table A transfers and retirements and the altered water allocation procedures under 2003 conditions would be about 46,000 AF greater than under the baseline scenario (an increase of about 8 percent). An annual average increase in storage of this amount could raise the water surface elevation by ten or twenty feet.

Between 1996 and 2004, the Department's historical operations analysis (Study No.2) showed that the proposed project resulted in a net increase in deliveries of SWP water. These increased deliveries delayed the Department's filling of its storage space in San Luis Reservoir in some years, usually by a matter of days, and in some months lowered SWP storage in San Luis Reservoir by several tens of thousands of AF. As a result, the proposed project lowered water surface elevations in San Luis Reservoir by five feet or less compared to the baseline scenario at times.

Delayed filling of San Luis Reservoir could affect water quality in several ways. The total dissolved solids content of water pumped into the reservoir may change because the total dissolved solids content of Delta water varies seasonally. Reduced storage could result in increased water temperature and reduced water surface area and evaporation. Reduced evaporation could have a minor beneficial effect on total dissolved solids content. Any changes in total dissolved solids content and water temperature attributable to the proposed project would not be expected to affect beneficial uses of the reservoir. Any change in total dissolved solids content would be insufficient to affect the reservoir's beneficial use designation for water supply. Any change in water temperature would be insufficient to affect the reservoir's designation as a warm-water fishery.

When water storage in San Luis Reservoir is less than 300,000 AF, excessive growth of algae degrades water quality. Although the proposed project may have reduced storage in San Luis Reservoir at times between 1996 and 2003 relative to the baseline condition, total storage in the reservoir by the SWP and the CVP did not fall below 300,000 AF. (See Impact 7.1-5 for a description of the effects of the proposed project on the quality of contractors' water supplies.)

Castaic Lake

The Department typically draws down storage in Castaic Lake in the summer and early fall to meet peak water demands. It refills the reservoir in the winter and spring with water from the Delta and local runoff. Figure 7.1-4 shows storage in Castaic Lake between 1975 and the present. The reservoir was cycled annually and on occasion drawn down substantially. Between 1975 and 1995, the average water surface elevation was 1474.3 feet above mean sea level.

Article 54 of the Monterey Amendment, provides that the three contractors that can obtain water from Castaic Lake and Lake Perris may borrow water from the reservoirs provided the borrowing contractor replaces it within five years. Article 54 is referred to as the flexible storage provision. The effects of the flexible storage provision on SWP operations are described in Chapter 6.

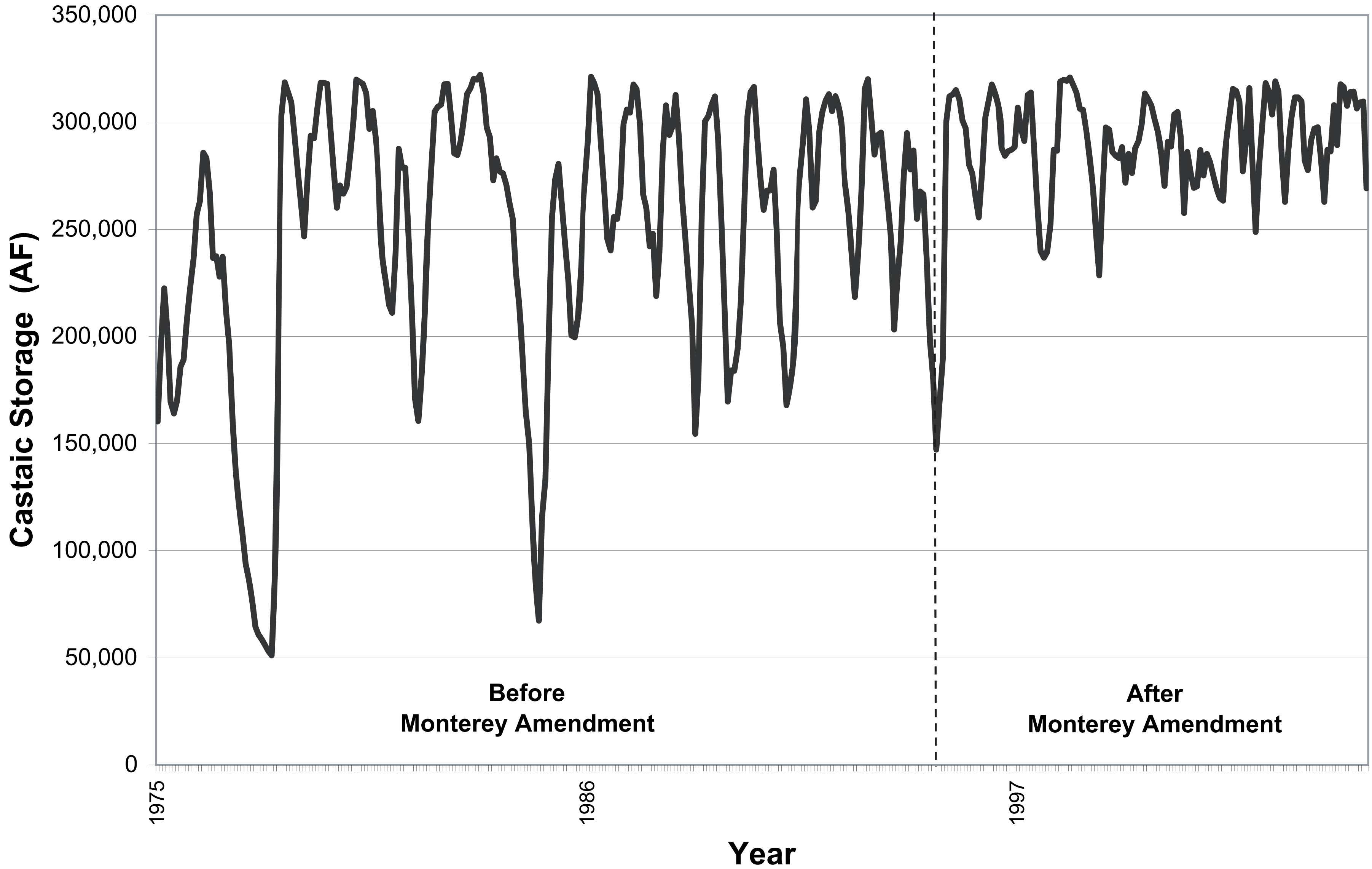
Between 1996 and 2003, two of the three eligible contractors, MWDSC and Castaic Lake WA, used the flexible storage provision and borrowed water from Castaic Lake. Information on the use of flexible storage in Castaic Lake between 1996 and 2003 including dates of withdrawals and replacements is provided in Table 6-26. MWDSC withdrew water from Castaic Lake on three occasions. Withdrawals ranged from 14,300 to 77,804 AF. The longest period between withdrawal and replacement by MWDSC was eighteen months. Castaic Lake WA also withdrew water from Castaic Lake on three occasions. Withdrawals ranged from 395 to 2,598 AF. The longest period between withdrawal and replacement by Castaic Lake WA was 37 months.

As indicated in Figure 7.1-4, after execution of the Monterey Amendment, Castaic Lake continued to be cycled annually but the cycles were smaller in amplitude than in the period from 1975 to 1995 despite the periodic borrowing by contractors described above. In that period, the difference between the highest and lowest water surface elevations averaged about 12 feet as compared to 33 feet in the period 1975 to 1995. Also, the average water surface elevation between 1996 and 2003 was 1497.7 feet above mean sea level, about 23 feet higher than between 1975 and 1995.

Several factors contributed to the reduced cycling and increased water surface elevations in Castaic Lake after 1995. Although borrowing by contractors reduced storage and water surface elevations in the reservoir at times, several other factors tended to increase storage and water surface elevations. They included reduced storage of local runoff due to additional fish release requirements and a series of wet years in the late 1990s. In addition, the Department was able to accommodate borrowing of water from Castaic Lake by reducing its annual summer drawdown of the reservoir compared to pre-Monterey Amendment conditions.

Under the baseline scenario, it was assumed that contractors would not have been able to borrow water from Castaic Lake. Furthermore, the Department would not have altered its operation of the reservoir to accommodate borrowing and, between 1996 and 2003, Castaic Lake would have been operated in the same way as it was between 1975 and 1995.

Changes in water storage and water levels in Castaic Lake may have affected water quality. Increased and more frequent refilling of the reservoir from the Delta could affect water quality because the total dissolved solids content of Delta water varies seasonally. Total dissolved solids content of Castaic Lake waters could increase or decrease depending on the timing of the refilling. Reduced storage could result in increased water temperature and reduced



Source: MWDSC, 2006.

FIGURE **7.1-4**
Castaic Lake Storage Levels Before and After Monterey Amendments

evaporation, which could have a minor effect on total dissolved solids content. The fluctuations in storage in Castaic Lake after implementation of the Monterey Amendment were generally less than in the period before the Monterey Amendment. Accordingly, seasonal changes in water quality in Castaic Lake, attributable to post-Monterey Amendment reservoir operations, were probably less than the changes that occurred before 1995. Any change in water quality that occurred was too small to affect the reservoir's ability to support its designated beneficial uses between 1996 and 2003.

Lake Perris

The Department typically draws down storage in Lake Perris in the summer and early fall to meet peak water demands. It refills the reservoir in the winter and spring with water from the Delta. Figure 7.1-5 shows storage in Lake Perris between 1975 and the present. The reservoir was cycled annually and on occasion drawn down substantially. Between 1975 and 1995, the average water surface elevation was 1580 feet above mean sea level.

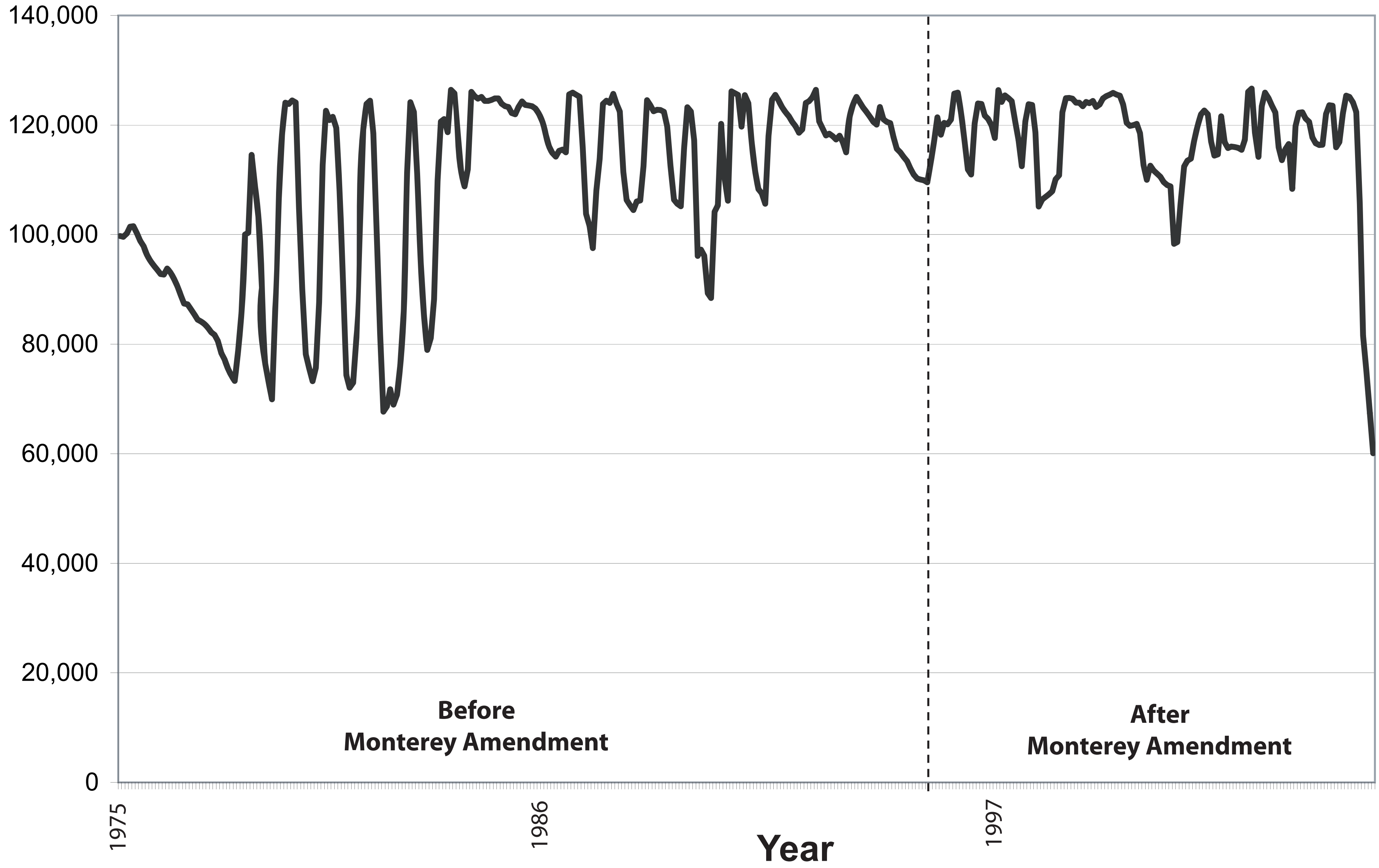
Article 54 of the Monterey Amendment, provides that the three contractors that can obtain water from Castaic Lake and Lake Perris may borrow water from the reservoirs provided the borrowing contractor replaces it within five years. By agreement, MWDSC is the only contractor that may withdraw water from Lake Perris under Article 54. Article 54 is referred to as the flexible storage provision. The effects of the flexible storage provision on SWP operations are described in Chapter 6.

MWDSC borrowed water from Lake Perris on three occasions between 1996 and 2003. Withdrawals ranged from 8,181 to 17,993 AF. The longest period between withdrawal and payback was twelve months.

As indicated in Figure 7.1-5, after execution of the Monterey Amendment, Lake Perris continued to be cycled annually but the cycles were smaller in amplitude than in the period 1974 to 1995 despite the periodic borrowing by MWDSC described above. In that period, the difference between the highest and lowest water surface elevations averaged about 4 feet as compared to10 feet in the period 1975 to 1995. Also, the average water surface elevation between 1996 and 2003 was 1584.1 feet above mean sea level, about 4 feet higher than between 1975 and 1995.

Although borrowing by MWDSC after 1995 reduced storage and water surface elevations in the Lake Perris at times, two other factors tended to increase storage and water surface elevations. One factor was a series of wet years in the late 1990s. In addition, the Department was able to accommodate borrowing of water from Lake Perris by reducing its annual summer drawdown of the reservoir compared to pre-Monterey Amendment conditions.

Changes in water storage and water levels in Lake Perris could affect water quality in the same way as was described above for Castaic Lake. Increased and more frequent filling of Lake Perris could improve water quality because currently reduced filling allows water quality to deteriorate. The fluctuations in storage in Lake Perris after implementation of the Monterey Amendment were generally less than in the period before the Monterey Amendment so this may have caused some deterioration of water quality. However, any changes were too small to affect the reservoir's ability to support most of its designated beneficial uses between 1996 and 2003.



Source: MWDSC, 2006.

FIGURE 7.1-5
Lake Perris Storage Levels Before and After Monterey Amendments

D50680.00

Monterey Amendment and Settlement Agreement DEIR

<u>Summary of Effects on Reservoirs</u>

The proposed project affected water levels in Lake Oroville, San Luis Reservoir, Castaic Lake and Lake Perris between 1996 and 2003. As a result of the change in water levels, some minor changes in water quality probably occurred. Any changes in water quality that occurred were not of sufficient magnitude to affect the water bodies' ability to support their designated beneficial uses. The proposed project had a ***less-than-significant impact*** on water quality in Lake Oroville, San Luis Reservoir, Castaic Lake and Lake Perris.

<u>Mitigation Measures</u>

None required.

Future Impacts

<u>Lake Oroville</u>

The proposed project would not change how the Department operates Lake Oroville but water storage and water surface elevations in Lake Oroville would be affected by the Table A transfers and retirements and the altered water allocation procedures. Storage and water surface elevations in Lake Oroville would not be affected by the water supply management practices.

The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in Lake Oroville. Average annual storage in Lake Oroville with the Table A transfers and retirements and the altered water allocation procedures under 2020 conditions would be about 7,000 AF greater than under the baseline scenario (an increase of about 0.3 percent). The increase in storage would not raise the water surface elevation by more than a fraction of a foot and would have no measurable effect on water quality.

<u>San Luis Reservoir</u>

The proposed project would not change the Department's operating objectives with respect to San Luis Reservoir but it could affect water storage and water surface elevations in the reservoir. Water storage in the reservoir could be affected by the Table A transfers and retirements, the altered water allocation procedures and the water supply management practices.

The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in San Luis Reservoir under 2020 conditions. Average annual storage in the SWP's share of San Luis Reservoir with the Table A transfers and retirements and the altered water allocation procedures under 2020 conditions would be about 60,000 AF greater than under the baseline scenario (an increase of about 13 percent). An annual average increase in storage of this amount could raise the water surface elevation by ten or twenty feet.

Using historical data from the period 1996 through 2004, the Department determined that in the future the water supply management practices would increase average annual deliveries of SWP water by about 50,000 AF per year, which would delayed the filling of San Luis Reservoir by several months on occasion (Study No. 3). Thus, the water supply management practices would lower storage and water levels in San Luis Reservoir at times.

It is expected that the effects of the water supply management practices on SWP deliveries would the filling of San Luis Reservoir would decline in the future. This is because opportunities for groundwater storage of SWP water outside contractors' service areas would be less frequent in the future than between 1996 and 2004 and use of the turnback pool declines. The water supply management practices would continue to cause delayed filling of San Luis Reservoir in the future but the delays would probably become smaller and smaller as demand for SWP water increases and opportunities to store SWP water in excess of a contractor's current year's needs decline.

Delayed filling of San Luis Reservoir could affect water quality in several ways as described above for the period 1996 through 2003. Most changes in water quality of reservoir waters, attributable to the proposed project, would be expected to be small and insufficient to affect beneficial uses.

Castaic Lake and Lake Perris

The effects of borrowing of water on water surface elevations in Castaic Lake and Lake Perris in the future will depend on the extent to which the contractors that can borrow water from the reservoirs make use of Article 54 and on future hydrologic conditions. Table 6-28 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would draw down the reservoirs to a greater extent than occurred between 1996 and 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoirs could remain drawn down for five years. Although the worst-case condition could occur, it would be unlikely.

Changes in water storage and water levels in the two terminal reservoirs could affect water quality. Increased and more frequent refilling of the reservoirs from the Delta could affect water quality because the total dissolved solids content of Delta water varies seasonally. The total dissolved solids content of reservoir water could increase or decrease depending on the timing of the refilling. Reduced storage could result in increased water temperature and reduced evaporation. Reduced evaporation could affect total dissolved solids content. However, it is expected that any changes in overall water quality in the reservoirs would be small because the primary water source would remain the same, the Delta. Depending on how far the reservoirs were drawn down, water temperature could rise considerably. Increased and more frequent refilling of Lake Perris would likely improve water quality because limited cycling of water in the reservoir currently causes water quality to deteriorate as a result of evaporation and recreational use.

Summary of Effects on Reservoirs

The proposed project would affect water levels and water quality in San Luis Reservoir, Castaic Lake and Lake Perris in the future. The changes in water quality would not be of a magnitude that could affect the water bodies' ability to support their designated beneficial uses. The proposed project would have a ***less-than-significant impact*** on water quality in Lake Oroville, San Luis Reservoir, Castaic Lake and Lake Perris.

Mitigation Measures

None required.

7.1-5 The proposed project could potentially change the quality of water supplies for SWP contractors and the water agencies they serve.

1996 — 2003

Almost all the water supplied to contractors by the SWP is diverted from the Sacramento-San Joaquin Delta. The quality of Delta water varies annually and seasonally, as does the quality of water diverted by the SWP. The quality of water diverted by the SWP also depends on the location of the diversion point.

Some additional SWP water was diverted into the North Bay Aqueduct as a result of the proposed project between 1996 and 2003 as compared to the baseline scenario. This was primarily the result of the transfer of Table A amounts from KCWA to Napa County FC&WCD and Solano County WA. Water was diverted into the North Bay Aqueduct at Barker Slough near the northern extremity of the Delta. Water quality in the northern parts of the Delta is similar to water quality in the lower reaches of the Sacramento River. As noted previously (see Impacts 7.1-1 and 7.1-2), the proposed project had little or no effect on flow or water quality in the Sacramento River between 1996 and 2003. Therefore, it would have had little or no effect on water quality delivered to users of the North Bay Aqueduct.

Most of the time between 1996 and 2004 the proposed project had no effect on the rate of diversion of water from the Delta by the SWP or water quality in the Delta at the Banks Pumping Plant. Some additional SWP water (44,000 AF) was diverted at the Banks Pumping Plant during wet months of wet or above normal years as a result of the proposed project. The additional diversions occurred in January 1998, February and March 1999, February and March in 2000, and March 2004. They occurred during periods of high Delta outflow and did not affect compliance with Delta standards established by D-1641. As discussed above in Impact 7.1-3, the additional diversions, attributable to the water supply management practices, may have shifted X2 slightly eastward compared to the baseline condition. However, any increase in salinity in Suisun Bay or the western Delta would be unlikely to have much effect on water quality at the SWP diversion point in the southern Delta. During the wet months of wet and above normal years the salinity of water at the Banks Pumping Plant is usually below its annual average of 258 mg/L. Even if the increased diversion had some effect on the salinity at the SWP diversion point, the effect would be small and would not threaten compliance with secondary drinking water standards.

Because the proposed project had little effect on water quality at the SWP diversion point between 1996 and 2003, it had little effect on water quality in the California Aqueduct and San Luis Reservoir or the quality of water supplied to Castaic Lake and Lake Perris from the aqueduct. The borrowing of water from Castaic Lake and Lake Perris between 1996 and 2003 could have had some effect on water quality in the reservoirs but if it did any effects would have been minor (see Impact 7.1-4). Because the proposed project had no effect or little effect on water quality in SWP facilities south of the Delta, it did not increase the need for water treatment or make compliance with SDWA standards more difficult.

Between 1996 and 2004, the contractors placed more than one million AF of SWP water in storage in groundwater basins outside their service areas in Kern County. Approximately, 686,357 AF more SWP water was placed in groundwater storage outside the contractors' service areas with the Monterey Amendment than under the baseline scenario. When contractors wish to withdraw water from storage it is pumped from the groundwater basin and delivered to the California Aqueduct or obtained through an in-lieu exchange with a storage partner with direct access to the groundwater basin. In an in-lieu exchange, a contractor that has placed SWP water in groundwater storage allows its storage partner to pump the stored groundwater for use in the partner's' service area. In return, the contractor takes delivery of some of the storage partner's allocated SWP water from the California Aqueduct that would otherwise have been delivered to the partner.

SWP water that has been placed in groundwater storage and then pumped out of the ground and into the California Aqueduct would have different characteristics than water flowing in the aqueduct. The addition of groundwater could affect the quality of water in the aqueduct. Stored water returned by an in-lieu exchange would have no effect on water quality in the California Aqueduct.

Between 1996 and 2003, only a small portion of the water placed in groundwater storage outside contractors' service areas was recovered, most of it by in-lieu exchanges, and so the potential for changes in water quality in the California Aqueduct were limited. Also, any water introduced into the aqueduct would have to meet the Department's acceptance criteria for non-SWP water. Because of this, groundwater storage and reintroduction of water to the California Aqueduct between 1996 and 2003 did not make compliance with SDWA standards more difficult. In fact, because groundwater generally has a lower TOC content than Delta water, the introduction of groundwater into the aqueduct may have made it slightly easier to treat.

The proposed project had a ***less-than-significant impact*** on the quality of the SWP contractors' SWP water supplies.

<u>Mitigation Measures</u>

None required.

Future Impacts

The expected future effects of the proposed project on water quality in the Sacramento River, the Delta and the SWP reservoirs are described in Impacts 7.1-2, 7.1-3 and 7.1-4, respectively. None of the water quality changes would be sufficient to increase the need for water treatment to maintain current levels of drinking water quality or make compliance with the SDWA more difficult. The proposed project would have a ***less-than-significant impact*** on the quality of the contractors' SWP water supplies.

<u>Mitigation Measures</u>

None required.

7.1-6 The proposed project could potentially alter the availability and quality of water supplies for the Feather River water rights contractors.

1996 — 2003

The CALSIM II model was used to simulate the effects of the transfers and retirements of Table A amount and the altered water allocation procedures that are a part of the Monterey Amendment on the Feather River water rights contractors under 2003 conditions. The results of the simulation for the baseline scenario and the proposed project under 2003 conditions and under different hydrologic year types are shown in Table 7.1-15. There is no difference between the deliveries to the Feather River water rights contractors under the two scenarios. Consequently, the transfers and retirements of Table A amounts and the altered water allocation procedures would have no effect on deliveries to the Feather River water rights contractors. The water supply management practices would have little or no effect on deliveries to the Feather River water rights contractors.

The Table A transfers and retirements and the altered water allocation procedures affected average annual and average monthly flow in the Feather River by no more than 0.15 percent relative to the baseline scenario between 1996 and 2003. Flow changes of this magnitude were too small to have any effect on water quality at the diversion points of the Feather River water rights contractors.

The proposed project had a ***less-than-significant impact*** on the availability of water to the Feather River water rights contractors and the quality of their supplies between 1995 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

The CALSIM II model was used to simulate the effects of the transfers and retirements of Table A amount and the altered water allocation procedures that are a part of the Monterey Amendment on the Feather River water rights contractors under 2020 conditions. The results of the simulation for the baseline scenario and the proposed project under 2020 conditions and under different hydrologic year types are shown in Table 7.1-15. There is no difference between the deliveries to the Feather River water rights contractors under the two scenarios. The water supply management practices would have little or no effect on deliveries to the Feather River water rights contractors in the future.

The proposed project would have a ***less-than-significant impact*** on the availability of water to the Feather River water rights contractors and the quality of their supplies in the future.

<u>Mitigation Measures</u>

None required.

7.1-7 The proposed project could potentially alter the availability and quality of water to the CVP and its contractors.

1996 — 2003

The proposed project could affect the availability of water to the CVP and the quality of water at its contractors' diversion points. CVP contractors north of the Delta could be affected by proposed project-induced changes in Sacramento River flow and Contra Costa WD could be affected by proposed project-induced changes in Delta outflow. CVP deliveries south of the Delta could be affected because at times the CVP uses the SWP's Banks Pumping Plant to divert water from the Delta. The proposed project could affect the availability of the Banks Pumping Plant for use by the CVP.

The CALSIM II model was used to simulate the effects of the transfers and retirements of Table A amount and the altered water allocation procedures that are a part of the Monterey Amendment on CVP deliveries south of the Delta (Study No. 4 in Appendix F). The results of the CALSIM II simulation for the baseline scenario and the proposed project under 2003 conditions and under different hydrologic year types are shown in Table 7.1-16. The differences between CVP deliveries under the two scenarios are less than 0.05 percent.

TABLE 7.1-16

AVERAGE ANNUAL DELIVERIES TO CENTRAL VALLEY PROJECT CONTRACTORS SOUTH OF THE DELTA ESTIMATED USING CALSIM II (TAF/Year)

Scenario	Demand	Delivery					
		All Years	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
1995 Baseline	3,460.0	1,762.5	2,224.7	2,078.4	1,859.7	1,605.8	725.9
2003 Baseline	3,460.0	1,741.9	2,238.0	2,049.5	1,858.3	1,562.3	657.0
2003 Proposed Project	3,460.0	1,740.0	2,246.0	2,053.2	1,844.0	1,552.8	656.9
2020 Baseline	3,460.0	1,737.4	2,353.1	2,070.5	1,797.0	1,542.5	682.9
2020 Proposed Project	3,460.0	1,733.9	2,356.4	2,067.3	1,801.2	1,515.8	687.6

A historical operations analysis data using from 1996 through 2004 was conducted to estimate the effects of the proposed project on SWP diversions at the Banks Pumping Plant (Study No. 2 in Appendix K). The Department estimated that the proposed project resulted in the pumping of an additional 44,000 AF of water from the Delta between 1996 and 2004. If the Banks Pumping Plant had not been used to pump this water for the SWP, the unused capacity would have been available to the CVP. The CVP makes use of available capacity in the SWP's Delta pumping facilities at times in accordance with an agreement between the Department and Reclamation to cooperatively use of the CVP's and SWP's Delta pumping facilities. The practice is referred to as Joint Point of Diversion or JPOD.

The Department analyzed the historical record and CALSIM II output to determine whether the proposed project prevented probable use of the Banks Pumping Plant by the CVP at any time between 1995 and 2005 (Study No. 6 in Appendix L). Any impacts would have been confined to those periods when the Banks Pumping Plant was operating at its full permitted capacity with the proposed project, but would have been operating at a reduced capacity under the baseline scenario. There are 12 months in the historical record when differences in pumping would have occurred.

The Department reviewed circumstances prevailing in each of the 12 months to determine whether the CVP would have been likely to use JPOD. The CVP would likely only use JPOD when it predicted that the CVP's share of San Luis Reservoir would not otherwise fill and when the energy costs associated with use of JPOD were acceptable. Between 1996 and 2005, the CVP's share of San Luis Reservoir storage filled in every year except 1997 when it fell short by a small amount, 40,000 AF. JPOD capacity was available in that year and Reclamation chose not to use it. Therefore, the Department concluded that any proposed project-induced change in the availability of capacity in the Banks Pumping Plant for the CVP between 1996 and 2005 would have no effect on the CVP's use of JPOD.

The proposed project had no effect on flows in the American and San Joaquin rivers and less than a 0.15 percent effect on flows in the Sacramento and Feather rivers and Delta outflow between 1996 and 2003 (see Impact 7.1-1). Flow changes of this magnitude are too small to have any effect on water quality at the diversion points of CVP contractors. Consequently, the proposed project would not affect water availability or quality at CVP diversion points.

The proposed project had a ***less-than-significant impact*** on water availability to the CVP and its contractors, or the water quality of water available to them, between 1996 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

The CALSIM II model was used to simulate the effects of the transfers and retirements of Table A amount and the altered water allocation procedures that are a part of the Monterey Amendment on the CVP deliveries south of the Delta under 2020 conditions. The results of the CALSIM simulation for the baseline scenario and the proposed project under 2020 conditions and under different hydrologic year types are shown in Table 7.1-17. The differences in CVP deliveries under the two scenarios are less than 1.5 percent, with slightly higher deliveries under the proposed project in most hydrologic year types.

As described in Chapter 6, the Department estimated that the water supply management practices could result in the Department pumping an average of an additional 50,000 AF per year of water in the future compared to the baseline scenario. Because the increased pumping would be partially offset by the effects of other provisions of the Monterey Amendment, primarily the Table A retirements, the actual increase in pumping would be somewhat less than 50,000 AF per year. If the Banks Pumping Plant were to be employed pumping this additional water for the SWP, the unused capacity available to the CVP would be reduced.

The Department conducted an historical analysis using the 73-year hydrologic record and CALSIM II output to determine the extent to which the future loss of availability of the Banks Pumping Plant to the CVP would affect CVP use of JPOD. The analysis was performed by reviewing CALSIM II estimates for the CVP's and SWP's storage in San Luis Reservoir for the proposed project and baseline scenarios. For various reasons, described in Appendix L, it is difficult to determine when the CVP would choose to use JPOD and so the Department decided to first determine the maximum potential future use of JPOD to fill the CVP's share of San Luis Reservoir.

The Department concluded that in six years of the 73-year hydrologic record the CVP could beneficially use JPOD. If the proposed project completely precluded the use of JPOD by the CVP the maximum effect would be a reduction in pumping availability of up to 100,000 AF in a single year and a maximum average effect of 5,000 AF per year. The reduction in pumping of

TABLE 7.1-17

AVERAGE ANNUAL DELTA PARAMETERS UNDER 2020 CONDITIONS ESTIMATED USING CALSIM II[a]

	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I Ratio
2020 BASELINE						
All Years	14,317.0	5,650.2	3,210.8	94.5	75.8	0.36
Wet Years	27,177.1	6,895.3	4,083.9	98.1	69.3	0.32
Above Normal Years	16,855.8	6,842.1	3,654.7	95.0	73.8	0.37
Below Normal Years	9,512.6	5,438.8	3,380.8	104.6	77.1	0.40
Dry Years	6,250.0	4,622.8	2,759.4	119.6	80.1	0.41
Critical Years	4,802.7	3,968.8	1,633.8	43.5	82.4	0.32
2020 PROPOSED PROJECT						
All Years	14,338.1	5,644.9	3,196.6	94.4	75.8	0.36
Wet Years	27,209.6	6,893.2	4,068.6	101.5	69.3	0.32
Above Normal Years	16,908.1	6,825.5	3,626.9	94.3	73.7	0.36
Below Normal Years	9,535.7	5,427.8	3,361.5	102.6	77.1	0.40
Dry Years	6,251.2	4,622.2	2,748.5	121.3	80.1	0.41
Critical Years	4,800.4	3,967.3	1,634.8	37.4	82.4	0.32

Note:
a. Includes effects of Table A transfers and retirements and altered water allocation procedures. Does not include effects of water supply management practices.

5,000 AF per year represents about 0.3 percent of the CVP's average annual pumping rate from the Delta at the Jones and Banks Pumping Plants. The actual impact of the proposed project on the CVP's use of JPOD would smaller, probably much smaller, than the maximum.

The proposed project would have a ***less-than-significant impact*** on water availability to the CVP.

<u>Mitigation Measures</u>

None required.

7.1-8 The proposed project could potentially change water quality in Plumas County streams.

The Settlement Agreement provides funds to Plumas County to improve environmental conditions in the Feather River watershed. Several projects funded between 2003 and 2005. Future projects are likely to be similar to those already funded.

Many of the projects already funded involve monitoring, environmental education, institutional capacity building and research. Projects of this type would likely ultimately benefit the environment but they would have no direct adverse environmental impacts. Some funded projects have involved or could involve construction activities that could have adverse effects on water quality. Each project type involving construction activities that are likely to be funded by the Settlement Agreement is discussed below. It is assumed in the analysis that none of the projects would have occurred under the baseline scenario.

The environmental analysis that follows is at a general or "program" level. The environmental effects of projects in Plumas County would be examined in more detail once the projects have been fully defined. If the environmental impacts of any project is determined to be potentially significant then environmental documents would be prepared pursuant to CEQA.

Most of the projects that would be built pursuant to the Settlement Agreement would have to comply with CWA requirements for stormwater disposal at construction sites. In conformance with the CWA the SWRCB adopted a State-wide general NPDES permit for stormwater discharges associated with construction activity (General Permit) in August 1999. Performance standards for obtaining and complying with the General Permit are described in NPDES General Permit No. CAS000002, Waste Discharge Requirements, Order No. 99.08 DWQ. The General Permit requires a General Construction Activity Stormwater Permit and preparation of a Stormwater Pollution Prevention Plan. Construction activities pursuant to the Settlement Agreement would be required to comply with the General Permit. The General Permit calls for the application of various best management practices (BMPs).

Examples of typical construction BMPs include: using temporary mulching, seeding, or other suitable stabilization measures to protect uncovered soils; storing materials and equipment to ensure that spills or leaks cannot enter the storm drain system or surface water; developing and implementing a spill prevention and cleanup plan; installing traps, filters, or other devices at drop inlets to prevent contaminants from entering storm drains; and using barriers, such as straw bales or plastic, to minimize the amount of uncontrolled runoff that could enter drains or surface water.

Dewatering during construction is sometimes necessary to keep trenches or excavations free of standing water when improvements or foundations/footings are installed. Clean or relatively pollutant-free wastewater that poses little or no threat to water quality may be discharged directly to surface water under certain conditions. RWQCBs have adopted a general NPDES permit for short-term discharges of small volumes of wastewater from certain construction-related activities. Permit conditions for the discharge of these types of wastewater to surface water are specified, for example, in "General Order for Dewatering and Other Low-Threat Discharges to Surface Waters" (Order No. 5-00-175, NPDES No. CAG995001). Discharges may be covered by the permit provided they are (1) either four months or less in duration, or (2) the average dry weather discharge does not exceed 0.25 million gallons per day. Construction dewatering, well development water, pump/well testing, and miscellaneous dewatering/low-threat discharges are among the types of discharges that may be covered by the permit. The permit also specifies standards for testing, monitoring, and reporting, receiving water limitations, and discharge prohibitions. Construction activities related to the proposed project could result in dewatering.

Stream Restoration

Stream restoration projects typically involve re-vegetation of denuded stream banks with native species, removal of non-native species and may include fencing to exclude livestock from the riparian zone. Some projects may also involve re-grading of stream banks, placement of gravel and woody debris in stream channels and construction of side channels and refuges for juvenile fish. Construction and planting on stream banks and particularly in-stream construction may cause the discharge of sediment into stream waters. However, because the purpose of stream restoration is long-term environmental improvement, designers and builders of restoration projects typically take steps to limit the short-term adverse effects of construction.

Restoration projects involving clearing of stream banks and planting with native species often use biodegradable coir matting to prevent bank erosion until the new vegetation becomes established. Also, projects involving substantial amounts of ground disturbance would require a grading permit from a city or Plumas County. Grading permits are likely to require soil erosion control measures appropriate to the site, which might include use of silt fences, hydro-seeding, etc. If in-water work is necessary, a Stream Alteration Agreements (1601/1603 Agreements) with the California Department of Fish and Game would have to be executed in advance of work. The agreement would likely include environmental safeguards and may limit the months in which work can be undertaken.

The mitigation measures that would likely be required for stream restoration projects would limit the discharge of sediment to streams. Any effects on water quality would be minor and transitory, limited to the construction period and its immediate aftermath.

Prevention of Down-cutting and Gullying

Down-cutting occurs when loss of vegetation increases the rate of flow in a natural stream. The increased flow carves a larger and deeper channel, which often leads to falling groundwater levels and further loss of vegetation. Down-cutting can be prevented or lessened by creating a series of ponds and drop structures. Projects of this type have been approved for Jordan, Last Chance and Hosselkus Creeks.

Some streamside and in-stream work would be necessary to install the drop structures. Required mitigation measures and impacts on water quality would be similar to those for stream restoration projects. Any effects on water quality would be minor and transitory, limited to the construction period and its immediate aftermath.

Well Construction

A well-drilling project located near the City of Portola has been approved for the Grizzly Lake Resort improvement District. The wells are of small capacity and would have little impact on groundwater hydrology in a lightly populated area.

Well drilling typically produces a solid or slurry waste consisting of material removed from the new well. The waste consists of ground up soil and rock and varying quantities of water. In undeveloped areas, well-drilling cuttings are typically discharged into an earth pit where the solids settle out and the water is recycled as drilling fluid. In more developed areas, cuttings are stored in tanks or lined debris boxes and trucked to a landfill. If well drilling occurs near a surface water body, it is likely that the contractor would employ standard construction erosion control measures to prevent cuttings from being washed into the water body. It is unlikely that well-drilling projects would have any effect on water quality.

Road Improvements

Road improvements may be needed to lessen adverse impacts on streams. A road relocation project has been approved for the Last Chance Creek watershed. It is expected that road projects built pursuant to the Settlement Agreement would be unpaved. Construction of the roads would require building and grading permits from Plumas County. Permit conditions would require proper design of roadside drainage ditches and culverts and the application of soil erosion control measures appropriate to the site during construction. Any effects on water quality would be minor and transitory, limited to the construction period and its immediate aftermath.

Summary of Effects of Watershed Improvements

The proposed project would improve water quality conditions in Plumas County streams over the long-term as stream restoration and other similar projects matured and yielded beneficial results. Some ***less-than-significant impacts*** to water quality would occur during and immediately following construction.

Mitigation Measures

None required.

7.1-9 The proposed project could potentially affect the Environmental Water Account

The purpose of the EWA is to enable diversion of water from the Delta by the SWP and CVP to be reduced at times when at-risk fish species may be harmed or killed while preventing the uncompensated loss of water to SWP and CVP contractors. A description of the EWA is contained in Chapter 6.

The proposed project could affect the EWA if proposed project-induced increased pumping at the Banks Pumping Plant was occurring at times when the agencies administering the EWA initiate pumping reductions. Thus, an impact on the EWA can only occur at those times when Delta pumping would be cut back under the baseline scenario because all of the contractors' demands are met, all SWP storage is full and EWA debt is paid. As indicated in Chapter 6, such circumstances occurred infrequently in 1996 through 2004 and would occur infrequently in the future. If an impact on the EWA occurred it would increase EWA debt compared to the baseline scenario.

The Department conducted a study using historical data from 1996 through 2004 to estimate the likely effect of the proposed project on the EWA (Study No. 7 in Appendix M). Many variables are involved in the analysis so it is unavoidably speculative.

1996 — 2003

The EWA began operation in December 2000. As indicated in Chapter 6, there were six occasions from 1996 though 2004 when the proposed project enabled increased pumping at the Banks Pumping Plant. Only one month was identified in the period between EWA commencement and the end of 2004 when both an EWA fish action and a proposed project-induced increase in pumping at the Banks Pumping Plant would have occurred. Because the fish action and proposed project-induced increased pumping occurred at different times in the month, it was concluded that the proposed project would have no impact on the EWA from 2000 to 2004.

Future

The Department estimated that in the future, the proposed project would enable an increase in pumping at the Banks Pumping Plant of 50,000 AF per year and that, using the 1996 through 2004 hydrology, increased pumping would occur in 11 months in the nine year period

(108 months). The Department estimated that the proposed project could affect the EWA in three of the nine years. The affect could increase the EWA debt by an average of 27,000 AF in the years that an increase in pumping could occur. The EWA has averaged about 250,000 AF of pumping curtailments at the Banks and Jones Pumping Plants from 2001 through 2006. Thus, the proposed project could increase EWA debt by about 10-percent in years when curtailments occurred.

If the EWA program continues in the future, the proposed project could increase its cost. However, because this is an economic and not a physical environmental impact no significance conclusions were drawn.

Mitigation Measures

None required.

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12. California Urban Water Agencies, *The Delta*, 1993.

13. Average calculated using data from California Department of Water Resources (DWR), Interagency Ecological Program website, http://iep.water.ca.gov/dayflow/index.html, and from DWR, Division of Flood Management website, http://cdec.water.ca.gov/cgi-progs/iodir/wsihist.

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22. U.S Geological Survey*, Seasonal/Yearly Salinity Variations in San Francisco Bay*, USGS website, accessed June 6, 2005, available at http://sfbay.wr.usgs.gov/access/wqdata/yearsdata/charts/sa9395nojava.html.

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24. The low point problem does not affect SWP water quality.

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43. State Water Resources Control Board, *Final EIR for Implementation of the 1995 Bay/Delta Water Quality Control Plan,* 1999.

44. State Water Resources Control Board, Water Right Decision 1641.

45. State Water Resources Control Board, Water Right Decision 1641.

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47. San Joaquin River Group Authority website, http://www.sjrg.org/EIR/eiseir_exsum1.htm, accessed September 6, 2005.

48. CALFED Bay Delta Program, *Programmatic Record of Decision for Final Programmatic EIR/EIS*, 2000.

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50. Between 1996 and 2003, several KCWA member agencies placed about 750,000 AF of SWP water in storage in the Kern Water Bank. These agencies had the ability to place SWP water in storage in Kern County when it was available prior to the Monterey Amendment. A survey conducted by KCWA indicated that in the absence of the Kern Water Bank the agencies would have stored the SWP water elsewhere in Kern County. Thus, the placement of 750,000 AF in groundwater storage in the Kern Water Bank would not have had any effect on Delta outflow.)

7.2 GROUNDWATER HYDROLOGY AND QUALITY

7.2 GROUNDWATER HYDROLOGY AND QUALITY

7.2.1 INTRODUCTION

7.2.1.1 Content

Chapter 6 describes the changes in SWP and SWP contractor operations that are attributable to the Monterey Amendment and the Settlement Agreement. Some of the operational changes attributable to the proposed project could have effects on groundwater hydrology and quality. Elements of the proposed project that could potentially affect groundwater hydrology and quality are listed in Table 7.2-1.

TABLE 7.2-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON GROUNDWATER HYDROLOGY AND QUALITY

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Groundwater levels	7.2-1
Permanent Table A transfers and retirements	Groundwater levels	7.2-1
Transfer of Kern Fan Element lands	Groundwater levels	7.2-1
Water supply management practices	Groundwater levels	7.2-1
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	NA
Watershed forum in Plumas	NA	NA
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

7.2.1.2 Analytical Method

Qualitative assessment of impacts to groundwater resources was conducted in accordance with standard professional practices for CEQA documents. Factors considered in the analysis include the past practice of groundwater banking activities in the San Joaquin Groundwater Basin. Historical records were examined to determine whether the proposed project had substantial effects on groundwater hydrology and quality between 1996 and 2003. The effects of the proposed project were separated from the effects of other unrelated groundwater storage projects developed during the same period.

7.2.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA guidelines. For the purposes of this EIR, impacts to groundwater would be judged to be potentially significant if the proposed project would:

- alter water quality in a groundwater basin sufficiently to substantially impair beneficial uses; or
- alter water levels in a groundwater basin sufficiently to substantially increase pumping costs or cause land subsidence.

Substantial changes are defined as changes beyond those normally observed in historical records, and that are disproportionate to any documented information on groundwater in the basin.

7.2.2 ENVIRONMENTAL SETTING

For planning and management purposes, the California Department of Water Resources (Department) has delineated 431 groundwater basins in California. Of these, 24 basins are further divided into 108 subbasins, giving a total of 515 distinct groundwater units.[1] Article 56 of the Monterey Amendment, which provides prior Department approval for SWP contractors to store SWP water outside their service areas for later use within their service areas, could theoretically affect groundwater basins anywhere in California. However, storage south of the Delta is more advantageous than storage north of the Delta. The following section includes a description of the groundwater basins that have been affected by the proposed project between 1995 and 2003 all of which lie in Kern County. Descriptions of other groundwater basins that could potentially be affected by the proposed project can be found on the Department's Bulletin 118.[2]

7.2.2.1 Physical Setting in 1995

The Department divides the Central Valley of California into two groundwater basins, the Sacramento Valley Groundwater Basin and the San Joaquin Valley Groundwater Basin. It further divides the San Joaquin Valley Groundwater Basin into subbasins, one of which, the Kern County Subbasin, would be affected by the proposed project. Kern County subbasin lies at the south end of the San Joaquin Groundwater Basin.

The San Joaquin Valley was formed by deposition of sediment in a north-northwestern trending trough. The aquifer system in the valley consists of continental and marine deposits several miles deep. The upper 2,000 feet generally contain fresh groundwater, with saline water at greater depths. The sediments that contain the aquifer system are primarily Tertiary– and Quaternary–aged continental sediments derived from the Coast Range to the west and the Sierra Nevada to the east. Overlying these formations are flood plain deposits. A significant hydrogeologic feature is the Corcoran Clay. This clay layer divides the aquifer system into two distinct aquifers, an unconfined to semi-confined upper aquifer above the clay layer and a confined aquifer below it.[3] However, the clay layer is not continuous, and is absent in portions of the Kern County Subbasin.

Historically, the upper aquifer system in the Kern County Subbasin was recharged by precipitation, infiltration from rivers and lakes and lateral inflow along the basin boundaries. The main surface water feature in the Kern County Subbasin is the Kern River. Before European settlement the Kern River flowed to Kern and Buena Vista Lakes and extensive wetlands. During wet periods, the lakes overflowed to Tulare Lake to the north, which itself overflowed into the San Joaquin River watershed. Groundwater levels in the basin varied but reached artesian conditions in the lowest parts of the subbasin.

In the 1860s, ranchers raised livestock and dry farmed wheat in the San Joaquin Valley portion of Kern County. In the 1870s, farmers began diverting the waters of the Kern River to irrigate their crops. For two decades, irrigators relied almost exclusively on surface waters for their water supplies, but in the 1890s, some took advantage of improvements in pumping technology and began turning to more reliable groundwater supplies.[4] Increasing use of groundwater caused the water table in parts of Kern County to fall by as much as 400 feet by 1960. Groundwater extraction between 1926 and 1970 has caused the ground surface to subside by eight to nine feet in the central part of the Kern County Groundwater Subbasin.[5]

Surface water imports to the area began in 1949 with the completion of the CVP's Friant-Kern Canal and increased in the 1960s and 1970s, as water from the SWP became available. Many irrigators contracted for deliveries of imported surface water and were able to reduce their use of groundwater. As a result, groundwater levels in some parts of the southern San Joaquin Valley began to rise.

Kern County Water Agency (KCWA), the largest of the SWP's agricultural contractors, and other water agencies in Kern County, manage surface and groundwater in the San Joaquin Valley portion of Kern County. Their surface water sources include flood flows from the Kern River, CVP deliveries from the Friant-Kern Canal and SWP deliveries from the California Aqueduct. Their groundwater source is the aquifer that underlies much of the land within the KCWA boundaries.

For many years, water agencies in Kern County have practiced conjunctive use of their surface and groundwater sources; that is, they actively manage their surface and groundwater sources to take advantage of the unique characteristics of each type of water source. Kern County agencies utilize in-lieu recharge and direct recharge management practices. In-lieu recharge is a water management practice that modifies the irrigation practices of water users who have access to surface water supplies and groundwater supplies. It substitutes surface water for irrigation in-lieu of normal groundwater pumping to increase groundwater supplies and conserve groundwater for use in future years. Direct recharge (artificial recharge) is a water management practice that applies water to percolation ponds to increase groundwater recharge and store water in an aquifer for later extraction.

When surface waters are available from the Kern River, the CVP or the SWP, farmers use surface waters to irrigate crops. When surface water supplies are insufficient, farmers supplement their surface water supplies with groundwater. When surface water availability exceeds farmers' needs, KCWA and those other water agencies with groundwater recharge facilities percolate the surface water to recharge the groundwater basin. Other agencies that manage groundwater banks with in-lieu recharge will then use any excess surface water in lieu of pumped groundwater, with the objective of allowing the basin to recover.

Kern County water agencies manage groundwater banks for use by other agencies as well as their own in-county use. The agencies use direct and in-lieu recharge to bank groundwater for their own later recovery. Some Kern County agencies also offer groundwater banking, which is the storage of a non-Kern County agency's water in Kern County groundwater basins for later recovery. The agencies can recover the water for the non-Kern County agency by direct pumping and conveyance of the water to the non-Kern County agency, or the Kern agencies can recover the water through an in-lieu exchange. Under an in-lieu exchange, the SWP or non-SWP surface water that would otherwise have been delivered to the Kern County agency would instead be delivered to the non-Kern County agency and the Kern County agency would pump a like amount of the non-Kern County agency's stored water.

Figure 7.2-1 shows total water supplies and water demand in the San Joaquin Valley portion of Kern County between 1970 and 1999. In years when total surface water supplies exceeded demand, groundwater storage increased as the excess supply was added to groundwater storage. In years when total surface water supplies were insufficient to meet demand, the deficit was made up groundwater pumping and groundwater storage decreased. Between 1970 and 1995, groundwater storage declined by 6.6 million acre-feet (AF), an average reduction in storage of 264,000 AF per year. Figure 7.2-2 shows cumulative groundwater storage for the period 1970 to 1995. During most of the 1970s, groundwater storage declined as a result of dry conditions and limited access to SWP water due to distribution system limitations. Groundwater storage increased from 1978 until the mid-1980s when a ten-year dry period began, resulting in a decline of approximately 7.3 million AF, compared to 1970 storage levels.[6]

7.2.2.2 Changes in Physical Setting between 1996 and 2003

Other than water level changes, there were no changes to the physical characteristics of the San Joaquin Valley Groundwater Basin, Kern County Subbasin after 1995. As shown in Figure 7.2-2, from 1996 to 1999, groundwater levels began to rebound after a long period of dry years. From 1996 to 1999, 1.58 million AF of water was delivered for banking within the San Joaquin Valley portion of Kern County, an average of about 395,000 AFY. Groundwater storage levels since then have continued to increase.

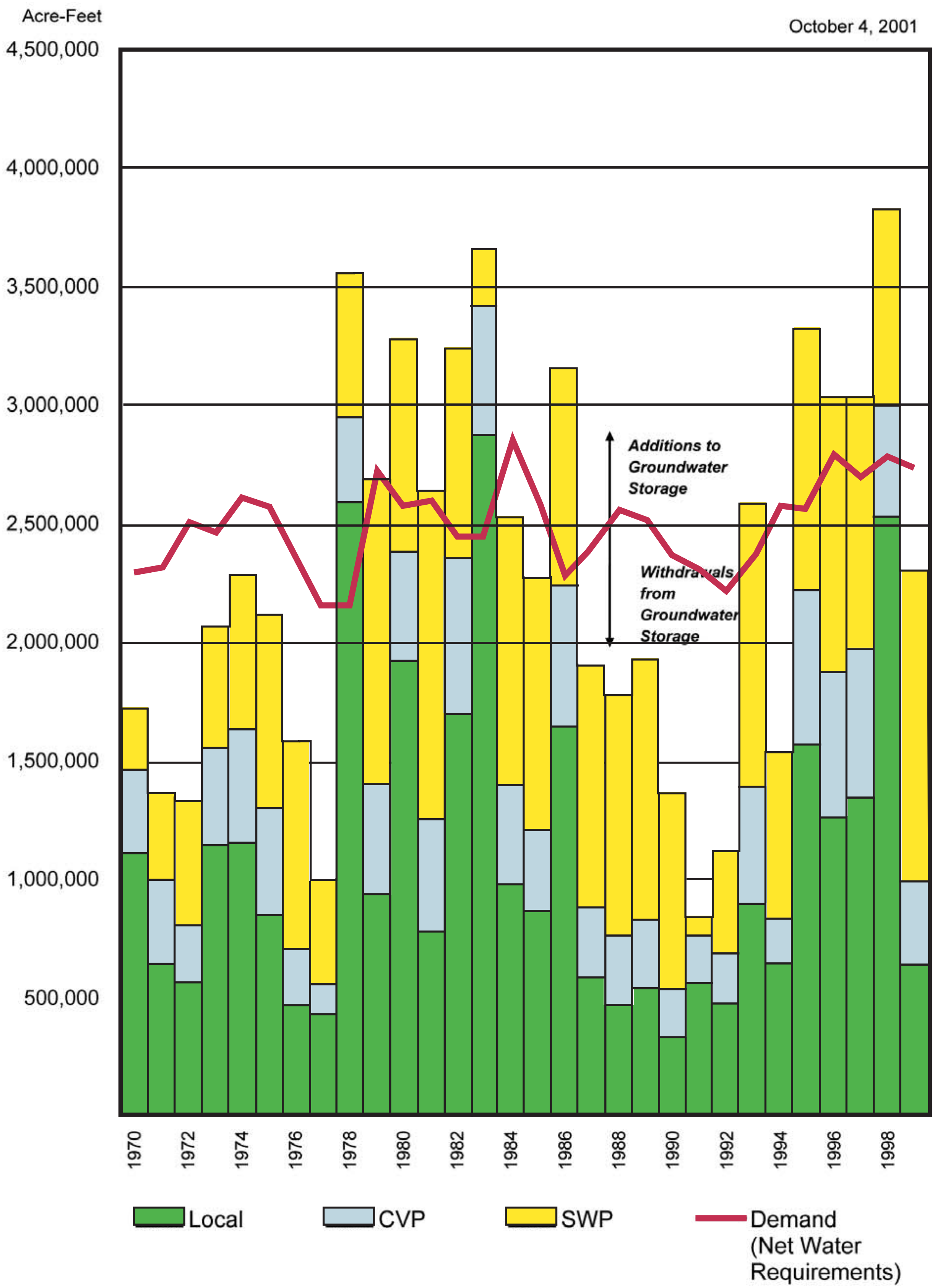
7.2.2.3 Regulatory Setting in 1995

Groundwater Legislation

In 1914, California created a system of appropriating surface water rights through a permitting process, but groundwater use has never been regulated by the State. Though the regulation of groundwater has been considered on several occasions, the California Legislature has repeatedly held that groundwater management should remain a local responsibility. Although they are treated differently legally, groundwater and surface water are closely interconnected in the hydrologic cycle. Because use of one resource will often affect the other, effective groundwater management must consider surface water supplies and uses.

Groundwater management needs are identified at the local water agency level and may be directly resolved at the local level. If groundwater management needs cannot be directly resolved at the local agency level, additional actions such as enactment of ordinances by local governments, passage of laws by the Legislature, or decisions by the courts may be necessary to resolve the issues. Upon implementation, local agencies evaluate program success and identify additional management needs. The State's role is to provide technical assistance to local agencies for their groundwater management efforts.

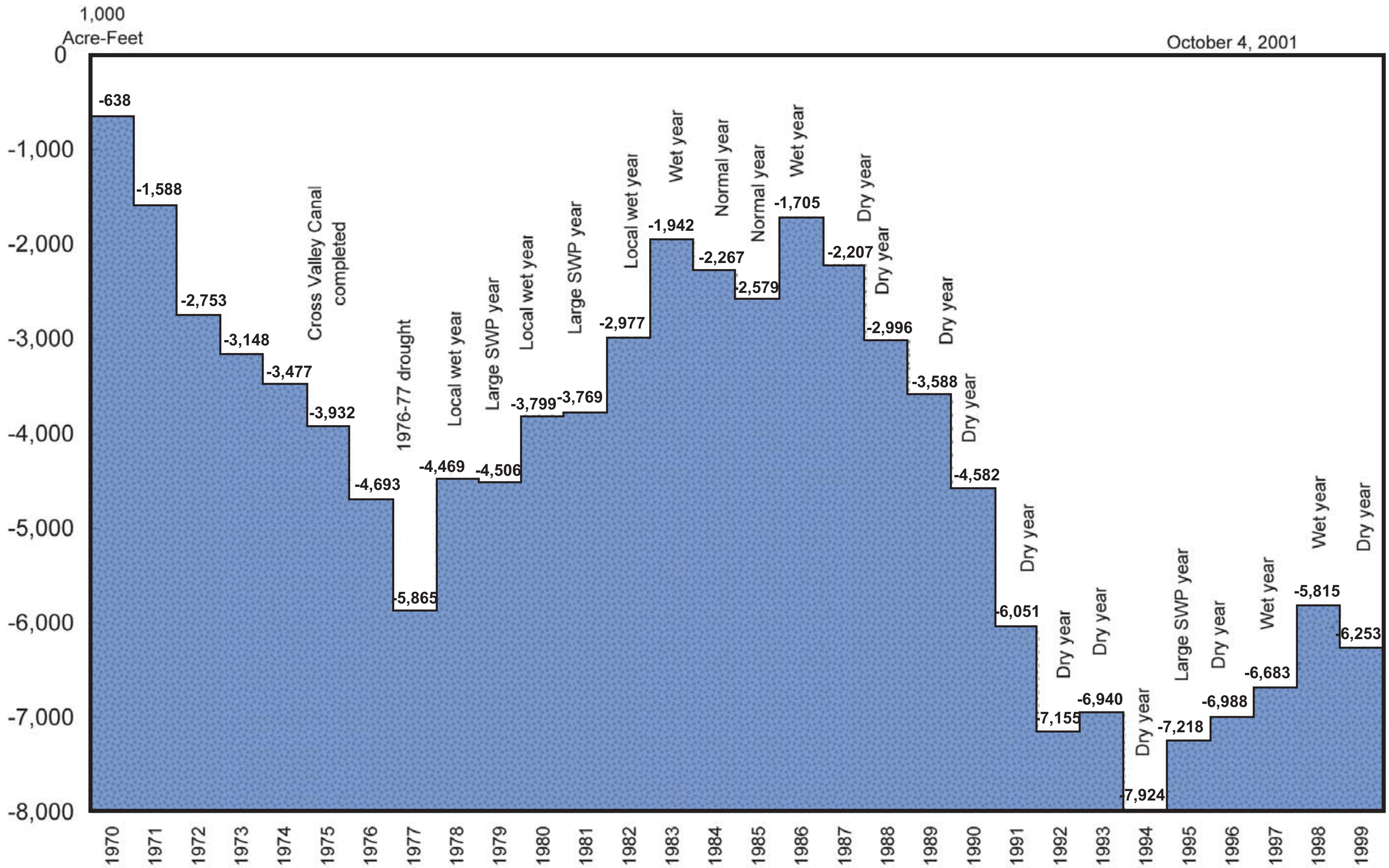
There are three basic methods available for managing groundwater resources in California: (1) management by local agencies under authority granted in the California Water Code or other applicable State statutes, (2) local government groundwater ordinances or joint powers



Source: Kern County Agency, Water Supply Report, 1999.

FIGURE **7.2-1**

Water Supplies and Use for San Joaquin Valley Portion of Kern County



Source: Kern County Water Agency, Water Supply Report, 1999.

FIGURE **7.2-2**

Cumulative Change in Groundwater Storage for San Joaquin Valley Portion of Kern County

agreements, and (3) court adjudications. No law requires that any of these forms of management be applied in a basin. Management is often instituted after local agencies or landowners recognize a specific groundwater problem. The level of groundwater management in any basin or subbasin is often dependent on water availability and demand.

Management by Local Agencies Under the California Water Code

More than 20 types of local agencies are authorized by statute to provide water for various beneficial uses. Many of these agencies also have statutory authority to institute some form of groundwater management. For example, a Water Replenishment District (Water Code, § 60000 et seq.) is authorized to establish groundwater replenishment programs and collect fees for that service. A Water Conservation District (Water Code, § 75500 et seq.) can levy groundwater extraction fees. Most of these agencies are identified in the Water Code, but their specific authority related to groundwater management varies. The Water Code does not require that the agencies report their activities to the Department.

In 1991, AB 255 (Stats. 1991, Ch. 903) was enacted authorizing local agencies overlying basins subject to critical conditions of overdraft, as defined in the Department's Bulletin 118-80, to establish programs for groundwater management within their service areas. Water Code section 10750 et seq. provided these agencies with the powers of a water replenishment district to raise revenue for facilities to manage the basin for the purposes of extraction, recharge, conveyance, and water quality. Seven local agencies in California adopted plans under this authority.

The provisions of AB 255 were repealed in 1992 with the passage of AB 3030 (Stats. 1992, Ch. 947). This legislation was significant in that it greatly increased the number of local agencies authorized to develop a groundwater management plan and set forth a common framework for management by local agencies throughout California. AB 3030, which is codified in Water Code section 10750 et seq., provides a systematic procedure to develop a groundwater management plan by local agencies overlying the groundwater basins defined by Bulletin 118-75 (DWR 1975) and updates. Upon adoption of a plan, these agencies could possess the same authority as a water replenishment district to "fix and collect fees and assessments for groundwater management" (Water Code, § 10754). However, the authority to fix and collect these fees and assessments is contingent on receiving a majority of votes in favor of the proposal in a local election (Water Code, § 10754.3). More than 200 agencies have adopted an AB 3030 groundwater management plan. None of these agencies is known to have exercised the authority of a Water Replenishment District.

Water Code section 10755.2 expands groundwater management opportunities by encouraging coordinated plans and by authorizing public agencies to enter into a joint powers agreement or memorandum of understanding with public or private entities that provide water service. At least 20 coordinated plans have been prepared to date involving nearly 120 agencies, including cities and private water companies.

Adjudicated Groundwater Basins

A second general form of groundwater management in California is court adjudication. In some California groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties turned to the courts to determine how much groundwater can rightfully be extracted by each user. The courts study available data to arrive at a distribution of the groundwater that is available each year, usually based on the California law of overlying use and appropriation. This court-directed process can be lengthy and costly. Many of these cases have been resolved with a court-approved negotiated settlement, called a stipulated judgment. Unlike overlying and non-overlying rights to groundwater, such decisions guarantee to each party a proportionate share of the groundwater that is available each year. The intense technical focus on the groundwater supply and restrictions on groundwater extraction for all parties make adjudications one of the strongest forms of groundwater management in California.

There are 19 court adjudications for groundwater basins in California, mostly in Southern California, including three in Kern County. Eighteen of the adjudications were undertaken in State Superior Court and one in federal court. For each adjudicated groundwater basin, the court usually appoints a watermaster to oversee the court judgment. In 15 of these adjudications, the court judgment limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. The basin boundaries are also defined by the court.

Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. As a result, agencies often import surface water to meet increased demand. The original court decisions provided watermasters with the authority to regulate extraction of the quantity of groundwater; however, they omitted authority to regulate extraction to protect water quality or to prevent the spread of contaminants in the groundwater. Because water quantity and water quality are inseparable, watermasters are recognizing that they must also manage groundwater quality.

Local Ordinances

A third general method of managing groundwater in California is through ordinances adopted by local governments such as cities or counties. Twenty-seven counties have adopted groundwater ordinances, and others are being considered. The authority of counties to regulate groundwater has been challenged, but in 1995 the California Supreme Court declined to review an appeal of a lower court decision Baldwin v. County of Tehama (1994) that holds that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers. However, the precise nature and extent of the police power of cities and counties to regulate groundwater is uncertain.

Ordinances are mostly a recent trend in groundwater management, with 24 of the 27 ordinances enacted since 1990. Local ordinances passed during the 1990s have significantly increased the potential role of local governments in groundwater management. The intent of most ordinances has been to hold project proponents accountable for impacts that may occur as a result of proposed export projects. Because adoption of most of these ordinances is recent, their effect on local and regional groundwater management planning efforts is not yet fully known. However, it is likely that future groundwater development will take place within the constraints of local groundwater management ordinances.

7.2.2.4 Changes in Regulatory Setting between 1996 and 2003

The State Legislature recognized the need for groundwater data in making sound local management decisions. In 1999, the Legislature approved funding and directed the Department to update the inventory of groundwater basins contained in Bulletin 118 (1975), California's Ground Water and Bulletin 118-80 (1980), Ground Water Basins in California. In 2001, the

Legislature passed AB 599, requiring the State Water Resources Control Board to establish a comprehensive monitoring program to assess groundwater quality in each groundwater basin in the State and to increase coordination among agencies that collect groundwater contamination information. In 2002, the Legislature passed SB 1938, which contains new requirements for local agency groundwater management plans to be eligible for public funds for groundwater projects.

Additional progress in groundwater management is reflected by passage of amendments to the Water Code (§§ 10753.4 and 10795.4 as amended, §§ 10753.7, 10753.8, and 10753.9 as amended and renumbered, and §§ 10753.1 and 10753.7 as added) through SB 1938 of 2002. The amendments require that groundwater management plans include specific components for agencies to be eligible for some public funds for groundwater projects. Further, financial assistance, such as through the Local Groundwater Assistance grant program (see Chapter 4, Assembly Bill (AB) 303), was included in legislation after 1995 to assist local agencies in management of groundwater resources.

7.2.3 IMPACTS AND MITIGATION MEASURES

7.2-1 The proposed project could potentially alter groundwater levels in the Kern County Groundwater Subbasin.

1996 — 2003

For many years, Kern County farmers and water agencies have practiced conjunctive use of surface and groundwater sources. They also practice groundwater banking. Between 1971 and 1994, 1.15 million AF of water was delivered for banking in the San Joaquin Valley portion of Kern County, an average of about 48,000 AFY. Groundwater was banked for KCWA member agencies, with a few exceptions.

Groundwater banking in Kern County increased after 1995. Between 1996 and 1999, 1.58 million AF of water was delivered for banking within the San Joaquin Valley portion of Kern County, an average of about 395,000 AFY, using local, SWP and CVP supplies. There were four reasons for the increase in groundwater banking after 1995, two of them related to the Monterey Amendment.

A primary reason for increased groundwater banking was a growing recognition by contractors that they needed to take measures to improve the reliability of their water supplies. The extended drought of 1987 through 1992 illustrated how unfavorable hydrology could drastically reduce the availability of SWP water. At the same time, actions proposed to protect several Delta fish species, listed as threatened or endangered, would place operational constraints on the SWP and further reduce supply reliability. To improve water supply reliability, KCWA, its member agencies and other SWP contractors began groundwater banking programs which would enable them to store water available in wet years for later use in dry years.

A second reason for increased banking was the series of wet years that followed the drought of 1987 through 1992. Beginning in 1995 and continuing through the late 1990s, consecutive wet years provided abundant water for storage in groundwater banks in the San Joaquin Valley portion of Kern County.

The Monterey Amendment contributed to the increase in groundwater banking in two ways. First, it provided contractual assurance that contractors would be able to store SWP water outside their service areas. Second, it transferred ownership of the Kern Fan Element property to local interests and the Kern Water Bank Authority developed percolation ponds and wells on the property and made it available for groundwater banking by its member entities.

Between 1996 and 2003, contractors delivered about 981,000 AF more SWP water for out-of-service area groundwater storage in Kern County than they withdrew. Of this amount, about 616,000 AF was for storage programs that received approval after implementation of the Monterey Amendment. KCWA estimates that every 100,000 AF of water placed in storage causes a rise a one-foot rise in the groundwater level. Thus, out-of-service area storage of SWP water in Kern County groundwater banks as a result of the Monterey Amendment probably raised groundwater levels by about six feet between 1996 and 2004.

As noted above, the Monterey Amendment transferred ownership of Kern Fan Element property to local interests enabling development of a groundwater bank there by the Kern Water Bank Authority. Between 1996 and 2003, Kern Water Bank Authority member entities delivered about 502,000 AF more water for storage in the Kern Water Bank than they withdrew. But, an analysis conducted by KCWA indicated that if the Kern Water Bank had not existed, the Kern Water Bank Authority member entities had capacity in other water banks available to them and would have been able to store the water elsewhere in Kern County (see Appendix E for details). Consequently, the Monterey Amendment-related transfer of ownership of the Kern Fan Element property did not affect groundwater levels between 1996 and 2003.

During the late 1990s and early 2000s, contractors that stored SWP water in Kern County did so to set aside the stored water for use in dry periods rather than to use it to increase their average annual deliveries of SWP water. This operating practice would result in water remaining in storage for several years and only being drawn down occasionally. Overall, the effect of the additional groundwater banking facilitated by the Monterey Amendment was to raise groundwater levels in Kern County by several feet relative to the baseline scenario. Thus, the proposed project had a modestly ***beneficial effect*** on groundwater levels in Kern County between 1996 and 2003 relative to the baseline.

Mitigation Measures

None required.

Future Impacts

Between 1996 and 2003, contractors delivered about 616,000 AF more SWP water for storage in groundwater banks outside contractors' service areas than they withdrew than they would have under the baseline scenario. It is expected that contractors would continue to take advantage of the opportunity to store SWP water in Kern County groundwater banks in the future. Several new groundwater banks are planned in Kern County so total storage capacity is expected to increase in the future. As demand increases in their service areas between 2003 and 2020, contractors are expected to need their full Table A amounts to meet current needs in most years. However, water would likely still be available for storage in wet years. Consequently, contractors are likely to store volumes of water less than those stored between 1996 and 2003 in groundwater banks in the future in dryer years, but similar or larger amounts in wetter years.

As described for impacts between 1996 and 2003, above, storage of SWP water in groundwater banks as provided for by the Monterey Amendment has the potential to raise groundwater levels by approximately 1 foot for every 100,000 AF of water stored. The proposed project would increase groundwater levels in parts of Kern County by several feet compared to the baseline scenario and thus would have a modestly ***beneficial effect***.

Mitigation Measures

None required.

ENDNOTES

1. California Department of Water Resources, *California Groundwater, Update 2003*, Bulletin 118, 2003.

2. California Department of Water Resources, *California Groundwater, Update 2003*, Bulletin 118, 2003.

3. California Department of Water Resources and U.S. Bureau of Reclamation, *Draft Environmental Water Account EIS/EIR*, 2003.

4. Hundley, Jr., Norris, *The Great Thirst, Californians and Water: A history*, University of California Press, 2001.

5. California Department of Water Resources, *California Groundwater, Update 2003*, Bulletin 118, 2003.

6. Kern County Water Agency, *Water Supply Report 1999*, 2003.

7.3 FISHERIES RESOURCES

7.3 FISHERIES RESOURCES

7.3.1 INTRODUCTION

7.3.1.1 Content

This section describes the SWP-related fisheries resources of the Feather, American, Sacramento, and San Joaquin rivers, the Sacramento-San Joaquin River Delta (Delta),[1] the mid-system regulating reservoir (San Luis Reservoir), and two terminal reservoirs (Lake Perris and Castaic Lake).

This section focuses on those elements of the SWP facilities that could be affected by the proposed project. It does not address the bulk of the SWP conveyance system. The remaining reservoirs, including Pyramid Lake, Lake Silverwood, the aqueduct sections, pipelines, and afterbays would not be affected. Fish found in the California aqueduct, the other reservoirs, and the forebays and afterbays would be unaffected by the proposed project. Amphibian resources are covered in Section 7.4 – Terrestrial Biological Resources. Specific hydrologic or water quality changes that could result from the proposed project are covered in Section 7.1 – Surface Water Hydrology, Water Quality, and Water Supply. This EIR section addresses issues related to the fisheries resources within the estuary, rivers, and reservoirs of the Central Valley and the Delta. Elements of the proposed project that could potentially affect fisheries are listed in Table 7.3-1.

TABLE 7.3-1

IMPACTS OF THE PROPOSED PROJECT ELEMENTS ON FISHERIES RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Flow and water quality in rivers and delta, water levels in reservoirs, availability and quality of water	7.3-1, 7.3-2, 7.3-3, 7.3-4, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Permanent Table A transfers and retirements	Flow and water quality in rivers and delta, water levels in reservoirs, availability and quality of water	7.3-1, 7.3-2, 7.3-3, 7.3-4, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Transfer of Kern Fan Element lands	Local development of the kern water bank (part of article 52 provisions)	7.3-5
Water supply management practices	Flow in delta, water levels in reservoirs, groundwater levels, availability and quality of water	7.3-1, 7.3-3, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guidelines on public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	NA
Watershed forum and restoration in Plumas County	NA	NA
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA
Note: NA – Not Applicable.		

Comments received in response to the Notice of Preparation pertinent to fisheries resources are summarized here. The full text of comment letters is available in Appendix B. Most comments reflected concerns about the state of fisheries resources within the streams potentially affected by the SWP, including the Delta estuary. These same comments requested an analysis of impacts from changes in water exports under pre-Monterey (baseline) conditions, and potential impacts under proposed project conditions. Other comments requested a detailed analysis of the transfer of water through the Delta. There were requests to evaluate potential impacts to fisheries resources in streams not directly influenced by SWP operations. Other comments requested that the EIR project into the future in relation to water use, export, and SWP operations.

7.3.1.2 Analytical Method

The proposed project can affect flows in the Delta and rivers upstream of the Delta, and in storage at some of the SWP reservoirs. This section describes the analyses that identify river flow and reservoir storage changes, quantifies their magnitude, and lays the groundwork for identifying other impacts caused by such flow and storage changes. The analyses also focus on potential mechanisms that might cause operational changes and thereby trigger impacts.

These flow and storage changes can in turn affect fishery resources. Analytical methods used to ascertain fisheries conditions include analysis of current and historical data, discussions with agency fish biologists, and model simulation that includes post-processing analyses of SWP operations.

Flow and Storage Analyses

Three methods were used to examine the effects of the proposed project on river and Delta flows and reservoir storage: 1) CALSIM II simulations and post-processing of CALSIM results, 2) analysis of historical data, and 3) extrapolation from historical data. The CALSIM II model directly simulates the effects of the Table A transfers and retirements, and a post-processing analysis of CALSIM II output enables determination of the effects of the altered water allocation procedures. Since CALSIM II does not model the water supply management practices, these provisions were analyzed using an analysis of historical data.

Modeling Data

CALSIM II was used to estimate the annual amount of water available for delivery to the SWP contractors over the 73-year period of hydrologic record used in the model (the analysis in Chapter 6 used the 1928-1994 time period, while the Fisheries Resources section uses the 1922-1994 time period). The total amount of water available each year was then allocated to the SWP contractors in accordance with pre-Monterey Amendment allocation procedures (baseline scenario) and post-Monterey Amendment allocation procedures (proposed project), considering the Table A transfers and retirements that are a part of the proposed project. Monterey Amendment-induced changes in deliveries to individual contractors located north of the Delta have the potential to alter flow in the Feather and Sacramento rivers, and Delta inflow. Also, Monterey Amendment-induced changes in deliveries to contractors located south of the Delta have the potential to alter Delta exports. Changes in Delta inflow and exports can affect Delta outflow. The effects of the Table A transfers and retirements and the altered water allocation procedures on river flow, Delta exports, and Delta outflow were determined by using spreadsheet analysis. The spreadsheet analysis tabulated the proposed project and the baseline scenarios under 2003 and 2020 conditions, the changes in allocations to the five contractors north of the Delta and determined the effect of these changes on Feather and Sacramento river flows and Delta inflow (see Appendix H). The analysis used 1922-1994 river flow estimates, and made the comparisons by year type on an annual and monthly basis. The delivery estimates for the 1922-1994 were made based on 2020 SWP demand estimates. The analysis also determined changes in annual deliveries to contractors located south of the Delta, which affects Delta exports, by year type.

The changes to Plumas County allocations are excluded from the analysis because the mechanisms for delivery to Plumas from Lake Davis affect Feather River flows in a different manner.

Historical Analyses

An estimate of the actual effects of the proposed project on Delta exports in the period 1996 to 2004 was determined in a historical operations analysis, based on actual operations and delivery data. This analysis included nearly all of the provisions of the Monterey Amendment, including Table A retirements and the water supply management practices.

Because CALSIM II does not simulate operation of the water supply management practices, it was necessary to perform a separate analysis of these provisions. This water supply management practices analysis was also based on historical data from 1996 through 2004, since these practices were employed during that time. The effects of the water supply management practices between 2003 and 2020 were estimated by extrapolation of results of the water supply management practices analysis, based on the known effects of the practices between 1996 and the present.

The Monterey Amendment contains provisions, other than the altered water allocation procedures, transfers, and retirement of Table A amounts, which have the potential to affect streamflow and Delta outflow. Article 54 allows some contractors, under certain conditions, to borrow water from Castaic Lake and Lake Perris. Article 56 gives prior California Department of Water Resources (Department) approval for contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or in San Luis Reservoir. Another provision of Article 56 establishes an annual turnback pool. Each of these water supply management practices, as well as the two historical analyses mentioned above, are described in Chapter 6.

Castaic Lake and Lake Perris are terminal reservoirs for the SWP at the end of the East and West Branches of the California Aqueduct. The borrowing of water from these reservoirs under Article 54 may affect the storage in these reservoirs. For historical perspective, the actual storage patterns experienced between 1996 and 2005, which included several actual borrowing and pay back events, were evaluated. To evaluate the potential effect on storage in these reservoirs, the maximum withdrawal permitted under Article 54 (approximately 50 percent of storage capacity) was evaluated.

<u>Fishery Analyses</u>

The Monterey Amendment and the Settlement Agreement were put into place in different years (see Chapter 5 for a discussion of the baseline conditions). Determination of conditions for the environmental setting in 1995 presented a challenge. While some data on fish salvage and distribution within the Delta exist for the years prior to 1996, data from 1996 on are more complete and reliable, and therefore most of the fisheries data presented within this section come from documents published after 1995. The discussion of special-status species is based on populations known from before and after 1995. State and federally listed species and species of concern are discussed if they were listed in 1995 or earlier. Also, State and federally listed species and species of concern that were listed as of 2003 are discussed (Green Sturgeon's listing status as of 2006 is used in this document). State and federal species of concern are typically treated as rare, threatened, or endangered within CEQA documents because they meet the definitions within CEQA Guidelines § 15380 which defines these terms. Collectively, all species listed under the California Endangered Species Act (CESA), the Federal Endangered Species Act (FESA), or listed as a Species of Concern by California Department of Fish and Game (CDFG), the US Fish and Wildlife Service (USFWS), or the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (also known as NOAA Fisheries) are considered special-status species within this document.

Unfortunately, when a species is designated a Species of Concern by one of the regulatory agencies, there is not a listing date associated with this action that could be used to sort species into the appropriate timeframe discussion. Because of this, the species categorized as Class 1 or Class 2 in *Fish Species of Special Concern in California,*[2] are considered to represent the State and Federal Species of Concern for the 1995 environmental setting. The 2003 environmental setting utilizes the 2003 list published by CDFG that contains both State and Federal Special Status species.[3] The California Natural Diversity Database (CNDDB) was queried for the U.S. Geological Survey 7.5-minute quadrangles that contained the reservoirs to determine if any special status species had been reported from these locations.[4] A query of the CNDDB was also run for those counties that contain SWP facilities.[5] This query resulted in a list of 25 species of fishes that would be considered special status. Most of these are found in areas not influenced by the proposed project. These include: the Colorado River which supports bonytail (*Gila elegans,* probably extirpated from California), Colorado pikeminnow (*Ptychocheilus lucius*, extirpated from California), and razorback sucker (*Xyrauchen texanus*); the Mohave River which support Mohave tui chub (*Gila bicolor mohavensis*); desert habitats in which all species of pupfish (*Cyprinodon* spp.) may be found; and streams within the Los Angeles Basin that do not have a connection to the SWP such as the Santa Ana rivers. Those species with some potential to be found within SWP facilities in 1995 are discussed in Section 7.3.2.2.

Although there are no reproducing populations of special-status species located in the reservoirs that are discussed in this section, the fisheries are of relevance as gamefish. Local-area representatives from CDFG were contacted by telephone and asked for information on the fisheries assemblages within the following reservoirs: San Luis Reservoir, Lake Perris, Castaic Lake, and Lake Oroville. Site-specific data for these reservoirs were scarce and routine survey information is generally not available. For this reason, fisheries assemblages and conditions were assumed to be the same in 1996 and 2003 for the reservoirs. Any changes that occurred between 1996 and 2003 are noted in Section 7.3.2.3.

Reservoirs

There are four main reservoirs that are analyzed in this section: Lake Oroville, San Luis Reservoir, Castaic Lake, and Lake Perris. Thresholds for evaluating significance of operation changes on reservoir fisheries depend on the species present and management goals of the reservoir. Many of the fish listed in the reservoirs associated with the SWP are the target of anglers. The use of this resource varies depending on factors such as access, productivity, and nearby population centers. This recreational fishery is of primary concern when discussing fisheries resources within these reservoirs. For Lake Oroville and San Luis Reservoir, modeling data from the proposed projects were compared to baseline data. Changes in monthly reservoir elevation were compared to the baseline elevations. For Castaic Lake and Lake Perris, actual reservoir elevations were compared to baseline elevations for 1996 through 2005, and a worst-case withdrawal scenario was used to evaluate potential future impacts. An increase in elevation reduces the solar warming of spawning grounds. As refuge habitat is flooded, it exposes young fish to higher rates of predation. Depending on various biotic and abiotic characteristics of the reservoir, a drop in reservoir levels may dewater nests, create overcrowding, or increase predation by birds and other animals.

Sacramento-San Joaquin Delta

The fisheries resources of the Delta are extensive and complex. The relationship between streamflows and tidal flows at various locations and the movement patterns of fish varies depending on the species being evaluated. For example, reductions in flows can delay upstream migration of adult salmon. Modifications in pumping patterns can change the flow patterns of the Delta and movement patterns of many species altering both upstream and downstream movement of fish. Flow changes in the Delta also can affect entrainment risk of young fishes.

In general, modeled baseline data was compared to the proposed project. The model output of the proposed project was compared to the modeled baseflow data. The percent change attributable to the project was calculated and averaged for a particular month and water year type following the methods previously discussed. Reductions in flow could impact a number of species depending on the magnitude of change and time of year.

Streams and Rivers

Fish rely on streams and rivers to provide living space. Within these streams and rivers, there is a relationship between abiotic factors, such as water flows, channel morphology, and toxins; and biotic factors, such as riparian vegetation, food availability, predator presence, on habitat quantity and quality. Water flow increases, decreases, and abrupt flow changes can create issues for fisheries depending on the abiotic and biotic characteristics. The Monterey Amendment has the potential to affect water flows in certain rivers at certain times of the year. Depending on the other related biotic and abiotic factors, increases in flow could result in reductions in available habitat for different life cycle stages of fish. For example, salmon fry require relatively shallow low-velocity areas in which to rear. Because an increase in flow typically results in increased velocities and depths, it may result in reductions in available habitat for salmon fry. Spawning habitat also may decrease with increased flow as depths and velocities change. Conversely, decreases in water flow could also have negative impacts on salmon. Decreases in flow could limit the availability of spawning sites, make upstream and downstream fish passage more difficult to impossible, increase the likelihood of predation, create conditions for high temperatures that are lethal to salmonids, increase infestation of pathogens, increase opportunities for poaching, etc.

7.3.1.3 Standards of Significance

The following standards of significance are based on the sample questions presented in CEQA Guidelines Appendix G, CEQA Guidelines §§ 15065 and 15380, and standards previously developed and used by the Department. Implementation of the project could have a potentially significant effect on the environment if it will:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as endangered, rare, or threatened, as listed in Title 14 of the California Code of Regulations (Section 670.2 or 670.5) or Title 50 of the Code of Federal Regulations (Sections 17.11 or 17.12);
- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the USFWS, CDFG, or NOAA Fisheries;
- Substantially degrade the quality of the environment (CEQA § 15065);
- Substantially reduce the habitat of a fish or wildlife species (CEQA § 15065);
- Cause a fish or wildlife population to drop below self-sustaining levels (CEQA § 15065);
- Threaten to eliminate a plant or animal community (CEQA § 15065);
- Substantially reduce the number or restrict the range of an endangered, rare, or threatened species (CEQA § 15065);
- Reduce the area or habitat value of critical habitat areas designated under FESA (Essential Fish Habitat);
- Have a substantial adverse effect on any riparian habitat or other sensitive natural communities identified in local or regional plans, policies, regulations, or by USFWS, CDFG, or NOAA Fisheries;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources;
- Substantially degrade structural characteristics or processes of the aquatic ecosystem; or
- Substantially reduce populations of fish species having economic or social value.

Impacts in any of the above categories would be considered potentially unavoidable significant effects of the projects if they could not be (a) eliminated, (b) avoided or minimized by redesign or relocation of some components of the proposed project, (c) reduced to a less-than-significant level, or (d) compensated for by replacement of equal habitat extent and value.

7.3.2 ENVIRONMENTAL SETTING

The SWP stretches from the Upper Feather River Lakes in Plumas National Forest to Lake Perris and Castaic Lake at the terminal ends in the south. The SWP contains a series of reservoirs and conveys water through natural river channels that support many species of fish, including species of special concern. While its main purpose is to store and distribute water to urban and agricultural contractors, the SWP also must comply with environmental regulations intended to protect and restore fish species, populations, and evolutionary significant units/discrete population segments. The following discussion includes a description of fish found within the SWP, the environmental regulations protecting them, and the changes in both that have occurred from 1996 to 2003.

7.3.2.1 Life Histories of Fish Species of Concern through 2003

The following paragraphs highlight the species of concern that live in waterways that may be affected by the proposed project.

Note: Fish species of concern involved with the Pelagic Organism Decline in the San Francisco Estuary (longfin smelt, delta smelt, and splittail) are discussed in section 7.3.2.4.

Green Sturgeon (*Acipenser medirostris*)

Green sturgeon are found from the Bearing Sea south to northern Mexico with the Sacramento River supporting the southern-most spawning population.[6] Historically this species spawned in much of the Sacramento River and potentially the San Joaquin River. The USFWS and NOAA Fisheries group Green sturgeon into two distinctive populations of fish. The two populations are the northern (spawns in the Klamath and Rogue rivers) and the southern (spawns in the Sacramento River). Adult sturgeon move into the Sacramento River presumably between February and May[7] and have been observed in the mainstem Sacramento River near Red Bluff.[8] Juveniles migrate to the ocean in the summer and fall following their second year in freshwater rivers or streams.[9] Juveniles have been captured in the Delta indicating that this area may be used as rearing habitat. Currently, the Sacramento River appears to support the only spawning population in the Central Valley (70 FR 17386). There are confirmed reports of adult green sturgeon in the Feather River, but young fish have never been observed.[10]

Chinook Salmon (*Oncorhynchus tshawytscha*)

Chinook salmon adults and juveniles move through the Delta on their way to and from the ocean. The different runs of adults enter the rivers at different times throughout the year. Some juvenile Chinook rear in the Delta for varying time periods on their way to the ocean. There are no spawning areas within the Delta suitable for use by adult salmon. The USFWS and NOAA Fisheries group Chinook in distinct populations of fish. Refer to Tables 7.3-2, 7.3-3, and 7.3-4 for Chinook salmon spawner populations. A discussion of the individual runs follows.

<u>Winter-Run</u> – Winter-run Chinook return to the upper Sacramento River between December and July but do not spawn until the spring and summer months (April-August).[11] Juveniles spend five to nine months in the river and Sacramento-San Joaquin Estuary before entering the ocean.[12] This fish was relatively abundant prior to the construction of Keswick Dam, Lake Shasta, and the Red Bluff Diversion Dam (RBDD) on the upper Sacramento River. Adult population estimates have been made annually since 1970 at the RBDD (Table 7.3-3). Since 1970, winter-run numbers were on a general decline up to 1997. Winter-run population estimate in 1994 hit an all time low of 144 fish. From 1997 up to 2005, winter-run numbers at the RBDD have been increasing. The population of returning adults in 2005 was 15,730. Part of this increase may be attributable to the resumption of stocking in 1998.[13] Over 250,000 juvenile hatchery stock winter-run Chinook were released into the Sacramento-San Joaquin System in 2002.[14]

<u>Spring-run</u> – Spring-run Chinook enter the Sacramento River between March and September. They move upstream into tributary headwaters where they hold in pools until they spawn between August and October.[15] Juveniles emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October through May.[16] Population estimates for spring-run Chinook in Mill Creek range from a low of 61 in 1993, to a high of 3,500 in 1975. Compared to the 1990s, spring-run

TABLE 7.3-2

CHINOOK SALMON SPAWNERS POPULATIONS IN SELECTED SACRAMENTO RIVER TRIBUTARIES

	Yuba River	Battle Creek		Big Chico	Butte Creek		Clear Creek		Mill creek		Feather River*2		American River*2
Year	Fall Run	Fall Run	Late Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run
1952	N/D	15,000	N/D	N/D	N/D	N/D	N/D	N/D	16,000	N/D	N/D	N/D	25,000
1953	6,000	16,000	N/D	N/D	N/D	N/D	1,500	N/D	10,000	N/D	28,000	N/D	28,000
1954	5,000	12,000	N/D	N/D	N/D	N/D	3,000	N/D	7,000	N/D	68,000	N/D	29,000
1955	2,000	26,000	N/D	N/D	N/D	N/D	500	N/D	3,000	N/D	86,000	N/D	17,000
1956	5,000	21,108	N/D	N/D	N/D	N/D	2,650	N/D	896	N/D	18,200	N/D	6,437
1957	1,205	5,330	N/D	N/D	N/D	N/D	330	N/D	5,316	N/D	10,750	N/D	7,707
1958	7,900	29,243	N/D	N/D	N/D	N/D	1,600	N/D	4,340	N/D	34,650	N/D	26,871
1959	10,000	30,233	N/D	N/D	N/D	N/D	775	N/D	837	N/D	80,150	N/D	31,143
1960	20,400	23,805	N/D	N/D	N/D	8,700	900	N/D	940	2,368	83,300	N/D	54,366
1961	9,200	19,856	N/D	N/D	N/D	3,082	N/D	N/D	1,689	1,245	43,700	N/D	25,509
1962	34,300	13,057	N/D	200	N/D	1,750	5,400	N/D	4,384	1,692	19,050	N/D	27,053
1963	37,000	17,514	N/D	500	N/D	6,100	10,000	0	1,286	1,315	33,900	600	41,021
1964	34,900	15,875	N/D	100	N/D	600	2,500	0	450	1,539	38,352	2,908	59,171
1965	10,200	9,194	N/D	50	0	1,000	2,500	0	150	N/D	23,235	738	38,569
1966	7,800	3,300	N/D	50	0	80	900	0	500	N/D	20,850	297	26,696
1967	23,500	5,210	N/D	150	N/D	180	370	N/D	500	N/D	11,956	146	23,147
1968	7,000	6,476	N/D	175	N/D	280	800	0	750	N/D	18,144	208	31,333
1969	5,230	5,826	N/D	200	N/D	830	1,240	0	1,700	N/D	60,578	348	47,265
1970	13,830	6,832	N/D	N/D	N/D	285	N/D	N/D	690	1,500	61,525	235	37,309
1971	5,650	5,289	N/D	0	615	470	N/D	N/D	980	1,000	47,041	481	51,790
1972	9,258	4,852	N/D	N/D	450	150	N/D	N/D	631	500	46,835	256	24,501
1973	24,119	8,135	N/D	50	N/D	300	N/D	N/D	420	1,700	73,577	205	94,777
1974	17,809	3,901	N/D	100	200	150	N/D	N/D	944	1,500	65,766	198	61,796
1975	5,641	4,857	N/D	N/D	1000	650	N/D	N/D	1,208	3,500	43,000	691	39,544
1976	3,779	5,444	N/D	N/D	640	46	1,013	N/D	245	N/D	62,000	699	28,374
1977	8,722	10,848	914	100	N/D	100	1,362	N/D	318	460	46,452	185	48,473
1978	7,416	3,652	N/D	N/D	20	128	60	N/D	300	925	37,759	204	21,091
1979	12,430	13,159	N/D	N/D	N/D	10	N/D	N/D	810	N/D	32,505	250	47,666
1980	12,406	14,443	N/D	N/D	N/D	226	N/D	N/D	320	500	35,295	669	49,802
1981	14,025	17,205	147	N/D	N/D	250	3,133	N/D	1,020	N/D	53,020	1,000	64,055
1982	39,367	26,795	43	N/D	N/D	534	785	N/D	1,290	700	55,519	2,000	43,898
1983	13,756	13,983	105	N/D	1000	50	N/D	N/D	200	N/D	30,522	1,702	35,300
1984	9,665	29,893	N/D	0	N/D	23	4,000	N/D	5,800	191	51,057	1,562	39,696

TABLE 7.3-2

CHINOOK SALMON SPAWNERS POPULATIONS IN SELECTED SACRAMENTO RIVER TRIBUTARIES

	Yuba River	Battle Creek		Big Chico	Butte Creek		Clear Creek		Mill creek		Feather River*2		American River*2
Year	Fall Run	Fall Run	Late Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run
1985	13,042	39,808	181	0	100	254	700	N/D	3,840	121	56,002	1,632	65,213
1986	19,328	31,252	197	N/D	N/D	1,371	N/D	N/D	574	291	55,471	1,433	55,067
1987	18,518	24,249	349	N/D	N/D	14	N/D	N/D	282	90	77,846	1,213	46,143
1988	9,000	67,475	53	N/D	N/D	1,290	4,453	N/D	1,487	572	49,036	6,833	33,514
1989	7,622	31,048	65	N/D	N/D	1,300	2,153	N/D	1,565	563	48,119	5,078	28,924
1990	N/D	21,088	92	0	N/D	250	1,011	N/D	N/D	844	6,126	1,893	10,239
1991	14,008	17,241	161	N/D	N/D	N/D	2,026	N/D	N/D	319	42,062	4,303	25,211
1992	6,362	12,708	344	0	N/D	730	600	N/D	999	237	40,545	1,497	11,267
1993	6,703	18,616	528	38	N/D	650	1,246	1	1,975	61	42,914	4,672	39,410
1994	10,890	43,265	598	2	N/D	474	2,546	0	1,081	723	53,584	3,641	40,087
1995	14,237	83,192	323	200	445	7,500	9,298	2	N/D	320	72,061	5,414	86,828
1996	27,900	73,587	1,337	2	500	1,413	5,922	N/D	N/D	253	65,277	6,381	82,396
1997	25,948	101,414	4,578	2	800	635	8,569	N/D	478	200	65,675	3,653	57,845
1998	31,090	98,308	3,079	369	500	20,259	4,259	47	546	424	18,889	6,746	66,580
1999	24,230	119,899	7,075	27	N/D	3,679	8,003	N/D	N/D	560	12,927	3,731	65,099
2000	14,955	75,106	4,194	27	714	4,118	6,687	19	N/D	544	132,863	3,657	110,219
2001	23,392	125,686	3,327	39	N/D	9,605	10,865	N/D	N/D	1,104	203,515	4,135	147,134
2002	24,051	463,296	2,669	N/D	3,415	8,785	16,071	66	2,611	1,594	125,670	4,189	134,069
2003	28,316	153,045	2,797	81	3,310	4,398	9,475	25	2,426	1,426	104,922	8,662	178,629
2004	14390	92,090	5,098	0	2,456	7,390	6,365	98	1,192	998	72,921	4,202	122,513
2005	15048	165,259	6,435	37	4,255	10,625	14,824	69	2,426	1,150	69,704	1,835	75,349
2006	N/D	N/D	N/D	299	N/D	4579	N/D	N/D	N/D	1,002	N/D	0	N/D

Notes:
*1 Includes Salmon from the mainstem population that were trapped at Keswick Dam and transported to Coleman National Fish Hatchery (CNFH).
*2 Includes Salmon that are wild spawners as well as hatchery spawned fish.
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

TABLE 7.3-3

SACRAMENTO RIVER AT RED BLUFF DIVERSION DAM CHINOOK SALMON SPAWNER POPULATIONS

Year	Fall Run*1	Late Fall Run*1	Winter Run	Spring Run
1960	218,940	N/D	N/D	N/D
1961	140,181	N/D	N/D	N/D
1962	127,837	N/D	N/D	N/D
1963	138,881	N/D	N/D	N/D
1964	142,584	N/D	N/D	N/D
1965	101,876	N/D	N/D	N/D
1966	111,881	N/D	N/D	N/D
1967	82,490	N/D	N/D	N/D
1968	98,429	N/D	N/D	N/D
1969	115,652	N/D	N/D	20,000
1970	65,142	N/D	40,409	3,652
1971	53,888	16,741	53,089	5,830
1972	33,958	31,559	35,929	7,038
1973	41,129	21,781	22,651	7,175
1974	47,019	6,083	18,536	3,800
1975	53,129	19,261	22,579	10,234
1976	45,753	15,908	33,029	25,095
1977	16,176	9,210	16,470	11,545
1978	32,235	12,479	24,735	5,669
1979	47,758	10,284	2,339	2,856
1980	21,961	9,093	1,142	9,363
1981	29,212	6,571	19,795	20,655
1982	17,966	3,981	1,233	23,156
1983	26,226	14,984	1,827	3,854
1984	36,965	6,540	2,662	7,823
1985	52,120	8,136	3,686	10,200
1986	68,821	7,820	2,566	15,948
1987	76,562	16,222	2,068	10,911
1988	63,998	12,507	2,129	9,601
1989	48,968	12,807	635	5,131
1990	32,109	6,892	384	3,896
1991	20,523	6,611	177	766
1992	23,914	9,356	1,159	371
1993	33,471	739	369	391
1994	44,729	291	144	862
1995	53,385	166	1,159	349
1996	71,725	48	1,012	378
1997	98,765	N/D	836	126
1998	5,718	38,239	2,831	1,115
1999	133,365	8,683	3,264	N/D
2000	87,793	8,632	1,263	71
2001	57,792	18,351	8,085	711
2002	45,523	36,004	7,348	273
2003	66,476	5,346	8,105	N/D
2004	34,050	8,824	7,784	395
2005	44,950	9,565	15730	N/D

Notes:
*1 Includes Salmon from the mainstem population that were trapped at Keswick Dam and transported to Coleman National Fish Hatchery.
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

TABLE 7.3-4

SAN JOAQUIN RIVER TRIBUTARY CHINOOK SALMON SPAWNER POPULATIONS

Year	Cosumnes River Fall Run	Merced River Fall Run	Tuolumne River Fall Run	Stanislaus River Fall Run	Mokelumne River Fall Run
1960	1,400	350	45,000	8,300	2,205
1961	N/D	50	500	1,900	137
1962	900	60	250	315	230
1963	1,500	20	100	200	481
1964	2,200	35	2,100	3,700	2,210
1965	800	90	3,200	2,231	1,300
1966	600	45	5,100	2,872	689
1967	500	600	6,800	11,885	3,000
1968	1,500	550	8,600	6,385	1,707
1969	4,400	600	32,200	12,327	2,685
1970	600	4,800	18,400	9,297	5,000
1971	500	3,651	21,885	13,621	5,200
1972	1,600	2,648	5,100	4,298	1,102
1973	900	1,172	1,989	1,234	2,600
1974	285	2,000	1,150	750	1,422
1975	725	2,400	1,600	1,200	1,900
1976	N/D	1,900	1,700	600	473
1977	N/D	1,011	450	0	250
1978	100	625	1,300	50	1,086
1979	150	2,147	1,183	110	1,507
1980	200	3,006	559	100	3,231
1981	N/D	10,415	14,253	1,000	4,954
1982	N/D	3,263	7,126	N/D	9,372
1983	200	18,248	14,836	500	15,861
1984	1,000	29,749	13,689	11,439	8,298
1985	220	16,052	40,322	13,473	7,682
1986	N/D	7,439	7,404	6,497	7,167
1987	0	4,126	14,751	6,292	1,630
1988	100	4,592	5,779	10,212	528
1989	N/D	427	1,275	1,510	280
1990	N/D	82	96	480	497
1991	N/D	119	77	394	410
1992	N/D	986	132	255	1,645
1993	N/D	1,678	471	677	3,157
1994	N/D	3,589	506	1,031	3,157
1995	N/D	2,922	827	619	5,517
1996	N/D	4,432	4,362	168	7,921
1997	N/D	3,660	7,146	5,588	10,175
1998	300	4,091	8,910	3,087	7,213
1999	N/D	4,766	8,232	4,349	5,333
2000	N/D	9,133	17,873	8,498	7,423
2001	N/D	9,660	8,782	7,033	8,035
2002	N/D	10,638	7,173	7,787	10,753
2003	N/D	3,079	2,163	5,902	10,239
2004	N/D	4,050	1,700	5,000	11,904
2005	N/D	2,921	500	3,500	18,680

Note:
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

numbers in Mill Creek from 2000 to 2005 have been greater. Feather River and Butte Creek have shown a similar trend of increasing spring-run numbers since 1995 as compared to years prior to 1995. The Feather River supports the spring-run Chinook population with spawning both in the river and at the Feather River hatchery. Cottonwood Creek, Big Chico Creek, Battle Creek, and Clear Creek also have runs of spring-run Chinook, but are fewer in numbers. Spring-run numbers in the Sacramento River at the RBDD have diminished in the 1990s and the early part of the 2000's when compared to the numbers in the 1970s and 1980s. The San Joaquin River population of spring-run Chinook was extirpated by the construction of Friant Dam in 1948 which blocked access to upstream spawning habitat. For spring-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, and 7.3-3.

Late fall-run – Adult late fall-run Chinook salmon migrate from October through April, with peak migration occurring in December.[17] Adults move through the SWP project area into spawning habitats of the Sacramento River. Salmon fry move downstream, and smolts emigrate to the ocean when spring freshets increase river flow, increase turbidity, and decrease temperatures in their natal tributaries.[18] Late fall-run Chinook spawn in the upper Sacramento River. Since 1971, the greatest number of late fall-run Chinook at the RBDD occurred in 1998 at 38,239 fish, the lowest occurred in 1996 at 48 fish. The late fall-run Chinook salmon numbers at the RBDD during the early part of the 2000s are comparable to the 1990s, 1980s, and 1970s. Battle Creek also supports a late fall-run. Numbers of late fall-run Chinook salmon in Battle Creek have trended upward since 1995. It is likely that the San Joaquin River also once supported a late fall-run, but it is now believed extirpated.[19] For late fall-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, and 7.3-3.

Fall-run – Historically, fall-run Chinook were in Central Valley streams that had enough water during the fall. Fall-run salmon generally spawned in streams on the valley floor and in foothill reaches below 500-feet elevation.[20] Typically, fall-run Chinook salmon enter the Sacramento-San Joaquin River system from July through December. Spawning occurs in October, November, and December. Extant runs of Chinook in the San Joaquin River system are fall-run fish that spawn in the Tuolumne, Merced, Cosumnes, Mokelumne, and Stanislaus rivers.[21,22,23] For fall-run numbers in the above five rivers, refer to Table 7.3-4. In the San Joaquin River, the fall-run population is generally less than 10,000 fish.[24] The Sacramento and San Joaquin River systems are heavily supplemented with hatchery raised fall-run Chinook. Fall-run Chinook salmon is the most abundant run at the RBDD. The highest total at RBDD since 1970 occurred in 1999 with 133,365 fish, the lowest occurred in 1998 with 5,718 fish. Fall-run totals at the RBDD during the 2000's have been comparable to the 1970's, 1980's, and 1990's. Yuba River, Battle Creek, Butte Creek, Clear Creek, Mill Creek, Feather River, and the American River, also all support fall-run Chinook salmon. For fall-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, 7.3-3, and 7.3-4.

Steelhead (*Oncorhynchus mykiss*)

Steelhead begin their migration from the ocean when winter rains provide large amounts of cold water for migration and spawning. Juvenile steelhead generally spend 1-3 years in freshwater before migrating to the ocean.[25]

Before water development during the last century, steelhead were more common in the Central Valley than they are today. Both hatchery and natural steelhead have declined in the Sacramento River system. Dams and other structures have blocked steelhead access to miles of rearing and spawning habitat. There is little history regarding steelhead distribution in the San Joaquin River system. Based on historical documentation of known Chinook salmon distribution, we can assume that steelhead were present from Kings River north.[26] Steelhead numbers in the San Francisco Bay area have also declined. Most of the streams in the San Francisco Bay area flow through heavily urbanized areas. These streams have been channelized, are associated with limited riparian vegetation, and generally have poor water quality.

In 1996, about 10 to 30 percent of adults returning to spawn were of natural origin,[27] down from an average of 88 percent for the 1953-1954 and 1958-1959 seasons.[28] The size of the steelhead run in the American River in the 1971-1972 and 1973-1974 season was 19,583 and 12,274, respectively.[29] Run sizes of 300, 1,500, and 250 were estimated for the 1990-1991 through 1992-1993 seasons, respectively.[30] Small numbers of wild fish remain, primarily in upper Sacramento River tributaries such as Deer, Mill, and Antelope Creeks and the Yuba River.[31] In 2003, populations of steelhead were found in the lower Stanislaus and Tuolumne rivers.[32] CDFG has identified the following Central Valley streams with potential to maintain self-sustaining wild runs of steelhead: Clear, Big Chico, Cow, Cottonwood, Battle, Mill, Deer, Antelope, and Butte Creeks, and the Yuba River.

Sacramento-San Joaquin roach (*Hesperoleucus symmetricus symmetricus*)

Sacramento-San Joaquin roach are found in a wide array of habitats in the Sacramento and San Joaquin river systems from the headwaters to the lower reaches of streams. Roach are often found in warmer streams because they are capable of surviving high water temperatures and low levels of dissolved oxygen.[33] However, they are also found in cooler-water higher elevation streams. They are relatively sensitive to elevated levels of salinity; a fact which precludes their use of much of the Delta and could limit movement between watersheds. Omnivorous, they feed by both grazing on the bottom and catching drifting prey. Roach mature after two to three years and spawning takes place in shallow flowing water over small gravel and is triggered by water temperatures over 16°C.[34]

River Lamprey (*Lampetra ayresi*)

River lamprey are found in several larger rivers and streams along the Pacific Coast including the Delta and several other streams that flow into the San Francisco Bay.[35] Adults move into the rivers to spawn in late spring and early summer. Spawning occurs on gravel substrates often well upstream from the estuary. Within the San Joaquin River System, spawning takes place primarily in the Tuolumne and Stanislaus rivers. Juveniles spend three to five years in freshwater before migrating to the ocean.

Pacific Lamprey (*Lampetra tridentata*)

Pacific lampreys are found in most of the larger rivers and streams along the Pacific Coast. Adults move into the rivers in late winter through spring. Spawning occurs in late spring and early summer on gravel substrates well upstream from the estuary. Juveniles spend five to seven years in freshwater before migrating to the ocean.

Hardhead (*Mylopharodon conocephalus*)

Hardhead can be found in some of the reservoirs in the Sierra foothills and larger mainstream rivers like the Feather, American, and Sacramento. Hardhead are one of the larger native minnows that can be found in the low- to mid-elevation streams of the Central Valley. Spawning behavior is poorly documented but presumably occurs over gravel substrates of riffles between April and May.

Striped Bass (*Morone saxatilis*)

This species is not considered a species of concern, but is included here as an example of a recreationally important that has been introduced into the habitats of the native fish species listed in the Fisheries Resources section. Striped bass are predacious on delta smelt and salmonids.

The San Francisco Estuary population of striped bass supports an important recreational fishery. Striped bass are not native to California. They were first introduced in 1879 and again in 1882.[36] Striped bass are facultatively anadromous. They spawn in tidal and non-tidal freshwaters of the Sacramento and San Joaquin rivers, and probably other suitable locations such as the Napa River and Suisun Marsh. Most spawning occurs between April and June, though spawning can occur before and after the peak period. Eggs and larvae drift downstream and larvae generally have population epicenters near those of delta smelt, about 20 km upstream of the two parts per thousand isohaline boundary (X2). Juvenile and adult striped bass rear in fresh to marine waters throughout San Francisco Estuary and the adjacent coastal ocean. The abundance of young-of-year San Francisco Estuary striped bass historically fluctuated in response to Sacramento-San Joaquin river outflows, being higher in years of high spring flow.[37] The flow versus abundance relationship for young-of-year striped bass changed coincident with the invasion of overbite clam, *Corbula amurensis*; a recent analysis by Department staff showed young-of-year abundance no longer responds to X2 variation. The CDFG Fall Mid-Water Trawl (FMWT) has monitored young-of-year striped bass population trends since 1967. The maximum abundance index (20,038) was recorded in 1967. The indices averaged 5,823 per year for the pre-overbite clam period, 1967-1986. Since then, the indices have averaged 741 per year, with a maximum of only 2,045 in 1992. Even after the overbite clam invasion, striped bass larvae were the third most numerous species collected during the first seven years of the CDFG survey of post-larval fishes. This suggests young striped bass still comprise a substantial portion of spring pelagic fish biomass in the upper estuary and Delta.

7.3.2.2 Physical Setting in 1995

The following discussion focuses on special-status fish species up to 1995.

Special Status Fish Species in 1995

The Sacramento-San Joaquin River system dominates the hydrology of Central California. Over the years, alteration in flow patterns, access barriers, diversion, and development have reduced the distribution and populations of many native fishes. In 1995, only two species, winter-run Chinook and delta smelt were State or federally protected. An additional four species and two runs of Chinook (spring-run and late fall-run) are considered special-status species by the USFWS, CDFG, or NOAA Fisheries (Table 7.3-5). The special-status fish list is compiled from *Fish Species of Special Concern in California*.[38]

The delta smelt was listed as a threatened species in March 1993 (58 FR 12854). Critical habitat for the species was designated in December 1994 and includes all of the Delta and Suisun Bay/Marsh (59 FR 65256). In 1995, green sturgeon were considered by the State to be suitable for listing as threatened[39] and are therefore considered a species of concern.

TABLE 7.3-5

SPECIAL STATUS FISH SPECIES AND DESIGNATED CRITICAL HABITAT WITHIN THE SACRAMENTO-SAN JOAQUIN DELTA IN 1995 AND 2003

Species	1995 Status (date) (source)	2003 Status (date) (source)	Critical Habitat
River Lamprey *Lampetra ayresi*	Class 3 (1)	State and Federal Species of Concern (2)	
Pacific Lamprey *Lampetra tridentata*	Class 4 (1)[B]	Federal Species of Concern (2)	
Kern Brook Lamprey *Lampetra hubbsi*	Class 2 (1)	State and Federal Species of Concern (2)	
Green Sturgeon *Acipenser medirostris*	Class 1-T (1)	State Species of Concern (2)	
Chinook *Oncorhynchus tshawytscha*			
Winter Run	Endangered (1/94) (59 FR 440)	Endangered	6/93 (58 FR 33212)
Spring Run	Class 1-E (1)	Threatened (9/99) (64 FR 57399)	
Fall/Late Fall Run	Fall Run: Class 4 (1) Late Fall: Class 2 (1)	Listing Not Warranted - Candidate (9/99) (64 FR 57399)	
Central Valley Steelhead *Oncorhynchus mykiss*	Class 4 (1)[C]	Threatened (3/98) (63 FR 13347)	
Delta Smelt *Hypomesus transpacificus*	Threatened (3/93) (58 FR 12854)	No Change	12/94 (59 FR 65256)
Longfin Smelt *Spirinchus thaleichthys*	Class 1 (1)	Species of Concern (2)	
Sacramento Splittail *Pogonichthys macrolepidotus*	Proposed for listing as threatened (64 FR 5963)	Threatened status remanded (9/03) (68 FR 55140)	

Notes:
A. From Moyle et al. (1995):
Class 1-E: Those species that meet the State or federal definitions as endangered.
Class 1-T: Those species that meet the State or federal definitions as threatened.
Class 2: Species of special concern. These are species with scattered or very localized populations. Considered equivalent of the 2003 Species of Special Concern status.
Class 3: A "watch list" designation for species whose range is much restricted in comparison to historic conditions.
Class 4: Populations that are apparently secure.
B. Noted as being in decline (Moyle et al. 1995).
C. "Winter steelhead" were noted as being in decline and probably deserving of being Class 3 (Moyle et al. 1995).
Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. CDFG (California Department of Fish and Game) 2003d. Special Animals list, July 2003. Available online at: http://www.dfg.ca.gov/hcpb/species/lists.shtml.

Population estimates put the green sturgeon at less than 2,000 adults.[40] Although steelhead were not formally considered a species of concern in 1995, NOAA Fisheries was conducting a status review of steelhead populations indicating that the species status was of concern.[41] Because of this, steelhead are considered a species of concern in 1995. Longfin smelt, due to its low numbers, was considered a species of concern in 1995. Sacramento splittail was proposed for listing as threatened under the FESA in January 1994 (64 FR 5963) because of their declining numbers and restricted distribution.

Winter-run Chinook salmon were listed as endangered in January 1994 under the FESA (59 FR 440). They were listed as endangered in September 1989 under the CESA.[42] Spring-run Chinook were considered suitable for listing as endangered in the mid-1990s;[43] however, because they were not listed in 1995, they were not considered a species of concern in 1995. Late fall-run Chinook are considered a species of concern. The population of fall-run fish was presumed to be stable in 1995.[44]

Feather and American River Fish

In 1995 the Feather River supported spring-run and fall-run Chinook (Table 7.3-2) and steelhead. Other species that were considered special status in 1995 that likely occurred within the Feather River include green sturgeon, Sacramento splittail, and striped bass. Sacramento splittail and striped bass can also be found within the American River. In 1995, The American River supported fall-run Chinook (Table 7.3-2).

Sacramento River Fish

The Sacramento River supports populations of several species of fish. The area between RBDD and the upper limits of the Delta are home to fish species that in 1995 were considered special status (Table 7.3-6). These include winter, late-fall, and spring-run Chinook, steelhead, green sturgeon, Sacramento splittail, and from the city of Sacramento downstream, delta smelt.

TABLE 7.3-6

1995 OCCURRENCE OF SPECIAL STATUS FISH SPECIES WITHIN THE RIVERS POTENTIALLY INFLUENCED BY THE PROPOSED PROJECT

Species	Sacramento River	Feather River	American River	San Joaquin River	Sacramento-San Joaquin Delta
Green Sturgeon	Present	Likely	Absent	Absent	Present
Chinook					
Winter-run	Present	Absent	Absent	Absent	Present
Spring-run	Present	Present	Absent	Absent	Present
Central Valley Steelhead	Present	Present	Present	Present	Present
Delta Smelt	Present	Absent	Absent	Absent	Present
Longfin Smelt	Present	Absent	Absent	Absent	Present
Sacramento Splittail	Present	Present	Likely	Present	Present

Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. Moyle, 2002. Inland Fisheries of California, 2nd Edition. University of California Press.
3. Anadromous Fish Restoration Program, 2006. California Department of Fish and Game. Online at http://www.delta.dfg.ca.gov/afrp/watersheds.asp.
4. California Department of Water Resources. 2007. Draft Environmental Impact Report. Oroville Facilities Relicensing. May 2007.

San Joaquin River Fish

Special status species of fish in the San Joaquin River include Kern River brook lamprey found well upstream in the system. Some wild steelhead and splittail may occur in the San Joaquin River upstream of tidal influence (Table 7.3-6), and fall-run Chinook occurs in the tributaries.

Sacramento-San Joaquin Delta Fish

The fisheries of the Delta are complex and change seasonally. Of the species discussed above, delta smelt's distribution is limited to brackish waters of the Delta. Three runs of

Chinook that were considered special status in 1995 can be found in the Delta, including the federally endangered winter-run, and the spring and late fall-run which are both species of concern. Other special-status fish species found in the Delta include steelhead, Sacramento splittail, green sturgeon, and longfin smelt (Tables 7.3-5 and 7.3-6).

Lake Oroville Fish

Lake Oroville's fishery is made of fish species that inhabited the Feather River and were impounded when the lake and dam were constructed in the 1960's. It also includes fish species that were intentionally or accidentally introduced to the lake. Bass fishing is very popular at the lake, with its excellent habitat and special angling regulations. Lake Oroville is recognized as one of the best bass fisheries in the western United States.

Lake Oroville supports both coldwater and warmwater fisheries. The warmwater fishery is made up primarily of spotted bass (*Micropterus punctulatus),* largemouth bass (*Micropterus salmoides*), redeye bass (*Micropterus coosae*), smallmouth bass (*Micropterus dolomieu)*, bluegill (*Lepomis macrochirus)*, green sunfish (*Lepomis cyanellus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis)*, channel catfish (*Ictalurus punctatus)*, and white catfish (*Ameiurus catus).* The coldwater fishery consists mainly of brown trout (*Salmo trutta)* and Chinook salmon. Starting in 2002, the Department began to stock Coho in Lake Oroville. A total of 178,529 Coho were stocked in 2002, consisting of a combination of fingerling and yearling size fish.

San Luis Reservoir Fish

The fishery of San Luis Reservoir is relatively complex when compared to other reservoirs in the SWP. Because of its proximity to the Delta pumping facilities, any species that is found in the Delta can be found in San Luis Reservoir.[45] The reservoir supports an excellent sport fishery for striped bass. Other species present include threadfin shad (*Dorosoma petenense*), golden shiner (*Notemigonus crysoleucas*), starry flounder (*Platichthys stellatus*), and kokanee (landlocked sockeye salmon, *Oncorhynchus nerka*).

Lake Perris Fish

This reservoir supports a warm water sport fishery consisting of largemouth bass, spotted bass, green sunfish, and channel catfish. The spotted bass were originally planted in 1974 as an alternative to the standard Florida-strain largemouth bass because they are more successful at spawning in fluctuating reservoirs.[46] Rainbow trout are planted by CDFG during the cooler months each year.[47] In 1994, 63,900 catchable size trout were planted.[48] Inland silversides (*Menidia beryllina*), threadfin shad, bluegill, and red-ear sunfish (*Lepomis microlophus*) provide forage for the gamefish. The bluegill in Lake Perris can reach 2-3 lbs and support a fishery of their own. There are no special-status fish species within the reservoir.[49]

Castaic Lake Fish

Castaic Lake supports a warm water bass fishery. The primary target species of Castaic Lake are striped bass and largemouth bass. A forage base of bluegill and assorted minnows in addition to providing its own fishery, supplies ample food for bass. A rainbow trout fishery is maintained by CDFG. In 1994, 43,800 catchable trout were stocked in Castaic Lake.[50] There are no special-status species reported from this reservoir.

Other Recreationally Important Fish

In the Delta, the striped bass index in 1994 was 1,247; down from typical highs of approximately 4,000 in the 1980's.[51] The all-time high striped bass index was in 1967, when it was over 20,000. The Delta also supports an important largemouth bass fishery, as well as catfish.

7.3.2.3 Changes in Physical Setting between 1996 and 2003

The following discussion focuses on changes to special-status fish species from 1996 to 2003.

Special Status Fish Species

The following discussion and list of special-status fish species within the rivers potentially influenced by the proposed project in this period (Table 7.3-7) is very similar to that presented for 1995 (Table 7.3-6), but there are some notable exceptions. First, in the Central Valley two species (spring-run Chinook and steelhead) considered species of concern in 1995 were listed as threatened under the FESA (steelhead in 1998 and Chinook in 1999). Second, Sacramento splittail was listed as a federally threatened species in 1999, but that status was remanded. On June 23, 2000, the Federal Eastern District Court of California remanded the threatened determination for Sacramento splittail and had the USFWS re-evaluate their decision. Subsequently, the USFWS removed the Sacramento splittail from the list of threatened species and moved it to the species of concern list.[52] Third, one watch list species and one secure species are now both species of concern (river and Pacific lamprey). Additional taxonomic work has resulted in the proposed division of the California roach (*Hesperoleucus symmetricus*) into several subspecies. One of these, the San Joaquin roach (*Hesperoleucus symmetricus symmetricus*) is considered a species of special concern by CDFG. The respective life history details for these species have been presented in Section 7.3.2.1.

Central Valley steelhead were federally listed as a threatened species in March 1998 (63 FR 13347) and include all wild spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries. As was the case in 1995, these populations continue to be supported by hatchery releases. The delta smelt remained listed as threatened in the FESA and CESA in 2003.

There has been no change in the listing status of winter-run Chinook since 1995. Spring-run Chinook were listed as threatened under the CESA in February 1999[53] and as threatened under FESA in September 1999 (64 FR 50394). Listing actions were taken following an extensive review period that indicated populations of this fish continued to decline. Following a formal status review process, NOAA Fisheries determined that the fall-run and late fall-run Chinook did not warrant listing (64 FR 50393). However, they did determine that the fall-run and late fall-run Chinook should be designated as candidates for listing under FESA (64 FR 50393). Fall and late fall-run Chinook are also listed by CDFG as a Species of Concern.

Sacramento splittail, while not a federally listed species, is a California species of concern and is therefore included in the following analysis.[54]

As of 2003, green sturgeon were considered by the State to be suitable for listing as threatened[55] and were therefore considered a species of concern. Population estimates put the green sturgeon at less than 2,000 adults.[56] As of July 6, 2006, the southern green sturgeon federal listing status changed to threatened. The northern green sturgeon federal listing status remains as a species of concern. A combination of reasons have led to this decision, including

TABLE 7.3-7

2003 OCCURRENCE OF SPECIAL STATUS FISH SPECIES WITHIN THE RIVERS POTENTIALLY INFLUENCED BY THE PROPOSED PROJECT

Species	Sacramento River	Feather River	American River	San Joaquin River	Sacramento-San Joaquin Delta
River Lamprey	Present	Present	Unknown	Present	Present
Pacific Lamprey	Present	Present	Present	Present	Present
Green Sturgeon	Present	Likely	Unknown	Unlikely	Present
Chinook					
Winter-run	Present	Absent	Absent	Absent	Present
Spring-run	Present	Present	Absent	Absent	Present
Fall/Late Fall-run	Present	Present	Present	Present	Present
Central Valley Steelhead	Present	Present	Present	Present	Present
Delta Smelt	Absent	Absent	Absent	Absent	Present
Longfin Smelt	Absent	Absent	Absent	Absent	Present
Sacramento Splittail	Present	Present	Likely	Present	Present
Hardhead	Present	Present	Present	Present	Absent
San Joaquin Roach	Present	Present	Present	Present	Absent
Striped Bass	Present	Present	Present	Present	Present

Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. Moyle, 2002. Inland Fisheries of California, 2nd Edition. University of California Press.
3. Anadromous Fish Restoration Program, 2006. California Department of Fish and Game. Online at http://www.delta.dfg.ca.gov/afrp/watersheds.asp.

an increase in sport-fishing pressure, declining populations statewide, and limited biological information.

River lamprey are considered a State and federal species of concern, primarily because so little is known about their natural history and large areas of potential habitat have been lost upstream of dams.[57] Pacific lamprey was considered secure (not in danger of extinction) but noted as being in decline in 1995.[58] Their decline continued through the 1990s and into the early 2000s. This decline has placed the Pacific lamprey as a federal species of concern because the large populations that were once common along the California coast are significantly diminished.[59] Longfin smelt are a State and federal species of concern.[60] Their status is primarily a result of their long-term population decline similar to the decline of the delta smelt. Hardhead are a California species of concern primarily because a combination of loss of cool, clear mid-elevation stream habitat and invasive sunfish has reduced populations.[61] San Joaquin roach are considered a species of concern because habitat degradation and fragmentation has resulted in increasing isolation of populations. Recruitment into or recolonization of historically occupied streams becomes more difficult as streams are occupied by non-native predators and barriers to movement are created.

Feather River Fish

The Feather River supports runs of fall-, late fall-, and spring-run Chinook, Central Valley steelhead, and Pacific lamprey. The Sacramento-San Joaquin roach appears to be absent in areas downstream of Oroville dam, but may still be present in the Feather River upstream of

Lake Oroville.[62] It is assumed that Sacramento splittail enter the lower river when flows permit during the appropriate time of year. Hardhead and striped bass may also be found here in appropriate habitats in the right season. Seasonal occurrence of fish species is presented in Table 7.3-8.

TABLE 7.3-8

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE FEATHER RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002, SWRI 2003
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Spring-run	Mar-Sep (May-June)	Aug-Oct (Sep)	3-15 months	(Jan-Feb, and April)	DWR 2002, Moyle 2002
Fall/Late Fall-run	Sep-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Jan-Mar	DWR 2002, Moyle 2002
Central Valley Steelhead	Sep-Mar (Sep-Oct)	Dec-Apr	1-2 years	Feb-Sep (Mar)	Moyle 2002, SWRI 2003
Sacramento Splittail	Jan-Mar	Feb-July (Mar-April)	1 Month	May-June	DWR 2007
Hardhead	N/A	Apr-May	N/A	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	Apr-June	N/A	N/A	DWR 2007

Source: California Department of Water Resources, Draft Environmental Impact Report, Oroville Facilities Relicensing, May 2007.

American River Fish

Similar to the Feather River, the American River supports a fall/late fall-run Chinook, Central Valley steelhead, and Pacific lamprey. It is unknown if sturgeon use this system, but it is likely that Sacramento splittail, hardhead, and striped bass can be found in the American River. Similar to the Feather River, the Sacramento-San Joaquin roach may be absent in areas downstream of Nimbus dam, but may still be present in the American River upstream of Folsom Lake. Seasonal occurrence of fish species is presented on Table 7.3-9.

Sacramento River Fish

The additional species found within the Sacramento River that were not considered special status in 1995 include river and Pacific lamprey, fall/late fall-run Chinook, Central Valley steelhead, Sacramento-San Joaquin roach, and hardhead. The Sacramento River continues to be the only watershed supporting winter-run Chinook and one of the only supporting spring-run Chinook. The Sacramento River also is the only watershed known to have green sturgeon. Populations of winter-run Chinook were at an all time low in 1994 but had rebounded by 2002 (Table 7.3-3) due in large part to aggressive population management and an intensive stocking regime.[63] Seasonal occurrence of fish species is presented on Table 7.3-10.

TABLE 7.3-9

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE AMERICAN RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Fall/Late Fall-run	Aug-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Jan-Mar	DWR 2002, Moyle 2002
Central Valley Steelhead	Aug-Mar (Sep-Oct)	Feb-Apr	1-2 years	Jan-Apr (Mar)	Moyle 2002
Sacramento Splittail	Jan-Mar	Feb-June (Mar-May)	1 month	May-June	
Hardhead	N/A	Apr-May	N/A	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	Apr-June	N/A	N/A	SWRI 2003

TABLE 7.3-10

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SACRAMENTO RIVER UPSTREAM OF TIDAL INFLUENCE

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est. Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Winter-run	Dec-July (Mar)	Apr-Aug (May-June)	5-10 months	July-Oct	Moyle 2002
Spring-run	Mar-Sep (May-June)	Aug-Oct (Sep)	3-15 months	Nov-Mar (Jan-Mar)	Moyle et al 1995, Moyle 2002
Fall-run	June-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Dec-Mar	Moyle 2002
Late Fall-run	Oct-Feb (Dec)	Jan-Apr (Feb-Mar)	7-13 months	Apr-June (Dec-Mar)	Moyle et al 1995, Moyle 2002
Central Valley Steelhead	Aug-Mar (Sep-Oct)		1-3 years		Moyle 2002
Sacramento Splittail	Dec-Mar	Mar-May	1-3months	Apr-July	Moyle et al 1995, Moyle 2002; Feyrer et al. 2005
Hardhead	N/A	Apr-May	entire life cycle	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	May	N/A	N/A	SWRI 2003

San Joaquin River Fish

The San Joaquin River continued to support special-status species in this period between 1996 and 2003. Those added to the previously discussed list include river and Pacific lamprey, Sacramento-San Joaquin roach, fall/late fall-run Chinook, Central Valley steelhead, hardhead, and Sacramento splittail. The steelhead spawn in the Tuolumne and Stanislaus rivers[64] and probably use the San Joaquin only as a migratory corridor. Seasonal occurrence of fish species is presented on Table 7.3-11.

TABLE 7.3-11

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SAN JOAQUIN RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall	Feb-May	3-5 years	Spring	Moyle 2002
Pacific Lamprey	Jan-June (Mar-May)	Feb-May	5-7 years	Spring	Moyle 2002
Kern Brook Lamprey	N/A	Spring-Summer	4-5 years	No information	Moyle et al 1995
Chinook					
Fall-run	Oct-Jan (Nov)	Oct-Jan (Nov)	1-7 months	Jan-Mar	Moyle 2002
Central Valley Steelhead	Aug-Mar	No Data	1-3 years	Spring	Moyle 2002
Sacramento Splittail	Dec-Mar	Mar-May	1-3 months	Apr-July	Moyle et al 1995, Moyle 2002; Feyrer et al. 2005
Hardhead	N/A	Apr-May	N/A		SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	May	N/A		SWRI 2003

Sacramento-San Joaquin Delta Fish

All of the listed species (see Table 7.3-5), with the exception of Kern brook lamprey are found within the Delta. Some species (Chinook, steelhead, river and Pacific lamprey, and sturgeon) migrate through the Delta on their way to spawning grounds further upstream. Others spend their entire life cycles in the Delta and seaward regions of the San Francisco Estuary (striped bass, delta smelt, longfin smelt, and Sacramento splittail). Seasonal occurrence of fish species is presented on Table 7.3-12.

Lake Oroville Fish

The fisheries of Lake Oroville are essentially the same in the period of 1996 to 2003 as compared to 1995. The Department and CDFG have provided for fishery improvements at Lake Oroville. The Department's efforts have more than doubled the amount of fish habitat enhancement at Lake Oroville. Since 1995, the Department has funded the entire Chinook salmon stocking at Lake Oroville. This represents over 80 percent of the 2.4 million fish stocked in Lake Oroville during that period. As mentioned previously, the Department began to plant

TABLE 7.3-12

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SACRAMENTO-SAN JOAQUIN DELTA

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency (all freshwater residency, not Delta residency)	Outmigration (peak)	Source
River Lamprey	Fall	N/A	3-5 years	Spring	Moyle 2002
Pacific Lamprey	Jan-June (Mar-May)	N/A	5-7 years	Spring	Moyle 2002
Kern Brook Lamprey	Not Present				Moyle 2002
Green Sturgeon	Feb-July	N/A	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Winter-run	Dec-July (Mar)	N/A	5-10 months	Oct-May	Moyle 2002; SWP/CVP fish facilities data
Spring-run	Mar-Sep (May-June)	N/A	3-15 months	Nov-Jun	Moyle 2002; SWP/CVP fish facilities data
Fall-run	June-Dec (Sep-Oct)	N/A	1-7 months	Jan-Jun	Moyle 2002; SWP/CVP fish facilities data
Late Fall-run	Oct-Apr (Dec)	N/A	7-13 months	Apr-Sep	Moyle 2002; SWP/CVP fish facilities data
Central Valley Steelhead	Aug-Mar (Sep-Oct)	N/A	1-3 years	Jan-Jun	Moyle 2002; SWP/CVP fish facilities data
Delta Smelt	Dec-Mar (Jan)	Feb-July (Apr-May)	1-2 months	N/A	Moyle 2002
Longfin Smelt	Winter	Nov-June (Feb-Apr)	0-2 months	Jan-Aug (Apr-June)	Moyle 2002
Sacramento Splittail	Dec-Mar	Feb-July (Mar-May)	All Year	N/A	Moyle et al 1995, Moyle 2002
Striped Bass	Apr-June	Apr-May	All Year	N/A	SWRI 2003

Coho salmon in 2002 as opposed to Chinook salmon. A total of 172,792, 58,802, and 251,126 Coho were planted in 2003, 2004, and 2006 respectively. None were planted in 2005 due to a fish disease problem with the egg supply. CDFG has continued to regularly stock brown trout. Since 1995, the Department has been conducting fish habitat enhancement projects at Lake Oroville. Willow trees (rooted and cuttings) have been planted, hundreds of brush shelters have been constructed in coves using Manzanita and over 6,500 Christmas trees collected from the surrounding area by the Department, CDFG, local boy scouts, schools, angling organizations, merchants, and waste disposal companies. The completion of the new Federal Energy Regulatory Commission license in 2008 is expected to provide more fisheries enhancement opportunities to Lake Oroville.

San Luis Reservoir and Castaic Lake Fish

The fisheries resources of these two reservoirs have not changed from 1996 to 2003. The fishery at San Luis Reservoir is still greatly influenced by imported water from the Delta. Castaic Lake continues to support an excellent warm-water bass fishery and CDFG continues to stock this lake with rainbow trout.

Lake Perris Fish

The reservoir sport fish assemblage is assumed to be essentially the same in the 1996 to 2003 period as it was in 1995 (see Impact 7.3-7 for a discussion of impacts). However, management of the reservoir has recently changed. Historically, this reservoir was subject to relatively extreme water elevation fluctuations that limited the spawning success of the bass and affected recreational use. In 2001, an interagency Memorandum of Understanding (MOU) was reached between CDFG, the Department, MWDSC, California Department of Boating and Waterways, and California State Parks that was intended to reduce reservoir water elevation fluctuation.[65] The MOU established a Lake Perris Operations Committee (LPOC) that was charged with development of operational guidelines. These guidelines established a maximum fluctuation of 0.5-foot per day with a total of 3 feet of elevation change between March 15 and May 1; the spring fish spawning period.[66] Additionally a minimum elevation goal of 1,584 feet between the start of Memorial Day weekend and Labor Day has been established, primarily to provide the maximum recreational space possible,[67] and also allow for relatively stable fish habitat.

Other Recreationally Important Fish

Striped bass is not considered a species of concern, but is included here as an example of a recreationally important species that has been introduced into the habitats of the native fish species listed in the Fisheries Resources section. The striped bass populations, in spite of appearing to rise through 2003, may in fact have been declining. By 2001 the population was estimated at over 1.5 million fish. This is well over the upper threshold established through the Striped Bass Conservation Plan and resulted in a cessation of stocking.[68] However, two indices calculated by CDFG for young-of-year striped bass, FMWT and summer townet survey (TNS), indicated that the striped bass population may have been in decline. The TNS population index was 1.5 in 2003; the second lowest index on record. The TNS index was below 10 every year since 1994.[69] The FMWT index in 2003 was 108, a slight increase from the record low of 71 in 2002, but still the second lowest on record.[70] Together, these indices indicate that the population of young striped bass continued to decline through 2003.

7.3.2.4 Decline of Delta Pelagic Organisms since 2003

The San Francisco Estuary is a highly modified ecosystem with numerous documented long-term ecological changes. Declining abundance of some estuarine fish taxa has been one conspicuous change. Longfin smelt, delta smelt, and young-of-year striped bass are several taxa that have declined since intensive monitoring programs were initiated in the 1950s and 1960s. Recently, these and other species have declined further and have generally had abundance indices that were lower than expected based on previous relationships to springtime river flow into the estuary. This recent decline, which happened somewhere between the late 1990s and early 2000s has been described as Pelagic Organism Decline (POD). The POD includes four fish species along with several zooplankton taxa. Life history background for three of the POD fishes (longfin smelt, delta smelt, and splittail) is provided below. Department monitoring, through the Interagency Ecological Program (IEP), has found the POD is likely restricted to pelagic fishes dependent on the upper estuary (Suisun Bay and the Delta). Pelagic marine fishes using San Francisco and San Pablo bays were not affected, nor were nearshore fishes (such as splittail described below) that inhabit the upper estuary.

It is not clear whether the POD represents a simple continuation of long-term declines or a new stressor that has further degraded pelagic fish resilience. Long-term influences such as river flow variation and overbite clam impacts on the pelagic food web are mentioned in the species life history sections below. The POD investigations have proceeded under a working hypothesis that the recent declines are a response to a new stressor (or at least a new version of an older stressor). The investigation centers around impacts of water project operations, food web changes, and contaminants (Table 7.3-13).

TABLE 7.3-13

SUMMARY OF THE PRIMARY ENVIRONMENTAL STRESSORS BEING EVALUATED AS PART OF THE PELAGIC ORGANISM DECLINE INVESTIGATIONS

Stressor Group	Stressor Subgroups	Affected fish life stage or time of year
Water Project Operations	➢ Winter entrainment ➢ Spring entrainment ➢ Fall habitat ➢ Entrainment of lower trophic-level	➢ Spawning adults ➢ Larvae ➢ Juveniles/maturing adults ➢ Juveniles
Food Web Changes	➢ Smelt-copepod co-occurrence ➢ Pelagic productivity sinks ➢ Benthic productivity sinks	➢ Juveniles ➢ Juveniles ➢ Larvae-juveniles
Contaminants	➢ Ambient water toxicity ➢ Pyrethroids ➢ Microcystis blooms	➢ All year ➢ All year ➢ Late summer/fall

Note: The Department recognizes that during the 2007 calendar year there has been a continued decline in pelagic fisheries within the San Francisco Estuary, most notably the delta smelt. The operation of the SWP, with emphasis on water deliveries via Banks Pumping Plant, is undergoing increased scrutiny from the public and various groups concerned about the health of fisheries and the Delta ecosystem. On May 31, 2007, the Department shut down the pumps at Banks after record low number of delta smelt. On June 8, 2007, limited pumping resumed to meet critical water needs. Increasingly, fish species in the Delta face stressors that include competition with invasive species, toxicity run-off from surrounding farms, and a shortage of food sources. Additional information is currently being obtained regarding the multiple threats currently faced in the Delta and San Francisco Estuary. The Department continues to follow all legal environmental restrictions regarding the timing and amount of water that is pumped at Banks. As new scientific data and legal environmental issues surface regarding the SWP operation in the Delta, the Department will continue to evolve its SWP operation strategies to ensure environmental compliance and SWP contractor deliveries. In winter 2008 a new POD synthesis report will be available that will include all the latest scientific data and information as it pertains to the Delta and the POD.

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Banks. As new scientific data and legal environmental issues surface regarding the SWP operation in the Delta, the Department will continue to evolve its SWP operation strategies to ensure environmental compliance and SWP contractor fulfillment. In Fall 2007 a new POD synthesis report will be available that will include all the latest scientific data and information as it pertains to the Delta and the POD.

Longfin Smelt (*Spirinchus thaleichthys*)

The San Francisco Estuary population of longfin smelt is the southernmost along the U.S. Pacific Coast. Most longfin smelt live two to three years. They spawn in tidal freshwaters of the Delta, Suisun Bay/Marsh, and probably other suitable locations such as the Napa River. Most spawning occurs between February and April, though spawning can occur well before and after the peak period. Larvae drift downstream and generally have population epicenters at X2. The juvenile and adult longfin smelt rear in brackish to marine waters throughout San Francisco Estuary and the adjacent coastal ocean. San Francisco Estuary longfin smelt population abundance fluctuates in response to Delta river outflows, being higher in years of high spring flow.[71] The flow versus abundance relationship for longfin smelt changed coincident with the invasion of overbite clam, *Corbula amurensis*; fewer longfin smelt are now produced per unit flow as indexed by X2. The CDFG Fall Midwater Trawl has monitored longfin smelt population trends since 1967. The maximum abundance index (81,790) was recorded in 1967. The indices averaged 17,060 per year for the pre-overbite clam period, 1967-1986. Since then, the indices have averaged 1,775 per year, with a maximum of 8,646 in 1995. Even after the overbite clam invasion, longfin smelt larvae were the most numerous species collected during the first seven years of the CDFG 20mm Survey of post-larval fishes. This suggests young longfin smelt still comprise a dominant portion of spring pelagic fish biomass in the upper estuary and Delta.

Delta Smelt (*Hypomesus transpacificus*)

Delta smelt is a landlocked relative of the surf smelt, *Hypomesus pretiosus*, and is endemic to the San Francisco Estuary. Most delta smelt live one year. They spawn in tidal freshwaters of the Delta, Suisun Bay/Marsh, and the Napa River. Most spawning occurs between March and May, though spawning can occur before and after the peak period. Larvae drift downstream and generally have population epicenters about 20 kilometers upstream of X2. Juvenile and adult delta smelt rear in fresh to brackish waters of Suisun Bay and the lower Sacramento River. Delta smelt population trends have fluctuated unpredictably through time. This suggests the delta smelt population is subjected to several significant drivers that cannot be readily aggregated into a variable like X2. The CDFG Fall Midwater Trawl has monitored delta smelt population trends since 1967 (Table 7.3-14). The maximum abundance index (1,673) was recorded in 1970; a nearly equivalent index (1,653) was recorded in 1980. Delta smelt larvae were the eighth most numerous species collected during the first seven years of the CDFG 20mm Survey of post-larval fishes.

Splittail (*Pogonichthys macrolepidotus*)

Splittail are a large cyprinid fish species endemic to the San Francisco Estuary and its watershed. Splittail can sexually mature at two years; most splittail seem to live at least five years and ages up to eight have been recorded. Splittail spawn on flooded vegetation, mainly during February through May. Splittail spawning habitat is greatly increased during periods of floodplain inundation in the Sacramento and San Joaquin basins. Consequently, like longfin smelt, splittail populations have fluctuated in response to river flows as indexed by X2. Unlike

TABLE 7.3-14

ADULT DELTA SMELT RECOVERY INDEX (BASED ON FALL MID-WATER TRAWL SURVEY)

Year	Recovery Index	Year	Recovery Index
1967	139	1987	72
1968	251	1988	67
1969	128	1989	76
1970	598	1990	81
1971	352	1991	171
1972	551	1992	26
1973	305	1993	400
1974	No Data	1994	19
1975	239	1995	252
1976	22	1996	28
1977	146	1997	62
1978	108	1998	169
1979	No Data	1999	322
1980	312	2000	265
1981	78	2001	314
1982	37	2002	33
1983	17	2003	101
1984	51	2004	25
1985	29	2005	4
1986	70		

Source: Emergency Petition to list the delta smelt as an endangered species under the ESA. Center for Biological Diversity, The Bay Institute, Natural Resource Defense Council. March 8, 2005.

longfin smelt, the invasion of overbite clam did not affect the X2-abundance relationship for splittail, presumably because the young fish are not dependent on the upper estuary pelagic food web. Young splittail feed on zooplankton, insect larvae, and miscellaneous benthic invertebrates, including overbite clams. Larval splittail typically rear in shallow freshwater habitats; juveniles may migrate into brackish water habitats. Juvenile and adult splittail are physiologically hardy and are very tolerant of estuarine conditions (elevated salinity, low dissolved oxygen, and high water temperatures). Splittail are not readily collected by the CDFG trawling surveys because they are often distributed in very shallow water. However, their annual abundance trends have been indexed by the Fall Midwater Trawl Survey since 1967. The index has averaged 32 per year, with a maximum index of 281 in 1998.

Splittail (*Pogonichthys macrolepidotus*)

Splittail are a large cyprinid fish species endemic to the San Francisco Estuary and its watershed. Splittail can sexually mature at two years; most splittail seem to live at least five years and ages up to eight have been recorded. Splittail spawn on flooded vegetation, mainly during February through May. Splittail spawning habitat is greatly increased during periods of floodplain inundation in the Sacramento and San Joaquin basins. Consequently, like longfin smelt, splittail populations have fluctuated in response to river flows as indexed by X2. Unlike longfin smelt, the invasion of overbite clam did not affect the X2-abundance relationship for splittail, presumably because the young fish are not dependent on the upper estuary pelagic food web. Young splittail feed on zooplankton, insect larvae, and miscellaneous benthic invertebrates, including overbite clams. Larval splittail typically rear in shallow freshwater habitats; juveniles may migrate into brackish water habitats. Juvenile and adult splittail are

physiologically hardy and are very tolerant of estuarine conditions (elevated salinity, low dissolved oxygen, and high water temperatures). Splittail are not readily collected by the CDFG trawling surveys because they are often distributed in very shallow water. However, their annual abundance trends have been indexed by the FMWT Survey since 1967. The index has averaged 32 per year, with a maximum index of 281 in 1998.

7.3.2.5 Regulatory Setting in 1995

Several federal, State, and regional agencies have jurisdictional responsibilities regarding permit approvals and other regulatory actions for public improvements and private development projects that may affect fisheries resources within the SWP service area. Following is a discussion of relevant federal and State regulations.

Federal

Federal Endangered Species Act of 1973 (FESA)

Section 3 of the FESA defines an endangered species as any species or subspecies of fish, wildlife, or plants “in danger of extinction throughout all or a significant portion of its range.” A threatened species is defined as any species or subspecies “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” Designated endangered and threatened species, as listed through publication of a final rule in the *Federal Register*, are fully protected from a “take” without an incidental take permit administered by the USFWS or NOAA Fisheries under Section 10 of the FESA. The term “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (50 CFR 17.3). The term “harm” in the definition of “take” means an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). The term “harass” in the definition of “take” means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Proposed endangered or threatened species are those for which a proposed regulation, but not a final rule, has been published in the *Federal Register*.

Section 7 of the FESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. This obligation requires federal agencies to consult with the USFWS or NOAA Fisheries on any actions (including issuing Clean Water Act Section 404 permits, issuing licenses, or providing federal funding) that may affect listed species to ensure that reasonable and prudent measures will be undertaken to mitigate impacts on listed species. Consultation with USFWS or NOAA Fisheries can be either formal or informal depending on the likelihood of the action to adversely affect listed species or critical habitat. Once a formal consultation is initiated, USFWS or NOAA Fisheries will issue a Biological Opinion (either a “jeopardy” or a “no jeopardy” opinion) indicating whether the proposed agency action will or will not jeopardize the continued existence of a listed species or result in the destruction or modification of its critical habitat. A federal permit cannot be issued for a project with a “jeopardy” opinion unless the project is redesigned to lessen impacts.

In the absence of any federal involvement, as in a privately-funded project on private land with no Federal permit or funding, only Section 10(a) of the FESA can empower the USFWS or

NOAA Fisheries to authorize incidental take of a listed species provided a habitat conservation plan (HCP) is developed. To qualify for a Section 10(a) permit, strict conditions must be met including a lengthy procedure involving discussions with USFWS, NOAA Fisheries, and local agencies, preparation of a HCP, and a detailed Section 10(a) permit application.

State

California Endangered Species Act (CESA)

The CESA declares that certain plant or animal species will be given protection by the State because they are of ecological, educational, historical, recreational, aesthetic, economic, and scientific value to the people of California. The CESA established that it is State policy to conserve, protect, restore, and enhance endangered species and their habitats. Under State law, plant and animal species may be formally designated rare, threatened, or endangered by the California Fish and Game Commission. Listed species are generally given greater attention during the project evaluation process by local governments, public agencies, and landowners than are species that have not been listed.

The CESA states, "Private entities may take plant or wildlife species listed as endangered or threatened under the Federal ESA and CESA, pursuant to a federal incidental take permit issued in accordance with Section 10 of the Federal ESA, if the CDFG certifies that the incidental take statement or incidental take permit is consistent with CESA." (Fish and Game Code Section 2080.1)

California Environmental Quality Act - Treatment of Listed Plant and Animal Species

Both the FESA and CESA protect only those species formally listed as threatened or endangered (or rare in the case of the State plant list). Section 15380 of CEQA Guidelines, however, independently defines "endangered" species of plants, fish, or wildlife as those whose survival and reproduction in the wild are in immediate jeopardy and "rare" species as those who are in such low numbers that they could become endangered if their environment worsens. Therefore, a project will normally have a significant affect on the environment if it will substantially affect a rare or endangered species or the habitat of the species. The significance of impacts to a species under CEQA, must be based on analyzing actual rarity and threat of extinction despite legal its status.

Sections 2090-2096 of the Fish and Game Code

In 1995, Section 2090 of the Fish and Game Code required that the lead agency consult with CDFG for projects likely to jeopardize the continued existence of a State-listed threatened or endangered species. This section and those that follow set forth the formal and informal consultation process to be followed in this consultation. They require reasonable and prudent alternatives be developed for projects that could jeopardize the continued existence of a State-listed species. It is also these sections of the code that establish the relationship between the State and federal consultation processes. However, as described below, these sections were repealed in 1999 and replaced with a process to obtain a permit based on an application to CDFG.

7.3.2.6 Changes in Regulatory Setting between 1996 and 2003

Federal

The regulatory climate as it relates to treatment of State or federally-listed rare, threatened, or endangered species between 1996 and 2003 is essentially the same as in 1995. Either USFWS or NOAA Fisheries is required to be consulted on all federal actions that could affect listed species. These agencies still prepare Biological Opinions. Development of HCPs has become more common as non-federal entities and organizations attempt to obtain incidental take permits under Section 10 of the FESA. The USFWS and NOAA Fisheries eliminated the Candidate 1 and Candidate 2 (C1 and C2) designations instead opting to use the terms Federal Candidate (the former C1 species) and Federal Species of Concern for the C2 species. Candidate species have been determined to be suitable for listing by the USFWS, or more information is required (NOAA Fisheries) before listing can occur. Candidate species are reviewed for potential listing actions on an annual basis. Regardless of a species status as C1 or C2 or, in 2003, as a Federal Candidate or Federal Species of Concern, they all meet the criteria for rare, threatened, or endangered according to CEQA Section 15380.

State

At the State level, Fish and Game Code Section 2097 limited the duration of the consultation process required under Sections 2090-2096. Unless a statute was enacted prior to January 1, 1994, the article would remain in effect only until the beginning of 1994. The section was extended for five years (through 1998) and repealed by the terms of Section 2097 on January 1, 1999. The consultation process was replaced with Section 2081 that requires an application be filed to obtain a permit from CDFG authorizing the take of State-listed species. Regardless of this change, CDFG may still consult with applicants whose projects could impact State-listed species for purposes of issuing permits. For federally protected species, an incidental take permit issued pursuant to the FESA may be accepted by CDFG provided the proper notification process is followed (Fish and Game Code Section 2080.1). Fish and Game Code Section 5515 lists fully-protected fish species.

7.3.3 IMPACTS AND MITIGATION MEASURES

Upstream of the Delta, the Feather, Sacramento, and American rivers are the water transport routes used to move water from the main SWP and CVP storage reservoirs to the Delta pumping plants. The proposed project has the potential to change how water is released for transport within these rivers. These changes could result in different flow levels at different times of year. Because these rivers support special-status species of fish, including steelhead and Chinook, changes in flow that substantially alter available habitat could result in impacts to these species.

The altered water allocation procedures and Table A retirements and transfers that are a part of the proposed project can affect flow in the Feather and Sacramento rivers, Delta inflow, and Delta exports, and the water supply management practices can affect Delta exports. Because Delta outflow is dependent on both Delta inflow and Delta exports, it can be affected by all of these provisions.

The altered allocation procedures and Table A retirements and transfers result primarily in a shift among contractors of the available supply in a given year, which affects the amount of that total SWP supply that is allocated to contractors located north of the Delta and to those located downstream of the Banks Pumping Plant. The retirement of Table A reduces demand, and at times may reduce total SWP deliveries. If deliveries upstream of the Delta increase slightly, deliveries south of the Delta may decrease slightly, and the water reaching the Banks pumps will decrease by approximately the amount of the increase in upstream allocations.

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. Modified releases from Lake Oroville would be unlikely due to small changes in deliveries that do not affect Delta water quality, minimum flow requirements, or other operational constraints of the SWP. The small changes are mostly below the measurement threshold of most river gages and Lake Oroville release controls. The Department would therefore have a difficult time modifying releases to exactly match the very small increment of delivery changes.

For this reason, the river flow analysis in this section assumes that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of the Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather and Sacramento river flows and Delta inflows would be slightly changed as a result of any changes in these deliveries. The analysis in this section reflects these assumptions. While at times, conditions might dictate an operational change that differs from these assumptions, that is not anticipated to occur very frequently. These potential operational changes are discussed in more general terms in the impact areas that follow.

Tables 7.3-15 and 7.3-16 show the total deliveries of SWP water, including both Table A and Article 21 water, to the five contractors north of the Delta and the 24 contractors south of the Delta. Each table shows contractor deliveries with the proposed project and under the baseline scenario and under 2003 and 2020 conditions, respectively. Under both the 2003 and 2020 conditions, the proposed project results in increased total deliveries to the five north of the Delta contractors.

Table 7.3-17 shows the changes in total annual deliveries to the Feather River and north of Delta contractors with the proposed project compared to the baseline, under 2003 and 2020 conditions, showing the change in average deliveries by year type and over all year types.

7.3-1 Implementation of the proposed project could potentially affect special-status fish species in the Feather River due to water flow changes.

This section describes proposed project impacts on the Feather River that may have occurred from 1996 to 2003, and potential future impacts of the proposed project. The Feather River is one of the natural waterways used to move water from SWP storage reservoirs north of the Delta to the Delta pumping plants. The proposed project has the potential to change how water is released for transport within the Feather River. These changes could result in different flow levels at different times of year. Because the Feather River supports special-status species of fish, including steelhead and Chinook salmon, changes in flow that substantially alter available habitat could result in impacts to these species.

As was discussed above, the river flow analysis in this section assumes that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather River flows would be slightly changed as a result of any changes in these deliveries. Under these conditions, there would be slight changes in Feather River flows downstream of contractor diversions to its confluence with the Sacramento River due to the changed diversions by

TABLE 7.3-15

TOTAL AVERAGE ANNUAL DELIVERIES UNDER 2003 CONDITIONS[a] (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2003 Baseline						
County of Butte	300	300	290	330	290	260
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	660	640	640	500	500	880
Subtotal (Feather River)	960	940	940	820	790	1,140
Napa County FC&WCD	7,360	8,760	7,400	7,470	7,130	5,030
Solano County	35,130	39,860	38,300	38,410	36,780	18,200
Cumulative Subtotal (N of Delta)	43,450	49,560	46,640	46,700	44,710	24,370
All other contractors (S of Delta)	3,045,000	3,540,000	3,582,000	3,508,000	2,831,000	1,476,000
Total SWP Deliveries	3,088,000	3,589,000	3,628,000	3,555,000	2,876,000	1,501,000
2003 Proposed Project						
County of Butte	300	280	300	350	290	260
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	660	590	700	640	610	900
Subtotal (Feather River)	950	880	1,000	990	900	1,150
Napa County FC&WCD	7,990	9,840	8,510	8,120	7,460	4,880
Solano County	36,130	41,780	39,840	37,700	36,120	19,630
Cumulative Subtotal (N of Delta)	45,080	52,500	49,350	46,810	44,480	25,670
All other contractors (S of Delta)	3,011,000	3,471,000	3,520,000	3,430,000	2,809,000	1,519,000
Total SWP Deliveries	3,056,000	3,523,000	3,569,000	3,477,000	2,853,000	1,545,000
2003 Change from Baseline						
Feather River	-10	-70	60	170	110	10
North of Delta (including Feather R)	1,630	2,940	2,710	110	-230	1,300
South of Delta	-34,000	-69,000	-62,000	-78,000	-22,000	43,000
Total SWP Deliveries	-32,000	-66,000	-59,000	-78,000	-23,000	44,000

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical

a. Includes deliveries of both Table A and Article 21 water.
b. Plumas County FC&WCD takes delivery of its SWP supply from Lake Davis, upstream of Lake Oroville, so its deliveries do not affect flows downstream of Lake Oroville.
Source: Appendix I.

TABLE 7.3-16

TOTAL AVERAGE ANNUAL DELIVERIES UNDER 2020 CONDITIONS[a] (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2020 Baseline						
County of Butte	13,300	12,790	15,240	16,670	13,380	11,530
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4,220	3,730	5,260	4,180	3,870	5,970
Subtotal (Feather River)	17,520	16,520	20,500	20,840	17,250	17,500
Napa County FC&WCD	20,080	24,520	24,350	22,730	17,760	8,760
Solano County	33,790	41,370	41,080	38,290	29,790	14,550
Cumulative Subtotal (N of Delta)	71,390	82,400	85,940	81,860	64,800	40,810
All other contractors (S of Delta)	3,242,000	4,143,000	3,985,000	3,622,000	2,717,000	1,302,000
Total SWP Deliveries	3,313,000	4,225,000	4,071,000	3,704,000	2,782,000	1,342,000
2020 Proposed Project						
County of Butte	13,390	12,920	15,290	16,840	13,440	11,600
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4,260	3,770	5,280	4,200	3,880	6,000
Subtotal (Feather River)	17,650	16,690	20,580	21,040	17,320	17,600
Napa County FC&WCD	23,120	29,600	28,490	25,920	19,250	9,200
Solano County	37,700	48,060	46,560	42,360	31,550	14,920
Cumulative Subtotal (N of Delta)	78,460	94,350	95,630	89,320	68,120	41,730
All other contractors (S of Delta)	3,219,000	4,090,000	3,943,000	3,626,000	2,700,000	1,308,000
Total SWP Deliveries	3,297,000	4,184,000	4,039,000	3,715,000	2,768,000	1,349,000
2020 Change from Baseline						
Feather River	120	170	70	190	70	110
North of Delta (including Feather R)	7,070	11,950	9,690	7,450	3,320	920
South of Delta	-23,000	-53,000	-42,000	4,000	-17,000	6,000
Total SWP Deliveries	-16,000	-41,000	-32,000	11,000	-14,000	7,000

Notes:
Ann Avg = Annual Average   AN = Above Normal   BN = Below Normal   Crit = Critical

a. Includes deliveries of both Table A and Article 21 water.
b. Plumas County FC&WCD takes delivery of its SWP supply from Lake Davis, upstream of Lake Oroville, so its deliveries do not affect flows downstream of Lake Oroville.

Source: Appendix F.

TABLE 7.3-17

CHANGE IN AVERAGE ANNUAL TOTAL DELIVERIES TO FEATHER RIVER AND NORTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
Feather River Contractors						
2003 Proposed Project vs. Baseline	-10	-70	60	170	110	10
2020 Proposed Project vs. Baseline	120	170	70	190	70	110
North of Delta Contractors						
2003 Proposed Project vs. Baseline	1,630	2,940	2,710	110	-230	1,300
2020 Proposed Project vs. Baseline	7,070	11,950	9,690	7,450	3,320	920

Notes:
Ann Avg = Annual Average   AN = Above Normal   BN = Below Normal   Crit = Critical
Source: Appendix F.

Feather River region contractors, but there would be no change in Lake Oroville storage. These conditions are used in the analysis of the impacts on flows in the Feather River for several reasons: the conditions provide a conservative estimate of the impacts on the flow; the changes are so small that they are not measurable in the system; and the Department would have a difficult time adjusting releases from Lake Oroville to exactly match the flow changes.

Under limited circumstances, there could be minor operational changes in the Feather River in response to the slight delivery changes to SWP contractors upstream from the Delta (Tables 7.3-17 and 7.3-18). When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in Lake Oroville releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger changes are the export/Delta inflow (E/I) ratio, Delta water quality constraints, and South Delta water levels. If this were the case and Oroville releases were affected, there would be a slight additional change in Feather River flows between the Thermalito Afterbay and its confluence with the Sacramento River. There would also be a slight change in Lake Oroville storage should such release changes be made. However, as indicated above, these conditions are not anticipated to occur frequently and the effects would not be significant.

TABLE 7.3-18

AVERAGE ANNUAL FLOW CHANGES IN FEATHER AND SACRAMENTO RIVERS DUE TO CHANGES IN SWP DELIVERIES TO FEATHER RIVER AND NORTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF, %)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
Flow Change Due to Change in Delivery, AF						
2003 Feather River	10	70	-60	-170	-110	-10
2020 Feather River	-120	-170	-70	-190	-70	-110
2003 North of Delta	-1,630	-2,940	-2,710	-110	203	-1,300
2020 North of Delta	-7,070	-11,950	-9,690	-7,450	-3,320	-920
Annual Baseline River Flows, AF						
2003 Baseline Feather River Flows	3,022,000	4,743,000	3,317,000	2,565,000	2,032,000	1,618,000
2020 Baseline Feather River Flows	3,015,000	4,733,000	3,381,000	2,560,000	2,030,000	1,545,000
2003 Baseline Sac River Flows	16,074,000	24,438,000	19,137,000	13,840,000	11,115,000	8,106,000
2020 Baseline Sac River Flows	15,965,000	24,201,000	19,086,000	13,749,000	11,039,000	8,103,000
Flow Change Due to Change in Delivery, as % of River Flow						
2003 Feather Basin Delivery Change/ Feather R Flow	0.0002%	0,0014%	-0.0018%	-0.0066%	-0.0054%	-0.0006%
2020 Feather Basin Delivery Change / Feather R Flow	-0.0041%	-0.0036%	-0.0022%	-0.0076%	-0.0034%	-0.0069%
2003 North of Delta Delivery Change / Sacramento R Flow	-0.0101%	-0.0120%	-0.0142%	-0.0008%	0.0020%	-0.0160%
2020 North of Delta Delivery Change / Sacramento R Flow	-0.0443%	-0.0494%	-0.0508%	-0.0542%	-0.0301%	-0.0114%

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical
Source: Appendix H.

1996 — 2003

Tables 7.3-15 and 7.3-17 shows the estimated changes in total average annual deliveries to the Feather River contractors with the proposed project compared to the baseline scenario under 2003 conditions by year type. Under 2003 conditions, deliveries to the Feather River contractors are estimated to increase slightly on average, increasing in some year types and decreasing in others. The largest delivery decrease is 70 AF per year, occurring in wet years. The largest delivery increase is 170 AF per year, occurring in below normal years.

Increases in deliveries to the Feather River contractors would result in decreased river flows downstream of those diversions. Table 7.3-18 shows flows for the Feather River for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. The largest annual Feather River flow increase is 0.0014 percent, occurring in wet years. The largest annual Feather River flow decrease, as a percentage of the baseline river flows, is 0.0066 percent, occurring in below normal years.

At most, the proposed project under 2003 conditions may result in only slight changes in Feather River flow as compared to the baseline. This slight change will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

At most, the proposed project under 2003 conditions may result in only slight changes in Feather River flow as compared to the baseline. This slight change will not constitute a substantial change in habitat and will not adversely affect special-status species of fish because, except for fall-run Chinook salmon, they spawn and rear in the low flow channel which would not be affected. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

<u>Mitigation Measures</u>

None required.

Future Impacts

Tables 7.3-16 and 7.3-18 show the estimated changes in total average annual deliveries to the Feather River contractors with the proposed project compared to the 2020 baseline scenario, by year type and over all year types. Under 2020 conditions, deliveries to the Feather River contractors are estimated to increase, on average and in all year types. The largest delivery increase is 190 AF per year, occurring in below normal years. Increases in deliveries to the Feather River contractors would result in decreased river flows downstream of those diversions. Table 7.3-19 shows the largest annual Feather River flow decrease, as a percentage of baseline river flows, is 0.0076 percent, occurring in below normal years.

An additional analysis was performed for the 2020 conditions to determine if there were individual months in which flow changes would be significantly different from annual changes. It was determined that the monthly changes were within the approximate range of annual values, and no comparable monthly tabulation was undertaken for the 2003 condition.

Table 7.3-19 shows monthly changes in Feather River flows resulting from changes in deliveries to the Feather River contractors with the proposed project compared to the baseline scenario under 2020 conditions. The maximum monthly delivery increase on the Feather River would be about 0.04 TAF (40 AF) in September of below normal years. This delivery increase would result in a reduction in Feather River flows downstream of those diversions of about 0.7 cubic feet per second (cfs), or 0.028 percent of Feather River flows in September of below normal years.

As stated above, the proposed project under 2020 conditions may result in only slight decreases in Feather River flow as compared to the baseline. This slight decrease will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2020 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

Mitigation Measures

None required.

7.3-2 Implementation of the proposed project could potentially affect special-status fish species in the American River due to water flow changes.

This section describes proposed project impacts on the American River that might have occurred from 1996 to 2003, and potential future impacts of the proposed project. None of the water supply management practices involve operation of facilities on the American River. Therefore, implementation of water supply management practices will have no impact on fisheries resources of the American River.

The American River flows downstream of Folsom Reservoir are managed by U.S. Bureau of Reclamation (Reclamation) to meet certain in-stream flow requirements which provide fishery benefits, supply CVP contractors, and other beneficial uses. The proposed project would not affect the American River in any direct way. Although some changes in American River operations may occur, the changes in deliveries to the Feather River and north of Delta contractors are not likely to affect CVP operations at Folsom Reservoir under most conditions.

The one possible mechanism that could trigger a change at Folsom Reservoir and change flows in the American River would be at times when Delta water quality becomes an issue and added Delta inflow is required. Because SWP and CVP operations are coordinated and Folsom Reservoir releases reach the Delta in about one day, as compared to three days from Lake Oroville and five days from Shasta Reservoir, an increased release may be made from Folsom Reservoir to achieve the desired water quality objective if a longer lead time is not available. The real-world frequency with which such an American River flow increase might be made is not possible to predict with any confidence using model output, and such release events often span a few days until other reservoir releases can be adjusted and the flows reach the Delta. The magnitude of such an increased release is likewise not predictable.

1996 — 2003

The magnitude of potential release changes from Folsom Reservoir, and the duration of those changes, was not predictable. If releases from Folsom were made to meet water quality or flow objectives in the Delta, the releases occured independent of water delivery to SWP contractors, and these resulted in brief increases in American River flow as compared to the baseline

TABLE 7.3-19

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (AF, %)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
2020 Monthly Flow Change Due to Change in Deliveries, AF													
Feather River Region: Butte, Plumas, Yuba City													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	-20,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-20,000	-20,000	-20,000	-120,000
22-94 Wet	-20,000	-0	-0	-0	-0	-0	-20,000	-20,000	-20,000	-20,000	-20,000	-30,000	-170,000
22-94 AN	-10,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-70,000
22-94 BN	-30,000	-0	-0	-0	-0	-10,000	-20,000	-20,000	-20,000	-20,000	-30,000	-40,000	-190,000
22-94 Dry	-10,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-70,000
22-94 Crit	-20,000	-10,000	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-20,000	-20,000	-10,000	-110,000
North Bay Region: Feather River Region, Solano, Napa													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	-700,000	-590,000	-600,000	-330,000	-370,000	-460,000	-600,000	-660,000	-680,000	-700,000	-700,000	-680,000	-7,070,000
22-94 Wet	-1,090,000	-920,000	-960,000	-680,000	-740,000	-840,000	-1,020,000	-1,100,000	-1,130,000	-1,170,000	-1,170,000	-1,130,000	-11,950,000
22-94 AN	-800,000	-670,000	-660,000	-400,000	-540,000	-710,000	-900,000	-970,000	-990,000	-1,030,000	-1,030,000	-990,000	-9,690,000
22-94 BN	-730,000	-620,000	-630,000	-290,000	-320,000	-450,000	-630,000	-730,000	-750,000	-770,000	-770,000	-750,000	-7,450,000
22-94 Dry	-340,000	-280,000	-280,000	-140,000	-150,000	-190,000	-290,000	-320,000	-330,000	-340,000	-340,000	-330,000	-3,320,000
22-94 Crit	-150,000	-120,000	-130,000	-40,000	-40,000	-50,000	-60,000	-70,000	-70,000	-70,000	-70,000	-70,000	-920,000
2020 Monthly Baseline River Flows, AF													
2020 Feather River Baseline Flows													
22-94 Avg	153,000	130,000	222,000	284,000	317,000	368,000	189,000	224,000	280,000	431,000	293,000	125,000	3,015,000
22-94 Wet	171,000	175,000	389,000	621,000	653,000	738,000	413,000	456,000	338,000	445,000	232,000	101,000	4,733,000
22-94 AN	152,000	105,000	222,000	289,000	391,000	541,000	151,000	274,000	261,000	519,000	362,000	114,000	3,381,000
22-94 BN	155,000	119,000	148,000	164,000	211,000	189,000	80,000	105,000	329,000	515,000	406,000	140,000	2,560,000
22-94 Dry	142,000	103,000	138,000	93,000	90,000	133,000	94,000	101,000	257,000	420,000	314,000	143,000	2,030,000
22-94 Crit	132,000	119,000	128,000	82,000	91,000	101,000	81,000	82,000	165,000	248,000	183,000	132,000	1,545,000
2020 Sacramento River Baseline Flows													
22-94 Avg	754,000	924,000	1,530,000	2,009,000	2,186,000	2,102,000	1,462,000	1,180,000	1,038,000	1,130,000	880,000	770,000	15,965,000
22-94 Wet	898,000	1,296,000	2,824,000	3,427,000	3,402,000	3,226,000	2,531,000	1,992,000	1,406,000	1,246,000	950,000	1,003,000	24,201,000
22-94 AN	726,000	958,000	1,356,000	2,730,000	2,940,000	3,104,000	1,746,000	1,362,000	1,086,000	1,301,000	980,000	798,000	19,086,000
22-94 BN	720,000	798,000	1,098,000	1,520,000	1,969,000	1,611,000	1,112,000	948,000	1,049,000	1,213,000	969,000	741,000	13,749,000
22-94 Dry	686,000	774,000	927,000	978,000	1,295,000	1,383,000	830,000	734,000	827,000	1,077,000	838,000	688,000	11,039,000
22-94 Crit	657,000	592,000	716,000	875,000	872,000	829,000	606,000	470,000	623,000	758,000	626,000	480,000	8,103,000

TABLE 7.3-19, Continued

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (AF, %)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
	Monthly Flow Reductions as a Percentage of Monthly Baseline River Flows												
2020 Change as % of Feather River Flows													
22-94 Avg	0.0114%	0.0019%	0.0000%	0.0000%	0.0001%	0.0010%	0.0070%	0.0064%	0.0049%	0.0042%	0.0068%	0.0175%	0.0041%
22-94 Wet	0.0121%	0.0004%	0.0000%	0.0000%	0.0000%	0.0005%	0.0054%	0.0053%	0.0068%	0.0051%	0.0108%	0.0292%	0.0036%
22-94 AN	0.0053%	0.0017%	0.0000%	0.0000%	0.0000%	0.0001%	0.0054%	0.0033%	0.0032%	0.0025%	0.0035%	0.0113%	0.0022%
22-94 BN	0.0191%	0.0029%	0.0000%	0.0000%	0.0000%	0.0041%	0.0242%	0.0201%	0.0054%	0.0048%	0.0077%	0.0280%	0.0076%
22-94 Dry	0.0072%	0.0020%	0.0000%	0.0000%	0.0003%	0.0016%	0.0066%	0.0071%	0.0027%	0.0025%	0.0037%	0.0081%	0.0034%
22-94 Crit	0.0169%	0.0043%	0.0000%	0.0000%	0.0010%	0.0075%	0.0090%	0.0074%	0.0054%	0.0067%	0.0090%	0.0109%	0.0069%
2020 Change as % of Sac River Flows													
22-94 Avg	0.0931%	0.0638%	0.0393%	0.0163%	0.0170%	0.0219%	0.0411%	0.0560%	0.0652%	0.0621%	0.0795%	0.0880%	0.0443%
22-94 Wet	0.1215%	0.0711%	0.0339%	0.0200%	0.0218%	0.0261%	0.0402%	0.0552%	0.0801%	0.0937%	0.1228%	0.1130%	0.0494%
22-94 AN	0.1105%	0.0698%	0.0490%	0.0145%	0.0184%	0.0230%	0.0516%	0.0710%	0.0912%	0.0790%	0.1047%	0.1246%	0.0508%
22-94 BN	0.1016%	0.0772%	0.0578%	0.0193%	0.0165%	0.0282%	0.0568%	0.0769%	0.0712%	0.0638%	0.0796%	0.1007%	0.0542%
22-94 Dry	0.0494%	0.0365%	0.0306%	0.0140%	0.0117%	0.0138%	0.0348%	0.0436%	0.0397%	0.0315%	0.0402%	0.0473%	0.0301%
22-94 Crit	0.0226%	0.0208%	0.0175%	0.0042%	0.0046%	0.0058%	0.0100%	0.0139%	0.0108%	0.0092%	0.0110%	0.0139%	0.0114%

Source: Appendix H.

scenario. Therefore, any impact on the American River from the proposed project under 2003 conditions attributed to upstream delivery increases were brief and minor, such as a pulse flow over a few days.

At most, the proposed project under 2003 conditions resulted in a very slight and brief increased release from Folsom Reservoir into the American River followed by a return to the baseline flows. Therefore, the proposed project under 2003 conditions had ***no impact*** on special-status fisheries resources in the American River.

<u>Mitigation Measures</u>

None required.

Future Impacts

As stated above, the American River does not operate as part of the SWP. Therefore, changes in deliveries to north of Delta contractors cannot directly alter streamflows in the American River. If releases from Folsom are made to meet water quality or flow objectives in the Delta, releases would occur independent of water delivery to SWP contractors, and these would result in brief increases in American River flow as compared to the baseline scenario. Therefore, the proposed project under 2020 conditions will have ***no impact*** on special-status fisheries resources in the American River.

<u>Mitigation Measures</u>

None required.

7.3-3 Implementation of the proposed project could potentially affect special-status fish species in the Sacramento River due to water flow changes.

1996 — 2003

As discussed previously, it is assumed that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather and Sacramento river flows would be slightly changed as a result of any changes in these deliveries. Under these assumptions, there would be slight changes in Feather and Sacramento river flows downstream of Feather River region contractor diversions and upstream of diversions to the north of Delta contractors, and additional changes in Sacramento River flows downstream of diversions to the north of Delta contractors. Since the largest potential change in Sacramento River flows is downstream of the diversion to the north of Delta contractors, it is the changes in those flows that are described in the following text.

Tables 7.3-17 and 7.3-18 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2003 conditions, by year type and over all year types. Under 2003 conditions, deliveries to these contractors are estimated to increase by an average of 1,630 AF per year. These deliveries are estimated to increase in most year types, by amounts up to 2,940 AF per year in wet years, and to decrease in one year type, by 230 AF per year in dry years.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. The largest annual Sacramento River flow decrease resulting from the proposed project, as a percentage of baseline river flows, is 0.016 percent, occurring in critically dry years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows in response to the slight delivery changes to SWP contractors upstream from the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

At most, the proposed project under 2003 conditions may result in minor decreases in Sacramento River flow as compared to the baseline scenario. This decrease in flow will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Sacramento River.

Mitigation Measures

None required.

Future Impacts

Tables 7.3-16 and 7.3-17 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the 2020 baseline scenario, by year type and over all year types. Under 2020 conditions, annual deliveries to the contractors north of the Delta are estimated to increase by an average of 7,070 AF per year, ranging from 920 AF in critically dry years to 11,950 AF in wet years. Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions. Table 7.3-18 shows the largest annual Sacramento River flow decrease, as a percentage of baseline river flows, is 0.0542 percent, occurring in below normal years.

Table 7.3-20 shows monthly changes in Sacramento River flows resulting from changes in deliveries to the north of Delta contractors with the proposed project compared to the baseline scenario under 2020 conditions. The maximum monthly delivery increases would be up to about 1,170 TAF (11,700,000 AF) in June through September of wet years as shown in Table 7.3-19. This delivery increase would result in a reduction in Sacramento River flows downstream of North Bay diversions of about 19 cfs in these months as shown in Table 7.3-20. As a percentage of baseline Sacramento River flows, the largest monthly decrease is 0.1246 percent, occurring in September of above normal years as shown in Table 7.3-19. The largest monthly decrease during critically dry years is 0.0226 percent, occurring in October.

As stated above, the proposed project under 2020 conditions could result in minor decreases in Sacramento River flow as compared to the baseline. This decrease in flow would not constitute a substantial change in habitat and would not adversely affect special-status species of fish.

TABLE 7.3-20

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (CFS)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2020 Decrease in Feather River Flows and Sacramento River Flows Upstream of North Bay Aqueduct Intake, cfs												
22-94 Avg	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.4
22-94 Wet	0.3	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.5
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
22-94 BN	0.5	0.1	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.4	0.5	0.7
22-94 Dry	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
22-94 Crit	0.4	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.2
2020 Decrease in Sac River Flows at the Delta, Downstream of North Bay Aqueduct Intake, cfs												
22-94 Avg	11.4	9.9	9.8	5.3	6.7	7.5	10.1	10.8	11.4	11.4	11.4	11.4
22-94 Wet	17.8	15.5	15.6	11.1	13.4	13.7	17.1	17.9	19.0	19.0	19.0	19.1
22-94 AN	13.1	11.3	10.8	6.5	9.8	11.6	15.2	15.8	16.7	16.7	16.7	16.7
22-94 BN	11.9	10.4	10.3	4.8	5.9	7.4	10.6	11.9	12.6	12.6	12.6	12.6
22-94 Dry	5.5	4.8	4.6	2.2	2.7	3.1	4.9	5.2	5.5	5.5	5.5	5.5
22-94 Crit	2.4	2.1	2.0	0.6	0.7	0.8	1.0	1.1	1.1	1.1	1.1	1.1

Source: Appendix H.

Therefore, the proposed project under 2020 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Sacramento River.

Mitigation Measures

None required.

7.3-4 Implementation of the proposed project could potentially affect special-status fish species in the San Joaquin River due to water flow changes.

1996 — 2003 and Future Impacts

None of the elements of the proposed project under 2003 or 2020 conditions involve operation of facilities on the San Joaquin River. Therefore, implementation of the proposed project will have ***no impact*** on fisheries resources of the San Joaquin River.

Mitigation Measures

None required.

7.3-5 Implementation of the proposed project Water Supply Management Practices could potentially affect special-status fish species in the Sacramento-San Joaquin Delta due to Delta export changes.

1996 — 2003

The Delta is home to dozens of fish species, both native and introduced. All of the special-status species of fish previously discussed (Section 7.3.2.1) either pass through the Delta during migration as adults and juveniles or are permanent residents.

Water is exported from the Delta at the Banks Pumping plant from Clifton Court Forebay. Increases in exports of water from the Delta could alter streamflows and Delta hydrodynamics and increase entrainment of fish at the pumping facilities. The export of water from the Delta has the potential to impact special-status species of fish as they move up and downstream through the Delta, or into and out of spawning habitats within the Delta.

Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change both the total quantity of SWP water delivered and the quantities of SWP water delivered to individual contractors. These changes in deliveries could affect Delta exports.

Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. Table 7.3-21 shows changes in annual deliveries to contractors south of the Delta with the proposed project as compared to the baseline scenario. Under 2003 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 34,000 AF, with delivery changes by year type ranging from decreases of about 78,000 AF in below normal years to increases of about 43,000 AF in critically dry years. Delivery changes can be made from south of Delta storage and may not alter Delta exports.

TABLE 7.3-21

CHANGE IN AVERAGE ANNUAL TOTAL EXPORTS TO SOUTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF, %)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2003 and 2020 Exports to South of Delta Contractors, AF						
2003 Baseline	3,045,000	3,540,000	3,582,000	3,508,000	2,831,000	1,476,000
2003 Proposed Project	3,011,000	3,471,000	3,520,000	3,430,000	2,809,000	1,519,000
2020 Baseline	3,242,000	4,143,000	3,985,000	3,622,000	2,717,000	1,302,000
2020 Proposed Project	3,219,000	4,090,000	3,943,000	3,626,000	2,700,000	1,308,000
Change in Exports to South of Delta Contractors, AF						
2003 Proposed Project vs. Baseline	-34,160	-68,830	-62,090	-78,070	-22,210	42,800
2020 Proposed Project vs. Baseline	-22,960	-52,910	-42,200	4,250	-17,140	5,970
Change in Exports to South of Delta Contractors, as % of Baseline South of Delta deliveries						
2003 Proposed Project vs. Baseline	-1.122%	-1.944%	-1.733%	-2.225%	-0.784%	2.899%
2020 Proposed Project vs. Baseline	-0.708%	-1.277%	-1.059%	0.117%	-0.631%	0.065%
Annual Baseline Delta Inflow (Sacramento + San Joaquin), AF						
2003 Delta Inflow	18,880,000	29,340,000	22,190,000	16,233,000	12,654,000	9,209,000
2020 Delta Inflow	18,770,000	29,126,000	22,125,000	16,137,000	12,564,000	9,198,000
Total Export Change South of Delta Contractors, as % of Sac and San Joaquin Delta Inflow						
2003 Proposed Project vs. Baseline	-0.1809%	-0.2346%	-0.2798%	-0.4809%	-0.1755%	0.4647%
2020 Proposed Project vs. Baseline	-0.1223%	-0.1817%	-0.1908%	0.0263%	-0.1364%	0.0649%

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical
Delivery changes south of the Delta may be met by changes in San Luis Reservoir storage releases. However, it is assumed that delivery changes would be made by changes in Delta exports.
Sources: Appendix F and H.

However, to provide the most conservative impact analysis, it is assumed that any increase in delivery would be made by increased exports. As a percent of baseline scenario Delta exports under 2003 conditions, the Table A retirements and transfers and altered water allocation procedures would be estimated to decrease Delta exports by an annual average of about 1.12 percent, with delivery changes by year type ranging from a decrease of 2.23 percent in below normal years to an increase of 2.90 percent in critically dry years. Any increase in exports in critically dry years would likely not occur in any one month, but over the course of multiple months, typically occurring during the summer.

Analysis of Effects of Proposed Project using Historical Data

In addition to the altered water allocation procedures and the transfers and retirement of Table A amounts analyzed above, the Monterey Amendment contains several other provisions, i.e., the water supply management practices, which could change deliveries of water to contractors. Changes in deliveries could in turn result in changes in exports from the Delta at Banks Pumping Plant. Monterey Amendment-induced changes in SWP operations and deliveries to SWP contractors are described in Chapter 6.

Provisions of the Monterey Amendment, other than the altered water allocation procedures and the transfers and retirement of Table A amounts, with the potential to affect flows in the Delta include Articles 52, 54, and 56. Article 52 transfers ownership of the Kern Fan Element property from the state to KCWA, which enabled local development of the Kern Water Bank. Article 54 of the Monterey Amendment provides that certain contractors may borrow water from Castaic

Lake and Lake Perris, up to specified amounts and provided they replace the water within five years. Article 56 of the Monterey Amendment gives prior Department approval for contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or storage in surface water reservoirs owned by the SWP or others. Another provision of Article 56 establishes an annual turnback pool. Each of these provisions and its potential effect on SWP operations is described in more detail in Chapter 6. The Article 52, 54, and 56 provisions apply to SWP operations south of the Delta and as such could affect Delta exports and Delta outflow.

Because CALSIM II does not model the water supply management practices provided for in the Monterey Amendment, an additional analysis was conducted based on historical data from 1996 through 2004. The estimated effects of nearly all of the Monterey Amendment provisions, including the Table A retirements and the water supply management practices, on Delta exports between 1996 and 2004 were determined by a historical operations analysis, summarized below and described in more detail in Chapter 6 and Appendix K.

The Department determined that these Monterey Amendment provisions resulted in increased pumping in a few months from 1996 to 2004. Increased pumping was infrequent because from 1996 to 2004 there were only a few months when these provisions resulted in an added SWP demand at a time when the contractors otherwise had all the SWP water they could use or store, and all SWP reservoirs south of the Delta were full or at their storage targets. The Department estimates that from 1996 to 2004, these provisions resulted in the SWP pumping a total of about 44,000 AF more at the Banks Pumping Plant than it would have under the baseline scenario. Thus, from 1996 to 2004 (see note below), these Monterey Amendment provisions increased Delta exports and reduced Delta outflow by a total of about 44,000 AF. The increase in Delta exports occurred during four events: January 13, 1998 (a wet year); February 24 through March 31 of 1999 (a wet year), February 22 through March 31 of 2000 (an above normal year), and March 23 through March 30 of 2004 (a below normal year). (See discussion on these four separate events below).

November through March are important months in the life cycle of many fish species within the Delta. Winter-run and fall/late fall-run Chinook salmon and Central Valley steelhead are migrating upstream to spawning grounds. Juvenile spring-run and late fall-run Chinook are moving downstream into the estuary during these months. Delta smelt and longfin smelt are also beginning to move into spawning areas. Movement into and out of the Delta by salmonids is typically not compromised by reductions in Delta flow, and many migrate during low flows. However, high flows provide important attraction flows for species migrating into the Delta from the ocean. These peak events are necessary to move river water further out into the San Francisco Bay and eventually the Pacific Ocean. Anadromous fish recognize these waters and essentially follow them to their spawning streams. It is unlikely that an intermittent, temporary reduction in Delta outflow under most conditions would reduce attraction flows or substantially confuse upstream migratory cues.

March is an important month, especially for the movement of juvenile fish into the estuary and eventually the ocean. All runs of juvenile Chinook are typically moving downstream along with steelhead smolts. Both river and Pacific lamprey move into the ocean in the spring. Localized movements of splittail, longfin, and delta smelt also occur in March. Longfin smelt larvae rear in the Delta during March, and in warmer years, delta smelt larvae start hatching in March.

An increase in river flows can increase the speed with which some fish move downstream and help reduce exposure to predators and water diversions. However, when pumping is increased during outmigration, juvenile fish may be more susceptible to entrainment in the SWP pumps. To investigate any possible entrainment increases due to the water supply management practices, salvage rates, the daily total number of fish salvaged at the Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility were calculated from existing CDFG databases (Tables 7.3-22 to 7.3-25).[72] The downstream movement of fish is a complex process where the fish follow multiple cues including water temperature, streamflow, pulse flows, day length, weather, moon phase, etc. This variety of factors makes it almost impossible to isolate the driving mechanism for fish movement and to determine if the Monterey Amendment resulted in increased entrainment. The water flows of Old and Middle rivers, located in the Delta, are known to influence the movement of Delta fish species. When the flows in Old and Middle rivers are positive (flows moving towards the mouth of the Delta), this is considered favorable for preventing fish salvage at Banks Pumping Plant. Likewise, when the flows of the Old and Middle rivers are -5,000 to -10,000 cfs, Delta fish species may migrate towards the Banks Pumping Plant, thus inducing fish loss at the salvage facilities.

Delta smelt and splittail salvage numbers for each period, or event, of proposed project under 2003 conditions induced pumping is included in Tables 7.3-22 to 7.3-25, along with salvage numbers for one week prior and after each event. There are a couple of purposes for including salvage numbers one week prior and after events due to induced pumping under 2003 conditions of the proposed project. One purpose is for numerical comparison and the second purpose is due to the behavior of delta smelt and splittail. When an increase in pumping occurs that may influence fish movement, it may take up to an estimated three to seven days for the cohorts of delta smelt and splittail to reach the salvage facilities (Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility) near the pumps.

Below is an event by event discussion of four time periods from 1996 to 2004 where the Monterey Amendment resulted in additional pumping at Banks Pumping Plant. An accompanying table is included for each event that shows daily information pertinent to a better understanding of conditions during the event (e.g., the amounts of Banks pumping, additional pumping related to the proposed project, Delta outflow, delta smelt and splittail salvage, and Old and Middle river flows). The events that demonstrate a possible impact to delta fish populations will have a correlation between increased pumping due to the proposed project and increased fish salvage numbers.

Note: The March 23 to March 30, 2004, event occurs outside of the 1996–2003 timeframe designated for this analysis. However, to conduct the analysis of when the Monterey Amendment resulted in increased pumping, we looked at all known historical data since 1995, this includes 2004 as it is part of the 2003-2004 water year. For the sake of a more thorough analysis, this event was included.

Event 1: January 13, 1998 (Table 7.3-22)

This proposed project-induced[73] pumping lasted only three hours; therefore, there is little to be derived from this event. High pumping occurred at Banks Pumping Plant in the weeks prior to January 13, possibly creating the salvage numbers seen in the week prior to January 13. In the two weeks following January 13, there was no recorded salvage for delta smelt or splittail.

Note: The term induced used in this context and throughout the impact section refers to when pumping at Banks Pumping Plant continued at a higher rate as a result of proposed project actions.

TABLE 7.3-22

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 1

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
6-Jan-98	6,046	11,971	50,975	12	18	-8,180			
7-Jan-98	6,722	13,310	42,889	32	18	-8,780			
8-Jan-98	7,068	13,995	37,048	12	12	-9,010			
9-Jan-98	7,250	14,355	35,391	8	12	-9,210			
10-Jan-98	7,246	14,347	39,285	12	126	-8,700			
11-Jan-98	7,292	14,438	42,922	16	98	-8,320			
12-Jan-98	7,340	14,533	80,832	0	90	-8,500			
13-Jan-98	7,465	14,781	118,687	8	12	-6,710	X (3 hours)	10,821	9.117%
14-Jan-98	76	150	148,787	0	0	-2,672			
15-Jan-98	76	150	170,551	0	0	-594			
16-Jan-98	74	147	209,504	0	0	229			
17-Jan-98	69	137	239,693	0	0	1,281			
18-Jan-98	76	150	260,661	0	0	1,353			
19-Jan-98	70	139	269,036	0	0	2,476			
20-Jan-98	74	147	259,226	0	0	2,730			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-23

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 2

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
17-Feb-99	71	141	202,946	0	0	3,230			
18-Feb-99	75	149	250,478	0	0	2,860			
19-Feb-99	0	0	266,433	0	0	3,080			
20-Feb-99	79	156	268,692	0	0	2,890			
21-Feb-99	0	0	271,306	0	0	3,350			
22-Feb-99	519	1,028	268,522	0	0	3,160			
23-Feb-99	1,397	2,766	255,648	0	0	2,105			
24-Feb-99	2,552	5,053	232,535	3	4	792	X	200	0.086%
25-Feb-99	2,994	5,928	208,393	42	12	706	X	200	0.096%
26-Feb-99	3,400	6,732	196,844	19	36	293	X	200	0.102%
27-Feb-99	4,006	7,932	188,383	0	60	-589	X	200	0.106%
28-Feb-99	2,395	4,742	186,227	32	4	-344	X	200	0.107%
1-Mar-99	2,372	4,697	187,961	32	8	99	X	65	0.034%
2-Mar-99	2,217	4,390	196,149	0	0	-632	X	65	0.033%
3-Mar-99	1,793	3,550	204,734	8	0	-325	X	65	0.032%
4-Mar-99	3,204	6,344	205,225	22	34	-157	X	65	0.031%
5-Mar-99	3,477	6,884	201,311	12	54	-1,584	X	65	0.032%
6-Mar-99	3,999	7,918	196,844	0	69	-2,607	X	65	0.033%
7-Mar-99	4,274	8,463	188,138	0	20	-2,170	X	65	0.034%
8-Mar-99	3,110	6,158	182,924	11	9	-2,389	X	65	0.035%
9-Mar-99	3,146	6,229	179,641	12	34	-1,744	X	65	0.036%
10-Mar-99	2,042	4,043	175,299	3	46	-1,713	X	65	0.037%
11-Mar-99	3,292	6,518	165,690	0	68	-2,031	X	65	0.039%
12-Mar-99	3,245	6,425	159,253	0	36	-2,243	X	65	0.041%
13-Mar-99	4,676	9,258	146,946	0	12	-3,610	X	65	0.044%
14-Mar-99	5,176	10,248	138,640	0	23	-3,970	X	65	0.047%
15-Mar-99	3,395	6,722	135,977	0	24	-3,340	X	65	0.047%
16-Mar-99	3,562	7,053	129,874	9	6	-2,361	X	65	0.050%
17-Mar-99	2,978	5,896	123,685	0	24	-2,505	X	65	0.052%
18-Mar-99	2,693	5,332	116,058	0	32	-2,740	X	65	0.056%
19-Mar-99	2,677	5,300	107,930	0	0	-2,326	X	65	0.060%
20-Mar-99	1,668	3,303	104,859	3	6	-1,854	X	65	0.062%
21-Mar-99	2,474	4,899	94,969	2	11	-2,362	X	65	0.068%
22-Mar-99	1,431	2,833	90,732	4	12	-2,287	X	65	0.071%
23-Mar-99	1,665	3,297	83,974	0	0	-2,196	X	65	0.077%
24-Mar-99	2,247	4,449	78,735	0	18	-2,740	X	65	0.082%
25-Mar-99	2,009	3,978	78,976	0	30	-2,283	X	65	0.082%
26-Mar-99	1,888	3,738	88,413	6	30	-1,545	X	65	0.073%
27-Mar-99	1,886	3,734	100,400	0	2	-1,103	X	65	0.064%
28-Mar-99	2,754	5,453	101,711	0	16	-2,452	X	65	0.063%
29-Mar-99	4,237	8,389	96,580	0	32	-3,400	X	65	0.067%
30-Mar-99	3,946	7,813	92,929	0	32	-2,840	X	65	0.069%

31-Mar-99	3,859	7,641	87,146	0	15	-2,495	X	65	0.074%
1-Apr-99	4,083	8,084	78,614	0	28	-2,530			
2-Apr-99	3,596	7,120	72,090	0	40	-2,520			
3-Apr-99	5,088	10,074	64,712	0	28	-2,940			
4- Apr-99	4,647	9,201	60,752	32	128	-3,731			
5- Apr-99	5,189	10,274	61,675	0	27	-4,060			
6- Apr-99	3,237	6,409	66,427	0	24	-2,691			
7- Apr-99	3,022	5,984	65,714	12	78	-1,981			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-24

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 3

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
15-Feb-00	7,913	15,668	324,512	374	624	-6,290			
16-Feb-00	8,806	17,436	321,960	300	93	-7,260			
17-Feb-00	9,059	17,937	316,143	300	204	-7,140			
18-Feb-00	9,229	18,273	284,090	172	97	-6,510			
19-Feb-00	8,705	17,236	255,747	254	190	-6,190			
20-Feb-00	8,165	16,167	238,533	504	147	-6,240			
21-Feb-00	9,487	18,784	217,887	420	150	-5,600			
22-Feb-00	9,182	18,180	219,455	290	189	-5,030	X	6,300	2.871%
23-Feb-00	8,059	15,957	249,789	392	104	-4,630	X	4,077	1.632%
24-Feb-00	5,998	11,876	280,322	196	175	-2,954	X	129	0.046%
25-Feb-00	5,811	11,506	272,494	143	56	-2,045	X	129	0.047%
26-Feb-00	5,669	11,225	267,690	165	84	-3,396	X	129	0.048%
27-Feb-00	5,987	11,854	274,470	202	88	-2,961	X	129	0.047%
28-Feb-00	5,995	11,870	317,695	230	186	-1,951	X	129	0.041%
29-Feb-00	5,998	11,876	320,289	151	40	-2,375	X	129	0.040%
1-Mar-00	5,995	11,870	316,206	171	39	-1,463	X	129	0.041%
2-Mar-00	6,550	12,969	297,784	192	33	-2,130	X	129	0.043%
3-Mar-00	7,962	15,765	271,872	126	81	-3,440	X	129	0.047%
4-Mar-00	8,718	17,262	255,238	120	117	-4,670	X	129	0.051%
5-Mar-00	8,902	17,626	250,397	96	66	-4,490	X	129	0.052%
6-Mar-00	7,854	15,551	262,011	111	84	-3,160	X	129	0.049%
7-Mar-00	8,120	16,078	262,398	57	51	-2,594	X	129	0.049%
8-Mar-00	8,540	16,909	269,821	120	104	-2,360	X	129	0.048%
9-Mar-00	4,028	7,975	283,544	81	54	-280	X	129	0.046%
10-Mar-00	3,936	7,793	274,339	61	50	1,335	X	129	0.047%
11-Mar-00	2,860	5,663	264,809	57	30	1,437	X	129	0.049%
12-Mar-00	5,009	9,918	242,934	54	66	-168	X	129	0.053%
13-Mar-00	5,299	10,492	224,245	27	84	-701	X	129	0.058%
14-Mar-00	3,201	6,338	211,232	24	69	1,294	X	129	0.061%
15-Mar-00	2,678	5,302	193,979	54	81	1,259	X	129	0.067%
16-Mar-00	3,090	6,118	171,339	21	45	911	X	129	0.075%
17-Mar-00	3,205	6,346	154,212	9	27	682	X	129	0.084%
18-Mar-00	5,422	10,736	138,879	12	100	-1,615	X	129	0.093%
19-Mar-00	6,679	13,224	124,025	9	36	-3,400	X	129	0.104%
20-Mar-00	6,640	13,147	115,824	48	1044	-3,110	X	129	0.111%
21-Mar-00	4,807	9,518	107,692	41	1579	-2,490	X	129	0.120%
22-Mar-00	5,878	11,638	94,230	18	219	-4,010	X	129	0.137%
23-Mar-00	4,707	9,320	88,740	27	141	-4,160	X	129	0.145%
24-Mar-00	4,270	8,455	84,932	3	150	-2,702	X	129	0.152%
25-Mar-00	4,381	8,674	80,596	3	99	-1,670	X	129	0.160%
26-Mar-00	4,529	8,967	72,280	6	87	-2,352	X	129	0.179%
27-Mar-00	5,793	11,470	64,817	10	93	-3,790	X	129	0.199%
28-Mar-00	5,198	10,292	60,463	39	405	-3,700	X	129	0.213%

29-Mar-00	5,546	10,981	55,078	42	181	-4,370	X	129	0.234%
30-Mar-00	6,674	13,215	49,619	24	222	-5,130	X	129	0.260%
31-Mar-00	5,716	11,318	47,338	27	153	-5,310	X	129	0.273%
1-Apr-00	5,712	11,310	42,968	60	141	-6,080			
2-Apr-00	6,065	12,009	39,416	6	84	-6,530			
3-Apr-00	5,600	11,088	38,258	0	75	-6,970			
4-Apr-00	6,125	12,128	34,660	18	99	-6,440			
5-Apr-00	3,432	6,795	38,650	12	9	-5,300			
6-Apr-00	4,203	8,322	36,000	6	63	-5,500			
7-Apr-00	4,098	8,114	34,070	12	69	-6,270			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-25

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 4

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
16-Mar-04	6,691	13,248	72,510	24	60	-7,925			
17-Mar-04	6,676	13,218	66,096	0	36	-7,712			
18-Mar-04	6,687	13,240	60,861	0	30	-7,715			
19-Mar-04	6,595	13,058	57,917	0	15	-7,628			
20-Mar-04	6,640	13,147	55,460	0	48	-7,657			
21-Mar-04	6,685	13,236	53,454	0	24	-7,706			
22-Mar-04	6,669	13,205	50,989	0	56	-5,574			
23-Mar-04	6,121	12,120	49,730	0	90	-5,237	X	3,412	6.860%
24-Mar-04	5,108	10,114	53,506	0	66	-5,439	X	1,404	2.624%
25-Mar-04	5,973	11,827	55,266	0	96	-6,734	X	3,115	5.636%
26-Mar-04	6,458	12,787	52,260	0	42	-7,125	X	4,075	7.797%
27-Mar-04	5,462	10,815	51,902	0	30	-6,459	X	2,103	4.051%
28-Mar-04	6,371	12,615	44,506	0	18	-7,010	X	3,903	8.769%
29-Mar-04	6,629	13,125	38,679	0	67	-8,032	X	4,413	11.410%
30-Mar-04	6,438	12,747	31,939	0	30	-7,241	X	4,035	12.634%
31-Mar-04	4,656	9,219	32,104	0	12	-6,231			
1-Apr-04	4,399	8,710	27,987	0	36	-7,612			
2-Apr-04	4,349	8,611	27,922	0	24	-6,642			
3-Apr-04	4,394	8,700	28,676	0	6	-5,958			
4-Apr-04	4,188	8,292	30,338	0	0	-6,501			
5-Apr-04	4,363	8,639	33,403	0	0	-7,331			
6-Apr-04	4,369	8,651	35,939	0	12	-8,167			
7-Apr-04	1,948	3,857	49,720	0	6	-6,734			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1995 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

Event 2: February 24, 1999 through March 31, 1999 (Table 7.3-23)

During the week prior to February 24, 1999, pumping at Banks Pumping Plant was down to zero twice, and in the 70 cfs range three times. Pumping at Banks Pumping Plant ramped up to 2552 cfs on the day that the proposed project induced pumping began. At this time salvage numbers began to increase. However, the proposed project-induced pumping only added 200 AF per day (or 101 cfs) for the first 5 days, and then added only 65 AF per day (or 33 cfs) to base pumping at Banks Pumping Plant for the rest of the impact period. The general increase in pumping may have led to increased salvage; however, the extra pumping due to the proposed project probably did not contribute.

Pumping at Banks was curtailed later in the spring to address an increase in delta smelt salvage at the Skinner facility. Banks pumping was curtailed by 292,000 AF between May 20, 1999 and June 30, 1999 to address the salvage of delta smelt.

Event 3: February 22, 2000 through March 31, 2000 (Table 7.3-24)

During the week prior to February 22, 2000, Old and Middle river flows were between -5,000 and -10,000 cfs. When reverse flows in Old River and Middle river combined exceed 5,000 cfs, fish salvage at the pumps tends to increase. The salvage numbers during the impact period relative to salvage numbers prior to the impact period seem to support this. Also, pumping at Banks Pumping Plant is upwards of 9000 cfs just prior to February 22. Of the pumping that actually occurred during this event, the first two days of the proposed project-induced pumping include 6,300 AF (3,182 cfs) and 4,077 AF (2,059 cfs), respectively, and then the proposed project-induced pumping reduces to 129 AF per day (65 cfs) over the base level for the duration of the impact period. During the impact period, overall pumping at Banks Pumping Plant ranges daily from levels of 2,000 cfs up to a high 8,000 cfs. Also, Old and Middle River flows move back to the positive, before going negative again towards the end of the impact period. Delta smelt salvage numbers generally decline throughout the impact period, while splittail levels remain consistent, with the exception of a spike on March 20 and 21. This could possibly be from Old and Middle river flows going from positive to negative three days prior. Overall Banks Pumping Plant pumping also increased at this time. Based on the evidence from this event, it seems unlikely that the proposed project exacerbated the salvage numbers.

Pumping at Banks was curtailed later in the spring to address an increase in delta smelt salvage at the Skinner facility. Banks pumping was curtailed by 28,000 AF between May 25, 2000 and May 31, 2000 to address the salvage of delta smelt.

Event 4: March 23, 2004 through March 30, 2004 (Table 7.3-25)

During the week prior to March 23, Old and Middle river flows were between -5,000 and -10,000 cfs. There was no recorded salvage of delta smelt at the Skinner facility during this period, although there was continued salvage of splittail. When reverse flows in Old and Middle rivers combined exceed 5,000 cfs, fish salvage at the pumps tends to increase (this is an especially dangerous time for juveniles, although few would be expected in the area in March). The salvage numbers relative to the salvage numbers prior to the proposed project-induced pumping seem to support this. Pumping at Banks Pumping Plant was around 6,500 cfs during the impact period, and dropped to 4,000 cfs after the impact period.

The proposed project-induced pumping had no impact on delta smelt in 2004, as there was no salvage during or following Event 4. The proposed project pumping may have contributed to splittail salvage during this event for the following reasons:

1. Old and Middle river flows are consistent prior to the impact period, during the impact period, and after the impact period.
2. After the impact period the splittail salvage numbers show a gradual decreasing trend from the end of March to the start of April.
3. Delta outflow decreases after the impact period, while salvage numbers go down.
4. The percent contribution of the proposed project to the overall pumping is high compared to other events.

For the reasons stated above, the incremental pumping may have increased splittail salvage at some times. It is possible to conclude that the proposed project may have contributed to increases in salvage under certain conditions from 1996 through 2004.

During 2004, the EWA was in operation, and the EWA Agencies were monitoring fish distribution and abundance, including salvage at the Banks and Jones plants. The EWA Agencies did not take any EWA action at any time during March 2004. EWA is discussed further below.

Proposed Project Impact Summary (1995 - 2003)

Increased pumping in November through March could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult delta smelt and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased pumping. Misdirection or delay of upstream movement could be a problem when Delta outflow is low. The fishes most susceptible to November-March hydrodynamic changes and export increases are outmigrating salmonids, and delta smelt moving upstream to spawn.

The Department prior to and during the inception of the proposed project in 1996, has been operating the SWP and all its subsidiary facilities (including Banks) in accordance with all environmental legal constraints. The environmental constraints that were pertinent for any given time from 1996 to 2003 would have mitigated for any additional pumping due to the proposed project in the Delta, this would include the proposed project and its water supply management practices. The Department believes that the environmental agreements developed with CDFG prior to and during the 1996-2003 timeframe were sufficient to protect Delta species from the impacts of pumping and satisfy any statutory requirements (see Mitigation Measures section below). In addition, the Banks pumping curtailments to address federal ESA concerns in 1996 (71,000 AF May 16-24), 1997 (10,000 AF June 7-11), 1999 (292,000 AF May 20-June 30), and 2000 (28,000 AF May 25-31) provided some added fish benefits. Beginning in 2000, the EWA Program provided a real-time adaptive management response to fish distribution, abundance, and salvage in the Delta.

<u>Environmental Programs</u>

The following summarizes mitigation and environmental programs already in place that were relevant to the SWP (thus the proposed project) and Delta fisheries covered by the federal biological opinions for the 1995-2003 timeframe:

1. CALFED Agreement and Bay-Delta Accord signed in 1994 committed State and federal agencies to improved coordination of water supply operations and protection of endangered species, and provided for the development of long-term Delta ecosystem restoration.
2. The Water Right Decision 1641 issued by the Regional Water Quality Control Board in 2000 included SWP and CVP standards for meeting water quality goals, including the X2 standard, and a combined SWP-CVP export reduction that varies depending on the water year type.
3. ESA-related Banks pumping curtailments in 1996 (71,000 AF May 16-24), 1997 (10,000 AF June 7-11), 1999 (292,000 AF May 20-June 30), and 2000 (28,000 AF May 25-31) provided some mitigation during this period.
4. The EWA was initiated in late 2000 to address impacts of Delta export pumping on fish. The EWA is a cooperatively-managed program intended to provide protection to the fish of the Bay-Delta Estuary through environmentally beneficial changes and increased flexibility in the operations of the SWP and CVP. The program was developed in 2000 as part of the CALFED Record of Decision (ROD), and was structured to address SWP and CVP impacts. The EWA program relies on continuous monitoring of fish distribution and density in the Delta, combined with assessment of the risk to the fish from Delta export pumping, to identify periods when pumping changes can best benefit fish. When there are fish species of concern present near the pumps, the Management Agencies recommended that pumping at Banks Pumping Plant and/or Jones Pumping Plant be curtailed to lower pumping rates to protect fish by reducing salvage at the pumps or to control in-Delta channel flows to avoid attracting fish (especially delta smelt) toward the pumps.
5. The Anadromous Fisheries Biological Opinion of 1995 (this was later superseded by one in 2004) provided FESA incidental take coverage for federally listed species of salmonids in the Delta. This also included operation restrictions of SWP facilities in the Delta.
6. The Delta Pumping Plant Fish Protection Agreement (“Four Pumps Agreement”, 1986) is an agreement with CDFG where the Department pays for direct losses of steelhead, Chinook salmon, and striped bass based on measured losses at Banks Pumping Plant. These payments have been used provide for fisheries mitigation and habitat enhancements. Examples of completed projects include installation of fish screens, and replacement of spawning gravel.
7. The Delta Smelt Biological Opinion of 1995 (this was later superseded by one in 2005) provides the Department with FESA incidental take coverage for delta smelt for the SWP and CVP. This included restrictions on operation of SWP and CVP facilities, including export restrictions.

Summary

When considered in context with the analysis of the four events outlined above and compliance with environmental programs relevant to the SWP which were already in place, the proposed project from 1996-2003 had a ***less-than-significant impact*** on special-status fish species in the Sacramento-San Joaquin Delta due to effects of the water supply management practices.

Mitigation Measure

None required.

Future Impacts

Increases in export of water from the Delta could alter streamflows and increase entrainment of fish at the pumping facilities. The export of water from the Delta has the potential to impact special-status species of fish as they move up and downstream through the Delta, or into and out of spawning habitats within the Delta.

Delta exports to contractors south of the Delta can be affected both by the altered allocation procedures and Table A transfers and retirements, and by the water supply management practices. The future effects of these two sets of Monterey Amendment provisions are evaluated in two separate analyses. These analyses are described in the two sections below, followed by a summary of the net effects of all Monterey Amendment provisions on Delta exports.

Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change both the total quantity of SWP water delivered and the quantities of SWP water delivered to individual contractors. These changes in deliveries could affect Delta exports.

Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. Table 7.3-16 shows annual deliveries to contractors south of the Delta with the proposed project and under the baseline scenario. Under 2020 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 23,000 AF, with delivery changes by year type ranging from decreases of about 53,000 AF in wet years to increases of about 6,000 AF in critically dry years. Delivery changes can be made from south-of-Delta storage and may not change Delta exports. However, to provide the most conservative impact analysis, it is assumed that any increase in delivery would be made by increased exports. As a percent of baseline scenario Delta exports under 2020 conditions, the Table A retirements and transfers and altered water allocation procedures would be estimated to decrease Delta exports by an annual average of about 0.71 percent, with delivery changes by year type ranging from a decrease of 1.28 percent in wet years to an increase of 0.46 percent in critically dry years.

Analysis of Effects of Water Supply Management Practices

In addition to the altered water allocation procedures and the transfers and retirement of Table A amounts analyzed above, the Monterey Amendment contains other provisions, i.e., the water supply management practices, which could change deliveries of SWP water to contractors. Changes in deliveries could in turn result in changes in exports from the Delta at Banks Pumping Plant. Monterey Amendment-induced changes in SWP operations and deliveries to SWP contractors resulting from the water supply management practices are described in Chapter 6.

Contractors took advantage of the water supply management practices from 1996 to 2004 and would be expected to continue to employ all or most of them in the future. Because the water supply management practices were actually used from 1996 to 2004, an analysis of the effects of these water supply management practices in that historical period offers insight into their likely future effects.

The Department conducted a historical water supply management practices analysis to determine whether storage outside contractors' service areas, extended carryover storage, the turnback pool and flexible storage in Castaic Lake and Lake Perris, would have resulted in increased pumping at the Banks Pumping Plant from 1996 to 2004 compared to the baseline scenario. The Department determined that the water supply management practices provisions would have increased pumping in a few months from 1996 to 2004. Increased pumping was infrequent from 1996 and 2004 because there were only a few months when these provisions would have resulted in an added SWP demand at a time when the contractors would otherwise have had all the SWP water they could use or store and all SWP reservoirs south of the Delta were full or at their storage targets. Increased pumping during these occasions from 1996 to 2004 would have reduced Delta outflow compared to outflow under the baseline scenario.

The future analysis differs from that performed for the 1996-2004 period by assuming that from 2004 on into the future, the contractors would have essentially filled within-service-area storage that could have been used from 1996 to 2004. Thus the future (2003-2020) analysis uses the 449,000 AF estimate of water supply management practices from 1996 to 2004 without offset for the ability to bank added water within their service areas.

Using the period from 1996 to 2004 (see note below), the Department's future analysis showed that the water supply management practices would have reduced total Delta outflow by a total of 449,000 AF over this nine-year period, or an average of about 50,000 AF per year. Because there would be a greater amount of added pumping under these assumptions, there are nine separate instances of Banks continuing to pump at a higher rate with the proposed project. Those nine reductions in Delta outflow would occur as follows: 1) December 9 through December 16, 1996, 2) January 3 through January 13, 1998, 3) November 1 through November 14, 1998, 4) December 1, 1998 through January 3, 1999, 5) January 14 through January 26, 1999, 6) February 24 through March 31, 1999, 7) February 1 through March 31, 2000, 8) March 19 through March 26, 2001, and 9) March 25 through March 30, 2004. (See discussion on these nine separate events below.) The years 1996 through 1999 were classified as wet years, 2000 was above normal, 2000 and 2001 were dry, 2003 was above normal, and 2004 was below normal. A table is included for each event that shows daily information to better understand conditions during the event (Tables 7.3-26 to 7.3-34).

See discussion for the 1996 to 2003 period of analysis, above, on November through March fish movement, and fish salvage issues. The same information is also pertinent in this section.

Below is an event by event discussion of nine time periods from 1996 to 2004 where the water supply management practices of the proposed project may induce additional pumping at Banks Pumping Plant.

Note: The March 25 to March 30, 2004, event occurs outside of the 1996-2003 timeframe designated for this analysis. However, 2004 is included as an additional data point for projecting the potential future impacts of the water supply management practices of the proposed project when increased pumping could occur, thus providing a more thorough analysis.

TABLE 7.3-26

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 1

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
2-Dec-96	4,855	9,613	17,178	0	0	-6,280			
3-Dec-96	5,239	10,373	15,989	0	0	-6,720			
4-Dec-96	4,160	8,237	21,653	0	0	-6,730			
5-Dec-96	5,492	10,874	40,836	0	0	-7,770			
6-Dec-96	6,482	12,834	79,168	0	0	-7,480			
7-Dec-96	6,627	13,121	83,400	0	0	-7,070			
8-Dec-96	6,569	13,007	81,562	0	4	-6,850			
9-Dec-96	6,492	12,854	78,657	0	0	-6,930	x	8,894	11.307%
10-Dec-96	6,582	13,032	96,759	0	0	-5,710	x	9,072	9.376%
11-Dec-96	3,927	7,775	126,482	0	0	-3,550	x	3,815	3.017%
12-Dec-96	5,723	11,332	157,406	0	0	-3,510	x	7,372	4.683%
13-Dec-96	6,330	12,533	203,863	0	0	-3,450	x	8,573	4.205%
14-Dec-96	5,164	10,225	252,537	0	0	-2,324	x	6,265	2.481%
15-Dec-96	6,676	13,218	248,092	0	0	-2,375	x	9,258	3.732%
16-Dec-96	5,,482	10,854	227,793	0	0	-2,938	x	6,894	3.027%
17-Dec-96	2,165	4,287	216,525	0	0	-629			
18-Dec-96	892	1,766	191,098	0	0	1,882			
19-Dec-96	805	1,594	172,030	0	0	1,893			
20-Dec-96	393	778	160,455	0	0	1,411			
21-Dec-96	2,166	4,289	166,720	6	0	446			
22-Dec-96	3,077	6,092	188,906	0	0	1,191			
23-Dec-96	1,254	2,483	218,049	0	0	3,820			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-27

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 2

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
25-Dec-97	7,276	14,406	14,389	36	334	-9,090			
26-Dec-97	7,275	14,405	12,929	30	4	-9,100			
27-Dec-97	7,235	14,325	12,387	12	12	-8,820			
28-Dec-97	7,235	14,325	11,462	8	36	-9,050			
29-Dec-97	7,241	14,337	10,324	24	12	-9,280			
30-Dec-97	7,236	14,327	9,755	36	0	-9,290			
31-Dec-97	7,233	14,321	9,656	0	24	-9,320			
1-Jan-98	7,224	14,304	9,409	12	12	-9,530			
2-Jan-98	7,217	14,290	13,149	0	12	-9,140			
3-Jan-98	7,214	14,284	15,709	0	20	-8,240	x	10,324	65.717%
4-Jan-98	6,744	13,353	30,076	6	6	-7,730	x	9,393	31.231%
5-Jan-98	6,203	12,282	43,631	0	6	-7,400	x	8,322	19.073%
6-Jan-98	6,046	11,971	50,975	12	18	-8,180	x	8,011	15.716%
7-Jan-98	6,722	13,310	42,889	32	18	-8,780	x	9,350	21.800%
8-Jan-98	7,068	13,995	37,048	12	12	-9,010	x	10,035	27.086%
9-Jan-98	7,250	14,355	35,391	8	12	-9,210	x	10,395	29.372%
10-Jan-98	7,246	14,347	39,285	12	126	-8,700	x	10,387	26.440%
11-Jan-98	7,292	14,438	42,922	16	98	-8,320	x	10,478	24.412%
12-Jan-98	7,340	14,533	80,832	0	90	-8,500	x	10,573	13.081%
13-Jan-98	7,465	14,781	118,687	8	12	-6,710	x	10,821	9.117%
14-Jan-98	76	150	148,787	0	0	-2,672			
15-Jan-98	76	150	170,551	0	0	-594			
16-Jan-98	74	147	209,504	0	0	229			
17-Jan-98	69	137	239,693	0	0	1,281			
18-Jan-98	76	150	260,661	0	0	1,353			
19-Jan-98	70	139	269,036	0	0	2,476			
20-Jan-98	74	147	259,226	0	0	2,730			

Notes:

a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-28

SOUTH DELTA AND

SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]
EVENT 3

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
25-Oct-98	5,726	11,337	25,621	0	6	-5,650			
26-Oct-98	4,335	8,583	29,300	0	20	-5,850			
27-Oct-98	4,263	8,441	30,062	0	18	-5,260			
28-Oct-98	3,709	7,344	33,094	0	12	-4,250			
29-Oct-98	3,889	7,700	21,384	0	0	-4,790			
30-Oct-98	3,911	7,744	20,954	0	0	-4,830			
31-Oct-98	3,549	7,027	20,214	0	14	-4,850			
1-Nov-98	5,644	11,175	13,613	0	18	-6,140	x	8,205	60.276%
2-Nov-98	4,481	8,872	17,244	0	0	-6,610	x	5,902	34.229%
3-Nov-98	3,428	6,787	18,485	0	0	-5,220	x	3,817	20.651%
4-Nov-98	2,484	4,918	18,523	0	48	-4,480	x	1,948	10.518%
5-Nov-98	2,995	5,930	16,895	0	24	-4,550	x	2,960	17.520%
6-Nov-98	3,018	5,976	16,856	0	6	-4,720	x	3,006	17.832%
7-Nov-98	3,611	7,150	19,562	0	0	-5,440	x	4,180	21.366%
8-Nov-98	4,512	8,934	21,538	0	24	-4,770	x	5,964	27.689%
9-Nov-98	2,574	5,097	25,988	0	0	-4,430	x	2,127	8.183%
10-Nov-98	1,974	3,909	28,530	0	6	-4,130	x	939	3.290%
11-Nov-98	2,568	5,085	28,831	0	12	-4,110	x	2,115	7.335%
12-Nov-98	2,007	3,974	26,346	0	0	-3,830	x	1,004	3.810%
13-Nov-98	2,316	4,586	24,701	0	0	-4,090	x	1,616	6.541%
14-Nov-98	1,911	3,784	26,429	0	0	-4,000	x	814	3.079%
15-Nov-98	1,570	3,109	28,437	0	0	-2,870			
16-Nov-98	873	1,729	32,791	0	0	-1,887			
17-Nov-98	767	1,519	36,280	0	0	-644			
18-Nov-98	1,028	2,035	38,519	0	0	322			
19-Nov-98	1,587	3,142	39,153	0	0	128			
20-Nov-98	1,609	3,186	44,069	0	0	-225			
21-Nov-98	1,377	2,726	46,688	0	0	-341			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-29

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 4

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
24-Nov-98	0	0	69,480	0	0	2,210			
25-Nov-98	0	0	78,596	0	4	1,218			
26-Nov-98	1,495	2,960	80,669	0	0	-15			
27-Nov-98	1,545	3,059	84,916	0	0	65			
28-Nov-98	2,585	5,118	73,763	0	0	-131			
29-Nov-98	2,847	5,637	77,210	0	0	-1,197			
30-Nov-98	2,288	4,530	84,493	0	6	-1,901			
1-Dec-98	1,315	2,604	93,163	0	0	84	X	419	0.450%
2-Dec-98	1,735	3,435	98,784	0	0	-14	x	419	0.425%
3-Dec-98	1,880	3,722	112,300	0	0	-408	x	419	0.373%
4-Dec-98	1,991	3,942	121,671	0	0	89	x	419	0.345%
5-Dec-98	1,998	3,956	124,607	0	0	329	x	419	0.337%
6-Dec-98	1,997	3,954	129,718	0	0	709	x	419	0.323%
7-Dec-98	1,993	3,946	132,165	0	0	785	x	419	0.317%
8-Dec-98	2,000	3,960	131,464	0	0	815	x	419	0.319%
9-Dec-98	1,991	3,942	130,698	0	0	808	x	419	0.321%
10-Dec-98	1,908	3,778	126,158	0	0	545	x	419	0.332%
11-Dec-98	1,786	3,536	121,940	0	0	-29	x	419	0.344%
12-Dec-98	1,907	3,776	118,545	0	0	-105	x	419	0.354%
13-Dec-98	1,952	3,865	115,721	0	4	-236	x	419	0.362%
14-Dec-98	1,985	3,930	112,466	0	0	599	x	419	0.373%
15-Dec-98	1,992	3,944	110,205	0	0	288	x	419	0.381%
16-Dec-98	2,045	4,049	107,752	8	0	152	x	419	0.389%
17-Dec-98	3,619	7,166	99,667	0	0	-1,359	x	419	0.421%
18-Dec-98	4,673	9,253	88,716	0	0	-2,920	x	419	0.473%
19-Dec-98	2,814	5,572	85,568	6	0	-875	x	419	0.490%
20-Dec-98	1,301	2,576	83,802	0	0	506	x	419	0.500%
21-Dec-98	1,309	2,592	79,941	0	0	867	x	419	0.525%
22-Dec-98	462	915	78,679	0	0	553	x	419	0.533%
23-Dec-98	3,179	6,294	69,546	0	0	170	x	419	0.603%
24-Dec-98	3,167	6,271	64,083	0	0	-171	x	419	0.654%
25-Dec-98	2,216	4,388	59,362	0	0	-490	x	419	0.706%
26-Dec-98	822	1,628	57,424	0	0	-403	x	419	0.730%
27-Dec-98	2,714	5,374	50,969	0	0	-966	x	419	0.823%
28-Dec-98	1,832	3,627	51,098	0	0	-925	x	419	0.821%
29-Dec-98	1,989	3,938	49,393	2	0	-968	x	419	0.849%
30-Dec-98	1,697	3,360	47,815	0	0	-1,085	x	419	0.877%
31-Dec-98	1,961	3,883	46,221	0	8	-742	x	419	0.907%
1-Jan-99	1,992	3,944	44,663	4	0	-284	x	129	0.289%
2-Jan-99	2,010	3,980	43,429	0	0	-436	x	129	0.297%
3-Jan-99	1,995	3,950	43,235	0	0	-233	x	129	0.298%

4-Jan-99	1,152	2,281	44,354	0	0	166			
5-Jan-99	935	1,851	44,629	0	0	149			
6-Jan-99	271	537	42,427	0	0	-364			
7-Jan-99	114	226	40,935	0	0	-152			
8-Jan-99	192	380	39,065	0	0	130			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-30

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 5

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
9-Jan-99	30	59	38,264	0	0	-264			
10-Jan-99	203	402	36,323	0	0	-987			
11-Jan-99	207	410	35,511	0	0	-1,290			
12-Jan-99	203	402	35,436	0	0	-764			
13-Jan-99	180	356	31,987	0	0	-1,669			
14-Jan-99	2,579	5,106	26,112	0	0	-3,960	x	129	0.494%
15-Jan-99	2,823	5,590	31,310	0	0	-5,100	x	129	0.412%
16-Jan-99	2,496	4,942	32,797	0	0	-4,660	x	129	0.393%
17-Jan-99	2,495	4,940	34,911	0	12	-4,140	x	129	0.370%
18-Jan-99	2,497	4,944	48,031	0	0	-4,350	x	129	0.269%
19-Jan-99	2,498	4,946	66,611	0	12	-4,330	x	129	0.194%
20-Jan-99	3,002	5,944	90,864	0	0	-4,250	x	129	0.142%
21-Jan-99	2,505	4,960	134,412	0	0	-2,887	x	129	0.096%
22-Jan-99	2,497	4,944	144,692	0	0	-3,460	x	129	0.089%
23-Jan-99	2,491	4,932	144,201	0	0	-3,137	x	129	0.089%
24-Jan-99	2,490	4,930	147,530	0	0	-2,688	x	129	0.087%
25-Jan-99	2,690	5,326	147,556	0	0	-2,792	x	129	0.087%
26-Jan-99	2,939	5,819	140,635	0	0	-1,574	x	129	0.092%
27-Jan-99	44	87	141,645	0	0	196			
28-Jan-99	119	236	131,826	0	0	468			
29-Jan-99	168	333	122,899	0	0	86			
30-Jan-99	200	396	112,668	0	0	-466			
31-Jan-99	194	384	114,781	0	1	327			
1-Feb-99	297	588	106,888	0	0	960			
2-Feb-99	222	440	98,220	0	0	-68			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-31

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 6

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
17-Feb-99	71	141	202,946	0	0	3,230			
18-Feb-99	75	149	250,478	0	0	2,860			
19-Feb-99	0	0	266,433	0	0	3,080			
20-Feb-99	79	156	268,692	0	0	2,890			
21-Feb-99	0	0	271,306	0	0	3,350			
22-Feb-99	519	1,028	268,522	0	0	3,160			
23-Feb-99	1,397	2,766	202,946	0	0	2,105			
24-Feb-99	2,552	5,053	232,535	3	4	792	x	1,400	0.602%
25-Feb-99	2,994	5,928	208,393	42	12	706	x	1,400	0.672%
26-Feb-99	3,400	6,732	196,844	19	36	293	x	1,400	0.711%
27-Feb-99	4,006	7,932	188,383	0	60	-589	x	1,400	0.743%
28-Feb-99	2,395	4,742	186,227	32	4	-344	x	1,400	0.752%
1-Mar-99	2,372	4,697	187,961	32	8	99	x	581	0.309%
2-Mar-99	2,217	4,390	196,149	0	0	-632	x	581	0.296%
3-Mar-99	1,793	3,550	204,734	8	0	-325	x	581	0.284%
4-Mar-99	3,204	6,344	205,225	22	34	-157	x	581	0.283%
5-Mar-99	3,477	6,884	201,311	12	54	-1,584	x	581	0.288%
6-Mar-99	3,999	7,918	196,844	0	69	-2,607	x	581	0.295%
7-Mar-99	4,274	8,463	188,138	0	20	-2,170	x	581	0.309%
8-Mar-99	3,110	6,158	182,924	11	9	-2,389	x	581	0.317%
9-Mar-99	3,146	6,229	179,641	12	34	-1,744	x	581	0.323%
10-Mar-99	2,042	4,043	175,299	3	46	-1,713	x	581	0.331%
11-Mar-99	3,292	6,518	165,690	0	68	-2,031	x	581	0.350%
12-Mar-99	3,245	6,425	159,253	0	36	-2,243	x	581	0.365%
13-Mar-99	4,676	9,258	146,946	0	12	-3,610	x	581	0.395%
14-Mar-99	5,176	10,248	138,640	0	23	-3,970	x	581	0.419%
15-Mar-99	3,395	6,722	135,977	0	24	-3,340	x	581	0.427%
16-Mar-99	3,562	7,053	129,874	9	6	-2,361	x	581	0.447%
17-Mar-99	2,978	5,896	123,685	0	24	-2,505	x	581	0.469%
18-Mar-99	2,693	5,332	116,058	0	32	-2,740	x	581	0.500%
19-Mar-99	2,677	5,300	107,930	0	0	-2,326	x	581	0.538%
20-Mar-99	1,668	3,303	104,859	3	6	-1,854	x	581	0.554%
21-Mar-99	2,474	4,899	94,969	2	11	-2,362	x	581	0.611%
22-Mar-99	1,431	2,833	90,732	4	12	-2,287	x	581	0.640%
23-Mar-99	1,665	3,297	83,974	0	0	-2,196	x	581	0.691%
24-Mar-99	2,247	4,449	78,735	0	18	-2,740	x	581	0.737%
25-Mar-99	2,009	3,978	78,976	0	30	-2,283	x	581	0.735%
26-Mar-99	1,888	3,738	88,413	6	30	-1,545	x	581	0.657%
27-Mar-99	1,886	3,734	100,400	0	2	-1,103	x	581	0.578%

28-Mar-99	2,754	5,453	101,711	0	16	-2,452	x	581	0.571%
29-Mar-99	4,237	8,389	96,580	0	32	-3,400	x	581	0.601%
30-Mar-99	3,946	7,813	92,929	0	32	-2,840	x	581	0.625%
31-Mar-99	3,859	7,641	87,146	0	15	-2,495	x	581	0.666%
1-Apr-99	4,083	8,084	78,614	0	28	-2,530			
2-Apr-99	3,596	7,120	72,090	0	40	-2,520			
3-Apr-99	5,088	10,074	64,712	0	28	-2,940			
4-Apr-99	4,647	9,201	60,752	32	128	-3,731			
5-Apr-99	5,189	10,274	61,675	0	27	-4,060			
6-Apr-99	3,237	6,409	66,427	0	24	-2,691			
7-Apr-99	3,022	5,984	65,714	12	78	-1,981			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-32

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 7

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
1-Feb-00	7,499	14,848	78,586	39	27	-8,110	x	414	0.53%
2-Feb-00	7,492	14,834	78,083	10	6	-8,810	x	414	0.53%
3-Feb-00	7,493	14,836	79,182	75	15	-9,400	x	414	0.52%
4-Feb-00	7,281	14,416	76,822	93	21	-8,530	x	414	0.54%
5-Feb-00	7,400	14,652	72,769	108	15	-8,430	x	6,491	8.92%
6-Feb-00	7,393	14,638	68,853	81	36	-7,860	x	6,554	9.52%
7-Feb-00	7,174	14,205	65,463	78	15	-8,160	x	3,784	5.78%
8-Feb-00	6,671	13,209	61,909	108	3	-7,620	x	5,037	8.14%
9-Feb-00	6,316	12,506	59,065	66	27	-7,610	x	5,204	8.81%
10-Feb-00	7,011	13,882	61,255	36	63	-8,750	x	3,918	6.40%
11-Feb-00	6,976	13,812	78,523	72	15	-9,180	x	5,187	6.61%
12-Feb-00	6,642	13,151	110,037	51	15	-8,600	x	4,609	4.19%
13-Feb-00	7,227	14,309	148,809	201	375	-9,480	x	8,688	5.84%
14-Feb-00	7,698	15,242	202,324	380	288	-8,450	x	6,336	3.13%
15-Feb-00	7,913	15,668	324,512	374	624	-6,290	x	7,519	2.32%
16-Feb-00	8,806	17,436	321,960	300	93	-7,260	x	10,501	3.26%
17-Feb-00	9,059	17,937	316,143	300	204	-7,140	x	9,714	3.07%
18-Feb-00	9,229	18,273	284,090	172	97	-6,510	x	3,991	1.40%
19-Feb-00	8,705	17,236	255,747	254	190	-6,190	x	6,662	2.60%
20-Feb-00	8,165	16,167	238,533	504	147	-6,240	x	10,110	4.24%
21-Feb-00	9,487	18,784	217,887	420	150	-5,600	x	5,340	2.45%
22-Feb-00	9,182	18,180	219,455	290	189	-5,030	x	7,738	3.53%
23-Feb-00	8,059	15,957	249,789	392	104	-4,630	x	3,026	1.21%
24-Feb-00	5,998	11,876	280,322	196	175	-2,954	x	414	0.15%
25-Feb-00	5,811	11,506	272,494	143	56	-2,045	x	414	0.15%
26-Feb-00	5,669	11,225	267,690	165	84	-3,396	x	414	0.15%
27-Feb-00	5,987	11,854	274,470	202	88	-2,961	x	414	0.15%
28-Feb-00	5,995	11,870	317,695	230	186	-1,951	x	414	0.13%
29-Feb-00	5,998	11,876	320,289	151	40	-2,375	x	414	0.13%
1-Mar-00	5,995	11,870	316,206	171	39	-1,463	x	419	0.13%
2-Mar-00	6,550	12,969	297,784	192	33	-2,130	x	419	0.14%
3-Mar-00	7,962	15,765	271,872	126	81	-3,440	x	419	0.15%
4-Mar-00	8,718	17,262	255,238	120	117	-4,670	x	419	0.16%
5-Mar-00	8,902	17,626	250,397	96	66	-4,490	x	419	0.17%
6-Mar-00	7,854	15,551	262,011	111	84	-3,160	x	419	0.16%
7-Mar-00	8,120	16,078	262,398	57	51	-2,594	x	419	0.16%
8-Mar-00	8,540	16,909	269,821	120	104	-2,360	x	419	0.16%
9-Mar-00	4,028	7,975	283,544	81	54	-280	x	419	0.15%
10-Mar-00	3,936	7,793	274,339	61	50	1,335	x	419	0.15%

11-Mar-00	2,860	5,663	264,809	57	30	1,437	x	419	0.16%
12-Mar-00	5,009	9,918	242,934	54	66	-168	x	419	0.17%
13-Mar-00	5,299	10,492	224,245	27	84	-701	x	419	0.19%
14-Mar-00	3,201	6,338	211,232	24	69	1,294	x	419	0.20%
15-Mar-00	2,678	5,302	193,979	54	81	1,259	x	419	0.22%
16-Mar-00	3,090	6,118	171,339	21	45	911	x	419	0.24%
17-Mar-00	3,205	6,346	154,212	9	27	682	x	419	0.27%
18-Mar-00	5,422	10,736	138,879	12	100	-1,615	x	419	0.30%
19-Mar-00	6,679	13,224	124,025	9	36	-3,400	x	419	0.34%
20-Mar-00	6,640	13,147	115,824	48	1,044	-3,110	x	419	0.36%
21-Mar-00	4,807	9,518	107,692	41	1,579	-2,490	x	419	0.39%
22-Mar-00	5,878	11,638	94,230	18	219	-4,010	x	419	0.45%
23-Mar-00	4,707	9,320	88,740	27	141	-4,160	x	419	0.47%
24-Mar-00	4,270	8,455	84,932	3	150	-2,702	x	419	0.49%
25-Mar-00	4,381	8,674	80,596	3	99	-1,670	x	419	0.52%
26-Mar-00	4,529	8,967	72,280	6	87	-2,352	x	419	0.58%
27-Mar-00	5,793	11,470	64,817	10	93	-3,790	x	419	0.65%
28-Mar-00	5,198	10,292	60,463	39	405	-3,700	x	419	0.69%
29-Mar-00	5,546	10,981	55,078	42	181	-4,370	x	419	0.76%
30-Mar-00	6,674	13,215	49,619	24	222	-5,130	x	419	0.85%
31-Mar-00	5,716	11,318	47,338	27	153	-5,310	x	419	0.89%

Notes:

a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-33

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 8

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
12-Mar-01	8,470	16,771	59,343	96	126	-4,920			
13-Mar-01	7,825	15,494	53,603	216	78	-6,260			
14-Mar-01	7,430	14,711	47,447	162	117	-5,777			
15-Mar-01	7,212	14,280	41,362	186	144	-5,800			
16-Mar-01	6,670	13,207	36,289	291	219	-5,529			
17-Mar-01	6,239	12,353	32,516	132	108	-5,281			
18-Mar-01	6,502	12,874	26,718	90	117	-5,130			
19-Mar-01	6,579	13,026	24,285	33	150	-5,290	x	6,096	25.104%
20-Mar-01	6,678	13,222	22,481	63	75	-5,720	x	6,292	27.990%
21-Mar-01	6,675	13,217	21,768	108	102	-5,830	x	6,287	28.879%
22-Mar-01	6,679	13,224	21,265	126	225	-5,450	x	6,294	29.600%
23-Mar-01	6,675	13,217	19,745	39	432	-5,660	x	6,287	31.839%
24-Mar-01	6,672	13,211	17,794	24	183	-6,170	x	6,281	35.295%
25-Mar-01	6,669	13,205	19,139	51	216	-6,140	x	6,275	32.785%
26-Mar-01	6,584	13,036	18,762	51	177	-6,190	x	6,106	32.545%
27-Mar-01	5,799	11,482	19,786	24	87	-6,160			
28-Mar-01	5,398	10,688	19,863	60	129	-6,740			
29-Mar-01	4,791	9,486	18,974	42	240	-6,430			
30-Mar-01	3,798	7,520	17,836	36	75	-6,080			
31-Mar-01	3,597	7,122	16,676	18	285	-6,020			
1-Apr-01	3,379	6,690	16,192	12	129	-5,930			
2-Apr-01	3,190	6,316	16,852	54	1,830	-4,880			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-34

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 9

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
18-Mar-04	6,687	13,240	60,861	0	30	-7,715			
19-Mar-04	6,595	13,058	57,917	0	15	-7,628			
20-Mar-04	6,640	13,147	55,460	0	48	-7,657			
21-Mar-04	6,685	13,236	53,454	0	24	-7,706			
22-Mar-04	6,669	13,205	50,989	0	56	-5,574			
23-Mar-04	6,121	12,120	49,730	0	90	-5,237			
24-Mar-04	5,108	10,114	53,506	0	66	-5,439			
25-Mar-04	5,973	11,827	55,266	0	96	-6,734	x	3,115	5.636%
26-Mar-04	6,458	12,787	52,260	0	42	-7,125	x	4,075	7.797%
27-Mar-04	5,462	10,815	51,902	0	30	-6,459	x	2,103	4.051%
28-Mar-04	6,371	12,615	44,506	0	18	-7,010	x	3,903	8.769%
29-Mar-04	6,629	13,125	38,679	0	67	-8,032	x	4,413	11.410%
30-Mar-04	6,438	12,747	31,939	0	30	-7,241	x	4,035	12.634%
31-Mar-04	4,656	9,219	32,104	0	12	-6,231			
1-Apr-04	4,399	8,710	27,987	0	36	-7,612			
2-Apr-04	4,349	8,611	27,922	0	24	-6,642			
3-Apr-04	4,394	8,700	28,676	0	6	-5,958			
4-Apr-04	4,188	8,292	30,338	0	0	-6,501			
5-Apr-04	4,363	8,639	33,403	0	0	-7,331			
6-Apr-04	4,369	8,651	35,939	0	12	-8,167			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

Event 1: December 9, 1996 through December 16, 1996 (Table 7.3-26)

The only delta smelt salvage occurred five days after the water supply management practices induced pumping, but this is still within the timeframe of possible impact due to the water management practices pumping. The only splittail salvage occurred on the day prior to the event. Based on this minimal salvage, there would be no affect on salvage.

Event 2: January 3, 1998 through January 13, 1998 (Table 7.3-27)

Old and Middle river flows were in the -5,000 to -10,000 cfs ranges for the entire impact period, and prior to the impact period. These flows reversed to positive flow after the impact period, perhaps the cause for the zero salvage found at this point. Delta outflow was also on the increase during and after the impact period. Additionally, after the impact period, Banks pumping was less than 100 cfs, for all these reasons the zero salvage found is not surprising.

The water supply management practices induced pumping would have sustained the same pumping levels that were found prior to the impact period. During the impact period, water supply management practices induced pumping would have been as much as 65 percent of the Delta outflow. Based on the fact that the water supply management practices would have sustained similar pumping patterns to those that occurred prior to the impact period, the water supply management practices would have possibly aided in the salvage numbers. Salvage numbers for delta smelt and splittail both increased during the water supply management practices induced pumping, and decreased to zero once the pumping was reduced to below 100 cfs.

Event 3: November 1, 1998 through November 14, 1998 (Table 7.3-28)

Old and Middle river flows were in the -4,500 cfs range for the entire impact period, and Delta outflow was relatively minimal. Banks Pumping Plant pumping was on a general decline during the impact period. Despite the fact that the water supply management practices would have resulted in pumping a high percentage of water as compared to the Delta outflow, there was no Delta smelt salvage in this time period, and the splittail salvage was sporadic, even before the impact period. Based on this, the water supply management practices would probably not have contributed to the salvage.

Event 4: December 1, 1998 through January 3, 1999 (Table 7.3-29)

Salvage was limited during this time period. The delta smelt and splittail cohorts that were salvaged correlate loosely with times of switch in Old and Middle river flows from positive to negative flows. During this event, the water supply management practices would probably not have contributed to salvage.

Event 5: January 14, 1999 through January 26, 1999 (Table 7.3-30)

Salvage was limited during this event. The only delta smelt salvage is found after the impact period, and that is only one fish. The splittail cohorts that were salvaged could possibly be due to negative flows in the Old and Middle rivers. During this event, the water supply management practices would probably not have contributed to salvage.

Event 6: February 24, 1999 through March 31, 1999 (Table 7.3-31)

There was no salvage in the week prior to the impact period; however, it was at this same time the flows in the Old and Middle river changed from positive to negative. Also, at this time, overall pumping at Banks Pumping Plant, independent of the water supply management practices, increased. During the week prior to February 24, pumping at Banks Pumping Plant was down to zero twice, and in the 70 cfs range three times. Pumping at Banks Pumping Plant ramped up to 2,552 cfs on the day that water supply management practices-induced pumping would have begun. It was at this time salvage numbers began to increase.

The general increase in pumping might have contributed to increased salvage. During this event, it is difficult to determine if the water supply management practices-induced pumping contributed to increased salvage. Salvage numbers increase after the impact period is over, probably due to an overall increase in pumping at Banks Pumping Plant.

Event 7: February 1, 2000 through March 31, 2000 (Table 7.3-32)

Old and Middle river flows were between -5,000 and -10,000 cfs during the first half of the impact period. Old and Middle river flows reach positive numbers for a few days from March 10 to March 17, but then go back negative. This could explain the number of splittail that are salvaged on March 20 and 21.

Overall pumping at Banks Pumping Plant ranges from mid 2,000's to low 9,000's cfs during this period. The water supply management practices would have had a variable impact on the overall pumping, ranging from 10,087 AF (5,508 cfs) to 419 AF (212 cfs). The 419 AF (212 cfs) would be the contribution from March 1 to March 31.

Overall, salvage numbers are high during this period, and seem to increase about a week after the water supply management practices would have increased the pumping. If the water supply management practices would have had an impact on salvage numbers, this is around the time a jump in salvage would have been anticipated. During this event, it is possible the water supply management practices would have had an impact on salvage of delta smelt and other species.

Event 8: March 19, 2001 through March 26, 2001 (Table 7.3-33)

Old and Middle river flows were between -5,000 and -10,000 cfs during the impact period. During this period, the water supply management practices would have contributed to about half of the overall pumping at Banks Pumping Plant, keeping the pumping about the same as the week prior to the impact period. With the water supply management practices sustaining pumping levels at around 6,500 cfs, and Old and Middle river flows between -5,000 and -10,000 cfs, it is not surprising that salvage numbers during the impact period are similar to the week prior. There is a large cohort of splittail that get salvaged after the impact period, possibly be due to a further increase in negative Old and Middle river flows. During this event, it is possible the water supply management practices would have had an impact on salvage of delta smelt and other species.

Event 9: March 25, 2004 through March 30, 2004 (Table 7.3-34)

No delta smelt were salvaged during this period. Old and Middle river flows were between -5,000 and -10,000 cfs, during, prior, and after the impact period. Banks Pumping Plant pumping dropped during the impact period to levels of 6,500 cfs to 5,500 cfs; this seemed to coincide with a drop in salvage of splittail. However, the post-impact time period also saw an increase in Delta outflow.

The water supply management practices induced pumping had no impact on delta smelt in 2004, as there was no salvage during or following Event 9. The water supply management practices may have contributed to splittail salvage during this event for the same reasons as explained in event 4 of the 1995-2003 analysis.

For the reasons stated above, the incremental pumping may have increased splittail salvage at some times. It is possible to conclude that the water supply management practices (thus the proposed project) under 2003 conditions may have contributed to increases in salvage under certain conditions.

Water Supply Management Practices Impact Summary (Future)

Based on the nine events discussed above, the water supply management practices of the proposed project would have contributed to salvage numbers during certain pumping events, especially during February and March.

The degree of fish salvage that would be attributable to the proposed project in relation to total pumping is difficult to estimate. As noted in the mitigation section below, the CVP and SWP Delta facilities are being reviewed as part of the Operations Criteria and Plan (OCAP) reconsultation process. However, reviewing average annual total projected Banks Pumping Plant pumping and determining the relationship of the proportion of that pumping that might be attributable to the proposed project is important. Banks pumping is estimated to average about 3,200,000 AF per year in the future, based on CALSIM output, and the approximate estimated future added pumping at Banks due to the water supply management practices of the proposed project is about 50,000 AF per year, or 1.6 percent of annual average total Banks pumping. If the same percentage is applied to the current EWA Program asset level of about 300,000-350,000 AF, the proportion of the EWA Program attributable to the water supply management practices of the proposed project would be about 5,500 AF.

In developing fisheries mitigation for the proposed project, several other factors were also examined. The first was to see if the added pumping attributable to the proposed project would occur at times of high fish sensitivity, and the other was to provide for tracking actual future water management actions of the proposed project.

Analysis of the 50,000 AF of added pumping at Banks resulting from the water supply management practices found that about 12,000 AF would generally occur in November and December, when the fish species of concern are seldom near the pumps (except for longfin smelt), with the remaining 38,000 AF of pumping occurring in the January-April period, when fish concerns are greater. Thus the degree of impact of the water supply management practices of the proposed project as a fraction of Banks pumping would be less than the 1.6 percent cited above, or about 1.2 percent.

Based on the analysis, increased future pumping due to the proposed project under 2020 conditions could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult delta smelt, longfin smelt, splitail, striped bass, and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased pumping. The fishes most susceptible to November-March hydrodynamic changes and export increases are outmigrating salmonids and delta smelt moving upstream to spawn. Increased entrainment of a special status species that resulted from the proposed project under 2020 conditions would be considered an adverse effect and would reduce a species' abundance. Delay of upstream or downstream migration could be considered an interference with the movement of resident and migratory species.

<u>Environmental Programs</u>

The following summarizes environmental programs either already in place or forthcoming that are relevant to the SWP (thus the proposed project) and Delta fisheries for the 2003-2020 timeframe:

1. The Anadromous Fisheries Biological Opinion of 2004 (replaces the biological opinion of 1995) provides FESA incidental take coverage for Sacramento River winter-run Chinook

salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead trout. This also includes operation restrictions of SWP facilities in the Delta. The federal and State agencies have reinitiated consultation on the salmonids opinion and a new biological opinion is scheduled to be adopted at the end of 2008. The new consultation will cover newly listed species, such as green sturgeon.

2. The Delta Pumping Plant Fish Protection Agreement ("Four Pumps Agreement", 1986) is an agreement with CDFG where the Department pays for direct losses of steelhead, Chinook salmon, and striped bass based on measured losses at Banks Pumping Plant. These payments will continue to be used to provide for fisheries mitigation and habitat enhancements. Examples of these projects include installation of fish screens, and replacement of spawning gravel.

3. The Delta Smelt Biological Opinion of 2005 (superseding the 1995 biological opinion) provides the Department with FESA incidental take coverage for delta smelt for the SWP and CVP. This includes restrictions on operation of SWP and CVP facilities, including export restrictions during the spring. This also establishes a delta Smelt Working Group that will determine an adaptive management approach to delta smelt protection among resource agencies. The USFWS concluded that any adverse impacts form the OCAP for the SWP and the CVP will be minimized or avoided by conservation and management measures incorporated ionto the project plan. The OCAP addresses operational impacts on delta smelt by committing the two projects to take early protective actions for the species. The OCAP incorporates the EWA into the delta smelt protective actions. In 2007, the United States District Court in Fresno found the Biological Opinion to be invalid but it did not vacate the opinion. The court is imposing a court-ordered remedy pending completion of reconsultation and a new Biological Opinion. The new biological opinion is scheduled to be adopted at the end of 2008. The new opinion will cover any newly listed or proposed-to-be-listed species, such as the longfin smelt.

4. The Delta Smelt Action Plan of 2005, jointly prepared by the Department and CDFG, describes current and future work needed to guide efforts to protect and restore delta smelt.

5. The Department, in conjunction with CDFG, will continue to develop the Bay-Delta Conservation Plan (BDCP) to provide the most comprehensive protection for the Delta ecosystem. The BDCP will address multiple Delta issues to conserve natural communities at the ecosystem level and provide for species recovery. The formal planning agreement was signed in 2006 consistent with provisions of the California Natural Community Conservation Planning Act and the FESA Section 10 for a HCP.

6. The Pelagic Fish Action Plan of 2007 was jointly prepared by the Department and CDFG under the direction of the Resources Agency. This plan incorporates the latest scientific information regarding protective actions for pelagic fish related to SWP operations.

7. The Adaptive Management Process results in the Department working with CDFG, USFWS, and NMFS to coordinate SWP operations with fishery needs. This process deals with real-time fish monitoring data and SWP operations. Often, the fish protection provided by this process goes beyond regulatory requirements. The following forums allow the SWP and CVP operations to be modified to prevent impacts to species of special concern:

    a. Data Assessment Team,

    b. Salmon Decision Process,

    c. Delta Smelt Working Group, and the

   d. Water Operations Management Team.

8. The IEP is closely associated with the Adaptive Management Process. Several State, including the Department, and federal agencies have been involved in the IEP since 1970. The IEP guides many of the actions taken by the Adaptive Management Process. The various agencies invest in the IEP to provide real-time monitoring data.

9. The Delta Risk Management Study (DRMS) was put into place to help the State determine how to make the Delta sustainable in the future. The 2000 CALFED Record of Decision presented its Preferred Program Alternative that described actions, studies, and conditional decisions to help fix the Delta. Included in the Preferred Program Alternative for Stage 1 implementation was the completion of a DRMS that would look at sustainability of the Delta, and that would assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences, and develop recommendations to manage the risk. For more information, refer to the following website: http://www.drms.water.ca.gov/.

10. Delta Vision is intended to identify a strategy for managing the Delta as a sustainable ecosystem that would continue to support environmental and economic functions that are critical to the people of California. Although it builds on work done through the CALFED Bay-Delta program, Delta Vision will broaden the focus of past efforts within the Delta to recommend actions that will address the full array of natural resource, infrastructure, land use, and governance issues necessary to achieve a sustainable Delta. For more information, refer to the following website: http://deltavision.ca.gov/.

11. In 2004, NOAA Fisheries released a biological opinion on the CVP and SWP long-term operations as described in the OCAP Biological Assessment. This biological opinion covers endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Southern Oregon/Northern California Coast coho salmon, threatened Central Valley steelhead, threatened Central California Coast steelhead, and critical habitat for Sacramento River winter-run Chinook salmon and coho salmon. This biological opinion is based on information provided by the U.S. Bureau of Reclamation and the Department. Project operations alter the quantity, timing, and quality of water passing into the Delta, thereby affecting conditions under which juvenile and adult salmonids live. This biological opinion determines whether or not SWP and CVP project effects are likely to jeopardize the continued existence of the affected ESA-listed salmon and steelhead or result in the destruction or adverse modification or designated critical habitat.

Summary

As compared to baseline conditions, potential exists for the proposed project to have an adverse impact on Delta fish species by increasing salvage at the Skinner facility as a result of higher pumping at Banks during certain periods when San Luis Reservoir would otherwise be full. This impact is *potentially significant*.

<u>Mitigation Measures</u>

Implementation of the following mitigation measure in combination with environmental programs already in place or forthcoming that are relevant to the SWP would reduce this impact to **a *less-than-significant level***.

7.3-5 *The Department shall implement operational assets that could be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon that would limit any adverse impact resulting from the proposed project on special status Delta fish species as a result of higher pumping at Banks during periods when San Luis Reservoir, absent of the proposed project, would be full.*

The Department (as discussed in the foregoing section discussing the 1996-2003 timeframe) will continue to operate the SWP and its facilities in accordance with all statutory requirements. To ensure compliance to all environmental guidelines, the Department follows a set of mitigation and environmental programs (some already in place and some forthcoming). Any additional pumping due to the proposed project under 2020 conditions in the Delta will be addressed by requirements that govern the operation of the Delta facilities of the SWP. In the immediate short-term time frame, the operational remedies imposed by the United States District Court, Eastern District of California, in Fresno will govern SWP operations to provide protection for the listed fish that are subject of that litigation.

Conclusion of current consultation on the OCAP with USFWS and NOAA Fisheries is expected to provide new Biological Opinions for delta smelt, salmon, and green sturgeon that would replace the court's order regarding operation of the project. The new Biological Opinion would then continue to provide the mitigation required to address the impacts of this proposed project.

As part of the resources to provide that fish protection, both in the remedy phase and for the longer term under new Biological Opinions, the Department has already committed the operational assets that are currently a part of the EWA. These assets may be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon.

The operational assets that are being committed as mitigation with respect to this proposed project are defined as follows, with the current EWA-related definitions embodied in the text:

- EWA has a 50 percent share of SWP export pumping of water classified as (b)(2) and Ecosystem Restoration Program (ERP) water from upstream releases;
- EWA shares the use of SWP pumping capacity in excess of the SWP's needs to meet contractor requirements with the CVP on an equal basis, as needed (such use may be under Joint Point of Diversion provisions in the Project Agencies water right permits);
- EWA assets include any water acquired through export/inflow ratio flexibility; and
- EWA has exclusive use of 500 cfs increase in authorized Banks Pumping Plant capacity in July through September (from 6,680 to 7,180 cfs).

Operational assets have averaged 82,000 AF per year in actual EWA operations from 2001-2006.

In addition to the operational assets defined above, some public funding does remain to acquire water in 2008 (State) and possibly through 2010 (federal). Also, it is anticipated that the Department will complete a water purchase from Yuba County Water Agency for 2008-2015 as part of the Yuba Accord that would provide 60,000 AF per year for EWA or equivalent fish protection purposes. The remainder of the assets required to complete an adequate program for fish protection would be identified through the OCAP ESA reconsultation process, and would address SWP operations including the impacts of the proposed project.

7.3-6 Implementation of the proposed project could potentially affect special-status fish species in the Sacramento-San Joaquin Delta due to Delta outflow changes.

1996 — 2003

The Delta is home to dozens of fish species, both native and introduced. All of the special-status species of fish previously discussed (Section 7.3.2.1) either pass through the Delta during migration as adults and juveniles or are permanent residents like delta smelt.

Several provisions of the Monterey Amendment have the potential to affect Delta outflow. They include the provisions that altered water allocation procedures and facilitated retirement and transfer of Table A amounts, which can affect flow in the Feather and Sacramento rivers, Delta inflow, and Delta exports; and the water supply management practices, which can affect Delta exports. Because Delta outflow is dependent on both Delta inflow and Delta exports, it can be affected by all of these provisions. In general, Delta outflow is equal to Delta inflow minus Delta exports. Therefore, the net effect of the proposed project on Delta outflow would be the changes resulting from the proposed project on Delta inflow minus the changes from the proposed project on Delta exports.

<u>Effects of Proposed Project on Delta Inflow</u>

Changes in Delta inflow resulting from the proposed project would be equal to its changes in Sacramento River flows (see Impact 7.3-3). Changes in Sacramento River flows would result from changes in deliveries to contractors north of the Delta, due to the altered water allocation procedures and the Table A retirements and transfers. Table 7.3-17 shows the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2003 conditions, by year type and over all year types.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions and decreased Delta inflow. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. Under 2003 conditions, Sacramento River flows, and thus Delta inflow and Delta outflow, are estimated to decrease on average by about 1,630 AF, with the greatest impact occurring in wet years with a decrease of 2,940 AF. The largest (and only) Delta inflow and Delta outflow increase is 203 AF per year, occurring in dry years. As a percentage of baseline scenario Delta outflow, the largest reduction is 0.016 percent, occurring in critically dry years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows and Delta inflow in response to the slight delivery changes to SWP contractors north of the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

Effects of Proposed Project on Delta Exports

Delta exports to contractors south of the Delta are analyzed in two different ways (see Impact 7.3-5). The first analysis uses CALSIM II and post-processing of model results, which was used to evaluate the effects of the altered allocation procedures and the Table A retirements and transfers. The second is a historical operations analysis which analyzes nearly all provisions of the Monterey Amendment, including the Table A retirements and water supply management practices. This latter analysis is intended to provide an estimate of the actual effects of the proposed project on Delta exports from 1996 to 2004, and is based on actual operations and delivery data during that period.

Based on this historical operations analysis, the Department estimates that from 1996 to 2004, these Monterey Amendment provisions resulted in the SWP pumping a total of about 44,000 AF more at the Banks Pumping Plant than it would have under the baseline scenario. Thus, from 1996 to 2004, these Monterey Amendment provisions increased Delta exports and reduced Delta outflow by a total of about 44,000 AF. The increase in Delta exports and reduction in Delta outflow occurred during four events: January 13, 1998; February 24 through March 31 of 1999, February 22 through March 31 of 2000, and March 23 through March 30 of 2004.

Summary of Effects of Proposed Project on Delta Outflow

The Table A retirements and transfers and the altered allocation procedures that are part of the Monterey Amendment would have very little effect on annual or monthly Delta inflow, and thus Delta outflow, compared to the baseline scenario under 2003 conditions.

The Table A retirements and the water supply management practices that are a part of the proposed project resulted in an estimated reduction in Delta outflow of a total of 44,000 AF from 1996 to 2004. The estimated reduction represents about 0.03 percent of total Delta outflow during that period.

Most of the time, the SWP diverts water from the Delta at the Banks Pumping Plant at the maximum possible rate consistent with compliance with Delta water quality standards. From time-to-time, in the wetter months, water is available in the Delta in amounts in excess of that needed to meet Delta environmental standards and the needs of the SWP and its contractors. That is, all the SWP reservoirs south of Delta are full or at their storage targets and all contractors' SWP current water needs have been met. It is only at such times that the Monterey Amendment could result in pumping of water that would otherwise have contributed to Delta outflow under the baseline scenario. From 1996 to 2004, these conditions occurred in January 1998, February and March 1999, February and March 2000, and March 2004.

A statistical correlation exists between Delta outflow as measured by the average location of the X2 salinity position and the population of certain fish species such as longfin smelt. Review of the X2 position under baseline conditions reveals that as expected, X2 moves further into San Francisco Bay under periods of high outflow and moves upstream into the Delta during periods of low outflow. The changes in X2 location between the proposed project and baseline scenario under 2003 conditions are plus or minus 100 meters. These changes in X2 location are based on CALSIM II model results and so reflect the effects of only the altered allocation procedures and the Table A retirements and transfers. The increase in Delta exports estimated in the historical operations analysis would decrease Delta outflow by a like amount and would be expected to shift the position of X2 upstream by a small but undetermined amount in the wet winter months when the extra pumping occurred. These changes are immeasurable in the field, and thus is not considered a substantial alteration of habitat used by special-status species of fish.

The standards of significance established for this proposed project require that a potentially significant impact be identified for any proposed project-related action that will adversely affect, either directly or through habitat modifications, any species protected under the State or federal Endangered Species acts or considered a candidate, or special-status by the USFWS, CDFG, or NOAA Fisheries. The evaluations in this discussion rely on a potential change in available habitat resulting from a substantial alteration in Delta inflow or outflow or a substantial increase in SWP exports from the Delta. Changes in Delta outflow attributable to the proposed project under 2003 conditions are minor and none are likely to substantially alter available habitat. Also, the San Joaquin and American River flows will not be impacted. Therefore, the proposed project under 2003 conditions will have a ***less-than-significant impact*** on fisheries resources from changes in Delta outflow.

Mitigation Measures

None required.

Future Impacts

The proposed project under 2020 conditions has the potential to alter Delta outflow. The net effect of the proposed project on Delta outflow would be the changes resulting from the proposed project on Delta inflow minus the changes from the proposed project on Delta exports.

Effects of Proposed Project on Delta Inflow

Changes in Delta inflow resulting from the proposed project would be equal to its changes in Sacramento River flows (see Impact 7.3-3). Changes in Sacramento River flows would result from changes in deliveries to contractors north of the Delta, due to the altered water allocation procedures and the Table A retirements and transfers. Tables 7.3-16 and 7.3-17 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2020 conditions, by year type and over all year types.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions and decreased Delta inflow. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2020 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. Under 2020 conditions, annual Sacramento River flows, and thus Delta inflow and Delta outflow, would be estimated to decrease on average by 7,070 AF. Delta inflow and Delta outflow would be estimated to decrease by amounts ranging from 920 AF in critically dry years to 11,950 AF in wet years. As a percentage of baseline scenario Delta outflow, the largest reduction would be 0.0542 percent, occurring in below normal years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows and Delta inflow in response to the slight delivery changes to SWP contractors north of the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

Effects of Proposed Project on Delta Exports

Delta exports to contractors south of the Delta can be affected both by the altered allocation procedures and Table A retirements and transfers, and by the water supply management practices, which are all a part of the Monterey Amendment. The effects of these two sets of Monterey Amendment provisions are evaluated in two separate analyses, as described in more detail in Impact 7.3-5.

The effects of the altered allocation procedures and Table A retirements and transfers on Delta exports, based on CALSIM II and post-processing of model results, are shown in Table 7.3-16. Due to these provisions, under 2020 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 23,000 AF, with delivery changes by year type ranging from decreases of about 53,000 AF in wet years to increases of about 6,000 AF in critically dry years. Delivery changes can be made from south-of-Delta storage and may not change Delta exports and Delta outflow.

The effects of the water management provisions on Delta exports are analyzed in a historical analysis, based on historical operations and delivery data from 1996 to 2004. This water supply management practices analysis was used to determine whether these provisions would have resulted in increased pumping at the Banks Pumping Plant from 1996 to 2004 compared to the baseline scenario. Because the water supply management practices were actually used from 1996 to 2004, an analysis of the effects of these water supply management practices in that historical period offers insight into possible future effects. The water supply management practices analysis showed that these provisions would have resulted in an estimated increase in exports at Banks Pumping Plant of a total of 449,000 AF over the nine-year period from 1996 to 2004 (refer to note above in description of events regarding the inclusion of 2004), or an average of 50,000 AF per year. This increase in exports occurred during 9 events out of this nine-year period. These increases in exports were small relative to total exports at Banks Pumping Plant, and typically occurred in wet months when Delta outflow was high. Delta outflow would be reduced by the amount of the increase in Delta export during those events.

Summary of Effects of Proposed Project on Delta Outflow

The Table A retirements and transfers and the altered allocation procedures that are a part of the Monterey Amendment would result in an average annual increase in Delta outflow compared to the baseline scenario under 2020 conditions. This increase in Delta outflow is the net result of a reduction in average annual Delta inflow due to additional exports to contractors north of the Delta, and a reduction in average annual exports at the Banks Pumping Plant due to reduced exports to contractors south of the Delta. Under 2020 conditions, the net increase in average annual Delta outflow resulting from these provisions would be estimated to be about 15,900 AF (the net of a 7,070 AF decrease in Delta inflow and Delta outflow, and a 23,000 AF decrease in Delta exports and increase in Delta outflow). By year type, the net effect of these provisions would range from an increase in Delta outflow of about 41,000 AF in wet years, to a decrease of about 11,700 AF in below normal years.

Some of the water supply management practices that are a part of the proposed project would have reduced Delta outflow between 1996 and 2004. These water supply management practices are conservatively estimated to reduce Delta outflow by about 50,000 AF per year.

Because the two analyses used to evaluate the two sets of Monterey Amendment provisions are different (one based on a model analysis and the other on historical data from 1996 through 2004), analysis results by year type cannot readily be combined. However, in general, the increases in Delta outflow due to the Table A retirements and transfers and altered water allocation procedures are larger in wetter years, which are the same year types when decreased Delta outflow due to the water supply management practices would likely be larger.

Review of the X2 position under 2020 baseline conditions reveals that as expected, X2 moves further into San Francisco Bay under periods of high outflow and moves upstream into the Delta during periods of low outflow. The changes in X2 location between the proposed project and baseline scenario under 2020 conditions are plus or minus 100 meters. These changes in X2 location are based on CALSIM II model results and so reflect the effects of only the Table A retirements and transfers and the altered allocation procedures. The increase in Delta exports estimated in the historical operations analysis would decrease Delta outflow by a like amount and would be expected to shift the position of X2 upstream by a small but undetermined amount in the wet winter months when the extra pumping would likely occur. The reductions in outflow would occur in some wet months of wet years at the time when Delta outflow is at its seasonal maximum. These changes are immeasurable in the field, and thus is not considered a substantial alteration of habitat used by special-status species of fish.

This is not of sufficient magnitude to be considered a substantial change in fish habitat. Therefore, the proposed project under 2020 conditions would have a ***less-than-significant impact*** on fisheries resources from changes in Delta outflow.

<u>Mitigation Measures</u>

None required.

7.3-7 Implementation of the proposed project could potentially affect recreational fisheries in Lake Perris and Castaic Lake.

1996 — 2003

Article 54 of the Monterey Amendment provides that the three contractors that can obtain water from Lake Perris and Castaic Lake may borrow water from those reservoirs provided the borrowing contractor replaces the water within five years. This is referred to as the flexible storage provision. By agreement, MWDSC is the only contractor that can withdraw water from Lake Perris under Article 54. See discussion in 6.4.3.1 for a further description of the effect of this provision on SWP operations. This provision of the proposed project could result in changes in storage at Lake Perris and Castaic Lake that could adversely affect important recreational fisheries.

Castaic Lake water elevations have generally increased on average from 1996 to 2003 (Figure 7.3-1). There has been over 20 vertical feet more water stored in Castaic Lake on average in the months of May through December since 1996 than in the period 1975 through 1995 prior to implementation. Similarly, storage in Lake Perris has increased since 1996 (Figure 7.3-2). Summertime storage at Lake Perris has increased by about eight to nine vertical

Figure 7.3-1. Average Monthly Water Surface Elevation at Castaic Lake

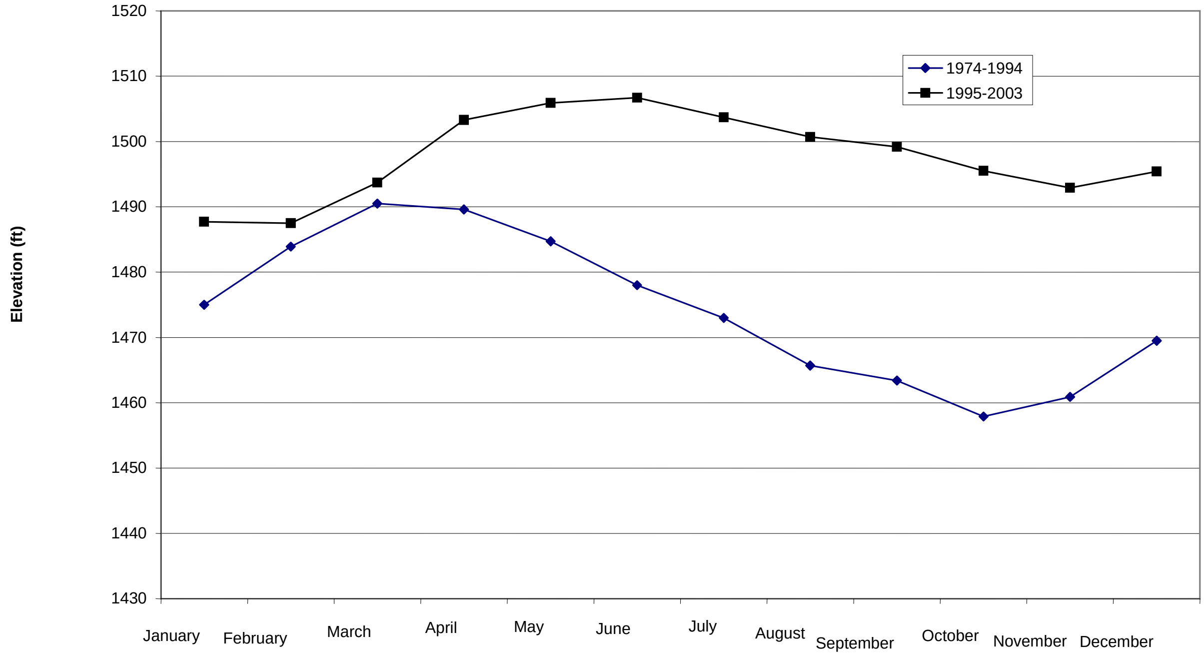
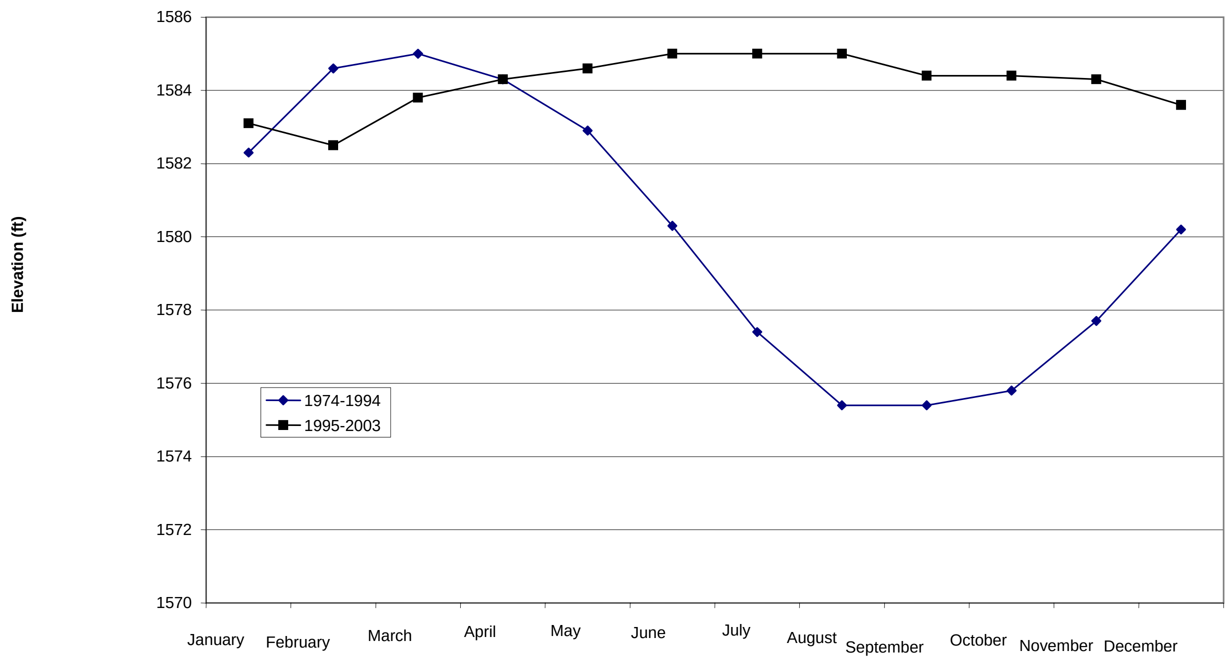


Figure 7.3-2. Average Monthly Water Surface Elevation at Lake Perris.



feet in the months of July through October. The reasons for this change were discussed in the Section 7.1. This increased level of storage has created a more stable reservoir elevation during the spring months. This is the period when most of the reservoir fish are reproducing and stable water levels are a benefit. Any changes in the amount of actual spawning habitat available would depend on shoreline configurations of the reservoir.

From 1996 to 2004, of the three eligible contractors, MWDSC and Castaic Lake WA took advantage of the flexible storage provision and borrowed water from Castaic Lake (Ventura County FCD did not utilize the provision) (Table 6-26 in Chapter 6). Castaic Lake WA withdrew water from Castaic Lake on three occasions but only small amounts were borrowed (395 to 2,589 AF). MWDSC withdrew water from Castaic Lake on three occasions. Withdrawals ranged from 14,300 to 77,804 AF. Two of these events were between December and February. This is outside the spawning season and not likely to effect the fisheries. One withdrawal event in March-April 2001 accounted for 50,000 AF. Review of the reservoir storage/elevation curve indicates that a reduction of 50,000 AF could have reduced the water surface elevation by about 30 feet. Because this event occurred during the spawning season, it could have exposed spawning beds of resident fish resulting in reduced reproductive success. What is unknown is the rate of withdrawal. In actions unrelated to the Monterey Amendment, the Department has typically followed recommended guidelines on drawdowns within Castaic Lake to prevent adverse impacts to fisheries resources and recreational uses and is as follows:

- March – seven foot water level over a seven day period (one foot per day);
- April and May – four foot water level drop over a four day period (one foot per day);
- June through September 15 – seven foot water level over a seven day period (one foot per day); and
- September 16 through February – two foot water level drop per day.

If these rates were followed, any eggs in existing nests should have had time to hatch. (It is important to note that the drawdown rates are not part of the required operation of Castaic, but are merely recommendations that are typically followed and may not be followed in the future.) These drawdown rates were likely based on the largemouth bass incubation and nest residency times which are seven and eight days respectively.[74] These times vary with temperature, decreasing as water warms. Other common, recreationally important species such as bluegill, black crappie, white crappie, and green sunfish have generally shorter incubation and nest occupancy periods than largemouth bass. Juvenile fish could have then moved into appropriate habitat based on water surface elevations. Assuming these rates were followed, and the fact there are no special-status species of fish within Castaic Lake, this withdrawal would have had a ***less-than-significant impact*** on the reservoir fisheries.

Relatively smaller amounts of water were borrowed by MWDSC from Lake Perris from 1996 to 2003. Only one of these occurred during the spring when 8,181 AF was borrowed from March 2000 to May 2000. This may have reduced the reservoir surface elevation by about ten feet over the course of three months. While this could dewater spawning habitat, the rate of reduction appears to be slow enough to allow eggs already in place to have hatched before being exposed. Therefore, this event is considered a ***less-than-significant impact*** to the reservoir fisheries.

Operational guidelines put into place in June 2003 establish maximum drawdown rates for Lake Perris of 0.5 foot per day between March 15 and May 1 with the total elevation change not to exceed three feet.[75] Compliance with these guidelines should limit impacts to reservoir fisheries resulting from borrowing of water. Payback of water is not subject to the same restrictions.

Mitigation Measures

None required.

Future Impacts

The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would drawdown the reservoirs to a greater extent than occurred from 1996 to 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half it maximum capacity of 131,500 AF. The reservoirs would remain drawndown for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1).

If the worst-condition were to occur, the initial reduction in reservoir elevation would reduce available open water habitat for recreationally important fish by almost half. Although detailed bathymetry is not available, it is expected that spawning habitats would also be substantially reduced. In addition, long-term drawdown could impact the density of fish populations; when reservoirs are drawndown fish would be more crowded. Available habitat would be reduced and the functional aquatic ecosystem would be degraded. Additionally, it is likely that more crowded and degraded habitat condition would reduce the populations of targeted sport fish (no endangered, rare, or threatened fish species are known to exist at Lake Perris or Castaic Lake), there is no evidence to indicate that populations would drop below self-sustaining levels or that effects would threaten to eliminate the recreational fishery, particularly for trout, which is restocked annually. According to the standards of significance, the borrowing of water from Lake Perris and Castaic Lake would have a ***less-than-significant impact*** on the aquatic ecosystem and fish populations of economic and social value.

Mitigation Measures

None required.

7.3-8 Implementation of the proposed project could potentially affect fisheries resources at Lake Oroville.

1996 — 2003 and Future Impacts

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. Releases from Lake Oroville would be unlikely to be modified due to small changes in deliveries that do not affect Delta water quality, minimum flow requirements, or other operational constraints of the SWP. The small changes are mostly below the measurement threshold of most river gauges and Lake Oroville release controls, and the Department would therefore have a difficult time modifying releases to exactly match the very small increment of the delivery changes.

If such changes did occur, they would be unlikely to exceed the annual differences in total deliveries to the five contractors located north of the Delta, as shown in Table 7.3-17. The maximum annual impact on Lake Oroville storage, should storage be affected, would be less than 12,000 AF in any year. Lake Oroville storage is seldom drawn below 1,000,000 AF, and at full capacity will hold 3,537,000 AF. Any impact would be less than 1 percent of storage, and would be insignificant.

Any decrease in Delta inflow due to increased deliveries to contractors north of the Delta could possibly trigger added Delta releases above the baseline under conditions where the E/I ratio governs, water quality standards require added releases, or south Delta water levels require added releases. In dry or critically dry year types, the change could trigger export reductions instead of increased releases. The releases could be triggered for a few days from the American River under some conditions, but are more likely to be triggered from Lake Oroville. The release quantity attributable to the proposed project could be up to the increased annual delivery amount shown in Table 7.3-17, but would likely be less since such triggering events would typically be of short duration.

Such added releases are expected to occur infrequently (less than annually). To the extent they do occur, they could affect reservoir storage. Because these added releases are linked to changes in delivery north of the Delta, impacts would not exceed 12,000 AF in any year.

As stated above, Lake Oroville would not undergo any significant changes in operation due to any aspect of the proposed project. The changes that would occur at Lake Oroville would not adversely affect any special-status species of fish, or significantly reduce populations of fish species having economic or social value, or adversely affect any habitat or other sensitive natural community. Therefore, the proposed project under 2003 and 2020 conditions will have a ***less-than-significant impact*** on Lake Oroville fisheries resources.

<u>Mitigation Measures</u>

None required.

7.3-9 Implementation of the proposed project could potentially affect fisheries resources at San Luis Reservoir.

1996 — 2003 and Future Impacts

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. San Luis Reservoir is the SWP's primary water storage facility south of the Delta and is greatly influenced by imported water from the Delta. Because of this, and its proximity to the Delta pumping facilities, any species that is found in the Delta can be found in San Luis Reservoir.[76]

The Department and the Reclamation equally share storage capacity in the reservoir. Due to water quality issues (see Section 7.1), the Department and Reclamation cooperate to try to maintain the reservoir low point above 300,000 AF.

The proposed project would not change the Department's operating objectives with respect to San Luis Reservoir but it could affect water storage and water surface elevations in the reservoir. The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in San Luis Reservoir. Figure 7.1-5 shows average monthly storage in San Luis Reservoir with the Table A transfers and retirements and the altered water allocation procedures with the proposed project and under the baseline scenario under 2003 conditions. Figure 7.1-9 shows the same data for the 2020 conditions (future). The differences between storage under the two scenarios are relatively small, but could increase average water surface elevations by ten to twenty feet. The results are similar for the future scenario.

As a result of the flexible storage provision of the Monterey Amendment, the Department established a limit on drawdown of Castaic Lake and Lake Perris. Under some circumstances, this could affect storage and water levels in San Luis Reservoir. The effects of the flexible storage provision on storage and water surface elevations in San Luis Reservoir would be small because the extra storage in Castaic Lake and Lake Perris would represent only a small percentage of storage in San Luis Reservoir.

From 1996 to 2003, the Department's analysis of historical data showed that several of the water supply management practices increased deliveries of SWP water. The practices delayed the Department's filling of its San Luis Reservoir space by a few months and the contractors' use of the water supply management practices lowered SWP storage in San Luis Reservoir by several tens of thousands of AF in some months. This is expected to continue into the future, although at a lesser extent because storage outside contractors' service area would occur less frequently (see Impact 7.1-1). However, this is not anticipated in adversely impact water temperature sufficiently to affect the reservoir's designation as a warm-water fishery.

Although the proposed project may have reduced storage in San Luis Reservoir at times from 1996 to 2003 (and is anticipated to do so in the future) relative to the baseline condition, total storage in the reservoir by the SWP and the CVP did not (and probably will not) fall below 300,000 AF.

As stated above, San Luis Reservoir for the 1996-2003 period and into the future has experienced and will likely continue to experience lowered water levels due to the proposed project. However, these changes will be minimal. Also, San Luis Reservoir will not undergo any significant changes in operation due to any aspect of the proposed project. The changes that would occur at San Luis Reservoir would not adversely affect any special-status species of fish (there are no populations of special-status fish species present in the reservoir), or significantly reduce populations of fish species having economic or social value, or adversely affect any habitat or other sensitive natural community. Therefore, the proposed project under 2003 and 2020 conditions will have a ***less-than-significant impact*** on San Luis Reservoir fisheries resources.

<u>Mitigation Measures</u>

None required.

ENDNOTES

1. Although legally defined as ending at the eastern end of Chipps Island, the Delta as it is used within this document refers to the limit of upstream tidal influence and downstream into the San Francisco Estuary, an area significantly larger than the legal description.

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7.4 TERRESTRIAL BIOLOGICAL RESOURCES

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7.4.1 INTRODUCTION

7.4.1.1 Content

This section describes those elements of the Monterey Amendment and the Settlement Agreement that have the potential to directly affect terrestrial biological resources (listed in Table 7.4-1).

One comment on the NOP, in a letter from the Department of Food and Agriculture by Steve Shaffer (Director of the Office of Agricultural and Environmental Stewardship), recommended that the cumulative loss of agricultural land as a result of the Monterey Amendment and the Settlement Agreement be analyzed for the potential impacts to wildlife. Migratory birds and some special-status species have adapted to using agricultural land (due to the loss of natural habitat), and if such land is taken out of production, it may no longer be suitable for use.

There are no designated critical habitat areas or local ordinances protecting terrestrial biological resources that will be affected by the proposed project; therefore, these issues will not be addressed in this section.

7.4.1.2 Analytical Method

The following documents were reviewed to describe the environmental setting as it existed in 1995:

- Biological information collected for the 1995 Draft and Final Program Environmental Impact Report (EIR) for the Implementation of the Monterey Agreement;
- The Final EIR for the Artificial Recharge, Storage and Overdraft Correction Program, Kern County, California (Kern Water Bank) (December 1986);
- The Kern Water Bank (KWB) First Stage Kern Fan Element Draft Supplemental EIR (December 1990); and
- The Semitropic Groundwater Banking Project EIR (March, 1994).

The following documents were reviewed to describe the environmental setting as it existed in 2003:

- A California Natural Diversity Database (CNDDB) query and U.S. Fish and Wildlife Service (USFWS) official species lists for the following 7.5 minute topographic quadrangle maps, including the Department facility and surrounding quads in an approximately 10-mile radius:
  - For Lake Perris – Riverside East, Sunnymead, El Casco, Steele Peak, Perris, Lakeview, Lake Elsinore, Romoland, and Winchester quads;
  - For Castaic Lake - Black Mountain, Liebre Mountain, Burnt Peak, Lake Hughes, Green Valley, Warm Springs Mountain, Whitaker Peak, Cobblestone Mountain, Piru, Val Verde, Newhall, and Mint Canyon quads;

TABLE 7.4-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON TERRESTRIAL BIOLOGICAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Terrestrial biological resources from potential changes in agricultural practice, new groundwater banks outside contractors' area, land use management of the Kern Fan Element property, fluctuations of water surface elevations in reservoirs, changes in river flows, and changes in Delta outflow	7.4-1, 7.4-2, 7.4-3, 7.4-4, 7.4-5, 7.4-6, 7.4-7, 7.4-8, 7.4-9
Permanent Table A transfers and retirements	Terrestrial biological resources from potential changes in agricultural practice, new groundwater banks outside contractors' area, land use management of the Kern Fan Element property, fluctuations of water surface elevations in reservoirs, changes in river flows, and changes in Delta outflow	7.4-1, 7.4-2, 7.4-3, 7.4-4, 7.4-5, 7.4-6, 7.4-7, 7.4-8, 7.4-9
Transfer of Kern Fan Element lands	Terrestrial biological resources with changes in land use and management of Kern Fan Element lands and construction of recharge ponds on the Kern Fan Element property	7.4-1, 7.4-3
Water supply management practices	Terrestrial biological resources from potential changes in agricultural practice, new groundwater banks outside contractors' area, land use management of the Kern Fan Element property, fluctuations of water surface elevations in reservoirs, changes in river flows, and changes in Delta outflow	7.4-1, 7.4-2, 7.4-3, 7.4-4, 7.4-5, 7.4-6, 7.4-7, 7.4-8, 7.4-9
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Terrestrial biological resources with changes in land use and management of Kern Fan Element lands and construction of recharge ponds on the Kern Fan Element property	7.4-1, 7.4-3
Watershed forum in Plumas	Terrestrial biological resources with improvements to the Feather River watershed	7.4-10
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

- For San Luis Reservoir – Mustang Peak, Crevison Peak, Howard Ranch, Ingomar, Pacheco Peak, Pacheco Pass, San Luis Dam, Volta, Three Sisters, Mariposa Peak, Los Banos Valley, and Ortigalita Peak NW quads; and
- For the Kern Fan Element – Lokern, Buttonwillow, Rio Bravo, Rosedale, Stevens, Tupman, East Elk Hills, West Elk Hills, Fellows, Taft, Mouth of Kern and Millux quads.

- A CNDDB query and USFWS official species lists of Plumas County; and the Sacramento/San Joaquin River Delta;

- A CNDDB query for a 200-foot wide corridor along the Feather River, from Lake Oroville to where it joins the Sacramento River; and the Sacramento River from where it joins the Feather River to the Delta;
- The KWB Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP), prepared by the Kern Water Bank Authority (KWBA) (October, 1997);
- The KWBA HCP/NCCP 2004 Annual Compliance Report and 2005-2006 Management Plan (May 2005);
- The Draft Western Riverside Multiple Species Habitat Conservation Plan (MSHCP), prepared for the County of Riverside Transportation and Land Management Agency (November 2002); and
- Personal communications with facility agents, including Cheryl Harding from the KWBA and Geary Hund from the California Department of Parks and Recreation (Lake Perris).

Certain facilities have been targeted for analysis in this document based on the changes implemented by the Monterey Amendment and Settlement Agreement. Due to the different locations throughout the state that implementation of the Amendment and Agreement would affect, the environmental setting for each facility or region affected is discussed separately below. A more detailed description of each area, including habitat communities and special-status species can be found in Appendix J. For the purposes of this report, special-status terrestrial biological resources are defined as those species listed as either threatened or endangered under either the California or federal ESAs, species identified by either the CDFG or the USFWS as “species of concern” and plant species identified by the California Native Plant Society (CNPS) in their Lists 1A, 1B, or 2. Further explanation of these categories is included under the Regulatory Setting Section. In addition, habitats considered to be rare by the CDFG are also considered special-status.

Changes that have occurred at the facilities as a result of other projects, have also been analyzed to determine if the proposed project could have a similar impact. This is particularly true for Lake Perris, where the water levels have been reduced to retrofit the dam.

7.4.1.3 Standards of Significance

For the purpose of this EIR, impacts to terrestrial biological resources are considered significant if the proposed project would:

- Have a substantial adverse effect, either directly or through habitat modification, on any species identified as endangered, rare, or threatened, as listed in Title 14 of the California Code of Regulations (Section 670.2 or 670.5) or Title 50 of the Code of Federal Regulations (Sections 17.11 or 17.12);
- Have a substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the USFWS or California Department of Fish and Game (CDFG);
- Reduce the number or restrict the range of an endangered, rare, or threatened species;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural communities identified in local or regional plans, policies, regulations, or by USFWS or CDFG;

- Have a substantial adverse effect on federally-protected wetlands as defined by Section 404 of the Clean Water Act (including marshes or vernal pools) through direct removal, filling, hydrological interruption, or other direct means;
- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the provisions of an adopted HCP, Natural Communities Conservation Plan, or other approved local, regional, or state HCP.

7.4.2 ENVIRONMENTAL SETTING

The California SWP stretches for more than 600 miles, from Lake Oroville in the north to Lake Perris in the south. Its main purpose is to store water and distribute it to urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley and Southern California. The project is also operated to meet water quality objectives in the Sacramento-San Joaquin River Delta, control Feather River floodwaters, provide recreational activities to the public, and enhance fish and wildlife habitat.

7.4.2.2 Physical Setting in 1995

Southern San Joaquin Valley portion of Kern, Tulare, and King Counties

The Monterey Amendment resulted in the transfer or retirement of Table A amounts that ultimately resulted in a reduction of irrigation water for the following water districts in the southern San Joaquin Valley: Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Wheeler Ridge-Maracopa WD, and the Dudley Ridge WD. The Belridge WSD, Berrenda Mesa WD, Lost Hills WD, and Wheeler Ridge-Maracopa WD are located within the KCWA boundaries along western Kern County. The Dudley Ridge WD is located in Kings County.

The vegetation communities in the southern San Joaquin Valley historically consisted of tule marsh, San Joaquin saltbush, and California prairie.[1] Beginning in the 1880s, marshes were drained and the valley floor was converted to agricultural uses. The majority of this land was in agricultural production by 1995. Major waterways in this region include the Kern River and a multitude of canals conveying agricultural water, including the California Aqueduct and the Cross Valley Canal. Approximately 15 special-status plants and 17 special-status animals have recorded occurrences within this region as of 1995 (see Table 7.4-2).

Kern Fan Element

The approximately 19,900 acre Kern Fan Element property is located in Kern County, about 20 miles west of Bakersfield and 10 miles south of Buttonwillow. Interstate 5 and the Kern River both bisect the area. The Kern Fan Element property had historically been subject to periodic flooding from the Kern River, and is able to absorb water at an extremely high rate, retaining it in underground aquifers. The land was used for cattle grazing in the 1880s, and then crop production in the 1930s. It was also explored for gas and oil resulting in numerous wells and pipelines. The Department purchased the land in 1988 with the intention of creating a groundwater bank. In 1995, four special-status plants and eleven special-status animals were known to occur on the Kern Fan Element property (see Table 7.4-2).

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
	1995	2003									
Plants											
Hoover's wolly- star (eriastrum) *Eriastrum hooveri*	T/-/4	D/-/4	Alkali sinks, washes. Usually on silty to sandy soils.		X						
Recurved larkspur *Delphinium recurvatum*	C2/-/1B	SC/-/1B	On alkaline soils		X						
San Joaquin woollythreads *Monolopia (Lembertia) congdonii*	E/-/1B	E/-/1B	Alkaline or loamy plains, sandy soils		X						
Slough thistle *Cirsium crassicaule*	C2/-/1B	SC/-/1B	Sloughs, riverbanks, and marshy areas		X						
Amphibians											
Western spadefoot *Scaphiopus hammondii*	C2/CSC	SC/CSC	Primarily grassland habitats, requires vernal pools for breeding and egg-laying.	X	X						
Reptiles											
Blunt-nosed leopard lizard *Gambelia sila*	E/E, FP	E/E, FP	Sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	X	X						
Western pond turtle *Actinenys marmorata (includes both subspecies)*	C2/CSC	SC/CSC	Permanent or nearly permanent bodies of water; requires basking sites, and suitable nesting sites	X	X			X	X	X	

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
	1995	2003									
Birds											
Bald eagle *Haliaeetus leucocephalus*	E/E	PD,T/E, FP	Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. General habitats include ocean shore, lake margins, and rivers for both nesting and wintering.			X	X	X			
Burrowing owl *Athene cunicularia*	C2/CSC	SC,BCC/CSC	Subterranean nester, dependant upon burrowing mammals, Burrow sites typically in open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation.	X	X						
California thrasher Toxostoma redivivum	-/-	SC/-	Lowland and coastal chaparral, riparian thickets				X	X	X		
Cooper's hawk *Accipiter cooperii*	-/CSC	-/CSC	Nests in riparian growths of deciduous trees, as in canyon bottoms of river floodplains, within open, interrupted or marginal woodland.		X		X				
Double-crested cormorant Phalacrocorax auritus	-/CSC	-/CSC	Fresh, brackish, and salt water, along coastal regions and inland lakes		X		X				
Lawrence's goldfinch *Carduelis lawrencei*	-/-	SC, BCC/-	Oak and riparian woodland, chaparral, pinion/juniper woodland, and weedy areas near water.		X		X		X		

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1995	Status[1] Federal/State/CNPS 2003	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
Least bell's vireo *Vireo bellii pusillus*	E/E	E,BCC/E	Summer resident of southern California, in low riparian habitat in the vicinity of water or in dry river bottoms; nests placed along margins of bushes or on twigs projecting into pathways, usually on willow, baccharis, or mesquite.				X				
Loggerhead Shrike *Lanius ludovicianus*	C2/CSC	SC,BCC/CSC	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.		X		X				
Northern Harrier *Circus cyaneus*	-/CSC	-/CSC	Breeds in shrubby vegetation within marshes, or grasslands.				X				
Osprey *Pandion haliaetus*	-/CSC	-/CSC	Large bodies of water supporting fish. Nest in exposed locations, often in the tops of trees or in snags in beaver swamps.				X	X			
Southwestern willow flycatcher *Empidonax traillii extimus*	E/E	E/E	Riparian woodlands in southern California.			X	X				

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
	1995	2003									
Swainson's hawk *Buteo swainsoni*	-/T	SC,BCC/T	Breeds in stands with few trees in Juniper-sage flats, riparian areas and oak savannahs. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X							
White-tailed (black shouldered) kite *Elanus leucurus*	-/*	SC,MNBMC/FP	Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. General nesting habitat is rolling foothill/valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland.				X	X			
Yellow warbler *Dendroica petechia brewsteri*	-/CSC	-/CSC	Nests in riparian habitat, often in willows, cottonwoods, aspens, sycamores and alders. Also nests in montane shrubbery in open conifer forests.				X				
Mammals											
American badger Taxidea taxus	-/CSC	-/SA (CSC in 2006)	Need friable soils and open, uncultivated ground in drier open stages of most shrub, forest, and herbaceous habitats.	X	X						

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
	1995	2003									
Buena Vista Lake shrew *Sorex ornatus relictus*	C1/CSC	E/CSC	Marshlands and riparian areas in the Tulare Basin. Prefers moist soil. Uses stumps, logs and litter for cover.	X	X						
Greater western mastiff bat *Eumops perotis californicus*	C2/CSC	SC/CSC	Roosts in crevices in cliff faces, high buildings, trees and tunnels; uses many open, semi-arid to arid habitats including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc.			X	X	X			
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	C2/T	SC/T	Western San Joaquin Valley on dry, sparsely vegetated loam soils. Need widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes		X						
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	E/T	Needs loose-textured sandy soils for burrowing, and suitable prey base, in annual grasslands or grassy open stages with scattered shrubby vegetation.	X	X			X			
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	E/E	Needs soft friable soils which escape seasonal flooding within saltbrush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley	X	X						

TABLE 7.4-2

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED BY THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Sacramento River and Delta	San Francisco Bay	Plumas County
	1995	2003									
Yuma myotis *Myotis yumanensis*	C2/-/-	SC/-	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution in closely tied to the bodies of water. Maternity colonies in caves, mines, buildings or crevices.		X		X	X	X		X

Notes 1. Status explanation

Federal

E Listed as endangered under the Federal Endangered Species Act.

T Listed as threatened under the Federal Endangered Species Act.

C1 Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.

C2 Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.

SC Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing. In 2006, the USFWS stopped maintaining a Federal Species of Concern list.

PD Proposed for Delisting.

D Delisted – Delisted species are monitored for five years after being delisted.

BCC US Fish and Wildlife Service, Bird of Conservation Concern

MNBMC US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern

\- No listing

State

E Listed as endangered under the California Endangered Species Act.

T Listed as threatened under the California Endangered Species Act.

CSC California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.

FP Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.

* Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution, or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).

SA Taxa found on the July 2003 Special Animals List, which have no legal or protection status.

\- No listing.

Other – California Native Plant Society

1B Rare, threatened or endangered in California and elsewhere

4 Plants of limited distribution.

Sources:

USFWS List of Candidate Fauna from California and Nevada as of 31 August 1994 (59 FR 58982).

Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, August 20, 1994.

State and Federal Endangered Animals for California and Listing Dates, Department of Fish and Game, Revised January 1994.

California Department of Fish and Game Natural Diversity Data Base Special Animals, December 1992 (The 1994 version could not be located).

Prior to the Department's purchase of the Kern Fan Element property, approximately 17,068 acres of the property was under extensive cultivation.[2] The remaining property contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland, which had been leased for oil recovery facilities. No wetland habitat was present in the project area, except for the canals used to convey agricultural water.

After the Department acquired the property, it continued to be farmed by tenants for several years. The Department gradually took the Kern Fan Element lands out of production and by 1995, approximately 16,000 acres of the Kern Fan Element consisted of fallow farmland that had been previously irrigated; 288 acres of actively irrigated farmland; and approximately 2,690 acres of native and disturbed vegetation, including open areas, and land maintained under dry farming for weed management. The remaining 490 acres consisted of roads, canals, and oil and gas facilities.[3]

Castaic Lake

The physical characteristics of Castaic Lake are described in Chapter 2. Vegetation communities surrounding Castaic Lake include coastal scrub, red shank-chamise chaparral, and undifferentiated chaparral scrub. Due to the steep topography, fluctuating water levels and minimal shoreline, little aquatic vegetation is associated with the lake margin. Castaic Lagoon, surrounded by coastal scrub habitat, is located below Castaic Dam, and has gentler slopes and constant water levels, which allows for the establishment of vegetation. In addition, the lagoon has maintained public beaches and campgrounds vegetated with grasses and non-native shrubs and trees, such as pines (*Pinus* sp.) and eucalyptus (*Eucalyptus* sp.). No sensitive habitats are known to occur within the margin of Castaic Lake that could be affected by the proposed project.

Creation of Castaic Lake has resulted in a large body of water in an otherwise arid region, which now provides habitat for large numbers of waterfowl, such as western grebes (*Aechmophorus occidentalis*), Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), gulls (*Larus spp.*) and American coots (*Fulica americana*). The uplands surrounding the lake provides habitat for those species adapted to the arid conditions of southern California. Many special-status species located in the region, however, use riparian habitats or upland habitats and would not be affected by changes in the water level at Castaic Lake. No special-status plants are known to occur along the lake margin. However, both bald eagles (*Haliaeetus leucocephalus*), which could use the lake surface to forage and greater western mastiff bats (*Eumops perotis californicus*), which could use the lake surface for drinking water and foraging, have been recorded at Castaic Lake (see Table 7.4-2).

Lake Perris

The physical characteristics of Lake Perris are described in Chapter 2. Vegetation communities surrounding Lake Perris include a band of riparian vegetation approximately 2.2 miles long, containing willows (*Salix* sp.) and mulefat (*Baccharis salicifolia)* on the northeast and eastern border, and mixed sage scrub along the northern and southern borders. The immediate northern shoreline is maintained as part of the Lake Perris State Recreation Area, and contains grassy lawns and shade trees such as pepper (*Schinus* sp.), eucalyptus, cypress (*Cupressus* sp.), palm (*Washingtonia* sp.), and pine.

Terrestrial wildlife that could be affected by the proposed project at Lake Perris use the riparian habitat and the lake surface (foraging raptors or bats, and waterfowl). The riparian zone provides relief from the arid uplands, including shade, shelter, food and perch sites for a number of bird species, many of which migrate through the area, and nesting habitat for waterfowl. No special-status plants are known to occur along the margin of Lake Perris, but 13 special-status terrestrial animals could use the lake or the riparian habitat for a portion of their lifecycles (see Table 7.4-2).

San Luis Reservoir

The San Luis Reservoir, with a 12,529-acre surface area, is located in western Merced County, just east of the Merced/Santa Clara County line. Lying in the foothills of the Diablo Range, the reservoir stores primarily imported water, though a few ephemeral streams, including Cottonwood Creek and San Luis Creek, also flow into the reservoir. Vegetation surrounding the facilities includes non-native grassland, coastal scrub and riparian habitats, but the shoreline generally lacks vegetation. No special-status plant species and eight special-status terrestrial wildlife species potentially use the reservoir (see Table 7.4-2).

Lake Oroville

Lake Oroville, with a maximum surface area of 15,000 acres is located on the Feather River, in Butte County, approximately 75 miles north of Sacramento. The reservoir is fed by the North, Middle, and South Forks of the Feather River and was formed in 1964 by the construction of the Oroville Dam. Other facilities associated with the lake include the Thermalito Forebay, the Thermalito Afterbay, the Feather River Hatchery, and the Feather River Low Flow Channel. Vegetation at the lake is limited due to loss of soil from wave action and periodic inundation followed by severe desiccation.

Terrestrial wildlife that could be affected by the proposed project at Lake Oroville use the Thermalito Complex, which supports emergent wetlands and annual grassland habitat. Additionally, wildlife can use the lake surface (foraging raptors or bats and waterfowl). Five special status plants and six special status wildlife species have been recorded along the lake margin or potentially use the lake for foraging.

Feather River

The Feather River, from the Dam at Lake Oroville to where it flows into the Sacramento River, is approximately 68 miles long. The river generally flows south from Lake Oroville across the Sacramento Valley, east of the Sutter Buttes, past the City of Oroville and Yuba City-Marysville and joining the Sacramento River from the north approximately 20 miles north-northwest of Sacramento.

Honcut Creek, the Yuba River, and the Bear River join the Feather River below Oroville. The Feather River currently supports a fragmented and narrow riparian forest compared to historic riparian forests. The majority of the trees associated with the riparian forest of the Feather River are broad-leaved and deciduous including cottonwoods (*Populus fremontii*), valley oaks (*Quercus lobata*), California sycamore (*Platanus racemosa*) and willows (*Salix* spp.). No special status plants and one special status wildlife species, the bank swallow (*Riparia riparia*) occurs along the Feather River.

Sacramento River

The lower Sacramento River, from where it meets the Feather River to where it enters the Sacramento/San Joaquin Delta, is predominantly channelized, leveed, and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has reduced water clarity and habitat diversity, relative to the upper portion of the river. The American River joins the Sacramento River in the City of Sacramento. As with the Feather River, the Sacramento River supports a fragmented and narrow riparian forest. There are no recorded occurrences of terrestrial special status plants or special status wildlife species within this portion of the Sacramento River, but western pond turtle *(Actinemys marmorata)*, are known to occur in the area.

Sacramento/San Joaquin Delta

The Sacramento/San Joaquin Delta (Delta) is a 1,100-square mile region in the center of the Great Central Valley of California. Historically, the Delta was a large natural marsh created by the confluence of the Sacramento, San Joaquin, Cosumnes, and Mokelumne rivers that extended along both sides of the Sacramento and San Joaquin Valleys reaching the lower foothills of the inner Coast Range to the west and the foothills of the Sierra Nevada on the east. The Delta now includes numerous islands reclaimed from original marshland for agricultural production. It is a level plain, except for the levees that have been constructed to prevent flooding of agricultural lands. Elevations range from below sea level to a few feet above sea level on levees. The river channels are meandering and have been modified by flood control and navigation. There are many overflow channels and brackish tidal water enters the area when river flow is low during the summer and fall.

7.4.2.3 Changes in Physical Setting between 1996 and 2003

Changes in the physical setting are described below.

Southern San Joaquin Valley portion of Kern County

Many changes have occurred in this region unrelated to this project as agricultural land has been converted to urban uses associated with the City of Bakersfield.

The Monterey Amendment encourages water banking. In Kern County, a total of 7,634 acres have been converted to shallow recharge basins since 1995, some of which is used for out-of-service area storage programs. This has occurred at the KWB (see below) and Arvin-Edison WSD. In addition, the Kern Delta WD has plans to develop a recharge program. In the future these districts are expecting to construct approximately 1,700 acres of ponds. Additionally, approximately eight new special-status animals have recorded occurrences within this region since 1995 (see Table 7.4-2).

Lake Perris

No changes in terrestrial biological resources have occurred at Lake Perris between 1996 and 2003. The riparian community has remained stable and healthy, providing habitat for least Bell's vireo, a state and federal endangered species, and a variety of other wildlife species. Efforts to improve the habitat include tamarisk and *Arundo* removal. A thorough assessment of the habitat has not occurred, but additional wildlife surveys have been conducted in the area under the Long-term HCP for the Stephen's Kangaroo Rat in Western Riverside County, and the Western Riverside County MSHCP. As a result, least Bell's vireo, greater western mastiff bat and the Yuma myotis bat have been documented at Lake Perris.[4]

Plumas County

As a result of the Settlement Agreement, Plumas County will receive funds to for watershed improvement projects. Located in northeastern California, where the Sierra Nevada and Cascade mountain ranges meet, Plumas County has more than 100 lakes, 1,000 miles of rivers and streams with over a million acres of national forest, including portions of the Plumas National Forest and Lassen Volcanic National Park.

These parks and much of the rural county supports many terrestrial wildlife species including over 300 species of birds, and large mammals such as deer, black bear and mountain lions. Most of Plumas County drains into the Feather River. The Middle Fork of the Feather River has been designated as a "National Wild and Scenic River" from the confluence of its tributary streams to one kilometer south of Beckworth, California.

7.4.2.4 Regulatory Setting in 1995

Federal

<u>Federal Endangered Species Act</u>

The Federal Endangered Species Act (FESA) prohibits "take" of federally-listed threatened or endangered wildlife species, without either a Section 7 or 10 permit. "Take" as defined, includes actions that involve harming, pursuing, possessing, or harassing individuals of a protected species, as well as "such acts as may include significant habitat modification or degradation" (50 CFR §17.3). For listed plants, the FESA does not strictly prohibit take but does require compliance with state and local regulations. Species identified as candidates for listing in either Category 1 or 2[5] do not have the full protection of the FESA; however, USFWS advises project applicants that a Category 1 or 2 species could be elevated to listed status at any time.

Under the FESA, the Secretary of the Interior and the Secretary of Commerce, jointly have the authority to list a species as threatened or endangered (16 United States Code [USC] 1533[c]). Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether the project would have a potentially significant impact on any federally-listed threatened or endangered species, on any species proposed to be listed under FESA, or would result in the destruction or adverse modification of critical habitat (16 USC 1536[3], [4]). Therefore, project-related impacts to these species or their habitats would be considered significant and would require mitigation.

Projects that would result in "take" of any federally-listed threatened or endangered species are required to obtain authorization from the USFWS through either Section 7 (interagency consultation) or Section 10(a) (incidental take permit) of FESA, depending on whether the federal government is involved in permitting or funding the project. The Section 7 authorization process is used to determine if a project with a federal nexus would jeopardize the continued existence of a listed species and what mitigation measures would be required to avoid jeopardizing the species. The Section 10(a) process allows take of endangered species or their habitat in non-federal activities.

Federal Regulation of Activities in Wetlands

The regulations and policies of various federal agencies (e.g., the United States Army Corps of Engineers [Corps], United States Environmental Protection Agency [EPA], USFWS, and the National Marine Fisheries Service [NMFS]) mandate that the filling or excavating of wetlands be avoided unless it can be demonstrated that no practicable alternatives exist. The Corps has primary federal responsibility for administering permits to fill jurisdictional waters of the U.S. under the Rivers and Harbors Act (Sections 9 and 10), Section 404 of the Clean Water Act and a Memorandum of Understanding with the EPA. Most waters of the U.S. are defined by list (e.g., lakes, ponds, rivers) but also include navigable waterways, their tributaries (including intermittent streams), and wetlands. The EPA, USFWS, NMFS, and several other agencies provide comment on Corps permit applications. The EPA has provided the primary criteria for evaluating the biological impacts of Corps permit actions in wetlands.

Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (16 USC, Sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs.

State

California Endangered Species Act

Under the California Endangered Species Act (CESA), the CDFG has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code 2050 *et seq.*). Listed wildlife species may not be "taken" without adequate mitigation and compensation. Under 1995 conditions, "take" meant to hunt, pursue, catch, capture, or kill or attempt to do so; it did not prohibit indirect harm by way of habitat modification. Listed plants could not be taken unless advance notice and request to salvage were given to CDFG. Typically, CDFG implemented endangered species protection by entering into management agreements (Section 2081 management agreements) with project proponents.

CDFG also maintains a list of "species of special concern", which are species that the CDFG has considered to be indicators of regional habitat changes, or are considered to be potential future protected species. Species of special concern do not have any special legal status, but CDFG affords these species special consideration when evaluating proposed projects.

CEQA Guidelines Section 15380

Although threatened and endangered species are protected by specific federal and state statutes, CEQA section 15380 provides that a species not listed on the federal or state lists of protected species may be considered rare or endangered if the species can be shown to meet certain specified criteria. Guidelines issued by the Director of CDFG state that CNPS List 1B plants fulfill these criteria and therefore should be included in environmental impact reports and mitigation. CDFG guidelines do not carry the obligations of law or regulation, but CDFG views this policy as a means to avoid project delays in addressing species issues of which the applicant was not formerly notified. Thus, CEQA provides an agency with the ability to protect a species from a project's potential impacts until the respective government agencies have an opportunity to designate the species as protected, if warranted.

Fish and Game Code - Sections 3503, 3503.5, 3513

Fish and Game Code Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nests or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto. Fish and Game Code Section 3503.5 protects all birds-of-prey (raptors) and their eggs and nests. Section 3513 states that it is unlawful to take or possess any migratory non-game bird as designated in the Migratory Bird Treaty Act. These regulations could require that elements of the proposed Project (particularly vegetation removal or construction near nest trees) be reduced or eliminated during critical phases of the nesting cycle unless surveys by a qualified biologist demonstrate that nests, eggs, or nesting birds will not be disturbed, subject to approval by CDFG and/or USFWS.

CDFG Streambed Alteration Agreement

Sections 1600-1607 of the California Fish and Game Code prohibit alterations of any streams, including intermittent and seasonal channels and many artificial channels without a permit from CDFG. The limit of CDFG jurisdiction is (subject to the judgment the Department), up to the 100-year flood level.

California Native Plant Society (CNPS)

Vascular plants listed as rare or endangered by the CNPS (Skinner and Pavlik, 1995),[6] but which have no designated status or protection under federal or state-endangered species legislation, are defined as follows:

List 1A Plants Believed Extinct.

List 1B Plants Rare, Threatened, or Endangered in California and elsewhere.

List 2 Plants Rare, Threatened, or Endangered in California, but more numerous elsewhere.

List 3 Plants About Which More Information is Needed – A Review List.

List 4 Plants of Limited Distribution – A Watch List.

In general, plants appearing on CNPS List 1 are considered to meet CEQA section 15380 criteria.

7.4.2.5 Changes in Regulatory Setting between 1996 and 2003

Federal

FESA

No change to the FESA occurred between 1995 and 2003, though the definition of “take” has been further refined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct”, where “harm” includes significant habitat modification or degradation that actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering (50 CFR 17.3). Project-related impacts to listed threatened or endangered species, species proposed for listing or their habitats are still considered significant and would require mitigation. The USFWS no longer tracks candidate species, though in 2003, these remained on the CDFG Special Animals list as "federal species of concern" and are considered rare under CEQA section 15380. As of May 2006, the USFWS no longer maintains the "federal species of concern" lists although many of these species remain on the CDFG Special Animals list. Table 7.4-3 lists each species whose status has changed since 1995 and explains the change. Information on species known to occur in the region, but not impacted by the proposed project, can be found in Appendix J.

TABLE 7.4-3

SPECIAL-STATUS UPDATES FOR PLANT AND WILDLIFE SPECIES KNOWN TO OCCUR IN THE PROJECT AREA

Common Name	Scientific Name	1994 Status (Federal/State/CNPS)	2003 Status (Federal/State/CNPS)
Hoover's woolly-star (eriastrum)	*Eriastrum hooveri*	T/--/CNPS 4	D/--/CNPS 4
Recurved larkspur	*Delphinium recurvatum*	C2/--/CNPS 1B	SC/--/CNPS 1B
Slough thistle	*Cirsium crassicaule*	C2/--/CNPS 1B	SC/--/CNPS 1B
Western spadefoot	*Scaphiopus hammondii*	C2/CSC	SC/CSC
Western pond turtle	*Clemmys marmorata*	C2/CSC	SC/CSC
Bald eagle	*Haliaeetus leucocephalus*	E/E, FP	T, PD/E, FP
Burrowing owl	*Athene cunicularia*	C2/CSC	SC, BCC/CSC
California thrasher	*Toxostoma redivivum*	-/-	SC/-
Lawrence's goldfinch	*Carduelis lawrencei*	-/-	SC, BCC/-
Least Bell's vireo	*Vireo bellii pusillus*	E/E	E, BCC/E
Loggerhead shrike	*Lanius ludovicianus*	C2/CSC	SC, BCC/CSC
Swainson's hawk	*Buteo swainsoni*	-/T	SC, BCC/T
White-tailed (black-shouldered) kite	*Elanus leucurus*	-/*	SC, MNBMC/FP
American badger	*Taxidea taxus*	-/CSC	-/SA
Buena Vista Lake shrew	*Sorex ornatus relictus*	C1/CSC	E/CSC
Greater western mastiff bat	*Eumops perotis californicus*	C2/CSC	SC/CSC
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*	C2/T	SC/T
Yuma myotis	*Myotis yumanensis*	C2/-	SC/-

Federal:

E	Listed as endangered under the Federal Endangered Species Act.
T	Listed as threatened under the Federal Endangered Species Act.
C1	Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.
C2	Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.
SC	Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing.
D	Delisted – Delisted species are monitored for five years after being delisted.
BCC	US Fish and Wildlife Service, Bird of Conservation Concern.
MNBMC	US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern.
-	No listing.

State:

E	Listed as endangered under the California Endangered Species Act.
T	Listed as threatened under the California Endangered Species Act.
CSC	California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
FP	Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.
*	Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution, or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).
SA	Taxa found on the July 2003 Special Animals List, which have no legal or protection status.
-	No listing.

Other:

CNPS 1B – Plants that are rare, threatened or endangered in the state of California.
CNPS 4 – Plants of Limited Distribution – A Watch List.

Federal Regulation of Activities in Wetlands

No changes to regulation of activities in wetlands have occurred between 1995 and 2003 in a way which would change the regulatory requirements of the proposed project.

Migratory Bird Treaty Act

No changes to the Migratory Bird Treaty Act have occurred between 1995 and 2003 in a way that would change the regulatory requirements of the proposed project.

State

California Endangered Species Act (CESA)

No change to the CESA has occurred between 1995 and 2003 in a way that would change the regulatory requirements of the proposed project. CDFG continues to maintain a list of candidate, threatened and endangered species, as well as species of concern. Project-related impacts on state endangered or threatened species and species of concern are considered significant under CEQA Guidelines Section 15380, and would require mitigation.

Changes to the state Fish and Game code occurred that limited the duration of the consultation process required under Section 2090-2096. Regardless of this change, CDFG still consults with applicants whose projects could impact state-listed species.

CEQA Guidelines Section 15380

No change to CEQA Guidelines Section 15380 has occurred between 1995 and 2003.

CDFG Streambed Alteration Agreement

Since 1995, the California Fish and Game Code that addresses the CDFG Streambed Alteration Agreements has been changed to include modifications to lakes. As a result of a 1999 Mendocino County court ruling, CDFG is required to meet CEQA requirements prior to issuing a lake or streambed alteration agreement. In addition, the Code was replaced in January 2004 with the new Sections 1600-1616, which lays out the timelines differently, extends the duration of agreements to five years with an option for longer terms, and raises the maximum fee that can be collected from $2,400 to $5,000.

Fish and Game Code-Section 3503, 3503.5, 3513

No change to Fish and Game Code Sections 3503, 3503.5, 3513 has occurred between 1995 and 2003.

Other Statutes, Codes, and Policies Affording Limited Species Protection

The sixth edition of CNPS's Inventory of Rare and Endangered Plants of California was published in August 2001. This edition included non-vascular plants (including mosses and liverworts) and more than 300 newly-described plants. While a plant's status may have changed between 1995 and 2003 due to new information, CNPS List 1 or 2 are now considered to meet CEQA section 15380 criteria and effects on these species are considered significant in this EIR. Table 7.4-3 lists each species whose status has changed since 1995 and explains the change. Information on species known to occur in the region, but not impacted by the proposed project can be found in Appendix J.

Kern Water Bank (KWB) Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/NCCP)

The USFWS and CDFG approved the HCP/NCCP in October 1997. The federal and state HCP and NCCP programs seek to make the permit application process more efficient, while still complying with current federal, state and county laws that protect threatened or endangered species. The goal is to conserve plant and wildlife species by preserving their natural communities. The HCP/NCCP serves as an HCP pursuant to Section 10(a)(1)(B) of the 1973 FESA, as well as a Natural Communities Conservation Plan (NCCP) under the California NCCP Act of 2001. It allows the incidental "take" of selected species in areas outside of preserve boundaries, while guaranteeing that natural communities capable of sustaining the covered species' population needs are preserved in perpetuity.

The KWB HCP/NCCP documents a plan to accomplish both water conservation and environmental objectives by:

1. Allowing the economic development of water recharge and recovery facilities;
2. Preserving compatible upland habitat and other sensitive areas of natural habitat and rare plants;
3. Conserving species listed as threatened or endangered, pursuant to federal and state environmental laws (listed species as well as other sensitive species);
4. Re-creating intermittent wetland/rangeland habitat;
5. Providing a conservation bank for third parties; and
6. Permitting farming.

The KWB HCP/NCCP planning area comprises the entire 19,900-acre Kern Fan Element property. A breakdown of permitted land uses is shown in Table 7.4-4. The KWB HCP/NCCP allows for the incidental take of up to 161 rare, threatened or endangered species with documented occurrences or potential habitat in the project area that may be affected by the proposed project, or species that do not currently occur and for which habitat does not currently exist in the project area, but for which habitat may be created in the future.

Western Riverside Multi-Species Habitat Conservation Plan (MSHCP)

The County of Riverside Transportation and Land Management Agency has prepared the Western Riverside MSHCP which serves as an HCP pursuant to Section 10(a)(1)(B) of the 1973 FESA, as well as a NCCP under the California NCCP Act of 2001. This plan, similar in function to the KWB HCP/NCCP, covers an area of 1.26 million acres in western Riverside County, including Lake Perris.

Existing and future state and federal lands will contribute approximately 338,000 acres (68 percent) of the total 500,000-acre MSHCP Conservation Area, with private sector development contributions of 72,000 acres (14 percent), public infrastructure project contributions of 25,000 acres (five percent), and local public land contributions of about 65,000 acres (13 percent). Approximately 97,000 acres of private lands will be conserved through local development processes, including mitigation for impacts to biological resources as a result of development projects in the Plan Area.

TABLE 7.4-4

KERN WATER BANK HCP/NCCP LAND USE DESIGNATIONS

Land Use	Area in Acres[1]
Recharge Basins	5,900[2]
Other Banking Facilities	481
Compatible Habitat	5,592[2]
Sensitive Habitat	960
DWR Mitigation Land	530
Farming	3,170
Conservation Bank[3]	3,267
Total	19,900

Notes:
1. Administrative modification will allow for a shift of up to 559 acres of Compatible Habitat and 95 acres of Sensitive Habitat acres to Recharge Basins or Other Water Banking Facilities as described in section V.D. of the HCP.
2. KWBA Mitigation Land – 146 acres of Recharge Basins and 489 acres of Compatible Habitat totaling 635 acres will be covered by a conservation easement.
3. Includes potential commercial development zone of up to 490 acres.

Source: Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan, 1997.

Long-term Habitat Conservation Plan for the Stephens' Kangaroo Rat

In 1995, the Riverside County Habitat Conservation Agency (RCHCA) requested a Section 10(a) permit from the USFWS, and a Section 2081 permit from the CDFG to allow the take of Stephen's kangaroo rat for otherwise lawful activities for a 30-year period. Further, the RCHCA proposed to implement a long-term HCP for the Stephen's kangaroo rat, which would ultimately result in the preservation of approximately 15,000 acres of Stephen's kangaroo rat habitat. Any private or public projects would be allowed to participate in the plan by paying mitigation fees, which would allow for the acquisition and management of habitat for the long-term management of the species. The permit was issued in May 1996. Lake Perris is located in the Core Reserve Area, but the reservoir and ancillary facilities operated by the Department are excluded from the reserve.

7.4.3 IMPACTS AND MITIGATION MEASURES

7.4-1 Implementation of the proposed project could potentially affect special-status terrestrial biological resources in the southern San Joaquin Valley portion of Kern and King's Counties as a result of potential changes in agricultural practices.

1996 — 2003

The southern San Joaquin Valley portion of Kern and King's County was once comprised of tule marsh, San Joaquin saltbush and California prairie habitats.[7] These supported a variety of endemic species adapted to xeric conditions, including the now federally-listed San Joaquin kit fox (*Vulpes macrotis mutica),* blunt nosed leopard lizard (*Gambelia sila*), and Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*). Agricultural conversion of the region in the late 1800s drained the marshes and irrigated the dry uplands, displacing native plants and animals and stressing remaining populations through a general increase in human activity and disturbance.

Though the value of agricultural land is generally lower than that of natural habitat to wildlife, some species have adapted and have extended their range into converted agricultural habitats. Rodents such as voles and ground squirrels, for example, can take advantage of increased food availability and water supply in agricultural lands to increase their populations, which in turn can provide a larger prey base for predators such as raptors. Grain and row crops (and the insects that feed on them) can support bird and mammal populations that would otherwise be constrained by the absence of such food resources in more xeric habitats. Conversely, increased levels of human activity, the plowing and tilling of soils, and the application of fertilizers, pesticides and herbicides to stimulate agricultural production can adversely affect native wildlife resulting in displacement or avoidance.

As discussed in Section 7.6, Agricultural Resources, there is no strong evidence to support a conclusion that land was taken out of irrigated production as a result of the proposed project. Although the proposed project resulted in a reduction of agricultural contractor's share of SWP Table A amount on an annual average basis, it increased the reliability of their supplies. As a result, the risk associated with planting permanent crops was reduced. The proposed project could have, therefore, accelerated an existing trend toward more permanent crops. However, no clear trend can be attributed to the proposed project that can be discerned for the period between 1996 and 2003.

The increased reliability in water supply could have affected the amount and types of agricultural production, which in turn affected the availability and utilization of agricultural habitat by wildlife. As a result (and due in part to economic benefits) farmers have, in some cases, replaced annual crops with permanent orchard crops such as grapes and almonds because they can depend on receiving water allocations annually, instead of being subject to drought conditions. Orchard crops provide even lower quality habitat than row crops due to increased cover, pesticide/herbicide applications and frequent disturbance.

While some animals have adapted to exploit cultivated fields (in some cases, becoming pests), few special-status species benefit from agricultural cultivation. San Joaquin kit fox are able to use the habitat for migration, but no longer can den. Swainson's hawks (*Buteo swainsoni*), however, commonly rely on the increased insect and rodent populations in agricultural fields within ten miles of their nests, actually preferring to forage in alfalfa, beet, tomato, rice (during the non-flooded period), cereal grain (including corn after harvest), and other low-growing, row or field crops; fallow fields; and dry- and irrigated pasture. Though only one Swainson's hawk nest has been recorded in the western portion of Kern County, it is highly unlikely that this nest would remain active if all of the surrounding farmland were converted from annual row-crops to orchards.

To the extent that some land was converted to orchard crops as a result of the proposed project, this would not prohibit San Joaquin kit fox migration, but could adversely impact Swainson's hawk, as this habitat is not suitable for foraging. However, there is only one recorded occurrence of Swainson's hawk within the water district boundaries that total almost 75,000 acres. The Swainson's hawk recorded occurrence was documented within the Tulare Lake Basin WSD. As discussed in Section 7.6, Agricultural Resources, no change in the proportion of permanent crops occurred in this district. Therefore, the impact on special-status terrestrial biological resources from a change in agricultural practices would be ***less than significant***.

Mitigation Measures

None required.

Future Impacts

Approximately 14,000 acre-feet of the Table A amount would be transferred from KCWA to urban water contractors in the future. As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. The trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributed to the proposed project that can be discerned from the historical analysis period. Additionally, the Tulare Lake Basin WD (where a Swainson's hawk nest has been recorded) is subject to periodic flooding which makes it unsuitable for anything but annual crops. Therefore, impacts on habitat for terrestrial biological resources, including Swainson's hawk and other raptors, would be ***less than significant***.

Mitigation Measures

None required.

7.4-2 Implementation of the proposed project could potentially affect special-status terrestrial biological resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element property) resulting from construction of new groundwater storage facilities.

1996 — 2003

Between 1996 and 2003, several contractors began storing water outside their service areas in groundwater banks in the southern San Joaquin Valley. Two types of groundwater banking projects exist in Kern County, direct recharge projects and in lieu projects. Direct recharge projects involve the construction of percolation ponds, while in lieu projects do not. Two new groundwater storage projects were built in Kern County outside the Kern Fan Element property between 1996 and 2003. The Arvin-Edison WSD Project is a direct recharge project and included the construction of 520 acres of percolation ponds. The Semitropic WSD Project is an in lieu project. Because in lieu projects involve minimal surface disturbance they have minimal effects on terrestrial wildlife habitat, as documented in the Semitropic WSD Project EIR. Prior to implementation of these groundwater banking projects, water districts prepared project-level CEQA documents to assess any environmental consequences of these projects.

Generally speaking, the creation of recharge basins would be advantageous to terrestrial wildlife species. Ponded water would provide habitat for migratory waterfowl, in a similar fashion to the tule marsh habitat that was historically present in the San Joaquin valley portion of Kern County. The one- to two-foot levees that form the basins could serve as corridors for other migratory wildlife such as San Joaquin kit fox. Aside from these beneficial impacts, if the water banks were constructed in areas of native habitat, then they could impact special-status species such as the San Joaquin kit fox, Tipton kangaroo rat, and blunt nosed leopard lizard.

Arvin-Edison WSD evaluated the construction of groundwater recharge basins and necessary infrastructure in its Arvin-Edison Water Management Project Negative Declaration. This document reported that the basins were to be constructed in land that was previously under active agriculture, and special-status species surveys of those areas would not be required. However, the project required an intertie to the California Aqueduct, which was located in an area with ruderal vegetation, and both special-status plant and wildlife surveys were conducted in February and March 1996. No special-status species were observed during these surveys and the project was found to have no impact on all biological resources.[8]

Because impacts associated with both groundwater banking programs were evaluated in a separate, project-level environmental documents which determined that no significant impact would occur, the proposed project has resulted in a ***less-than-significant impact*** on terrestrial biological resources.

<u>Mitigation Measures</u>

None required.

Future Impacts

Between 1996 and 2003, several contractors began storing water outside their service areas in groundwater banks in the southern San Joaquin Valley. It is expected that in the future, contractors would increase their use of groundwater banks, resulting in construction of approximately 500 acres of additional recharge basins. While this would create open water and wetland habitat for waterfowl, the conversion of land for use as recharge basins could adversely impact terrestrial biological resources if the location serves as habitat for special-status species. Therefore, the impacts on special-status terrestrial biological resources would be *potentially significant*.

<u>Mitigation Measures</u>

Impacts to terrestrial biological resources in the southern San Joaquin Valley portion of Kern and King's counties would be reduced through the following mitigation measures; however because the Department has no jurisdiction over local agency decisions and cannot enforce implementation of these measures, and the impacts of individual activities are unknown at this time, this impact remains ***potentially significant and unavoidable****.*

7.4-2 a) *Special-status species surveys shall be conducted prior to the site selection for future recharge basins, to determine if any special-status plants or wildlife would be impacted. To the extent possible, the basins shall be sited such that any special-status species and their habitats are avoided.*

b) *If special status species cannot be avoided, then mitigation for impacts shall be required consistent with current requirements from the CDFG and USFWS. If the future projects are located within the Kern Water Bank Master Permit Credit Area, then mitigation credits may be purchased at the Kern Water Bank Conservation Bank.*

c) *The water districts shall prepare CEQA documents to assess any environmental impacts from the construction and use of future recharge basins.*

This mitigation would prevent any adverse impact to special-status terrestrial biological resources through avoidance of special-status species and their habitat. If avoidance is not possible, then consultation with the resource agencies will be required to determine appropriate mitigation. At this time, without knowing the future site locations, it is unrealistic to provide specific mitigation for the special-status species that may be affected.

7.4-3 Implementation of the proposed project could potentially affect special-status terrestrial biological resources on the Kern Fan Element property due to changes in land use and management.

1996 — 2003

The Monterey Amendment called for ownership of the Kern Fan Element property to be transferred from the Department to the KCWA, which occurred in 1996. In 1995, the KCWA received interim permits/authorizations from the USFWS and CDFG to initiate water banking to take advantage of a high availability of water due to a heavy snow pack in the Sierras. As a condition of the interim permit, KCWA was required to set aside permanent habitat mitigation land, which had moderate habitat value, or natural vegetation, until the long term HCP could be implemented in the Kern Fan Element.[9] The interim project was carried out in two stages. The first stage resulted in the rehabilitation of disused canals and inundation of approximately 1,500 acres of former agricultural land. Pre-construction surveys were conducted, and revealed poor habitat values throughout the Stage 1 area, and no suitable habitat for listed species.

The second stage resulted in the inundation of approximately 1,400 acres of grassland and fallow agricultural land, which had the potential to support listed species. Biological surveys were conducted in all areas proposed for disturbance by either construction or flooding and 58 potential San Joaquin kit fox dens were found to be unoccupied and destroyed, and the animals did not return prior to construction. Approximately 300 potential Tipton kangaroo rat burrows were located during surveys, but were not monitored for the presence of Tipton kangaroo rat. If any of these burrows were inhabited, then a take may have occurred if the animals were unable to escape. Approximately one-quarter to one-third of a known population of San Joaquin woolly threads were inadvertently covered with excavated soils during project construction. The location of this plant was not identified prior to construction, but upon discovering the damage, the area was flagged and avoided. Construction of the recharge basins resulted in the loss of potential San Joaquin kit fox and Tipton kangaroo rat habitat, the potential take of Tipton kangaroo rat, and the destruction of a portion of the San Joaquin woolly thread population. This was not fully mitigated for prior to project construction, but has been mitigated for through post-construction participation in the Kern Water Bank HCP/NCCP.

Since 1996, the KWBA has been responsible for land management of the Kern Fan Element property. Lands have been managed in accordance with a HCP/NCCP approved by USFWS and CDFG in 1997.[10] The KWB HCP/NCCP documents a plan to accomplish both water conservation and environmental objectives, mitigating project specific impact to less than significant at a regional level. The primary water conservation objective is the storage of water in aquifers during times of surplus for later recovery during times of shortage. The primary environmental objective is to set aside large areas of the Kern Fan Element property for endangered, threatened and other sensitive species and to implement a program to protect and enhance the habitat.

Under the KWB HCP/NCCP, the 19,900-acre Kern Fan Element property was divided up for different land uses (see Table 7.4-4).

- Recharge Basins and Other Banking Facilities – Permanent operation of the banking facilities included the flooding of basins, constructing facilities for recovery of the water from underground aquifers and maintenance of all project facilities.

- Compatible Habitat – This habitat is largely fallowed agricultural land that has become established as non-native annual grassland that has been preserved and managed around the banking facilities. It will provide upland habitat for San Joaquin kit foxes and other upland species.
- Sensitive Habitat – Three areas of sensitive habitat containing remnant native saltbush and valley sink scrub habitat have been identified. They are comprised of historic upland habitat and non-farmed locations on the Kern Fan Element property and will benefit native upland species. These areas will be protected throughout the life of the permit.
- Department Mitigation Land – A 530-acre conservation easement has been established on the Kern Fan Element property to mitigate other projects carried out by the Department prior to the transfer of this land to the KCWA. This easement will be managed by KWBA in accordance with the management plan established for the area.
- Farming – 3,170 acres of the project site may be farmed in a manner appropriate to soil conditions found on site. The land may also be used for water recharge and recovery purposes, including recharge basins, levees and related uses.
- Conservation Bank - 3,267 acres of potential and occupied habitat has been designated for a conservation bank. Under the HCP, KWBA may use, or sell up to 490 acres of this habitat for commercial development. Much of this land was pre-approved mitigation land by CDFG and is adjacent to other land preserved in the area. KWBA can use or sell up to 3,267 conservation credits to landowners, developers and others for mitigation for projects within the Master Permit Credit Area.

Between 1998 and 2003, the KWBA built an additional 4,080 acres of shallow recharge basins on the Kern Fan Element property. Some of acres were located within an area designated for farming.[11] Of the original 3,267 acres of available conservation credits, 744 acres have been sold as of December 31, 2005.

Several measures were implemented in accordance with the KWB HCP/NCCP, to reduce impacts on native or migratory wildlife using the Kern Fan Element property, including:

- Maintaining water levels constant, to the extent possible to prevent impacts on birds nesting in the recharge basins;
- Slowly refilling basins and canals that have been idle for more than two years, so that any covered animals will be able to escape before drowning;
- Constructing shallow canal side slopes to allow animals to escape from the interior and extending internal access roads across new canals, which would provide access for animals to cross the canal when wet;
- Surveying unused canals that will be used in the near future, prior to the burrowing owl nesting season. Any burrows found will be collapsed, in consultation with the Resource Agencies, to prevent nesting in those locations;
- Vegetation removal from roadways, turnouts, interbasin structures, road crossings and control structures will be accomplished by burning, motor grading (used minimally), mowing, herbicide or hand. Vegetation removed from canals and basins will be accomplished by hand control, lightweight equipment (weed-eaters), grazing, mowing and burning; and

- Complying with the "Interim Measures for Use of Rodenticides in Kern County," in order to prevent damage to facilities from rodents and to prevent the poisoning of listed species.

A Vegetation Management Plan was created to describe cost effective vegetation management and restoration practices for the long-term adaptive management and enhancement of the Kern Water Bank. Protection of existing and newly established sensitive habitats, vegetation management of compatible habitat using effective, low-cost adaptive methods and exotic pest plant control are primary goals under this management plan.

Under the KWB HCP/NCCP, the KWBA has authorization to incidentally take (including harm or harass) 161 covered species that are listed, or may be listed in the future under FESA. Of these species, fourteen special-status plants and animals have recorded occurrences on the Kern Fan Element property. Since the approval of the KWB HCP/NCCP, no take has been reported or is known to have occurred in the Kern Fan Element property.[12]

In addition to the KWB HCP/NCCP, an Initial Study and Addendum was prepared for the Kern Water Bank, which included mitigation measures to reduce impacts on terrestrial biological resources. These mitigation measures, in addition to measures from the KWB HCP/NCCP have reduced the impact of the proposed project to a ***less-than-significant level***, and are incorporated into this document to mitigate for future impacts of the proposed project, as discussed below.

<u>Mitigation Measures</u>

None required.

Future Impacts

As noted under above, the KWBA manages land within the Kern Fan Element property in accordance with a KWB HCP/NCCP, approved by the USFWS and CDFG in 1997. As of December 31, 2004, 4,699 acres of recharge basins[13] have been constructed with an additional 1,201 acres to be developed. In addition, the KWBA constructed 2,415 acres of recharge basins on lands designated for farming, and constructed 258 acres of other banking facilities, with approximately 289 more acres that could be developed.

Because the Kern Fan Element property is under a HCP/NCCP, the KWBA is required to follow specific guidelines to prevent take of special-status species and to enhance and preserve the natural habitat currently present. Under the conditions of the KWB HCP/NCCP, the KWBA is required to prepare annual reports summarizing activities within the Kern Fan Element property including updates on the water supply management and related activities; any amendments to the HCP/NCCP; a summary of any take occurrences; land and habitat management and mitigation measures; monitoring programs and studies; mitigation measures and cooperation with wildlife agencies; and the status of conservation credits. An independent study regarding the impacts related to the transfer, development and operation of the KWB in light of the Kern Environmental Permits, documented that the KWB is operating as intended and within the confines of the KWB HCP/NCCP.[14]

Under the Settlement Agreement, additional restrictions have been placed on allowable uses of the Kern Fan Element property. The KWBA will retain title to the Kern Fan Element property. The KWBA shall continue to use the property for operation of a water bank and other uses authorized by the HCP, so long as such use remains legally and economically feasible. If KWBA determines use of the property as a water bank becomes legally or economically infeasible, and the property cannot feasibly be used for SWP purposes provided in California Water Code §12930 et seq. or if DWR and KWBA are unable to agree on terms and conditions for such SWP use, then the KWBA may transfer or develop the property for another purpose provided that no unmitigable adverse environmental impacts result from the new use. Any net proceeds of land transfer or development will be used by the KWBA for water management purposes. Furthermore the 490 acres, designated as a "Commercial Development Zone" in the KWB HCP/NCCP, may not be developed and are now included in the conservation bank land use component. Provided that there is enough development within the Master Permit Credit Area, the proposed project would insure the complete build out of the conservation bank, thus protecting a total of 3,267 acres of potential or occupied habitat.

While no incidental take has occurred since the creation of the Kern Water Bank (with exception of San Joaquin woolly threads), it is possible that the proposed project could result in take during construction, operation and maintenance, through collapsed burrows, road kills, crushed by grading equipment, harassment, habitat loss, drowning, etc. This would result in a *potentially significant* impact on special-status terrestrial wildlife.

<u>Mitigation Measures</u>

The proposed project would result in impacts to terrestrial biological resources on the Kern Fan Element property that would be reduced to ***less than significant*** through the following mitigation measures currently implemented by the KWBA. These measures were outlined in the Initial Study and Addendum to Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP:

7.4-3 a) *Biological Monitor*

A qualified biologist shall monitor all ground disturbing activities during construction in the Sensitive Habitat Sector and will oversee measures undertaken to reduce the take of listed species.

b) *Construction practices*

i. *Delineation of Disturbance Areas – During construction, KWBA shall clearly delineate disturbance area boundaries by stakes, flagging, or by reference to terrain features, as directed by CDFG and USFWS to minimize degradation or loss of adjacent wildlife habitats during operation.*

ii. *Signage – During construction, KWBA shall post signs and/or place fencing around construction sites to restrict access of vehicles and equipment unrelated to site operations.*

iii. *Resource Agency Notification – At least 20 working days prior to initiating ground disturbance for project facilities in designated salvage/relocation areas, KWBA shall notify the Fresno Field Office of CDFG and the Sacramento Field Office of USFWS of its intention to begin construction activities at a specific location and on a specific date. The agencies will have ten working days to notify the KWBA of their intention to salvage or relocate* *listed species in the construction area. If KWBA is notified, it shall wait an additional five days to allow the salvage/relocation to take place.*

iv. *Salvage and Relocation – KWBA shall allow time and access to USFWS and/or CDFG, or their designees, to relocated listed species, at the Resource Agencies' expense, from construction areas prior to disturbance of areas that have been identified by the Resource Agencies as having known populations of the listed species they wish to salvage or relocate.*

v. *Construction Site Review – All construction pipes, culverts, or similar structures with a diameter of three inches or greater that are stored at a construction site on the Kern Water Bank for one or more overnight periods shall be thoroughly inspected for trapped kit foxes and other animals before the subject pipe is subsequently buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight shall be capped. If during construction a kit fox or other animal is discovered inside a pipe, that section of pipe shall not be moved or, if necessary, shall be moved only once to remove it from the path of construction activity until the animal has escaped.*

vi. *Employee Orientation – An employee orientation program for construction crews, and others who will work on-site during construction, shall be conducted and shall consist of a brief consultation in which persons knowledgeable in endangered species biology and legislative protection explain endangered species concerns. The education program shall include a discussion of the biology of the listed species, the habitat needs of these species, their status under FESA and CESA, and measures being taken for the protection of these species and their habitats as a part of the project. The orientation program shall be conducted on an as needed basis prior to any new employees commencing work on the Kern Water Bank. Every two years or at the beginning of construction for the Supply/Recovery canal, a refresher course will be conducted for employees previously trained. A fact sheet conveying this information shall also be prepared for distribution to all employees. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be filed at KWBA's office and shall be accessible by CDFG and USFWS.*

vii. *Standards for Construction of Canals - Concrete lined canals will have a side slope of 1.5 to 1 or less and the sides will have a concrete finish which will assist in the escape of animals. If canals are determined by CDFG or USFWS to be substantial impediments to kit fox movement, plank or pipe crossings will be provided across concrete canals in areas identified as having high kit fox activity.*

c) *On-Going Practices*

i. *Equipment Storage - All equipment storage and parking during site development and operation shall be confined to the construction site or to previously disturbed off site areas that are not habitat for listed species.*

ii. *Traffic Control - KWBA's project representative shall establish and issue traffic restraints and signs to minimize temporary disturbances. All* *construction related vehicle traffic shall be restricted to established roads, construction areas, storage areas, and staging and parking areas. Project related vehicles shall observe a 25 MPH speed limit in all project areas except on county roads and state and federal highways.*

iii. *Food Control - All food-related trash items such as wrappers, cans, bottles, and food scraps generated both during construction and during subsequent facility operation shall be disposed of in closed containers and shall be regularly removed from the site. Food items may attract kit foxes onto a project site, consequently exposing such animals to increased risk of injury or mortality.*

iv. *Dog Control - To prevent harassment or mortality of kit foxes or destruction of kit fox dens or predation on this species; no domestic dogs or cats, other than hunting dogs, shall be permitted on-site.*

v. *Pesticide Use - Use of rodenticides and herbicides on the site shall be permitted in accordance with the Vegetation Management Plan, which incorporates by reference the Interim Measures for Use of Rodenticides in Kern County, and which will incorporate by reference any other applicable laws, rules and regulations regarding the use of pesticides as they take effect.*

d) *Project Representatives*

KWBA shall designate a specific individual as a contact representative between KWBA, USFWS, and CDFG to oversee compliance with protection measures-detailed herein. KWBA shall provide written notification of the contact representative to CDFG and USFWS within 30 days of issuance of the Permits and the Management Authorizations. Written notification shall also be provided by KWBA to CDFG and USFWS in the event that the designee is changed.

e) *Notification Regarding Dead, Injured or Entrapped Listed Animals*

Any employee or agent of KWBA who kills or injures a San Joaquin kit fox, blunt nosed leopard lizard, Tipton kangaroo rat, San Joaquin antelope squirrel, or other listed species listed as a threatened or endangered animal under FESA or CESA, or who finds any such animal either dead, injured, or entrapped on the Kern Water Bank shall report the incident immediately to KWBA's representative who shall, in turn, report the incident or finding to USFWS and CDFG. In the event that such observations are of entrapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape unimpeded. In the event that such, observations are of injured or dead animals, KWBA shall immediately notify USFWS and CDFG by telephone or other expedient means. KWBA shall then provide formal notification to USFWS and CDFG, in writing, within three working days of the finding of any such animal(s). Written notification shall include the date, time, location, and circumstances of the incident.

The USFWS contact for this information shall be the Assistant Field Supervisor for Endangered Species, Sacramento Field Office. The CDFG contact shall be *the Environmental Services Supervisor at the San Joaquin Valley-Southern Sierra Region Headquarters.*

USFWS or CDFG will be notified if any other animal, which is otherwise a listed species, is found dead or injured.

f) *Construction of Supply/Recovery Canal*

Within 60 days prior to the construction of the supply/recovery canal within the zone marked within the Map of the Kern Water Bank, KWBA shall conduct a limited survey within the area of the Kern Water Bank, which <u>*will be*</u> *affected by that construction, with the sole goal of identifying potential San Joaquin kit fox dens. KWBA shall contact USFWS and CDFG pursuant to the salvage procedures set forth above if any kit fox dens are found.*

g) *Take Avoidance Protocol for Fully Protected Species*

Existing data on the blunt nosed leopard lizard at the Kern Water Bank indicates that populations occur within habitat set asides (either sensitive, compatible, or conservation bank habitat), thus the likelihood of take from project construction, operation, and maintenance is negligible. However, in the future adaptive management measures may expand to areas of suitable habitat.

Until such time that the KWBA obtains appropriate authorization for take of the state-designated fully protected blunt-nosed leopard lizard by the Fish and Game Commission, the following take avoidance protocol shall apply in any areas that contain suitable habitat of the blunt-nosed leopard lizard:

i. *A qualified biologist shall survey any areas proposed for project related disturbance that contain suitable habitat for the blunt-nosed leopard lizard to determine the likelihood of presence. Suitable habitat consists of valley and foothill grasslands, saltbush scrubland, iodine bush grassland, and alkali flats.*

ii. *If blunt nosed leopard lizards are found to occur in areas proposed for project facilities construction or maintenance, consideration of avoidance should take place first. If avoidance is not practicable, then the blunt nosed leopard lizard will be trapped and relocated prior to disturbance at KWBA's expense in accordance with the applicable annual management plan. This work must be done by or under the direction of USFWS staff by persons with appropriate experience and with their own take for scientific purposes permits. This procedure will avoid any violation of state law.*

Three other species, which may be found on the Kern Water Bank, are also state designated fully protected species: American peregrine falcon, Greater sandhill crane, and White-tailed kite. The likelihood of the take of any of these species from project construction, operation, and maintenance is negligible due to their mobility and preferred habitats. However, to avoid any take of these species, the same take avoidance protocol as set out for the blunt nosed leopard lizard shall apply to each of these three species.

The use of a biological monitor, and special construction activities and on-going practices will result in a heightened awareness and education regarding sensitive biological resources, which will reduce the potential for impacts on special-status species. In addition, the use of a project representative as a liaison between the KWBA and the resource agencies will expedite notification regarding any take of a listed animal. While take of a fully protected species is not anticipated, this mitigation outlines avoidance protocol to further reduce the likelihood of said take. Together these mitigation measures and the beneficial net increase of habitat for special-status species through implementation of the HCP/NCCP will reduce any potential impact to a less-than-significant level.

7.4-4 Implementation of the proposed project could potentially affect special-status terrestrial biological resources at Castaic Lake.

1996 — 2003

Article 54 of the Monterey Amendment provides that certain SWP contractors may borrow water from Castaic Lake, which must be replaced within five years. If a contractor borrows water from Castaic Lake, the storage volume is reduced and the water level falls. Depending on the amount borrowed and the supplies available to the contractor that borrowed it, it may take anywhere from a few weeks to a year or more for the contractor to replace the borrowed water in the reservoir. Thus, this provision of the Monterey Amendment has the potential to reduce the surface elevation in Castaic Lake compared to baseline operations.

To accommodate potential borrowing by these contractors, the Department has reduced the amount of its typical annual drawdown of Castaic Lake, with the result that the reservoir is maintained at a generally higher surface elevation than prior to the Monterey Amendment. The surface elevation at Castaic Lake for this time period increased an average of 10 to 20 feet most of the time. Although borrowing by contractors reduced water surface elevation in the reservoir at times, the Department's reduced annual drawdown, except during emergencies, maintenance, or borrowing by contractors, led to an increase in average water surface elevation.

Special-status terrestrial wildlife that are recorded at, or expected to use Castaic Lake include greater western mastiff bats and wintering bald eagles that use the lake as a food and water source. In addition, riparian communities, which have been identified as sensitive by CDFG, have been recorded in the natural creeks up and downstream of Castaic Lake, but not at the lake margin which is too steep to support any vegetation. This slight change in lake surface elevation would not adversely affect the quality of riparian habitat up- or downstream from Castaic Lake or the productivity of the lake, which would not adversely affect foraging opportunity.

Because the proposed project is not likely to adversely affect the riparian habitat up- or downstream of Castaic Lake, nor is it likely to affect productivity of the lake, it has had a ***less-than-significant impact*** on terrestrial biological resources.

<u>Mitigation Measures</u>

None required.

Future Impacts

Between 1996 and 2003, the only water agencies that took advantage of Article 54 were the Castaic Lake WA, and MWDSC. It is expected that the two contractors mentioned above, and Ventura County WA, would borrow SWP water from Castaic Lake in the future when it is to their advantage to do so, potentially lowering the water level temporarily by 110 to 155 feet. In actions unrelated to the Monterey Amendment, operational limits have been placed on drawdown activities to prevent adverse impacts to fisheries resources and recreational uses and are as follows:

March	Seven feet per seven-day period
April and May	Four feet per seven-day period
June through September 15	Seven feet per seven-day period
September 16 through February	Two feet per day

The worst-case condition could occur if the contractors borrowed the maximum amount of water permitted under Article 54 and the water was not replaced for the maximum permitted duration of five years. In this case, 160,000 acre-feet would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 acre-feet. The reservoir would remain drawn down for five years. This could result in drawdowns greater than those under baseline operations. Although the worst case condition could occur, it would be unlikely because it is in the interests of the Department and the contractors that receive water from Castaic Lake to keep the terminal reservoir full most of the time.

There is no vegetation associated with the Castaic Lake shoreline due to the steep slopes. Special-status species associated with the water surface or lake margin include the greater western mastiff bat and wintering bald eagle, which use the lake for foraging and for water supply. As discussed in Section 7.3, a reduction in lake levels could reduce overall fish populations, a food source for the bald eagle, generally reported for southern California reservoirs as 2-10 eagles between November and March each year (Stephenson and Calcarone 1999). However, as the lake is stocked for recreational fisheries use, it is unlikely that fish populations would drop below a level that could adversely affect wintering bald eagles. Therefore, the proposed project would have a ***less-than-significant impact*** on special status terrestrial biological species at Castaic Lake.

<u>Mitigation Measures</u>

None required.

7.4-5 Implementation of the proposed project could potentially affect special-status terrestrial biological resources at Lake Perris.

1996 — 2003

Article 54 of the Monterey Amendment provides that certain SWP contractors may borrow water from Lake Perris, which must be replaced within five years. If a contractor borrows water from Lake Perris, the storage volume is reduced and the water level falls. Depending on the amount borrowed and the supplies available to the contractor that borrowed it, it may take anywhere from a few weeks to a year or more for the contractor to replace the borrowed water in the reservoir. Thus, this provision of the Monterey Amendment has the potential to reduce the average monthly surface elevation in Lake Perris beyond what is required for SWP operations.

Borrowing of water from Lake Perris between 1996 and 2003 led to reduced cycling and increased water surface elevations after 1995. Lake Perris surface elevations increased on average four feet as a result of the proposed project. Although borrowing by contractors reduced water surface elevations in the reservoirs at times, the Department's reduced annual drawdown, except during emergencies, maintenance, or borrowing by contractors, led to an increase in average water surface elevations.

Lake Perris supports a variety of special-status species (Table 7.4-2) including the osprey (*Pandion haliaetus*), greater western mastiff bat and Yuma myotis (*Myotis yumanensis*) that use the lake for foraging and water supply. Additionally, two special status species, the double-crested cormorant (*Phalacrocorax auritus*), and the bald eagle, are known to winter at Lake Perris. An average increase of four feet in surface elevation and fluctuations within the magnitude of that prior to implementation of the proposed project are not likely to adversely affect the productivity of the lake, and therefore would not affect the species recorded at Lake Perris.

Because the proposed project is not likely to affect productivity of the lake, it has had a ***less-than-significant impact*** on special status terrestrial biological resources.

Mitigation Measures

None required.

Future Impacts

MWDSC has the option of borrowing up to 65,000 acre-feet of water, which could result in a 30 to 35 foot drop in surface elevation from its normal maximum storage elevation of 1588. It is assumed that if this amount were borrowed, the drop in water surface elevation would occur between September and March, because of a 2001 Memorandum of Understanding (MOU) among CDFG, the Department, MWDSC, California Department of Boating and Waterways, and California State Parks. The MOU established a Lake Perris Operations Committee (LPOC) that developed operational guidelines, establishing a maximum fluctuation of 0.5-foot per day with a total of three feet of elevation change between March 15 and May 1, the spring fish-spawning period.[15] Additionally a minimum elevation goal of 1,584 feet between the start of Memorial Day weekend and Labor Day has been established, primarily to provide the maximum recreational space possible.[16]

The worst-case condition could occur if the contractors borrowed the maximum amounts of water permitted under Article 54 and the water was not replaced for the maximum permitted duration of five years. In this case, 65,000 acre-feet would be borrowed from Lake Perris (about half its maximum capacity of 131,500 acre-feet), and the reservoir would remain drawn down for five years. Although the worst case condition could occur, it would be unlikely because it is in the interests of the Department and the contractors that receive water from Lake Perris that it be kept full most of the time.

As discussed above, and in Section 7.3, a reduction in lake levels could reduce overall fish populations, which in turn could adversely affect terrestrial biological resources that use the lake to forage. As part of the Department's ongoing seismic repairs at Lake Perris, the Santa Ana Watershed Association (SAWA) is currently conducting quarterly bird surveys to document how that drawdown affects birds in the area. The results of these surveys may provide insight into the effects on the reduction of food resources as a result of future drawdowns. Regardless, a reduction in food resources could result in reduced nesting success for raptors, bats, and waterfowl, which would result in a ***potentially significant and unavoidable impact***.

Mitigation Measures

None feasible.

7.4-6 Implementation of the proposed project could potentially affect riparian habitat and the special-status terrestrial species it supports at Lake Perris.

1996 — 2003

Lake Perris has an extensive lake-dependent riparian corridor located along its eastern margin that supports special-status species including California thrasher (*Toxostoma redivivum*), Cooper's hawk (*Accipiter cooperii*), Lawrence's goldfinch (*Carduelis lawrencei*) least Bell's vireo (*Vireo bellii pusillus*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), white tailed kite (*Elanus leucurus*), and yellow warbler (*Dendroica petechia brewsteri*). Additionally, in 2007 the California gnatcatcher (*Polioptila californica*) was observed using the riparian corridor. Drastic changes in surface elevation during the growing season or a prolonged drawdown could have substantial impacts on riparian vegetation, which supports a variety of wildlife species, providing food, shelter, and nesting habitat.

As discussed above, Lake Perris experienced an average increase of four feet in surface elevation and fluctuations of that magnitude prior to implementation of the proposed project. As this change is not likely to have a substantial adverse effect on the riparian habitat along or adjacent to Lake Perris, it has had a ***less-than-significant impact*** on riparian habitat.

Mitigation Measures

None required.

Future Impacts

Under the worst-case condition, approximately half of the water in Lake Perris could be borrowed for a period of up to five years. Although the worst case condition could occur, it would be unlikely because it is in the interests of the Department and the contractors that receive water from Lake Perris that it be kept full most of the time. As discussed above, drastic changes in surface elevation at Lake Perris, beyond what is required for SWP purposes, during the growing season or a prolonged drawdown could have substantial impacts on riparian vegetation.

As part of the Department's ongoing seismic repairs at Lake Perris, a number of mitigation measures have been initiated to reduce impacts to riparian vegetation. An irrigation system that draws water from Lake Perris and feeds the entire stretch of riparian vegetation has been installed. As of May 2007, the riparian vegetation is irrigated twice per week. The success of this system is being monitored monthly by the California Department of Parks and Recreation and may provide insight into the effects of drawdown on the riparian habitat.

Regardless, a decline in the riparian vegetation would be *potentially significant* as this habitat is considered sensitive by DFG, and it supports the special-status species above.

Mitigation Measures

Impacts to the riparian habitat located at Lake Perris may be reduced with the implementation of the following mitigation:

7.4-6 a) *Baseline Studies - A surface and groundwater hydrology study shall be conducted to determine what water source is maintaining the riparian habitat. In addition, a qualified biologist shall conduct a complete habitat assessment of the riparian habitat documenting the size of the habitat, and all wildlife and plant species that use this habitat, including any special-status species. Protocol-level surveys for species known or expected to occur in the riparian habitat (i.e. least Bell's vireo) shall be conducted. A certified arborist shall evaluate the health of the trees and prepare an arborist report.*

b) *Annual Monitoring - Once a baseline is established, annual monitoring will be required to determine changes in hydrologic activities, changes in the health of the riparian habitat, and changes in the use of said habitat by special-status and other wildlife species.*

Should a prolonged drawdown (longer than one year) occur, an irrigation system shall be installed to water the riparian habitat or the existing irrigation system shall be maintained and operated (assuming it is successful in maintaining riparian vegetation during the seismic repairs). In addition, monthly monitoring shall occur to document any changes in the riparian habitat and allow for a timely adjustment of the watering schedule.

Implementation of the above mitigation measures may reduce the impact on the riparian habitat and the associated special-status species to a less-then-significant level, if the changes in water do not impact the riparian habitat, or if any loss of water is supplemented through the sub-surface or surface irrigation. However, because of the complexity of the system, it is unknown at this time what the real impacts on the riparian habitat will be and therefore, the residual impact cannot be assessed. This remains a ***potentially significant and unavoidable impact***.

7.4-7 Implementation of the proposed project could potentially affect special-status terrestrial biological resources at the San Luis Reservoir.

1996 — 2003

Because storage is limited south of the Delta, the Department keeps as much water as possible in San Luis Reservoir, the Department's major south-of-the-Delta storage facility. Occasionally, several of the water supply management practices that are part of the Monterey Amendment (Article 56) caused filling of the reservoir to be delayed by a few months in the winter and early spring relative to the baseline scenario. However, average water surface elevation increased during this period as described in Section 7.1.

Sensitive terrestrial biological resources associated with San Luis Reservoir include local riparian habitats found in intermittent creeks that flow into the reservoir, the special-status species that are associated with this habitat, special-status birds and mammals that use the lake to forage, and San Joaquin kit foxes that use the area as a migratory corridor. The relatively small changes in surface elevation and the delay in filling did not adversely affect the riparian habitat, affect foraging quality, or limit the San Joaquin kit fox from migration.

Therefore, the proposed project has had a ***less-than-significant impact*** on special-status terrestrial biological resource.

<u>Mitigation Measures</u>

None required.

Future Impacts

The altered allocation procedures and Table A transfers and retirements would result in increased storage in San Luis Reservoir much of the time under 2020 conditions as shown in Figure 7.1-9 in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply. Occasionally, several of the water supply management practices that are part of the Monterey Amendment (Article 56) would cause filling of the reservoir to be delayed by a few months in the winter and early spring relative to the baseline scenario. Water levels could be reduced by up to 50 feet. However, the modeling found that this would occur less often between 2003 and 2020 then it had between 1996 and 2003.

Sensitive terrestrial biological resources associated with San Luis Reservoir include local riparian habitats found in intermittent creeks that flow into the reservoir, the special-status species that are associated with this habitat, special-status birds and mammals that use the lake to forage, and San Joaquin kit foxes that use the area as a migratory corridor. An increase in surface elevation would not adversely affect the riparian habitat, affect foraging opportunity, or limit the San Joaquin kit fox from migration. Therefore, the proposed project will have a ***less-than-significant impact*** on special-status terrestrial biological resources.

<u>Mitigation Measures</u>

None required.

7.4-8 Implementation of the proposed project could potentially affect special-status terrestrial biological resources along the Feather, American, Sacramento and San Joaquin Rivers.

1996 — 2003

North of the Delta, the Feather, Sacramento, and American rivers are the water transport routes used to move water from the main storage reservoirs to the Delta pumping plants. Article 55 conveyance provisions of the proposed project has the potential to change how water is released for transport within these rivers. These changes could result in different flow levels at different times of years. However, as discussed in Sections 7.1 and 7.3, the change in flow in the rivers from the proposed project, has been so minimal it would not likely affect any terrestrial resources along the rivers. Therefore, a ***less-than-significant impact*** on special status terrestrial resources would occur as a result of the proposed project.

<u>Mitigation Measures</u>

None required.

Future Impacts

The CALSIM II model compared 2020 baseline conditions to the 2020 proposed project to determine the percent change in flow for the Feather, American, Sacramento, and San Joaquin rivers. As discussed in Section 7.3, streamflow changes resulting from the 2020 proposed project are so small that they would not substantially affect any special status terrestrial species or their habitat. Therefore, this impact would be ***less than significant***.

Mitigation Measures

None required.

7.4-9 Implementation of the proposed project could potentially affect special-status terrestrial biological resources within the Sacramento/San Joaquin Delta.

1996 — 2003

The volume of water discharged through the Delta has been greatly reduced by many factors, resulting in adverse impacts to terrestrial biological resources. As discussed in Section 7.1, implementation of the proposed project would not substantially change Delta outflow. Therefore, impacts on terrestrial biological resources associated with the Delta would be ***less than significant***.

Mitigation Measures

None required.

Future Impacts

As discussed above, the volume of water discharged through the Delta has been greatly reduced by many factors, resulting in adverse impacts to biological resources. Based on CALSIM II model results, no change was found in Delta outflow under the 2020 baseline compared to the 2020 proposed project. Therefore, impacts on terrestrial biological resources associated with the Delta would be ***less than significant***.

Mitigation Measures

None required.

7.4-10 Implementation of the proposed project could potentially benefit special-status terrestrial biological resources in Plumas County as a result of watershed improvement projects.

1995 — 2003

Because the Settlement Agreement was not implemented during this period, there were no watershed improvements in Plumas County and there was ***no impact***.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum, which would identify and oversee the implementation of watershed improvement projects.

These projects take many forms, but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition.

The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of stream bank in a county with thousands of miles of stream channels. It is possible that construction of these projects could have a temporary adverse impact to terrestrial biological resources, but as the goal is to improve the stream banks, these impacts would be less than significant. The proposed project would have a modest ***long-term beneficial effect*** on the terrestrial biological resources of selected stream channels in Plumas County, relative to 2003 conditions.

Mitigation Measures

None required.

ENDNOTES

1. Kuchler, A.W. 1977. The map of the natural vegetation of California. Pp. 909-938 and supplement, in *Terrestrial Vegetation of California* (M.G. Barbour and J. Major, eds.). John Wiley & Sons, NY.

2. Kern Water Bank Authority, Initial Study and Addendum to Monterey Amendment EIR of the KWBA *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, June 1997.

3. Central Coast Water Authority, *Draft Program Environmental Impact Report for the Implementation of the Monterey Agreement – Statement of Principles by the State Water Contractors and the State of California Department of Water Resources for Potential Amendments to the State Water Supply Contracts*, May 1995.

4. Hund, Geary, Senior Ecologist, California State Parks, Inland Empire District, personal communication, October, 2003.

5. Category 1 candidate species are taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened. Category 2 candidate species are those for which information now in the possession of the USFWS indicates that proposing to list as endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.

6. California Native Plant Society, *California Native Plant Society's Inventory of Rare and Endangered Vescular Plants of California (sixth edition)*, Sacramento, CA, 2001.

7. Kuchler, A.W. 1977. The map of the natural vegetation of California. Pp. 909-938 and supplement, in Terrestrial vegetation of California (M.G. Barbour and J. Major, eds.). John Wiley & Sons, NY, 1022 pp.

8 Arvin-Edison Water Storage District, *Arvin-Edison Water Management Negative Declaration*, May 1996, p. 2-5.

9. Kern County Water Agency-Kern Water Bank Authority, Interim Water Recharge Project Biological Monitoring Report for Period April 1995-March 31, 1996.

10. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan,* October 1997.

11. Parker, Jonathan, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

12. Harding, Cheryl, Administrator, Kern Water Bank Authority, email communication with Emily Keller, EIP team, December 18, 2003.

13. Kern Water Bank Authority, *Habitat Conservation Plan/Natural Community Conservation Plan*, 2004 Annual Compliance Report and 2005-2006 Management Plan, May 2005.

14. California Department of Water Resources, *Draft Study of the Transfer, Development and Operation of the Kern Water Bank*, 2007.

15. Lake Perris Operations Committee, Lake Perris Operations Guidelines, effective June 9, 2003.

16. Lake Perris Operations Committee, Lake Perris Operations Guidelines, effective June 9, 2003.

17. Stephenson, J.R., and G.M. Calcarone. 1999. Southern California mountains and foothills assessment: habitat and species conservation issues. General Technical Report GTR-PSW-172. Albany, CA: Pacific Southwest Research Station, USDA Forest Service.

7.5 VISUAL RESOURCES

7.5 VISUAL RESOURCES

7.5.1 INTRODUCTION

7.5.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on visual resources. Some elements of the proposed project have the potential to directly affect visual resources, and these elements are shown in Table 7.5-1.

TABLE 7.5-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON VISUAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes visual character associated with potential changes in agricultural practices	7.5-1
Permanent transfers of water	Changes visual character associated with potential changes in agricultural practices	7.5-1
Transfer of Kern Fan Element lands	Changes visual character associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.5-3
Water supply management practices	Changes visual character associated with construction and operation of groundwater storage facilities/Changes in reservoir levels	7.5-2, 7.5-4, 7.5-5
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Changes in visual character associated with restrictions on development of 490 acres of land in Kern Fan Element	7.5-3
Watershed forum in Plumas	Changes in visual character associated with development of watershed improvement projects	7.5-6
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

During public review of the Notice of Preparation for this EIR, interested parties submitted no comments on visual resources.

7.5.1.2 Analytical Method

Qualitative assessment of impacts on visual resources was conducted in accordance with standard professional practices for CEQA documents. Factors considered in the analysis included:

- the nature and magnitude of changes in visual character;
- the number and importance of vantage points from which changes would be viewed;
- the number of viewers who would be affected; and
- likely reactions to changes in visual character.

Substantial changes are defined as changes beyond those normally observed because of historical variation of fluctuation, changes that are disproportionate to any previously experienced, or irreversible changes that would negatively affect an average person's impression of an area. Site visits to the facilities were used to record the visual character of the facilities and the shoreline characteristics of those facilities that could be affected by changes in water surface elevations. Site visits to Lake Perris and Castaic Lake in May 2007 were used to analyze potential future impacts of drawdown on visual resources.

7.5.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA guidelines. For the purposes of this EIR, impacts to visual resources would be considered significant if the proposed project would:

- have a substantial effect on a scenic vista;
- substantially damage scenic resources including but not limited to, trees, rock outcroppings and historic buildings within a state scenic highway corridor; or
- substantially degrade the visual character of any area.

7.5.2 ENVIRONMENTAL SETTING

7.5.2.1 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern County

Topography of the southern San Joaquin Valley portion of Kern County is flat. Historically, shallow lakes and seasonal wetlands occupied much of the valley floor. In the early part of the twentieth century, the lakes and wetlands were drained and the valley bottom converted to agricultural use. Now the southern San Joaquin Valley portion of Kern County is largely devoted to agriculture. In 1995, about 800,000 acres of land were irrigated with about 40 percent of the land devoted to permanent crops.[1] The predominant visual impression of the area is of vast areas of tree and field crops extending across the valley floor to the foothills.

Prior to 1995, direct groundwater recharge using percolation ponds was only practiced on a small scale in Kern County. Agencies that practiced direct groundwater recharge included KCWA, Arvin-Edison WSD, North Kern WSD, Rosedale-Rio Bravo WSD, Buena Vista WSD and West Kern County WD.[2] Less than one percent of the land on the valley floor was devoted to percolation ponds. Percolation ponds were not a prominent visual feature in the southern San Joaquin Valley.

Kern Fan Element

The Kern Fan Element consists of 20,546 acres of land located in Kern and Kings counties, southwest of Bakersfield. The Kern Fan Element lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. The terrain is flat with no more than a few feet of topographical relief. In 1995, there were no major structures on Kern Fan Element except for Interstate 5 (I-5), the Cross Valley Canal, and some abandoned tanks and other oil field equipment, and about 3,000 acres of percolation ponds.

The Kern Fan Element was farmed for many years until the mid-1980s. After the California Department of Water Resources (Department) purchased the land in 1986, the agricultural fields were gradually taken out of production. By 1995, agriculture had ceased on the property and introduced annual grasses and forbs had colonized the land.

Castaic Lake

Castaic Lake is the terminus of the West Branch of the California Aqueduct. It was completed in 1972 and is located about 45 miles northwest of Los Angeles and about two miles north of the community of Castaic. The lake has a maximum capacity of 323,700 acre-feet, a surface area of 2,240 acres and 29 miles of shoreline.[3] Water surface elevations are typically at their highest level in March and at their lowest level in October. In the period 1974 through 1994, the difference between the highest and lowest monthly average water surface elevations was about 33 feet.

Castaic Lake lies in an area where the topography is steep with incised valleys. Vegetation around the lake consists of coastal scrub and chaparral with some landscaped campgrounds and recreation areas (Figure 7.5-1). Due to the steep topography along a majority of the lake margin and fluctuating water levels, vegetation is sparse and isolated to areas of the lake margin along gradual slopes. Above the lake margin, native scrub vegetation covers the steep hillsides surrounding the reservoir. When the lake is drawn down a visually prominent band of bare rock and soil is exposed around its perimeter.

Lake Perris

Lake Perris is located just south of the City of Moreno Valley and is supplied with water from the East Branch of the California Aqueduct. It has a capacity of 131,500 acre-feet, a surface area of 2,320 acres and a 10-mile long shoreline.[4] Water surface elevations typically reach a high point in March and a low point in August or September. In the period 1974 through 1994, the difference between the highest and lowest monthly average water surface elevations was about 10 feet.

Lake Perris lies within a natural bowl and is surrounded by hills covered by sage-scrub (Figure 7.5-2). There is no development around the shoreline except for picnic areas, camping sites, boat docks and parking lots, located primarily on the north side of the lake. The picnic areas and camping sites are landscaped and irrigated. Approximately two miles of established riparian vegetation is located along the eastern shoreline. When Lake Perris is drawn down a visually prominent band of rock and soil is exposed.

Source: California Department of Water Resources, 2006.

FIGURE 7.5-1
Castaic Lake

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Source: California Department of Water Resources, 2006.

FIGURE 7.5-2
Lake Perris

D50680.00

San Luis Reservoir

San Luis Reservoir is located in western Merced County, just east of the Merced/Santa Clara County line. The reservoir has a maximum capacity of 2,027,800 acre-feet, a surface area of 12,520 acres, and a 65-mile long shoreline.[5] Water surface elevations typically reach a high point in March and a low point in August. In the period 1974 through 1994, the difference between the highest and lowest monthly average water surface elevations was about 220 feet.

The reservoir shoreline is undeveloped except for the state-owned recreation facilities on its north side. Views of the reservoir primarily consist of annual grassland, coastal sage-scrub, and riparian woodland that are characteristic of the relatively low rounded foothills of the Diablo Range (Figure 7.5-3). When San Luis Reservoir is drawn down, a broad visually prominent band of rock and soil is exposed.

Lake Oroville

When Lake Oroville is filled to its maximum operating storage level, it covers 15,810 acres and has a 167-mile shoreline (Figure 7.5-4). The reservoir is visible from the road and walkway along the crest of the dam and is prominently visible from State Route (SR) 162 and to a lesser extent from SR 70 and from a number of local roads. Many of the most immediate views are from the marinas, boat launch areas, campgrounds, picnic areas, and other developed recreational areas surrounding the reservoir.[6]

Reservoir water surface elevation is the critical factor affecting the aesthetic quality of views of the reservoir. When the reservoir is at or near its maximum operating storage level, and the water surface meets fully vegetated shorelines, it is at its most attractive. As drawdown occurs during the summer and fall, an increasingly broad ring of unvegetated shoreline appears. In narrow or steep-sided branches of the reservoir, large drawdowns can create conditions in which it appears the reservoir is set within a deep, red-sided canyon. In areas where slopes are gradual, areas that appear to be large, reddish mudflats are created.[7]

7.5.2.2 Changes in Physical Setting between 1996 and 2003

Southern San Joaquin Valley Portion of Kern County Excluding the Kern Fan Element

There were no major changes in visual resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) between 1996 and 2003. Of the changes that occurred some were attributable to the proposed project and others were not. The construction of the Kern Water Bank Canal conversion of open land to percolation ponds was attributable, to the proposed project. The gradual conversion of agricultural lands to urban uses, particularly near the city of Bakersfield, was not attributable to the proposed project. The existing trend toward planting high value permanent crops in place of field crops continued. Neither the proposed project-induced changes nor the other changes have greatly altered the predominant visual impression of the area - vast areas of tree and field crops extending across the valley floor to the foothills.

Kern Fan Element

Most of the changes in visual resources in the Kern Fan Element between 1996 and 2003 are attributable to the proposed project. They include the construction of percolation ponds and the Kern Water Bank Canal and are described above.


Source: California Department of Water Resources, 2006.

FIGURE **7.5-3**
San Luis Reservoir

Source: California Department of Water Resources, 2006.

FIGURE 7.5-4
Lake Oroville

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Castaic Lake

Between 1995 and 2003 there were several times when Castaic Lake was drawn down for repairs or from drought conditions. These drawdowns exposed large portions of barren soil, rock, and silt usually under the normal operating water surface elevations. Otherwise, there have been no substantial and permanent changes in visual resources at Castaic Lake between 1996 and 2003.

Lake Perris

There have been no substantial changes in visual resources at Lake Perris between 1996 and 2003.

San Luis Reservoir

There have been no substantial changes in visual resources at San Luis Reservoir between 1996 and 2003 except for those that are a consequence of the proposed project and are described above.

Lake Oroville

There have been no substantial changes in visual resources at Lake Oroville between 1996 and 2003.

Plumas County

Plumas County is located where the Sierra Nevada meets the Cascade Mountains in northeastern California. It is a rural county with no large cities. With an area of 2,554 square miles and a population of about 21,000, it has a population density of about eight people per square mile. Much of the county is within the Plumas and Lassen National Forests. Principal economic activities in the county are recreation, services, and forest products.

The Feather River drains most of Plumas County. There are more than 1,000 miles of streams and more than 100 lakes in the Feather River watershed. Many streams remain in a natural condition but others have been extensively developed for water supply and hydropower generation. Pacific Gas and Electric operates a series of hydropower projects on the North Fork of the Feather River. There are three SWP reservoirs in Plumas County; Antelope Lake on a tributary of the North Fork, and Frenchman Lake and Lake Davis on tributaries of the Middle Fork. Hydropower projects and water supply reservoirs alter natural flow regime and stream channel morphology.

7.5.2.3 Regulatory Setting in 1995

Lake Perris is located in Riverside County. The County of Riverside General Plan contains policies designed to conserve significant scenic resources along designated scenic highways for future generations and to manage development along scenic highways and corridors so as not to detract from the area’s scenic quality. Ramona Expressway, which runs just south of Lake Perris, has been noted as an “Eligible County Scenic Highway” due to the visual significance of the area it traverses.

San Luis Reservoir is located in Merced County. The Merced County General Plan recognizes three river corridors and views of the Sierra Nevada and Coast Range as major scenic vistas. The plan also notes that the county's rural lands, which comprises 90 percent of total land area, has a high scenic value. SR 152, west of I-5, is a designated State Scenic Highway. This segment of SR 152 is located just north of San Luis Reservoir.

Castaic Lake is located in Los Angeles County. The general plan contains a scenic highway element, which may be incorporated into other portions of an updated general plan when that is adopted (currently in process). Castaic Lake is within the Santa Clarita Valley Area Plan, which contains additional policies that supplement the regional policies in the county general plan. Under the Caltrans State Scenic Highway designation system, I-5, which bisects Castaic Lake and provides extensive views of the reservoir, is eligible for designation as a scenic highway, but an Official Designation has not been adopted. SR 14, which also features prominent views of the reservoir, has not been designated as eligible.[8]

Lake Oroville is in Butte County. The Butte County General Plan is in the process of being updated; however, a new plan has not yet been adopted. The current general plan includes a Scenic Highway Element, which was adopted in 1977. The element focuses on coordination with Caltrans during the identification and designation of scenic highways in the county and establishes policies for development along scenic corridors.[9] None of the policies are directly applicable to the proposed project. Under the Caltrans State Scenic Highway designation system, SR 70 is eligible for designation as a scenic highway, but an Official Designation has not been adopted. SR 162, which features more prominent views of the reservoir, has not been designated as eligible.[10]

7.5.2.4 Changes in Regulatory Setting between 1996 and 2003

There have been no substantial changes in the regulatory framework since 1996 that would affect the analysis of visual resources impacts, except for a Scenic Highways Element included in the 2004 Kern County General Plan. Highways in Kern County that provide access to existing and potential groundwater bank areas are not officially designated for scenic value either by Caltrans or the county general plan.

7.5.3 IMPACTS AND MITIGATION MEASURES

7.5-1 Implementation of the proposed project could potentially affect visual resources in the southern San Joaquin Valley portion of Kern County as a result of changes in agricultural practices.

1996 — 2003

The Monterey Amendment enables various changes in the way the Department allocates water among contractors during times of shortage and surplus and enables agricultural contractors to retire and transfer a portion of their Table A amounts. The effect of these changes was to increase the reliability of water supplies but decrease the total amount of Table A water available to farmers in Kern County. The reliability and availability of agricultural water supplies is one factor that may contribute to the amount and types of crops that farmers decide to plant, which in turn affects the appearance of the landscape in the southern San Joaquin Valley portion of Kern County.

Throughout the lands within the KCWA's boundaries, farmers have replaced annual crops, such as alfalfa, corn and potatoes, with permanent crops, such as grapes and almonds. Permanent crops are generally taller and provide more visual variety than annual crops. Permanent crops break up the uninterrupted views across miles of flat land, prevalent where annual crops are grown in the southern San Joaquin Valley.

As shown in Table 7.6-3 in Section 7.6 Agricultural Resources, the acreage of permanent crops in the service areas of four KCWA member agencies that rely heavily on SWP water increased from 72,769 acres in 1995 to 109,669 acres in 2001, an approximately 50 percent increase. Of the three SWP contractors in Kings County, Kings County WD, reports cultivation of an increasing proportion of permanent crops within its service area. This is probably the result of general trends because SWP water represents only a small proportion of the district's water supply. A second contractor, Tulare Lake Basin WSD, reports no change in the proportion of permanent crops in its district. Periodic flooding, clayey soil types, and a high water table limits cultivation of permanent crops in the Tulare Lake Basin WSD.

Therefore, it is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have altered the appearance of lands within the KCWA's boundaries. However, no clear trend can be attributable to the proposed project that can be discerned for the period between 1996 and 2003 and any changes have not resulted in a dramatic change in visual character. Furthermore, any changes would have been seen by a limited number of viewers and probably noticed by even fewer. Therefore, the impact of the proposed project on visual resources is considered to be ***less than significant***.

<u>Mitigation Measures</u>

None required.

Future Impacts

Approximately 14,000 acre-feet of the Table A amount would be transferred from KCWA to urban water contractors in the future. As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in visual character. Furthermore, any changes would be seen by a limited number of viewers and probably noticed by even fewer. Therefore, the impact of the proposed project on visual resources is considered to be ***less than significant***.

<u>Mitigation Measures</u>

None required.

7.5-2 Implementation of the proposed project could potentially affect visual resources in the southern San Joaquin Valley portion of Kern County

(excluding the Kern Fan Element) as a result of construction and operation of new groundwater storage facilities.

1996 — 2003

The Monterey Amendment enabled SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several M&I contractors entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1996 and 2003, Semitropic WSD, Arvin-Edison WSD and the Kern Water Bank Authority (KWBA) developed or expanded water banks.[11] The water bank developed by the KWBA is discussed separately under Impact 7.5-3, below.

The water banking program developed by Semitropic WSD was an "in lieu" program, did not involve the construction of new facilities, and would have no effect on visual resources. Arvin-Edison's water banking program involved the construction of 520 acres of percolation ponds at two sites referred to as the North Canal Spreading Works and the South Canal Spreading Works. Vacant land or cropland was converted to percolation ponds by the construction of one- to two-foot-high perimeter levees.[12]

Vacant agricultural lands in the southern San Joaquin Valley are typically covered with weedy vegetation that is green in late winter and early spring and then dries to a golden color the rest of the year. Annual cropland is green during the long growing season in the southern San Joaquin Valley and exhibits exposed soil during the rest of the time. Vacant agricultural land or cropland converted to ponds would be flooded for several months in the winter and spring of most years. The ponds would be dry in the summer and fall and would support sparse weedy vegetation. The weedy vegetation would likely remain green for a few weeks after the ponds had dried up.

Although replacement of 520 acres of vacant land or cropland with percolation ponds altered the appearance of parts of the southern San Joaquin Valley, it did not alter the overall visual character of the area. The changes at the North Canal Spreading Works were visible to travelers on Buena Vista Boulevard and Tejon Highway. The changes at the South Canal Spreading Works were visible to travelers on SR 99. The alteration in visual resources attributable to the proposed project is considered to be a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As noted above, the Monterey Amendment enables SWP contractors to store water outside their service areas for later use within their service areas. Between 1996 and 2003, water banks were developed, and 520 acres of percolation ponds were constructed. It is expected that in the future, contractors would increase their use of groundwater banks. For purposes of the analysis, it is assumed a similar amount of ponds (approximately 500 acres) would be constructed in the future. The conversion of land for use as percolation basins would alter the visual appearance of the land as described above for 1996 to 2003 and would not be perceived as adverse. The impacts on visual resources are considered to be ***less than significant***.

Mitigation Measures

None required.

7.5-3 Implementation of the proposed project could potentially affect visual resources in the Kern Fan Element as a result of construction and operation of new groundwater storage facilities.

1996 — 2003

Prior to 1995, approximately 3,034 acres of shallow percolation ponds existed in the Kern Fan Element. The KWBA subsequently constructed the Kern Water Bank Canal; a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[13] Between 1996 and 2003, an additional 1,665 acres were converted to shallow percolation ponds, for a total of 4,699 acres in 2003 in the Kern Fan Element. The Kern Water Bank Canal has a uniform cross-section and is confined between earthen levees. It is a prominent feature in the landscape but one that is visually consistent with other waterways in the area including the Cross Valley Canal and the California Aqueduct.

Although these land use changes have altered the appearance of lands within the Kern Fan Element, they did not alter the overall visual character of the area. The changes would be seen by a limited number of viewers and would probably be noticed by even fewer. The alteration in visual resources is considered to be a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As noted above, between 1996 and 2003, the KWBA built approximately 1,665 acres of shallow percolation ponds within the lands designated as intermittent wetland habitat. Under the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds within the intermittent wetland habitat.

The Habitat Conservation Plan for the Kern Fan Element allows developed uses on about 4,000 acres of the Kern Fan Element.[14] Developed uses include farming, permanent facilities for the Kern Water Bank, and commerce. Approximately, 490 acres is designated for possible commercial use. Between 1996 and 2003, no development occurred on the 490-acre parcel. Because the Settlement Agreement prohibits development of this parcel, the parcel would remain undeveloped under the proposed project.

As a consequence of the proposed project, an additional approximately 1,200 acres of land would be converted to percolation ponds. Although these changes would alter the appearance of lands within the Kern Fan Element, the alteration in appearance would be minimally visible and is considered to be a ***less-than-significant impact***.

Mitigation Measures

None required.

7.5-4 Implementation of the proposed project could affect visual resources at Castaic Lake and Lake Perris.

1996 — 2003

Visual quality at Castaic Lake and Lake Perris is at its best when these reservoirs are full or almost full. At Castaic Lake, the shoreline, for the most part, abuts the steep walls of the narrow valley it sits within with vegetation along these hillsides growing down to the lake margin. At Lake Perris approximately two miles of riparian vegetation has developed along the eastern shoreline and two main recreation areas on the north side of the lake, include man made beaches, picnic areas, camping sites and parking lots. During normal operation of the reservoirs, there are fluctuations of the water levels in the reservoirs. When the reservoirs are drawn down, a band of soil or rock is initially exposed around the reservoirs' perimeters. The perimeter band is initially devoid of vegetation and may include tree stumps and other debris that are not visible when the reservoirs are full. Although temporary views of potential trash and debris along exposed beach areas could occur, removal of such materials is an ongoing activity carried out by the California Department of Parks and Recreation (CDPR) at Lake Perris and Castaic Lake. The appearance of the perimeter band is often initially in sharp contrast to the reservoir pool and surrounding vegetation making it a prominent visual feature. However, natural succession of vegetation around the reservoir edge results in some shoreline areas with emergent vegetation. Visual quality is temporarily degraded when water levels in the reservoirs are lowered, however visual quality is generally restored when water levels are raised.

Article 54 of the Monterey Amendment allowed SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions. As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, the borrowing of water lowered the water surface elevations in Castaic Lake and Lake Perris relative to what they would have been in the absence of borrowing, and there was little effect on average water surface elevations in the post-Monterey Amendment period. Average water surface elevations at the two lakes were actually higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1996 to 2003 was about 23 feet higher than between 1974 and 1995. At Lake Perris, the average surface water elevation was about four feet higher during the same period.

The higher water surface elevations between 1996 and 2003 at Castaic Lake and Lake Perris would have resulted in a reduction in the width of the band of exposed soil and rock around the perimeter of the two reservoirs, so the project would have contributed to some improvement in visual quality, during that time period, and the proposed project may have had a modest *beneficial impact* on visual resources between 1996 and 2003. Therefore, the proposed project resulted in a ***less-than-significant impact*** on visual resources.

<u>Mitigation Measures</u>

None required.

Future Impacts

As noted earlier, Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions which could affect water levels in these reservoirs.

Under the proposed project, it is expected that in the future, Castaic Lake WA, MWDSC and Ventura County WA would borrow SWP water from Castaic Lake when it is to their advantage to do so. Similarly, MWDSC would borrow water from Lake Perris.

The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would draw down the reservoirs to a greater extent than occurred between 1996 and 2003.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoirs would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1)

If the worst-case scenario were to occur, the extended drawdown scenario could increase the area exposed around the perimeter of the two reservoirs for a potentially greater duration than what would have occurred in the absence of the project.

The visual quality of the reservoirs is, in part, characterized by water level elevations and the amount of shoreline exposure, as described previously. The amount of vegetation along the shoreline, which is also related to water levels, also contributes to the viewshed. The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the three eligible contractors make use of Article 54 and future hydrologic conditions. As shown in Figures 7.5-5 and 7.5-6, recent significant drawdowns at both Castaic Lake and Lake Perris, respectively, exposed a wide band of barren soil and silt that is below normal operating lake levels. It is possible that future borrowing could drawdown the reservoirs to 50 percent of their capacity more often than would occur without the project. This would increase the exposed area around the perimeter of the two reservoirs, diminishing the natural lake appearance. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Castaic Lake and Lake Perris are economically and physically infeasible because of the scale of the area to be covered at either reservoir. Therefore, although the visual effects of drawdown would be temporary (up to five years), this is considered a ***potentially significant and unavoidable impact***.

<u>Mitigation Measures</u>

None available.

7.5-5 Implementation of the proposed project could potentially affect visual resources at San Luis Reservoir and Lake Oroville.

1996 — 2003

As discussed under Impact 7.5-4, visual quality is at its best when reservoirs are full or almost full. At Lake Oroville and San Luis Reservoir, the changes in the amount of water stored were small and insufficient to have much effect on water surface elevations compared to baseline

FIGURE **7.5-5**

Visual Character of Castaic Lake During Extreme Drawdown Event in 2006

PBS&J

FIGURE **7.5-6**
Visual Character of Lake Perris During Extreme Drawdown Event in 2007

conditions (see Impact 7.1-4 in Section 7.1); therefore, changes in visual quality would not be apparent at these two reservoirs. Therefore, the proposed project resulted in a ***less-than-significant impacts*** on visual resources at San Luis Reservoir and Lake Oroville.

<u>Mitigation Measures</u>

None required.

Future Impacts

Provisions of the Monterey Amendment could affect water levels in San Luis Reservoir. In the future, most of the time, the proposed project would raise water levels in San Luis Reservoir by 10 to 20 feet under 2020 conditions. Occasionally, the Article 56 provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir in the spring of wet years relative to the baseline scenario. Surface water levels could be reduced by up to 50 feet, but the reduction would typically persist for only a few months and would not be expected to affect visual character compared to baseline conditions. Therefore, the proposed project resulted in a ***less-than-significant impacts*** on visual resources at San Luis Reservoir and Lake Oroville.

<u>Mitigation Measures</u>

None required.

7.5-6 Implementation of the proposed project could potentially affect visual resources in Plumas County as a result of watershed improvement projects.

1996 — 2003

Because the Settlement Agreement was not completed in this period, there were no watershed improvement projects as a result of the proposed project and there was ***no impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition.

The types of projects that are anticipated would include stream restoration (revegetation of stream banks and removal of non-native species, for example), preventing stream down-cutting and gullying through the creation of a series of ponds and drop structures, well drilling, and unpaved road improvements to reduce erosion and sedimentation. The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of streambank in a county with thousands of miles of stream channels. The proposed project would have a ***beneficial effect*** on the appearance of stream channels in Plumas County.

Mitigation Measures

None required.

ENDNOTES

1. Kern County Water Agency, *Water Supply Report 1998*, March 2002.

2. Conant, Ernest, and Young Wooldridge, personal communication with John Davis, EIP team, October 2003.

3. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

4. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

5. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

6. Placer County Water Agency and U.S. Bureau of Reclamation, *Draft American River Basin Cumulative Impact Report, Appendix D*, August 2001.

7. Placer County Water Agency and U.S. Bureau of Reclamation, Draft American River Basin Cumulative Impact Report, Appendix D, August 2001.

8. Caltrans, *Officially Designated State Scenic Highways and Historic Parkways*. http://www.dot.ca.gov/hq/LandArch/scenic_highways/index.htm.

9. Butte County, *Butte County General Plan*, Scenic Highway Element, 1997.

10. Caltrans, *Officially Designated State Scenic Highways and Historic Parkways*. http://www.dot.ca.gov/hq/LandArch/scenic_highways/index.htm.

11. Conant, Ernest, and Young Wooldridge, personal communication with John Davis, EIP team, October 2003.

12. Arvin-Edison Water Storage District, *Arvin-Edison Water Management Project Negative Declaration*, July 1996.

13. Jonathon Parker, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

14. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, October 1997.

7.6 AGRICULTURAL RESOURCES

7.6 AGRICULTURAL RESOURCES

7.6.1 INTRODUCTION

7.6.1.1 Content

This section describes the potential effects of the proposed project on agricultural resources. The proposed project could potentially affect agricultural resources in those parts of the San Joaquin Valley served by the SWP.

The proposed project consists of the Monterey Amendment and the Settlement Agreement. The Monterey Amendment amends the terms of the long-term water supply contracts between the California Department of Water Resources (Department) and its contractors. The amendments change how SWP water is allocated among the contractors and allows changes in management of SWP water. Chapter 6 describes the changes in SWP and SWP contractor operations that are attributable to the Monterey Amendment. Some of the operational changes attributable to the Monterey Amendment would affect deliveries of SWP water to SWP contractors and could consequently have effects on agricultural resources.

The Settlement Agreement would not be expected to have any effects on agricultural resources. It would have no effect on deliveries of SWP water to contractors in the San Joaquin Valley. Elements of the proposed project that could affect agricultural resources are shown in Table 7.6-1.

TABLE 7.6-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON AGRICULTURAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Acreages of irrigated farmland	7.6-1
Permanent transfers of water	Acreages of irrigated farmland	7.6-1
Transfer of Kern Fan lands	NA	NA
Water supply management practices	NA	NA
Restructured financial arrangements	NA	NA
Settlement Agreement	NA	NA
Note: NA – Not Applicable.		

During public review of the Notice of Preparation for this EIR, the State Department of Food and Agriculture commented on the NOP and noted that the proposed project has the potential for significant positive impacts on agricultural water users but at the same time could have long-term adverse impacts on agriculture from water transfers away from agricultural to urban users. Specific issues raised include permanent loss of agricultural production capacity associated with project growth-inducing impacts and cumulative loss of agricultural production and resources. Growth-inducing impacts are addressed in Chapter 8 and cumulative impacts are addressed in Chapter 10.

7.6.1.2 Analytical Method

The impacts of the proposed project on agricultural resources in the period 1996 to 2003 were examined by compiling and analyzing historical information on irrigated acreage and cropping patterns and relating them to proposed project-related changes in the agricultural water supply. Environmental documents prepared for Monterey Amendment-related transfers of Table A amounts from agricultural contractors to M&I contractors were examined and knowledgeable persons were interviewed to determine the effects of altered SWP deliveries on the acreage of irrigated agricultural land and cropping patterns. Possible future impacts were examined by compiling information on trends in agriculture and determining the likely effects of proposed project-related changes in agricultural water supply on the trends.

7.6.1.3 Standards of Significance

For purposes of this EIR, impacts on agricultural resources would be considered significant if the proposed project would:

- Result in a permanent conversion of a substantial acreage of Prime, Unique or Statewide Important Farmland; or
- Result in a substantial inconsistency with objectives of local, regional and state plans, including zoning for agricultural use or Williamson Act Contracts.

7.6.2 ENVIRONMENTAL SETTING

7.6.2.1 Physical Setting in 1995

All of the SWP's agricultural contractors are located in Kern County and Kings County except for Oak Flat WD,[1] which is located in Stanislaus County.

Kern County

Kern County is located at the southern end of the San Joaquin Valley. Western Kern County is located on the valley floor whereas foothills and mountains of the Sierra Nevada occupy the eastern part of the county. The southern San Joaquin Valley portion of Kern County is very flat. Historically, shallow lakes and seasonal wetlands occupied much of the valley floor. In the early part of the twentieth century, the lakes and wetlands were drained and the valley bottom converted to agricultural use. Soils in the valley portion of Kern County have two general origins, delineated approximately by the trough of the valley. The eastern alluvial fans were developed from a much higher energy environment, deposited by the precipitation and runoff of the Sierra Nevada. The soils are mostly of granitic origin, well drained, absent of salinity, with large well developed groundwater basins and ideal for agriculture. However the western alluvial fans originated from sedimentary rock formed on the sea bottom and consequently resulted in poorly drained soils of marginal quality. Most of the soils on the west side of the valley required some reclamation before crops could be grown profitably. Now, most of the southern San Joaquin Valley portion of Kern County is devoted to agriculture. Because the climate is arid, with an average of less than six inches of annual precipitation, almost all crops must be irrigated.[2]

There are many irrigation districts in the San Joaquin Valley portion of Kern County. The first irrigation districts were originally formed to deliver local surface water. Additional districts formed when the SWP and the Friant-Kern Canal, a part of the CVP, were built. KCWA was created by the state legislature and ratified by the electorate in Kern County in 1961. KCWA has the authority to acquire and contract for water supplies for the county. It has additional powers to manage flood and storm waters and to protect the quality of underground waters. KCWA is a major SWP contractor. Its Table A amount represents about one-quarter of the total SWP Table A amount.

Figure 7.6-1 shows irrigated acreage in the San Joaquin Valley portion of Kern County from 1970 to 1999. The amount of irrigated acreage in a particular year depends on numerous factors including crop prices and the availability of surface water. The mean irrigated acreage in the period was 867,400 acres. A maximum of 972,800 acres was irrigated in 1984. A minimum of 729,400 acres was irrigated in 1991, a very dry year. About 800,000 acres was irrigated in 1994.[3]

Water demand in the San Joaquin Valley portion of Kern County averages about 2,500,000 acre-feet (AF) per year. Water sources include local ground and surface water and imported water from the SWP and CVP. SWP water represents as much as 50 percent of the San Joaquin Valley portion of Kern County's supply in some years. Information on Kern County's water supply between 1970 and 1998 is provided in Figure 7.2-1.

Kings County

Kings County lies north of Kern County on the western side of the floor of the San Joaquin Valley. A large portion of the farmland in the county lies on the historical Tulare Lake bed. High water tables, clayey and saline soils in portions of the valley floor in Kings County influence the type of crops planted. Soil reclamation was necessary in some areas before any crops could be farmed. Farmland occupies 85 percent of the county. The climate is arid and almost all crops are irrigated.

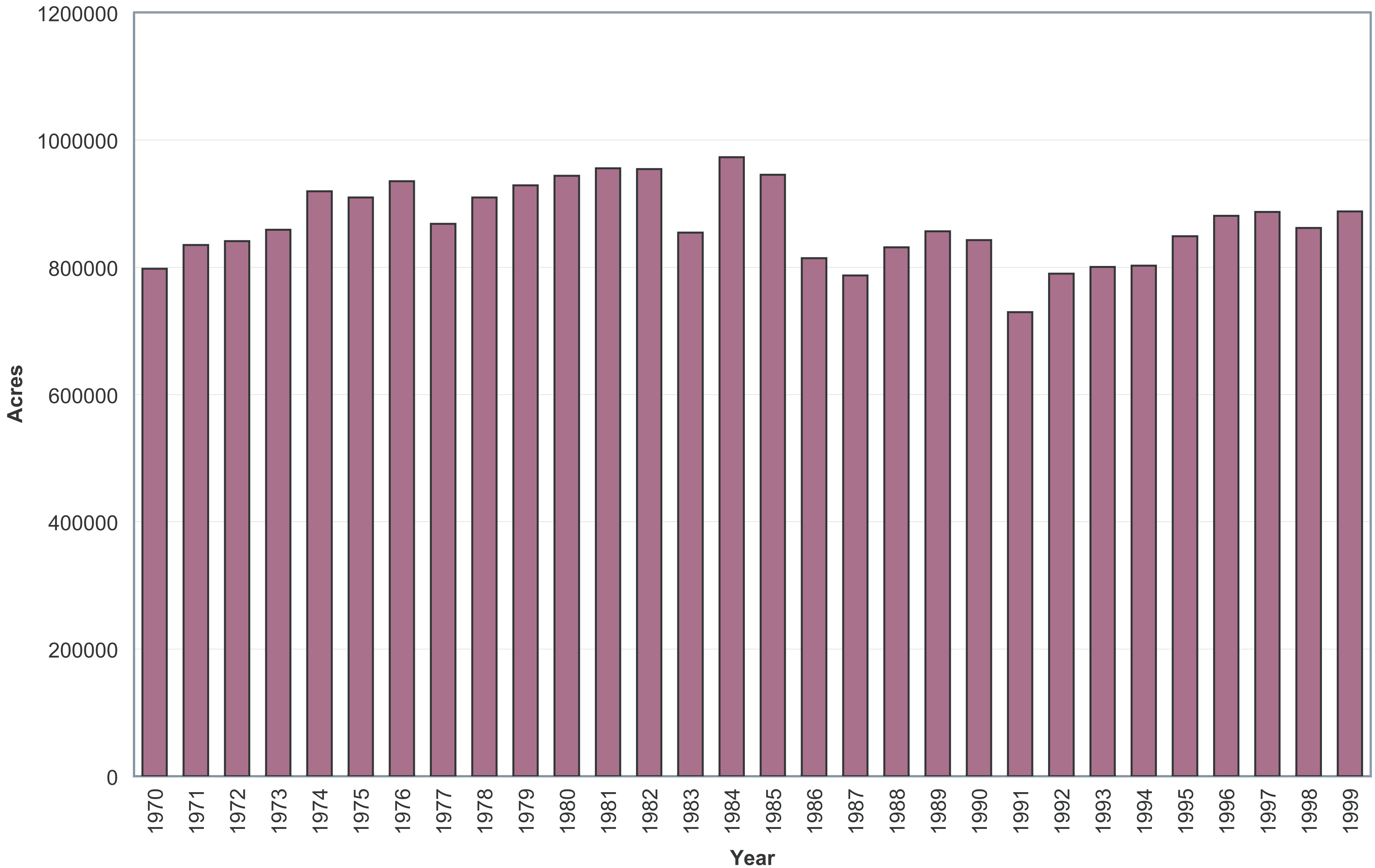
Agricultural lands in three water districts in Kings County would be affected by the proposed project, Kings County WD, Dudley Ridge WD and Tulare Lake Basin WSD. Kings County WD's boundaries encompass 143,000 acres of land. The district obtains most of its water supplies from the Kings and Kaweah rivers. SWP water represents less than five percent of Kings County WD's supplies.[4]

Tulare Lake Basin WSD's boundaries encompass 178,000 acres of land. Most of district lies within lands formerly occupied by Tulare Lake. Its sources of water include the Kings and Tule rivers, groundwater and the SWP.[5]

Dudley Ridge WD's boundaries encompass 37,660 acres of land about half of which is irrigated. Almost all its water is obtained from the SWP.[6]

7.6.2.2 Changes in Physical Setting between 1996 and 2003

For several decades, the proportion of permanent crops (fruits and nuts) in the San Joaquin Valley has increased and the proportion of field crops has decreased. In 1980, field crops were cultivated on 72 percent of the cropland in the San Joaquin Valley. In 1997, field crops were grown on 55 percent of the cropland.[7] In late 1970s and 1980s interest rates made financing very expensive and many smaller farming operations were bought out by larger operations. After the prolonged six-year drought of 1986 to 1992 and the reduction in Delta pumping necessitated by more stringent Delta water quality standards and the Central Valley Project Improvement Act, many agricultural operations re-evaluated their farming strategies. The



Source: PBS&J, 2007.

FIGURE **7.6-1**

Irrigated Acreage in the San Joaquin Valley Portion of Kern County

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aforementioned events resulted in a shift in the views of Westside farmers and had a large impact on how future farming was to occur. Some agricultural land was abandoned during this period as profitability was drastically reduced. The trend toward planting high value permanent crops and vegetables in place of field crops continued into the 2000s.

The value of agricultural production in the San Joaquin Valley has increased between 1996 and the present. The value of agricultural production in Kern County in 2005 was $3.5 billion. Current trends show increasing acreages of tree crops and decreasing acreages of field crops and to lesser extent vegetable crops.[8] The value of agricultural production in Kings County in 2005 was $1.4 billion. Kings County is also experiencing a trend toward increased acreage of tree crops.[9]

7.6.3 IMPACTS AND MITIGATION MEASURES

7.6-1 Proposed project-induced changes in SWP deliveries to agricultural contractors could potentially result in a permanent conversion of Prime, Unique, and/or Statewide Important Farmland acreage and could potentially result in substantial inconsistencies with local, regional, or State objectives addressing agricultural resources.

1996 — 2003

As a result of the Monterey Amendment, average annual deliveries of SWP water to agricultural contractors as a group under 2003 conditions decreased by 10 percent compared to the baseline scenario. The decrease in average annual deliveries to agricultural contractors as a group was caused by the provisions of the Monterey Amendment that altered water allocation procedures (Article 18) and provided for a retirement of 45,000 AF of Table A from agricultural contractors and transfers of 130,000 AF of Table A amounts from agricultural to M&I contractors (Article 53). The greatest reductions in deliveries were experienced by agricultural contractors that transferred Table A amounts to others. The following analysis is focused on the agencies with the greatest reductions in average annual deliveries.

Table 7.6-2 shows the Table A transfers and retirements that occurred between 1996 and 2003. Agricultural contractors retired 45,000 AF of Table A amount and transferred 114,000 AF of Table A amount to M&I contractors as specified in the Monterey Amendment. An additional 22,273 AF of Table A amount was transferred by Tulare Lake Basin WSD to several M&I and agricultural contractors unrelated to the Monterey Amendment.

Between 1995 and 2003, agricultural contractors in Kern and Kings retired or transferred to municipal contractors a total of 159,000 AF of Table A amount. Approximately 64,000 acres of land could be irrigated with 159,000 AF of water in a year when full Table A amounts are delivered and assuming KCWA's average application rate of 2.48 feet.

<u>Kern County</u>

Since the Monterey Amendment, 159,000 AF of Table A amount has been retired or transferred. Of this amount, most (154,670 AF) was owned by KCWA member agencies. KCWA member agencies retiring or transferring considerable amounts of Table A amount included Belridge WSD (41,335 AF), Berrenda Mesa WD (32,000 AF), Lost Hills WD (21,290 AF) and Wheeler Ridge-Maricopa WD (51,815 AF). They retired or transferred 146,440 AF, more than 90 percent of the total Table A amount retired or transferred by KCWA member agencies.

TABLE 7.6-2

MONTEREY AMENDMENT TABLE A AMOUNT TRANSFERS AND RETIREMENTS

Transferring/Retiring Contractor	Transaction Type	Purchasing Contractor	Quantity (AF)
Semitropic Water Storage District[a]	Retirement	NA	3,000
Tejon-Castaic Water District[a]	Retirement	NA	900
Wheeler Ridge-Maricopa Water Storage District[a]	Retirement	NA	10,815
Improvement District No. 4[a]	Retirement	NA	4,330
Lost Hills Water District[a]	Retirement	NA	6,290
Belridge Water Storage District[a]	Retirement	NA	15,335
Dudley Ridge Water District	Retirement	NA	4,330
Belridge Water Storage District[a]	Transfer	Palmdale Water District	4,000
Belridge Water Storage District[a]	Transfer	Napa County Flood Control and Water Conservation District	4,025
Belridge Water Storage District[a]	Transfer	Solano County Water Agency	5,756
Belridge Water Storage District[a]	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	10,000
Belridge Water Storage District[a]	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	2,219
Berrenda Mesa Water District[a]	Transfer	Mojave Water Agency	25,000
Berrenda Mesa Water District[a]	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	7,000
Lost Hills Water District[a]	Transfer	Alameda County Flood Control and Water Conservation District – Zone 7	15,000
Wheeler Ridge-Maricopa Water Storage District[a,b]	Transfer	Castaic Lake Water District	41,000
Tulare Lake Basin Water Service District	Transfer	Antelope Valley – East Kern Water Agency	3,000
Tulare Lake Basin Water Service District	Transfer	Dudley Ridge Water District	3,973
Tulare Lake Basin Water Service District	Transfer	Alameda County Flood Control and Water Conservation District, Zone 7	400
Tulare Lake Basin Water Service District	Transfer	County of Kings	5,000
Tulare Lake Basin Water Service District	Transfer	Coachella Valley Water District	9,900

Notes:
a. Kern County Water Agency member agencies.
b. Pending resolution of a legal challenge.

Belridge WSD, Berrenda Mesa WD, Lost Hills WD and Wheeler Ridge-Maricopa WD are located on the western side of Kern County. Prior to construction of the SWP, agricultural land in Belridge WSD and Lost Hills WD was dry farmed or used for sheep grazing. Within Berrenda Mesa WD and Wheeler Ridge-Maricopa WD, agricultural lands were used for non-irrigated pasture or were irrigated with groundwater. Groundwater supplies were subject to quality and quantity problems. After completion of the SWP, irrigation systems were built or expanded in the four districts. However, some farmers in the districts were unable to operate their farms profitably for various reasons and consequently, the districts' allocations of SWP water were often not fully used.

Table 7.6-3 shows historical irrigated acreage for Belridge WSD, Berrenda Mesa WD, Lost Hills WD and Wheeler Ridge-Maricopa WD. Irrigated acreage varies depending on the availability of water. In years when it is expected that water will be in short supply, farmers typically plant fewer annual crops. Because irrigators in the four district's are heavily dependent on SWP supplies, irrigated acreage varies with the availability of SWP supplies in the four districts to a greater degree than it does elsewhere in the KCWA service area.

TABLE 7.6-3

HISTORICAL IRRIGATED ACREAGE IN FOUR DISTRICTS IN KERN COUNTY

Agency	1985	1990	1991	1995	1999	2001
Belridge WSD						
Annual crops	42,544	38,390	6,750	35,530	25,495	10,400
Permanent crops	5,179	5,730	5,570	6,310	20,545	27,785
All crops	47,723	44,120	12,320	41,840	46,040	38,185
Berrenda Mesa WD						
Annual crops	9,096	1,213	0	1,860	6,080	9,037
Permanent crops	29,988	29,379	28,146	24,736	25,110	20,814
All crops	39,084	30,592	28,146	26,596	31,190	29,851
Lost Hills WD						
Annual crops	39,562	26,372	3,520	39,545	36,065	22,700
Permanent crops	8,720	14,954	14,767	13,800	16,905	20,645
All crops	48,282	41,330	18,287	53,345	52,970	43,345
Wheeler Ridge-Maricopa WSD						
Annual crops	70,352	56,023	39,087	58,562	56,465	40,795
Permanent crops	27,531	26,123	25,369	27,923	36,938	40,425
All crops	97,883	82,146	64,456	86,485	93,403	81,220

Source: Kern County Water Agency.

In 1985, about 233,000 acres were irrigated in the four districts in a year when the agricultural contractors received all the SWP water that they had requested. Farmers were able to plant based on market conditions unlimited by water availability. In 1990, the agricultural contractors received only 50 percent of the SWP water they had requested and in 1991 they received no SWP water. Irrigated acreage dropped by about 15 percent and 45 percent in the four districts in 1990 and 1991 compared to 1985 conditions. In 1995 and 1999, agricultural contractors again received 100 percent of the SWP water they had requested. Irrigated acreage in the four member agencies rose again.

Irrigated acreage in years when agricultural contractors received their full SWP allocation before the Monterey Amendment (1985) and after the Monterey Amendment (1995 and 1999) are fairly similar. The average irrigated acreage in 1995 and 1999 for the four KCWA member agencies was about 216,000 acres, or about seven percent less than in 1985. This change is within a range that might be expected as prices for agricultural products fluctuate.

As noted above, some farmers within the four districts had been unable to use their full Table A amounts profitably prior to the Monterey Amendment. Some land, for which SWP water was available, had never been put into production because the total cost of water, land reclamation, and installation and operation of irrigation systems was greater than likely revenue from crops. Some formerly irrigated land had been taken out of production prior to the Monterey Amendment for economic reasons. Thus, some of the transferred Table A had never been used and part of it was associated with land that had been taken out of irrigated production prior to the Monterey Amendment.

There is no strong evidence to support a conclusion that a substantial amount of land was taken out of irrigated production in the four districts as a result of the Monterey Amendment. Any change in irrigated acreage potentially caused by the Table A transfers may have been masked by the change in the types of crops grown between 1995 and 2003. Some crops use less water than others. For example, a given water supply can irrigate more acres of tree crops than some annual crops such as alfalfa. Several CEQA documents prepared by the agencies that transferred Table A amounts state that no land was taken out of irrigated production as a result of the transfers.[10]

<u>Kings County</u>

Three water agencies in Kings County are SWP contractors, Kings County WD, Dudley Ridge WD and Tulare Lake Basin WSD. Dudley Ridge WD retired 4,330 AF of Table A amount as part of the 45,000 acre-foot retirement called for in the Monterey Amendment.

The only SWP contractor in Kings County that experienced a reduction in Table A amount is a result of the Monterey Amendment was Dudley Ridge WD. The district's Table A amount declined from 61,673 AF to 57,343 AF or by about 7 percent. The reduction is too small to have much effect on irrigated acreage.

<u>Impact Conclusions</u>

The proposed project had little or no impact on the acreage of irrigated land in the southern San Joaquin Valley. If any land was taken out of irrigated production it remained in agricultural use as dry farmed or fallow land and was not converted to water uses. No Prime, Unique or Farmland of Statewide Importance was converted to nonagricultural uses nor were conflicts created with respect to existing agricultural zoning or Williamson Act contracts as a result of the proposed project. The proposed project had a ***less-than-significant impact*** on the area of land irrigated in the southern San Joaquin Valley and on special status farmland between 1995 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

As a result of the Monterey Amendment, average annual deliveries of SWP water to agricultural contractors by 2020 would be expected to be five percent less than they would under the baseline scenario. The decrease in average future annual deliveries to agricultural contractors was caused by the provisions of the Monterey Amendment that altered water allocation procedures (Article 18) and enabled transfers of Table A amounts (Article 53).

The altered allocation procedures were implemented in 1995 and no further changes in the procedures would occur between 2003 and 2020. Two additional Monterey Amendment-related Table A transfers would occur between 2003 and 2020. For this analysis it was assumed that KCWA would transfer 12,000 AF of Table A amount to Coachella Valley WD and 4,000 AF to Desert WA. The transfers would be too small relative to KCWA's total water supply to have an appreciable effect on the acreage of irrigated land in Kern County.

The proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land and would not be converted to urban uses. No Prime, Unique or Farmland of Statewide Importance would be converted to non-agricultural uses nor would a conflict be created with respect to existing agricultural zoning or Williamson Act contracts as a result of the proposed project. The proposed project would have a ***less-than-significant impact*** on the area of land irrigated in the southern San Joaquin Valley or on special status farmland.

Mitigation Measures

None required.

ENDNOTES

1. A small portion of Tulare Lake Basin WSD lies within Tulare County.

2. California Department of Water Resources, *Draft Environmental Impact Report on Kern Water Bank Project*, 1986.

3. Kern County Water Agency, Annual Report, 2000.

4. Mills, Don, Kings County Water District, personal communication with Fan Lau, EIP Associates, March 14, 2005.

5. Graham, Brent, Tulare Lake Basin WSD, personal communication with Katy Ehrlich, Davis Research, May 26, 2006.

6. Besecker, Rick, Provost and Pritchard Engineering Group, managers of Dudley Ridge WD, personal communication with Katy Ehrlich, Davis Research, May 30, 2006.

7. Congressional Research Service, *California's San Joaquin Valley: A Region in Transition*. 2005.

8. Kern County, Department of Agriculture and Measurement Standards, Agricultural Crop Report, 2005.

9. Kings County, Department of Agriculture and Measurement Standards, Agricultural Crop Report, 2005.

10. Montgomery Watson, *Draft and Final Environmental Impact Report on Transfer of Water Entitlements from Berenda Mesa Water District for use in Dougherty Valley*, 1995 and 1996; Water Transfer Associates, *Draft and Final Supplemental Environmental Impact Report on Transfer of Water Entitlements from Berenda Mesa Water District for use in Dougherty Valley*, 1997; and Belridge Water Storage District, *Draft and Final Environmental Impact Report on Transfer of State Project Water Entitlements from Belridge Water Storage District, Lost Hills Water District and Wheeler Ridge-Maricopa Water Storage District*, 1998.

7.7 AIR QUALITY

7.7 AIR QUALITY

7.7.1 INTRODUCTION

7.7.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on air quality. Only some elements of the proposed project have the potential to directly affect air quality (see Table 7.7-1).

TABLE 7.7-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON AIR QUALITY

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Air emissions associated with changes in amount of agricultural land disturbance	7.7-1
Permanent transfers of water	Air emissions associated with changes in amount of agricultural land disturbance	7.7-1
Transfer of Kern Fan Element lands	Air emissions with construction and operation of percolation ponds, and transfer of Kern Fan lands	7.7-3
Water supply management practices	Air emissions associated with construction and operation of expended groundwater facilities outside service areas, and with changes in recreational traffic and boating as a result of water surface elevation changes	7.7-2, 7.7-4, 7.7-5, 7.7-6, 7.7-7
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Air emissions associated with development of 490 acres of land in Kern Fan Element	7.7-3
Watershed forum in Plumas	Air emissions associated with development of watershed improvement projects	7.7-8
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

No comment letters related to air quality were received in response to the NOP circulated for the proposed project.

7.7.1.2 Analytical Method

Air quality impacts related to criteria air pollutant emissions and toxic air contaminants were evaluated qualitatively and quantitatively. Factors considered in the analysis included how changes in agricultural practices could affect the amount of land disturbance, how changes in reservoir water surface elevations could alter shoreline erosion potential or affect boating uses and traffic, and potential for soil erosion as a result of watershed improvement projects.

The URBEMIS 2002 version 8.7.0 computer model was used to estimate construction reactive organic gasses (ROG) and nitrogen oxides (NO_x) emissions associated with groundwater bank facilities. For this analysis, it was assumed construction would generally occur over a four-month period (July through October) and would involve the following pieces of equipment on a daily basis: one crawler tractor, one grader, one off-highway truck, and one rubber-tired loader. The results were compared to San Joaquin Valley Air Pollution Control District's (SJVAPCD's) threshold for emissions, which is based on an annual (not daily) rate. The SJVAPCD assumes if all required particulate matter (PM_{10}) control measures are implemented according to its rules and regulations, PM_{10} impacts are not significant.

7.7.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, impacts on air quality would be considered significant if the proposed project would:

- conflict with or obstruct implementation of applicable air quality plans;
- violate any air quality standards or contribute substantially to an existing or projected air quality violation;
- cause cumulatively considerable net increases of any criteria pollutant for which an affected region is in non-attainment under applicable federal or state ambient air quality standards; or
- expose sensitive receptors to substantial pollutant concentrations.

7.7.2 ENVIRONMENTAL SETTING

7.7.2.1 State Water Project Area Environmental Setting

The SWP service area comprises a large portion of the State of California. The proposed project's environmental setting for air quality is broad, as air quality varies dramatically throughout the state based on factors such as population and topography. The federal government has divided the state into air basins that roughly follow the geography of a region.

The federal and state governments have set standards for "criteria air pollutants". An air basin may be further divided into "non-attainment areas" depending on whether there are areas in an air basin that do not meet the ambient air quality standards for various criteria air pollutants.

In California, the biggest air quality issues are those that deal with the criteria pollutants PM_{10} and ozone, as well as toxic air contaminants (TACs), which are not criteria air pollutants but can have acute and chronic effects.

7.7.2.2 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern and Kings Counties Including Kern Fan Element

All of the SWP's agricultural contractors are located in Kern County and Kings County except for Oak Flat WD.

Kern and Kings counties are in the San Joaquin Valley Air Basin (SJVAB). This air basin is in non-attainment of federal and state standards for both PM10 and ozone. The SJVAB also has areas where TACs are problematic. In 1995, the SJVAB was designated by the U.S. Environmental Protection Agency (EPA) as being in "serious" non-attainment for the federal one-hour ozone standard. No other federal ozone standard was in place at the time. This led to the preparation of the 1994 Ozone Attainment Plan, which was prepared by the local air agency and was adopted in November of 1994. The SJVAB was also in "serious" non-attainment of the federal PM_{10} standard and developed a plan to bring the basin into attainment of the standard.

In 1995, the State as a whole experienced health impacts from TACs, mostly from diesel particulate matter. At that time, Kern County had several areas where the estimated inhalation cancer risk was greater than 250 per million people.

Castaic Lake

Castaic Lake is located in Los Angeles County in the South Coast Air Basin (SCAB) which in 1995 was designated an "extreme" non-attainment of the federal one-hour ozone standard. The County was also considered to be in non-attainment of the federal PM_{10} standards. As with the counties in the San Joaquin Valley, TACs were also a problem in Los Angeles County, with the majority of TACs attributable to diesel particulate matter. In 1995, most of southern Los Angeles County had an estimated TAC inhalation cancer risk greater than 250 per million people.

Lake Perris

Lake Perris is located in Riverside County, which is also within the SCAB. In 1995, Riverside County had federal designations for ozone and PM_{10} that were identical to those of Los Angeles County. The western portion of the County, however, had areas with TAC inhalation risks greater than 250 per million people.

San Luis Reservoir

The San Luis Reservoir is located in Merced County, which is part of the SJVAB. In 1995 Merced County, along with Kern County, shared the SJVAB's "serious" non-attainment designations for the federal ozone and PM_{10} standards. The County had small pockets where the TAC inhalation risk was greater than 250 per million people.

Lake Oroville

Lake Oroville is located in Butte County. In 1995, Butte County was part of the Northern Sacramento Valley Air Basin (NSVAB). At that time, Butte County was considered "moderate" non-attainment for ozone and PM_{10}. An NSVAB Air Quality Attainment Plan was adopted in 1991 that addressed ozone, and, to a lesser extent, PM_{10}. As of January 1993, the local air district had not been able to completely adhere to the implementation schedule established in the ozone plan, although new rules and regulations were adopted. A Butte County Congestion Management Plan, which identified actions to reduce vehicle trips and associated air emissions, was adopted in 1992.[1]

7.7.2.3 Changes in Physical Setting between 1996 – 2003

Southern San Joaquin Valley portion of Kern and Kings Counties including Kern Fan Element

By 2003, the air basin's attainment status had been changed to "severe" nonattainment for the federal ozone standard. The SJVAPCD was also readying to petition the EPA to reclassify the Basin to "extreme" for one-hour ozone standard to allow the Basin more time to attain the standard. The Basin remained a "serious" non-attainment area for the federal PM_{10} standard. The Basin also remained a non-attainment area for State ozone and PM_{10} standards. The SJVAPCD thresholds of significance in 2003 was 10 tons/year of ROG, 10 tons/year NO_x, and an excess cancer risk of 10 in one million from TACs. Risk from diesel particulate matter in the Basin had improved since 1995, but areas still existed where TAC risk was high.

Castaic Lake

The Basin remained in non-attainment of federal ozone and PM_{10} standards, with an "extreme" non-attainment ozone designation. Los Angeles County was also non-attainment of the federal and State carbon monoxide (CO) standards. The Basin also did not attain the state ozone or PM_{10} standards.

Lake Perris

In 2003, Riverside County had federal and state designations for ozone, CO and PM_{10} that were identical to those of Los Angeles County, described above.

San Luis Reservoir

In 2003, Merced County had federal and state designations for ozone and PM_{10} that were identical to those of the rest of the SJVAB (i.e., serious" non-attainment area for the federal PM_{10} standard and non-attainment area for State ozone and PM_{10} standards.)

Lake Oroville

In 2003, Butte County was considered a moderate non-attainment area for the federal ozone standard in the NSVAB.

7.7.2.4 Regulatory Setting in 1995

Regulations related to air quality relevant to the proposed project area are described below.

Federal

The EPA is the federal agency responsible for setting and enforcing the federal ambient air quality standards for atmospheric pollutants. The EPA regulates emission sources that are under the exclusive authority of the federal government, such as aircraft, ships, and certain locomotives.

As part of its enforcement responsibilities, the U.S. EPA requires each state with nonattainment areas to prepare and submit a State Implementation Plan (SIP) that demonstrates the means to attain the federal standards. The SIP must integrate federal, state, and local plan components and regulations to identify specific measures to reduce pollution, using a combination of performance standards and market-based programs.

State

The California Air Resources Board (CARB), a part of the California Environmental Protection Agency (Cal EPA), is responsible for the coordination and administration of both federal and State air pollution control programs within California. In this capacity, the CARB conducts research, sets State ambient air quality standards, compiles emission inventories, develops suggested control measures, and provides oversight of local programs. The CARB establishes emissions standards for motor vehicles sold in California, consumer products (such as hairspray, aerosol paints, and barbecue lighter fluid), and various types of commercial equipment. It also sets fuel specifications to further reduce vehicular emissions. The CARB also has primary responsibility for the development of California's SIP, for which it works closely with the federal government and the local air districts.

Regional

Air Quality Districts

Numerous local agencies throughout California have jurisdiction over local air quality control. The agencies boundaries normally follow political boundaries. These local agencies, called "air quality management districts" or "air pollution control districts" are responsible for permitting many sources of air emissions and developing rules to regulate activities and operations that contribute to the degradation of air quality. Because they are regularly commenting agencies or responsible agencies, many districts also have produced guidance to help project applicants comply with CEQA. These guidance documents normally contain thresholds of significance for criteria pollutants. Thresholds of significance can vary significantly between agencies, but most thresholds are correlated to an air district's attainment plans for the criteria pollutants. Projects that have the potential to generate criteria pollutants in excess of local thresholds are considered significant.

San Joaquin Valley Air Pollution Control District

The western portion of Kern County (including the Kern Fan Element) and Merced County (San Luis Reservoir), which are in the SJVAB, are regulated by the SJVAPCD. The SJVAPCD sets thresholds of significance for emissions from construction and operational activities for projects. For construction activities, the SJVAPCD specifies that thresholds would not normally be exceeded as long as a project is complying with specific PM_{10} control measures. For operational activity, the SJVAPCD specifies a threshold of 10 tons/year of ROG, 10 tons/year of NO_x, and a cancer risk from TACs of greater than 10 in one million.

South Coast Air Quality Management District

Orange County, and portions of Los Angeles (Castaic Lake) and Riverside (Lake Perris) counties, fall under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). As with the SJVAPCD, the SCAQMD has thresholds of significance for project emissions. These thresholds are:

- 550 pounds per day of CO
- 75 pounds per day of volatile organic carbons (VOC)
- 100 pounds per day of NO_x
- 150 pounds per day of sulfur oxides (SO_x)
- 150 pounds per day of PM_{10}.

Butte County Air Quality Management District

Air quality in Butte County is regulated by the Butte County Air Pollution Control District (BCAPCD). The BCAPCD participates with the Sacramento Metropolitan Air Quality Management District and Sacramento Area Council of Governments in collaborative efforts to address regional ozone and PM_{10} air quality problems.[2] Thresholds of significance for air emissions established by the BCAPCD in 1995 were:[3]

- 137 pounds per day of CO
- 50 pounds per day of ROG
- 50 pounds per day of NO_x
- 80 pounds per day of SO_x
- 80 pounds per day of PM_{10}.

General Plans

General Plans of Riverside, Merced, Los Angeles, Kern, and Butte counties contain goals and policies to address air quality and pollutant emissions. Based on the impact analyses presented below, there are no aspects of the proposed project that would be considered inconsistent with general plan policies pertaining to air quality.

7.7.2.5 Changes in Regulatory Setting between 1996 – 2003

There have been no substantial changes in the regulatory framework since 2003 that would affect the analysis of air quality impacts. Changes in attainment status, which are relevant to annual emissions in the SJVAPCD and the types of construction and operational controls that must be implemented by projects, were noted above.

Plumas County General Plan

Plumas County

Plumas County is located within the jurisdiction of the Northern Sierra Air Quality Management District. The County is currently in attainment of all the federal standards for criteria air pollutants. The County also attains all of the State standards for criteria air pollutants with the exception of PM_{10}. The Portola Valley, located in the southeast portion of the County, is also in nonattainment of the State $PM_{2.5}$ standard.

7.7.3 IMPACTS AND MITIGATION MEASURES

7.7-1 Changes in the amount of agricultural land disturbance occurring in the southern San Joaquin Valley portion of Kern County resulting from reallocation of water supplies during droughts and/or permanent transfers could potentially affect the amount of PM_{10} emissions.

1996 — 2003

Agricultural activity, especially activity associated with the disturbance of soil, such as discing, can be a source of PM_{10}, which is a criteria pollutant. Both Kern and Kings counties are located in the SJVAB, which experiences unhealthy levels of PM_{10}.

The Monterey Amendment enables various changes in the way the California Department of Water Resources allocates water among contractors during times of shortage and surplus and enables agricultural contractors to retire and transfer a portion of their Table A amounts. The effect of these changes was to increase the reliability of water supplies but decrease the total amount of Table A water available to farmers in Kern County. The reliability and availability of agricultural water supplies is one factor that may contribute to the amount and types of crops and associated land disturbance activities.

It is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have reduced the frequency and type of land disturbance within the KCWA's boundaries. Consequently, associated PM_{10} emissions would have been limited or reduced. Therefore, thresholds adopted by the SJVAPCD would not have been exceeded on an annual basis. Therefore, the project would not cause a net increase in criteria air pollutants in a non-attainment area or conflict with an air quality plan. However, because no clear trend can be attributable to the proposed project that can be discerned for the period between 1996 and 2003, the proposed project's impact would be ***less than significant***.

Mitigation Measures

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in soil disturbance. Because associated PM_{10} emissions would not be expected to increase as a result of the proposed project, adopted thresholds would not be exceeded, and the proposed project's impact would be ***less than significant***. There would be no conflict with adopted air quality plans because there would be no increase in emissions that would adversely affect the region's attainment status.

Mitigation Measures

None required.

7.7-2 Article 56 conditions providing for development or expansion of groundwater storage facilities outside contractor service areas would result in land disturbance and pump operation, which could potentially generate PM_{10}, NO_x and diesel TAC emissions in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element).

1996 — 2003

The Monterey Amendment enables SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several contractors entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1996 and 2003, Semitropic WSD, Arvin-Edison WSD and the KWBA developed or expanded water banks. The water banking program developed by Semitropic WSD project involved the construction of a pipeline connecting the District's service area to the California Aqueduct. Arvin-Edison's water banking program involved the construction of 520 acres of percolation ponds at two sites referred to as the North Canal Spreading Works and the South Canal Spreading Works. Vacant land or cropland was converted to percolation ponds by the construction of one or two-foot high perimeter levees. The Semitropic facility was built prior to the Monterey Amendment. In 2002, the Kern Delta WD Water Banking and In-Lieu Water Supply Project involved the construction of new facilities including groundwater recharge basins, pipelines/canals and associated facilities to deliver supplies from the California Aqueduct to Kern Delta and the Arvin-Edison Canal, a pipeline to convey surface supplies to farmers in the eastern side of Kern Delta as part of an in-lieu banking program, and an extraction well field to recover stored groundwater and covey supplies back to the California Aqueduct. These new facilities were integrated into the existing water management system.

Construction of the groundwater storage facilities required the use of heavy-duty construction equipment. This equipment generated diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities also generated PM_{10}. Because the proposed project would have implemented all of the SJVAPCD's required PM_{10} control measures, PM_{10} construction emissions would be below SJVAPCD thresholds. Based on the amount of total acreage disturbed over that time period, NO_x and ROG emissions would not have exceeded SJVAPCD thresholds on an annual basis. Further, the emission of these pollutants was temporary because they lasted only as long as the construction was occurring.

Operation of a groundwater bank requires pumping to convey water to percolation ponds and to extract water from underground. These pumps would not have existed prior to the creation of the new groundwater banks. However, electric motors that were used for the pumps would be relatively pollution-free. Diesel engines used for back-up power would emit ROG, NO_x and diesel particulate, but emissions would be infrequent, and it is unlikely that sensitive receptors would be close enough to the pumps to be affected by diesel TAC.

Therefore, because the proposed project did not result in a net increase in criteria air pollutants over SJVAPCD annual thresholds in a non-attainment area, and there would have been no conflict with implementation of the adopted air quality plan for the region, this is considered to be a ***less-than-significant impact***. Further, any construction-related emissions would have been temporary. Operational emissions would not have exceeded adopted criteria.

Mitigation Measures

None required.

Future Impacts

The Monterey Amendment enables SWP contractors to store water outside their service areas for later use within their service areas. Several contractors have entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1996 and 2003, water banks were developed, and 520 acres of percolation ponds were constructed. It is expected that in the future, contractors would increase their use of groundwater banks. If future increased groundwater banking involved active recharge, then new percolation ponds would be built. For purposes of the analysis, it is assumed a similar amount of ponds (approximately 500 acres) would be constructed.

Construction of the percolation ponds would involve the use of heavy-duty construction equipment, which would generate diesel particulate matter (a TAC), as well as ozone precursors, ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities would also generate PM_{10}. During construction, the proposed project would be required to implement all of the SJVAPCD's PM_{10} control measures; therefore, construction emissions would be below SJVAPCD thresholds. Assuming a similar amount of land disturbance in the future, ROG and NO_x emissions would not exceed SJVAPCD standards. Further, emissions would be temporary, because they would last only as long as the construction was occurring.

Operation of a groundwater bank would require pumping to convey water to percolation ponds and to extract water from underground. Electric motors would be relatively pollution-free. The only impacts would be construction-related.

Therefore, because the proposed project would not result in a net increase in criteria air pollutants over SJVAPCD annual thresholds in a non-attainment area, and, as a result, there would no conflict with implementation of the adopted air quality plan for the region, this is considered to be a ***less-than-significant impact***. Further, any construction-related emissions would be temporary. Operational emissions, which would generally be limited to electric pumps, would not exceed adopted criteria.

Mitigation Measures

None required.

7.7-3 Construction of KWBA percolation ponds and canal and operation of the pumping facilities resulting from the transfer of Kern Fan Element lands could potentially generate air pollutant emissions.

1996 — 2003

In 1995, KWBA constructed 3,034 acres of recharge ponds. From 1998 through 2003, an additional 4,080 acres were converted to shallow percolation ponds, for a total of 7,114 acres in 2003 in the Kern Fan Element. The KWBA also constructed the Kern Water Bank Canal, a 6-mile long earthen canal extending fro the Kern River to the California Aqueduct. Elsewhere in Kern County, outside of the Kern Fan Element, approximately 520 acres of percolation ponds were developed as part of other groundwater storage projects.

Construction of the percolation ponds, canal, and other facilities required the use of heavy-duty construction equipment. This equipment generated diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities also generated PM_{10}. Because the proposed project would have implemented all of the SJVAPCD's suggested PM_{10} control measures, PM_{10} construction emissions would be below SJVAPCD thresholds. Based on a conservative assumption of 800 acres per year of soil disturbance to construct the ponds, NO_x and ROG emissions would not have exceeded SJVAPCD thresholds. Further, the duration of construction-generated air pollutant emissions was limited to the construction periods only.

Operation of the facilities requires pumping to convey water to percolation ponds and to extract water from underground. With the proposed project, there would have been increased pumping to convey water through the system, as compared to pre-project conditions. While electric pump use would have increased, this would not have increased air emissions, as electric pumps are relatively pollution-free.

Therefore, because the proposed project did not result in a net increase in criteria air pollutants over SJVAPCD annual thresholds in a non-attainment area, there would have been no conflict with implementation of the adopted air quality plan for the region. This is considered to be a ***less-than-significant impact***. Further, any construction-related emissions would have been temporary. Operational emissions would not likely have exceeded adopted criteria.

Mitigation Measures

None required.

Future Impacts

Between 1996 and 2003, the KWBA built approximately 4,700 acres of shallow percolation ponds in the Kern Fan Element as part of a groundwater recharge project designed to take advantage of one of the provisions of the Monterey Agreement. The Habitat Conservation Plan for the Kern Fan Element allows developed uses on about 4,000 acres of the Kern Fan Element.[4] Developed uses include farming, permanent facilities for the Kern Water Bank and commerce. Approximately, 490 acres is designated for possible commercial use. Between 1995 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel, so under the proposed project the parcel would remain undeveloped. In the future, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds.

Construction of the 1,200 acres of percolation ponds would require earthmoving and the use of heavy-duty construction equipment. The KWBA would be required to comply with all the SJVAPCD suggested control measures for the reduction of PM_{10} during construction. This would reduce PM_{10} emissions to levels that are less-than-significant, as addressed in the SJVAPCD CEQA Guide for Assessing and Mitigating Air Quality Impacts. Based on the average amount of acreage disturbed on an annual basis between 1995 and 2003, it is unlikely that the entire 1,200 acres would be converted in one year. Therefore, the amount of ROG and NO_x emissions would not exceed the SJVAPCD thresholds.

The operation of these percolation ponds would require pumping to convey water to the ponds and to extract water from underground. Electric pumps would be relatively clean, and would generate few emissions. Diesel-powered pumps could be used for temporary emergency power, which would generate mostly NO_x and diesel TAC. However, diesel generator use would be infrequent, and it is unlikely that sensitive receptors would be close enough to the pumps to be adversely affected by diesel TAC. Operational emissions would, therefore, not be substantial.

Construction activities would represent the greatest source of air emissions. Because construction emissions would not generate levels of PM_{10}, ROG or NO_x in excess of SJVAPCD thresholds, the proposed project would not result in a net increase in criteria air pollutants in a non-attainment area that could conflict with implementation of the adopted air quality plan for the region. This is considered to be a ***less-than-significant impact***.

Mitigation Measures

None required.

7.7-4 Water supply management practices that allow greater flexibility in reservoir storage would result in fluctuations in water levels at Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville which could potentially alter the amount of recreational boating at the reservoirs, which could affect ROG emissions.

1996 — 2003

Article 54 of the Monterey Amendment allowed SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions. Article 56 of the Monterey Amendment allowed SWP contractors to store water in San Luis Reservoir when storage space in excess of that needed for SWP operations is available. As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, the borrowing of water lowered the water surface elevations in Castaic Lake and Lake Perris relative to what they would have been in the absence of borrowing, and there was little effect on average water surface elevations in the post-Monterey Amendment period. Average water surface elevations at the two lakes were actually higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1996 to 2003 was about 23 feet higher than between 1974 and 1995. At Lake Perris, the average surface water elevation was about four feet higher during the same period. The increases at Castaic Lake and Lake Perris were probably attributable to a series of wet years that occurred in the late 1990s, and also as a result of an alteration in reservoir operations designed to accommodate Article 54 borrowing. The range of water level fluctuations were also within the range of historic operating condition fluctuations.

At Lake Oroville and San Luis Reservoir, the changes in the amount of water stored were small and insufficient to have much effect on water surface elevations (see Impact 9.1-4 in Section 7.1).

Recreational boats with engines contribute a disproportionately large amount of emissions to the statewide emissions inventory. The recreational boat category accounts for approximately nine percent of the total ROG emissions from off-road sources statewide according to the CARB's 2003 inventory. This is mostly due to the fact that recreational boats have traditionally not been subject to the same amount of regulation as many other sources. The amount of recreational boat use usually increases with increasing water levels at reservoirs where people normally participate in these types of recreational activities. Conversely, boating decreases when water levels are lower.

Higher water surface elevations tend to create more opportunities for recreational boating and can increase the number of hours these types of vehicles were used. Greater emissions of ROG would have been associated with this greater use of recreational boats, if boating use increased above and beyond previous levels in response to more times when water levels were higher. To exceed the SJVAPCD threshold of significance of ten tons per year for ROG, boat use would have had to increase by approximately eight percent statewide. It is unlikely that higher surface water levels at the reservoirs resulted in increased recreational boat activity that increased statewide use by eight percent or more. Consequently, this would have been a ***less-than-significant impact*** because it would not have exceeded thresholds that would have adversely affected attainment for the air basins.

Mitigation Measures

None required.

Future Impacts

As discussed above, the amount of recreational boat use usually increases with increasing water levels at reservoirs where people normally participate in these types of recreational activities. Conversely, boating decreases when water levels are lower.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions. Article 56 of the Monterey Amendment allows SWP contractors to store water in San Luis Reservoir when storage space in excess of that needed for SWP operations is available. Borrowing of water by contractors has the potential to lower the water surface elevations at Castaic Lake and Lake Perris. Because the difference in water storage would be small in Lake Oroville and San Luis Reservoir (see Impact 7.1-4B in Section 7.1), there would be little, if any, effect on water surface elevations.

Operation of the reservoirs would result in similar fluctuations as those recorded for the period between 1996 and 2003 and are expected to be within the range of more recent (post-Monterey) historical fluctuations. Analysis of reservoir levels for future SWP operations indicate that reservoir water surface elevations would likely be similar to historical recorded reservoir levels. Because future water surface elevation changes would not differ substantially from 1995 conditions, the amount of boating that would generate emissions would be similar. However, as discussed in Sections 7.1 and 7.9, the proposed project could result in changes to water levels in Castaic Lake and Lake Perris greater than those recorded in the past.

Boating would likely be the same as baseline conditions or could decrease due to drawdown conditions at Castaic Lake and Lake Perris. Therefore, boating emissions would not exceed thresholds and would not conflict with the regional air quality plan. Consequently, this would result in a ***less-than-significant impact***.

Mitigation Measures

None required.

7.7-5 Fluctuation in water levels at Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville in response to water supply management practices that provide greater storage flexibility could potentially alter the amount of recreational uses at the reservoirs, which could affect vehicle emissions associated with travel to and from the reservoirs.

1996 — 2003

As discussed in Impact 7.7-4, higher water surface elevations at Castaic Lake and Lake Perris, could have created more opportunities for recreational activities. This could have increased the number of vehicle trips to and from the reservoirs on a seasonal basis that would, in turn, result in increases in traffic-generated ROG and NO_x emissions on a seasonal basis. However, it is unlikely that the number of vehicles would have substantially increased to levels where emissions thresholds would have been exceeded on a permanent basis such that there would have been a conflict with the adopted air quality attainment plan. At Lake Oroville and San Luis Reservoir, the changes in the amount of water stored were small and insufficient to have much effect on water surface elevations (see Impact 7.1-4 in Section 7.1), so recreation-related vehicle traffic air emissions would not be substantially affected. Therefore, this would have been a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As discussed in Impact 7.7-4, borrowing of water by contractors has the potential to lower the water surface elevations at Castaic Lake and Lake Perris, while water levels at San Luis Reservoir and Lake Oroville would exhibit little, if any, change.

As discussed in Sections 7.1 and 7.9, the proposed project would not result in changes to the reservoir levels beyond those recorded in the past most of the time. Operation of the reservoirs would result in similar fluctuations as those recorded for the period between 1996 and 2004. Therefore, the reservoirs are expected to be within the range of more recent (post-Monterey) historical fluctuations. Analysis of reservoir levels for future SWP operations indicate that reservoir water surface elevations would be similar to historical recorded reservoir levels. However, future water surface elevations at Castaic Lake and Lake Perris could be lower than 2003 conditions, and, therefore, the amount of recreation-generated traffic would be expected to decrease.

With little, if any, net increase in traffic volumes, there would be less potential for generating ROG and NO_x emissions that would exceed district thresholds. Therefore, there would be a negligible effect on basin attainment status. Consequently, this would result in a ***less-than-significant impact***.

Mitigation Measures

None required.

7.7-6 Fluctuation in water surface elevations at Castaic Lake and Lake Perris as a result of flexible storage and extended carryover practices could potentially alter the amount of shoreline exposed to wind erosion, which could generate wind-blown particulate emissions.

1996 — 2003

As described in Impact 7.7-4, average water surface elevations at Castaic Lake and Lake Perris were higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1995 to 2003 was about 23 feet higher than between 1974 and 1995. At Lake Perris, the average surface water elevation was about 4 feet higher during the same period. The increases at Castaic Lake and Lake Perris were probably attributable to a series of wet years that occurred in the late 1990s, and also as a result of an alteration in reservoir operations designed to accommodate Article 54 borrowing. The range of water level fluctuations at Castaic Lake and Lake Perris were also within the range of historic operating condition fluctuations.

For Castaic Lake and Lake Perris, the higher water elevations would have reduced the amount of shoreline exposed to wind erosion, which would have reduced particulate emissions during those periods. Therefore, because there would not be more shoreline exposed to wind erosion, which could be a source of dust emissions, thresholds would not be exceeded, and the impact would be ***less than significant.***

Mitigation Measures

None required.

Future Impacts

As noted earlier, Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions. The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would draw down the reservoirs to a greater extent than occurred between 1996 and 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoirs would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1).

If the worst-condition were to occur, the reduction in reservoir elevations would expose soil to wind. Because the soils at Castaic Lake are characterized as clays; the exposed soil would be subject to limited wind and/or water erosion potential and therefore, limited levels of particulate matter would be generated. Soils at Lake Perris are characterized as sandy which would be subject to increased rates of wind-induced soil erosion and associated particulate matter emissions. Due to the size of the air quality basin in comparison to Lake Perris, the dense population of the area, and the relatively high levels of pollutants normally found in the area, it would be difficult to determine what effects an extended drawdown at Lake Perris would have on air quality. Therefore, the potential for wind erosion of soil at Lake Perris could be greater under future conditions than baseline conditions. Mitigation measures such as hydroseeding or spraying water over exposed soils would be economically and physically infeasible because of the potential area of exposed soils and scale of effort to reduce wind erosion. Therefore, impacts would be ***potentially significant and unavoidable***.

<u>Mitigation Measures</u>

None available.

7.7-7 Fluctuation in water surface elevations at San Luis Reservoir and Lake Oroville as a result of flexible storage and extended carryover practices could potentially alter the amount of shoreline exposed to wind erosion, which could generate wind-blown particulate emissions.

1996 — 2003

At Lake Oroville and San Luis Reservoir, the changes in the amount of water stored were small and insufficient to have much effect on water surface elevations (see Impact 7.1-4 in Section 7.1). The amount of shoreline exposed to wind erosion would not have differed substantially from pre-Monterey conditions. Therefore, because there would not be more shoreline exposed to wind erosion, which could be a source of dust emissions, thresholds would not be exceeded, and the impact would be ***less than significant.***

<u>Mitigation Measures</u>

None required.

Future Impacts

Article 56 of the Monterey Amendment allows SWP contractors to store water in San Luis Reservoir when storage space in excess of that needed for SWP operations is available. In the future, contractors can be expected to continue to take advantage of Article 56 of the Monterey Amendment and store water in San Luis Reservoir when storage space in excess of that needed for SWP operations is available. As noted in Impact 7.7-4, water surface elevations in Lake Oroville and San Luis Reservoir would show little change. Therefore, the amount of shoreline exposed to wind erosion, which would be a source of particulate dust emissions, would not differ substantially in the future. Therefore, because there would not be more shoreline exposed to wind erosion, which could be a source of dust emissions, thresholds would not be exceeded, and the impact would be ***less than significant.***

Mitigation Measures

None required.

7.7-8 Construction and operation of watershed improvements in Plumas County could potentially generate air pollutant emissions.

1996 — 2003

Because the Settlement Agreement was not completed in this period, there were no watershed improvement project as a result of the proposed project and there was ***no impact***.

Mitigation Measures

None required.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the stability of stream banks and native vegetation by returning them to a more natural condition. The types of projects that are anticipated would include stream restoration (revegetation of stream banks and removal of non-native species, for example), preventing stream down-cutting and gullying through the creation of a series of ponds and drop structures, well drilling, and unpaved road improvements to reduce erosion and sedimentation.

Construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting), which could require the use of heavy-duty construction equipment. The heavy equipment would be a source of diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities could also generate PM_{10}. The number and size of watershed improvement projects that would result from the proposed project are relatively small, and the number of pieces of heavy equipment operating at any one time and the amount of acreage disturbed on a daily basis would be commensurately limited. Therefore, emissions would not be substantial. Further, air emissions would be temporary and would occur only as long as the construction activities, so there would be no adverse, permanent effect on air quality in the region.

Additionally, the projects would be expected to improve soil erosion conditions along a few miles of streambank in a county with thousands of miles of stream channels, such that the potential for wind-generated PM_{10} emissions from exposed soils would ultimately be reduced over the long-term. Therefore, this is considered a ***less-than-significant impact.***

Mitigation Measures

None required.

ENDNOTES

1. City of Chico, *Master Environmental Assessment for Chico General Plan*, Section 7 (Air Quality), January 1994.

2. City of Chico, *Master Environmental Assessment for Chico General Plan*, Section 7 (Air Quality), January 1994.

3. Butte County Planning Department, Gateway Chico Project Draft Program EIR, April 1994, p.44.

4. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, October 1997.

7.8 GEOLOGY, SOILS, AND MINERAL RESOURCES

7.8 GEOLOGY, SOILS, AND MINERAL RESOURCES

7.8.1 INTRODUCTION

7.8.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement related to geologic soil conditions, and mineral resources. Only some elements of the proposed project have the potential for direct impacts related to geology and soils. The elements of the proposed project with the potential to have impacts directly related to geology and soils are shown in Table 7.8-1. Although the proposed project would result in percolation pond construction in Kern County, the operation of the percolation ponds would result in no impact to existing mineral resources in the area, including oil and gas extraction. Therefore, no further analysis of current mineral resources is presented in the section.

TABLE 7.8-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON GEOLOGY, SOILS, AND MINERAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes in soil erosion with changes in agricultural practices	7.8-1
Permanent transfers of water	Changes in soil erosion with changes in agricultural practices	7.8-1
Transfer of Kern Fan Element lands	Changes in soil erosion with changes in agricultural practices and construction activities	7.8-3
Water supply management practices	Changes in soil erosion with changes in reservoir levels, agricultural practices, and construction activities	7.8-2, 7.8-4, 7.8-5
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	7.8-3
Watershed forum in Plumas	Changes in soil erosion with construction activities	7.8-6
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

No comment letters related to geology, soils, or mineral resource impacts were received in response to the NOP circulated for the proposed project.

7.8.1.2 Analytical Method

The analysis of potential geologic and soils impacts throughout the proposed project areas was based on *Geology of California*, Second Edition, by Robert M. Norris and Robert W. Webb, information from the *Natural Resources Conservation Service* (formerly the U.S. Soil Conservation Service); a large variety of publicly available technical reports, as well as published information describing the project SWP facilities and their geologic characteristics. The information obtained from these sources was reviewed and summarized to establish existing conditions and to identify potential environmental effects, based on the standards of significance presented in this section. In determining the level of significance, the analysis assumes that the proposed project would comply with relevant federal, State, and local regulations governing seismic safety, and hazards associated with unstable soils.

7.8.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, a significant impact related to geology and soils would occur if the proposed project would:

- result in substantial soil erosion or the loss of topsoil; or
- be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse.

7.8.2 ENVIRONMENTAL SETTING

7.8.2.1 State Water Project Area Environmental Setting

The geological setting in the regions which the project traverses is varied and complex. Realistically, the geological setting for the SWP is equivalent to describing the geological setting for most of the state of California. The SWP traverses six of the 12 geomorphic provinces in California: the Sierra Nevada, the Great Valley, the Coast Ranges, the Transverse Ranges, the Peninsular Ranges, and the Colorado Desert. These geomorphic provinces are based on landforms and late Cenozoic structural and erosional history.[1]

7.8.2.2 Physical Setting in 1995

Southern Portion of San Joaquin County Including Kern Fan Element

The San Joaquin Valley basin is bordered to the south and east by the Sierra Nevada and Tehachapi mountains, which are composed of crystalline igneous and metamorphic rock. Exposed consolidated marine sedimentary rock from the Coast Range are evident in the layer of sediment above bedrock underlying the San Joaquin basin. The Kern Fan Element is a large, deep, and asymmetrical sedimentary basin located in the southern portion of the San Joaquin Valley.

The marine sedimentary rock is overlain by a thick series of continental rocks and semi-consolidated to unconsolidated sediments. These sediments are several thousand feet thick under the Kern Fan Element, and encapsulate the primary groundwater basin. The portion of this sediment that is usable for groundwater storage is located above the base of the fresh water in the basin. This area of the groundwater basin is dominated by the alluvial fan and lake material that comprise the Kern Fan Element. Further, groundwater development is limited to the upper portions of the fresh water aquifer system in this basin.

The southern San Joaquin Valley, including the Kern Fan Element is dominated by the alluvial fan deposited by the Kern River, and consists of thick deposits of sand and gravel with extensive but discontinuous silt and clay beds.[2] The sand and gravel deposits are remnants of old streambed channels which generally occur in long, winding, and interconnecting stingers and sheets that are prevalent throughout the Kern Fan Element, but less evident along its borders. These sand and gravel deposits are highly permeable, but are imbedded with less permeable areas comprised of fine-grained silt and clay deposits. These silt and clay deposits are more extensive along the edges of the alluvial fan and in some areas may intersect with clay beds deposited in lakes. In general, the upper layers of the alluvial fan deposits form an unconfined to semi-confined aquifer system that provides a large amount of groundwater recharge area.

Soils in the southern portion of the San Joaquin Valley, including the Kern Fan Element, range from highly permeable, coarse sandy soils to silty loam with very low permeability.[3] In general, the soils present are characterized as deep, well-drained sandy loam that have moderate to rapid permeability with low water retention, and have a slight erosion potential. These soils are interspersed with pockets of clay deposits that are characterized by low-permeability and are often associated with saline-alkali conditions.[4]

Castaic Lake

Castaic Lake is located in an area characterized by a series of mountain ranges in an east-west orientation that stretch directly across the dominant northwest trend of the other major structural and geomorphic features in the state. Castaic Lake is surrounded by the Sierra Pelona range to the east, the Piru mountains to the south, and the Pine and Topatopa mountains to the west. The topography in Castaic Lake is composed of steep hillsides with incised valleys originally formed by the confluence of Elizabeth Canyon Lake and Castaic Creeks.

Castaic Lake geological formations consist of stream channel alluvium and marine shales, mudstones, siltstones, and fine sandstones of the upper Miocene Castaic Formation. Evidence of deformation of the Castaic Formation is visible in the folding of the well-developed bedding in the sediments of nearby deposits. Further, irregular topography of nearby hills suggest considerable sliding, slumping, flow, and creep within these rocks.

Soils in the Castaic Lake area include stream channels and mountain slopes that are significantly different from one another. The stream channel deposits consist of sand, gravel, and cobbles that have high permeability. On the other hand, the mountain slopes consist of soils that contain clay, silty clay, and silty loams. These mountain deposits have a low to moderately rapid permeability and have a high soil erosion potential. On a site visit in April 2007, California Department of Water Resources (Department) staff observed a major landslide that occurred along the northeastern shore of the lake in 2005 and other areas where wind-wave erosion has formed cuts into the hillsides and induced slumping.

Lake Perris

Lake Perris is located in Riverside County, east of Interstate 15 in the Alessandro Valley. This area is part of the Peninsular Ranges physiographic province of California, which is characterized by steep, elongated ranges and valleys that lie in a northwesterly direction. Lake Perris is located in a structural upland known as the Perris Plain, a highly eroded, faulted mass of crystalline rock that has been stream-cut into valleys deeply filled with ancient alluvial deposits. Lake Perris is generally defined by a natural bowl, with a gently sloping topography towards the west, where the dam is located.

Soils in the Lake Perris area are generally derived from unconsolidated granitic alluvium derived from local igneous parent material. In general, the soils of the Perris Plain are fine- to medium-grained valley soils that develop shallow slopes, basins, old terraces, and alluvial fans. Soil classifications in this area include loam and sandy loam. These soils exhibit a relatively rapid permeability, but in some areas these soils have a moderately high runoff due to an impervious clay layer found at a depth of approximately two to four feet.

San Luis Reservoir

San Luis Reservoir was built on the border of the Eastern Franciscan and Sierran Blocks, two major formations of late Mesozoic and Cenozoic sedimentary rocks, where geologists have identified the Coast Range Thrust Zone.[5]

Soils in the San Luis Reservoir area include mountain slopes that are significantly different from one another. Mountain slopes to the east consist of soils characteristic of the terraces adjacent to the western edge of the San Joaquin Valley and on the foothills of the Coast Range. These soils on the eastern side of San Luis Reservoir are very deep to moderately deep, gently to strongly sloped, well drained soils that have high organic matter content on the foothills. The mountain slopes and the valleys to the west consist of shallow to moderately deep, steep and very steep, well drained to excessively drained soils with rock outcrops. These mountain deposits have a low to moderately rapid permeability and a relatively high soil erosion potential.

Lake Oroville

Lake Oroville is located in the western Sierra Nevada foothills, within the metamorphic belt of the Sierra Nevada geomorphic province. Most of the reservoir is situated within Mesozoic volcanic and metavolcanic rocks, with some areas of older (Paleozoic) metavolcanic rocks to the north. The eastern part of Lake Oroville is adjacent to granitic plutons associated with the Sierra Nevada Range.[6] The reservoir lies in an area that historically experienced relatively low seismic activity. The only known active fault in the area is the Cleveland Hill fault, approximately three miles from the dam, which ruptured in August 1975 and caused a magnitude 5.7 earthquake.

Soil profiles in the volcanic and metavolcanic rocks underlying the reservoir tend to be thick, while thin profiles are present on the granitic rocks to the east. The thinner soil profiles are readily eroded by wave/wind action. The amount of bank erosion for a particular length of shoreline is closely related to the underlying geologic material, soil cover, and wave/wind action. Moderately sloping banks, most prevalent in the main basin, are generally more susceptible to wave action from wind currents across a wide expanse of water, and from wave action caused by recreational powerboats. Lower elevations within the reservoir fluctuation zone are exposed to erosion less frequently than those areas near the normal maximum pool level.

Landslides are numerous along the banks of Lake Oroville and continue into the depths of the lake. However, the amount of material derived from active landslide activity is minimal when compared to the amount of incoming watershed sediment and material derived from shoreline erosion.[7]

7.8.2.3 Changes in Physical Setting between 1996 and 2003

Geological and soil conditions generally do not change within a short period of time and, therefore, the environmental setting described under 1994 conditions for southern San Joaquin Valley portion of Kern County (including the Kern Fan), Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville are generally the same under 2003 conditions.

Lake Perris

In 2005, the Department identified potential seismic safety risks in a section of the foundation of Perris Dam. While there is no imminent threat to life or property, in the interest of ensuring the maximum public safety for those using and living downstream of the lake, the Department decided to lower the water level approximately 25 feet while additional analysis was performed. This lowering is not related to the Monterey Amendment or Settlement Agreement water transfers.

Following an independent expert analysis, the Department announced in October 2005 it will move ahead with plans to repair Perris Dam. The Department is currently evaluating the best and most feasible repair alternatives to address the seismic concerns at Perris Dam. The decision on a preferred repair alternative was made earlier this year. In 2006, The Department decided to further reduce water levels to 60 percent full and observe other areas of the dam structure. It is expected that design work, environmental documentation and permitting will take approximately two to three years, followed by construction work. The Department estimates that all activities related to this project will be done by 2012.

Concurrently, the Department is performing a reconnaissance-level study to evaluate a wide range of options for the future long term use of the facility. This initial study is intended to narrow the possible options and may initiate further detailed studies of one or more preferred alternatives. Because these activities are temporary, these changes to Lake Perris are not used in the following analysis but will be evaluate in a separate project-specific environmental document.

Plumas County

Plumas County is located in the northern part of the Sierra Nevada geomorphic province. The Sierra Nevada province starts in the north at Lassen Peak in the Cascade Range and continues to the south where it meets the Tehachapi Mountains. The Sierra Nevada province is comprised principally of Cretaceous granitic plutons; remnants of Paleozoic and Mesozoic metavolcanic and metasedimentary rocks, and Cenozoic volcanic and sedimentary rocks. The Paleozoic and Mesozoic metavolcanic and metasedimentary rocks were intruded by the granitic plutons approximately 77 to 225 million years ago, resulting in local uplift and deformation of the overlying older rock. Regional uplift and rapid erosion of most of the overlying metamorphic rocks closely followed intrusion of the plutons, exposing the underlying granitic rocks. Continued uplift and erosion, accompanied by volcanic activity and alpine glaciation resulted in the present pattern of deep-walled valleys that characterize the Sierra Nevada.[8]

The Diamond Mountains and Sierra Nevada Range traverse through the County in a northwesterly direction. The Diamond Mountains dominate the eastern portion of the County, while the Sierra Nevada Range dominates the southwestern portion of the County. Between the two mountain ranges is the Plumas Trench. Several faults have resulted in the uplift of the Diamond and Sierra Nevada ranges, with the northwesterly tending Melones fault traversing through the County and forming the major structural boundary between the two ranges. Many of the valleys formed from this fault and were once filled with glacial lakes. The glaciers eroded the underlying granitic rocks on the mountain peaks and formed a vast alluvial meadow system in the headwaters of the Feather River.[9]

The soils in the valleys or low-lying areas of Plumas County are dominated by highly erodible granitic and sedimentary deposits.[10] To date, there have been no soil surveys conducted by the U.S. Department of Agriculture, National Resources Conservation Services (NRCS) for Plumas County. However, an erosion study conducted by the USDA has shown that soils in Plumas County have low permeability and are prone to erosion from storm water runoff.[11]

7.8.2.4 Regulatory Setting in 1995

Regulations related to geologic hazards and soil erosion relevant to the proposed project are described below.

Federal

There are no applicable federal regulations pertaining to seismic hazards or soil erosion applicable to the proposed project.

State

Major State regulations include the California Code of Regulations, Title 24, Part 2, the *California Building Code* and California Public Resources Code, Division 2, Chapter 7.8, the *Seismic Hazards Mapping Act*. Both these regulations apply to public buildings and a large percentage of private buildings intended for human occupancy. The California Building Code (CBC) is based on the Uniform Building Code (UBC), which is used widely throughout United States (adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous more detailed and/or more stringent regulations.

<u>Other Geotechnical Considerations</u>

Chapter 18 of the CBC regulates the excavation of foundations and retaining walls, and Appendix Chapter 33 regulates grading activities, including drainage and erosion control, and construction on expansive soils. Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal-OSHA regulations (Title 8 of the CCR) and in Section A33 of the CBC.

Other State regulations pertaining to the management of erosion and sedimentation are described in Section 7.1. Although the primary purpose of these regulations and standards is the protection of surface water resources from the effects of land development (such as turbidity caused by sedimentation), measures included in such regulations and standards also reduce the potential for erosion and soil loss resulting from construction activities. Such regulations include, but are not limited to, the National Pollutant Discharge Elimination System (NPDES) program for management of construction and municipal stormwater runoff, which is part of the federal CWA and is implemented at the State and local level through issuance of permits and preparation of site-specific pollution protection plans. Sections 1600 through 1607 of the CDFG

Code regulates activities that would alter stream characteristics, including sedimentation caused by erosion.

Local

General Plans of Riverside, Merced, Los Angeles, Kern, and Butte counties contain goals and policies to address potential hazards associated with geologic and soil constraints. Based on the impact analyses presented below, there are no aspects of the proposed project that would be considered inconsistent with general plan policies pertaining to geotechnical hazards or safety.

7.8.2.5 Changes in Regulatory Setting between 1996 and 2003

There has been no change in geology and soils regulations. Therefore, the regulatory setting described under 1995 conditions applies to 2003.

7.8.3 IMPACTS AND MITIGATION MEASURES

7.8-1 Implementation of the proposed project could potentially change rates of erosion in the southern San Joaquin Valley portion of Kern County as a result of changes in agricultural practices.

1996 — 2003

The Monterey Amendment enables various changes in the way the Department allocates water among contractors during times of shortage and surplus and enables agricultural contractors to retire and transfer a portion of their Table A amounts. The effect of these changes was to increase the reliability of water supplies but decrease the total amount of Table A water available to farmers in Kern County. The reliability and availability of agricultural water supplies is one factor that may contribute to the amount and types of crops and associated land disturbance activities.

It is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have reduced the frequency and type of land disturbance within the KCWA's boundaries. Consequently, associated wind-generated erosion would have been limited or reduced.

Although changes in agricultural practices potentially altered the rate of soil erosion within the KCWA's boundaries, the changes would not be considered significant. Furthermore, soils in Kern County can generally be characterized as being slightly erodible; therefore, this impact is considered ***less than significant***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Therefore any change in agricultural practices would not be expected to result in a dramatic change in soil disturbance and associated wind-generated erosion.

Although changes in agricultural practices could potentially alter the rate of soil erosion within the KCWA's boundaries, the changes would not be considered significant. Furthermore, soils in Kern County can generally be characterized as being slightly erodible; therefore, this impact is considered ***less than significant***.

Mitigation Measures

None required.

7.8-2 Implementation of the proposed project could potentially change rates of erosion in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) as a result of construction of new groundwater storage facilities.

1996 — 2003

The Monterey Amendment enabled SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several M&I contractors have entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1996 and 2003, Semitropic WSD, Arvin-Edison WSD and the Kern Water Bank Authority (KWBA) developed or expanded water banks.[12] The water bank developed by the KWBA is discussed separately under Impact 7.8-3.

The water banking program developed by Semitropic WSD was an "in lieu" program, did not involve the construction of new facilities, and had no effect on the rates of erosion. Arvin-Edison's water banking program involved the construction of 520 acres of percolation ponds at two sites referred to as the North Canal Spreading Works and the South Canal Spreading Works. Vacant land or cropland was converted to percolation ponds by the construction of one or two-foot high perimeter levees.[13] Grading was required to construct the percolation ponds. However, construction of the ponds and associated levees occurred on topography that is relatively flat and required only minor grading and compaction of soils. In addition, soils in the area are classified as slightly to very slightly erodible by wind.[14] Although replacement of 520 acres of vacant land or cropland with percolation ponds changed rates of erosion, this impact is considered ***less than significant***.

Mitigation Measure

None required.

Future Impacts

As noted above for impact during 1996 – 2003, the Monterey Amendment enabled SWP contractors to store water outside their service areas for later use within their service areas.

Between 1996 and 2003, several contractors began storing water in groundwater banks in the southern San Joaquin Valley. It is expected that in the future, contractors would increase their use of groundwater banks. If future increased groundwater banking involved active recharge then new percolation ponds would be built. It is anticipated that an additional 500 acres of ponds would be constructed. Grading would be required to construct the percolation ponds. However, construction of the ponds and associated levees would occur on topography that is relatively flat and would require only minor grading and compaction of soils that are classified as slightly to very slightly erodible by wind.[15] Further, future projects would be required to comply with CEQA and prepare environmental documentation in addition to this EIR to complete proposed percolation ponds. Therefore, the construction of additional percolation ponds would result in a ***less-than-significant impact*** attributed to changing rates of soil erosion.

Mitigation Measures

None required.

7.8-3 Rates of erosion in the Kern Fan Element could potentially be affected by changes in land use.

1996 — 2003

Prior to 1996, approximately 3,034 acres of shallow percolation ponds existed in the Kern Fan Element. The KWBA also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[16] Between 1996 and 2003, an additional 1,665 acres were converted to shallow percolation ponds, for a total of 4,699 acres in 2003 in the Kern Fan Element. As previously described, grading was required to construct the percolation ponds. However, construction of the ponds and associated levees occurred on topography that is relatively flat and required only minor grading and compaction of soils. Furthermore, soils in the Kern Fan Element can generally be characterized as being slightly erodible. Therefore, although conversion of approximately 1,665 acres of land to percolation ponds changed rates of erosion, this impact is considered ***less than significant***.

Mitigation Measure

None required.

Future Impacts

As a result of the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds in the Kern Fan Element.

The Habitat Conservation Plan for the Kern Fan Element allows developed uses on about 4,000 acres of the Kern Fan Element.[17] Developed uses include farming, permanent facilities for the Kern Water Bank and commerce. Approximately, 490 acres is designated for possible commercial use. Between 1994 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel and so under the proposed project the parcel would remain undeveloped.

As a consequence of the proposed project, approximately 1,200 acres of land would be converted to percolation ponds. Grading would be required to construct the percolation ponds. However, construction of the ponds and associated levees would occur on topography that is relatively flat and that would require only minor grading and compaction of soils. Furthermore, soils in the Kern Fan Element can generally be characterized as being slightly erodible. Further, construction of ponds would require additional CEQA documentation. Therefore, conversion of approximately 1,200 acres of land to percolation ponds would not substantially change rates of erosion, and impacts are considered ***less than significant***.

Mitigation Measures

None required.

7.8-4 Implementation of the proposed project could potentially affect rates of erosion at Castaic Lake and Lake Perris.

1996 — 2003

Article 54 of the Monterey Amendment allowed SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions which could affect water surface elevations in these reservoirs. As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, the average water surface elevations at Castaic Lake and Lake Perris was about four feet higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1996 to 2003 was about 20 feet higher than between 1974 and 1995. The higher water surface elevations in the period 1996 to 2003 resulted in a reduction in the width of the band of exposed soil and rock around the perimeter of the two reservoirs and a consequent reduction in potential erosion.

The proposed project had a ***less-than-significant impact*** on erosion between 1996 and 2003.

Mitigation Measure

None required.

Future Impacts

As noted earlier, Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions which could affect water levels in these reservoirs. The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would draw down the reservoirs to a greater extent than occurred between 1996 and 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoirs would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1 in Chapter 6).

If the worst-condition were to occur, the reduction in reservoir elevations would drop dramatically and increase the potential for soil erosion by exposing a larger ring of soil around the perimeter of the reservoirs to wind and rain.

Because the soils at Castaic Lake are characterized as clays; even though the slopes are steep along the perimeter, exposed soil would be subject to limited wind and/or water erosion. Slopes at Lake Perris exhibit a gentle to flat topography but the soils are characterized as sandy which would be subject to increased rates of soil erosion. Therefore, soils at Lake Perris could be subject to increased rates of wind and rain erosion associated with exposure from a potential extended drawdown attributed to Article 54. Mitigation measures such as hydroseeding or landscaping to prevent erosion are not economically or physically feasible to cover such a wide area to prevent runoff of soil into the lake. Therefore, this impact would be ***potentially significant and unavoidable***.

<u>Mitigation Measures</u>

None available.

7.8-5 Implementation of the proposed project could potentially affect rates of erosion at San Luis Reservoir and Lake Oroville.

1996 — 2003

Various provisions of the Monterey Amendment affect water surface elevations in San Luis Reservoir. Water surface elevation in Lake Oroville would not be affected by the proposed project.

Most of the time, the proposed project raised water levels in San Luis Reservoir by 10 to 20 feet under 2003 conditions. The higher water surface elevations in the period 1996 to 2003 resulted in a reduction in the width of the band of exposed soil and rock around the perimeter of the reservoirs and a consequent reduction in potential erosion. Occasionally, the Article 56 provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir in the spring of wet years relative to the baseline scenario. Surface water levels could be reduced by up to 50 feet, but the reduction would typically persist for only a few months and would not significantly affect erosion rates. Therefore, the proposed project had a ***less-than-significant impact*** on erosion between 1996 and 2003.

<u>Mitigation Measure</u>

None required.

Future Impacts

As noted earlier, provisions of the Monterey Amendment could affect water levels in San Luis Reservoir. In the future, most of the time, the proposed project would raise water levels in San Luis Reservoir by 10 to 20 feet under 2020 conditions. Occasionally, the Article 56 provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir in the spring of wet years relative to the baseline scenario. Surface water levels could be reduced by up to 50 feet, but the reduction would typically persist for only a few months and would not be expected to affect erosion rates. Therefore, the proposed project had a ***less-than-significant impact*** on erosion.

Mitigation Measures

None required.

7.8-6 Implementation of the proposed project could potentially increase the rate of soil erosion in Plumas County as a result of watershed improvement projects.

1996 — 2003

Because the Settlement Agreement was not executed in this period, there were no impacts from the proposed project within Plumas County. Therefore, the project had ***no impact***.

Future Impacts

The Settlement Agreement resulted in funding for Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the stability of stream banks and native vegetation by returning them to a more natural condition, therefore, reducing the rate of soil erosion.

The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of streambank in a county with thousands of miles of stream channels. The proposed project would result in short-term construction impacts that would be regulated by State water quality regulations, as discussed in Section 7.1, for the prevention of erosion and sedimentation from construction activities. The proposed project would reduce soil erosion rates in Plumas County and impacts would be ***less than significant***.

Mitigation Measures

None required.

ENDNOTES

1. Norris, Robert M. and Robert W. Webb, *Geology of California*, 1990, page 55.

2. California Department of Water Resources, *Draft Environmental Impact Report on Kern Water Bank Project*, 1986.

3. California Department of Water Resources, *Draft Environmental Impact Report on Kern Water Bank Project*, 1986.

4. U. S. Department of Agriculture Soil Conservation Service, *Soil Survey of Kern County, California, Northwestern Part*, 1988.

5. Norris, Robert M. and Robert W. Webb, *Geology of California*, 1990, pages 376 to 377.

6. California Division of Mines and Geology, *Geologic Map of California*, 1977.

7. California Department of Water Resources, *Oroville Facilities FERC Project No. 2100, Preliminary Draft Environmental Assessment*, Volume III, Section 5.3 (Geology, Soils, and Paleontological Resources), January 2005.

8. California Public Utilities Commission, *Pacific Gas and Electric Company's Application for Authorization to Divest Its Hydroelectric Generating Facilities and Related Assets, Draft Environmental Impact Report, Volume 7, Chapter 4*, November 200, page 4.16-7.

9. Plumas County Flood Control and Water Conservation District, *Draft Feather River Watershed Management Strategy*, January 15, 2004, page 5.

10. Plumas County Flood Control and Water Conservation District, *Draft Feather River Watershed Management Strategy*, January 15, 2004, page 7.

11. Plumas County Flood Control and Water Conservation District, *Draft Feather River Watershed Management Strategy*, January 15, 2004, page 7.

12. Conant, Ernest, Young Wooldridge, personal communication with John Davis, EIP team, October 2003.

13. Arvin-Edison Water Storage District, *Arvin-Edison Water Management Program Negative Declaration*, 1994.

14. Arvin-Edison Water Storage District, May 1996, *Arvin-Edison Water Management Project Negative Declaration*, page 3-4.

15. Arvin-Edison Water Storage District, May 1996, *Arvin-Edison Water Management Project Negative Declaration*, page 3-4.

16. Parker, Jonathon, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

17. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, October 1997.

7.9 RECREATION

7.9 RECREATION

7.9.1 INTRODUCTION

7.9.1.1 Content

This section describes the impacts of the Monterey Amendment and Settlement Agreement on recreational resources. Only some elements of the proposed project have the potential to directly affect recreational resources or opportunities as a result of altered operations at Castaic Reservoir, Perris Lake, San Luis Reservoir, and Lake Oroville (see Table 7.9-1). Changes in river flows in the Feather, Sacramento, American, and San Joaquin rivers, attributable to the proposed project are too small to affect recreational uses in or along the rivers.

TABLE 7.9-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON RECREATIONAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes in recreation with changes in reservoir storage levels	7.9-1, 7.9-2
Permanent transfers of water	Changes in recreation with changes in reservoir storage levels	7.9-1, 7.9-2
Transfer of Kern Fan Element lands	NA	NA
Water supply management practices	Changes in recreation with changes in reservoir storage levels	7.9-1, 7.9-2
Restructured financial arrangements	NA	NA
Settlement Agreement	NA	NA

Note:
NA – Not Applicable.

During public review of the NOP for this EIR, interested parties submitted comments regarding issues that should be evaluated in the EIR. One comment was received concerning recreational issues. The comment noted that the Plumas watershed is a strategic natural resource which would yield benefits from proper management, including streamflow augmentation, water storage in meadows, floodplain protection, water quality and quantity protection, and increased value through recreation and tourism.

7.9.1.2 Analytical Method

The assessment of impacts on recreational resources was conducted in accordance with standard professional practices for CEQA evaluations. A professional consultant with substantial experience in recreational resource assessment conducted site visits to areas with recreational resources that could be affected by the proposed project. Other recreational resources were assessed through review of a variety of California Department of Water Resources (Department) or other public reports. These resources were exclusively associated with reservoirs, the operation of which could be affected by the proposed project. All reservoirs analyzed herein are State Recreational Areas (SRAs) and operation of these SRAs are under jurisdiction of the California Department of Parks and Recreation (CDPR).

Site visits to the facilities were used to record the types of recreational facilities and the shoreline characteristics of those facilities that could be affected by changes in water surface elevations. Such effects may influence the nature of recreation resources. Site visits to Perris Lake and Castaic Lake in May 2007 were used to analyze potential future impacts of drawdown on recreation resources. In addition on-site resource managers were asked their opinions on the relationship between water surface elevations and recreational resource values such as boating or fishing.

Factors considered in the analysis include:

- monthly average water surface elevations under various project scenarios;
- relationship between water surface elevations and constructed recreation facilities and natural features that support recreational use; and
- monthly impacts on recreation based on different monthly average water surface elevations.

7.9.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA guidelines. For the purposes of the EIR, impacts on recreational resources would be considered significant if the proposed project would:

- substantially damage recreational resources or facilities; or
- result in a substantial reduction in recreational use or activities.

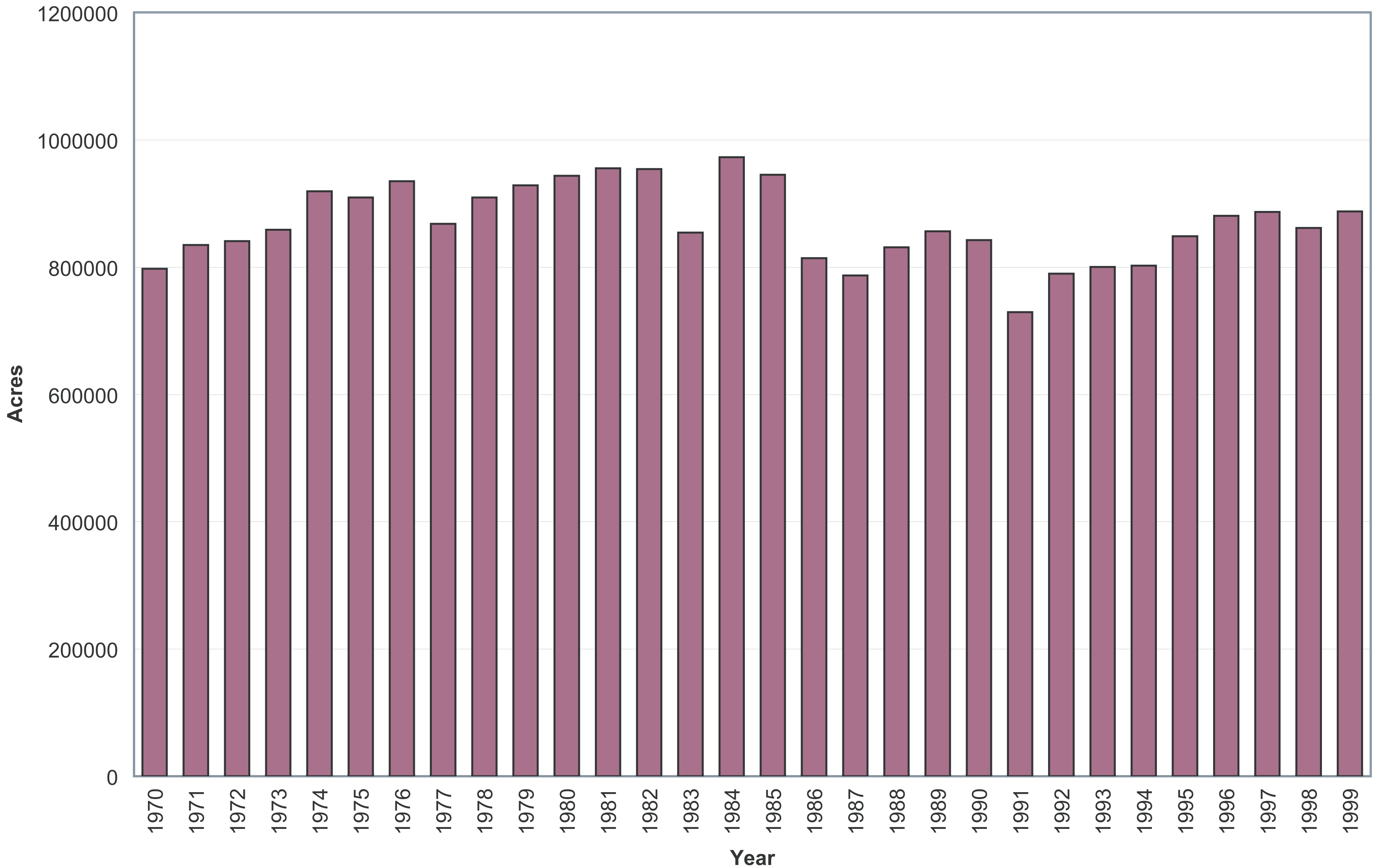
7.9.2 ENVIRONMENTAL SETTING

7.9.2.1 Physical Setting in 1995

Lake Oroville

Lake Oroville is located on the Feather River in Butte County, near the City of Oroville. Lake Oroville and Oroville Dam, completed in 1968, are part of a complex which includes Hyatt Powerplant, Thermalito Diversion Dam and Powerplant, the Feather River Fish Hatchery, Thermalito Power Canal, Thermalito Forebay, Thermalito Pumping Generating Plant, Thermalito Afterbay, and the Lake Oroville Visitors Center (Figure 7.9-1). The Oroville-Thermalito Complex was designed as an efficient water and power system. It stores about 3.5 million acre-feet of water and generates power from releases made through Hyatt Powerplant and two other Thermalito generating plants. The Fish Diversion Dam was built to lead salmon and steelhead, returning to spawn, into the Feather River Fish Hatchery.

At maximum pool, the water surface covers approximately 15,810 acres, or nearly 25 square miles, and has a 167-mile shoreline. Boating, camping, sailing, fishing, picnicking, horseback riding, wildlife viewing, fish hatchery tours, educational exhibits, and enjoyment of the scenery of the Sierra Nevada foothills are offered in and around the Lake Oroville. In 1994, the Department completed nearly half of a 35-mile long bicycle trail with completion scheduled for1997. Additionally, there are two full-service marinas, five car-top boat launch ramps, and ten floating campsites. Many of the reservoir's recreational facilities within the Oroville SRA are



Source: PBS&J, 2007.

FIGURE **7.6-1**
Irrigated Acreage in the San Joaquin Valley Portion of Kern County

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contractor or concessionaires. Recreational use recorded for 1994 totaled approximately 1,275,000 recreational days. In the period 1985 through 1994, the difference between the highest and lowest monthly water surface elevations was about 240 feet (ft).

A section of the Feather River, commonly referred to as the Low Flow Channel, between the Oroville Fish Diversion Dam and the Thermalito Afterbay, is an important recreation resource for the residents and visitors of the Oroville SRA. This area, under California Department of Fish and Game (CDFG) regulations, is accessible and open for fishing north of the Table Mountain Bicycle Bridge. In the spring and fall, salmon are known to congregate at the Thermalito Afterbay outlet. In addition to recreational fishing, the Low Flow Channel section of the river is also used for swimming, wildlife viewing, sightseeing, hiking, and bicycling.

San Luis Reservoir

San Luis Reservoir, completed in 1962, is located in western Merced County, just east of the Merced/Santa Clara County line (see Figure 7.9-2). The reservoir has a maximum capacity of 2,027,800 acre-feet, a surface area of 12,520 acres, and a 65-mile long shoreline.[1] San Luis Reservoir is a popular recreational use area in the State Water Project (SWP), with approximately 184,000 recreational days recorded in 1994. It lies within the relatively low rounded foothills of the Diablo Range. Its shoreline is undeveloped except for State-owned recreation facilities on its north side. Vegetation around the reservoir consists of annual grassland, coastal sage-scrub, and riparian woodland. Water surface elevations typically reach a high point in March and a low point in August. In the period 1974 though 1994, the difference between the highest and lowest monthly average water surface elevations was about 220 ft.

At maximum pool, most of the shoreline around San Luis Reservoir abuts steep sloping hillsides. Some portions of the shoreline, however, are flatter including several low gradient drainages that enter the lake with lower slopes, and portions of the southeast shore where the slopes are less severe.

Along most of the maximum pool shoreline there is a wave cut bench backed by steep bedrock banks capped by eroded soil columns. Narrow pebble beaches have developed in flatter areas and some sand beaches in protected areas in the vicinity of Goosehead Point (see Figure 7.9-2). There are two main recreation areas: Dinosaur Point and the Basalt area. Dinosaur Point is located at the west end of the lake. It has a boat launch, abundant parking, a few shaded picnic sites and bank angling in the immediate area. The Basalt area is located on the southeast side of the reservoir. It contains a camping area, a boat launch with parking, and generally flatter slopes along the shoreline, which support good lakeshore swimming and wading activity. In addition to these developed areas, there are several large unofficial turnout areas along Highway 152 that provide access to small lakeshore areas along the reservoir's north shore via trails of varying lengths.

Castaic Lake

Castaic Lake is the terminus of the West Branch of the California Aqueduct in Los Angeles County. It was completed in 1972 and is located about 45 miles northwest of Los Angeles and about two miles north of the community of Castaic. The lake has a maximum capacity of 323,700 acre-feet, a surface area of 2,240 acres and 29 miles of shoreline.[2] Water surface elevations are typically at their highest level in March and at their lowest level in October.

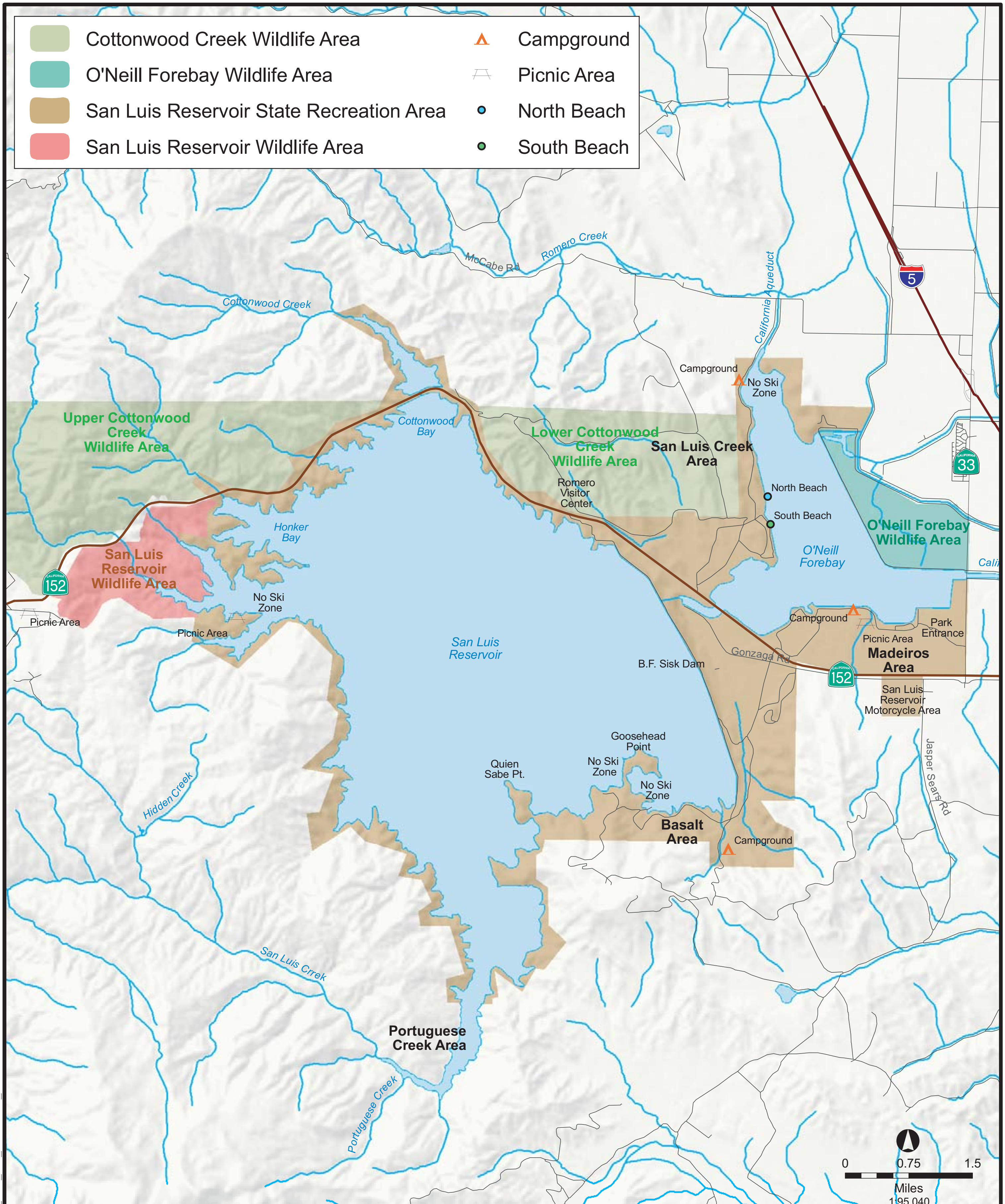


FIGURE 7.9-2

San Luis Reservoir Recreational Facilities

Castaic Lake is one of the SWP's largest recreational lakes with approximately 400,200 recreational days recorded in 1994. A major attraction is the 425-foot tall Castaic Dam (see Figure 7.9-3). The lake is used primarily for sailing, power boating, water and jet skiing, and fishing. The lake is stocked with bass, trout, and catfish. Vendors provide boat rentals and fishing tackle and bait. Other recreational facilities include hiking and biking trails, picnic areas and playgrounds. Rental group picnic areas are available for up to 600 persons.

Castaic Lake was created in a narrow valley bordered by steep mountain slopes. When the reservoir is full, the shoreline, for the most part, abuts the steep walls of the valley. Along the shoreline, the walls show evidence of wave-cut erosion into the hillsides.

When the reservoir is full (maximum pool), some of the areas where the shoreline is not steep include low gradient entries to the reservoir. These include entries at Elizabeth Lake Canyon at the apex of the “East Arm” and near the Elderberry Forebay Dam (see Figure 7.9-3). In addition, the shoreline generally tends to be less steep along the north shore, where the slopes near the shoreline are gentler. Even here, however, there are locations where the slopes in the immediate area of maximum pool are steep and rocky. Riparian vegetation is essentially absent from the shoreline.

The recreational facilities at Castaic Lake include boat-launching facilities at both the eastern and western ends of the dam, and picnicking and camping facilities on the western end of the dam. As noted, recreational activities include general boating and boat angling. Bank angling extends along the shoreline from both ramp areas. Anglers use the eroded bedrock shelf just below the maximum pool water surface elevation.

“Castaic Lagoon” is located immediately downstream of Castaic Dam and serves as a recharge basin for the downstream water basin. The lagoon is used for non-power boating and canoeing, bank angling, and swimming. Swimming season on the lagoon runs from mid-May to mid-September. In 1994, 72 recreational vehicle campsites were opened on the eastern shore of the lagoon. Camping facilities are located away from the shoreline and there are picnicking facilities in developed areas along the parking lot fringe next to an engineered reservoir bank. While these facilities are not considered water-based recreational resources, any loss of or reduction in water-based recreational resources or activities at the lake may adversely influence picnicking and camping uses.

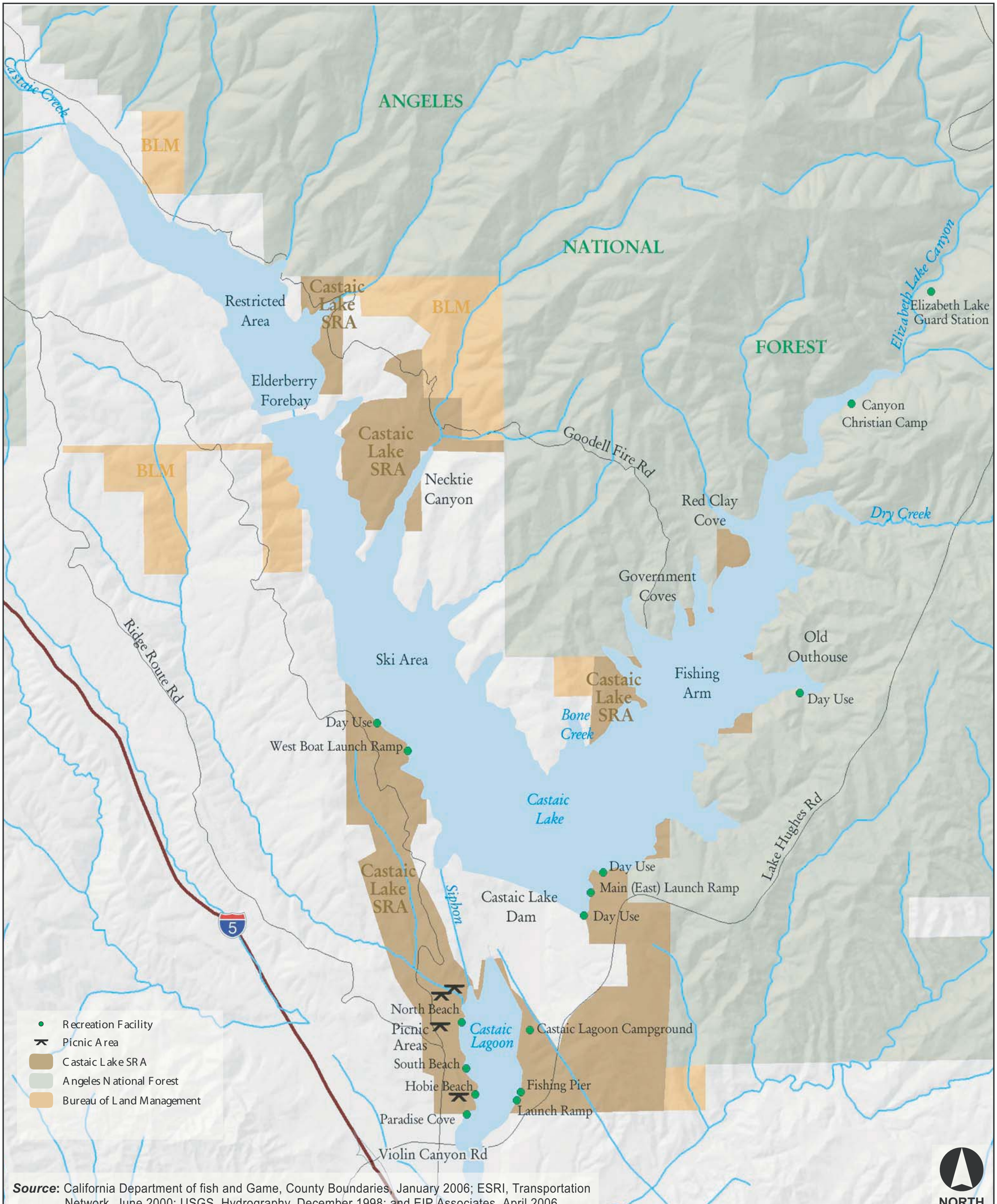
Recreational resources and activities along the shoreline can be directly affected by lake surface water elevations (e.g., boat ramps, and handicap access ramps to beaches). Table 7.9-2 shows that monthly averages for Castaic Lake surface elevations taken between 1974 and 1994 decline from highest elevations in April to lowest elevations in October. In the period 1974 though 1994, the difference between the highest and lowest monthly average water surface elevations was about 32 ft. Table 7.9-3 shows the visitation numbers to Castaic Lake during 1991 through 2003 for both spring/summer and fall/winter seasons.

TABLE 7.9-2

AVERAGE MONTHLY WATER SURFACE ELEVATIONS FOR CASTAIC LAKE (1974 THROUGH 1994)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Elevation*	1,475.0	1,483.9	1,490.5	1,489.6	1,484.7	1,478.0	1,473.0	1,465.7	1,463.4	1,457.9	1,460.9	1,469.5

Note:
* Feet above mean sea level.



Source: California Department of fish and Game, County Boundaries, January 2006; ESRI, Transportation Network, June 2000; USGS, Hydrography, December 1998; and EIP Associates, April 2006.

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FIGURE **7.9-3**

Castaic Lake Recreation Facilities

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TABLE 7.9-3

CASTAIC LAKE VISITATION NUMBERS FROM 1991 TO 2003

Year	Spring/Summer	Fall/Winter
1991	401,431	163,355
1992	383,469	128,625
1993	314,790	90,073
1994	231,336	68,049
1995	261,122	110,473
1996	273,197	90,468
1997	275,174	80,776
1998	262,954	75,025
1999	239,791	84,195
2000	273,164	80,771
2001	260,728	89,419
2002	261,003	99,023
2003	260,334	97,609

Notes:
Spring/Summer Months are April-September.
Fall/Winter Months are October-March.
Source: California Department of Water Resources, 2007.

Lake Perris

Lake Perris, completed in 1972, is located in northwestern Riverside County just south of the City of Moreno Valley. It is the southernmost reservoir of the SWP and is one of the most popular recreational lakes in the SWP system with approximately 1,298,700 recreational days recorded in 1994. Lake Perris is supplied with water from the East Branch of the California Aqueduct. It has a capacity of 131,500 acre-feet, a surface area of 2,320 acres and a ten-mile long shoreline.[3]

Lake Perris lies within a natural bowl surrounded by hills covered in sage-scrub. Slopes along the shoreline are generally gentle but increase in steepness progressively away from the lake shore. There is no development around the shoreline except for picnic areas, camping sites, boat docks and parking lots, which are located primarily on the north side of the lake (see Figure 7.9-4). The picnic areas and camping sites are landscaped and irrigated. Approximately two miles riparian vegetation has developed along the eastern shoreline. Water surface elevations typically reach a high point in March and a low point in August or September.

The lake is relatively shallow with generally gentle lakebed slopes. There are two main recreation areas; the main north shore area and the Bernasconi area. The main north shore area includes man-made beaches protected by constructed groins, a marina with about 200 boat slips, boat rentals, a small market, boat launch ramps, picnicking areas adjacent to the beaches, an equestrian staging area, camping areas situated well back from the shore, and extensive parking. The Bernasconi Area on the south shore of the lake contains picnic and camping areas, a waterskiing area, and parking. Horse, bicycle, and hiking trails circle the lake and connect the major recreation facility areas.

A prominent island in Lake Perris is Alessandro Island. The island is a boat-in-only area with some picnic tables. The island is steep and rocky but there are several well-shaded small beaches.

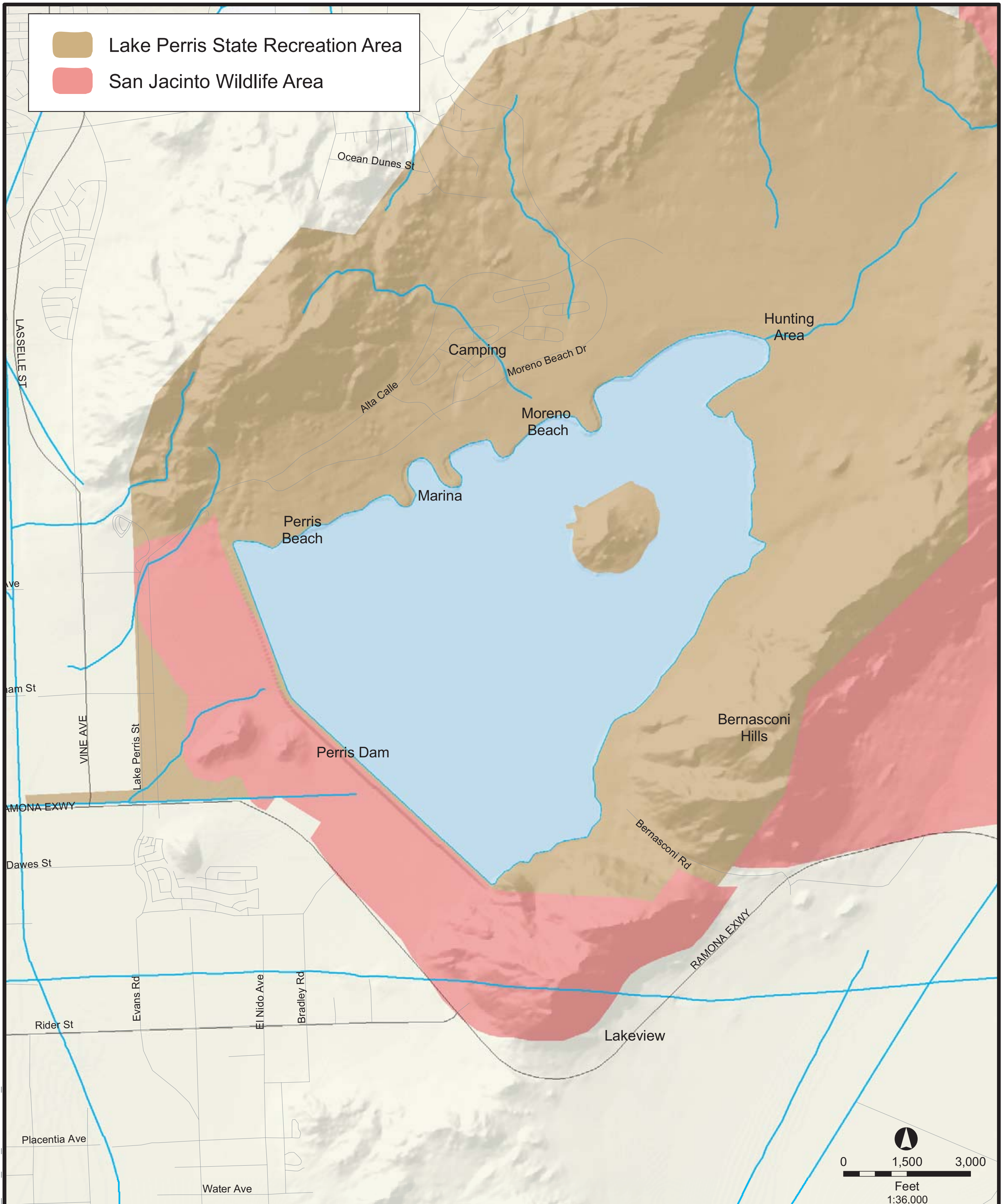

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FIGURE **7.9-4**

Lake Perris Recreational Facilities

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Monterey Plus and Settlement Agreement DEIR

Water surface elevations influence angling and boating uses east of Alessandro Island, personal watercraft launching, boat launching, wading and swimming uses at the beaches, and boat mooring at the marina. Water elevation levels in Lake Perris can have a direct effect on the nature or availability of recreational resources around the lake (e.g., boat ramps and angling locations). Table 7.9-4 shows the monthly averages for Lake Perris surface elevations taken between 1974 and 1994. The difference between the highest and lowest monthly average water surface elevations from 1974 through 1994 was about 10 ft.

TABLE 7.9-4

AVERAGE MONTHLY WATER SURFACE ELEVATIONS FOR PERRIS LAKE (1974 THROUGH 1994)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Elevation*	1,582.3	1,584.6	1,585.0	1,584.3	1,582.9	1,580.3	1,577.4	1,575.4	1,575.4	1,575.8	1,577.7	1,580.2

Note:
* Feet above mean sea level.

7.9.2.2 Changes in Physical Setting between 1996 and 2003

There are no significant changes in the environmental setting for recreational resources compared to those conditions described previously for the setting discussion presented in Section 7.9.2.1, except that the recreational mountain bicycle trail was completed at Lake Oroville at the end of 1997. Although Lake Perris was drawn down for seismic safety repairs starting in 2005, this drawdown is only temporary, lasting between five and 10 years, and is not considered a change in physical setting for the following impact analysis. However, the changes that have occurred from the drawdown at Perris Lake are used to analyze potential future impacts to recreation resources from the Monterey Amendment.

7.9.2.3 Regulatory Setting in 1995

The Castaic Lake SRA is located in Los Angeles County and is managed by the Los Angeles County Department of Parks and Recreation. Oroville Lake, Perris Lake, and San Luis Reservoir are located in Butte, Riverside, and Merced counties, respectively. The recreational activities at Oroville Lake and San Luis Reservoir are under the jurisdiction of federal, state, and local agencies. The CDPR governs recreation activities at Perris Lake.

Operations at the San Luis Reservoir are governed by both the Department and the USBR under agreements for delivery of water to SWP and CVP water. Minimum levels of stored water are required in the San Luis Reservoir to prevent water quality problems (i.e., low-point problem). The regulation of water levels in San Luis Reservoir does not consider impacts on recreational use of the reservoir water, which is mainly limited to shoreline fishing.

7.9.2.4 Changes in Regulatory Setting between 1996 and 2003

The regulatory setting for 2003 is unchanged from that for 1994 discussed above, except for the following change at Lake Perris.

In addition to the recreational setting presented above, recreational resources at Lake Perris have been further enhanced by a multi-agency MOU guiding water surface elevation management. This MOU, signed in 2001 by the Departments of Water Resources, Parks and

Recreation, Boating and Waterways, and CDFG along with MWDSC, established the "Lake Perris Operations Guidelines". These guidelines are as follows:

- seek to fill or refill and maintain an elevation of 1,584 ft from the Saturday following the Memorial Day holiday to Labor Day;
- limit elevation change to 0.5 ft per day, with an objective to limit change no more than three feet, from March 15th through May 1st; and
- maintain full reservoir operational flexibility from the Tuesday following Labor Day until March 14.

In addition, these guidelines provide recreational resource protection, benefits to fishery resources and improved water quality at Lake Perris.

7.9.3 IMPACTS AND MITIGATION MEASURES

7.9-1 Implementation of the proposed project could potentially affect recreational resources at Castaic Lake and Lake Perris.

1996 — 2003

Several provisions of the Monterey Amendment have the potential to affect water surface elevations in Castaic Lake and Lake Perris. They include transfer and retirement of Table A amounts, the altered water allocation procedures and the water supply management practices. The Settlement Agreement would have no effect on water surface elevations. An evaluation of the effects of the Monterey Amendment on water surface elevations in the four reservoirs is contained in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply.

Although the primary purpose of the reservoirs is water supply, they also provide recreational opportunities. Recreation resources at each of the reservoirs are affected by water surface elevations. The following paragraphs describe potential effects of the Monterey Amendment on recreational resources at each of the reservoirs.

<u>Castaic Lake</u>

Average water surface elevations in Castaic Lake increased about 20 ft between 1996 and 2003 compared to the pre-1995 condition. The raise is attributable to several factors but the Monterey Amendment is primary among them. The Article 54 provisions of the Monterey Amendment permit borrowing of water from Castaic Lake by three contractors under certain conditions. Although this caused the water surface of the reservoir to be drawn down at times between 1996 and 2003, the drawdown remained within the range experienced prior to 1995.

As discussed earlier in this section, there is a direct relationship between surface water elevations in Castaic Lake and the availability of recreational facilities and uses. One example is the wave-cut bench, cut into the generally steep reservoir slopes, and located generally about 15 ft below the maximum pool elevation. This bench provides bank angling opportunities, but at high water surface elevations the bench is underwater. The bank is available to support angling at water surface elevations from about 15 to 35 ft below the maximum pool elevation.

At maximum pool conditions (surface elevation at 1,515 ft above sea level) for example, the lake's boating capacity is maximized at 500 boats. At a 1,500-ft elevation, the bedrock shelf around the lake becomes useable for bank fishing. Below the elevation 1,495 ft, navigational hazards begin to emerge, and between 1,485 ft and 1,460 ft, boating safety hazards are at their maximum. At 1,485 ft, four of the six lanes of the West Launch boat ramp become unusable. The remaining two lanes at West Launch are lost when lake elevations recede beneath 1,480 ft.

In addition to the loss of use of the West Launch ramp, a number of other adverse effects on recreational facilities and use occur when lake elevations drop below 1,480 ft. These include significant reductions in the surface area of the “arms” of the lake, detracting from the recreational boating experience. Also, the lake’s boating capacity is reduced to 300 boats and bank angling in the West Arm of Castaic Lake is lost.

As discussed in Section 7.1, borrowing of water by contractors has the potential to lower the water surface elevations at Castaic Lake at times, but, in fact, the average water surface elevation was higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1996 to 2003 was about 20 ft higher than between 1974 and 1994.

As shown in Figure 7.1-6 in Section 7.1, monthly average Castaic Lake water storage volumes were higher throughout the year between 1996 and 2003 compared to pre-1995 conditions. Of particular significance were increases in water surface elevations in excess of 20 ft from May through December. The higher storage volumes and surface elevations were mainly a result of the Department storing more water in the reservoir in anticipation of future withdrawals. The Department was able to accomplish this because of wetter years during this time period. Because the proposed project generally increased water storage volumes, and thus surface elevations, throughout the years, the project had a net positive effect on recreational resource assets. The only activity that might have been adversely affected is bank angling, which in part depends on access to specific bedrock benches at around elevation 1,500 ft.

<u>Lake Perris</u>

Average water surface elevations in Lake Perris increased about four feet between 1996 and 2003 compared to the pre-1995 condition. The raise is primarily attributable to the Monterey Amendment. The Article 54 provisions of the Monterey Amendment permit borrowing of water from Lake Perris by MWDSC under certain conditions. Although this caused the water surface of the reservoir to be drawn down at times between 1996 and 2003, the drawdown remained within the range experienced prior to 1995.

As discussed above, there is a direct relationship between surface water elevations in Lake Perris and the availability of recreational facilities and uses. For example, at a surface water elevation of 1,594 ft, the lake is at maximum pool and maintains a 450-boat capacity. At elevation 1,580 ft and lower, boat ramp #7 becomes inoperative. At 1,575 ft the waterlines at Lake Perris beaches get further from shade and picnicking and parking facilities. At 1,570 ft and lower, the east end of the lake becomes unusable and boating capacity is significantly reduced. In addition, boat ramp #5 and the Power Cover ramp (#14) become inoperative at around 1,570 ft. Normal low pool is achieved at a surface elevation of 1,560 ft and ramp #6 becomes inoperative at 1,548 ft. Lastly, “low low pool” is achieved at 1,540 ft.

As shown in Figure 7.1-7 in Section 7.1, monthly average water storage volumes, and thus water surface elevations, at Lake Perris were higher from May through December. Monthly average surface elevations corresponding to storage volumes show increases between five and 10 ft from July through November. Water levels since 1995 for the period between January through April were slightly higher than prior to 1995. The Department was able to accomplish this because of wetter years during this time period. As the proposed project generally increased water surface elevations through much of the year, the project had a net beneficial effect on recreational resource.

Impact Conclusion

The proposed project had a modestly beneficial effect on recreational resources at Castaic Lake and Lake Perris between 1995 and 2003. The proposed project had a ***less-than-significant impact*** on recreation at these two reservoirs.

Mitigation Measures

None required.

Future Impacts

Castaic Lake

Increases in average water surface elevations in Castaic Lake that occurred between 1996 and 2003 compared to pre-1995 conditions would be expected to persist in the future during the same water year conditions. The effects of borrowing of water on water surface elevations in Castaic Lake in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake. It is quite possible that future borrowing would draw down the reservoir to a greater extent than occurred between 1996 and 2003.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake; about half its maximum capacity. The reservoir would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1 in Chapter 6).

If the worst-condition were to occur, there is a greater opportunity for damage to occur to the boat docks. Boating hazards increase as lake levels decrease, and waterskiing is also impacted. A three foot elevation drop will close the beaches at Castaic Lake. Historically, Castaic Lake has seen water levels drop annually that impacted recreational opportunities. However, recreation at Castaic Lake has not had to deal with the impacts of an extended drawdown (more than one year) with half the full pool volume. An extended drawdown during the summer at Castaic could eliminate waterskiing and force more stringent speed controls on boats. Additionally, the quality of fishing and the amount of fishing opportunities would be decreased during an extended drawdown.

Records of lake visitation numbers at Castaic Lake from 2003 to 2005 in Table 7.9-5, show that during the last significant drawdown of the lake (during 2005) visitation numbers fell by seven to 12 percent during the summer months and about 30 to 36 percent during the winter months from 2003 through 2005. Therefore, impacts of an extended drawdown would be expected to result in a greater reduction in visitation numbers.

Although drawdown would be expected to remain within the normal SWP operating range experienced prior to 2003 in the future, in the worst-case scenario, contractors could drawdown by half the volume of the lake, as allowed under Article 54, for up to five years before repayment of water, and reduce recreational use, resulting in *potentially significant impacts* to recreation.

TABLE 7.9-5 CASTAIC LAKE VISITATION NUMBERS FROM 2003 to 2005		
Year	**Spring/Summer**	**Fall/Winter**
2003	260,334	97,609
2004	242,292	69,186
2005	229,040	62,270

Notes:
Spring/Summer Months are April-September.
Fall/Winter Months are October-March.
Source: California Department of Water Resources, 2007.

Lake Perris

Increases in average water surface elevations in Lake Perris that occurred between 1996 and 2003 compared to pre-1995 conditions would be expected to persist in the future. Similar to Castaic Lake, the number of boats allowed on Lake Perris is determined by water levels. At full storage capacity, with water surface elevation at 1,588 ft, Lake Perris' boat carrying capacity is 450 and the following facilities are fully operational: three public boat launches, two personal water craft launches, one providing access pursuant to Americans with Disabilities Act (ADA) accessible fishing dock, and two swim beaches. The effects of borrowing of water on water surface elevations in Lake Perris in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Lake Perris. It is quite possible that future borrowing would draw down the reservoir to a greater extent than occurred between 1996 and 2003.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoir would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1 in Chapter 6).

The average number of visitors to Lake Perris SRA is 1.17 million per year. Most visitations take place in the summer months, peaking in July. Visitation in the fall and winter months is only 20 to 30 percent of visitation during the spring and summer months. Visitation numbers listed in Table 7.9-6 represent paying guests, free admittance, and overnight campers.

TABLE 7.9-6 LAKE PERRIS VISITATION NUMBERS FROM JULY 2003 TO FEBRUARY 2006[1]		
Year	**Spring/Summer**	**Fall/Winter**
2003	950,809	275,546
2004	912,093	190,576
2005	873,654	92,712

Note:
1. The Fall Winter 2005/2006 numbers only include visitors in October 2005-February 2006.
Source: California Department of Water Resources, 2007.

If the worst-condition were to occur, drawdown of the lake by 50-percent of its volume would reduce water elevations to around 1,556 feet. Recent drawdowns have resulted in a 40-percent reduction in volume in Lake Perris for seismic safety and retrofit of the dam. The drawdowns have reduced the water surface elevations to about 1,563 feet. This elevation is higher than, but similar to what is expected to occur should contractors draw down the maximum water allowable under Article 54. The decrease in water surface elevation to 1,563 feet resulted in reduced recreational capacity and availability of facilities. Boat carrying capacity was reduced to 250 boats due to shallow depths and boating hazards. Boat launches decreased by 51 and 53 percent during the summer and winter, respectively. One public boat launch, both personal water craft launches, the ADA fishing dock, and one swim beach have become inoperable. Speed limits around Allesandro Island were reduced from 35 to 5 miles per hour. In addition, waterfowl hunting, permitted at near maximum full pool, is currently not allowed due to safety and animal cover issues. The lower water levels also reduced access to shore fishing potentially reduced fish access to quality habitat for spawning. While having no direct impact on trails, the draw down exposes water features that may be unattractive to nature enthusiasts, hikers, bikers, and horse back riders, potentially diminishing the reservoir's recreational value. The reductions in multiple facilities and activities have contributed to the overall decline in attendance (Figure 7.9-5).

Table 7.9-7 summarizes the change in average yearly summer and winter attendance following the drawdown of lake surface elevation. Following the drawdown in lake surface elevation from a summer monthly average of 118,695 to 71,260 (AF), overall attendance decreased by 41 percent. Similarly, following the draw down from an average winter volume of 118,777 to 65,817 (AF), attendance decreased by 52 percent.

TABLE 7.9-7

LAKE PERRIS SUMMER AND WINTER VISITATION (2001- 2006)

Average Number of Visitors/Year	Pre-Draw	Post-Draw	Percent Reduction
Winter	128,665	61,400	52
Summer	716,846	423,595	41
Source: California Department of Water Resources, 2007.			

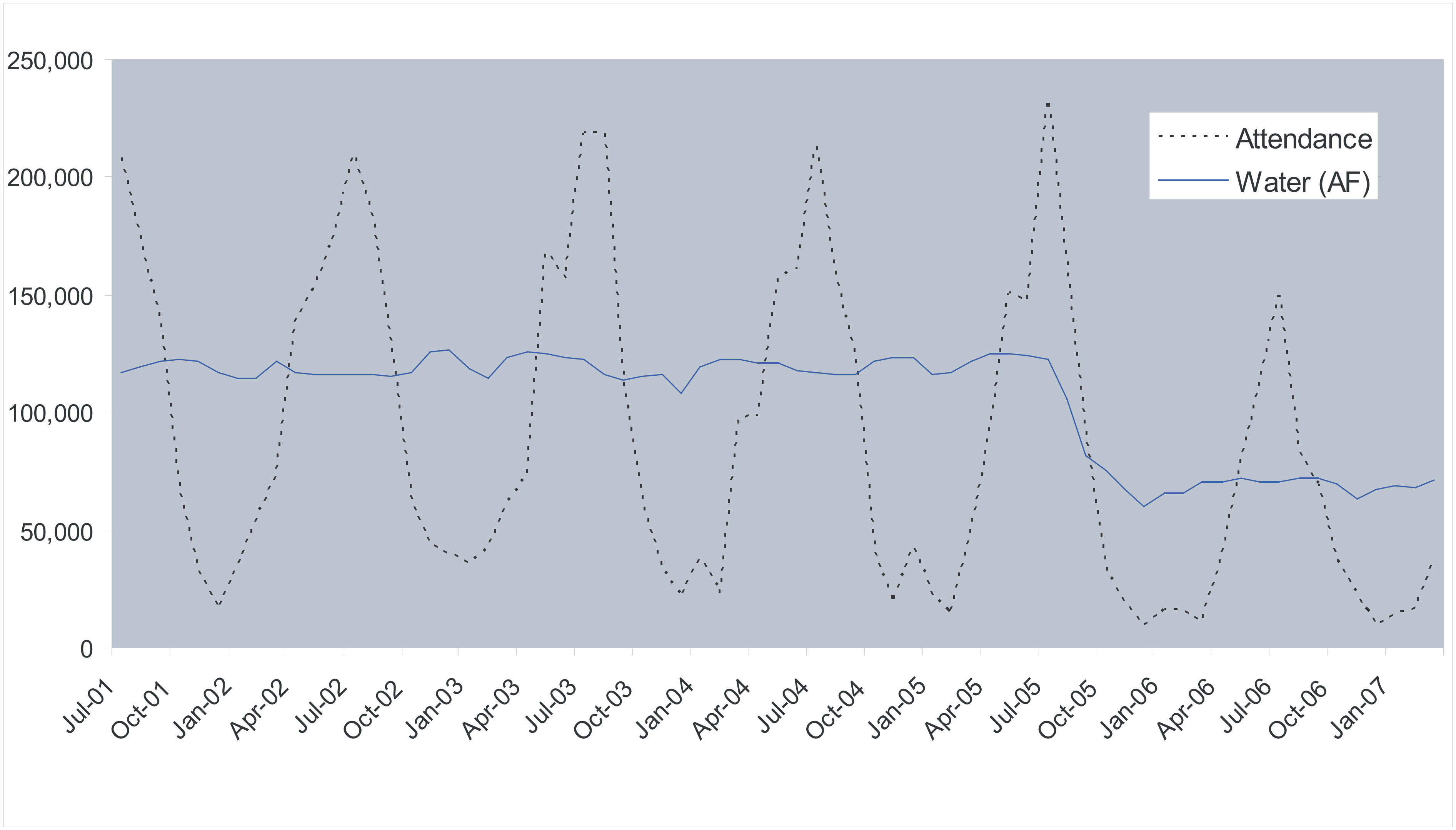
Although, drawdown would be expected to remain within the normal SWP operating range experienced prior to 2003 in the future, in the worst-case scenario, contractors could drawdown the maximum amount allowed under Article 54, up to half the volume of the lake for up to five years before repayment of water, and reduce recreational use, resulting in *potentially significant impacts* to recreation.

Impact Conclusions

In the future, the proposed project could result in *potentially significant impacts* to recreational resources at Castaic Lake and Lake Perris.

Mitigation Measures

Implementing the following mitigation measures would ensure that impacts to recreation from Article 54 extended drawdowns would be reduced. However, because the following mitigations would not guarantee the restoration of recreation opportunities, impacts to recreation would remain ***potentially significant and unavoidable***.



***Source*:** Department of Water Resources, 2007.

FIGURE **7.9-5**
Lake Perris SRA: Attendance (number of visitors) and Lake Volume (acre-feet)

7.9-1 a) *The Department shall notify the public at the onset of the loss of recreational resources due to Article 54 drawdowns at Perris Lake and Castaic Reservoir. Notification shall be made until the withdrawal is repaid through local media outlets including, but not limited to, newspapers and radio, local parks and recreation departments, and on the CDPR's website. If the maximum amount in Article 54 is withdrawn from either reservoir, then the Department shall use television advertisements to inform the public of the severity and duration of the Article 54 drawdown.*

b) *To the extent feasible, the Department shall install, extend, or upgrade existing facilities (including lifeguard towers and emergency assistance equipment) to allow safe access to lower lake levels during multi-year drawdowns.*

c) *The Department shall monitor water quality during drawdown periods and when swimming is allowed using the current full-body contact criteria and laboratory methods adopted by the California Department of Health Services or the U.S. Environmental Protection Agency, as applicable.*

d) *The Department shall prepare and provide funding for a management plan to control invasive plant species that could expand into recreational areas during extended drawdown periods.*

7.9-2 Implementation of the proposed project could potentially affect recreational resources at San Luis Reservoir and Lake Oroville.

1996 — 2003

Several provisions of the Monterey Amendment have the potential to affect water surface elevations in Lake Oroville and San Luis Reservoir. They include transfer and retirement of Table A amounts, the altered water allocation procedures and the water supply management practices. The Settlement Agreement would have no effect on water surface elevations. An evaluation of the effects of the Monterey Amendment on water surface elevations in the four reservoirs is contained in Section 7.1.

Although the primary purpose of the reservoirs is water supply, they also provide recreational opportunities. Recreation resources at each of the reservoirs are affected by water surface elevations. The following paragraphs describe potential effects of the Monterey Amendment on recreational resources at each of the reservoirs.

<u>Lake Oroville</u>

The proposed project had very little effect on water storage in Lake Oroville under 2003 conditions as shown in Figure 7.1-4 in Section 7.1. Consequently, it had little or no effect on water surface elevations or recreational resources.

<u>San Luis Reservoir</u>

As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, the proposed project affected water levels in San Luis Reservoir. Occasionally, several of the water supply management practices that are part of the Monterey Amendment (Article 56) caused filling of the reservoir to be delayed by a few months in the winter and early spring relative to the baseline scenario. However, average water surface elevation increased during this period, as shown in Figure 7.1-5 in Section 7.1.

The primary recreational activity at San Luis Reservoir is shoreline angling. A wave-cut bedrock bench cut into the generally steep reservoir slopes is located about 12 ft below the maximum pool elevation. This bench provides angling opportunities when the water surface elevation is 12 to 32 ft below the maximum pool elevation.

The raise in average water surface elevations attributable to the proposed project may have a modest beneficial effect on shoreline angling. San Luis Reservoir is drawn down in the summer and fall almost every year. The slightly higher water levels may enable angling from the bench to persist a little longer into the summer than with the baseline scenario. The occasional depression of water surface elevations as a result of Article 56 provisions would occur in the winter months when recreation is minimal. If lowered water levels persist into the spring it may delay the start of angling from the bench.

The proposed project had no effect on recreational resources at Lake Oroville and minimal effect on recreational resources at San Luis Reservoir between 1996 and 2003. Therefore, the proposed project had a ***less-than-significant impact*** on recreation at the Lake Oroville and San Luis Reservoir.

<u>Mitigation Measures</u>

None required.

Future Impacts

<u>Lake Oroville</u>

The proposed project would have very little effect on water storage in Lake Oroville under 2020 conditions as shown in Figure 7.1-8 in Section 7.1. Consequently, it would have little or no effect on water surface elevations or recreational resources in the future.

<u>San Luis Reservoir</u>

The proposed project would increase storage in San Luis Reservoir much of the time under 2020 conditions as shown in Figure 7.1-9 in Section 7.1. Average water surface elevations would rise by 10 to 20 ft compared to the baseline scenario. Occasionally, several of the water supply management practices that are part of the Monterey Amendment (Article 56) would cause filling of the reservoir to be delayed by a few months in the winter and early spring relative to the baseline scenario. Water levels could be reduced by up to 50 ft.

The raise in average water surface elevations in the future attributable to the proposed project may have a modest beneficial effect on shoreline angling. San Luis Reservoir is drawn down in the summer and fall almost every year. The slightly higher water levels may enable angling from the bench to persist a little longer into the summer than with the baseline scenario. The occasional depression of water surface elevations as a result of Article 56 provisions would occur in the winter months when recreation is minimal. If lowered water levels persist into the spring it may delay the start of angling from the bench. However, the proposed project would result in less-than-significant impacts to recreational activities in San Luis Reservoir compared to baseline conditions.

In the future, the proposed project would have no effect on recreational resources at Lake Oroville and a minimal effect on recreational resources at San Luis Reservoir. Therefore, the proposed project would have a ***less-than-significant impact*** on recreation at these two reservoirs.

Mitigation Measures

None required.

ENDNOTES

1. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

2. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

3. California Department of Water Resources, *Management of the State Water Project (Calendar year 2000),* Bulletin 132-01, December 2002.

7.10 LAND USE AND PLANNING

7.10 LAND USE AND PLANNING

7.10.1 INTRODUCTION

7.10.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on land use resources (land use and planning). Only some elements of the Monterey Amendment and the Settlement Agreement have the potential to directly affect land use resources. The elements with the potential to directly affect land use resources are shown in Table 7.10-1.

TABLE 7.10-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON LAND USE AND PLANNING

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes in land uses associated with changes in agricultural practices	7.10-1
Permanent transfers of water	Changes in land uses associated with changes in agricultural practices	7.10-1
Transfer of Kern Fan Element lands	Changes in land use associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.10-1
Water supply management practices	Changes in land use associated with construction and operation of groundwater storage facilities	7.10-1
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Changes in land use associated with development of 490 acres of land in Kern Fan Element	7.10-1
Watershed forum in Plumas	NA	NA
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA
Note: NA – Not Applicable.		

During public review of the NOP for this EIR, interested parties submitted no comments on land use and planning.

7.10.1.2 Analytical Method

The assessment of impacts to land use resources was conducted in accordance with standard professional practices for CEQA documents. Factors considered in the analysis included:

- the actual and projected nature and magnitude of changes in land use;
- the number of established communities that would be physically divided; and
- likely reactions to changes in land uses.

Substantial changes are defined as changes beyond those normally observed because of historical variation or fluctuation, changes that are disproportionate to any previously experienced or irreversible changes that would negatively affect an average person's impression of an area.

7.10.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA guidelines. For the purposes of this EIR, impacts to land use resources would be considered significant if the proposed project would:

- physically divide an established community;
- conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or
- conflict with any applicable habitat conservation plan or natural community conservation plan.

7.10.2 ENVIRONMENTAL SETTING

7.10.2.1 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern County Including Kern Fan Element

In 1998, Tenneco West sold approximately 20,000 acres of land in the Kern Fan to the Department. The Department began examining ways to use the Kern Fan Element of the Kern Water Bank as a groundwater storage facility for SWP water. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately convinced the Department to halt feasibility studies and design work on the project.[1] The uncertainties were created by proposed water quality standards for the Delta and issues associated with the protection of threatened and endangered species, both of which would have reduced the amount of water that could be pumped from the Delta. Later, the Department concluded that these constraints on Delta pumping made development of an SWP groundwater storage facility in the Kern Fan Element not feasible at the time.[2] In 1994, the potential of the Kern Fan Element for groundwater storage remained unrealized and the land in the Kern Fan Element remained undeveloped.

7.10.2.2 Changes in Physical Setting between 1996 and 2003

The land use designations in the Kern Fan Element have remained unchanged since 1994. Therefore, the environmental setting described under 1995 conditions for southern San Joaquin Valley portion of Kern County (including the Kern Fan) is the same under 2003 conditions.

7.10.2.3 Regulatory Setting in 1995

Regulations related to land use relevant to the proposed project are described below.

Federal

There are no applicable federal regulations pertaining to land use.

State

There are no applicable state regulations pertaining to land use.

Local

General Plans of the various counties and cities of California contain goals and policies to address land use. Individual projects under the proposed project would be expected to be consistent with goals and policies in applicable General Plan documents.

7.10.2.4 Changes in Regulatory Setting between 1996 and 2003

There has been no change in regulations governing land use; therefore, the regulatory setting described under 1995 conditions applies to conditions from 1996 to 2003 as well.

7.10.3 IMPACTS AND MITIGATION MEASURES

7.10-1 Implementation of the proposed project could potentially change land use designations, thereby physically dividing an established community in the southern San Joaquin Valley portion of Kern County.

1996 — 2003

It is possible that some land was converted to permanent crops as a result of the proposed project. As discussed in Section 7.6, Agricultural Resources, this was an existing trend. In addition, a change in cropping patterns would not represent a change in land use since the land would remain in agricultural production. If the land use planning authority did change existing land use designations and zoning, the appropriate environmental review would have been conducted to approve such a change at that time.

In 1995, the Monterey Amendment added Article 52 to the SWP contracts, and required the Department to convey state-owned land, other property and water in the Kern Fan Element to KCWA. Some SWP water had already been placed in storage in the Kern Fan Element at the time that the Monterey Amendment was negotiated as a result of the Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program. Article 52 required that one-half of the stored SWP water would remain SWP water but the other half would be transferred to Kern County Water Agency.

In 1995, the Kern Water Bank Authority (KWBA) constructed 3,034 acres of recharge ponds. From 1998 through 2003, an additional 4,080 acres were converted to shallow percolation ponds, for a total of 7,114 acres in 2003 in the Kern Fan Element. KWBA also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[3] Elsewhere in Kern County, outside of the Kern Fan Element, approximately 520 acres of percolation ponds were developed as part of other groundwater storage projects.

A Habitat Conservation Plan (HCP) was developed for the Kern Fan Element. The HCP allows developed uses on about 4,000 acres of the Kern Fan Element.[4] Developed uses include farming, permanent facilities for the Kern Water Bank and commerce. Approximately 490 acres of land adjacent to Interstate 5 (I-5) is designated for possible commercial use. Between 1995 and 2003, no development occurred on the 490-acre parcel.

Implementation of the proposed project has altered the physical use of the land; however, overall land use and designations have not changed. The operation of percolation ponds is compatible with the surrounding existing uses. No commercial, retail, office, residential or other uses were developed, and an established community has not been divided. In addition, development of uses in the Kern Fan Element was consistent with the HCP. Therefore, the impact of the proposed project on land use is considered to be ***less than significant***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Because agricultural use would continue, there would be no change in land use. If the land use planning authority were to change existing land use designations and zoning, the appropriate environmental review would be under taken to approve such a change at that time.

The HCP for the Kern Fan Element allows developed uses on about 4,000 acres of the Kern Fan Element.[5] Developed uses include farming, permanent facilities for the Kern Water Bank and commerce. Approximately, 490 acres is designated for possible commercial use. Between 1994 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel and so under the proposed project the parcel would remain undeveloped.

Under the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds in the Kern Fan Element. It is also anticipated that an additional 500 acres of ponds would be developed as part of other groundwater storage facilities in Kern County. Construction of percolation ponds and associated levees could alter land use patterns. However, the land use designations would not change and the percolation ponds would be compatible with the surrounding uses. No commercial, retail, office, residential or other uses that would support population have been designated, and an established community has not been divided. Therefore, the impact of the proposed project on land use would be ***less than significant***.

<u>Mitigation Measures</u>

None required.

ENDNOTES

1. California Department of Water Resources, Bulletin 132-93:11-12, 1995.

2. California Department of Water Resources, Bulletin 132-94:26, 1996.

4. Jonathon Parker, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

5. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, October 1997.

6. Kern Water Bank Authority, *Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan*, October 1997.

7.11 HAZARDS AND HAZARDOUS MATERIALS

7.11 HAZARDS AND HAZARDOUS MATERIALS

7.11.1 INTRODUCTION

7.11.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement related to hazards and hazardous materials. No elements of the proposed project would have the potential to create hazards to human health as a result of use, transport or disposal of hazardous substances (see Table 7.11-1).

TABLE 7.11-1

IMPACTS OF PROPOSED PROJECT ELEMENTS RELATIVE TO HAZARDS AND HAZARDOUS MATERIALS

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Percolation pond construction and exposure of workers to hazardous materials	7.11-1A and 7.11-1B
Permanent transfers of water	Percolation pond construction and exposure of workers to hazardous materials	7.11-1A and 7.11-1B
Transfer of Kern Fan Element lands	Percolation pond construction and exposure of workers to hazardous materials	7.11-1A and 7.11-1B
Water supply management practices	Percolation pond construction and exposure of workers to hazardous materials	7.11-1A and 7.11-1B
Restructured financial arrangements	NA	NA
Settlement Agreement	NA	NA

Note:
NA – Not Applicable.

Hazardous substances are substances which, by their nature and reactivity, have the capacity of causing harm or a health hazard during normal exposure or an accidental release or mishap, and are characterized as being toxic, corrosive, flammable, reactive, an irritant or strong sensitizer. The term “hazardous substances” encompasses chemicals regulated by both the US Department of Transportation’s (DOT) “hazardous materials” regulations and the Environmental Protection Agency’s (EPA) “hazardous waste” regulations, including emergency response. Hazardous wastes require special handling and disposal because of their potential to damage public health and the environment. A designation of “acutely” or “extremely” hazardous refers to specific listed chemicals and quantities.

Activities and operations that use or manage hazardous or potentially hazardous substances could create a hazardous situation if release of these substances occurred. Individual circumstances, including the type of substance, quantity used or managed, and the nature of the activities and operations, affect the probable frequency and severity of consequences from a hazardous situation. Federal, state and local laws regulate the use and management of hazardous or potentially hazardous substances. Creation of human health hazards or exposure of people to existing sources of potential health hazards is considered in this section.

In general, hazards associated with the proposed project would be related to the presence of residual agricultural chemicals, hazardous materials used as part of routine maintenance activities, fuel or waste oil storage tanks, and oil and gas pipelines.

During public review of the NOP for this EIR, interested parties submitted no comments related to hazardous substances.

7.11.1.2 Analytical Method

The assessment of project impacts related to hazards and hazardous substances was conducted in accordance with standard professional practices. Factors considered in the analysis include the potential for exposure of humans to unidentified hazardous substances in soils during construction activities for percolation ponds in Kern Fan Element and in Plumas County as a result of watershed improvement projects.

7.11.1.3 Standards of Significance

The following standard of significance is based on Appendix G of CEQA guidelines. For the purposes of this EIR, impacts related to hazards and hazardous substances would be considered significant if the proposed project would:

- Create a significant hazard to the public or the environment through reasonable foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

7.11.2 ENVIRONMENTAL SETTING

The setting for the proposed project with respect to hazards or hazardous materials is limited to areas that would have construction activities. In particular, those areas include the Kern Fan Element and the Plumas County watershed where activities would be limited to construction of percolation ponds for groundwater banking and improvements to natural drainage features in the Plumas County watershed, respectively.

7.11.2.1 Physical Setting in 1995

Prior to signing the Monterey Amendment, the California Department of Water Resources (Department) was preparing to use the Kern Fan Element for the creation of a groundwater bank for the future reliability of water supplies. Prior to the Department acquiring the Kern Fan Element, the land was historically used for agricultural production. Once the land was acquired by the Department, agricultural practices were eliminated over a five-year period and the land was fallowed. In 1995, KWBA constructed 3,034 acres of recharge southwest of the City of Bakersfield and near the Kern River.

The hazards and hazardous materials setting for the Kern Fan Element was described in the Supplemental EIR for the first stage of the Kern Water Bank project. The setting described was generally related to the hazardous materials present in the soils in the Kern Fan Element. The 1990 Supplemental EIR for the first stage of the Kern Water Bank described the results of soil sampling done throughout the Kern Fan Element to characterize potential contamination. Pesticides, herbicides, and other contaminants were found in soil samples near the pond sites, with isolated pockets of petroleum compounds found near oil pipelines or facilities.[1] Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR for the first stage of the Kern Water Bank identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[2]

7.11.2.2 Changes in Physical Setting between 1996 – 2003

The physical setting for hazards and hazardous materials described under 1996 conditions would be the same as under 2003 conditions.

7.11.2.3 Regulatory Setting in 1995

The following describes the federal and state regulatory setting for the period prior to 1995.

Federal

Many agencies regulate hazardous materials. These include federal agencies such as the EPA, the Occupational Safety and Health Administration (OSHA), the Nuclear Regulatory Commission (NRC), the DOT and the National Institutes of Health (NIH). The following represent federal laws and guidelines governing hazardous materials prior to 1995:

- Federal Water Pollution Control Act,
- Clean Air Act,
- Occupational Safety and Health Act,
- Federal Insecticide, Fungicide, and Rodenticide Act,
- Comprehensive Environmental Response Compensation and Liability Act,
- Guidelines for Carcinogens and Biohazards,
- Superfund Amendments and Reauthorization Act Title III,
- Resource Conservation and Recovery Act,
- Safe Drinking Water Act, and
- Toxic Substances Control Act.

At the federal level, the principal agency regulating the generation, transport and disposal of hazardous materials is the EPA, under the authority of the Resource Conservation and Recovery Act (RCRA). The EPA regulates hazardous waste sites under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Applicable federal regulations are contained primarily in Titles 29, 40, and 49 of the Code of Federal Regulations (CFR).

State

The California Environmental Protection Agency (Cal-EPA) and the Office of Emergency Services (OES) of the State of California establish rules governing the use of hazardous materials. Chemical suppliers are responsible for complying with all applicable packaging, labeling and shipping regulations.

Applicable state laws include the following:

- Public Safety/Fire Regulations/Building Codes,
- Hazardous Waste Control Law,
- Hazardous Substances Information and Training Act,
- Hazardous Materials Release Response Plans and Inventory Act ,
- Air Toxics Hot Spots and Emissions Inventory Law, and
- Underground Storage of Hazardous Substances Act.

Within Cal-EPA, the Department of Toxic Substance Control (DTSC), formerly the Department of Health Services, has primary regulatory responsibility, with delegation of enforcement to local jurisdictions that enter into agreements with the state agency, for the generation, transport and disposal of hazardous materials under the authority of the Hazardous Waste Control Law (HWCL). In 1993, Senate Bill (SB) 10821 assigned to Cal-EPA the authority and responsibility to establish a unified hazardous waste and hazardous materials management regulatory program (known as the Unified Program) under Health and Safety Code (HSC) Chapter 6.11. The purpose of the Unified Program is to consolidate, coordinate, and make consistent, both locally and statewide, six different hazardous materials and hazardous waste regulatory programs. State regulations applicable to hazardous materials are indexed in Title 26 of the California Code of Regulations (CCR).

Local

Prior to 1995, local agencies regulated hazards and hazardous materials exercising their police powers under existing State regulations for the monitoring and enforcement of those regulations. In Kern County, the Environmental Health Services Department (EHSD) monitors new land development for environmental quality, including hazards to human health and handling of hazardous materials through its Hazardous and Solid Waste Division. Likewise, in Plumas County the department responsible for monitoring and enforcement of hazardous materials is the Public Health Agency, Environmental Health Division (EHD).

7.11.2.4 Changes in Regulatory Setting between 1996 – 2003

Federal

The regulatory setting for federal regulations is not substantially different from those that exist in the 1995 regulatory setting described previously. Changes applicable to the proposed project involved adjustments to the list and maximum contaminant levels for some of the hazardous materials regulated by the various federal agencies.

State

The regulatory setting for state hazardous materials regulations is not substantially different than those in 1995, as described previously.

Local

The regulatory setting for state hazardous materials regulations is not substantially different than those in 1995, as described previously, except for formation of local California Unified Program Agencies (CUPAs) to assist in the monitoring and emergency planning for hazardous materials release. The local CUPAs formed after 1995 are the Kern County EHSD and the Plumas County EHD.

7.11.3 IMPACTS AND MITIGATION MEASURES

7.11-1 Construction activities could potentially expose workers or the public to previously unidentified hazards or hazardous materials.

1996 — 2003

The proposed project resulted in construction activities in the southern San Joaquin Valley portion of Kern County between 1996 and 2003.

As mentioned previously, 3,034 acres of recharge ponds existed in the Kern Fan Element. Kern Water Bank Authority (KWBA) also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[3] Between 1998 and 2003, an additional 4,080 acres were converted to shallow recharge basins, for a total of 4,699 acres in 2003 in the Kern Fan Element. Elsewhere in Kern County, outside of the Kern Fan Element, approximately 520 acres of percolation ponds were developed as part of other groundwater storage projects. The construction of percolation ponds resulted in ground-disturbing activities that could have exposed construction workers to residual chemicals associated with past and present agricultural practices involving the use of pesticides, fungicides, and similar agricultural products on crops and soils.

Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR for the first stage of the Kern Water Bank identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[4]

Residues of agricultural chemical products in farmed soils as a result of routine agricultural operations are not typically managed as hazardous waste when used in accordance with adopted laws and regulations. Nonetheless, individuals performing excavation and grading activities would be at a greater risk of exposure to agricultural chemical residues in soil through inhalation of dust from soil movement. Construction of the ponds would also involve the use of heavy equipment that would contain fuels and lubricants. These products contain hazardous compounds, and an accidental release of these materials could injure construction workers, contaminate soil or water, or present a fire/explosion hazard.

Construction contracts included specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as fuels. Title 8 of the CCR also addresses the use of hazardous products in the work environment, which would apply to construction contractors. The potential for inadvertent spills of materials, which could affect nearby surface water bodies or groundwater, was managed through construction site Best Management Practices (BMPs). Therefore, impacts would be ***less than significant***.

Mitigation Measures

None required.

Future Impacts

The proposed project would result in construction activities at several locations including the southern San Joaquin Valley portion of Kern County and Plumas County. As described in Chapter 4, the proposed project includes changes in the way water is allocated among contractors, water transfers, transfer of the Kern Fan Element, water supply management practices, establishment of the Plumas Watershed Forum, and administrative, procedural and financial restructuring of contract administration. The implementation of watershed improvement projects in Plumas County would also involve the use of heavy equipment, resulting in a similar potential for the release of hazardous materials as described for construction of the percolation ponds.

Under the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds in the Kern Fan Element. It is also anticipated that an additional 500 acres of ponds would be developed as part of other groundwater storage facilities in Kern County. The construction of percolation ponds would result in ground-disturbing activities that could expose construction workers to residual chemicals associated with past and present agricultural practices involving the use of pesticides, fungicides, and similar agricultural products on crops and soils. Residues of agricultural chemical products in farmed soils as a result of routine agricultural operations are not typically managed as hazardous waste when used in accordance with adopted laws and regulations. Nonetheless, individuals performing excavation and grading activities would be at a greater risk of exposure to agricultural chemical residues in soil through inhalation of dust from soil movement. Construction of the ponds would also involve the use of heavy equipment that would contain fuels and lubricants. These products contain hazardous compounds, and an accidental release of these materials could injure construction workers, contaminate soil or water, or present a fire/explosion hazard. The implementation of watershed improvement projects in Plumas County would also involve the use of heavy equipment, resulting in a similar potential for the release of hazardous materials as described for construction of the percolation ponds.

All future percolation pond projects would require additional environmental analysis pursuant to current CEQA Guidelines. Further, construction contracts would include specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as fuels. Title 8 of the CCR also addresses the use of hazardous products in the work environment, which would apply to construction contractors. The potential for inadvertent spills of materials, which could affect nearby surface water bodies or groundwater, would be managed through construction site BMPs. Therefore, impacts would be ***less than significant***.

Mitigation Measures

None required.

ENDNOTES

1. California Department of Water Resources, *Kern Water Bank, First Stage Kern Fan Element, Draft Supplemental Environmental Impact Report*, December 1990, pages 44 through 69.

2. California Department of Water Resources, *Kern Water Bank, First Stage Kern Fan Element, Draft Supplemental Environmental Impact Report*, December 1990, pages 61 through 69 and pages 87 through 94.

3. Jonathon Parker, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

4. California Department of Water Resources, *Kern Water Bank, First Stage Kern Fan Element, Draft Supplemental Environmental Impact Report*, December 1990, pages 61 through 69 and pages 87 through 94.

7.12 NOISE

7.12 NOISE

7.12.1 INTRODUCTION

7.12.1.1 Content

This section describes the noise impacts associated with the Monterey Amendment and the Settlement Agreement. Only some elements of the Monterey Amendment and the Settlement Agreement have the potential to affect noise levels. The elements with the potential to directly affect noise levels are shown in Table 7.12-1.

TABLE 7.12-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON NOISE

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Noise associated with changes in agricultural practices	7.12-1
Permanent transfers of water	Noise associated with changes in agricultural practices	7.12-1
Transfer of Kern Fan Element lands	Noise associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.12-3
Water supply management practices	Noise associated with construction and operation of groundwater storage facilities/Changes in recreational use due to fluctuations in reservoir levels	7.12-2, 7.12-4, 7.12-5
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Noise associated with development of 490 acres of land in Kern Fan Element	7.12-3
Watershed forum in Plumas	Noise associated with development of watershed improvement projects	7.12-6
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

During public review of the NOP for this EIR, interested parties submitted no comments regarding noise.

7.12.1.2 Analytical Method

The assessment of potential noise impacts was conducted in accordance with standard professional practices. Factors considered in the qualitative analysis include:

- sources of new or increased noise levels;
- the nature and magnitude of changes in noise;
- the types of sensitive land uses that would be exposed to new or increased noise levels; and
- likely reactions to changes in community noise levels.

7.12.1.3 Standards of Significance

The following standards of significance are based on Appendix G of CEQA Guidelines. For purposes of this EIR, implementation of the proposed project may have a significant adverse noise impact if it would result in any of the following:

- exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinances, or applicable standards of other agencies;
- exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; or
- a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The CEQA Guidelines also do not define the levels at which temporary and permanent increases in ambient noise are considered “substantial.” For the purposes of this analysis, noise impacts would be considered significant if the project resulted in the following:

- construction activities lasting more than one day that increase the ambient noise levels by 10 dBA or more at any noise-sensitive location;
- a permanent (i.e., long term operational) increase of 5 dBA Community Noise Equivalent Level (CNEL) over ambient noise levels at any noise-sensitive land use; or
- a permanent (i.e., long term operational) increase of 3 dBA CNEL over ambient noise levels at any noise-sensitive land use location where the future resulting noise level would exceed 70 dBA CNEL (i.e., the noise levels would be considered unacceptable for noise-sensitive uses by most public agencies).

The CEQA Guidelines do not define the levels at which groundborne vibration or groundborne noise is considered “excessive.” This analysis uses the Federal Railway Administration’s vibration impact thresholds for sensitive buildings, residences, and institutional land uses. These thresholds are 65 VdB at buildings where vibration would interfere with interior operations (e.g., sensitive research buildings), 80 VdB at residences and buildings where people normally sleep, and 83 VdB at institutional buildings with primarily daytime use.[1]

7.12.2 ENVIRONMENTAL SETTING

7.12.2.1 Introduction

Fundamentals of Sound and Environmental Noise

Sound is technically described in terms of amplitude (loudness) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (“dB”). The decibel scale is a logarithmic scale that describes the physical intensity of the pressure vibrations that make up any sound. The pitch of the sound is related to the frequency of the pressure vibration. Since the human ear is not equally sensitive to a given sound level at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (“dBA”) provides this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Noise, on the other hand, is typically defined as unwanted sound. A typical noise environment consists of a base of steady “background” noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this background noise is the sound from individual local sources. These can vary from an occasional aircraft or train passing by to virtually continuous noise from, for example, traffic on a major highway. Table 7.12-2 lists representative noise levels for the environment.

TABLE 7.12-2

REPRESENTATIVE ENVIRONMENTAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	—110—	Rock Band
Jet Fly-over at 100 feet		
	—100—	
Gas Lawnmower at 3 feet		
	—90—	
		Food Blender at 3 feet
Diesel Truck going 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime		
Gas Lawnmower at 100 feet	—70—	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet	—60—	
		Large Business Office
Quiet Urban Area during Daytime	—50—	Dishwasher in Next Room
Quiet Urban Area during Nighttime	—40—	Theater, Large Conference Room (background)
Quiet Suburban Area during Nighttime		
	—30—	Library
Quiet Rural Area during Nighttime		Bedroom at Night, Concert Hall (background)
	—20—	
		Broadcast/Recording Studio
	—10—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

Source: California Department of Transportation, 1998.

Several rating scales have been developed to analyze the adverse effect of community noise on people. Since environmental noise fluctuates over time, these scales consider that the effect of noise upon people is largely dependent upon the total acoustical energy content of the noise, as well as the time of day when the noise occurs. Those that are applicable to this analysis are as follows:

- L_{eq}—The equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- L_{dn}—The Day-Night Average Noise Level, is a 24-hour average L_{eq} with a 10 dBA "penalty" added to noise during the hours of 10:00 P.M. to 7:00 A.M. to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24 hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
- *CNEL*—The Community Noise Equivalent Level, is a 24-hour average L_{eq} with a 10 dBA "penalty" added to noise during the hours of 10:00 P.M. to 7:00 A.M., and an additional 5 dBA penalty during the hours of 7:00 P.M. to 10:00 P.M. to account for noise sensitivity in the evening and nighttime. The logarithmic effect of these additions is that a 60 dBA 24 hour L_{eq} would result in a measurement of 66.7 dBA CNEL.
- L_{50}—A statistical noise level, is the noise level which is exceeded 50 percent of the time during which the noise is measured.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day, night, or over a 24 hour period. Environmental noise levels are generally considered low when the L_{dn} or CNEL is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA. Examples of low daytime levels are isolated natural settings that can provide noise levels as low as 20 dBA, and quiet suburban residential streets that can provide noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of low-moderate level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with more noisy urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA).

When evaluating changes in 24-hour community noise levels, a difference of 3 dBA is a barely-perceptible increase to most people.[2] A 5 dBA increase is readily noticeable, while a difference of 10 dBA would be perceived as a doubling of loudness.[3] Except in a carefully controlled laboratory condition, a change of 1 dBA is very difficult to perceive.

Noise levels from a particular source generally decline as distance to the receptor increases. Other factors such as the weather and reflecting or shielding also help intensify or reduce the noise level at any given location. A commonly used rule of thumb for roadway noise is that for every doubling of distance from the source, the noise level is reduced by about 3 dBA at acoustically "hard" locations (i.e., the area between the noise source and the receptor is nearly complete asphalt, concrete, hard-packed soil, or other solid materials) and 4.5 dBA at acoustically "soft" locations (i.e., the area between the source and receptor is normal earth or has vegetation, including grass). Noise from stationary or point sources is reduced by about 6 to 7.5 dBA for every doubling of distance at acoustically hard and soft locations, respectively. Noise levels are also generally reduced by 1 dBA for each 1,000 feet of distance due to air absorption. Noise levels may also be reduced by intervening structures—generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA. The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 dBA with closed windows. The exterior-to-interior reduction of newer homes is generally 30 dBA or more.

Fundamentals of Environmental Groundborne Vibration

Vibration is sound radiated through the ground. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. The ground motion caused by vibration is measured as particle velocity in inches per second and in the U.S. is referenced as vibration decibels (VdB).

The background vibration velocity level in residential and educational areas is usually around 50 VdB. The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people, or the slamming of doors. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity level, and 100 VdB, which is the general threshold where minor damage can occur in fragile buildings.[4]

The general human response to different levels of groundborne vibration velocity levels is described in Table 7.12-3.

TABLE 7.12-3

HUMAN RESPONSE TO DIFFERENT LEVELS OF GROUNDBORNE VIBRATION

Vibration Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception for many people.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Source: Federal Railroad Administration, 1998.

7.12.2.2 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern County

The Southern San Joaquin Valley portion of Kern County includes the communities of Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco. The majority of Kern County is rural, and the southern San Joaquin Valley portion of Kern County is largely devoted to agriculture. Sources of noise within the southern San Joaquin Valley portion of Kern County include, stationary equipment and operations, construction activities, and agricultural operations, although vehicular traffic is the primary source of noise throughout the area. Along with Interstate 5 (I-5), State Routes (SR) 14, 33, 41, 43, 46, 58, 65, 99, 119, 155, 166, 178, 184, 202, and 223 traverse the County. One- and two-lane rural roads access agricultural areas, while two- and four-lane roads travel through the more urbanized areas.

Kern Fan Element

The Kern Fan Element consists of 20,546 acres of land located in Kern County southwest of Bakersfield. The Kern Fan Element lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. In 1995, there were no major structures on Kern Fan Element except for I-5, the Cross Valley Canal, and some abandoned tanks and other oil field equipment.

The Kern Fan Element was farmed for many years until the mid-1980s. After the California Department of Water Resources (Department) purchased the land in 1986, the agricultural fields were gradually taken out of production. By 1995, agriculture had ceased on the property and introduced annual grasses and forbs had colonized the land. Therefore, vehicular traffic is the primary source of noise throughout the area. The Kern Fan Element is primarily bisected by rural roads, SRs 99, 119, 166, and 223, and I-5.

7.12.2.3 Changes in Physical Setting between 1996 – 2003

Southern San Joaquin Valley portion of Kern and King Counties excluding the Kern Fan Element

There were no major changes in noise levels in the southern San Joaquin Valley portion of Kern and Kings counties (excluding the Kern Fan Element) between 1996 and 2003. Of the changes that occurred, nearly all were attributable to the gradual conversion of agricultural lands to urban uses, particularly near the city of Bakersfield, and to increased traffic on highways. These changes were not attributable to the proposed project.

Kern Fan Element

Between 1996 and 2003, noise levels in the immediate vicinity of proposed project in the Kern Fan Element increased temporarily while percolation ponds and the Kern Water Bank Canal were constructed as described above. Otherwise, ambient noise levels in the Kern Fan Element are similar to those in 1995.

Plumas County

Plumas County is located where the Sierra Nevada meets the Cascade Mountains in northeastern California. It is a rural county with no large cities. With an area of 2,554 square miles and a population of about 21,000, it has a population density of about eight people per square mile. Much of the county is within the Plumas and Lassen National Forests. Principal economic activities in the county are recreation, services and forest products. Plumas County is accessed primarily via US Highway 395 and SRs 36, 49, 70, and 89. Vehicle travel along these highways are the major source of noise in the county.

7.12.2.4 Regulatory Setting in 1995

The California Government Code requires that a noise element be included in the general plan of each county and city in the state. These noise elements serve as comprehensive programs for including noise control in the land use planning process. They are tools that county and city planners use to ensure that sensitive land uses are not exposed to excessive noise levels, and that mitigation be identified and implemented to ensure noise-generating activities do not adversely affect such uses.

Impacts with the greatest potential to conflict with general plan noise levels are associated with the construction and operation of groundwater banks, which would occur in Kern and Kings counties only. Direct impacts of the proposed project in Riverside, Merced, Los Angeles, and Butte counties would be limited to traffic- and boating-related noise, which were determined to not result in any significant impacts that could conflict with county noise policies.

Kern County General Plan Noise Element

The major goals of the Noise Element of the Kern County General Plan are to establish reasonable standards for maximum desired noise levels in Kern County and to develop implementation programs which could effectively deal with noise.[5] Because vehicular traffic is the primary source of noise throughout the area, the noise standards and programs were prepared to address this source. The noise standards adopted by the County are identified in Table 7.12-4.

TABLE 7.12-4

KERN COUNTY GENERAL PLAN NOISE STANDARDS

Land Use Category	dBA L_{50} Day	dBA L_{50} Night	dBA L_{dn} or CNEL
Insensitive Uses[1]	65	60	75
Moderately Sensitive Uses[2]	60	55	70
Sensitive Uses[3]	55	45	65
Highly Sensitive Uses[4]	50	40	60

Notes:
1. Uses that are not adversely affected by higher noise levels. These uses include agriculture, water areas, natural open space, undeveloped land, and manufacturing.
2. Included are those uses that are not adversely affected by moderate noise levels. These uses include country and athletic clubs, general commercial, restaurants, and professional offices.
3. Those uses where noise controls are necessary (without noise control the uses would be greatly disrupted. These uses include attached residences, hotels, and out-patient clinics.
4. Includes uses where any noise could be greatly disruptive (effective noise controls are very important for these uses). These uses include single-family dwellings, educational facilities, hospitals, convalescent homes, and wildlife sanctuaries.

If the noise is not smooth and continuous, one or more of the corrections below applies:

Type of Noise Operation	dBA Correction
Noise source operated less than 15 minutes of any one-hour period	+5
Noise source operated less than 5 minutes of any one-hour period	+10
Noise source operated less than 1 minute of any one-hour period	+15
Noise of impulsive character (i.e., hammering, etc.)	-5
Noise of periodic character (hum, screech, etc.)	-5

Source: Kern County, 1989.

7.12.2.5 Changes in Regulatory Setting between 1996 – 2003

Impacts with the greatest potential to conflict with general plan noise levels are associated with the construction and operation of groundwater banks, which would occur in Kern and Kings counties only. Direct impacts of the proposed project in Riverside, Merced, Los Angeles, and Butte counties would be limited to traffic- and boating-related noise, which were determined to not result in any significant impacts that could conflict with county noise policies.

Plumas County General Plan

The Noise Element of the Plumas County General Plan was prepared to ensure that the location, density, and intensity of development within both prime and moderate opportunity areas is done so as to achieve reasonable safety from noise hazards and that "noise sensitive areas" are protected.[6] The noise standards adopted by the County are identified in Figure 7.12-1.

7.12.3 IMPACTS AND MITIGATION MEASURES

7.12-1 Changes in the amount and reliability of SWP water deliveries could potentially alter agricultural practices, which could affect noise levels.

1996 — 2003

The Monterey Amendment enables various changes in the way the Department allocates water among contractors during times of shortage and surplus and enables agricultural contractors to retire and transfer a portion of their Table A amounts. The effect of these changes was to increase the reliability of water supplies but decrease the total amount of Table A water available to farmers in Kern County. The reliability and availability of agricultural water supplies is one factor that may contribute to the amount and types of crops and associated land disturbance activities.

It is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have altered the traffic volumes and use of agricultural machinery in affected areas. A doubling of traffic volumes or pieces of machinery operating at any one time would be needed to create a 3 dBA increase in roadway noise levels. The number of vehicular trips to fields with permanent crops would have likely been the same or slightly less than the number of trips to fields with annual crops and would have been unlikely to affect traffic volumes on affected rural roads. Likewise, the use of agricultural machinery would also have been the same or less. Therefore, increased noise levels associated with the proposed project would have resulted in a ***less-than-significant impact***.

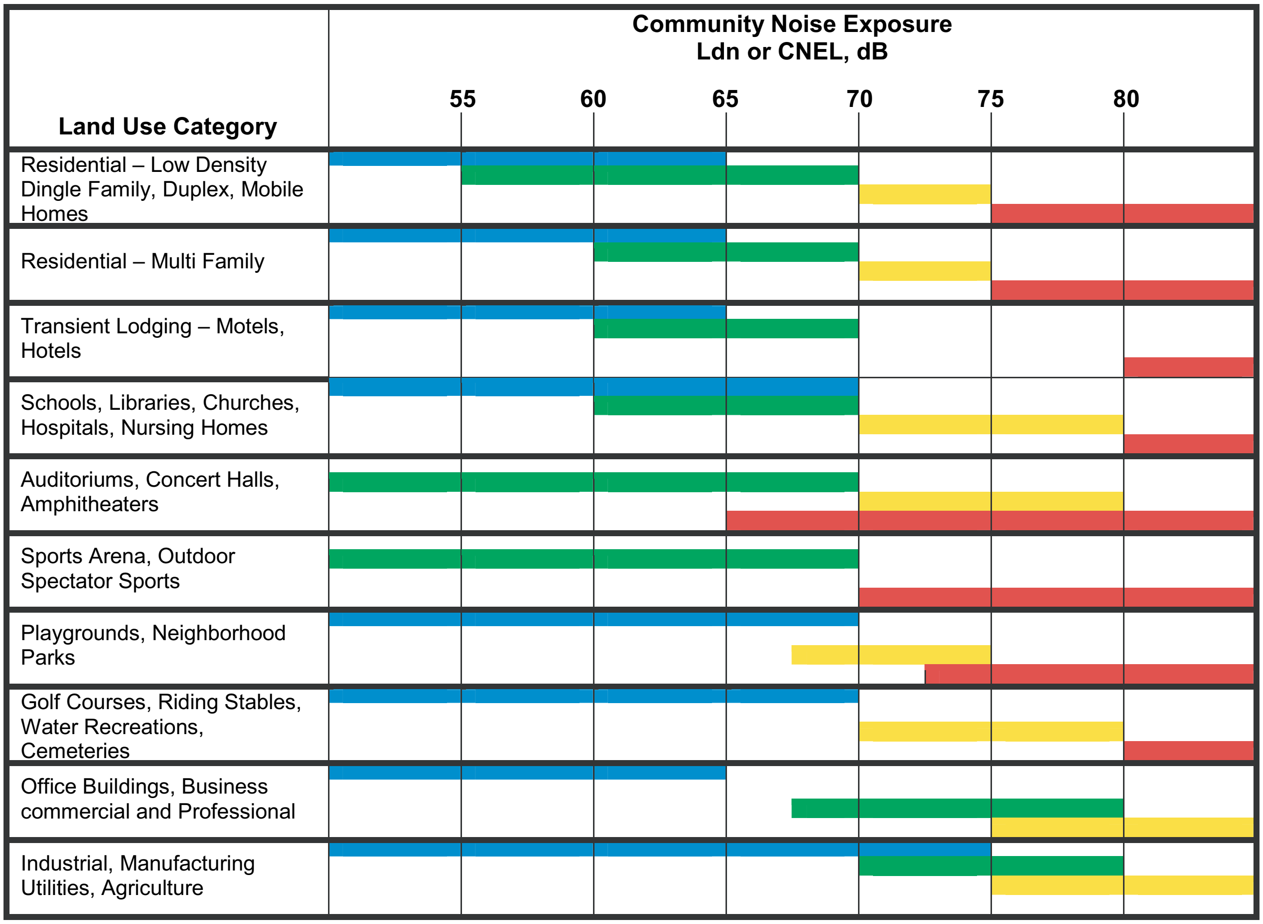
<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period.

It is possible that additional land could be converted to permanent crops as a result of the proposed project, and that changes in agricultural practices could alter the traffic volumes and



Normally Acceptable	Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable	New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features included in the design. Conventional construction, with closed windows and fresh air supply systems or air condition will normally suffice.
Normally Unacceptable	New construction or development should generally be discourages. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable	New construction or development should generally not be undertaken.

Source: Plumas County General Plan, 1998 and PBS&J, 2006.

FIGURE **7.12-1**

Land Use Compatibility for Community Noise Environments

use of agricultural machinery in affected areas. As discussed above, doubling of traffic volumes or pieces of machinery operating at any one time would be needed to create a 3 dBA increase in roadway noise levels. The number of vehicular trips to fields with permanent crops would likely be the same or slightly less than the number of trips to fields with annual crops and would be unlikely to affect traffic volumes on affected rural roads. Likewise, the use of agricultural machinery would also be the same or less. Therefore, increased noise levels associated with the proposed project would result in a ***less-than-significant impact***.

Mitigation Measures

None required.

7.12-2 Implementation of the proposed project could potentially affect noise levels in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) as a result of construction and operation new groundwater storage facilities.

1996 — 2003

The Monterey Amendment enables SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several contractors have entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1996 and 2003, Semitropic WSD, Arvin-Edison WSD and the Kern Water Bank Authority (KWBA) developed or expanded water banks. The water banking program developed by Semitropic WSD project involved the construction of a pipeline connecting the District's service area to the California Aqueduct. Arvin-Edison's water banking program involved the construction of 520 acres of percolation ponds at two sites referred to as the North Canal Spreading Works and the South Canal Spreading Works. Vacant land or cropland was converted to percolation ponds by the construction of one or two-foot high perimeter levees. Grading was required to construct the percolation ponds.

Construction of the new groundwater storage facilities required the use of heavy-duty diesel equipment such as bulldozers, graders, trucks, and drilling equipment. The U.S. EPA has compiled data regarding the noise generating characteristics of specific types of construction equipment and typical construction activities. These data are presented in Table 7.12-5 and Table 7.12-6 for a reference distance of 50 feet. These noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 84 dBA measured at 50 feet from the noise source to the receptor would reduce to 78 dBA at 100 feet from the source to the receptor, and reduce by another 6 dBA to 72 dBA at 200 feet from the source to the receptor.

Construction activities primarily affected noise levels in the immediate vicinity of the construction sites. In the case of the proposed project, there were no sensitive uses located in close proximity to the construction sites that would be adversely impacted by daytime construction activities and noise levels. Therefore, construction noise levels did not substantially increase existing noise levels at existing land uses that are sensitive to noise.

Construction activities that occurred under the proposed project also had the potential to generate low levels of groundborne vibration. Table 7.12-7 identifies various vibration velocity levels for the types of equipment that could have been operated at the project sites during construction.

TABLE 7.12-5

NOISE RANGES OF TYPICAL CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Levels in dBA L_{eq} at 50 feet[1]
Front Loader	73–86
Trucks	82–95
Cranes (moveable)	75–88
Cranes (derrick)	86–89
Vibrator	68–82
Saws	72–82
Pneumatic Impact Equipment	83–88
Jackhammers	81–98
Pumps	68–72
Generators	71–83
Compressors	75–87
Concrete Mixers	75–88
Concrete Pumps	81–85
Back Hoe	73–95
Pile Driving (peaks)	95–107
Tractor	77–98
Scraper/Grader	80–93
Paver	85–88

Note:
1. Machinery equipped with noise control devices or other noise-reducing design features does not generate the same level of noise emissions as that shown in this table.

Source: U.S. EPA 1971 as presented in City of Los Angeles, 1998.

TABLE 7.12-6

TYPICAL OUTDOOR CONSTRUCTION NOISE LEVELS

Construction Phase	Noise Levels at 50 Feet (dBA L_{eq})	Noise Levels at 50 Feet with Mufflers (dBA L_{eq})
Ground Clearing	84	82
Excavation, Grading	89	86
Foundations	78	77
Structural	85	83
Finishing	89	86

Source: U.S. EPA 1971 as presented in City of Los Angeles, 1998.

TABLE 7.12-7

TYPICAL VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

Construction Equipment	PPV (in./sec.)			
	25 Feet	100 Feet	200 Feet	400 Feet
Pile Driver (Impact)	0.644	0.081	0.028	0.010
Vibratory Roller	0.210	0.026	0.009	0.003
Large Bulldozer	0.089	0.011	0.004	0.001
Loaded Trucks	0.076	0.010	0.003	0.001
Jackhammer	0.035	0.004	0.002	0.001
Small Bulldozer	0.003	<0.001	<0.001	<0.001

Source: Derived from Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, May 2006, p. 12-12.

There were no sensitive uses located in close proximity to the construction sites that would be adversely impacted by daytime construction activities. Therefore, construction activities did not expose sensitive receptors to substantial vibration levels.

Operation of a groundwater bank requires pumping to convey water to percolation ponds and to extract water from underground. A representative range of noise levels for electric pumps is estimated to be 68 to 72 dBA (see Table 7.12-3) at 50 feet. If proper mufflers are provided, noise levels could be further reduced. The expansion of water banks attributable to the proposed project would result in an increase in noise emissions from pumps compared to pre-1995 conditions. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses.

When completed, vehicular movements associated with routine maintenance of the new facilities were probably the same or less than those associated with use of the land for agriculture. More pumping to convey water in and out of water banks would occur than before 1995, but the additional noise would be emitted far from sensitive receptors. Therefore, proposed project is considered to have a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As noted above, the Monterey Amendment enables SWP contractors to store water outside their service areas for later use within their service areas. Between 1996 and 2003, water banks were developed, and 520 acres of percolation ponds were constructed. It is expected that in the future, contractors would increase their use of groundwater banks. If future increased groundwater banking involved active recharge, then new percolation ponds would be built. For purposes of this analysis, it is assumed a similar amount of ponds (approximately 500 acres) would be constructed.

The conversion of land for use as percolation basins could result in construction of the percolation basins and pumping/conveyance facilities and new access roads or alteration of existing access roads, which could in turn result in temporary increase in construction-related noise levels. However, this impact would be temporary and short-term and would not be considered significant. Routine maintenance equipment and vehicles would access the new facilities and temporarily increase noise levels in the immediate vicinity of the maintenance operations. Operation of a groundwater bank requires pumping to convey water to percolation ponds and to extract water from underground. Electric motors, gasoline engines or diesel engines power the pumps. A representative range of noise levels for pumps is estimated to be 68 to 72 dBA (see Table 7.12-3) at 50 feet. If proper mufflers are provided, noise levels could be further reduced. The expansion of water banks attributable to the proposed project would result in an increase in noise emissions from pumps. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Further, as noted above, this increase would be intermittent and not significant. The noise impacts of new groundwater storage facilities are considered to be ***less than significant***.

Mitigation Measures

None required.

7.12-3 Noise levels in the Kern Fan Element could be potentially affected by development of groundwater storage facilities.

1996 — 2003

The Monterey Amendment calls for ownership of the Kern Fan Element to be transferred from the Department to the KCWA. This occurred in 1995. The KCWA then transferred ownership to a new agency, the KWBA. The KWBA built a groundwater storage facility, the Kern Water Bank, to take advantage of a provision of the Monterey Amendment that enables SWP contractors to store water outside their service areas.

Between 1996 and 2003, as part of the Kern Water Bank, approximately 1,665 acres of land were converted to shallow percolation ponds, a six-mile long earthen canal, the Kern Water Bank Canal, and several wells and pump stations were built. Unpaved roads were built to provide access to the new facilities. However, there were no sensitive uses located in close proximity to the construction sites that were adversely impacted by daytime construction noise and groundborne vibration levels. Routine maintenance of the new facilities results in temporary noise levels. Operation of the Kern Fan Element requires pumping to convey water to percolation ponds, to extract water from underground, and to convey water in the Kern Water Bank Canal. Electric motors power the pumps. A representative range of noise levels for pumps is estimated to be 68 to 72 dBA (see Table 7.12-5) at 50 feet. The installation and operation of pumps associated with the construction of percolation ponds in the Kern Fan Element attributable to the proposed project would result in an increase in noise emissions from pumps compared to pre-1995 conditions. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Ongoing maintenance of the new facilities is intermittent and not considered a substantial source of increased noise levels at sensitive land uses. Therefore, these land use changes are considered to have a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

In the future, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds. The construction-related noise impacts are temporary and short-term and would be considered less than significant. Operation of the Kern Fan Element requires pumping to convey water to percolation ponds and to extract water from underground. A representative range of noise levels for electric pumps is estimated to be 68 to 72 dBA (see Table 7.12-3) at 50 feet. If proper mufflers are provided, noise levels could be further reduced. The installation and operation of pumps associated with the operation of percolation ponds in the Kern Fan Element attributable to the proposed project could result in an increase in noise levels. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Additionally, maintenance of the new facilities would occur intermittently and would not constitute a significant increase in area noise levels. Thus, any such construction and operation activities are considered to create a ***less-than-significant impact***.

The KWBA manages lands within the Kern Fan Element in accordance with a Habitat Conservation Plan (HCP) approved by U.S. Fish and Wildlife Service (USFWS) in 1997. The HCP allows developed uses on about 4,000 acres of the Kern Fan Element. Developed uses include farming, permanent facilities for the Kern Water Bank and commerce. Approximately 490 acres are designated for possible commercial use. Between 1995 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel, and so under the proposed project the parcel would remain undeveloped. Noise levels at the parcel would be unchanged.

<u>Mitigation Measures</u>

None required.

7.12-4 Fluctuation in water levels at Castaic Lake, Lake Perris, Lake Oroville, and San Luis Reservoir could potentially alter the amount of recreational boating at the reservoirs, which could affect noise levels.

1996 — 2003

The amount of recreational boat use usually increases with increasing water levels at reservoirs where people normally participate in these types of recreational activities. Conversely, boating decreases when water levels are lower.

As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply average water surface elevations at Castaic Lake and Lake Perris were higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. At Lake Oroville changes in the amount of water stored were small and insufficient to have an effect on water surface elevations and water levels in San Luis Reservoir would be higher during winter months (see Impact 7.1-4 in Section 7.1).

Recreational activities would not have changed as a result of project implementation in Lake Oroville or San Luis Reservoir. Recreational activities could have been enhanced in Castaic Lake and Lake Perris as a result of increased water levels during the boating season. However, the range of water surface fluctuations would have been within the range of operating conditions prior to project implementation. Therefore, increased water surface levels would not have been expected to result in much of an increase in the amount of boating days or numbers of boats and, in turn, boating-related noise levels over pre-Monterey conditions. Increases in noise levels would not have increased by more than 3 dBA over the long-term. Consequently, this would have been a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed above, the amount of recreational boat use usually increases with increasing water levels at reservoirs where people normally participate in these types of recreational activities. Conversely, boating decreases when water levels are lower.

As described in Section 7.1, average water surface elevations at Castaic Lake and Lake Perris would be similar to historical ranges and baseline conditions (2003). However, water levels in San Luis Reservoir could be lower during winter months (see Impact 7.1-4 in Section 7.1).

Recreational activities would not change as a result of project implementation in Lake Oroville or San Luis Reservoir. Recreational activities could be enhanced in Castaic Lake and Lake Perris as a result of increased water levels during the boating season. Although, the range of water surface elevations would be anticipated to be within the range of operating conditions prior to project implementation for Castaic Lake and Lake Perris, recreational activities could be affected by the drawdown allowed through Article 54 of the proposed project. Article 54 provisions allow for several contractors to drawdown these two reservoirs to half their maximum capacity for up to five years before repayment. Although the worst-case condition could occur, it would be unlikely (as discussed in Chapter 6). Assuming that future flexible storage use is similar to historic use since 1996, no significant impact would occur. If the worst-case scenario were to occur, water surface levels would decrease the amount of boating days or numbers of boats and, in turn, boating-related noise levels more than what would have occurred in the absence of the project. Consequently, this would be a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

7.12-5 Fluctuation in water levels at Castaic Lake, Lake Perris, Lake Oroville, and San Luis Reservoir could potentially alter the amount of recreational uses at the reservoirs, which could affect traffic noise levels.

1996 — 2003

As discussed in Impact 7.12-4, higher water surface elevations at Castaic Lake and Lake Perris, could have created more opportunities for recreational activities. This could have increased the number of vehicle trips to and from the reservoirs on a seasonal basis that would, in turn, result in increases in traffic-generated noise on a seasonal basis. However, it is unlikely that the number of vehicles would have substantially increased to levels where noise thresholds would have been exceeded on a permanent basis such that there would have been a conflict with the local noise standards. San Luis Reservoir water surface levels would be lower during winter months, so recreation-related vehicle traffic noise would not be substantially affected. Therefore, this would have been a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed in Impact 7.12-4, water surface elevations at Castaic Lake and Lake Perris, could result in fewer opportunities for recreational activities. This could decrease the number of vehicle trips to and from the reservoirs on a seasonal basis that would, in turn, result in decreases in traffic-generated noise on a seasonal basis more than what would have occurred in the absence of the project. However, within normal SWP operating conditions it is unlikely that the number of vehicles would be substantially different than baseline conditions. At Lake Oroville, changes in the amount of water stored would be small and insufficient to have an effect on water surface elevations and water levels in San Luis Reservoir would be higher during winter months, so recreation-related vehicle traffic noise would not be substantially affected. Therefore, this would be a ***less-than-significant impact***.

Mitigation Measures

None required.

7.12-6 Implementation of the proposed project could potentially affect noise levels in Plumas County as a result of watershed improvement projects.

1996 — 2003

Because the Settlement Agreement was not completed in this period, there were no watershed improvement project as a result of the proposed project and there was ***no impact***.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms, but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition.

The types of projects that are anticipated would include stream restoration (revegetation of stream banks and removal of non-native species, for example), preventing stream down-cutting and gullying through the creation of a series of ponds and drop structures, well drilling, and unpaved road improvements to reduce erosion and sedimentation. The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of stream bank in a county with thousands of miles of stream channels. These activities could result in temporary increases in construction noise levels at the site of the improvements. Noise would be generated by the use of equipment such as backhoes, trucks, and drilling equipment. The improvements would generally occur in locations where little or no development is present. No operational increase in noise levels would be anticipated. The potential noise impact from construction activities would be short-term and is considered to be ***less than significant***.

Mitigation Measures

None required.

ENDNOTES

1. Federal Railroad Administration, *High-Speed Ground Transportation Noise and Vibration Impact Assessment*, December 1998.

2. Federal Highway Administration, *Highway Noise Fundamentals*, United States Department of Transportation, September 1980.

3. Federal Highway Administration, *Highway Noise Fundamentals*, United States Department of Transportation, September 1980.

4. Federal Railroad Administration, *High-Speed Ground Transportation Noise and Vibration Impact Assessment*, December 1998.

5. Kern County Planning Department, *Noise Element of the Kern County General Plan*, December 1989.

6. Plumas County, *Plumas County General Plan*, February 1994.

7.13 CULTURAL AND PALEONTOLOGICAL RESOURCES

7.13 CULTURAL AND PALEONTOLOGICAL RESOURCES

7.13.1 INTRODUCTION

7.13.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on cultural and paleontological resources. Only some elements of the proposed project have the potential to directly affect cultural resources (see Table 7.13-1). Historic resources that would not be impacted by the project are excluded from the discussion. Cultural and paleontological resources are discussed below.

TABLE 7.13-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON CULTURAL AND PALEONTOLOGICAL RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Damage or destruction of cultural and paleontological resources associated with changes in agricultural practices	7.13-1
Permanent transfers of water	Damage or destruction of cultural and paleontological resources associated with changes in agricultural practices	7.13-1
Transfer of Kern Fan Element lands	Damage or destruction of cultural and paleontological resources associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.13-3
Water supply management practices	Damage or destruction of cultural and paleontological resources associated with construction and operation of groundwater storage facilities/Changes in reservoir levels	7.13-2, 7.13-4, 7.13-5
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Damage or destruction of cultural and paleontological resources associated with restrictions on development of 490 acres of land in Kern Fan Element	7.13-3
Watershed forum in Plumas	Damage or destruction of cultural and paleontological resources associated with development of watershed improvement projects	7.13-6
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

During public review of the NOP for this EIR, concerns were raised regarding impacts to resources of cultural significance to Native American sites that occur or may occur within project areas, particularly reservoir fluctuation zones (Patrick Porgans and Associates, March 28, 2002).

7.13.1.2 Analytical Method

Cultural Resources

Archaeological resources evaluated for potential impacts were identified from previous environmental studies, and record searches at the appropriate information centers which are cited in this section.

Paleontological Resources

Paleontological resources evaluated for potential impacts were identified from previous studies of rock units that underlie project areas, rock units similar to those under the project areas, and previous discoveries. Previous studies that provided information for the analysis are cited in this section.

7.13.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, impacts on cultural resources would be considered potentially significant if the proposed project would:

- cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines Section 15064.5;
- directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or
- disturb any human remains, including those interred outside of formal cemeteries.

7.13.2 ENVIRONMENTAL SETTING

Definition of Cultural Resources

For the purposes of this analysis, the term "cultural resources" generally encompasses three broad categories: archaeological resources, historical resources, and Native American ethnic and cultural values and concerns. Archaeological resources are byproducts of human activities, either during prehistoric or historic times, and include human remains. In general, archaeological resources occur at or beneath the ground surface. There are exceptions, however, such as petroglyphs, bedrock milling slicks or mortars, or other features which are visible on exposed rocks. Historical resources are defined by their age and generally refer to events and features associated with Euroamerican settlement, primarily structures or other above-ground remains. A site may be both historical and archaeological, particularly if the materials within the site indicate occupation span long periods of time. The subject of Native American ethnic and cultural values and concerns covers a broad range of resources. Most prominent is the use of sacred and traditional lands by contemporary Native Americans for ceremonies, faunal and botanical resource exploitation, or other traditional activities. These areas often correspond to unrecorded archaeological and/or historical sites, such as rock art or petroglyph sites, or traditional funerary areas. Since many Native Americans are reluctant to discuss the location of sacred and traditional lands or associated activities, specific location information for many of these areas are unknown.

Geologic units containing fossils (paleontological resources) are present in many locations in the system. Most of the rock units containing fossils are sedimentary rocks associated with seas that covered most of California during the Mesozoic and early Paleozoic (about 75 to 290 million years ago [mya]). The type and distribution of fossils within a geologic unit provide valuable information that helps expand scientific knowledge about the range of plant and animal species and the ecosystems that were present millions of years ago.

7.13.2.1 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern and Kings Counties Including Kern Fan Element

Archaeological Resources

Since the 1960s, several important studies have been conducted in the southern San Joaquin Valley. Riddell and Olsen's examination of Paleoindian projectile points in private collection from the Tulare Lake basin offered the first evidence of early Holocene use of the region.[1] Fredrickson and Grossman's excavation of KER-116 for the California Department of Water Resources (Department) also indicated a Paleoindian occupation.[2] Hartzell's reexamination of the Buena Vista Lake assemblages further refined the cultural chronology for the area,[3] the results of which were supported by Sutton and Des Lauriers' overview of obsidian research from the southern San Joaquin Valley. To summarize, hydration measurements from localities in the nearby foothills and sites in or adjacent to lakeshore settings suggest exploitation of lacustrine resources was greatest between ca. 2,500 to 1,000 years before present (BP), when those environments were most productive. Prior and subsequent to this time period, hydration readings on obsidian artifacts suggest sporadic exploitation of lakeshore resources.[4]

Numerous cultural chronologies for the southern San Joaquin Valley and nearby regions have been offered by archaeologists, however critical gaps in the extant prehistoric record still exist. Although the cultural sequences differ in some of the details or vary by several hundred years, in general they concur, and identify similar technological and socio-political developments in California prehistory. Currently, the regional cultural sequence is divided into five periods: Paleoindian, Millingstone, Early, Middle, and Late.

Archaeological evidence suggests that California was settled during the **Paleoindian Period** (ca. 12,000-8,000 BP). In the southern San Joaquin Valley, numerous marshes and grassland environments offered early populations opportunities to procure a variety of resources.[5]

Assemblages dating to the **Millingstone Period (ca. 8,500 to 5,500 BP)** show similarities to the San Dieguito complex of Southern California, and contain a variety of flaked and cobble tools. Associated fauna from KER-116 reflect a generalized subsistence strategy, which incorporated artiodactyls, lagomorphs, waterfowl, fish, and turtles.[6]

More definitive evidence of prehistoric populations occurs during the **Early Period** (ca. 5,500 BP to 2,600 BP). Collections from a number of sites in the region typically contain numerous handstones and millingstones, reflecting greater use of seeds and nuts in the diet. Most reconstructions of Early Period economies, however, stress exploitation of faunal resources, such as deer and rodents, or a range of waterfowl and fish species.[7]

An increase in the frequency of ground stone artifacts during the **Middle Period** (ca. 2,600 BP to 1,000 BP) indicates greater reliance on botanical resources than in earlier times. The presence of pestles in addition to handstones and millingstones suggests incorporation of resources such as roots or perhaps acorns, which have higher processing costs. Waterfowl, fresh water fish taxa, and terrestrial fauna remains indicate exploitation of lakeshore and upland territories. Recovery of artifacts manufactured from exotic materials, such as extra-local obsidian, implies trade with other groups from different regions.[8]

Likely ancestral to the ethnohistoric Emigdiano, Castac, Chumash, Tataviam, and Gabrieliño/Tongva cultures, the **Late Period (ca. 1,000 to 500 BP)** is marked by greater elaboration of social, political, and economic organization. A subsistence strategy based largely on fishing and hunting of marine resources further develops during this time. Affiliations between southern San Joaquin Valley and coastal California groups imply an expansion and intensification of exchange networks during the Late Period.[9]

Ethnographic research in the San Joaquin Valley and the lower Sierra Nevada foothills has identified three cultural groups in the area: the Northern Valley, Southern Valley, and Foothill Yokuts. The Southern Valley Yokuts included a large number of distinct small tribes. The traditional Southern Valley Yokuts' territory included the southern end of the San Joaquin Valley and the area around Tulare, Buena Vista, and Kern lakes. Subsistence practices emphasized lacustrine resources, including waterfowl, fish (trout, salmon, chub, perch, and suckers), turtles, mussels, roots, and seeds. Less important were terrestrial fauna, such as tule elk, pronghorn antelope, mule deer, jackrabbits, and ground squirrels.[10]

Early European exploration of the area and the advent of missions appear to have had little effect on the Southern Valley Yokuts. In 1833, however, an outbreak of malaria took an estimated 75 percent of the native population. Subsequent annexation of California severely affected the Southern Valley Yokuts, as they were displaced and their land settled by immigrants.[11]

Paleontological Resources

The Southern San Joaquin Valley has a rich history of paleontological research, largely due to the deposition of faunal and floral remains into a prehistoric, Late Cretaceous marine environment along the western edge of the Valley. Deposited between 80 and 65 mya was a range of fossils, including dinosaur, reptile, fish, invertebrate fauna, and plant remains, that have since been recovered.[12] Northeast of Bakersfield, sediments, fauna, and flora that were deposited into a bay eventually fossilized. Subsequent geologic events uplifted the fossil-rich sediments, which eroded and exposed rich paleontological resources, such as the Sharktooth Hill bone bed. A 100-square-mile formation, this bone bed contains a variety of fossilized remains.[13]

Kings County is home to the Kettleman Hills, which contain three geological rock deposits: the Etchegoin, San Joaquin, and Tulare formations.[14] This region contains an abundance of invertebrate, vertebrate, and botanical fossils dating from the Pliocene Epoch (5.3 to 1.6 million years old). The area contains 370 registered fossil localities of approximately 570 registered fossil localities throughout Kings County.[15] Many of the fossils were preserved in a complex environment that integrated fresh water, estuarine, and marine conditions directly related to the sea that existed during the Tertiary Period (66.4 to 1.6 mya).

Castaic Lake

Archaeological Resources

Archaeological research around Castaic Lake began in the 1930s, when Richard Van Valkenberg initiated a systematic study of the area. In the early 1970s, salvage excavation at Castaic Reservoir was conducted. A records search at the South Central Coastal Information Center identified eight cultural resource surveys within the Castaic Lake area, and fourteen additional studies within a ¼-mile radius of Castaic Lake. Six prehistoric sites are located within the reservoir. Two are at an elevation of 1520 feet (ft) above mean sea level (amsl), and the other four range in elevation from 1275 to 1380 ft amsl.

The cultural chronology for Castaic Lake follows the general prehistory of the central coast and surrounding regions offered by.[16] Currently, the cultural sequence for Castaic Lake does not reflect the antiquity observed in near-by areas; evidence of human occupation of the area prior to 5,500 years ago is yet undiscovered.

Early Period (ca. 5,500 – 2,600 B.P.) sites typically contain contracting-stem and side-notched projectile points, several types of *Olivella* and *Haliotis* beads, mortar/pestle and millingslab/handstone technologies. Several sites show evidence of exploiting terrestrial and marine resources, suggesting a diverse economy.

Middle Period (ca. 2,600 – 1,000 B.P.) assemblages include contracting-stem and side-notched projectile points, several types of *Olivella* beads, and mortar/pestle technology. There appears to be an increase in use of maritime resources, and use of ocean-going vessels. Inland regions are populated during this time, and there is evidence that trade and exchange developed between highly populated coastal and inland villages.

Late Period (ca. 1,000 – 500 B.P.) assemblages imply an increasing cultural sophistication. There appears to be a highly level of craftsmanship, especially in the production of basketry, stonework, beadwork, seaworthy vessels and associated technology. Social and religious development seems to have been highly evolved. There is evidence that the large populations associated with this period were supported by abundant and varied local resources.

The area surrounding Castaic Lake was occupied by two Native American groups: the Interior Chumash and the Tataviam. Very little is known about the Interior Chumash. The Emigdiano appear to be a peripheral Interior Chumash group. The extent of their territory is an approximation, and is estimated to have included Grapevine to the east, Mount Abel Road to the west, Castaic Lake to the east, and Cuddy Valley Road to the south. The northern boundary is poorly defined, but is thought to have been equidistant from Lake of the Woods and Fillmore. While no prehistoric campsites or residences have been identified, some of the most elaborate Chumash pictographs occur within this area. Aside from historical documents which suggest a few Native Americans lived at a village on Tecuya Creek and others worked at the Rancheria of Casteque on the north shore of Castac Lake, there is no enthographical or archaeological data on the Emigdiano or their neighbors to the southeast, the Castac Chumash.[17]

To the south, the Tataviam lived primarily on the upper reaches of the Santa Clara River, east of Piru Creek, north to the Antelope Valley, south to the San Gabriel Mountains, and as far east as the Soledad Pass. Early ethnographies indicate that Tataviam territory was bounded by various Chumash groups. Although recognized as a culturally distinct group, archaeological data recovered from Tataviam-affiliated village sites in the area imply subsistence patterns and ritual practice were similar to those of neighboring Chumash and Gabrielino culture groups.[18]

Paleontological Resources

Los Angeles County is known for paleontological deposits, including fossil marine vertebrates and land vertebrates from rock deposited during the last 25 million years. During the Miocene and Pliocene Periods (from 23.7 to 1.6 mya), most of the greater Los Angeles Basin and the surrounding hills, including the Santa Clarita Valley and the Castaic Lake area, was submerged. Deposition of marine animals and shore birds in this marine environment created more than 1,100 known vertebrate fossil localities within the County. Primarily occurring within 700 square miles of hilly terrain underlain by fossil-producing rock formations, a substantial portion of the region containing these localities has been developed. In addition, much of the remaining area is threatened, particularly areas surrounding the Santa Clarita Valley and Castaic Lake; destruction of fossil sites in the area renders the remaining deposits even more valuable.[19]

Lake Perris

Archaeological Resources

The area surrounding Lake Perris is archaeologically sensitive.[20] Prior to the construction of Perris Dam and the creation of Perris Reservoir, the California Department of Parks and Recreation (DPR) and the University of California, Riverside (UCR) conducted a pedestrian cultural resources survey the Lake Perris State Recreation Area (LPSRA). Approximately 50 percent of the LPSRA was surveyed, including all of the areas adjacent to the reservoir and approximately 615 acres within the reservoir pool itself.[21] The survey identified approximately 110 sites within and immediately adjacent to the LPSRA. Most are on the north and northwest flank of Mt. Russell; only one site is located within the reservoir footprint. All but one site are either prehistoric habitation or resource processing locations. Nearly all sites contain bedrock milling equipment, such as mortars or metates, and many also contain petroglyphs or pictographs. One site identified during the survey is an isolated petroglyph.[22] A records search conducted at the Eastern Information Center identified one prehistoric site within the Perris Reservoir at an elevation of 1565 ft amsl. Recorded in 1970, the site consists of a boulder outcrop with mortar depressions and an associated handstone.

Indications of more recent use of the area are few. Only two sites recorded in the LPSRA contain both historic and prehistoric components. Several sites contain stone walls that may date to the historic era, but this is unverified, and the rock formations may relate to prehistoric times. Although the lack of historic sites may reflect the fact that the area was not used during the recent past or that sites dating to this era may be located outside of the survey corridor, historic resources were not routinely recorded during the 1970s. If DPR and UCR followed common survey methods of the time and essentially ignored historic-era sites, there may be numerous unrecorded historic-age deposits within the LPSRA.[23]

Our current understanding of the prehistory of the area is based on years of archaeological and ethnographical research. The earliest regional cultural chronology was offered by Wallace, later refined by Warren.[24,25,26] Initially the definitions of the horizons was based primarily on artifact assemblages, however subsequent investigations that incorporated radiometric assays and comparative site analyses have not changed the basic chronology offered by Wallace. In addition, although much of the early work that led to the development of a regional prehistoric framework was conducted along the coast, research has shown the Wallace/Warren model to be applicable to inland southern California as well.[27,28]

The **Early Man Horizon** (ca. pre-6,000 B.C.) represents Paleo-Indian populations in the region. Large projectile points and scrapers may reflect small, nomadic bands of hunters; however, the data are limited; in the near-by Mojave Desert, recent studies have suggested that groups practiced a more generalized economy.

In contrast to the Early Man Horizon, the **Milling Stone Horizon** (ca. 6,000-1,000 B.C.) is well-represented in the area. An extensive tool-kit consisting of ground, battered, and flaked stone speaks to a diversified economy during the Milling Stone Horizon; one that incorporated plants into the subsistence base. An overall lack of projectile points during the early part of the Milling Stone Horizon may reflect a decline in hunting activities, perhaps due to a decrease in faunal populations. The reintroduction of large projectile points during the latter part of this horizon suggests a return to an economy that exploited a variety of resources.

The **Intermediate Horizon** (ca. 1,000 B.C.-750 A.D.) appears to be a transitional time in the archaeological record. Very little is known about this horizon. While Intermediate Horizon assemblages appear similar to those attributed to the Middle Horizon, differences in projectile point morphology and the introduction of portable mortars and pestles (used in acorn processing) implies that a significant technological shift occurred.

Finally, the **Late Prehistoric Horizon** (ca. 750 A.D. to Spanish contact [1769 A.D.]) is a time of increased sedentism and technological sophistication. Tool-kits become more diverse, and included steatite bowls, asphaltum, cremations, funerary objects, an elaborate shell industry, and the introduction of bedrock milling slicks. The continued use of mortars and pestles implies a constant need for reliable food resources. The presence of small projectile points (reflecting the introduction of the bow and arrow) suggests a shift in hunting technologies, one that was more efficient over the spear.

Regional ethnographies identify the Cahuilla as the primary Native American group in the Lake Perris vicinity. The Cahuilla of central southern California utilized a large area, including mountain ranges and passes, foothills, canyons, valley floors, and lower desert environs. Villages were typically located in canyons where resources were most plentiful. Subsistence practices included hunting small animals, and gathering acorns, mesquite, screw beans, piñon nuts, seeds, tubers, roots, and greens. Interaction with other tribes was common, as the Cahuilla territory was bisected by the Cocopa-Maricopa Trail, a major trade route, and was adjacent to two other well-used routes.[29]

The Cahuilla initially were hostile to Europeans; however, interaction with several *assistencias* in 1819 led the Cahuilla to adopt some European practices. In 1863 a small pox epidemic killed many Cahuilla. In 1877 reservations were established, and the traditional lifeways of the Cahuilla were suppressed.[30]

Paleontological Resources

Lake Perris has been designated as a highly sensitive paleontological area. This area contains an extensive fossil record, ranging from diverse marine mollusks in the Jurassic Period (about 150 mya) to the oldest known Tertiary flora (about 60 mya) in Southern California, and includes a wide range of large, ice age mammals from the Pliocene and Pleistocene Epochs (2.5 mya to10,000 years ago).[31] These remains chronicle marine advances, beach and lake formation, and climate change. Fossils from the Miocene Epoch (23.7 to 5.3 mya) are known to be present in project lands in the Coachella Valley, particularly in Western Riverside County, where fossiliferous layers occur in sediments lying on the surface of crystalline bedrock or that have been exposed by faulting activity. Pleistocene Epoch fossils have been found within four ft of the ground surface in large areas of the Perris Plain, which includes the area surrounding Lake Perris.[32]

San Luis Reservoir

Archaeological Resources

In the 1960s, several state agencies conducted salvage excavation at San Luis Reservoir. Treganza surveyed the area, followed by excavations of a single component, Late Period site, CA-MER-14, by Crabtree and, later, Riddell. In 1966 and 1967 the Grayson site (CA-MER-S-94) was excavated by Olsen and Payen. Based on their work, Olsen and Payen hypothesized the local population practiced a hunting and acorn-gathering economy.[33] A records search conducted at the Central California Information Center identified 26 cultural resources within the San Luis Reservoir. Of these, twenty-two sites are located at an elevation of at least 400 ft amsl, and four sites occur between elevations of 250 and 275 ft amsl.

Unlike other areas of California, where there is evidence of prehistoric populations dating to at least 10,000 B.P., the archaeological record for the San Luis Reservoir area dates back just 5,200 years. Four complexes have been identified in the region: Positas, Pacheco, Gonzaga, and Panoche complexes.

The **Posita Complex** dates ca. 5,200 - 4,500 B.P. This complex is distinguished by a lack of burials. Artifacts associated with this complex include perforated discoidals, seed and grain processing technologies (mortars, pestles, millingstones, and handstones), formalized flaked stone tools (scraper planes and small flake scrapers), spire-lopped *Olivella* beads, and perforated pebble pendants.

Following the Posita Complex, the **Pacheco Complex** is divided into two phases. The earlier of the two phases, **Pacheco Complex B** dates between 4,500 - 2,600 B.P. Assemblages attributed to this phase include large leaf-shaped or foliate projectile points, small quantities of ground stone (slabs and mortars), thick rectangular *Olivella* and *Haliotis* beads, and freshwater mussel beads. Use of this phase is provisional, as it manifests at only one site and is largely intuitive and based on artifact typologies within the Central California Taxonomic System.

Pacheco Complex A sites (ca. 2,600 – 1,000 BP) contain flexed burials, large stemmed and side-notched projectile points, a variety of *Olivella* beads, *Macoma* beads, a range of bone ornaments and tools, stone and pebble ornaments and pendants, and ground stone tools (mortar/pestle and millingstone/handstone). Small quantities of marine shell speak to some connection with coastal environments. House floors have been associated with this phase, and are circular features 3 - 4 meters in diameter.

Gonzaga Complex date between ca. 1,000 - 450 B.P. The complex is characterized by a variety of milling tools, including bowl mortars, shaped mortars, slab [hopper] mortars, slab millingstones, and handstones. Projectile points are uncommon, and most often are square tapered-stem points or occasionally serrated. Bone tools, ear ornaments, beads are abundant and elaborately made. House floors increase in size, up to 7 to 10 meters in diameter.

The **Panoche Complex** dates from ca. 450 - 150 B.P. Associated artifacts include a range of mortar and pestle forms, some millingstones and handstones, small side-notched and concave-base triangular arrow points, bone tools, steatite artifacts, and a variety of beads and ornaments. Structures include both smaller dwellings approximately 10 - 15 meters in diameter and larger assembly houses 25 meters across.

At the time of contact, the local Native American population was the Northern Valley Yokut. Their territory extended from north of Stockton southward past the Calaveras River, west to the crest of the Diablo Range, and east to the Sierra Nevada foothills. Within the confines of the Northern Valley Yokut territory, the San Joaquin River and its tributaries collected vast amounts of water, creating tule-choked marshes. Fishing and hunting of waterfowl along these waterways were important subsistence activities, as were harvesting acorns, roots, and seeds. Villages typically were situated along riverbanks or atop of mounds, protecting the inhabitants from flooding.[34]

As with other tribes in California, interaction with Europeans resulted in a decline in Northern Valley Yokut population. Establishment of the missions decimated the native population, and diseases introduced by Europeans killed many people. Later, as the valley became a prime agricultural area, the Yokuts were removed from their territory.[35]

<u>Paleontological Resources</u>

Several fossil-bearing units occur in the area surrounding the San Luis Reservoir, generally of Pleistocene and Miocene age. These units, particularly the Pleistocene alluvial units, such as the Los Banos Alluvium, are known to contain important paleontological resources, including dinosaur, reptile, fish, invertebrate fauna, and plant remains.[36]

Lake Oroville

<u>Archaeological Resources</u>

Archaeological research associated with the construction of the Oroville Facilities commenced in the early 1950s. Most of the early studies focused on Native American cultural resources, as opposed to historic-era remains; however, recent research included historic accumulations as part of the cultural landscape.[37]

The earliest studies were conducted by students from the University of California, initially under the guidance of Treganza, then later Heizer. In the 1960s, Riddell and Olsen conducted large inventories and several excavations along the Feather River, while Ritter and Chartkoff led the most extensive survey of the time. After the installation of the facilities, various studies were conducted in the 1980s and 1990s. Most recently, archaeologists from Sonoma State University and California State University, Sacramento surveyed more than 7,500 acres of the reservoir fluctuation zone, resulting in the discovery of 170 archaeological sites and re-recordation of 43 sites.[38]

A prehistoric chronology for Butte County and the surrounding area is provided in Serverston et al.[39] Prior to 5,000 B.P., evidence of human occupation in the Lake Oroville area is missing, although there are indications that humans inhabited near-by areas. The earliest date secured for Lake Oroville is approximately 3,000 B.P.

The **Mesilla Complex** (ca. 3,000 - 2,000 B.P.) is the oldest complex in the Lake Oroville sequence. A variety of dart-sized projectile points are associated with this complex, including leaf-shaped, stemmed, and side-notched forms manufactured from basalt, chert, and slate. Grinding implements for vegetal and seed processing are also common, as are *Olivella* and *Haliotis* beads, charmstones, and bone tools and ornaments. The archaeological record implies seasonal use of the area by small bands and groups.

During the **Bidwell Complex** (ca. 2,000 - 1,200 B.P.) it appears that people began establishing permanent villages, and possibly cemeteries, in the area. Dart points are similar to those recovered from older contexts. Fishing technologies are developed, and include the use of nets held in place with stones. Milling slabs and wooden mortars imply acorn processing. Other implements include steatite vessels, likely used for cooking.

The bow and arrow are introduced to local Native Americans during the **Sweetwater Complex** (ca. 1,200 - 500 B.P.). This innovation resulted in smaller, lightweight stemmed and corned-notched projectile points. Grinding implements are almost exclusively mortar and pestle. Steatite industries become more elaborate, and include a variety of forms (cups, platters, bowls, and smoking pipes). The use of bone and shell artifacts increases, and the acorn complex is well-developed.

The **Oroville Complex** (ca. 500 – 150 B.P.) is the ethnographic Maidu-Konkow times. Acorn processing is a primary focus. Small arrow-sized projectile points and bedrock mortars are dominant tool forms. Bone industry is highly developed, and includes tubular beads, whistles, gorge hooks, gaming pieces, and awls. Other artifact forms include steatite pipes and clamshell disk beads.

The Konkow Maidu tribe, also referred to as the Northwestern Maidu, is one of three linguistically related groups known as the Maidu. The Konkow Maidu traditional territory abutted that of the Mountain Maidu to the northeast and the Nisenan to the south. They occupied lands near the base of the Sierra Nevada foothills from around Chico Creek in the north, south to the Sutter Buttes along the Feather River, and included a stretch of the Sacramento River around Chico. A particularly large Konkow Maidu population was also located north and east of present-day Oroville along the North, Middle and South Forks of the Feather River.[40] Konkow Maidu settlements typically consisted of several smaller villages supported by a larger village, which served as the ceremonial and political hub for the community. Seasonal subsistence practices of the Konkow largely consisted of hunting deer in the summer (the meat dried for winter) and gathering grass seeds in the spring. Other important resources to the diet included salmon, acorns, and pine nuts. Trade networks extending north-south and east-west contributed extra-local resources to the diet and material cultural.[41]

The arrival of Europeans and Euro-Americans largely destroyed traditional Konkow Maidu practices. The introduction of diseases in the early 1800s decimated the native population. Some Konkow Maidu settled on the Nome Lackee Reservation in Tehama County in 1854, but poor conditions at the reservation caused many to return to the Oroville area. In 1863, 500 of the Konkow Maidu people were forcibly removed from the Oroville area to the Round Valley Reservation in Mendocino County. Forced to march 100 miles, many of the younger and older populations did not survive the trek. In the 1960s, the Oroville Facilities inundated one of the rancherias and many of the places the Konkow Maidu traditionally had fished.[42]

Paleontological Resources

Portions of the Lake Oroville vicinity contain the Jurassic Monte de Oro formation (known to contain paleontological resources[43]), the Chico formation, the Miocene Lovejoy basalt formation, the Tuscan formation, and a metamorphosed assemblage of Paleozoic and Mesozoic metasedimentary rocks.[44] The Monte de Oro formation, which occurs in only a few small locations in the Sierra Nevada foothills, all in the vicinity of Lake Oroville and portions of the Feather River, contains a variety of marine shells, and an abundance plant remains.[45,46] Miocene plant and vertebrate fossils (about 11 mya) have been discovered along the foothills, particularly in the central Sierra Nevada, as part of the Lovejoy formation. Such fossils typically are observed in bluffs along rivers and streams and may be present in the project areas.[47] The Chico formation also contains a high concentration of fossils, including California's first pterosaur, and the State's first Mesozoic bird, an *Ichthyornis*, a *Hesperornis*, and a neognath.[48]

7.13.2.2 Changes in Physical Setting between 1996 and 2003

The nature and types of cultural resources present generally do not change and, therefore, the environmental setting described under 1995 conditions would be the same under 2003 conditions. The cultural resource setting for Plumas County is provided below.

Plumas County

Archaeological Resources

A moderate amount of archaeological research has been conducted in Plumas County, primarily in Lassen National Forest. Work conducted at Bucks Lake and Big Meadows suggests minimal use of the area prior to ca. 4500 B.P.[49,50] Later, human use of the region increased. Sites identified in the area include villages, base camps, temporary camps, bedrock milling stations, and toolstone quarries.[51]

Northern Sierra Nevada cultural chronology includes the last 10,000 millennia, however the two earliest phases (**Walker Lake Phase** [ca. pre-10,000 B.P.] and **Tahoe Reach Phase** (ca. 10,000 – 8,000/7,500 B.P.]) is represented by only a few isolated projectile points, which suggests that during these phases groups were highly mobile. The next phase (**Spooner Phase** ca. 8,000/7,500 – 5,000 B.P.) is also poorly represented in the archaeological record for the area.

Better documentation exists for the **Early Martis Phase** (ca. 5,000 – 3,000 B.P). A high frequency of ground stone tools, presence of pit houses and storage pits, suggests extended stays in the area, with on-site activities focused on seed processing and resource storage. Projectile points forms include Martis contracting-stem, split-stem, and Steamboat forms. The **Late Martis Phase** (ca. 3,000 – 1,300 B.P.) is similar to Early Martis Phase; however, projectile point forms for the Late Martis Phase include Martis corner-notched, Elko Corner-notched, and Elko-eared forms.

The advent of bow and arrow technology occurs during the **Early Kings Beach Phase** (ca. 1,300 – 700 B.P.). Assemblages from this phase consist of Rosegate and Gunther series projectile points, small flaked stone tools, and bedrock mortars, the latter related to acron processing. The **Late Kings Beach Phase** (750 – 150 B.P.) is similar to the Early Kings Beach Phase, but Desert-series projectile points replace earlier forms.

The Northeastern Maidu tribe, also called the Mountain Maidu, is one of three groups ascribed to the Maiduan family of languages. The Northeastern Maidu typically occupied mountain meadows generally 4,000 ft amsl or higher, encompassing Lassen Peak on the northwest, south to Pilot Peak and the Sierra Buttes, and east to Snowstorm Mountain and Honey Lake. To the west, Northeastern Maidu territory abutted that of the Konkow Maidu. Permanent villages were established throughout the area, including Mountain Meadows, Big Meadows/Lake Almanor, Butte, American, Indian, Genesee, and Red Clover valleys. The Northeastern Maidu knowledge of local flora and fauna was extensive; subsistence practices included gathering of seeds and nuts, and hunting, with most resources having multiple uses.[52]

Unlike their neighbors, the Konkow Maidu, the Northeastern Maidu were much more dependent upon hunting. The arrival of Euro-Americans in Northeastern Maidu territory upset the Native Americans' subsistence practices. Some Native Americans resorted to killing settlers' livestock as a means to survive, which often led to retaliation by the settlers. Conflicts with settlers often resulted in the death of Native Americans, which, in addition to the spread of diseases, rapidly diminished the Northeastern Maidu population.[53]

Paleontological Resources

Portions of Plumas County contain the Monte de Oro and Chico formations. The Monte de Oro formation contains a variety of shells of marine animals, mostly broken, and abundant remains of a large variety of land plants and occurs in only a few small locations in the Sierra Nevada foothills.[54,55] By the beginning of the Tertiary Period, the landscape of the Sierra Nevada changed from the deep oceans to shallow, lagoon-lined sea along the foothills. Miocene plant and vertebrate fossils (about 11 mya) have been discovered along these foothills. Such fossils typically are observed in bluffs along rivers and streams and may be present in the project areas.[56] The Chico formation contains a high concentration of fossils, including California's first pterosaur, and the State's first Mesozoic bird remains, an *Ichthyornis*, a *Hesperornis*, and a neognath.[57]

7.13.2.3 Regulatory Setting between 1996 and 2003

The treatment of cultural resources is governed by federal, State, and local laws and guidelines. There are specific criteria for determining whether prehistoric and historic resources or objects, and traditional cultural sites are significant and/or protected by law. Federal and State significance criteria generally focus on the resource's integrity and uniqueness, its relationship to similar resources, and its potential to contribute important information to scholarly research. Some resources that do not meet federal significance criteria may be considered significant by State criteria. The laws and regulations seek to lessen impacts on significant prehistoric or historic resources. The federal, State, and local laws and guidelines for protecting historic resources are summarized below.

Federal

Federal laws for cultural resources are governed primarily by Section 106 of the National Historic Preservation Act of 1966 (amended 1999). The Code of Federal Regulations Title 36 includes specific information on the protection of historic resources. A historic property is defined to mean any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties, as well as localities that are of traditional religious and/or cultural importance to a Native American tribe or Native Hawaiian organization.

State

Historical Resources

CEQA requires public agencies to consider the effects of proposed projects on both "historical resources" and "unique archaeological resources." Pursuant to Public Resources Code (PRC) Section 21084.1, a "project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." Section 21083.2 of the PRC also requires agencies to determine whether a proposed project would have a significant effect on "unique archaeological resources." Section 15064.5 of the State CEQA Guidelines (California Code of Regulations [CCR] Title 14, Chapter 3) provides additional guidance on how agencies are to determine the significance of impacts on historical and archaeological resources. Pending future evaluation of cultural resources against the criteria noted below, resources will be managed as though eligible.

Section 15064.5 of the State CEQA Guidelines defines a "historical resource" as a resource that meets at least one of the following three criteria:

- A resource listed in or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (CRHR), as defined in PRC Section 5024.1 and CCR Section 4850 et seq.;
- A resource included in a local register of historical resources, as defined in PRC Section 5020.1(k) or identified as significant in a historical resources survey meeting the requirements of PRC Section 5024.1(g) – unless the preponderance of evidence demonstrates that it is not historically or culturally significant; or
- Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the lead agency's determination is supported by substantial evidence in light of the whole record.

PRC Section 21084.1 and Section 15064.5 (a)(4) also acknowledge that even if a resource does not meet the above criteria, this fact shall not preclude a lead agency from determining that the resources may be a historical resource as defined in PRC Sections 5020.1(j) or 5024.1.

The CRHR was created in 1992 and is intended as an authoritative listing of the State's significant historical and archaeological resources (PRC Section 5024.1 and CCR Section 4852). The criteria for listing in the CRHR (codified in PRC Section 5024.1 and clarified in CCR Section 4852) are intended to serve as the definitive criteria for assessing the significance of historical resources for purposes of CEQA.

By definition, the CRHR includes the following resources:

- Listed in the NRHP;
- Formally determined eligible for listing in the NRHP;
- California Historical Landmarks beginning with #770; and
- California Points of Historical Interest beginning with those designated in January 1998.

The second category of "historical resources" under PRC Section 21084.1 includes those "deemed significant pursuant to criteria set forth in subdivision (g) of Section 5024.1." Subdivision (g) of the statute provides that a resource identified as significant in a historical survey may be listed in the CRHR if the survey meets all of the following criteria:

- The survey has been or will be included in the State Historic Resources inventory;
- The survey and the survey documentation were prepared in accordance with procedures and requirements of the State Office of historic Preservation;
- The resource is evaluated and determined to have a significance rating of Category 1 to 5 on the DPR Historic Resources Inventory Form; and
- If the survey is 5 years or older at the time of its nomination for inclusion in the CRHR, the survey is updated to identify historical resources which have become eligible or ineligible due to changed circumstances, or further documentation is provided on those resources which have been demolished or altered in a manner that substantially diminished the significance of the resource.

A resource is presumed to constitute an "historical resource" if it is included in a "local register of historical resources" meeting the above criteria, unless "the preponderance of evidence demonstrates that it is not historically or culturally significant' (CCR Section 15064.5[a][2]).

In addition to assessing whether historical resources potentially affected by a proposed project are listed in the CRHR or have been identified in a survey process meeting the requirements of PRC Section 5024.1(g), lead agencies have a responsibility to evaluate resources against the CRHR criteria for eligibility before making a finding as to a proposed project's impacts on historical resources (PRC Section 21084.1; CCR Section 15064.5[a][3]). A resource shall be considered historically significant if it is significant at the local, state, or national level under one or more of the following criteria:

1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
2. Is associated with the lives of persons important in our past;
3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic value; or
4. Has yielded, or may be likely to yield, information important in prehistory or history.

For a resource to be determined eligible for listing in the CRHR, it must be historically significant and retain enough of its historic character or appearance to be recognizable as a historic resource and to convey the reasons of its significance. "Integrity" is defined as the retention of the resource's physical identify that existed during its period of significance. Integrity is determined by considering the location, design, setting, materials, workmanship, feeling, and association of the resource.

Archaeological Resources

CEQA and the State CEQA Guidelines also require lead agencies to consider whether projects will affect archaeological resources (PRC Section 21083.2 and CCR Section 15064.5[c]). If an archaeological site is a historic resource meeting one of the above criteria, agencies shall follow the provisions of PRC Section 21084.1. If, however, an archaeological site does not meet these criteria, but does meet the definition of an "unique archaeological resource" as defined in PRC Section 21083.2(g), the resource must be considered under CEQA in compliance with PRC Section 21080.1. An unique archaeological resource is defined in PRC Section 21083.1(g) as "an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;
2. Has a special and particular quality such as being the oldest of its type or the best available example of its type; or
3. Is directly associated with a scientifically recognized important prehistoric or historic event or person."

Native American Burials

California law protects Native American burials, skeletal remains and associated grave goods regardless of their antiquity and provides for the sensitive treatment and disposition of those remains (California Health and Safety Code Section 7050.5, California PRC Sections 5097.94 *et seq*.). Section 7050.5(b) of the California Health and Safety code specifies protocol when human remains are discovered. These requirements have been incorporated into Section 15064.5(e) of the CEQA Guidelines.

Local

General Plans

General Plans of the various counties and cities of the State of California contain goals and policies aimed at protecting cultural resources in the region.

Kern County

The Kern County General Plan includes extensive reviews of archaeological research, history and ethnography in the county, and Native American concerns are noted (especially in regard to cemeteries). The appropriateness of using Native American monitors is indicated. The Plan notes that impacts may occur when development takes place without consideration of important resources, and it notes the prudence of using inventories and avoiding impacts to sites by various means.

Merced County

Merced County has a significant amount of historical and archaeological resources. The overall goal of the County is to recognize and manage those significant resources. Policy directions consist of recommending careful management of projects that affect resources, and limited and controlled public access to sites.

Riverside County

Riverside County has a significant amount of historical, archaeological, and paleontological resources. The sensitivity of these resources has been mapped county-wide. The General

Plan Policies are intended to ensure the preservation of cultural, historical, archaeological, paleontological, geological, and educational resources in the County.

Los Angeles County

Los Angeles County has a significant amount of historical and archaeological resources. The County is preparing to update their General Plan. The current General Plan contains goals and policies to "promote the preservation and enhancement of landmarks, sites, and areas of cultural, historical, archaeological and urban design significance."

Butte County

The Butte County General Plan has been incrementally updated with revision dates for the various sections ranging from 1971 to 2004. None of the 12 sections of the General Plan contain any goals or policies relating to cultural or paleontological resources. The County is currently planning a General Plan Update.

7.13.2.4 Changes in Regulatory Setting between 1996 and 2003

Federal

Revisions to 36 CFR 800 were made in January 2001 call for a significant increase in Native American consultation in the Section 106 process. Native American Tribes must now be consulted at all phases of work, including eligibility of prehistoric sites, which was not previously required.

State

<u>California Senate Bill 297</u>

This bill addresses the disposition of Native American burials in archaeological sites and protects such remains from disturbance, vandalism, or inadvertent destruction; establishes procedures to be implemented if Native American skeletal remains are discovered during construction of a project; and establishes the Native American Heritage Commission to resolve disputes regarding the disposition of such remains. It has been incorporated into Section 15064.5(e) of the State CEQA Guidelines.

There has been no significant change in regulations governing cultural resources. The regulatory setting described under 1995 conditions for southern San Joaquin Valley portion of Kern County (including the Kern Fan), Castaic Lake, Lake Perris and San Luis Reservoir is the same under 2003 conditions. The regulatory setting for Plumas County is provided below.

Local

<u>Plumas County General Plan</u>

Goals for the preservation of historical resources are established in the Plumas County General Plan. Protection and preservation of historical and prehistoric sites, structures, and objects for their scientific, educational and cultural values is required. Private owners are encouraged to preserve and rehabilitate historical buildings and to continue their use as an integral part of the community.

7.13.3 IMPACTS AND MITIGATION MEASURES

7.13-1 Reallocation of water supplies during droughts and/or permanent transfers of water could potentially affect agricultural practices, which could damage or destroy cultural and paleontological resources in the southern San Joaquin Valley portion of Kern County and Kings County.

1996 — 2003

The Southern Valley Yokuts Native American Groups occupied the southern portion of San Joaquin Valley portion of Kern and Kings counties; therefore, archaeological sites could be present. As described in the setting discussion, prehistoric sites have been recorded in the Kern Fan Element. In addition, paleontological deposits have also been identified in the southern portion of the county. Some of these deposits are exposed, while others are buried. Ground disturbance associated with agricultural activity has the potential to damage or destroy prehistoric archaeological artifacts and paleontological materials at or under the soil surface.

Agricultural activities include plowing (which disturbs the soil profile to a deeper level), discing (which disturbs the soil profile to a shallower level) and other ground-disturbing activities. The maintenance of annual crops usually involves plowing that disturbs a deeper level of the soil profile. The maintenance of permanent crops or fallow land usually involves discing for weed control that disturbs a shallower level of the soil profile. Because the reliability and availability of agricultural water supplies can affect the amount and types of crops that farmer's plant, the extent and frequency of land disturbance is also expected to vary in response to water availability. As discussed in Section 7.6, Agricultural Resources, there is no strong evidence to support a conclusion that land was taken out of irrigated production as a result of the proposed project.

Ground disturbance associated with agricultural activity could expose artifacts resulting in damage and/or destruction of potentially significant cultural and paleontological resources. However, agricultural activity existed prior to implementation of the proposed project and the land had been disturbed for a variety of agricultural uses depending on the availability of water, among other factors. Therefore, any resources present on the site would most likely have already been disturbed or destroyed. Therefore, the impact of the proposed project would be ***less than significant***.

<u>Mitigation Measures</u>

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing annual crops with permanent crops is expected to continue. Impacts on cultural and paleontological resources would be similar to those described above for the period 1995 through 2003 (see Impact 7.13-1, 1996 — 2003 discussion).

Ground disturbance associated with agricultural activity could expose artifacts resulting in damage and/or destruction of potentially significant cultural and paleontological resources. Prior to implementation of the proposed project the land was disturbed for a variety of agricultural uses depending on the availability of water, among other factors. Any resources present on the site would most likely have been disturbed or destroyed when agricultural practices began in the area. Therefore, the impact of the proposed project would be ***less than significant***.

<u>Mitigation Measures</u>

None required.

7.13-2 Groundwater banks developed or expanded in response to opportunities to store groundwater outside service areas under Article 56 could potentially damage or destroy cultural and paleontological resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element).

1996 — 2003

The Monterey Amendment provides prior Department approval for SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several urban contractors entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1995 and 2003, Semitropic WSD, and Arvin-Edison WSD developed or expanded water banks.

The water banking program developed by Semitropic WSD involved the construction of a pipeline connecting the District's service area to the California Aqueduct. Arvin-Edison's water banking program involved the construction of 520 acres of percolation ponds at two sites referred to as the North Canal Spreading Works and the South Canal Spreading Works. Vacant land or cropland was converted to percolation ponds by the construction of one or two-foot high perimeter levees.[58] Grading was required to construct the percolation ponds. The Semitropic WSD facility was built prior to the Monterey Amendment.

In 2002 the Kern Delta WD prepared an EIR for their Water Banking and In-Lieu Water Supply Project. This project involved the construction of new facilities including groundwater recharge basins, pipelines/canals and associated facilities to deliver supplies from the California Aqueduct to Kern Delta and the Arvin-Edison Canal, a pipeline to convey surface supplies to farmers in the eastern side of Kern Delta as part of an in-lieu banking program, and an extraction well field to recover stored groundwater and covey supplies back to the California Aqueduct. These new facilities were integrated into the existing water supply management system.

Prehistoric sites were identified in both the Semitropic and Arvin-Edison project areas. Two prehistoric sites and nine isolated artifacts were identified along the Semitropic project proposed pipeline alignments.[59] Known cultural resource sites are also located in the Arvin-Edison service area; however, these sites were identified as outside of the project impact area.[60] Archaeological and paleontological deposits have also been identified in the southern portion of the county. Some of these deposits are exposed while others are buried. Ground disturbance involved with the installation of these facilities could have resulted in the damage and/or destruction of cultural resources.

CEQA documents for both the Semitropic and Arvin-Edison included mitigation measures designed to protect identified and previously unidentified archaeological and paleontological resources during construction. The Arvin-Edison Management Project Negative Declaration included mitigation that if previously unidentified paleontolgical resources were discovered during construction activities that work would cease and a qualified paleontologist would examine the discovery and make recommendations for appropriate data recovery.[61] Construction of the Semitropic project had the potential to adversely affect cultural and paleontological resources, but mitigation measures were implemented to reduce impacts to a less-than-significant level. No significant resources were found during either project. Therefore, the proposed project is considered to have had a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

The Kern Delta WD identified the potential for cultural resources to be adversely affected as a result of implementation of the Kern Delta WD Water Banking and In-Lieu Water Supply Project in the future.[62] The Final EIR (State Clearinghouse #20001011103) evaluated the potential for such resources to be damaged and/or destroyed. Mitigation measures included development and implementation of a Cultural Resources Treatment Plan to ensure that if previously unidentified archaeological resources were discovered during construction activities, that work would cease and a qualified archaeologist would examine the discovery and make recommendations for appropriate data recovery. With implementation of the mitigation measures, the impact would be reduced to a level of less than significant with the exception of discovering Native American human remains. The EIR concluded that any disturbance of Native American human remains would result in a potentially significant and unavoidable impact.

As noted above in the 1996 — 2003 discussion, the Monterey Amendment facilitates SWP contractors to store water outside their service areas for later use within their service areas. Between 1996 and 2003, several contractors began storing water in groundwater banks in the southern San Joaquin Valley. It is expected that in the future, contractors would increase their use of groundwater banks. If future increased groundwater banking involved active recharge, then new percolation ponds would be built. It is expected that an additional 500 acres of ponds would be developed as part of other groundwater storage facilities in Kern County. Grading would be required to construct the percolation ponds that could expose identified and/or previously unidentified cultural and paleontological resources to damage and/or destruction. As described under the Impact 7.13-2, 1996 — 2003 discussion, such resources have been identified in the project area. Therefore, the construction of additional percolation ponds could result in a *potentially significant impact*.

<u>Mitigation Measures</u>

Implementation of the following mitigation measures would reduce impacts to cultural and paleontological resources in the southern San Joaquin Valley portion of Kern County and Kings County. However, because the Department does not have jurisdiction over local land use decisions in Kern County, impacts would be ***potentially significant and unavoidable***.

7.13-2 a) *An analysis to identify the potential presence of archaeological resources on the project site shall be conducted. The analysis shall include, at a minimum, a records check and literature survey from the appropriate California Historic Resources Information System (CHRIS) center and a Phase I Cultural Resources Investigation by an archaeologist listed on the Register of Professional Archaeologists (RPA). If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection, or the recovery, preservation, study, and curation of the resource, as appropriate. The analysis and the measures developed shall be consistent with the practices and intent described in Section 21083.2 et seq. of the Public Resources Code, as well as Sections 15064.5 et seq. and 15126.4(b) of the California Code of Regulations, and shall be consistent with current professional archaeological standards.*

The archaeologist shall prepare a report of the results of any study prepared, following accepted professional practice. Copies of the report shall be submitted to the Lead Agency and to the appropriate CHRIS information center.

The Lead Agency shall also consult, as appropriate, with the Native American Heritage Commission and appropriate Native American tribal representatives to address Native American cultural values with respect to archaeological contexts.

Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost.

7.13-2 b) *An analysis to identify the potential presence of paleontological resources on the project site shall be conducted. If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection or recovery, preservation, study, and curation of the resource, as appropriate. The analysis and measures developed shall be consistent with the practices and intent described in the Conformable Impact Mitigation Guidelines developed by the Society of Vertebrate Paleontology (News Bulletin No. 163, 1995) and shall be consistent with current professional paleontological standards.*

Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost.

7.13-2 c) *In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately, the area of the find shall be protected, and the Lead Agency immediately shall notify the County Coroner of the find and comply with the provisions of PRC Section 5097 with respect to Native American involvement, burial treatment, and re-burial, if necessary.*

Implementation of Mitigation Measure 7.13-2(c) would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.

7.13-3 Transfer of land in the Kern Fan Element to the Kern County WA could potentially result in damage and/or destruction of cultural and paleontological resources in the Kern Fan Element as a result of development of groundwater banks.

1996 — 2003

In 1995, the Kern Water Bank Authority (KWBA) constructed approximately 3,034 acres of shallow recharge ponds in the Kern Fan Element. From 1998 through 2003, KWBA constructed an additional 4,080 acres of recharge ponds, for a total of 7,114 acres in 2003, in the Kern Fan Element. The KWBA also constructed the Kern Water Bank (KWB) Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[63]

As previously noted in the Impact 7.13-1, prehistoric sites have been recorded in the Kern Fan Element, and paleontological deposits have been identified in the southern portion of the county. Some of these deposits are exposed while others are underground. Ground disturbance associated with the construction of groundwater storage facilities could expose paleontological resources. Prior to construction, archaeological investigations were completed in the Kern Fan Element and for the KWB Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP). Some of these investigations recorded significant archaeological sites at or near the Kern Fan Element project area.[64] Mitigation measures were also adopted to ensure that if previously unidentified archaeological resources were discovered during construction activities, that work would cease and a qualified archaeologist would examine the discovery and make recommendations for appropriate data recovery. Therefore, the proposed project is considered to have had a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As noted in the discussion above for 1996 – 2003, above, through 2003 the KWBA built approximately 7,114 acres of groundwater storage facilities (4,699 acres in the Recharge Sector and 2,415 within the Farming Sector). Under the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds.

The HCP for the Kern Fan Element allows developed uses on about 4,000 acres of the Kern Fan Element.[65] Developed uses include farming, permanent facilities for the KWB and commerce. Approximately, 490 acres is designated for possible commercial use. Between 1996 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel, so under the proposed project the parcel would remain undeveloped.

As a consequence of the proposed project, approximately 1,200 acres of land would be converted to percolation ponds. Construction of percolation ponds and associated levees could expose cultural and paleontological resources to damage and/or destruction. As in the discussion for 1996 – 2003, such resources have been identified in the project area. Therefore, the conversion of an additional approximately 1,200 acres of land to percolation ponds could result in a *potentially significant impact*.

Mitigation Measures

Impacts to cultural and paleontologic resources at the Kern Fan Element would be reduced to ***less-than-significant*** through the following mitigation measures currently implemented by the KWBA. These measures were outlined in the Initial Study and Addendum to the Monterey Amendment EIR of the KWBA, KWB HCP/NCCP. Under the Settlement Agreement, the parties recognize that the Addendum has been completed and agree not to challenge the mitigation measures (Settlement Agreement, III.F). The following mitigation measures have and will continue to be implemented as provided in the Addendum:

7.13-3 a) *Prior to any ground-disturbing work on the KWB, anthropologists or other qualified individuals shall engage in pedestrian surveys of the areas to be impacted, with the survey reconnaissance to be at 5- to 15-meter transects.*

b) *Any cultural resources found during the survey process will be recorded, mapped, evaluated, and mitigated prior to the ground-disturbing activity, pursuant to Section 106 of the National Historic Preservation Act.*

c) *The eight recorded archeological sites on the KWB will be evaluated and mitigated pursuant to Section 106*.

d) *If any human remains are found at any time on the KWB, work will be halted in the area of the discovery, and the Kern County coroner will be notified.*

7.13-4 Water supply management practices that provide greater flexibility in the location, frequency, and the amount of water stored and/or borrowed at Castaic Lake and Lake Perris could potentially expose cultural and paleontological resources to damage and/or destruction.

1996 — 2003

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions which could affect water surface elevations in these reservoirs.

Borrowing of water from Castaic Lake and Lake Perris between 1996 and 2003 led to reduced cycling and increased water surface elevations after 1995. Although borrowing by contractors reduced water surface elevations in the reservoirs at times, the Department's establishment of limits on drawdown, except during emergencies or borrowing by contractors, and a series of wet years, led to an increase in average water surface elevations. As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, the average water surface elevations at Castaic Lake and Lake Perris were actually higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. The average water surface elevation at Castaic Lake from 1996 to 2003 was about 20 ft higher than between 1974 and 1995. At Lake Perris, the average surface water elevation was about four ft higher during the same time period. The higher water surface elevations in the period 1996 to 2003 resulted in a reduction in the width of exposed area around the perimeter of the two reservoirs, which reduced the potential for cultural or paleontological resources to be subject to damage.

Archaeological and paleontological resources could have been inundated when the reservoirs were filled. As described in the setting, sensitive archaeological and paleontological resources could exist in the vicinity of Castaic Lake and Lake Perris. Impacts on archaeological and paleontological resources can occur as a result of lower water levels, which can expose resources that are normally submerged to increased risks of wind erosion or inadvertent or deliberate human disturbance. However, as described above, water levels in the reservoirs were actually higher most of the time between 1996 and 2003. Therefore, the potential for exposing any cultural and/or paleontological resources around Castaic Lake and Lake Perris to damage and/or destruction were ***less than significant*** between 1996 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Castaic Lake and Lake Perris under certain conditions which could affect water levels in these reservoirs. Castaic Lake WA, MWDSC and Ventura County WA, would borrow SWP water from Castaic Lake when it is to their advantage to do so. Similarly, MWDSC would borrow water from Lake Perris. Most of the time, future borrowing of water would result in a reduction of water surface elevations at the two reservoirs at certain times, but the time between maximum fluctuations would be no more frequent or greater than prior to the Monterey Amendment. However, the effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the eligible contractors make use of Article 54 and future hydrologic conditions. It is likely that future borrowing could drawdown Castaic Lake and Lake Perris to half their maximum capacities; a greater extent than occurred historically. This could increase the exposed area around the perimeter of the two reservoirs and increase the potential for known and/or unknown cultural or paleontological resources to be subject to damage more than what would have occurred in the absence of the project.

As identified in the setting, six prehistoric sites are located within Castaic Lake. Of these recorded sites, two are located above the maximum reservoir pool and the other four are located below the minimum pool. Therefore, none of the known recorded sites would be exposed under Article 54 drawdown conditions. At Lake Perris, the one recorded site could be exposed under Article 54 drawdown conditions. Even though no recorded sites could be exposed at Castaic Lake, the potential exists for one known and/or unknown cultural or paleontological resources to be exposed to risk of damage and/or destruction if Article 54 drawdown is implemented. Therefore, impacts to cultural and paleontological resources associated with lower water surface elevations at Castaic Lake and Lake Perris would be *potentially significant.*

<u>Mitigation Measures</u>

Implementation of the following mitigation measures would reduce impacts to cultural and paleontological resources at Castaic Lake and Lake Perris to a ***less-than-significant level***.

7.13-4 *Implement Mitigation Measures 7.13-2(a) through (c).*

7.13-5 Water supply management practices that provide greater flexibility in the location, frequency, and amount of water stored and/or borrowed at Lake Oroville and San Luis Reservoir could potentially expose cultural and paleontological resources to damage and/or destruction.

1996 — 2003

Various provisions of the Monterey Amendment affect water surface elevations in San Luis reservoir. Water surface elevation in Lake Oroville would not be affected by the proposed project.

Most of the time the proposed project would raise water levels in San Luis Reservoir by 10 to 20 ft under 2003 conditions. The fluctuation of water levels in the reservoir is common and generally a result of normal operations of the facilities. The fluctuation can be linked to many factors including increased rain fall for the year, changes in water supply management practices, an increase need for contractors to store water, etc. Higher water surface elevations in the period 1995 to 2003 resulted in a reduction in the width of the band of exposed soil around the perimeter of the reservoirs. The higher water surface elevations are probably attributable to storage of water by contractors, but they may also be attributable to other factors.

Occasionally, the Article 56 Provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir in the spring of wet years relative to the Baseline scenario. Surface water levels could be reduced by up to 50 ft but the reduction would typically persist for only a few months and would not affect cultural resources.

Archaeological and paleontological resources could have been inundated when the reservoirs were filled. As described in the setting, sensitive archaeological and paleontological resources could exist in the vicinity of Lake Oroville and San Luis Reservoir. Impacts on archaeological and paleontological resources can occur as a result of lower water levels, which can expose resources that are normally submerged to increased risks of wind erosion, or inadvertent or deliberate human disturbance. Between 1995 and 2003 there were instances when reductions in water levels occurred in the San Luis Reservoir; however, cultural resources would not have been affected. The potential for exposing any cultural and/or paleontological resources around Lake Oroville and San Luis Reservoir to damage and/or destruction were ***less than significant*** between 1996 and 2003.

<u>Mitigation Measures</u>

None required.

Future Impacts

Various other provisions of the Monterey Amendment could affect water levels in San Luis Reservoir. Most of the time the proposed project would raise water levels in San Luis Reservoir by 10 to 20 ft under 2003 conditions. Occasionally, the Article 56 provisions of the Monterey Amendment would result in a reduction in water surface elevation in San Luis Reservoir in the spring of wet years relative to the baseline scenario. Surface water levels could be reduced by up to 50 ft but the reduction would typically persist for only a few months and would not be expected to affect erosion rates. Therefore, the potential for exposing any cultural and/or paleontological resources around Lake Oroville and San Luis Reservoir to damage and/or destruction would be ***less than significant***.

<u>Mitigation Measures</u>

None required.

7.13-6 Implementation of the proposed project and its alternatives could result in potential damage and/or destruction of cultural and paleontological resources in Plumas County as a result of watershed improvement projects.

1996 — 2003

Because the Settlement Agreement was not completed in this period, there were no watershed improvement projects as a result of the proposed project and there was ***no impact***.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve stream banks and native vegetation by returning them to a more natural condition.

As described above under Environmental Setting, portions of Plumas County were occupied in prehistoric and historic times by several Native American groups, and many of these areas have not been surveyed for cultural resources. Much of the proposed restoration and stabilization work would occur in or near stream channels, which tended to be common areas for Native American settlement, as well as for gathering riparian plant materials, fishing, or conducting ceremonial activities. Evidence of these activities (i.e., archaeological sites), as well as the historically or culturally significant sites themselves, is likely to be present. Consequently, to the extent that construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting), archaeological resources, including human burials, which could be present in these areas, could be damaged or destroyed.

Portions of Plumas County, particularly near Lake Oroville and the Feather River, are underlain by the Monte de Oro rock formation, which contains a variety of fossils that chronicle landscape changes in the Sierra Nevada foothills in the Mesozoic and Paleozoic Periods. Tertiary plant and vertebrate fossils have been observed in bluffs along rivers and streams and may also be present along the Feather River. Proposed restoration and stabilization work would occur in or near stream channels, which are locations in which fossils have been observed. And, as described above, restoration and bank stabilization activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting), and paleontological resources that could be present in areas where restoration work is proposed could be damaged or destroyed.

The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of streambank in a county with thousands of miles of stream channels. Nevertheless, implementation of proposed watershed improvement projects could result in the potential to damage or destroy cultural and paleontological resources, and this is considered a *potentially significant impact*.

Mitigation Measures

Implementation of the following mitigation measures would reduce impacts to cultural and paleontological resources as a result of implementation of watershed management projects in Plumas County. However, the Department has no jurisdiction over Plumas County projects or mitigations and this impact would be ***potentially significant and unavoidable***.

7.13-6 *Implement Mitigation Measures 7.13-2(a) through (c).*

ENDNOTES

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7.14 PUBLIC SERVICES AND UTILITIES

7.14 PUBLIC SERVICES AND UTILITIES

7.14.1 INTRODUCTION

Public services and utilities are those physical assets and community services that are vital to a community's welfare and livability. Public services include police and fire protection, schools, and the provision of libraries and parks. Some public services, typically those with extensive physical facilities, are referred to as utilities. Utility services include the provision of electricity, natural gas, water, wastewater collection and treatment, storm water drainage, and solid waste.

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on public services and utilities. Elements of the proposed project that have the potential to directly affect public services and utilities are summarized in Table 7.14-1. No elements of the Monterey Amendment and the Settlement Agreement would have the potential to directly affect public services and utilities.

TABLE 7.14-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON PUBIC SERVICES AND UTILITIES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes in public services and utility capacity associated with changes in agricultural practices	7.14-1
Permanent transfers of water	Changes in public services and utility capacity associated with changes in agricultural practices	7.14-1
Transfer of Kern Fan Element lands	Changes in public services and utility capacity associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.14-1
Water supply management practices	Changes in public services and utility capacity associated with construction and operation of groundwater storage facilities	7.14-1
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Changes in public services and utility capacity associated with development of 490 acres of land in Kern Fan Element	7.14-1
Watershed forum in Plumas	NA	NA
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

During public review of the NOP for this EIR, interested parties submitted no comments related to public services and utilities.

7.14.1.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, impacts on public services and utilities would be considered potentially significant if the proposed project would:

- result in substantial adverse physical impacts resulting from the provision of new or physically altered governmental facilities, the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for fire protection, police protection, schools, parks, or other public facilities;
- exceed wastewater treatment requirements or require construction of new water or wastewater treatment facilities, storm water facilities or expansion of existing facilities, the construction of which could cause significant environmental effects; or
- generate enough solid waste to exceed landfill capacity or substantially shorten the life of a landfill.

7.14.2 IMPACTS AND MITIGATION MEASURES

With the exception of water supply and energy, the following discussion describes why the proposed project would not have a direct impact on public services and utilities. The water transfer elements of the proposed project and use of pumps for groundwater storage facilities could have an effect on water supply and energy use. Impacts on water supply are described in Section 7.1. Impacts on energy use are described in Section 7.16. The proposed project could indirectly affect public services and utilities by inducing population growth. Growth-inducing impacts are evaluated in Chapter 8.

7.14-1 Implementation of the proposed project could potentially have result in the need for new or expanded governmental facilities or an increase in demand for public services and utilities.

1996 — 2003

Implementation of the proposed project resulted in direct physical effects at several locations including the southern San Joaquin Valley portion of Kern County, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and the Sacramento-San Joaquin Delta.

The proposed project does not include the construction of new facilities or alteration of existing facilities. None of the proposed project elements would have directly resulted in population changes that would have generated a need for new or expanded governmental facilities or an increase in demand for public services and utilities. There would have been no resulting direct increase in population or structures that would have required additional police and fire protection, school capacity, parks or other public facilities. Similarly, the proposed project would not increase water supply treatment and/or distribution facilities, wastewater collection and treatment facilities, storm water runoff collection facilities, and/or solid waste collection and disposal. Therefore, ***no impact*** would have occurred. Growth inducing effects of the proposed project are evaluated in Chapter 8 of this EIR.

<u>Mitigation Measure</u>

None required.

Future Impacts

Implementation of the proposed project would result in direct physical effects at several locations including the southern San Joaquin Valley portion of Kern County, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, the Sacramento-San Joaquin Delta, and Plumas County.

None of the project elements would directly result in changes in population that would generated a need for new or expanded governmental facilities or an increase in demand for public services and utilities. There would be no resulting direct increase in population or structures that would require additional police and fire protection, school capacity, parks or other public facilities. Similarly, there would be no increase in water supply treatment and/or distribution facilities, wastewater collection and treatment facilities, storm water runoff collection facilities, and/or solid waste collection and disposal. Therefore, ***no impact*** would occur. Growth inducing effects of the proposed project are evaluated in Chapter 8 of this EIR.

<u>Mitigation Measure</u>

None required.

7.15 TRAFFIC AND TRANSPORTATION

7.15 TRAFFIC AND TRANSPORTATION

7.15.1 INTRODUCTION

7.15.1.1 Content

This section describes the impacts of the Monterey Amendment and the Settlement Agreement on transportation resources (traffic and circulation). Only some elements of the proposed project have the potential to directly affect transportation resources (see Table 7.15-1).

TABLE 7.15-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON TRAFFIC AND TRANSPORTATION

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Reallocation of water supplies in droughts	Changes in traffic patterns associated with changes in agricultural practices	7.15-1
Permanent transfers of water	Changes in traffic patterns associated with changes in agricultural practices	7.15-1
Transfer of Kern Fan Element lands	Changes in traffic patterns associated with construction and operation of groundwater storage facilities in Kern Fan Element	7.15-3
Water supply management practices	Changes in traffic patterns associated with construction and operation of groundwater storage facilities/ Changes in recreational use due to fluctuations in reservoir levels	7.15-2, 7.15-4
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	Changes in traffic patterns associated with development of 490 acres of land in Kern Fan Element	7.15-3
Watershed forum in Plumas	Noise associated with development of watershed improvement projects	7.15-5
Amendment of Plumas SWP contract	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

During public review of the NOP for this EIR, interested parties submitted no comments on transportation resources.

7.15.1.2 Analytical Method

The assessment of impacts to transportation resources was conducted in accordance with standard professional practices. Factors considered in the analysis include:

- changes in traffic and circulation patterns in the southern San Joaquin Valley portion of Kern County as a result of the proposed project; and
- changes in traffic and circulation patterns in Plumas County as a result of watershed improvement projects.

7.15.1.3 Standards of Significance

The following standards of significance are based on Appendix G of CEQA guidelines. For the purposes of this EIR, impacts to traffic and circulation patterns would be considered potentially significant if the proposed project would:

- cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system; or
- exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways.

7.15.2 ENVIRONMENTAL SETTING

7.15.2.1 Physical Setting in 1995

Southern San Joaquin Valley Portion of Kern County

Kern County is comprised of the communities of Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco. Interstate 5 (I-5) is the major highway bisecting the County, trending southeast to northwest. State Routes (SR) 14, 33, 41, 43, 46, 58, 65, 99, 119, 155, 166, 178, 184, 202, and 223 traverse the County. The majority of Kern County is rural, and the southern San Joaquin Valley portion of Kern County is largely devoted to agriculture. One- and two-lane rural roads access agricultural areas, while two- and four-lane roads travel through the more urbanized areas. Kern County residents enjoy the benefits of short commute times and little roadway congestion in their cities. According to the Texas Transportation Institute's 2002 Urban Mobility Study, the nation's longest-running study of traffic congestion, Bakersfield has the least roadway congestion of any of California's urban areas with an average commute time of 15 minutes.[1]

Kern Fan Element

The Kern Fan Element consists of 19,900 acres of land located in Kern County southwest of Bakersfield. The Kern Fan Element was farmed for many years until the mid-1980s. After the California Department of Water Resources (Department) purchased the land in 1986, the agricultural fields were gradually taken out of production. By 1994, agriculture had ceased on the property and introduced annual grasses and forbs had colonized the land. The area is traversed by I-5, SRs 99, 119, 166, and 223 and paved and unpaved rural roads.

San Luis Reservoir

San Luis Reservoir is in Merced County and primary access to the reservoir and surrounding recreation area is SR 152 off of I-5.

Castaic Lake

Castaic Lake is in Los Angeles County. Primary access to the lake and the Castaic Lake Recreation Area is I-5 and SR 126.

Lake Perris

Lake Perris is in Riverside County and primary access to the lake and surrounding recreation area is I-215, SR 60 and SR 91.

Lake Oroville

Lake Oroville is in Butte County, northeast of the City of Oroville. Lake Oroville State Recreation Area surrounds much of the lake. SRs 70, 149, 99, 191, and 162 provide access to Lake Oroville.

7.15.2.2 Changes in Physical Setting between 1996 – 2003

Highway construction and improvements are ongoing in Kern, Riverside, Los Angeles, Merced and Butte counties. In fact, there are approximately 500 projects a day planned for California highways.[2] Between 1996 and 2003, a significant number of transportation improvement projects were completed throughout the State. Various major improvement projects have been completed on highways that provide access to project facilities. These improvements have consisted primarily of widening and interchange improvements. Further improvements to these State routes are funded as part of the federal Transportation Improvement Plan (TIP).

Between 1996 and 2003, and as a result of the proposed project, some minor access roads associated with groundwater storage facilities were built in Kern County.

Plumas County

Plumas County is a rural county with no large cities. With an area of 2,554 square miles and a population of about 21,000, it has a population density of about eight people per square mile. Much of the county is within the Plumas and Lassen National Forests. Principal economic activities in the county are recreation, services and forest products. Plumas County is accessed primarily via U.S. Highway 395 and SR 36, 49, 70, and 89.

7.15.2.3 Regulatory Setting in 1995

Various federal, state and local agencies are responsible for transportation in the areas affected by the proposed project. The most relevant agencies and laws and regulations are described below.

Federal

Federal Highway Administration

The Federal Highway Administration coordinates highway transportation programs in cooperation with states and other partners to enhance the country's safety, economic vitality, quality of life, and the environment. Major program areas include the Federal-Aid Highway Program, which provides federal financial assistance to states for construction and improvement of the National Highway System, urban and rural roads, and bridges. This program provides funds for general improvements and development of safe highways and roads.

State

California Department of Transportation (Caltrans)

The California Department of Transportation (Caltrans) and its predecessors are responsible for planning, designing, building, operating and maintaining California's 15,000-mile State Highway System.

California Transportation Commission (CTC)

The California Transportation Commission (CTC) is responsible for programming and allocating funds for the construction of highway, passenger rail and transit improvements throughout California. The Commission also advises and assists the Secretary of Business, Transportation, and Housing Agency and the Legislature in formulating and evaluating State policies and plans for California’s transportation programs. The Commission is also an active participant in the initiation and development of State and federal legislation that seeks to secure financial stability for the State’s transportation needs.

State Transportation Improvement Program (State TIP)

The State TIP is a multi-year capital improvement program of transportation projects on and off the State Highway System, funded with revenues from the State Highway Account and other funding sources. The fund estimate serves to identify the amount of new funds available for the programming of transportation projects. Once the fund estimate is adopted, Caltrans and the regional planning agencies prepare TIPs for submittal by December 15th. Caltrans prepares the Interregional Transportation Improvement Plan and regional agencies prepare Regional Transportation Improvement Plans. Public hearings are held in January (even years) in both northern and southern California. The State TIP is adopted by the CTC by April (even years).

State Highway Operations and Protection Program (SHOPP)

The State Highway Operations and Protection Program (SHOPP) is a funding program for Caltrans-initiated projects that meet certain guidelines in accordance with Government Code Section 14526.5, Streets and Highways Code Section 164.6. These projects must be approved by the CTC, a separate governmental body from Caltrans. SHOPP is a four-year program of projects that address traffic safety, roadway rehabilitation, roadside rehabilitation, and operations related to the State Highway System.

Local

Kern Council of Governments (KCOG)

Kern Council of Governments (KCOG) is an association of city and county governments created to address regional transportation issues while protecting the integrity and autonomy of each jurisdiction. Its member agencies include the County of Kern and the eleven incorporated cities within Kern County, including Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco.

The Kern County 2000 Regional Transportation Plan is comprised of the Action Element, which establishes a plan for addressing identified needs and issues in accordance with the goals, objectives, and policies of the Regional Transit Plan, Intelligent Transportation Systems, Congestion Management Program, Air Quality Conformity, and a Financial Element. In addition, Kern County utilizes Transportation System Management (TSM) in its transportation planning, a system-wide approach to maximize use of existing facilities and available resources. KCOG, in cooperation with the City of Bakersfield, Kern County, and Caltrans, has developed TSM strategies to reduce traffic congestion.

Butte County Association of Governments (BCAG)[3]

Butte County Association of Governments (BCAG) is an association of the cities of Biggs, Chico, Gridley, Oroville, the Town of Paradise and the County Butte.

BCAG is responsible for the preparation of all federal and state transportation plans that secure funding for the region's highways, transit, streets and roads, pedestrian and other transportation system improvements. BCAG provides a forum for study and resolution of regional transportation issues and is the administrative and policymaking body for the region's public transit services.

BCAG also serves as the lead agency for development of several state highway project improvements within Butte County in cooperation with Caltrans and the Federal Highway Administration. BCAG works in cooperation with local government, state and federal agencies and the public to improve transportation in Butte County.

Butte County

Butte County oversees development within unincorporated areas of the county. Butte County's jurisdictional boundaries are defined by the Sacramento River, Butte Creek, and Glenn and Colusa counties to the west; Tehama County to the north; Plumas County to the east; and Sutter and Yuba counties to the south. South Honcut Creek and Wilson Creek are the southeast boundary with Yuba County. The county encompasses approximately 1,670 square miles (1,068,000 acres) and can be divided into three general topographical areas: a valley area, a foothill region east of the valley area, and a mountain region east of the foothills. The county includes five incorporated communities (Chico, Oroville, Paradise, Gridley, and Biggs) and several small unincorporated rural communities. The Butte County General Plan sets forth goals and policies regarding a variety of issue areas including traffic and transportation. The County is currently going through a General Plan Update process to plan for growth through 2030.

Los Angeles County Metropolitan Transportation Authority (Metro)

The Los Angeles County Metropolitan Transportation Authority (Metro) is the regional transportation planner for all of Los Angeles County. Metro develops and oversees transportation plans, policies, funding programs, and both short-term and long-range solutions that address the County's increasing mobility, accessibility and environmental needs. Metro implements a variety of projects, programs and plans in support of these goals.[4]

Metro implements the statewide Congestion Management Program (CMP) for Los Angeles County. The CMP for Los Angeles County requires that the traffic impact of individual development projects of potential regional significance be analyzed. A specific system of arterial roadways plus all freeways comprise the CMP system. A total of 164 intersections are identified for monitoring on the system in Los Angeles County.

Riverside County Transportation Commission (RCTC)

The Riverside County Transportation Commission (RCTC) is responsible for administering the Measure A program in Riverside County. The RCTC has also been designated as the Congestion Management Agency (CMA) for Riverside County. As the CMA, the Commission has developed a CMP that more effectively utilizes transportation funds by linking land use, transportation and air quality efforts. The focus of the CMP is the development of an Enhanced Traffic Monitoring System in which real-time traffic count data can be accessed by RCTC to evaluate the condition of the Congestion Management System as well as meet other monitoring requirements at the State and federal levels.

Merced County Association of Governments (MCAG)

Merced County Association of Governments (MCAG) is an association of the cities of Merced, Atwater, Livingston, Los Banos, Dos Palos, and Gustine and the County of Merced. MCAG acts as the Regional Transportation Planning Agency, the Local Transportation Authority, and as he CMA for the County.

As Regional Transportation Planning Agency and Metropolitan Planning Organization, MCAG is the primary transportation facilitator in Merced County. Responsibilities are many, from acquiring priority projects to assuring money accepted for improving transportation has been properly utilized. MCAG must also be in the forefront of coordinated regional transportation planning activities, and to do so effectively requires the correct tools and program support. Work elements of the Transportation Planning Work Program seek to maintain a quality improvement program and provide additional means to successfully accomplish the goals and objectives established by the MCAG Governing Board.

General Plans

General Plans of the various counties and cities of the State of California contain a mandatory transportation and circulation element that includes policies to facilitate the respective Counties' Congestion Management Plans as well as local and regional transportation planning. All individual projects under the proposed project would be expected to comply with the policies of the transportation element of the applicable General Plan.

7.15.2.4 Changes in Regulatory Setting between 1996 – 2003

Local

Plumas County

Plumas County is not a member of any regional council of government as it relates to transportation and circulation networks.

7.15.3 IMPACTS AND MITIGATION MEASURES

7.15-1 Changes in the amount of agricultural land disturbance resulting from reallocation of water supplies and/or permanent transfers could potentially affect traffic and circulation in the southern San Joaquin Valley portion of Kern County.

1996 — 2003

The Monterey Amendment enables various changes in the way the Department allocates water among contractors during times of shortage and surplus and enables agricultural contractors to retire and transfer a portion of their Table A amounts. The effect of these changes was to increase the reliability of water supplies but decrease the total amount of Table A water available to farmers in Kern County. The reliability and availability of agricultural water supplies is one factor that may contribute to the amount and types of crops and associated land disturbance activities.

It is possible that some land was converted to permanent crops as a result of the proposed project, and that these changes in agricultural practices could have altered the traffic volumes in affected areas. The number of vehicular trips to fields with permanent crops would have likely been the same or slightly less than the number of trips to fields with annual crops and would have been unlikely to affect traffic volumes on affected rural roads. Therefore, increased vehicle volumes associated with the proposed project would have resulted in a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As discussed in Section 7.6, Agricultural Resources, the proposed project would have little or no impact on the acreage of irrigated land in the southern San Joaquin Valley in the future. Assuming that any land is taken out of irrigated production as a result of the proposed project, it would remain in agricultural use as dry farmed or fallow land. In addition, the trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period.

It is possible that additional land could be converted to permanent crops as a result of the proposed project, and that changes in agricultural practices could alter the traffic volumes in affected areas. The number of vehicular trips to fields with permanent crops would likely be the same or slightly less than the number of trips to fields with annual crops and would be unlikely to affect traffic volumes on affected rural roads. Therefore, increased noise levels associated with the proposed project would result in a ***less-than-significant impact***.

Mitigation Measures

None required.

7.15-2 Implementation of the proposed project could potentially affect traffic and circulation in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element) as a result of construction and operation of new groundwater banks.

1996 — 2003

The Monterey Amendment enabled SWP contractors to store water outside their service areas for later use within their service areas. To take advantage of this, several contractors entered into agreements with water agencies in the southern San Joaquin Valley to temporarily store SWP water in groundwater banks. Between 1995 and 2003, Semitropic WSD, and Arvin-Edison WSD developed water banks and constructed about 500 acres of percolation ponds. The water bank developed by the Kern Water Bank Authority (KWBA) is discussed separately under Impact 7.15-3, below.

Traffic volumes on some rural roads temporarily increased during construction of the ponds, but the amount of traffic would not have been substantial and would have been for the duration of construction only. Vehicular movements associated with routine maintenance of the new facilities were probably the same or less than those associated with pre-1995 use of the land for agriculture. The proposed project is considered to have a ***less-than-significant impact*** because level of service standards would not be exceeded.

Mitigation Measures

None required.

Future Impacts

It is also anticipated that an additional 500 acres of ponds would be developed as part of other groundwater storage facilities in Kern County. The impacts of future conversion of lands for use as percolation basins would affect traffic and circulation in the same way as past land conversion for the same purpose, as discussed above. The small increases in vehicular movements attributable to construction and operation of the percolation ponds would have little effect on traffic flow on the affected rural roads. The proposed project would have a ***less-than-significant impact***.

Mitigation Measures

None required.

7.15-3 Traffic and circulation in the Kern Fan Element could potentially be affected by construction and operation of percolation ponds.

1996 — 2003

In 1995, the Kern Water Bank Authority (KWBA) constructed 3,034 acres of recharge ponds. From 1998 through 2003, an additional 4,080 acres were converted to shallow percolation ponds, for a total of 7,114 acres in 2003 in the Kern Fan Element. KWBA also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[5] Unpaved roads were constructed to provide access to the new facilities. Traffic volumes on some rural roads temporarily increased during the construction period. In addition, routine maintenance of the new facilities resulted in a permanent increase in vehicular traffic. Prior to 1995, the land now occupied by the ponds lay fallow and generated little or no traffic. The small increases in vehicular movements attributable to construction and operation of the proposed project had little adverse effect on traffic flow on the affected rural roads. Consequently, the proposed project is considered to have a ***less-than-significant impact***.

<u>Mitigation Measures</u>

None required.

Future Impacts

Approximately 490 acres are designated for possible commercial use. Between 1995 and 2003, no development occurred on the 490-acre parcel. The Settlement Agreement prohibits development of this parcel, and so under the proposed project the parcel would remain undeveloped.

Under the proposed project, it is expected that the KWBA would construct an additional 1,200 acres of percolation ponds in the Kern Fan Element. The impacts of future conversion of lands for use as percolation basins would affect traffic and circulation in the same way as past land conversion for the same purpose, as discussed above. The small increases in vehicular movements attributable to construction and operation of the percolation ponds would have little effect on traffic flow on the affected rural roads. The proposed project would have a ***less-than-significant impact*** on traffic and circulation.

<u>Mitigation Measures</u>

None required.

7.15-4 Fluctuation in water levels at Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville could potentially alter the amount of recreational use at the reservoirs, which could affect traffic volumes on state and local roadways.

1996 — 2003

The amount of recreational boat use usually increases with increasing water levels at reservoirs where people normally participate in these types of recreational activities. Conversely, boating decreases when water levels are lower.

As described in Section 7.1, Surface Water Hydrology, Water Quality, and Water Supply, average water surface elevations at Castaic Lake and Lake Perris were higher between 1996 and 2003 than in the pre-Monterey Amendment period before 1995. At San Luis Reservoir water levels lower during winter months (see Impact 7.1-4 in Section 7.1).

Recreational activities would not have changed as a result of project implementation at San Luis Reservoir. Recreational activities could have been enhanced in Castaic Lake and Lake Perris as a result of increased water levels during the boating season. However, the range of water surface fluctuations would have been within the range of operating conditions prior to project implementation.

Higher water surface elevations could have created more opportunities for recreational activities and this could have increased the number of vehicle trips to and from the reservoirs on a seasonal basis. However, in relation to existing traffic loads and roadway capacity, it is unlikely that level of service standards would have been exceeded on a permanent basis. Therefore, this would have been a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

As discussed in Section 7.9 Recreation, higher water surface elevations could create more opportunities for recreational activities. Likewise, this could increase the number of vehicle trips to and from the reservoirs on a seasonal basis. However, the lakes have specific carrying capacity for recreational vehicles (i.e., boats) and parking, and it is unlikely that the number of vehicles would have substantially increased to levels that exceed roadway capacity or violate level of service standards. Article 56 of the Monterey Amendment allows SWP contractors to store water in San Luis Reservoir when storage space in excess of that needed for SWP operations is available. At San Luis Reservoir water levels would be lower during winter months and water levels at Lake Oroville would not change compared to baseline conditions. Because the difference in water storage would be small in Lake Oroville and San Luis Reservoir (see Impact 7.1-4 in Section 7.1), there would be little, if any, effect on water surface elevations and recreation-related vehicle traffic would not be substantially affected.

The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would draw down the reservoirs to a greater extent than occurred between 1996 and 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half its maximum capacity of 131,500 AF. The reservoirs would remain drawn down for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1 in Chapter 6).

In general, future operation of Castaic Lake and Lake Perris would result in similar fluctuations as those recorded for the period between 1996 and 2003 and are expected to be within the range of more recent (post-Monterey) historical fluctuations. Because it is likely that future water surface elevation changes would not differ substantially from 2003 conditions, the amount of traffic from recreational visits would be similar. However, as discussed in Chapter 6, the proposed project could result in drawdown of water levels in Castaic Lake and Lake Perris greater than what would have occurred in the absence of the project and for potentially longer periods of time than recorded in the past.

Recreational visits would likely be the same as baseline conditions or if the worst-condition were to occur, could decrease due to drawdown conditions at Castaic Lake and Lake Perris in the future. Therefore, impacts to traffic would be ***less than significant***.

Mitigation Measures

None required.

7.15-5 Construction and operation of watershed improvement projects in Plumas County could potentially affect traffic and circulation.

1996 — 2003

Because the Settlement Agreement was not completed in this period, there were no watershed improvement project as a result of the proposed project and there was ***no impact***.

Mitigation Measures

None required.

Future Impacts

The Settlement Agreement provides funds to Plumas County to establish a watershed forum and implement watershed improvement projects. The watershed forum would identify opportunities for watershed improvements and would oversee the implementation of individual projects. Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers.

The number and size of watershed improvement projects that would result from the proposed project are relatively small. The projects would be expected to improve conditions along a few miles of stream bank in a county with thousands of miles of stream channels. These activities could result in temporary increases in construction vehicles at the site of the improvements, which would cause a temporary increase in local traffic. No operational increase in traffic would be expected. The potential impact from construction vehicles would be short-term and is considered a ***less-than-significant impact***.

Mitigation Measures

None required.

ENDNOTES

1. Kern Economic Development Corporation, 2003.

2. CalTrans website, FAQ regarding Highway Condition Information http://www.dot.ca.gov/hq/roadinfo/faq.htm.

3. Butte County Association of Governments website, http://www.bcag.org/, accessed May 18, 2006.

4. Los Angeles County Metropolitan Transportation Authority (Metro) website, http://www.mta.net/projects_plans/default.htm, accessed May 18, 2006.

5. Jonathon Parker, Kern Water Bank Authority, personal communication with John Davis, EIP team, October 2003.

7.16 ENERGY

7.16 ENERGY

7.16.1 INTRODUCTION

This section describes the existing environmental conditions and the consequences of the Monterey Agreement on power production and power consumption. It evaluates and discusses the consequences associated with the operation of the proposed project. Significance of impacts is determined by applying significance criteria set forth in the State CEQA Guidelines.

The SWP is one of the largest water and power systems in the world. Hydroelectric and coal-fired facilities, along with contractual arrangements, are the major power sources for SWP power operations. The California Department of Water Resources (Department) uses its power resources primarily to run the pumps that move SWP water to California farmlands and cities and to provide peak power to utilities. Because the Department has the flexibility to regulate SWP pumping on an hourly basis, maximum SWP pumping is generally scheduled when power costs are low. By scheduling as much off-peak pumping as possible, the Department is able to take advantage of less expensive surplus electrical generation. Conversely, the Department maximizes its power generation for the benefit of the interconnected electrical grid during the on-peak hours when electric demand is highest. In this manner, the Department is able to manage a comprehensive power resources program that helps minimize the cost of water deliveries to SWP water supply contractors while maximizing the benefits to the statewide electric grid.[1]

The Department's power planning process begins with a review of all projected loads and resources including pump load, generation from the Department's facilities, generation from joint facilities, sales, purchases, and exchanges. The net of these loads and resources yields a power portfolio in which the Department often has a net deficit during the off-peak hours and a net surplus in the on-peak hours. The Department then procures the deficit and markets the surplus in stages; baseline amounts are transacted in advance, and the remaining deficit and surplus quantities are transacted as the year progresses and more information becomes available regarding hydrology, water demands, etc. SWP is generally a net purchaser of electric energy.

In 2002, energy used by the SWP pumping and generating facilities totaled 8,390 Giga-Watt hours (GWh). In 2002, the Department sold 1,170 GWh of energy to 15 utilities and 13 power marketers, totaling about $58 million in revenue. The Department received an additional $24 million in revenues for capacity and exchanges. To meet SWP energy demands in 2002, the Department purchased 2,090 GWh of energy.[2] In 2000, operating the SWP pumping and generating plants required 9,190 GWh of energy to deliver approximately 3.6 million acre-feet (AF) overall and approximately 1.8 million AF to southern California.[3] In 2000, the Department sold approximately 2,920 GWh of energy to 24 utilities and 16 power marketers.[4] The Department also purchased 2,940 GWh of energy in 2000.[5]

For more details on energy used, generated, purchased, sold, and transmitted as part of the SWP, refer to the annually released Bulletin 132: Management of the State Water Project (http://www.swpao.water.ca.gov/publications/).

7.16.2.1 Content

The area of analysis for the evaluation of potential effects on power generation and consumption due to implementation of the Monterey Agreement includes power plants, pumping plants, and associated facilities along the SWP. Also in the analysis are facilities not owned by the SWP (Figure 7.16-1).

Three Monterey Plus model studies have been post-processed to evaluate power impacts. The studies evaluated represent 1994 Baseline condition, the 2020 Pre-Monterey condition, and the 2020 Post-Monterey condition. Power generation and consumption for the SWP are calculated using the SWP Power spreadsheet. This is the Department-approved method of calculating power from CALSIM II output.

7.16.2.2 Standards of Significance

The environmental consequences of the proposed project will be measured in terms of how it will affect the net energy requirements of the SWP. This is consistent with the significance criteria used in the CALFED Bay-Delta Program Final Programmatic EIS/EIR[6] and the South Delta Improvements Program EIS/EIR.[7]

Project effects on the SWP net energy requirements would be considered potentially significant if the proposed project would:

- result in a substantial increase, of more than 10 percent, in net electricity consumption.

An increase of more than 10 percent would be considered an unavoidable significant effect of the project if it could not be (a) eliminated, (b) avoided or minimized by redesign or relocation of some components of the proposed project, (c) reduced to a less-than-significant level, or (d) compensated for by mitigation of equal extent and value.

In addition to the significance criteria discussed in the previous paragraph, the significance criteria listed below is based on Appendix G of the State CEQA Guidelines. The project would have a significant impact on utilities and service systems if the proposed project would:

- require or result in the construction of new water, wastewater treatment, or electrical power generation facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

7.16.3 ENVIRONMENTAL SETTING

7.16.3.1 Energy Sources

The SWP is the largest single user of electrical power in California. The electrical power needed to operate the SWP comes from a combination of SWP hydroelectric facilities, the coal-fired Reid Gardner Power Plant, and contracts with other energy producers.[8]

Hydroelectric

The SWP conveys an annual average of about 2.4 million AF of water through its 17 pumping plants, 8 hydroelectric power plants, 3 pumping-generating plants, 29 dams and reservoirs, and about 675 miles of aqueduct and pipelines. As water is released from SWP reservoirs, the

***Source*:** DWR 2005 Bulletin 160-05. California Water Plan Update 2005.

PBS&J

FIGURE **7.16-1**

Energy Components of the State Water Project

generation facilities produce power that is either used by the SWP or sold to electric utilities and marketers. Hydroelectric generation from SWP facilities is the largest power source for the SWP. Approximately 1.401 giga-watts (GW) of capacity is available from hydroelectric facilities (Table 7.16-1). The combined Hyatt Pumping-Generating Plant and Thermalito Pumping-Generating Plant (Hyatt-Thermalito), near Oroville in Butte County, generate about 2,200 GWh of energy in a median water year. The Thermalito Diversion Dam Power Plant, downstream of Lake Oroville, generates 24 GWh of energy per year. Other SWP plants that generate energy include:

- Alamo,
- Devil Canyon,
- Gianelli,
- Mojave Siphon, and
- Warne.

TABLE 7.16-1

SWP POWER FACILITIES

Power Type	Name	County	Maximum Capacity (GW)
Hydroelectric			
	Thermalito Diversion Dam	BUTTE	0.003
	Hyatt-Thermalito	BUTTE	0.759
	Gianelli	MERCED	0.222
	Alamo	LOS ANGELES	0.018
	Warne	LOS ANGELES	0.078
	Mojave Siphon	SAN BERNARDINO	0.030
	Devil Canyon	SAN BERNARDINO	0.291
		TOTAL	**1.401**
Coal	Reid Gardner		0.235

Source: California Department of Water Resources 2005. 160-05. California Water Plan Update 2005.

Together, these five plants provide 17 percent of the total energy used by the SWP. Table 7.16-1 provides the county locations and power capacity of each plant.

Coal

Since July 1983, the Department has been receiving energy from Reid Gardner Power Plant, a coal-fired facility near Las Vegas, Nevada, under the “Participation Agreement Reid Gardner Unit No. 4” with Nevada Power Company (NPC). Under this agreement, the Department owns 67.8 percent of Unit 4 and receives up to 0.235 GW (90.4 percent of capacity) from it while NPC owns the remainder of Unit 4 as well as all of Units 1, 2, and 3. In addition, the capacity of Unit 4 was upgraded by 0.015 GW in June 1990,[9] and the Department’s entitlement of this 0.015 GW of capacity and associated energy began in September 1998. However, starting in August 2004, due to heat rate issues related to new environmental restrictions, Unit 4 has not been able to operate above its original capacity. Consequently, until this issue is resolved, the Department will not be receiving any energy associated with the upgrade capacity. Under the agreement, NPC has limited right to interrupt the Department’s energy deliveries during specific periods; NPC is obligated to pay the Department for the interrupted energy deliveries based on NPC’s combustion turbine costs. In year 2013, ownership of Unit 4 will revert back to NPC.

Contractual Resource Arrangements

The Department has several short-term and long-term contracts for electricity purchases, exchanges, transfers, and sales with electric utilities in California and other western states. The Department has an existing contract with Pacific Gas & Electric that terminates in 2014 for the transmission service in northern California; the balance of transmission service required to operate the SWP is obtained through the California Independent System Operator.[10]

The energy needed to operate the SWP that is not provided by SWP facilities and the Reid Gardner Power Plant is obtained through joint development, exchanges, and purchases from other energy suppliers as indicated in the following sections:

Joint development:

- In 1966, the Department entered into a contract with the Los Angeles Department of Water and Power (LADWP) for the joint development of the West Branch of the California Aqueduct. LADWP constructed and operates the Castaic Power Plant from which the Department receives capacity and energy based on weekly water schedule through the West Branch. In 2002, the Department received 757.076 GWh of energy generated at Castaic Power Plant.[11]
- Other joint facilities include Gianelli Pumping-generating plant, a joint hydroelectric facility between the Department (0.222 GW) and the Bureau of Reclamation (0.202 GW).
- As described above, Reid Gardner Power Plant Unit 4 is also a joint SWP and NPC facility.

Power exchange (Power Contract and Capacity Exchange Agreement):

- The Department and Southern California Edison (SCE) had two power agreements that expired at the end of 2004: the 1979 Power Contract and the 1981 Capacity Exchange Agreement (CEA).[12]
- Under the 1979 Power Contract, the Department provides to SCE the following: 1) up to 0.350 GW (about 40%) of the energy from Hyatt-Thermalito; 2) up to 0.120 GW of capacity and all the energy from Devil Canyon Power Plant Units 1 and 2; 3) up to 0.015 GW of capacity and all the energy from Alamo Power Plant; and all the energy produced at the Metropolitan Water District of Southern California's electric recovery plants that are made available to the Department. In return, the Department received off-peak energy from SCE equal to the amount of energy provided to SCE plus an additional amount of energy.[13]
- Under the CEA, the Department provided 4.125 GWh of energy to SCE during on-peak periods at the maximum delivery rate of 0.225 GW. In exchange, SCE returned approximately 110 percent of this energy during mid-peak and off-peak periods to the Department. In addition, SCE waives 75 percent of its charges to the Department for specified transmission service used for SWP pumping and generating facilities, and SCE also makes an annual payment of $900,000 to the Department.
- Under the Settlement Agreement on December 26, 2002, the Department and SCE agreed to revise certain agreement provisions regarding SCE's right to curtail energy deliveries to the Department. SCE paid the Department $30 million as compensation for curtailing exchange energy in 2000 and 2001.

Purchases

The Department also obtains energy for the SWP through long-term and short-term purchase agreements including the following:

- The Department obtains about 400 GWh of energy in a median water years from the Pine Flat Power Plant, which is owned and operated by Kings River Conservation District.
- The Department obtains energy from five hydroelectric plants (with 0.03 GW of capacity) that are owned and operated by Metropolitan Water District of Southern California (MWD); in 2004, the Department purchased 498 GWh.
- From 1991 through 2004, the Department purchased from PacifiCorp 0.1 GW of capacity and associated energy. This contract was terminated in 2004.
- The Department has an agreement with MWD to enter into short-term purchases and exchanges of surplus energy from MWD's Colorado River Aqueduct system.
- Through the Western Systems Power Pool agreement, the Department purchases energy from member utilities and power marketers as needed for SWP operations.[14]

To meet future SWP energy requirements, the Department evaluates new energy resources and reviews SWP power requirements with consideration for the following factors:

- ability to meet energy demand for pumping;
- transmission access;
- anticipated water deliveries;
- cost of resource and cost of financing;
- environmental impacts and mitigation costs;
- and operating characteristics.[15]

7.16.4 IMPACTS AND MITIGATION MEASURES

Electrical energy demand in California will vary depending on economic and population trends. As a result, peak electrical energy demand within the state is expected to increase by approximately 0.01 GW per year for the foreseeable future.[16] Based on the evaluations of recent demand and population trends, fuel costs, power generation capability and construction, meteorological conditions, actions outside California, and other factors, the California Energy Commission (CEC) concluded that, for the foreseeable future, capacity additions will exceed the peak demand growth in California. While various factors may trigger calls for load curtailments, supply reserve margins should be adequate to meet the reasonably foreseeable demands.

7.16-1 Implementation of the proposed project would potentially result in increased demand for energy.

1996 — 20003

The post-processed power results were only ran for the 2020 Level-of-Development. The 2020 conditions show a total long-term net load increase of only 1.6 percent (see Future Impacts section). It is reasonable to conclude that the increase would have been less between 1996 through 2003. In addition, the amount of power required was within the limits of the planned power supply since no new facilities were built to fulfill energy needs from the proposed project. Therefore, this is a ***less-than-significant impact***.

Mitigation Measures

None required.

Future Impacts

The post-processed power results show that there is a minimal increase in the long term net power load when going from a Pre-Monterey condition to a Post-Monterey condition at the 2020 Level-of-Development. The total long-term net load increase was 2.02 percent (Table 7.16-2).

Under the 2020 Post-Monterey conditions, when compared to 2020 Pre-Monterey condition, some of the powerplants would generate less energy (Alamo, Mojave, and Devil Canyon), some would produce the same amount of energy (Gianelli, Oroville, and Thermalito), and some would produce more energy (Warne and Castaic) (Table 7.16-3). An overall increase of 128 GWh in energy loads at the pumping plants is also observed; about 75 percent of this increase occurs at South Bay and Edmonston Pumping Plants. Four other pumping plants show a decrease in energy loads: Dos Amigos, Las Perillas, and Badger Hill (Table 7.16-3).

SWP pumping facilities are designed to meet the anticipated demands of the SWP Contractors, and this rated capacity would not be exceeded by implementation of the proposed project. The amount of additional power required would be within the limits of the planned power supply, and no expansion or construction of new facilities to generate power would be required. No new long-term or short-term contracts would be necessary under the 2020 Post-Monterey conditions. Additionally, with a total long-term net load increase of 2.02 percent due to the proposed project, the impact to electrical power would be ***less than significant***.

Mitigation Measures

None required.

TABLE 7.16-2

SWP ENERGY LOAD AND GENERATION FOR MONTEREY PLUS EIR ALTERNATIVES (AVERAGE ANNUAL GWH AT PLANT)

	1994 Baseline			2020 Pre-Monterey			2020 Post-Monterey			2020 Difference (GWh) MPP minus baseline			2020 Difference (%) MPP minus baseline		
Period	Load	Generation	Net load	Load	Generation	Net load	Load	Generation	Net load	Load	Generation	Net load	Load	Generation	Net load
1922-93	7,363	4,283	3,080	10,082	5,019	5,063	10,210	5,045	5,165	128	26	102	1.27	0.52	2.02
1929-34	6,108	3,018	3,090	5,531	2,762	2,769	5,326	2,686	2,640	-205	-76	-129	-3.71	-2.76	-4.65
1987-92	5,525	2,777	2,748	5,790	2,780	3,017	5,833	2,796	3,037	37	17	20	0.63	0.60	0.67

Source: California Department of Water Resources, 2007.

TABLE 7.16-3

ENERGY AND FLOW AT SWP POWERPLANTS AND PUMPING PLANTS (1922-1993 AVERAGE ANNUAL)

	1994 Baseline		2020 Pre-Monterey		2020 Post-Monterey		2020 Difference MPP minus baseline		2020 Difference (%) MPP minus baseline	
	Energy (GWh)	Flow (TAF)	Energy (GWh)	Flow (TAF)	Energy (GWh)	Flow (TAF)	Energy (GWh)	Flow (TAF)	Energy (%)	Flow (%)
Powerplant										
Oroville	2,035	3,695	2,014	3,727	2,015	3,724	0	-3	0.02	-0.09
Thermalito	236	2,926	237	2,949	237	2,946	0	-3	-0.11	-0.11
Gianelli	101	470	128	604	128	552	0	-53	-0.21	-8.72
Alamo	98	936	116	1,109	115	1,100	-1	-9	-0.84	-0.84
Mojave	85	892	122	1,287	122	1,280	-1	-7	-0.54	-0.54
Devil Canyon	988	887	1,412	1,168	1,405	1,262	-7	-6	-0.48	-0.48
Warne	279	488	373	652	385	673	12	21	3.25	3.25
Castaic	462	478	616	638	638	661	22	23	3.58	3.57
Total	**4,284**	**-**	**5,018**	**-**	**5,045**	**-**	**25**	**-**	**-**	**-**
Pumping Plant										
Banks	873	2,940	946	3,186	949	3,167	3	-19	0.34	-0.59
South Bay	112	140	126	158	147	184	21	26	16.72	16.72
Del Valle	1	15	2	24	2	24	0	0	1.03	1.03
Gianelli	144	523	176	643	194	722	19	78	10.77	12.14
Dos Amigos	387	2,805	419	3,042	396	2,869	-24	-173	-5.70	-5.70
Las Perillas	9	118	12	158	10	126	-2	-32	-19.96	-19.96
Badger Hill	24	118	32	158	25	126	-6	-32	0.65	-19.96
Buena Vista	371	1,532	522	2,157	525	2,171	3	14	0.65	0.65
Teerink	451	1,528	635	2,153	639	2,167	4	14	0.65	0.65
Chrisman	937	1,467	1,354	2,120	1,376	2,153	21	33	1.58	1.58
Edmonston	3,280	1,467	4,739	2,120	4,814	2,153	75	33	1.58	1.58
Oso	137	490	183	654	190	677	6	23	3.46	3.46
Pearblossom	637	906	936	1,331	944	1,342	8	11	0.85	0.85
Total	**7,363**	**-**	**10,082**	**-**	**10,212**	**-**	**128**	**-**	**-**	**-**

Source: California Department of Water Resources, 2007.

ENDNOTES

1. California Department of Water Resources 2004. Bulletin 132-03. Management of the California State Water Project – Calendar Year 2002.

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7. South Delta Improvements Program EIS/EIR 2005 (Draft).

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16. California Energy Commission. 2002. 2002-2012 Electricity Outlook Report.

8. GROWTH-INDUCING IMPACTS

8. GROWTH-INDUCING IMPACTS

8.1 INTRODUCTION

This chapter describes the effects of the proposed project, the Monterey Amendment and the Settlement Agreement, on economic and population growth and construction of housing. Some provisions of the Monterey Amendment have the potential to increase the amount of water available to some SWP M&I contractors, which could in turn affect urban growth. These provisions are those that deal with water allocation procedures, transfers and retirements of Table A amounts, and water supply management practices.

8.1.1 CEQA Requirements

To comply with CEQA, an EIR must discuss the ways in which the proposed project could affect economic or population growth in the vicinity of the project and how the characteristics of the project could result in other activities with adverse impacts to the environment [CEQA Guidelines Section 15126.2(d)].

Specifically, CEQA Guidelines Section 15126.2(d) states that an EIR must:

> "Discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects, which would remove obstacles to population growth (a major expansion of a wastewater treatment plant might, for example, allow for more construction in service areas). Increases in the population may tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. Also discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment."

Economic growth refers to the extent to which a proposed project could cause increased activity in the local or regional economy. Economic and population growth can be induced in a number of ways, including through the elimination of obstacles to growth, or through the stimulation of economic activity. Elimination of obstacles to growth refers to the extent to which a proposed project removes infrastructure limitations or removes regulatory constraints that could result in growth. For example, an increase in the capacity of utility or road infrastructure that is installed as part of the proposed project could allow either new or additional development in the surrounding areas. Increases in the population may tax existing community service facilities, requiring new facilities, the construction of which could cause potentially significant environmental impacts.

8.1.2 Summary of Growth Analyses in Previous CEQA Documents

The 1995 Program EIR on the Monterey Agreement assessed the potential growth-inducing impact of the Monterey Agreement from a statewide and regional perspective. After execution of the Monterey Amendment, various water agencies prepared program- or project-level CEQA documents on proposed permanent transfers of Table A amounts. Each of those documents presented a local, service area-level analysis of a proposed transfer, reached conclusions regarding the potential for the transfer to induce growth, and discussed characteristics of the project that facilitated other activities that could significantly affect the surrounding environment. The conclusions from these previous CEQA documents are summarized below.

Monterey Agreement

The Monterey Agreement EIR, issued in November 1995, acknowledged that implementation of the Monterey Agreement would "…result in direct and secondary economic effects in the regions relinquishing and transferring (exporting) water and in those regions acquiring (importing) those entitlements (and ultimate deliveries)".[1] The EIR included estimates of SWP deliveries to M&I and agricultural contractors at full Table A demand, with and without implementation of the Monterey Agreement. It was estimated that, when contractor demands reached full Table A amounts and all of the 130,000 AF of Table A amount identified in the Monterey Agreement had been transferred from agricultural to M&I contractors, deliveries to all M&I contractors combined would increase by a net amount of 8,900 AF relative to the without-project condition, and that the additional water could support an additional population of 39,700.[2]

Monterey Amendment Table A Transfers

Consistent with the provisions of the Monterey Amendment, which provides for the permanent transfer of 130,000 AF of Table A amounts from agricultural to M&I contractors, KCWA transferred 114,000 AF of its Table A amount to six M&I contractors between 1996 and 2003. Various CEQA documents were prepared addressing the transfers. In some cases, a transfer was addressed in more than one CEQA document. Table 8-1 lists the most pertinent CEQA documents and identifies the purpose of the transfers. Other relevant CEQA documents for each transfer are footnoted in the table. Table 8-1 summarizes the conclusions in the earlier CEQA documents for information purposes only. Although information in these earlier documents may corroborate conclusions of this analysis, this EIR provides an independent review of the transfers and provisions of the Monterey Amendment and the Settlement Agreement.

Some transfers were specifically proposed to serve new developments, while others were to augment existing supply sources and improve reliability for existing users. KCWA member agencies and the purchasing agencies reviewed the potential environmental effects of the proposed water transfers in CEQA documents. Most CEQA documents authored by M&I contractors receiving Table A transfers concluded that the transfers could remove obstacles to growth and that the new water provided by the transfers would eventually support additional population. Therefore, the transfers could be growth-inducing and could result in secondary effects on noise levels, demand for public services and utilities, air quality, wildlife habitat, transportation, and other resources. Those agencies that identified significant and unavoidable secondary impacts adopted a CEQA Statement of Overriding Considerations for the identified adverse environmental impacts. To fulfill its responsibilities as a Responsible Agency, the Department reviewed these CEQA documents, each agency's Notice of Determination and other documents including the Statements of Overriding Considerations. The Department adopted its own Notices of Determination that concurred with the local agency findings.

TABLE 8-1

SUMMARY OF PREVIOUS CEQA DOCUMENTS FOR TABLE A TRANSFERS

CEQA Document	Lead Agency	Table A Transfer Amount (AF)	Seller	Buyer	Purpose of Transfer	Identified as Growth-Inducing	Summary of Environmental Effects
Mojave WA Acquisition, Transfer and Use of Berrenda Mesa WD Table A State Water Project Water Entitlement Final EIR, October 29, 1996 SCH #96021040	Mojave WA	25,000	Berrenda Mesa WD (Kern County WA)	Mojave WA	Offset existing overdraft and future water demand within the Mohave River Basin and the remainder of the Agency's service area	No	NA
Transfer of Water Entitlements from Berrenda Mesa WD for Use in the Dougherty Valley Area Final EIR, February 1996 SCH #95033045	Berrenda Mesa WD	7,000[1]	Berrenda Mesa WD (Kern County WA)	San Ramon Service District	Programmatic transfer of up to 75,000 ac-ft from Berrenda Mesa WD; project-level transfer of 7,000 ac-ft of this amount for use in Dougherty Valley	Yes	Development of Dougherty Valley would result in conversion of open space and agricultural uses to urban uses and extension of urban services and roads.
Transfer of Water Entitlements from Berrenda Mesa WD for Use in the Doughtery Valley Final Supplemental Final EIR, December 17, 1997 SCH#96082036	Alameda County FC&WCD Zone 7	7,000[1]	Berrenda Mesa WD (Kern County WA)	Alameda County FC&WCD Zone 7	Provide a sustainable, permanent, and reliable water supply for use in Dougherty Valley	Yes	Development of Dougherty Valley would result in conversion of open space and agricultural uses to urban uses and extension of urban services and roads. It would also Induce indirect economic growth in the Tri-Valley region.
Palmdale WD 1996 Water Facilities Master Plan Final Master Environmental Impact Report, September 1996 SCH #96031009	Palmdale WD	4,000	Belridge WSD (Kern County WA)	Palmdale WD	Permanent transfer of 4,000 AFY of SWP entitlement and the related capacity from the Belridge WSD for use to reduce reliance on local groundwater resources and to meet projected long-term customer demand	Yes	Less open space and more people, fewer plants and animals and reduced habitats, more structures and roads, less varied landform and natural drainage and more graded and paved land, less water, energy and fossil fuels and other natural resources, more vehicles and the resultant air pollution and potential climatological changes, and other effects on Antelope Valley's natural desert environment.

TABLE 8-1

SUMMARY OF PREVIOUS CEQA DOCUMENTS FOR TABLE A TRANSFERS

CEQA Document	Lead Agency	Table A Transfer Amount (AF)	Seller	Buyer	Purpose of Transfer	Identified as Growth-Inducing	Summary of Environmental Effects
Zone 7 WA Water Supply Planning Program Final Program Environmental Impact Report, July 1999 SCH #98041040	Alameda County FC&WCD Zone 7	10,000	Belridge WSD (Kern County WA)	Alameda County FC&WCD Zone 7	Implement water transfers to meet projected immediate and near-term M& I and agricultural demands in the Alameda County FC&WCD Zone 7 service area	Yes	Growth accommodated by the proposed project could result in potentially significant and unavoidable impacts to traffic and congestion, air pollution, loss of agricultural land and open space, loss of wildlife habitat, visual character, changes in topography, traffic noise, solid waste, exposure to seismic hazards, wastewater discharge, school and park demand, increased flooding potential, urban runoff pollution and increased energy demand.
Zone 7 WA Water Supply Planning Program Final Program Environmental Impact Report, July 1999 SCH #98041040	Alameda County FC&WCD Zone 7	15,000	Lost Hills WD (Kern County WA)	Alameda County FC&WCD Zone 7	Implement water transfers to meet projected immediate and near-term M& I and agricultural demands in the Alameda County FC&WCD Zone 7 service area	Yes	Growth accommodated by the proposed project could result in potentially significant and unavoidable impacts to traffic and congestion, air pollution, loss of agricultural land and open space, loss of wildlife habitat, visual character, changes in topography, traffic noise, solid waste, exposure to seismic hazards, wastewater discharge, school and park demand, increased flooding potential, urban runoff pollution and increased energy demand.
Negative Declaration & Initial Study for the Proposed Acquisition of State Water Project Entitlements, June 2000 SCH # 20000093	Napa County FC&WCD	4,025	Belridge WSD (Kern County WA)	Napa County FC&WCD	Provide for below normal-year reserves and supplemental supply for member cities	No	

TABLE 8-1

SUMMARY OF PREVIOUS CEQA DOCUMENTS FOR TABLE A TRANSFERS

CEQA Document	Lead Agency	Table A Transfer Amount (AF)	Seller	Buyer	Purpose of Transfer	Identified as Growth-Inducing	Summary of Environmental Effects
Transfer of State Water Project Entitlements to the Solano County WA Final Environmental Impact Report, August 2000 SCH #2000032066	Solano County WA	5,756	Belridge WSD (Kern County WA)	Solano County WA	Improve the Cities of Fairfield and Vacaville's water supply reliability and contribute to providing a supply adequate to meet planned population growth and development objectives specified in their respective General Plans	No (accommodate planned growth)	Approved growth would result in conversion of undeveloped land resulting in the loss of vegetation and wildlife habitat.
Castaic Lake WA Supplemental Water Project Transfer of 41,000 Acre-Feet of State Water Project Table A Amount Final Environmental Impact Report, December 2004 SCH #1998041127	Castaic Lake WA	41,000	Wheeler Ridge-Maricopa WSD (Kern County WA)	Castaic Lake WA	Maintain the water supply needed to meet water demands of existing users and a portion of future water demand from anticipated growth within the Castaic Lake WA service area	Yes	Changes in visual character, increased light and glare, conversion of agricultural land, loss of vegetation and wildlife habitat and special status species, loss or disturbance of cultural resources, exposure to seismic and geologic hazards, loss of topsoil, exposure to hazardous substance releases and wildland fires, conversion to urban uses, increased noise levels, increased demand on public services and utilities, need for new or modified transportation network, and degradation of receiving water quality.

Note:
1 The 7,000 acre-foot Table A transfer from Berrenda Mesa WD to Alameda County FC&WCD Zone 7 was analyzed in two separate CEQA documents, an EIR by Berrenda Mesa WD and a supplemental EIR by Alameda County FC&WCD Zone 7.

8.2 ANALYSIS OF GROWTH INDUCING IMPACTS

8.2.1 Analytical Methods

Overview

This section describes the methods used to analyze the potential growth-inducing impact of the proposed project. There is no precise way to determine whether an increase in water supply, increase in the population – the excess of births over deaths. In the 1990s, over 80 percent of California's population growth was the result of natural increase. While in the future, immigration will continue to play a significant role in California's population growth, natural increase is expected to remain by far as the strongest driver of growth. The Monterey Amendment and Settlement Agreement would not be expected to have any effect on natural increase or net migration to the State and thus would have no effect on statewide population. However, the shifting of water supplies from one area of the State to another could facilitate construction of new housing in certain areas and a shift in the location of population growth at the local level. The analysis adopted for this EIR evaluates the potential for increases in growth at the local level.

The method of analysis adopted for this EIR was to identify those M&I contractors that could receive additional water as a result of the proposed project, and for those contractors, calculate the amount of additional water that could be made available and then estimate the population that could be supported by that amount of water.

In the analysis, a number of conservative assumptions are made, which result in over-estimating the potential increase in local population growth associated with the proposed project. These assumptions are as follows. First, the analysis only considers those M&I contractors that receive more water as a result of the proposed project. Those M&I contractors that receive less water as a result of the Monterey Amendment are, to the extent water may be a limiting factor to growth in their service areas, assumed to be able to obtain alternative water supplies. Secondly, it was assumed that those M&I contractors that received an increase in average annual deliveries would allocate the new water to urban growth rather than for other purposes. Some of the M&I contractors that receive additional SWP water may instead choose to use some or all of it for purposes other than to supply new residents, such as for groundwater overdraft protection or to improve the reliability of their dry-year supplies for existing water users. Lastly, if M&I contractors in need of water to support urban growth did not receive it as a result of the Monterey Amendment, they might find alternate water sources to do so. In this case, that same growth would have occurred without the proposed project.

The provisions of the Monterey Amendment that could affect deliveries of SWP water to M&I contractors include the Table A transfers and retirements, the water allocation procedures and the water supply management practices. The Table A transfers and retirements and water allocation procedures could have a substantial effect on average annual deliveries, as described in Chapter 6. The water supply management practices could increase effective deliveries to contractors in dry periods but would not have much effect on annual average deliveries.

Deliveries of SWP water to a contractor can include both scheduled Table A water and unscheduled, interruptible Article 21 water. For purposes of the growth analysis in this EIR, contractor deliveries are considered two ways, based on: Table A deliveries alone, and Table A and Article 21 deliveries combined. The reason for this is that an individual contractor's ability to include Article 21 water in its long-range supply plans depends on the specific circumstances and storage opportunities available to that contractor. Prior to the Monterey Amendment, Article 21(g) stated that the Department would not deliver scheduled “surplus water” if that water would encourage the development of an economy dependent on continued delivery of the water. Under the Monterey Amendment, the scheduled “surplus water” provisions were eliminated, including Article 21(g). The State Water Project Delivery Reliability Report states that for those SWP contractors who are able to store their wet weather supplies, Article 21 supply can be stored to offset other water that would have been withdrawn from storage. But in the absence of storage, Article 21 water is not likely to contribute significantly to local water supply reliability and should not be used to support growth. Ultimately, incorporating supplies received under Article 21 into the assessment of water supply reliability is a local decision based on specific local circumstances, facts, and the level of water supply reliability required.[3] For the analysis in this EIR, considering deliveries both with and without Article 21 water provides a range which includes the maximum SWP supply that a contractor might actually be able to put to use.

The effects of the Table A transfers and retirements and the water allocation procedures on average annual deliveries to individual contractors were estimated using the CALSIM II model as described in Chapter 6. The Table A transfers included in the estimates are those shown in Tables 6-3 and 6-4. Table A transfers include all of the transfers called for by the Monterey Amendment that have been completed so far, including the 41,000 acre-foot Castaic Lake WA transfer, for a total Table A transfer of 114,000 AF between 1995 and 2003. It was assumed for the purposes of analysis that the remaining 16,000 AF of Table A transfer called for in the Monterey Amendment would be transferred from KCWA to Coachella Valley WD and Desert WA. This EIR recognizes that the transfers to Castaic, Coachella and Desert are either in litigation or not yet complete. However by including them in the analysis, this EIR considers full implementation of this provision of the Monterey Amendment.

The effect of the proposed project on deliveries to M&I contractors varies from contractor to contractor. The water allocation procedures under the proposed project would result in a decrease in average annual deliveries of Table A water per acre-foot of M&I Table A amount. Therefore, those M&I contractors that were not recipients of Table A transfers would receive a decrease in average annual Table A deliveries; while those M&I contractors that were recipients of Table A transfers would more than offset those decreases and receive a net increase in average annual Table A deliveries. The water allocation procedures under the proposed project would also result in a potential increase in average annual deliveries of Article 21 water per acre-foot of M&I Table A amount. However, as noted above, an individual contractor’s ability to use Article 21 water depends on the specific circumstances and storage opportunities available to that contractor. Further, Article 21 water is made available only periodically and generally for a limited time, and the procedures for allocating Article 21 water only apply on those occasions when the demand for Article 21 water exceeds the availability of that supply. Therefore, an individual contractor’s ability to increase its Article 21 deliveries under the proposed project is dependent on whether it can actually use or store this water during those infrequent times when these allocation rules would apply.

The water supply management practices under the proposed project provide opportunities for all contractors to more efficiently manage those SWP supplies available to them by storing SWP water outside their service areas in groundwater banks or in San Luis Reservoir, and for certain contractors, by borrowing water from Castaic Lake and Lake Perris. They also include the establishment of a turnback pool, which provides financial incentives to contractors with more Table A water than they need in a given year to turn that water back for purchase by other contractors that can use it.

Although use of the water supply management practices could increase the reliability of M&I contractors' water supplies, there would be little effect on average annual deliveries of SWP water for reasons described in Chapter 6. It was assumed that land use planning agencies in the service areas of M&I contractors that received an increase in critical year SWP deliveries but did not receive an increase in their average SWP supplies would be unlikely to approve new development on the basis of increased dry year deliveries alone.

Method for Estimating Population Growth

Those M&I contractors that were recipients of permanent transfers of Table A amounts would receive increased average annual Table A deliveries as a result of the proposed project. To determine the potential for an increase in water supply to support additional population, per capita water consumption factors were used to estimate population growth. As most of the SWP's urban customers are located either in Southern California (South Coast Hydrologic Region) or the San Francisco Bay Area (San Francisco Bay Hydrological Region) and all of the recipients of Table A transfers are located in these two regions, water consumption factors for these regions were used in the calculations. Gallons per capita per day (GPCPD)[4] information was obtained from *The California Water Plan Update* (Bulletin 160-05). As described in Bulletin 160-05, current levels of water use were prepared and presented from recent actual years, as opposed to including statistical adjustments as was done in previous Bulletin 160 publications. Three years were selected to show the range of actual water supplies and use based on a range of hydrologic conditions:[5]

- 1998, which was a wet water-supply year statewide;
- 2000, an overall average or normal water year; and
- 2001, a below average or dry year for most of the state.

Bulletin 160-05 considered three "future scenarios" for 2030 (the future year established for estimating future water demands and the delivery capabilities of existing and planned facilities). The three scenarios are:[6]

- Current Trends – Recent trends continue for population growth and development patterns, agricultural and industrial production, environmental water dedication, and conservation.
- Less Resource Intensive – Recent trends continue for population growth and development patterns, higher agricultural and industrial production, more environmental water dedication, and higher conservation compared to current trends.
- More Resource Intensive - Higher population growth and development patterns, higher agricultural and industrial production, no additional environmental water dedication, and less conservation compared to current trends.

For each of these scenarios, Bulletin 160-05 included urban water use and population projections for 2030, by hydrologic regions throughout the state. Table 8-2 presents this data for the South Coast and San Francisco Bay Hydrological Regions, and the GPCPD rates calculated from this data. In Table 8-3, the GPCPD rates for each scenario were used to estimate the population that could be supported by the additional average annual SWP deliveries to certain M&I contractors. The future year used in this EIR is 2020, compared to the 2030 future year used by the Department for Bulletin 160-05. Therefore, the population calculations would represent population estimates for 2030. The actual population in 2020 would be expected to be something less.

TABLE 8-2

GPCPD FOR THE SOUTH COAST AND SAN FRANCISCO BAY HYDROLOGIC UNITS

Year	Hydrologic Unit	Total Urban Water Use (TAF)	Population	GPCPD
1998	San Francisco Bay	991	5,937,000	149
1998	South Coast	3,621	17,555,000	184
2000	San Francisco Bay	1,069	6,106,000	156
2000	South Coast	4,249	18,223,000	208
2001	San Francisco Bay	1,110	6,224,000	159
2001	South Coast	3,990	18,611,000	191
Current Trend				
2030	San Francisco Bay	1,267	7,857,000	144
2030	South Coast	5,122	23,827,000	192
Less Resource Intensive				
2030	San Francisco Bay	1,115	7,857,000	127
2030	South Coast	4,340	23,827,000	163
More Resource Intensive				
2030	San Francisco Bay	1,467	7,857,000	144
2030	South Coast	6,259	23,827,000	188
Source: California Department of Water Resources, California Water Plan Update, Bulletin 160-05.				

8.2.2 Results of the Analysis

Average annual SWP deliveries were estimated for the proposed project and for the projected baseline condition in 2020 (see Tables 6-22 and 6-25 in Chapter 6, Effects of Proposed Project on SWP and SWP Contractor Operations). Based on Table A deliveries only, eight M&I contractors would receive increased average annual deliveries of SWP water under the proposed project in 2020 when compared to the baseline. M&I contractors that would receive increased average annual Table A deliveries include Napa County FC&WCD, Solano County WA, Alameda County FC&WCD Zone 7, Castaic Lake WA, Coachella Valley WD, Desert WA, Mojave WA, and Palmdale WA. Considering deliveries of Table A and Article 21 water combined would result in seven M&I contractors receiving increased average annual deliveries of SWP water under the proposed project in 2020 when compared to the baseline. M&I contractors that would receive increased average annual deliveries of Table A and Article 21 water combined include Napa County FC&WCD, Solano County WA, Alameda County FC&WCD Zone 7, Castaic Lake WA, Coachella Valley WD, Mojave WA, and Palmdale WA. Increased average annual deliveries to each of these M&I contractors are shown in Table 8-3 together with the estimated population that the additional water could support under each of the future scenarios. As shown in Table 8-3, the total increase in average annual deliveries to the eight M&I contractors of Table A water is 90,900 AF per year, and to the seven M&I contractors of Table A and Article 21 water combined is 91,400 AF per year. This increase in water supply could support a total estimated maximum of new residents in the service areas of the affected water agencies under current trends of 470,241 based on Table A deliveries alone and up to 484,499 based on both Table A and Article 21 deliveries. Under the less resource intensive scenario, the increased water supply could support an estimated maximum of 545,517 new residents based on Table A deliveries and up to 561,684 based on both Table A and Article 21 deliveries. Under the more resource intensive scenario, the increased water supply could support an estimated maximum of 392,808 new residents based on Table A deliveries alone, and up to 405,103 based on both Table A and Article 21 deliveries.

TABLE 8-3

POTENTIAL POPULATION INCREASE DUE TO ESTIMATED AVERAGE ANNUAL DELIVERIES IN 2020

	Additional Deliveries (AFY)[1]			Potential Additional Population[2]					
				Based on Table A Deliveries			Based on Table A and Article 21 Deliveries		
SWP M&I contractors	**Table A Deliveries**	**Article 21 Deliveries**	**Total**	**Current Trends**	**Less Resource Intensive**	**More Resource Intensive**	**Current Trends**	**Less Resource Intensive**	**More Resource Intensive**
Napa County FC&WCD	2,400	800	3,200	14,879	16,871	12,830	19,839	22,494	17,106
Solano County WA	3,200	800	4,000	19,839	22,494	17,106	24,798	28,118	21,383
Alameda County FC&WCD, Zone 7	25,100	700	25,800	155,610	176,440	134,179	159,950	181,360	137,921
Castaic Lake WA	31,700	800	32,500	147,396	173,619	120,425	151,115	178,001	123,464
Coachella Valley WD	6,700	700	7,400	31,153	36,696	25,453	34,408	40,529	28,112
Desert WA	1,500	-3,300	-1,800	6,975	8,215	5,698	0[3]	0[3]	0[3]
Mojave WA	17,800	0	17,800	82,765	97,490	67,620	82,765	97,490	67,620
Palmdale WD	2,500	0	2,500	11,624	13,692	9,497	11,624	13,692	9,497
Total	**90,900**	**500**	**91,400**	**470,241**	**545,517**	**392,808**	**484,499**	**561,684**	**405,103**

Notes:
1. Average annual increases in deliveries to M&I contractors resulting from the proposed project, as compared to the baseline scenario, from Tables 6-22 and 6-25.
2. Based on 2030 GPCPD rates for the South Coast and the San Francisco Bay Hydrologic Regions, per the California Water Plan Update, Bulletin 160-05.
3. Assumed no population growth associated with negative total additional deliveries.

Therefore, under any and all of the future scenarios, implementation of the proposed project could support population growth in some areas. As mentioned above, the GPCPD are based on 2030; therefore, it is reasonable to assume that the actual population growth in 2020 for these areas would be less. The effects of this increase in population are discussed below.

Elimination of Obstacles to Growth

Increased average annual deliveries of SWP water to affected service areas could result in the construction of additional local infrastructure to deliver the water supplies. This could remove an obstacle to growth.

Economic Effects

At the local level, the increased population that could result from increased average annual deliveries of SWP water could stimulate increased economic activity as a result of an increased demand for goods and services necessary to support the population growth. The need for additional goods and services would induce increased employment. An increase in future employees would require the development of physical space. It is the characteristics of this physical space and its specific location that would determine the type and magnitude of associated environmental impacts of this economic activity.

Environmental Impacts

Because there could be an increase in population in some areas, currently undeveloped land could be converted to urban uses or current urbanization could be intensified, which could have secondary (or indirect) environmental effects such as impacts on special-status species and their habitat, changes in storm water quality and quantity due to increased impervious surface cover, reduction in air quality, increased traffic and noise levels, reduction in public service and utility levels of service, etc. Some of the EIRs prepared by recipients of Table A transfers identified similar secondary impacts in their service areas (see Table 8-1).

The specific environmental effects associated with increased population are too speculative to predict or evaluate since the exact location and manner of potential future development within the eight M&I contractors' services areas cannot be determined. However, this Program EIR provides an independent but generalized analysis of secondary impacts based on the known environmental effects of urban development in California. This analysis is presented below. The project-specific environmental impacts of implementing the proposed project are evaluated in Chapter 7 of this EIR.

The conversion of land to urban uses could result in a variety of different environmental impacts. Land that would be converted to urban uses along transportation routes and on the fringes of existing urban and suburban areas is typically undeveloped or used for agriculture. Conversion to urban uses of agricultural lands removes this land permanently from being available for agricultural production. In addition, conversion of agricultural or undeveloped lands eliminates most of the wildlife habitat value of these lands. Landform and drainage patterns could be altered, with natural drainage channels largely replaced by engineered storm water systems. Impermeable roofs, parking lots, and roadways could replace permeable surfaces with a consequent increase in storm water runoff and a decrease in groundwater recharge. Various substances associated with homes, yards, and vehicle use (paints, pesticides, plasticizers, oil and grease, brake dust, pet wastes, etc) could be deposited on urban surfaces and conveyed to natural waterways. The introduction of people and vehicles into previously unpopulated or lightly populated areas could increase traffic, noise levels, air pollutant emissions, the generation of sanitary wastewater and solid waste, and the demand for local services.

8.3 DISCUSSION AND CONCLUSIONS

The analysis described above provides a conservative, over-estimate of both the potential increase in population at the local level and of the resulting range of potential growth impacts that could result from the proposed project. This is because of the following assumptions:

- For those M&I contractors that receive more water as a result of the proposed project, all this additional water is assumed to be used to support growth in those contractors' service areas rather than be used for other purposes.
- For those M&I contractors that receive more water as a result of the proposed project, it is assumed that in the absence of the proposed project they would not have been able to find alternative water supplies to support this same growth.
- Those M&I contractors that receive less water as a result of the proposed project are, to the extent water may be a limiting factor to growth in their service areas, assumed to be able to obtain alternative water supplies.

If any of these assumptions were untrue then potential growth impacts would be less than the estimates presented above. The veracity of these assumptions and their effects on the estimated growth impacts are examined below.

8.3.1 Use of Additional SWP Water by M&I Contractors

The EIRs prepared on the transfers of Table A amount from KCWA to the M&I contractors provide an indication of the M&I contractors' intentions. Five of the EIRs indicate that the M&I contractors intend to use the additional SWP water to support growth but several note that some of the water would be used for a different purpose. Different purposes include the use of the additional water to recharge over-drafted groundwater basins, to replace more expensive water supplies and to improve system reliability by storing the extra SWP water for use in years when water availability from the SWP or other water sources is limited.

Groundwater basins are in an over-drafted condition in the service areas of two of the municipal water agencies that would receive additional SWP water (Mojave WA and Palmdale WD). The EIR prepared on the transfer of Table A amount from a KCWA member agency, Berrenda Mesa WD, to Mojave WA indicates that Mojave WA intends to use some of its additional SWP supply for groundwater replenishment. The EIR prepared on the transfer of Table A amount from a KCWA member agency, Belridge WSD, to Palmdale WD indicates that Palmdale WD intends to use some of its additional SWP supply to reduce reliance on groundwater. Thus, only a portion of the additional SWP water received by Mojave WA and Palmdale WD would be used to support growth.

It is unlikely that any of the eight M&I contractors receiving increased SWP deliveries would use the additional SWP supply to replace more expensive water from another source. For these eight M&I contractors, SWP water is probably their most expensive current major source of water. None of the EIRs on the Table A transfers indicate that M&I contractors intend to use their additional SWP water for this purpose.

Any of the eight M&I contractors could allocate some or all of the additional SWP water supply to improving reliability rather than supporting additional growth. One way of improving reliability is to store SWP water within or outside a contractor's service area for later use in dry years. As noted above, Mojave WA and Palmdale WD intend to use some of their additional SWP supply to replenish groundwater basins, which would have the effect of increasing the reliability of their water supply systems. Two other M&I contractors, Castaic Lake WA and Alameda County FC&WCD Zone 7, stored SWP water outside their service areas between 1994 and 2003. This suggests that they are using part of the additional SWP water to improve the reliability of their water systems.

Another way to improve reliability is to increase system reliability by increasing use of SWP water when it is available and using other sources when SWP water is in short supply. The EIR on the Table A transfer from the Belridge WD to Solano County WA indicates that Solano County WA intends to use a portion of its additional SWP water to improve its system reliability in this way. The Negative Declaration on the Table A transfer from the Belridge WD to Napa County FC&WCD indicates that Napa County FC&WCD would use all of its additional SWP supply to improve system reliability.

Some of the eight M&I contractors receiving additional SWP water intend to use part of it to support growth and the rest for another purpose, primarily improving system reliability. It is not clear how much of the additional SWP water would be used to support growth and how much would be used for other purposes.

8.3.2 Alternative Water Supplies to Support Growth

Some or all of the estimated population growth could probably occur with or without the Monterey Amendment. If the eight (or seven based on combined Table A and Article 21 deliveries) M&I contractors receiving an increase in average annual deliveries as a result of the Monterey Amendment did not receive the increase they would have sought alternative sources of water. It is likely that some of the eight M&I contractors would be able to find some alternative water supplies to support growth in their service areas. Alternative water supplies could include transfers from SWP agricultural contractors (unrelated to the Monterey Amendment) or other agricultural agencies, seawater or brackish water desalination, and wastewater reclamation.

Assuming that transfers from agricultural agencies could be made that would provide reliable water and not cause unacceptable local impacts, such transfers are the most likely source of an alternative water supply for municipal water agencies because the water so obtained would likely be less expensive than water obtained by desalination or wastewater reclamation. Water costs are only a small part of a typical urban household budget but they often represent a considerable proportion of farmers' total cost of production and so a small increase in water cost can have a large effect on farm profitability. Desalination, water reclamation and waste water treatment, though costly, are being developed and used by municipal water agencies, especially in southern California.

Urban water use is not as sensitive to cost as agricultural use. The alternative water would probably be more expensive than SWP water but the water agencies would be able to pass the increased cost on to urban water users. Municipal water agencies pass on increased water costs to their customers through connection charges and monthly water bills. Connection charges are one-time charges for connection of new buildings to a municipal water system and are typically added to the cost of new homes. Connection charges are typically set based on the construction cost of the extra pipes, pumps, and tanks needed to serve water to a new neighborhood and are not related to the unit cost of water. Because connection charges generally do not depend on the unit cost of water, they would typically not be affected by a change in water source. Thus, the cost of new homes would likely be unaffected by a change in water source. However, new homeowners could experience higher monthly charges than they would have if their water purveyor had received additional SWP water.

8.3.3 Local Decision Making on Land Use Planning

It is unclear whether in certain areas increased average annual SWP deliveries eliminate an obstacle to growth. The proposed project would not improve infrastructure capacity or remove a regulatory constraint that had previously limited growth in the municipal contractor's service areas. It is possible that uncertainty in water supplies could, in and of itself, be considered an obstacle to growth because planners might have limited growth (urbanization) based on water supply availability. For instance, the 2004 EIR on the Table A transfer to Castaic Lake WA states that the transfer would eliminate an obstacle to growth.

Although a project may have growth-inducing potential, it may not result in growth. Neither the Department nor the water agencies to which it delivers water make decisions with regard to where and how growth should occur. General decisions regarding growth are made through the general planning process at regional and local levels. However, growth is ultimately controlled by decisions made with respect to individual development proposals at the local level by cities and counties. Availability of water is only one of many factors that land use planning agencies consider when making decisions about growth.

The cities and counties are responsible for considering the environmental effects of their decisions. When new developments are proposed, the cities and counties prepare environmental documents pursuant to CEQA. The impacts of growth would be analyzed in detail either in general plan EIRs or in project-level CEQA documents. Mitigation of identified impacts would be the responsibility of the local jurisdictions in which the growth would occur. Mitigation measures could include locating the growth in areas where sensitive resources are absent, minimizing the loss of resources, or replacing any loss. If identified impacts could not be mitigated to a level below the established thresholds, then the local jurisdiction would need to adopt overriding considerations.

8.3.4 Conclusions

The additional water supply that would be made available by the Monterey Amendment through average annual Table A deliveries to eight M&I contractors could support a maximum increase in population of approximately 392,808 to 561,684 (depending on the future scenario) in their service areas. Average annual Table A and Article 21 deliveries to seven M&I contractors could support a maximum increase in population of approximately 405,104 to 561,685. This analysis concludes that some of this water could support additional growth. This conclusion is similar to that found in environmental documents prepared by the sellers and buyers of Table A water. It is unlikely that all of such population growth would occur because some of the water would be used for other purposes such as improving the reliability of water supplies, or that any growth that did occur could be attributed to the Monterey Amendment because it is likely that in some cases alternative sources would have been used to support this growth in the absence of SWP supplies.

Increases in population can result in new development that causes adverse impacts to the environment. This study concludes that some of the impacts are potentially significant and cannot be avoided. This conclusion is similar to conclusions found in some of the environmental documents prepared by sellers and buyers of Table A water. The types of impacts and potential mitigation measures are discussed in Section 8.2 and are common to urban development projects.

Neither the Department nor local water supply agencies make local decisions regarding growth and where it will occur. Cities and counties in the contractor service areas affected by the increased population are responsible for considering the environmental effects of their growth and land use planning decisions. When new developments are proposed, the cities and counties prepare environmental documents pursuant to CEQA. Where appropriate, they must consider mitigation measures, alternatives and overriding considerations.

ENDNOTES

1. Central Coast Water Authority, *Draft Environmental Impact Report, Implementation of the Monterey Agreement*, May 1995, page 3-21.

2. Central Coast Water Authority, *Draft Environmental Impact Report, Implementation of the Monterey Agreement*, May 1995, Table 3.8-2, page 3-25.

3. California Department of Water Resources, *2005 State Water Project Reliability Report,* June 2006, page 15.

4. GPCPD: total urban water use in TAF*325853.319*1000/(population)*365.

5. California Department of Water Resources, *California Water Plan Update 2005*, December 2005, Volume 3, page 1.5.

6. California Department of Water Resources, *California Water Plan Update 2005*, December 2005, Volume 1, pages 4.11 and 4.12.

9. RELIABILITY OF WATER SUPPLIES AND GROWTH

9. RELIABILITY OF WATER SUPPLIES AND GROWTH

9.1 INTRODUCTION

Each contractor's SWP contract contains a Table A, which identifies the amount of water that contractor has contracted for with the State with an amount listed for each year the contract is in effect. For each contractor, Table A amounts were initially low, to match the low demands when the contracts were signed, and then built up over the years as its demands were projected to increase. Table A amounts for most contractors reached a maximum in 1990. The Table A amount in any year is used to indicate the maximum amount of dependable SWP water that the State agrees to make available for delivery to a contractor during the year. The State and SWP contractors also use Table A amounts to serve as a basis for allocation among the contractors of available water when supplies are limited, and of some SWP costs. (See Section 2.5.1 for a detailed discussion of Table A.)

When the SWP was originally conceived, water planners envisioned that the SWP would deliver the full Table A amount in most years, with additional facilities constructed as contractors' Table A amounts increased. However, the planned SWP yield was constrained by planned facilities that were never built, as well as by more stringent water quality requirements and new environmental regulations. As a consequence, in recent years the SWP is able to deliver full Table A amounts only in wetter years. In some wet years, the SWP can deliver more than the Table A amounts. In drier years, SWP deliveries can be substantially less than full Table A amounts.

The plaintiffs in PCL v. DWR argued that urban planning agencies might overestimate the amount of water available to support urban growth by basing planning decisions on the contractual Table A amount of an SWP contractor and not on a more realistic expectation of annual SWP water deliveries. The Court of Appeal noted that "There is certainly the possibility that local decision makers are seduced by contractual entitlements and approve projects dependent on water worth little more than a wish and a prayer."[1] The possibility of decision-makers approving urban developments that would not have been approved if they had a more realistic idea of water availability from the SWP was termed a "paper water" problem because reliance is arguably placed on water that exists only on paper in the SWP long-term water supply contracts.

The plaintiffs in PCL v. DWR argued that the proposed project's elimination of Article 18(b) eliminated the possibility of a downward adjustment of the Table A amounts to be more reflective of the SWP's actual capability to deliver water. In other words, the plaintiffs argued that without Article 18(b), the original Table A amounts would be maintained causing the "paper water" problem to persist by affecting planners' urban growth decisions.

The purpose of this chapter is to explore whether planners in the SWP service area relied on full Table A amounts in the SWP long-term water supply contracts and, if so, whether that SWP "paper water" problem could be ameliorated if Article 18(b) were retained and invoked.

9.1.1 Analytical Method

There are several factors that would have to coincide to create SWP "paper water" problem. First, the local planning process must rely on the SWP water supply contracts and use them in determinations of whether to approve development projects. Secondly, the water supply information derived from the SWP contracts must lead to unrealistic assumptions about SWP water deliveries, such as assuming full Table A deliveries every year. Lastly, these unrealistic SWP supply assumptions must be one reason the project was approved.

To explore the possibility of a "paper water" problem, documents that are or could be used by local planning entities to plan and approve growth were reviewed. These included General Plans, Specific Plans, Urban Water Management Plans (UWMPs), EIRs, and public documents published by the California Department of Water Resources (Department), including the recent State Water Project Delivery Reliability Report. Particular attention was given to how development decisions relied upon these documents and how they described SWP delivery capabilities or reliability. In addition, recent legislation and other factors were examined to determine whether they might affect any possibility that SWP "paper water" might influence urban planning in the future.

9.2 PERTINENT LAWS, REGULATIONS, AND PLANNING PRACTICES

Land use planners in California employ various procedures and practices to evaluate if adequate water supplies and other utilities are available to support urban growth. The procedures and practices have evolved over time in response to growing concern that urban growth might be outpacing the available water supply. They are described below.

9.2.1 California Department of Water Resources Publications and Communications

The Department continually provides SWP and other water related information to the SWP contractors and the public. Since 1963, the Department has published an annual bulletin (Bulletin 132) that provides information on the planning, construction, financing, management, and operations of the SWP. The Department also prepares and publishes the California Water Plan (Bulletin 160) approximately every 5 years. The plan includes projections of future water demand and supply constraints of the SWP and the State's other water resources, and options for meeting future water demands. In addition, since the beginning of SWP operation, the Department has annually notified and updated its contractors on the amount of Table A water available for delivery in the coming year. Since 1996 the Department has also posted this information on its web site to provide regular updates on water availability in the coming year based on stream flow measurements, snow surveys, and storage in SWP reservoirs. The notices are provided so that SWP contractors, other water agencies, local planners, and the public are able to remain abreast of water conditions and events that affect deliveries by the SWP.

The Settlement Agreement provisions include new procedures for disclosure of SWP delivery capabilities and replacement of the term "entitlements," as Table A amounts were previously referred to in the SWP contracts, with the term "Table A amounts," so that land use planning agencies would be less likely to misinterpret the supplies that would be made available under the SWP long-term water supply contracts. Also as part of the Settlement Agreement, the Department agreed to publish *The State Water Project Delivery Reliability Report,* to update the report every two years, and to distribute the report to all SWP contractors and all city, county, and regional planning departments within the SWP service area. The purpose of the report is to provide current information to SWP contractors and to planning agencies regarding the overall delivery capability of the existing SWP facilities under a range of hydrologic conditions and supply availability to each contractor in accordance with other provisions of the contractors' contracts. The Department published *The State Water Project Delivery Reliability Report* in 2003. The updated report for 2005 was published in June 2006.

9.2.2 Urban Water Management Plans

In 1983, the California Legislature enacted the Urban Water Management Planning Act (California Water Code [CWC], Division 6, Part 2.6, Sections 10610 - 10656). The Act requires every urban water supplier that provides water to 3,000 or more customers, or that provides over 3,000 AF of water annually, to prepare and adopt an UWMP and update it every five years. The purpose of the plan is to assist water suppliers in carrying out long-term planning to ensure adequate water supplies to meet existing and future demands for water. The Act describes the required contents of an UWMP, as well as how urban water suppliers should adopt and implement their plans. The first round of UWMPs was prepared in 1985, and successive editions must be produced every 5 years. Updated UWMPs from most urban water agencies were required to be completed in December 2005.

The Act recognizes that water is a limited and renewable resource subject to ever increasing demands and that conservation and efficient use of urban water supplies is a statewide concern. By directing urban water suppliers to prepare UWMPs, the Legislature established a clear policy direction for local water agencies to actively pursue conservation and efficient use of water to protect both the State's people and its water resources. The Act has been amended several times, most recently in 2004, to clarify and expand the content of the UWMPs. Current provisions of the Act require water agencies to describe ongoing and planned water conservation measures, provide a water shortage contingency analysis, describe the availability and potential use of recycled water, and provide an assessment of water supply reliability 20 years into the future under various hydrologic conditions. The Act also requires water agencies to hold a public hearing prior to UWMP adoption, with notification to all cities and counties within their service area, and to then provide copies of the adopted UWMP to those cities and counties.

9.2.3 Senate Bills 610 and 221 and Water Supply Assessments

Senate Bill (SB) 610 and SB 221 were enacted and became effective on January 1, 2002. These laws reflect the desire to incorporate water supply and demand analysis in the planning process. SB 610 amends portions of the CWC, including the sections enacted as the Urban Water Management Planning Act (Section 10610 - 10656), and Public Resources Code Division 13, which includes CEQA. SB 610 requires the preparation of a Water Supply Assessment (WSA) during the CEQA process for all projects that include: more than 500 residences; mixed-use projects that would have a water demand equivalent to the demand of 500 residential units; non-residential uses that would employ more than 1,000 persons or more than 250,000 square feet of floor space; a proposed hotel or motel, or both having more than 500 rooms; a proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area; or a mixed-use project that includes one or more of the projects specified.

SB 610 is designed to expand the information typically contained in an UWMP, and the amendments to CWC Section 10631 were designed to make the two processes consistent. A key difference is that UWMPs must be revised every five years, in years ending with either zero or five, while WSAs pursuant to SB 610 are required as part of the environmental review process for each individual qualifying project. As a result, the minimum 20-year planning horizons for each type of document may cover slightly different periods. Water Supply Assessments must "describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for (1) an average year; (2) a single dry year; and (3) multiple dry years."

Under SB 221, approval by a city or county of residential subdivisions of 500 units or more, as defined by California Government Code Section 66473.7(a)(1), requires an affirmative written verification of sufficient water supply. SB 221 is designed as a mechanism to ensure that collaboration on finding the needed water supplies to serve a new, large subdivision and existing and planned future uses for the next 20 years occurs again at the tentative tract map approval stage. This verification must also include documentation of historical water deliveries for the previous 20 years, as well as a description of reasonably foreseeable impacts of the proposed subdivision on the availability of regional water resources. As a result of the information contained in the written verification, the city or county may attach conditions to assure the water supply as part of the subdivision map approval process.

9.2.4 City and County General Plans

The General Plan Guidelines for the State of California[2] describe the contents of general plans, which by law must contain seven required elements (Land Use, Circulation, Housing, Conservation, Open Space, Noise, and Safety). An optional water element may be incorporated, but most General Plans typically are organized by only the required elements. Within the contexts of Conservation, Open Space, and Safety, there are several opportunities to discuss water and the Guidelines do identify optional suggestions to address water resources and demand on water resources. The EIR prepared in conjunction with the General Plan typically provides some assessment of the adequacy of water resources to accommodate housing and other development being planned to accommodate projected population growth.

With respect to planning development to accommodate population growth, the State Planning and Zoning Law provides that the housing element of General Plans may not be constrained by the lack of all needed government services. This includes public water service. The housing element is required to plan for the housing allocated to a given city or county pursuant to Government Code section 65584. To the extent that governmental services, like a public water supply, are not available to fully meet a city's or county's housing allocation, Government Code section 65583(c)(3) requires the city or county to "remove the governmental constraints" to the development of the housing described in the General Plan. This approach furthers the State General Plan policy declaring that "the availability of housing is of vital statewide importance, and the early attainment of decent housing and a suitable living environment for every California family is a priority of the highest order" that "requires the cooperative participation of government and the private sector in an effort to expand housing opportunities and accommodate the housing needs of Californians of all economic levels." (Gov't Code section 65580.) While future build-out of housing and other population-accommodating development planned at the General Plan level may exceed presently available water supplies, this is not inappropriate at the General Plan level, and recent State Legislation (SB 610 and SB 221) ensures that specific housing and other development projects are not approved and constructed without a demonstrated, adequate water supply.

SB 610 and 221 and UWMP requirements have introduced more disclosure and communication on water supply and demand among cities, counties, and water agencies as part of the planning and project approval process. In addition, prior to the adoption or substantial amendment of a General Plan, the planning agency must send a copy of the proposed plan or amendment to any public water system with 3,000 or more service connections that serves water to retail customers within the area covered by the proposal. The public water system has at least 45 days to comment on the proposed plan and must provide a copy of its most recent UWMP and other water supply information to the city or county.

9.2.5 Will Serve Letters

To approve a specific development, the lead agency (i.e., the agency with responsibility to approve or carry out the project) must comply with CEQA. This involves an assessment of the potential for the proposed project to result in significant impacts to various environmental resources, including utilities and public services. Often some evaluation of the adequacy of water supply to support the project is included in the assessment. In the past, the preparation of many CEQA documents resulted in a request to the local water agency for a “will serve” letter. Typically this letter stated that the water agency had adequate water supplies and sufficient distribution system capacity to serve the project site, and therefore the relevant water agency indicated that they “will serve” the proposed project. Usually, water agencies responded affirmatively, except in certain special circumstances (e.g., chronic water shortages, periods of extended drought, or where infrastructure limitations made the provision of water service uneconomical to the service provider).

9.3 RESULTS OF SURVEYS AND LITERATURE REVIEW

9.3.1 General Plans

To assess the role that water supply and availability have in influencing land use planning decisions in general, two surveys were conducted, one by EIP Associates in 2004,[3] and the other by LSA Associates in 2003.[4] Together, these surveys covered most of the SWP urban service area. The surveys reviewed general plans and growth projections to determine the extent to which water supply availability and reliability are taken into consideration during their preparation. The General Plans analyzed in the surveys were chosen to provide a representative sample of cities in the state, including those located in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California, including MWDSC’s service area. The selected plans include large, medium, and small cities (with a population of between 100,000 and 400,000, between 50,000 and 100,000, and less than 50,000, respectively). However, due to the generally smaller population of cities outside Southern California, cities in all three categorical sizes could not be identified for each of the regions studied. Also, plans or plan elements that were being updated at the time of these surveys were generally excluded from the analysis because the updates had not been finally adopted. The LSA Study also examined Specific Plans for large-scale development projects, UWMPs and water system Master Plans for the Southern California region.

Between the two studies, 60 General Plans (and other plans) were reviewed to determine which plan elements contained information regarding water supply, particularly the Land Use, Open Space/Conservation, and Public Services Elements. The General Plans were also evaluated to determine whether they contained information about existing water use, identified water use by land use type, included statements indicating that future water demand could be met, or provided evidence that the land use plan had been, or may need to be, adjusted in response to water availability.

Based on the two surveys, General Plans in the SWP service area prepared in the last decade typically have not analyzed water supply and demand to determine how much development could be supported by existing water supplies, nor did they evaluate the reliability of existing water supplies. Of the General Plans surveyed, they typically do not treat water supply as a constraint on the development of land. Many General Plans include a policy requiring developers to demonstrate that water facilities are available to serve proposed developments; however, these policies typically address the adequacy of the water distribution system rather than the adequacy of the water supply itself.

A few recent plans include policies that suggest future growth may be limited by water availability, e.g. County of San Luis Obispo and City of Calistoga. However, these plans are the exceptions to the general rule that long-term growth decisions predicated on analyses in the General Plans do not consider water supply a constraint to growth. These recent plans, however, may reflect an emerging trend of increased attention to water supply issues at the General Plan level, which is discussed later in this chapter.

At the project development level, the LSA Study found that all Specific Plans and associated EIRs for the large-scale developments surveyed assessed water supply availability, but to varying degrees and based on varying sources of water supply information. But none of those documents surveyed relied on or even cited the Table A amounts of the SWP contracts.

Based on the limited sample size of General Plans surveyed, and the even smaller number of Specific Plans surveyed, it is impossible to conclusively show that no developments in the SWP service area had ever been approved in reliance on the contractual Table A amounts. In fact, a case involving SWP water from Castaic Lake Water *Agency (Santa Clarita Organization for Planning the Environment v County of Los Angeles (2003) 106 Cal. App. 4th 715, 722),* a court of appeal found that an EIR for a county-approved residential and commercial property development inadequately relied on a discussion of "entitlement' that made "no attempt to calculate or even discuss the differences between entitlement and actual supply" and that contained "no estimates from the DWR, the agency that manages the SWP…". See also *California Oak Foundation v Santa Clarita (2005) 133 Cal.App.4th 1219, 1236)*.

However, to the extent that this situation had occurred in the past, it is almost certain not to occur in the future. With passage of SB 610 and SB 221, formal consideration of water supply availability is now required at the EIR and tentative tract map stages of development approval. And as a result of Settlement Agreement provisions of the proposed project, a wider and more concise dissemination of information on SWP reliability data by the Department will help minimize any unrealistic assumptions of SWP availability.

9.3.2 Urban Water Management Plans

UWMPs are fundamental water supply documents required by California law, and water supply information they contain could be used by planners and other public agencies to understand their local water supply situations. If UWMPs indicated that the SWP delivered full Table A amounts every year, and if land-use planners in areas receiving SWP water referred to these reports when making planning decisions or approvals, then a "paper water" problem may have been created. To assess this potential issue, the UWMPs of several M&I contractors were surveyed to assess how they reported the projected availability of SWP supplies.

Most UWMPs of M&I contractors included discussion of the variability of SWP supplies. The sophistication of information in each contractor's UWMP varied, but all surveyed acknowledged that the SWP cannot deliver full Table A values in all years. Table 9-1 presents the results of a survey of some M&I contractors' UWMPs.

All of the UWMPs of the larger M&I contractors surveyed present SWP supply information that indicates the inherent fluctuations in SWP deliveries to them. While the UWMPs vary in their presentation of SWP data, there may be several reasons for this variability, including differing assumptions regarding the reliability of the SWP supply available to them, and differences in each contractor's need for SWP water. For example, most of the surveyed UWMPs reported that SWP water availability is greatly affected by hydrology. In addition, each contractor's need

TABLE 9-1

REPORTED SWP RELIABILITY IN CONTRACTOR UWMPS

Agency	Source	Reported SWP Average Deliveries	Reported SWP Dry Delivery	Reported SWP Critically Dry Delivery
Mojave WA	1994 Regional Water Management Plan	79%	n/a	n/a
Castaic Lake WA	2000 Urban Water Management Plan	60%	n/a	39%
Alameda County WD	2001-2005 Urban Water Management Plan	74%	43%	15%
San Gorgonio Pass WA	2003 Technical Memorandum - Supply and Demand Forecast Summary	81%	n/a	n/a
Santa Clara Valley WD	2001 Urban Water Management Plan	74%	47%	11%
Palmdale WD	2000 Urban Water Management Plan	87%	52%	23%
MWDSC	2000 Urban Water Management Plan	(1)	(1)	(1)
Desert WA	2000 Urban Water Management Plan	82%	n/a	n/a
Antelope Valley-East Kern WA	2000 Urban Water Management Plan	72%	50%	30%
Alameda County WD	Urban Water Management Plan	74%	43%	15%
Solano County WA	Urban Water Management Plan	n/a	45%	30%
Solano County WA	2000 Urban Water Management Plan	74%	n/a	n/a

Note:
1. MWDSC did not specifically indicate SWP expected deliveries by year type, and instead used the full range of SWP expected reliability published by California Department of Water Resources in Bulletin 160-98.

for SWP water depends on demands within its service area and the mix of water supplies available to it. The UWMPs included those from large M&I contractors including the MWDSC, Alameda County WD, Zone 7 WA, Santa Clara Valley WD, San Gabriel Valley Municipal WD, Mojave WA, Castaic Lake WA, and others. None of these M&I contractors indicated in their UWMP that they would receive full Table A amounts from the SWP in every year or even most years.

The data regarding SWP delivery that was published by M&I contractors in their recent UWMP did not present an unrealistic expectation that full SWP deliveries would be received every year. A person reviewing these UWMPs would have gained an understanding of the complexity of the SWP and its susceptibility to annual California weather patterns. It is highly unlikely that data in these UWMPs contributed to a situation where urban planners in these M&I contractors' service areas approved development based on unrealistic assumptions of full Table A deliveries from the SWP in most years. It is more likely that information such as that contained in the UWMP surveyed increased awareness of water supply challenges and the need to continually support additional supply development and conservation projects. This survey of UWMP did not attempt to evaluate the accuracy of the information included in individual EIRs. Some of them may be subject to challenge with regard to whether the plan adequately discloses specific reliability questions. For example, in 2004, the Castaic Lake Water Agency Urban Water Management Plan was found inadequate for not adequately describing the reliability of its groundwater supplies because it did not address timing issues related to the treatment of groundwater contamination – its discussion of SWP supplies was not found to be inadequate (*Friends of the Santa Clara River v. Castaic Lake Water Agency 123 Cal.App. 4th 1, 12*).

The UWMPs discussed in this section were plans that predate the 2005 UWMP updates. Current plans are likely to be more complete with regard to the variability and reliability of water deliveries. To the extent that the varying presentations of SWP data in M&I contractors' UWMPs were a function of inconsistent assumptions regarding SWP availability rather than a function of varying supply mixes and needs, that variability will likely be less given the information and direction provided by the State Water Project Delivery Reliability Report since its initial publication in 2003.

9.3.3 Department Publications

SWP contractors, urban planning agencies, and members of the public may also have sought information regarding SWP delivery capability from documents published by the Department itself. As the State agency charged with operating and maintaining the SWP, the Department has continually published reports concerning the operation and management of the SWP. Some of these documents have regularly included information regarding SWP delivery capabilities. A brief review of some of these publications revealed that the Department has discussed the delivery potential of the SWP in many of them, and that the Department has openly acknowledged that the SWP can not deliver full Table A amounts, or the original minimum SWP yield of 4.2 million AF, every year. In contrast, these publications have sought to present a realistic picture of what the SWP can be expected to deliver and what factors affect SWP deliveries.

The annual Bulletin 132 series, "Management of the State Water Project" has been a standard Department publication since the beginning of the SWP. Each edition of Bulletin 132 reports on the operations and management of the SWP for a particular calendar year. Bulletin 132 routinely discussed the actual delivery capability of the SWP. For instance, Bulletin 132-83 indicated that the firm yield of the SWP at that time was 2.5 million AF per year, but that it would decrease to near 2.0 million AF by year 2000 (page 3). Bulletin 132-90 projected the firm yield of the SWP facilities as 2.4 million AF per year (page 86). In fact, most annual editions of Bulletin 132 presented SWP delivery capability information indicating that the SWP would not deliver 4.2 million AF.

As directed by the California Legislature, the Department also has the duty of publishing the California Water Plan every 5 years. The California Water Plan, or Bulletin 160, is intended to be the chief statewide water planning document. A review of past Bulletin 160s indicates that the yield of the SWP has been realistically presented in those publications as well. Bulletin 160-87 (published November 1987) states that "dependable water supplies from the SWP are now about 2.3 million AF per year," (page 24). Bulletin 160-93 indicates that "the seven-year average dry-period yield of the SWP with its current facilities operating according to Water Right

Decision 1485 requirements is about 2.4 million AF per year," (page 63). Similarly, Bulletin 160-98 includes information regarding the probability of the SWP delivering particular quantities of water in any year. It specifies that "existing SWP facilities have only a 65 percent chance of making full deliveries under 1995 level demands" and "under a 2020 level demand scenario, existing SWP facilities have less than a 25 percent chance of making full deliveries," (page 3-33).

The State Water Project Delivery Reliability Report discussed in great detail the ability of the SWP to deliver water. The *2005 State Water Project Delivery Reliability Report* defines water reliability as "…how much one can count on a certain amount of water being delivered to a specific place at a specific time". Factors that contribute to water reliability include the availability of the water from the source, availability of the means of conveyance, and the level and pattern of water demand in the delivery service area (destination).[5] The 2005 State Water Project Delivery Reliability Report identifies that the total of all contractors' maximum Table A amounts is 4.173 million AF. Under 2005 conditions average Table A delivery from the Delta is 2.818 million AF and average Article 21 delivery is 260,000 AF.[6]

Public planning agencies, water providers, or members of the public had access to the information in the surveyed Department Bulletins (Bulletins 160 and 132). As with the results of the survey of UWMPs, it appears that information regarding SWP deliveries was not presented in a simplistic, one-dimensional fashion wherein full deliveries were assumed in every year regardless of hydrology. Instead, Department publications like Bulletins 132 and 160 attempted to explain the complexity of water delivery projections and the many confounding factors that increase or decrease SWP deliveries. Planners reading this information would have gained an appreciation for the inherent fluctuations and unpredictability of SWP supply availability, as well as the inability of the SWP to deliver full Table A amounts as originally planned when the SWP was constructed. These publications, then, provided realistic SWP delivery information, and neither local agencies nor the public were led to believe that SWP deliveries up to the full contract amounts were available in all years. The State Water Project Delivery Reliability Report provides even more detailed information.

9.4 CONCLUSIONS

9.4.1 SWP Water Supply and Urban Planning in the Past

The surveys of General Plans indicate that land use planners and local jurisdictions did not in the past typically consider water availability as a constraint to growth. Local jurisdictions generally develop their General Plans for future growth to accommodate the expected housing needs. Water supply and infrastructure is then planned in response to the General Plan growth levels. Thus land-use planners appear to assume that local water agencies will obtain the supply necessary to meet the long-term water demand that results from planned growth at the General Plan level. Although planners may have considered various sources of information on water availability during plan formulation (e.g., Department publications, SWP contracts, UWMPs, etc.), general plans do not typically make reference to them or include detailed information on water supplies. Even if planners were concerned about water availability, they may not have focused their attention on SWP delivery capabilities because SWP water is not the primary water source within most contractors' service areas – it is a supplemental water source. For example, SWP water constitutes only 22 percent of total current water use within the MWDSC service area.

The fact that land use planning historically did not view water supply as part of the planning process is probably attributable to historical factors, especially the building in California of very large water projects that provided sufficient supply for populations fifty or more years into the future. At the time these projects were built, California urban areas were experiencing booming growth and expected these trends to continue. Water projects, much like highways and sewage treatment plants, are often built on a large scale because of the high cost and difficulty of completing them, and the difficulty or inability to expand them. Additionally, the large capital investment and the various funding mechanisms used to build large water projects like dams, reservoirs, and canals are usually only approved periodically. When such a large investment in infrastructure is made, it is more economical and politically feasible to expend a small amount of additional funding at that time to build a larger project, than to build several independent, additional projects later. For example, San Francisco's Hetch Hetchy system, Los Angeles' Owens River/Mono Basin system, the CVP, the Colorado River water system, and the SWP were designed to meet water demands for many years into the future when they were built. As a result, in the past, planners did not have to be very concerned that urban growth might be limited by water availability. Water availability has become a concern in some local jurisdictions more recently as a result of local elected decision makers and/or local voters deciding to limit or retard growth and using water availability as the implementing mechanism. Examples include the Monterey Peninsula, parts of Marin County, and the Santa Barbara area. In addition, water supply is generally considered at the development level, but prior to passage of SB 610 and 221, to varying degrees of sophistication.

Because land use planners and decision-makers have paid little attention to water availability in general, it follows that they have been influenced very little or not at all, by the Table A amounts in the SWP contracts or any other information on the delivery capabilities of the SWP. Whether the Table A amounts gave planners a false impression of the SWP's delivery capability becomes moot. Thus, based on the planning documents surveyed, the water supply capability of the SWP was not considered in making urban development decisions.

While it appears that past growth and development decisions in many jurisdictions may have been made without thought of water supply limitations, it is also apparent that there is no widespread misunderstanding or misreporting of SWP delivery information. If local planners or the public had considered water supply issues and consulted documents reporting SWP supply information such as an UWMP or Department publications and website postings, they would have received realistic information regarding SWP supplies and could not have reasonably believed that the SWP delivered full Table A amounts in every year or even most years.

The UWMPs reviewed presented a realistic picture of how SWP deliveries fluctuate based on the amount of precipitation in a year or series of years. These UWMPs included those of the largest M&I contractors that provide water to urban areas. It is unlikely that planners in these areas would have assumed full SWP Table A deliveries every year, or in most years, when public documents prepared by their local SWP M&I contractors and the Department itself all indicated that SWP deliveries were not full contractual Table A amounts every year. If they did so, then their assumptions were not founded on any of the publications reviewed. The review of documents presented here indicates that the Department and M&I contractors have provided a realistic picture of the SWP's delivery capability and its constraints.

9.4.2 SWP Water Supply and Urban Planning in the Future

In the future, although the Table A amounts in the SWP contracts are greater than the average annual delivery capability of the SWP, it is unlikely that land use planners and decision-makers would base their decisions only on the Table A amounts in the SWP long-term water supply contracts. The vast majority of public water supply documents that discuss the SWP include a realistic discussion of the SWP's delivery capability. Furthermore, with the passage of Senate Bills 610 and 221, and the biennial publication of the *State Water Project Delivery Reliability Report* by the Department, it is almost certain that future land use and water supply planning will be more closely linked than they have been in the past. Lastly, planners are more likely to base water availability assumptions on the UWMPs and the State Water Project Delivery Reliability Report than on SWP contract documents.

A recent survey of land use agencies[7] suggests that in the last year or two many of California's cities and counties have begun to link decisions on land-use and water resources. The passage of SB 221 and SB 610 appear to have "…generated considerable new activity at the local level. …It is also possible that some communities with local policies have increased the rigor of their review process since the enactment of the new state laws."[8] Although the survey also noted that "…it is not possible to comment on the depth or quality of the planning and review activities undertaken by local governments…"[9] it noted that some city and county departments responsible for land-use decisions now participate in the planning activities of their local water utilities.

The "paper water" problem is really a question of whether local planners recognize the limitations on the reliability of SWP supplies. In the early years of the SWP, the total Table A amount as it ramped up to maximum Table A amounts was important because this number was also intended to be the firm yield of the SWP. In recent years, for operations and planning purposes, the concept of firm yield has been relaced with water delivery reliability curves which show the likelihood of water deliveries by the SWP in any year given the range of historical hydrologic events. Table A amounts now serve primarily as a way of allocating certain SWP costs and water shortages and surplus among the contractors. Reducing the Table A amount through invocation of Article 18(b) is not relevant given current day operations and planning based on water delivery reliability curves.

The surveys and literature review undertaken as part of this EIR show little evidence that a "paper water" problem was created by the contractual SWP Table A amounts or that it affected urban growth decisions. However, even if a "paper water" problem did arise from land use planners relying on the Table A amounts, the passage of SB 610 and 221 and the State Water Project Delivery Reliability Report have led to better information dissemination to local planners regarding the reliability of SWP supplies. Thus, the elimination of Article 18(b) by the proposed project would not have an effect on urban growth and would not create a continued "paper water" problem because planners either do not consider SWP water supplies when approving growth at the General Plan level, or have more detailed, realistic, and readily available SWP delivery information available to them to consider at the development approval level.

ENDNOTES

1. PCL vs. DWR.

2. California Office of Planning and Research, *General Plan Guidelines*, 2003*.*

3. EIP Associates, *Evaluation of Planning Entitlement and Water Supply Availability within the State Water Project Service Area*, February 2004.

4. LSA Associates, *Evaluation of Water Supply and Growth Planning in Southern California,* prepared for MWDSC, 2003.

5. California Department of Water Resources, *2005 State Water Project Reliability Report*, page 3*,* June 2006.

6. California Department of Water Resources, *2005 State Water Project Reliability Report*, Tables 5-2 and 5-3, pages 17 and 18*,* June 2006.

7. Hanak, Ellen and Antonina Simeti, *Water Supply and Growth in California: A Survey of City and County Land-Use Planners*, June. (available from Public Policy Institute of California – http://www.ppic.org/main/home.asp), 2004.

8. Hanak, Ellen and Antonina Simeti, *Water Supply and Growth in California: A Survey of City and County Land-Use Planners*, June, page 21, 2004.

9. Hanak, Ellen and Antonina Simeti, *Water Supply and Growth in California: A Survey of City and County Land-Use Planners*, June, page 21, 2004.

10. OTHER CEQA CONSIDERATIONS

10.0 INTRODUCTION TO CEQA CONSIDERATIONS

Section 15126 of the California Environmental Quality Act (CEQA) Guidelines requires that all aspects of a project must be considered when evaluating its impact on the environment, including planning, acquisition, development, and operation. As part of this analysis, the EIR must also identify (1) significant environmental effects of the proposed project, (2) significant environmental effects that cannot be avoided if the proposed project is implemented, (3) significant irreversible environmental changes that would result from implementation of the proposed project, and (4) growth-inducing impacts of the proposed project.

The Executive Summary and Chapter 7 of this EIR provide a comprehensive identification of the proposed project's environmental effects, including the level of significance both before and after proposed mitigation measures. In addition, Chapter 8 of this EIR provides a comprehensive analysis of growth-inducing effects.

Section 15130(a) of the CEQA Guidelines requires that an EIR contain an assessment of the cumulative impacts that could be associated with project implementation. This assessment is included in Section 10.1, Cumulative Environmental Impacts.

Section 15126.2(b) of the CEQA Guidelines requires that an EIR describe any significant impacts that cannot be avoided, even with the implementation of feasible mitigation measures. The effects of the proposed project on various aspects of the environment are discussed in detail in Section 10.2, Significant and Unavoidable Impacts.

Section 15126.2(c) of the CEQA Guidelines requires a discussion of any significant irreversible environmental changes that would be caused by the proposed project. This analysis is included in Section 10.3, Significant and Irreversible Environmental Impacts.

Although not required by CEQA, this chapter includes an analysis of the proposed project's potential impact on social and economic factors in Section 10.4, Environmental Justice.

10.1 CUMULATIVE ENVIRONMENTAL IMPACTS

10.1 CUMULATIVE ENVIRONMENTAL IMPACTS

10.1.1 INTRODUCTION

As defined in CEQA Guidelines Section 15355, a cumulative impact is an environmental impact that is created as a result of the combination of the project evaluated together with other projects causing related impacts. CEQA requires that an EIR discuss cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines Section 15130(a)). "Cumulatively considerable" means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past, current, and probable future projects (CEQA Guidelines Section 15065(a)(3)). If an incremental effect is not cumulatively considerable, then the lead agency does not need to consider that effect significant and must briefly describe the reason why (CEQA Guidelines Section 15130(a)).

CEQA Section 15130(b) states that the discussion of cumulative impacts need not provide as much detail as the discussion of the effects attributable to the project. The level of detail should be guided by what is practical and reasonable.

The following elements are necessary for an adequate discussion of significant cumulative impacts (CEQA Guidelines Section 15130(b)):

- A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency; or a summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area wide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.
- A defined geographic scope of the area affected by the cumulative effect and a reasonable explanation for the geographic limits identified.
- A summary of expected environmental effects that might be produced by those projects with specific reference to additional information stating where that information is available.
- A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

10.1.2 Method of Analysis

The cumulative impact analysis for the Monterey Plus EIR includes past, present and probable future water development projects that impact resources impacted by the proposed project which would occur in the southern San Joaquin Valley (including Kern County and the Kern Fan Element); SWP reservoirs including Castaic Lake, Lake Perris, San Luis Reservoir and Lake Oroville; the Sacramento and Feather rivers, the Sacramento-San Joaquin Delta and Plumas County.

San Joaquin Valley – Projects considered in the cumulative analysis include other groundwater storage projects including the Semitropic Stored Water Recovery Unit.

SWP Reservoirs – There are no projects that would change water levels in Castaic Lake. The Seismic Retrofit project at Lake Perris would reduce water levels over a period of up to 10 years. The San Luis Reservoir Low Point Improvement Project would change water levels in San Luis Reservoir.

Sacramento and Feather Rivers and Sacramento-San Joaquin Delta – Projects considered in the cumulative analysis include those which could affect water flows in the Sacramento and Feather rivers and the Sacramento-San Joaquin Delta.

Plumas County – Projects in Plumas County which could contribute to cumulative impacts include pond and plug projects and stream bank stabilization and channel form projects in the counties watersheds.

The criteria used to identify individual projects for consideration in this cumulative analysis included: (1) whether the project is under active consideration; (2) whether the project would be operational or contemplated within the timeframe of the proposed project; and (3) whether the project in combination with the proposed project would have the potential to affect the same resources. If a project met all of these criteria then it was considered reasonably foreseeable and was selected for inclusion in the cumulative impact analysis. Each of the projects that met the criteria as shown in Table 10.1-1 were then assessed to see if these projects, in combination with the proposed project could contribute to a cumulative impact. An assessment was also made to determine if the cumulative impact analysis would be quantitative or qualitative.

The qualitative analysis considers projects that are in the planning stage and are being discussed by various entities (such as various CALFED actions), projects that are not quantifiable using CALSIM simulations (see Table 5-1) or other modeling or analytical programs, but are projects that could have an effect on the same environmental resources as the proposed project. These cumulative projects are addressed qualitatively in order to disclose information about potential cumulative impacts. For resources including surface water hydrology, water quality, water supply, and fisheries, this qualitative analysis complements the discussion that is based on a quantitative analysis. All other resource topics that are not dependent on hydrology, water level, or water quality or that are not effectively evaluated using hydrologic modeling (visual, agricultural, air quality, geology, land use, hazards, noise, cultural, public services and utilities and transportation) are qualitatively assessed.

The following are summary descriptions of the projects considered in this cumulative analysis. Most of the descriptions are summarized based on descriptions provided in the June 2007 Proposed Lower Yuba River Accord Draft EIR/EIS. Table 5-3 in Chapter 5, Methods identifies which of these projects was included in the CALSIM II modeling assumptions for the proposed project.

Shasta Lake Enlargement Project

The CALFED ROD includes enlargement of Shasta Reservoir as an option to increase storage upstream of the Delta. One alternative to expand Shasta Reservoir is to raise the height of the dam by 6.5 feet, which would enlarge the reservoir by 290 TAF, and would inundate a small

TABLE 10.1-1

PROJECTS IDENTIFIED FOR CONSIDERATION IN DETERMINING WHETHER THEY MEET CRITERIA FOR BEING REASONABLY FORESEEABLE AND INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Line	Project	Criterion 1: Is the action under active consideration?	Criterion 2: Would the action be completed or operational within the timeframe being considered for the proposed project?	Criterion 3: Does the action, in combination with the proposed project alternatives, have the potential to affect the same resources?
CALFED Storage Program				
1	Shasta Lake Enlargement Project	√	√	√
2	North-of-the-Delta Off Stream Storage (Sites Reservoir)	√	√	√
3	In-Delta Storage Program (Delta Wetlands Project)	√	√	√
4	Los Vaqueros Reservoir Expansion Project	√	√	√
5	Upper San Joaquin River Storage Project	√	√	√
CALFED Conveyance Program				
6	South Delta Improvements Program (SDIP)	√	√	√
7	8,500 cfs at Banks	√	√	√
8	10,300 cfs at Banks Pumping Plant	No	No	No
9	Tracy Fish Test Facility	No	No	No
10	Lower San Joaquin Flood Improvements	No	No	No
11	Old River and Rock Slough Water Quality Improvement Project	√	√	√
12	Delta Cross Channel Re-operation and Through-Delta Facility	√	√	√
13	North Delta Flood Control and Ecosystem Restoration Project	√	√	√
14	Delta-Mendota Canal/California Aqueduct Intertie	√	√	√
15	Clifton Court Forebay-Tracy Pumping Plant Intertie	No	No	No
CALFED Drinking Water Quality Program				
16	South Bay Aqueduct Improvement and Enlargement Project	√	√	No
17	San Luis Reservoir Low Point Improvement Project	√	√	√
18	CALFED Ecosystem Restoration Program	√	√	√
19	Bay Delta Conservation Plan	No	No	No
20	CALFED Levees Program	√	√	No
21	Franks Track Improvements	√	No	No
22	West Side Drainage Plan	No	No	No
Other CVP/SWP-related Projects				
23	Freeport Regional Water Project	√	√	√
24	Trinity River Mainstream Fishery Restoration Program	√	√	√

TABLE 10.1-1

PROJECTS IDENTIFIED FOR CONSIDERATION IN DETERMINING WHETHER THEY MEET CRITERIA FOR BEING REASONABLY FORESEEABLE AND INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Line	Project	Criterion 1: Is the action under active consideration?	Criterion 2: Would the action be completed or operational within the timeframe being considered for the proposed project?	Criterion 3: Does the action, in combination with the proposed project alternatives, have the potential to affect the same resources?
25	Sacramento Valley Water Management Agreement (Phase 8)	√	√	√
Water Transfer and Acquisition Programs				
26	CALFED Environmental Water Account	√	√	√
27	CALFED Environmental Water Program	√	No	No
28	Delta Improvements Package	√	√	√
	Plumas Watershed Projects			
29	Pond and Plug Projects - Sulphur Creek - Last Chance Creek Phase II - Red Clover at Dotta	√	√	√
30	Stream Bank Stabilization and Channel Form Projects - Spanish Creek	√	√	√
Additional Projects				
31	Dry Year Water Purchase Program	√	√	√
32	Governor's Drought Risk Reduction Investment Program	√	No	No
33	CVPIA Water Acquisition Program	√	√	√
34	Contra Costa Water District Alternative Intake Project	√	√	√
35	Long-Term CVP and SWP Operations Criteria and Plan Reconsultation	√	√	√
36	CVP Long-Term Contract Renewals	√	√	√
37	CVP/SWP Integration Proposition	√	√	√
38	City of Stockton Delta Water Supply Project	√	√	√
39	Yuba River Development Project FERC Relicensing	√	No	√
40	San Joaquin River Restoration Settlement Act (Friant Settlement Legislation)	√	No	No
41	Isolated Delta Facility (Peripheral Canal)	√	No	√
42	South-of-Delta Water Banking: Madera Irrigation District Water Banking Project	√	√	√
43	South-of Delta-Water Banking: Semitropic Water Storage District –Expansion of Groundwater Banking Facilities	√	√	√

TABLE 10.1-1

PROJECTS IDENTIFIED FOR CONSIDERATION IN DETERMINING WHETHER THEY MEET CRITERIA FOR BEING REASONABLY FORESEEABLE AND INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Line	Project	Criterion 1: Is the action under active consideration?	Criterion 2: Would the action be completed or operational within the timeframe being considered for the proposed project?	Criterion 3: Does the action, in combination with the proposed project alternatives, have the potential to affect the same resources?
44	Contra Costa Canal Encasement Project (CEQA)/ Contra Costa Canal Replacement Project (NEPA)	√	√	No
45	San Joaquin Valley Drainage Project	√	√	No
46	Folsom Dam Safety and Flood Damage Reduction Project	√	√	No
47	Sacramento River Water Reliability Study	√	√	√
48	CVP M&I Water Shortage Policy	√	√	No
49	Folsom Dam Raise Project	√	√	√
50	Suisun Marsh Levee and Habitat Restoration Program	√	√	√
51	San Joaquin River Recirculation Feasibility Study	√	No	No
52	East Branch Enlargement	√	√	√
52	Lake Perris Seismic Retrofit Project	√	√	√

Notes:
The decision-making criteria used to determine whether a project should be addressed in the cumulative impact analysis for the Administrative Draft EIR (ADEIR) are listed in columns 2, 3 and 4 above. Projects determined to meet all three of these criteria are included in the more detailed cumulative analysis, which will be discussed in the resource-specific chapters of the ADEIR. For each of the three criteria listed above, a checkmark (√) is used to denote a "yes" decision. Unless otherwise noted above, projects that do not meet all three of the criteria will not be included in the more detailed cumulative analysis discussed in this chapter.

portion of McCloud River that is protected under the California Wild and Scenic Rivers Act, as well as portions of the Pit River and Upper Sacramento River. Other alternatives include modifications to the dam and reservoir reoperations. This project is currently in the planning stages, with an Initial Alternatives Information Report prepared in 2004.

The Shasta Enlargement Project could contribute to cumulative effects on water supplies and associated resources. The project could increase water supplies available for export in those years when Shasta Reservoir otherwise would have spilled. Additionally, this project could modify the timing and magnitude of upstream reservoir releases in wet years. An environmental document for this project has not been issued yet, but is anticipated to be released in 2008.

Sites Reservoir

The CALFED agencies are currently studying several off-stream storage locations including Sites Reservoir, which would be located 70 miles northwest of Sacramento, as possible options for additional storage. With a potential maximum capacity of 1.8 MAF, Sites Reservoir could increase the reliability of water supplies for a large portion of the Sacramento Valley and could improve fish migration by reducing water diversions on the Sacramento River. If this project were implemented, one of its operational benefits would be its ability to store water from high winter flows and release the stored water during the summer months, which could be used to manage salinity and water quality conditions in the Delta.

The Sites Reservoir Project could contribute to cumulative effects on water supplies and associated resources. The project could increase water supplies available for export in those years when export supplies otherwise would be limited. This project also could modify the timing and magnitude of upstream reservoir releases in wet years. An NOP/NOI for this project was issued in November 2001 and public scoping for the environmental document occurred in January 2002. The environmental document and engineering feasibility study for this project are in progress, and are scheduled for completion near the end of 2008.

Delta Wetlands Project

The CALFED Agencies have researched various options for storing water in the Delta. In-Delta storage would increase the reliability, operational flexibility, and water availability for south-of-Delta water users. An in-Delta storage facility could capture peak flows through the Delta during the winter when the CVP and SWP systems do not have the capacity or ability to capture these flows. Water could then be released from the in-Delta reservoirs during periods of export demands, typically during the summer months. Storing additional water in the Delta would provide an opportunity to change the timing of Delta exports and the ability to capture flows during periods when there would be reduced impacts to fish. One option is to lease or purchase the Delta Wetlands Project, a private water development project that would store up to 217 TAF on two islands in the Delta and dedicate two other islands for habitat improvements. As part of the Delta Wetlands Project, Webb Tract and Bacon Island would be converted to reservoirs, and Bouldin Island and Holland Tract would be used as wetland and wildlife habitat. The Delta Wetlands Project was previously analyzed in environmental documents, and permits were issued for the private project in 2001.

In 2006, the Department released a supplemental report to its 2004 In-Delta Storage Draft State Feasibility Report. The 2006 supplemental report identifies other events (e.g., pelagic organism decline, increased focus on seismic instability and global climate change) occurring in the Delta that will affect water project operations. Decisions required to implement this type of in-Delta project are not expected to be made until after 2008.

Los Vaqueros Reservoir Expansion Project

Reclamation, the Department and the Contra Costa WD are conducting a feasibility study examining alternatives to improve water quality and water supply reliability for Bay Area water users while enhancing the Delta environment, which will include expanding the existing Los Vaqueros Reservoir, as well as a variety of other alternatives. Current work has focused on planning level evaluations of expanding reservoir storage from 100 TAF up to 275 TAF to improve water quality and water supply reliability. An expanded reservoir would require a new or expanded Delta intake, with a capacity of up to about 1,000 cfs for the maximum reservoir size. Locations being considered for the new Delta intake include Old River and adjacent channels. The purposes of the Los Vaqueros Reservoir expansion include increased reliability, water quality, and environmental water supply. A connection to Bethany Reservoir is also currently under study.

The Los Vaqueros Reservoir Expansion Project is in the early planning stage. An Initial Alternatives Information Report was released in 2005 and more recently, a NOI/NOP to prepare an EIS/EIR was released in 2006.

Upper San Joaquin River Storage Project

As part of the Upper San Joaquin River Basin Storage Investigation, Reclamation, the Department and their partners are evaluating the potential for increasing surface water storage in the upper San Joaquin River watershed. Additional storage opportunities ranging from between 250 to 700 TAF could be provided by raising Friant Dam to expand Millerton Lake, or alternate storage options potentially could serve as an equivalent storage program to Friant Dam Enlargement. Depending on its operation, an expanded facility could provide additional reservoir storage capacity for improved flood control and an additional source of water available to help restore and improve aquatic habitats and water quality in the San Joaquin River and the Delta.

The investigation is being undertaken through a two-phased plan of study. Phase 1 is designed to identify water resource opportunities and issues in the Upper San Joaquin River watershed, and includes an appraisal of opportunities to increase surface storage and conjunctive use of groundwater. Phase 2 is designed to provide more detailed analysis and would begin with public meetings to determine the scope of the study. Reclamation and the Department are in the process of preparing a Plan Formulation Report for the Upper San Joaquin River Basin Storage Investigation. Concurrent with this effort, surveys for the environmental document and permit applications also are being performed in the study area. The environmental document and engineering feasibility study for this project are in progress, and are scheduled for completion in 2009.

South Delta Improvement Program (SDIP)

The CALFED ROD identifies the SDIP as an action included in its Programmatic EIS/EIR to address regional and local water supply needs, as well as the needs of the aquatic environment. The SDIP is a project that is proposed by Reclamation and the Department, and includes a series of proposed actions designed to improve water quality and protect salmon in the south Delta while allowing the SWP to operate more effectively. These proposed actions are intended to maximize diversion capability into Clifton Court Forebay, while providing an adequate water supply for the SDWA and reducing the effects of SWP exports on aquatic resources. The SDIP includes physical/structural improvements as well as operational changes that, together, represent a balanced approach to meeting California's water needs.

The major components of the SDIP include:

- Increasing the maximum allowable diversion capacity at the SWP Clifton Court Forebay;
- Dredging a portion of Old River to improve conveyance capacity;
- Constructing permanent operable barriers to improve water supply reliability and water quality;
- Dredging local channels to reduce the frequency of barrier operations and to accommodate improvements to existing agriculture; and
- Constructing a permanent operable fish control structure at the head of Old River to improve conditions for salmon migrating up and down the San Joaquin River.

CALFED agencies determined that the objectives outlined in the PEIS/EIR could not be met without some of these South Delta improvements.

Reclamation and the Department currently are pursuing the development of environmental compliance documentation for the SDIP, including a joint EIS/EIR and an ASIP. Following completion of the environmental document and regulatory compliance processes, Reclamation and the Department have identified a two-stage decision-making process for the SDIP project. Stage 1 is designed to address the physical/structural improvements, including the new operable gates, dredging and agricultural modifications. At the end of Stage 1, it is anticipated that a decision document (ROD/NOD) would be issued for the physical/structural component of the project. After the Stage 1 decision, it is anticipated that Stage 2 would address the proposed operational component to increase water deliveries south of the Delta, and most likely would involve preparation of supplemental environmental documentation.

8,500 cfs at Banks Pumping Plant

The operational component of the SDIP is designed to optimize the use of the Delta to convey CVP and SWP export water by modifying operations to increase pumping at the SWP Banks Pumping Plant at the head of the California Aqueduct. At this time, authorized pumping is limited to 6,680 cfs. Operational changes proposed by the Department as part of the SDIP would: (1) increase the maximum diversion limit of 6,680 cfs to 8,500 cfs from March 15 to December 15; and (2) modify existing pumping criteria from December 15 to March 15 to allow greater use of SWP export capacity to provide more water for communities, businesses and agricultural users south of the Delta when it is environmentally sound to do so.

The proposed increase in export capacity to 8,500 cfs would allow more water to be moved through the Delta by all acquisition programs during the summer months. Because purchases in the CVP/SWP Upstream of the Delta Region are less expensive per acre-foot than purchases in the Export Service Area, water programs could purchase more water with a fixed amount of money in the CVP/SWP Upstream of the Delta Region.

Rock Slough and Old River Water Quality Improvement Project

Contra Costa WD has completed two important Delta water quality improvement projects that will improve water quality for Contra Costa WD's customers and help the Department manage water resources in the Delta. The projects, known as the CALFED Rock Slough and Old River Water Quality Improvement Projects, each improve water quality for Contra Costa WD's 500,000 customers by re-locating local sources of agricultural drainage that are near Contra Costa WD's water supply intakes. The projects were funded by the California Department of Water Resources (Department) as part of a series of water quality improvement projects being undertaken in the CALFED Bay-Delta Program.

The project in Rock Slough has relocated an agricultural drainage discharge from Veale Tract that historically drained into Rock Slough, one of Contra Costa WD's major sources of water from the Delta. Drainage from Veale Tract is now discharged outside of Rock Slough, where strong currents quickly dilute the drainage without re-directing impacts. Agricultural drainage can contain elevated concentrations of salt and nutrients and is a concern when drains are located near drinking water intakes with little dilution. This project also helps federal and state agencies meet an important water quality standard and allows these agencies to provide better and more efficient operations in the Delta.

A similar project was also completed near the Contra Costa WD's Old River Pump Station, Contra Costa WD's other major source of supply. This project modified an agricultural drain discharge from Byron Tract by lengthening the outfall into Old River to eliminate possible impacts to the Contra Costa WD's source water quality. Previously, the outfall extended only to the immediate bank of the river, where channel velocities are slow and dilution of the discharge was minimal. Now, the discharge extends 150 feet into the middle of Old River, where much higher channel velocities quickly dilute the drainage ensuring no impacts to any other water users or to the Delta ecosystem. Part of the project was completed through a partnership with the Town of Discovery Bay, which also completed a new outfall system for the Town's wastewater discharge. A related but separate phase of this second project, now in the planning stage, would further improve Delta water quality for all Delta users by removing sediments and trace levels of substances such as heavy metals, herbicides, and pesticides from the Kellogg Creek watershed prior to discharge into Old River.

Delta Cross Channel Re-operation and Through-Delta Facility

As part of the CALFED ROD, changes in the operation of the Delta Cross Channel and the potential for a Through-Delta Facility (TDF) are being evaluated. Studies are being conducted to determine how changing the operations of the Delta Cross Canal could benefit fish and water quality. This evaluation will help determine whether a screened through-Delta facility is needed to improve fisheries and avoid water quality disruptions. In conjunction with the Delta Cross Canal operations studies, feasibility studies are being conducted to determine the effectiveness of a TDF. The TDF would include a screened diversion on the Sacramento River of up to 4,000 cfs and conveyance of that water into the Delta.

Both a Delta Cross Canal reoperation and a TDF would change the flow patterns and water quality in the Delta, affecting water quality, fisheries, ecosystems, and water supply reliability. Further consideration of related actions would take place only after completion of several assessments, which are currently in progress.

North Delta Flood Control and Ecosystem Restoration Project

The CALFED ROD identifies the North Delta Flood Control and Ecosystem Restoration Project, which is proposed by Reclamation and the Department, as an implementation action that would provide conveyance, flood control and ecosystem benefits through construction of floodway improvements in the North Delta (such as on the lower Mokelumne River and Georgiana Slough). Potential flood control components being considered include bridge replacement, setback levees, dredging, island bypass systems and island detention systems. The Department and the Corps are conducting a feasibility study to examine potential flood control system improvements that would provide benefits to aquatic and terrestrial habitats and alleviate flood-related problems in the North Delta. In support of the environmental review process, an NOP/NOI was prepared and public scoping was held in 2003. Modeling studies are under preparation, and construction preliminarily scheduled to begin in 2008.

Delta-Mendota Canal/California Aqueduct Intertie

Reclamation is evaluating the potential for the CVP/SWP Intertie, which would consist of the construction and operation of a pumping plant and pipeline connections between the Delta-Mendota Canal and the California Aqueduct. The CVP/SWP Intertie would be used in a number of ways to achieve multiple benefits, including: (1) meeting current water supply demands; (2) allowing for the maintenance and repair of the CVP Delta export and conveyance facilities; and (3) providing operational flexibility to respond to emergencies related to both the CVP and the SWP.

Currently, the average daily pumping capacity at the Jones Pumping Plant is limited to a maximum of 4,600 cfs, which is the existing capacity of the upper Delta-Mendota Canal and its intake channel. However, because of conveyance limitation in the lower Delta-Mendota Canal and other factors, pumping at the Jones Pumping Plant is almost always less than 4,600 cfs. Delta-Mendota Canal conveyance capacity is affected by: (1) subsidence; (2) canal siltation and deposition; (3) the amount, timing, and location of water deliveries from the Delta-Mendota Canal; (4) facility design; and (5) other factors. By connecting the upper Delta-Mendota Canal with the California Aqueduct, the CVP/SWP Intertie would allow year-round CVP Jones pumping up to 4,600 cfs, subject to all applicable export pumping restrictions for water quality and fisheries protections. CVP Jones capacity would remain limited to its existing authorized pumping capacity of 4,600 cfs. This project was included in Reclamation's OCAP and a Draft EIS is expected to be available in fall 2007.

San Luis Reservoir Low Point Improvement Project

Reclamation and Santa Clara Valley WD are pursuing an evaluation of the San Luis Reservoir Low Point Improvement Project, which would use one, or a combination of alternatives, including treatment options, bypasses, and other storage options to reduce the risk of "low point" water levels. When water levels in San Luis Reservoir are low, high water temperatures combined with wind induced mixing result in algal blooms at the reservoir's water surface. This condition degrades water quality, making it difficult or impractical to treat the water, and can prevent deliveries from San Luis Reservoir. To solve the low point problem, Reclamation and the Department have operated the reservoir to maintain water levels above the critical low elevation, or low point, requiring approximately 200 TAF of water to remain as "carry-over" in the reservoir.

Given likely growth in future water demands, and additional regulatory requirements, it is anticipated that storage in San Luis Reservoir would be more fully exercised and result in more frequent and lower late-summer storage levels in the reservoir. Alternatives being considered to address water quality issues related to the low point problem and to increase the effective storage capacity in the reservoir include but are not limited to: (1) a bypass to the San Felipe Unit around San Luis Reservoir; (2) treatment options such as dissolved air flotation; (3) algae harvesting or application of algaecides; (4) lowering the San Felipe Division intake facilities; and (5) expansion of Pacheco Reservoir.

An NOI/NOP to prepare an EIS/EIR was released in 2002, and an Appraisal Report for the Low Point Improvement Project was issued in 2006. The Appraisal Report recommends that a federal feasibility study be initiated to further study potential measures for resolving these water-related issues and, thus, the project is currently in the planning stages.

CALFED Ecosystem Restoration Program

The goals of the CALFED Ecosystem Restoration Program (ERP) are to:

- Facilitate the recovery of 19 at-risk native species and contribute to the recovery of 25 additional species;
- Rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water quality;
- Maintain and enhance fish populations critical to commercial, sport and recreational fisheries; Protect and restore functional habitats, including aquatic, upland and riparian, to allow species to thrive;
- Reduce the negative impacts of invasive species and prevent additional introductions that compete with and destroy native species; and
- Improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The ERP Plan, which is divided into the Sacramento, San Joaquin, and Delta and Eastside Tributary regions, includes the following kinds of actions:

- Develop and implement habitat management and restoration actions, including restoration of river corridors and floodplains, reconstruction of channel-floodplain interactions, and restoration of Delta aquatic habitats;
- Restore habitat that would specifically benefit one or more at-risk species;
- Implement fish passage programs and conduct passage studies;
- Continue major fish screen projects and conduct studies to improve knowledge of their effects;
- Restore geomorphic processes in stream and riparian corridors;
- Implement actions to improve understanding of at-risk species;
- Develop understanding and technologies to reduce the impacts of irrigation drainage on the San Joaquin River and reduce transport of contaminant (selenium) loads carried by the San Joaquin River to the Delta and the San Francisco Bay; and
- Implement actions to prevent, control, and reduce impacts from nonnative invasive species.

ERP actions will contribute to cumulative benefits on fish and wildlife species, habitats, and ecological processes.

Freeport Regional Water Project

The East Bay Municipal Utilities District (EBMUD) has entered into a partnership with the Solano County WA to design and build a regional water supply project that would assure water for East Bay customers in dry years and needed water for the Sacramento region. EBMUD's Mokelumne River water supply is adequate to meet the water supply needs of the district's 1.3 million customers in normal and wet years, but in prolonged droughts, customers face severe rationing. Through the project, EBMUD customers' drought year cutbacks would be reduced.

In 2002, EBMUD and the County of Sacramento (in association with the City of Sacramento and with support from Reclamation) formed the project, which is responsible for the joint effort to draw water from the Sacramento River near the town of Freeport. The Draft EIR was published in 2003 and the Final EIR was published and certified in 2004. Reclamation issued the ROD in January 2005.

The following elements were approved under the 2004 EIR and subsequently refined through supplemental CEQA documents in 2006:

- A new 185 mgd water intake structure and pump station on the Sacramento River near Freeport;
- A new large diameter pipeline to transport water eastward to the new Solano County WA WTP and the existing Folsom South Canal to supply EBMUD customers;
- A new WTP in central Sacramento County, owned and operated by Solano County WA, which would provide treated surface water supplies to the Sacramento area; and
- A new pumping facility and large diameter pipeline would treat and transport water from the southern end of the Folsom South Canal to EBMUD's Mokelumne Aqueduct for use by EBMUD customers.

This program is included in the 2004 OCAP consultation.

Trinity River Mainstream Fishery Restoration Program

The purpose of this program is to alleviate impacts to fish due to deliveries of CVP water from the Trinity River. The Draft EIS for the Trinity River Mainstream Fishery Restoration Program was issued in October 1999, the Final EIS was issued in November 2000, and the ROD was signed in December 2000. Westlands WD filed suit against the Interior to enjoin it from implementing the ROD, which would increase the flow of water to the Trinity River, resulting in less water being imported from the Trinity River at Lewiston Dam to the Central Valley. Under the ROD, Interior would boost water flows on the lower Trinity to an average of 595 TAF annually, compared to the roughly 340 TAF previously retained in the river. Implementation of ROD was delayed due to litigation and completion of a Supplemental EIS (SEIS). A Draft SEIS was published in April 2004, however work on the SEIS was suspended pending resolution of court proceedings. In November 2004, the U.S. Court of Appeals denied the petitions for rehearing filed by Westlands WD and the Northern California Power Agency. The SEIS will not be completed and the ROD is now being implemented. This program is included in the 2004 OCAP consultation.

Sacramento Valley Water Management Agreement (Phase 8)

The short-term phase of the Sacramento Valley Water Management Program (SVWMP) resolves water quality and water rights issues arising from the need to meet the flow-related water quality objectives of the 1995 Bay-Delta WQCP and the SWRCB's Phase 8 Water Rights Hearing process. In addition, the Short-Term Program would promote better water management in the Sacramento Valley and develop additional water supplies through a cooperative water management partnership. Program participants include Reclamation, Department, Northern California Water Association, San Luis & Delta-Mendota Water Authority, some Sacramento Valley water users, and CVP and SWP contractors. Short-Term Program actions would be locally proposed projects and actions that include the development of groundwater to substitute for surface water supplies, conjunctive use of groundwater and surface water, refurbishing existing groundwater extraction wells, installing groundwater monitoring stations, installing new groundwater extraction wells, reservoir reoperation, system improvements such as canal lining, tailwater recovery, and improved operations, and surface and groundwater planning studies. These short-term projects and actions would be implemented for a period of 10 years in areas of Shasta, Butte, Sutter, Glenn, Tehama, Colusa, Sacramento, Placer, and Yolo counties. The NOI/NOP was published on August 5, 2003.

CALFED Environmental Water Account

The EWA Program is a "cooperative management program whose purpose is to provide protection to the fish of the Bay-Delta Estuary through environmentally beneficial changes in the operations of the CVP and the SWP, at no uncompensated water cost to the CVP/SWP Projects' water users. The EWA is intended to provide sufficient water, combined with the Ecosystem Restoration Program and the regulatory baseline, to address CALFED's fishery protection, and restoration/recovery needs." As reported in the 2005 EWA Acquisition Strategy Report, EWA assets also have been used in limited ways to provide fish benefits upstream of the Delta during some years. The EWA Program's approach to fish protection requires the acquisition of alternative sources of CVP/SWP water supply, called "assets," which are used to augment stream flows and Delta outflows, to modify exports to provide fishery benefits, and to repay the CVP/SWP contractors whose supplies have been interrupted by actions taken to benefit fish (70 FR 8605). The EWA Program was initially designed as a short-term program, and its continued use as a long-term management tool is being considered by the EWA Agencies.

The existing EWA Program will sunset on December 31, 2007. Currently, the Department and Reclamation plan to temporarily extend the existing EWA Program, and they are in the process of developing supplemental environmental documentation for this extension of the program that is anticipated to be released by the end of the year. While it is uncertain at this time whether a long-term EWA Program or a program equivalent to the EWA will be implemented in the future, or what the elements of such a program will be, the best assumption that can be made at this time is that an equivalent program would continue, with conditions similar to those for the existing EWA Program.

Delta Improvements Package

The Delta Improvements Package outlines actions related to water project operations in the Delta that would result in increased water supply reliability, improved water quality, environmental protection and ecosystem restoration, protection of the Delta Levee system, and analyses and evaluation to support improved real-time and long-term management.

The Delta Improvements Package also outlines conditions under which the SWP would be allowed to increase its permitted export pumping capacity from 6,680 cfs to 8,500 cfs. In addition to the commitments in the CALFED ROD to avoid adverse fishery impacts and to protect in-Delta water supply reliability, these conditions include:

- Construction of permanent operable barriers in the South Delta;
- Development of a salinity management plan for the San Joaquin River;
- Improvements to protect water quality near the Contra Costa Canal;
- Environmental protection for important native fish species, including implementation of the Ecosystem Restoration Program; and
- Development of a long-term EWA (or a program equivalent to the EWA).

Plumas Watershed Projects

Pond and Plug Projects

The pond and plug technique removes material from the gully forming the pond and that removed material is used to form the plug, therefore the gully is filled with alternating ponds and plugs; the stream is then put into existing remnant channels or constructed channels on the historic floodplain. This method reduces erosive forces, raises the meadow water table, and restores function to the stream and meadow complex.

Sulphur Creek - There are six similar projects of various scale on Sulphur Creek to be done using a phased approach. Sulphur Creek is a deeply entrenched channel with an extremely high sediment load which causes increased bank erosion and meadow dewatering. The intent of this restoration project is to arrest the sediment load moving down the Sulphur Creek channel, obliterate the gully and reconnect the stream with its historic floodplain.

Last Chance Creek Phase II - Last Chance Creek is an incised channel in a stream and meadow complex. This stream is experiencing bank erosion and meadow dewatering. The intent of this restoration project is to obliterate the gully, raise the meadow water table and reconnect the stream with its historic floodplain.

Red Clover at Dotta - Red Clover Creek is an incised channel in a stream and meadow complex. This stream is experiencing bank erosion and meadow dewatering. The project intent is gully obliteration and to restore meadow function which will help to maintain stream base flow.

Stream Bank Stabilization and Channel Form Projects

A variety of treatment techniques are used to stabilize stream channels in incised systems. Rock vanes are used on stream meander bends to force flows away from banks. Channel constrictions using large woody debris and rock in the sections of streams between meander bends and directs flows toward the center of the channel transporting sediment. Gravel bars which can increase erosional forces are contoured to create a floodplain in the gully dissipating stream energy and vertical banks are laid back to increase channel capacity and stability. These techniques are used in concert with vegetation and biotechnical erosion controls to further strengthen banks.

Spanish Creek - There are thirteen projects in the Spanish Creek watershed that will use these stream bank stabilization and channel form techniques. These projects are of various size and scale and are to reduce bank erosion, increase sediment transport, and halt channel migration through Meadow and American valleys.

Dry Year Water Purchase Program

In mid-January 2001, several CVP and SWP contractors requested that Reclamation and the Department initiate planning for a dry year water acquisition program, based on the dry year hydrology to date. The Department announced the 2001 Dry Year Water Purchase Program (Dry Year Program) in March 2001. This program was the first dry year acquisition program by the Department since the 1991, 1992, and 1994 Drought Bank programs. The Dry Year Program was implemented again in 2002 through 2004, and may be activated in the future to help public agencies throughout California supplement their water supplies in dry years.

The program intends to reduce the possibility of any hardship associated with water shortages through the facilitation of water transfers, and it is open to CVP contractors, SWP contractors, and third party users. In 2001, the Department provided 138.8 TAF of water from willing sellers in Northern California to eight SWP contractors. In 2002, the Department secured 22 TAF of water from willing sellers in Northern California and provided it to four water agencies throughout the state. In 2003 and 2004, the Department purchased very little water under the program.

Transfers negotiated between CVP and SWP contractors and other water users, such as the 2001 CVP Forbearance Agreement with Westlands WD and the 2003 crop idling acquisition by MWD from water agencies upstream of the Delta as part of its Colorado River Contingency Plan, are parts of the Dry Year Program. The mandatory reduction in California's use of Colorado River5 water could increase demand for water upstream of the Delta, and increase acquisitions under the Dry Year Program.

CVPIA Water Acquisition Program

Section 3402 of the CVPIA identifies the purposes of the CVPIA as protection, restoration, and enhancement of fish, wildlife, and associated habitats in the Central Valley. The CVPIA provides for the acquisition of water for protecting, restoring, and enhancing fish and wildlife populations. To meet water acquisition needs under the CVPIA, the Interior has developed a joint Reclamation and USFWS Water Acquisition Program.

The CVPIA requires the provision of firm water supplies to specified National Wildlife Refuges, State Wildlife Areas, and private wetlands in the Grassland Resource Conservation District for the purpose of optimum habitat management on the refuge lands3. CVPIA Section 3406(d)(1) requires that the Secretary of the Interior immediately provide specific quantities of water to the refuges and indicates that long-term contractual agreements should be developed for water provided. These are referred to as "Level 2" supplies, for which Reclamation and Interior entered into long-term water supply agreements/contracts with USFWS and CDFG. The CVPIA requires full delivery of this water in all year types except critically dry water years, as determined by Reclamation for allocation of CVP water. In the case of a critically dry water year, the Secretary of the Interior may reduce Level 2 refuge water supplies by up to 25 percent.

Section 3406(d)(2) of the CVPIA refers to “Level 4” refuge water supplies, which are the supplies required for optimum habitat management of the existing refuge lands identified in the “1989 Report on Refuge Water Supply Investigations.” The CVP must acquire the increment of water between Level 2 and Level 4 supplies from willing sellers. Section 3406(d)(2) requires that, upon enactment of the CVPIA, Level 4 water be provided in 10 percent cumulative increments per year with provision of full Level 4 supplies after 10 years. Reclamation has been acquiring Level 4 water on a short-term basis from willing sellers since 1993. Meeting Level 4 requirements requires the annual acquisition of an additional 133,264 AF above Level 2 water supplies.

Refuge water acquisitions are primarily from CVP contractors, and delivery is typically taken at O’Neill Forebay for delivery to the refuges in the San Joaquin Valley. In recent years, acquired water to meet Level 4 needs has averaged between 70 TAF to 80 TAF. Coordination among the CVPIA Water Acquisition Program, the EWP, and EWA requires Reclamation, USFWS, and other CALFED agencies to determine how to address individual program goals while pursuing joint acquisitions.

Contra Costa Water District Alternative Intake Project

The Alternative Intake Project is a drinking water quality improvement project proposed for implementation by the Contra Costa WD and Reclamation. For extended periods each year, Delta water quality at Contra Costa WD’s exiting intakes does not meet Contra Costa WD adopted water quality objectives, thus requiring Contra Costa WD to use higher quality water stored in Los Vaqueros Reservoir to blend with the diverted Delta water. To ensure that state and federal regulatory requirements for drinking water and the water quality objectives can be met now and in the future, Contra Costa WD is proposing to relocate some of its existing diversions to Victoria Canal, a location in the Delta that has higher quality source water than that which is currently available at Contra Costa WD’s Old River and Rock Slough intakes, to improve the quality of both its source and delivered water. Although the new intake would change the location, timing and quality of some of Contra Costa WD’s diversions, Contra Costa WD is not seeking to increase its water rights, CVP contract amounts, or permitted Los Vaqueros Reservoir filling rates. A Draft EIR/EIS was released in May 2006; the Final EIR/EIS was released in October 2006.

Long-Term CVP and SWP Operations Criteria and Plan Reconsultation

The Long-term OCAP serves as the operational standard by which Reclamation operates the integrated CVP/SWP system. The OCAP describes how Reclamation and the Department operate the CVP and the SWP to divert, store, and convey water consistent with applicable law. Reclamation and the Department completed an update to the OCAP in 2004 to reflect recent operational and environmental changes occurring throughout the CVP/SWP system. Additionally, Reclamation received BOs from the USFWS and NMFS in 2004 and 2005. The terms and conditions specified in the USFWS and NMFS BOs establish the instream habitat conditions and operational requirements that Reclamation and Department must maintain as part of integrated CVP/SWP operations. For these reasons, the OCAP provides the basis for the hydrologic modeling assumptions and the comparative analytical simulations that were performed as part of the hydrologic assessment of effects on resources in this EIR/EIS. The 2004 OCAP included specific projects such as the CVP/SWP Intertie, the Freeport Regional Water Project, and the Trinity River Mainstream Fishery Restoration Program, as described herein.

Due to numerous changed circumstances since the 2004/2005 OCAP consultation, Reclamation has requested re-initiation of Section 7 ESA consultation on OCAP with both NMFS and USFWS. In a letter to NMFS dated April 2006, and clarified in May 2006, Reclamation requested initiation of early and formal consultation on the effects of long-term CVP and SWP operations on all federally listed species and critical habitat which may be affected by those operations, to include the newly designated critical habitat for Central Valley steelhead, Central Valley spring-run Chinook salmon, and Central Coast steelhead. Reclamation also requested initiation of conferencing on the effects of the OCAP on the federally threatened southern DPS of North American green sturgeon, which would convert into a formal and early consultation following the effective date of the final rule designating its status (i.e., July 2006). In addition, in a letter dated July 2006, Reclamation also requested re-initiation of formal consultation on the OCAP from the USFWS. The major reason for this re-initiation was changed circumstances regarding delta smelt populations, particularly related to new and constantly emerging information stemming from the POD study effort in the Delta. At this time, a date for the completion of these consultations is unknown.

CVP Long-Term Contract Renewals

There are approximately 250 long-term water service contracts that are dependent upon CVP operations to receive water for agricultural, or M&I uses. Most of these contracts extend for a term of 40 years, and were scheduled to expire in 2004 or subsequent dates prior to 2029. Water needs assessments were performed for each CVP water contractor eligible to participate in the CVP long-term contract renewal process. The water needs assessments confirmed a contractor's past beneficial use and determined future CVP water supplies needed to meet the contractor's anticipated future demands. These assessments were based on a common methodology used to determine the amount of CVP water required to balance a contractor's water demands with available surface and groundwater supplies. In 2005 and 2006, Reclamation issued decisions (ROD and a Finding of No Significant Impact [FONSI]) for renewing contracts of the Sacramento River Division, the Sacramento River Settlement Contracts, the Delta-Mendota Canal Division, the Friant Division and several individual contracts. Preparation of environmental documents for other divisions and contracts are ongoing, and are expected to be completed following Reclamation's ESA reconsultation on the 2004 OCAP BA.

CVP/SWP Integration Proposition

Reclamation, the Department, and SWP contractors have proposed increasing the integration of CVP and SWP operations by maximizing the existing and proposed SWP conveyance capacity (including the implementation of the SDIP) of both CVP and SWP supplies. Under the proposal, the state would have the primary responsibility for delivering water to federal wildlife refuges, which would allow for increased supply flexibility, particularly south of the Delta. The CVP would be increasingly responsible for maintaining Delta water quality, and CVP facilities would be used to store additional water in Northern California for SWP customers. The proposal is also structured to allow for supporting the continued implementation of the EWA Program or a program equivalent to the EWA.

City of Stockton Delta Water Supply Project

The Delta Water Supply Project (DWSP) would involve development of a new supplemental water supply for the City of Stockton by diverting water from the San Joaquin River, treating the Delta water at a new water treatment plant, and distributing the treated water for municipal and industrial uses. The DWSP would consist of a surface water diversion/intake facility, a new raw water conveyance pipeline, a new water treatment facility, and treated water transmission pipelines to deliver water to the City's existing water distribution system. The project also would include a groundwater recharge component. Treated surface water would be injected into the groundwater aquifer for storage until it is needed, and then would be pumped or "recovered" from the groundwater aquifer for use.

The Final EIR was completed in 2005. Construction is anticipated to begin in 2008, and the first phase (including the water treatment plant) of the project is scheduled for completion by 2010.

Madera Irrigation District Water Banking Project

The Madera Irrigation District (MID) is in the process of developing the Madera Water Supply and Groundwater Enhancement Project in an effort to help reduce drought impacts in the San Joaquin Valley. MID has purchased a 13,648-acre ranch, which would be used for the project. Under this proposed project, pumping facilities would convey MID water to the ranch, where the water would be allowed to percolate and form a 'water bank' beneath the ranch. Banked water could be pumped and used locally when supply is low, providing a key regional water supply benefit. The project would help MID in its efforts to conserve and more efficiently use its local and CVP water supplies.

Reclamation published a Draft EA/FONSI for the Pilot Recharge and Recovery Project at Madera Ranch in February 2007. The proposed action consists of the pilot recharge and recovery of up to 11 TAF per year of Madera's Friant Division CVP water between February 2007 and April 2009. The recharged water would eventually be recovered by pumping groundwater using existing wells within district boundaries (Madera Ranch property overlies the recovery area). Approval of these actions would allow Madera to use its 2006-2009 Friant Division allocations to collect data on recharge rates and groundwater hydrology in the area, thereby supplementing evaluations made about the suitability of the area for future recharge and banking operations.

Semitropic Water Storage District – Expansion of Groundwater Banking Facilities

Semitropic Water Storage District (SWSD) has obtained the necessary permits to initiate construction of a second phase of its groundwater banking program. The new facility, called the Stored Water Recovery Unit, is designed to increase the storage capacity of the groundwater banking project by 650 TAF to a maximum of 1.65 MAF, and would increase recovery capacity by 200 TAF per year, for a total guaranteed or pumpback capacity of 290 TAF per year (SWSD Website 2004). Including its entitlement exchange capability of up to 133 TAF per year, the SWSD Water Storage Bank would be able to deliver up to 423 TAF per year of dry year yield to the California Aqueduct.

Through a separate action, Reclamation has analyzed and proposes to approve a water transfer, groundwater banking and exchange project that would provide up to 15 TAF of water per year to the SWSD on behalf of Westlands WD. The exchange could occur in one of three ways: (1) Westlands WD would exchange the requested amount of banked water for an equal amount of SWSD's allocation of SWP Table A water; (2) Westlands WD would exchange the requested amount of banked water for an equal amount of CVP water; or (3) SWSD would pump groundwater stored on behalf of Westlands WD into the California Aqueduct. The return of the water (up to 15 TAF) stored and credited within SWSD bank would be returned to

Westlands WD via exchange within the next 10 years, subject to applicable CVP contractual requirements.

Additional opportunities for new water banking partners to share in the benefits of the Stored Water Recovery Unit are available. Future partners could include existing banking partners, public agencies, and the EWA Program.

Sacramento River Water Reliability Study

The purpose of the SRWRS is to develop a water supply plan that is consistent with the Water Forum objectives of pursuing a Sacramento River diversion to meet the water supply needs of the Placer-Sacramento region and to promote ecosystem preservation along the lower American River. Reclamation is preparing the SRWRS with the cost-sharing partners: Placer County Water Agency (PCWA), City of Sacramento, City of Roseville, and Sacramento Suburban Water District (SSWD). The NOI and NOP for preparation of a joint EIS/EIR were issued in July and August 2003, respectively. Reclamation is the lead agency under NEPA, and PCWA is the lead agency under CEQA.

To meet the water supply needs of the cost-sharing partners, the SRWRS will identify a package of water supply infrastructure components, including new or expanded diversion(s) from the Sacramento, Feather, or American rivers, and new or expanded water treatment and pumping facilities, storage tanks, and major transmission and distribution pipelines. The additional water supplies considered in the SRWRS for each cost-sharing partner include: (1) additional water supply of up to 35 TAF for PCWA's M&I demand with a treatment capacity of 65 million gallons per day (mgd), (2) additional water supply of up to 29 TAF in Water Forum average, drier, and driest years for SSWD's M&I demand and groundwater stabilization program with a treatment capacity of 15 mgd, (3) additional water supply of up to 7,100 AF for the City of Roseville's M&I demand with a treatment capacity of 10 mgd, and (4) additional water supply of up to 58 TAF with a water treatment capacity of 165 mgd for the City of Sacramento's M&I demand.

Folsom Dam Raise Project

In February 2002, the Corps issued the Supplemental Plan Formulation Report/EIS/EIR for the American River Watershed, California, Long Term Study, which describes, analyzes, and reports impacts of flood damage reduction and ecosystem restoration along the American River, and includes the Corps' proposal to raise Folsom Dam seven feet to reduce the Sacramento area's flood risks. Study of the American River Watershed was initially authorized in the Flood Control Act of 1962 (PL 87-874) with direction from Congress given to the Corps to survey for flood control and allied purposes.

The feasibility study was conducted in coordination with the Reclamation Board and SAFCA as the non-federal sponsors. This study supplements the 1996 Supplemental Information Report and the 1991 Feasibility Report for the American River Watershed Investigation. This document and its technical appendices support decision-making by the Corps and the non-federal sponsors, which include the Reclamation Board and SAFCA. In May 2006, the Corps issued the Public Draft SEIS/EIR and the Post Authorization Decision Document for the Folsom Dam Raise, Folsom Bridge portion of the American River Project.

Construction of Folsom Bridge is scheduled to begin in fall.

East Branch Enlargement Project

The Department proposes Phase II of the East Branch Extension of the California Aqueduct, which would involve construction of new supporting facilities and enhancement of an existing pump station in western San Bernardino County within the cities of Redlands and Highland and the unincorporated community of Mentone. The project would connect the San Bernardino Valley MWD's existing Foothill Pipeline to the existing Crafton Hills Pump Station to increase the capacity of deliveries of SWP water to the San Gorgonio Pass WA and San Bernardino Valley MWD service areas. With implementation of the East Branch Enlargement project, the capacity of the East Branch Aqueduct would increase from 50 cfs to 150 cfs. The proposed project would increase water deliveries through the system by 8,650 AFY.

Lake Perris Seismic Retrofit Project

Beginning in 2005, water levels in Lake Perris were drawn down for a seismic retrofit of the dam. The Department is initiating repairs to the dam which include replacing the foundation material and reinforcing it with a stability berm placed on top of the improved foundation. This will allow the lake to return to its previous maximum operating pool elevation after construction. Other aspects of the repair plan include constructing a new outlet tower and emergency outlet release facility. Construction is estimated to begin in the fall of 2008. Dam completion is expected by fall 2010. All projects concerning the Perris Dam are anticipated to be complete by fall 2012.

10.1.3 Cumulative Impact Analysis

If a technical issue area included a project-specific impact as a result of implementation of the proposed project, a cumulative context is presented. The context of the cumulative analysis varies by technical issue area. For example, air quality impacts are evaluated against conditions in the relevant air basin. Because the proposed project area includes the State-wide SWP service area, it is geographically broad. Therefore, the cumulative context for each technical issue area is further defined by the specific geographic area affected by project implementation including: the southern San Joaquin Valley (including Kern County and the Kern Fan Element); SWP reservoirs including Castaic Lake, Lake Perris, San Luis Reservoir and Lake Oroville; the Sacramento and Feather rivers, the Sacramento-San Joaquin Delta and Plumas County. Then the cumulative impact analysis takes into consideration whether the projects listed in Table 10.1-1 in combination with the proposed project would have the potential to affect the same resources. If there is not a combined effect then a finding of no impact is made. If there would be a combined effect, then a determination is made if that combined effect would: (1) result in a significant cumulative effect; and (2) if the proposed project's contribution to the effect would be considerable. Finally, a determination is made as to whether mitigation measures recommended for the project-specific impact would reduce the proposed project's contribution to the cumulative impact to a less-than-significant level; therefore, resulting in a less-than-significant cumulative impact.

The cumulative impact analysis is presented by technical issue area.

Surface Water Hydrology, Water Quality, and Water Supply

The cumulative context for surface water hydrology, water quality and water supply includes the Feather and Sacramento rivers and the Sacramento-San Joaquin Delta.

10.1-1 Implementation of the proposed project in combination with cumulative water development projects could potentially affect river flow in the Feather and Sacramento rivers and outflow from the Delta to the San Francisco Bay

Sacramento and Feather Rivers

The proposed project would have a less than 0.15 percent effect on flows in the Sacramento and Feather rivers, an essentially immeasurable change. Flow in the Feather River in the future would be affected by future operations of the SWP which will alter as demand increases in the SWP service area and new reservoirs (Sites Reservoir, Upper San Joaquin River Reservoir) are added to the SWP. Flow in the Sacramento River in the future would be affected by future operations of the SWP and the CVP as water demand grows and an enlarged Shasta Reservoir is incorporated into the systems. Future flow changes from these actions could be large, much larger than those attributable to the proposed project. Flows may be increased or decreased and their seasonal pattern altered. No significance determination was made with respect to cumulative flow changes in the Sacramento and Feather rivers or for the flow changes produced by the proposed project. However, the proposed project's contribution to flow changes would not be considerable.

Sacramento-San Joaquin Delta

The proposed project would increase diversions by the SWP from the Delta by an average of 50,000 AF per year and would reduce Delta outflow by a like amount. This reduction represents about 0.35 percent of average annual Delta outflow.

Many of the future projects and programs listed in Table 10.1-1 have the potential to affect flows in the Delta. New water storage projects would increase the capture of water during the rainy season and during snowmelt. The overall effect of the projects would be to reduce inflow to the Delta and Delta outflow in late winter and spring. Inflow to the Delta would increase in the summer as water was released from reservoirs to flow to the pumps in the Delta. Delta outflow in the summer would probably not change much because environmental regulations already limit diversions from the Delta and prescribe objectives for Delta outflow.

The increased diversions from the Delta attributable to the proposed project would occur in the wetter months of wet years and would reduce Delta outflow at such times. Water to meet future demand and to fill the new reservoirs would also reduce Delta outflow in the wetter months of wet years but the effects are likely to be much greater than those of the proposed project. For example, the SWP expects to divert about 220,000 AF more water from the Delta in 2020 than it did in 2003 just to meet growing demand in its service area. No significance determination was made with respect to cumulative flow changes in the Delta or for the flow changes in the Delta produced by the proposed project. However, the proposed project's contribution to flow in the Delta changes would not be cumulatively considerable.

Impact Summary

Future projects and actions (including the proposed project) that substantially alter flow in the Sacramento and Feather rivers and Delta inflow and outflow could produce changes in water quality. Flow related changes in water quality together with storm water and treated wastewater discharges from new urban development in the Sacramento and Feather river watersheds and the Delta could have a potentially significant cumulative impact on water quality.

However, because the proposed project would contribute less than 0.15 percent to the total cumulative change in flows in the Sacramento and Feather rivers, and approximately 0.35 percent of average annual Delta outflow, the project's contribution to decreased water quality would not be considerable and this would be a less-than-significant cumulative impact.

Mitigation Measures

None required.

Groundwater Hydrology and Water Quality

The cumulative context for ground water hydrology and water quality is the groundwater basins underlying the San Joaquin Valley.

The effects of the proposed project would be to raise water levels in some groundwater subbasins in Kern County as a result of storage of water in the Kern Water Bank and storage of SWP water by contractors outside their service areas, a modestly beneficial effect. The proposed project would have a negligible effect on groundwater quality and would not contribute to cumulative effects on water quality. Because there would be no adverse impact, there would be no combined effect with other cumulative projects. Therefore, ***no cumulative impact*** would occur.

Fisheries Resources

The cumulative context for fisheries resources includes the Feather and Sacramento rivers and the Sacramento-San Joaquin Delta.

There was no project-specific impact on fisheries identified in the American and San Joaquin rivers, and therefore, there would be ***no cumulative impact***.

10.1-2 Implementation of the proposed project in combination with cumulative water development projects could potentially affect special-status fish species in the Sacramento-San Joaquin Delta due to Delta export changes.

Increased cumulative exports from the Delta could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult smelt and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased exports. The fishes most susceptible to November-March hydrodynamic changes and export increases are out-migrating salmonids and smelt moving upstream to spawn. Increased entrainment of a special-status species that resulted from the proposed project in combination with other cumulative projects would reduce a species' abundance. Disruption of upstream or downstream migration could be considered an interference with the movement of resident and migratory species. This would result in a potentially significant cumulative impact.

For the 1996 – 2003 analysis, CALSIM II simulations analyzed the effects of export changes from Table A transfers and retirements, and altered water allocation procedures. These changes could affect Delta exports. Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. Total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 34,000 AF.

Because CALSIM II does not model the water supply management practices provided for in the Monterey Amendment, an additional analysis was conducted based on historical data from 1996 through 2004. The estimated effects of nearly all of the Monterey Amendment provisions, including the Table A retirements and the water supply management practices, on Delta exports between 1996 and 2004 were determined by a historical operations analysis, described in more detail in Chapter 6 and Appendix K. Monterey Amendment-induced changes in SWP operations and deliveries to SWP contractors are described in Chapters 6 and 7.

The Department estimates that from 1996 to 2004, the water supply management practices resulted in the SWP pumping a total of about 44,000 AF more at the Banks Pumping Plant than it would have under the baseline scenario. Thus, from 1996 to 2004, these Monterey Amendment provisions increased Delta exports and reduced Delta outflow by a total of about 44,000 AF.

However, as mentioned in the fisheries section (Impact 7.3-5, 1996 – 2003), the Department prior to and during the inception of the proposed project in 1996, has been operating the SWP and all its subsidiary facilities (including Banks) in accordance with all environmental legal constraints. The environmental constraints that were pertinent for any given time from 1996 to 2003 would have mitigated for any additional pumping due to the proposed project in the Delta, this would include the proposed project and its water supply management practices. The Department believes that the environmental agreements developed with DFG during the 1996-2003 timeframe were sufficient to protect Delta species from the impacts of pumping and satisfy any statutory requirements. In addition, the Banks pumping curtailments to address federal ESA concerns in 1996, 1997, 1999, and 2000 provided some added fish benefits. Beginning in 2000, the EWA Program provided a real-time adaptive management response to fish distribution, abundance, and salvage in the Delta.

The following lists mitigation and environmental programs already in place that were relevant to the SWP (thus the proposed project) and Delta fisheries covered by the federal biological opinions for the 1996-2003 timeframe:

1. CALFED Agreement and Bay-Delta Accord,
2. The Water Right Decision 1641 issued by the Regional Water Quality Control Board,
3. ESA-related Banks pumping curtailments,
4. The EWA (initiated in late 2000),
5. The Anadromous Fisheries Biological Opinion of 1995 (this was later superseded by one in 2004),
6. The Delta Pumping Plant Fish Protection Agreement, and
7. The Delta Smelt Biological Opinion of 1995 (this was later superseded by one in 2005).

The standards of significance established for this proposed project require that a significant impact be identified for any proposed project-related action that will have a substantial adverse effect, either directly or through habitat modifications, on any species protected under the State or federal Endangered Species acts or considered a candidate, or special-status by the USFWS, CDFG, or NOAA Fisheries. Considering the Department's relevant SWP legal environmental compliance, the proposed project's impact to special-status fish species in the Sacramento-San Joaquin Delta from 1996 to 2003 would have been a less-than-significant cumulative impact.

Delta exports to contractors south of the Delta can be affected both by the altered allocation procedures and Table A transfers and retirements, and by the water supply management practices. The future effects of these two sets of Monterey Amendment provisions are evaluated in two separate analyses, using CALSIM II and historical data.

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change both the total quantity of SWP water delivered and the quantities of SWP water delivered to individual contractors. These changes in deliveries could affect Delta exports. Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. For the future conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 23,000 AF.

Contractors took advantage of the water supply management practices from 1996 to 2004 and would be expected to continue to employ all or most of them in the future. Because the water supply management practices were actually used from 1996 to 2004, an analysis of the effects of these water supply management practices in that historical period offers insight into their likely future effects.

The Department conducted a historical water supply management practices analysis to determine whether they would have resulted in increased pumping at the Banks Pumping Plant. This analysis differs from that performed for the 1996-2004 period by assuming that from 2004 on into the future, the contractors would have essentially filled within-service-area storage that could have been used from 1996 to 2004. Thus the 2003-2020 analysis uses the 449,000 AF estimate, or an average of about 50,000 AF per year.

Based on this (plus additional analysis from the fisheries section, impact 7.3-5, Future Impacts), the water supply management practices of the proposed project would have contributed to salvage numbers, especially during February and March. The increment of fish protection that would be attributable to the proposed project in relation to total pumping is difficult to estimate. As noted in mitigation from the fisheries section (impact 7.3-5, Future Impacts), the CVP and SWP Delta facilities are being reviewed as part of the OCAP reconsultation process. However, reviewing average annual total projected Banks Pumping Plant pumping and determining the relationship of the proportion of that pumping that might be attributable to the proposed project is important. Banks pumping is estimated to average about 3,200,000 AF per year in the future, based on CALSIM output, and the approximate estimated future added pumping at Banks due to the water supply management practices of the proposed project is about 50,000 AF per year, or 1.6 percent of annual average total Banks pumping. If the same percentage is applied to the current EWA Program asset level of about 300,000-350,000 AF, the proportion of the EWA Program attributable to the water supply management practices of the proposed project would be about 5,500 AF.

In developing mitigation for the fish for the proposed project, several other factors were also examined. The first was to see if the added pumping attributable to the proposed project would occur at times of high fish sensitivity, and the other was to provide for tracking actual future water management actions of the proposed project and preclude the added pumping when it would otherwise occur.

Analysis of the 50,000 AF of added pumping at Banks resulting from the water supply management practices found that about 12,000 AF would generally occur in November and December, when the fish species of concern are seldom near the pumps, with the remaining

38,000 AF of pumping occurring in the January-April period, when fish concerns are greater. Thus the degree of impact of the water supply management practices of the proposed project as a fraction of Banks pumping would be less than the 1.6 percent cited above, or about 1.2 percent.

Based on the analysis, increased future pumping due to the proposed project under 2020 conditions could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult delta smelt and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased pumping.

The following list identifies other environmental programs already in place or forthcoming that are relevant to the SWP (thus the proposed project) and Delta fisheries for the 2003-2020 timeframe:

1. Anadromous Fisheries Biological Opinion of 2004;
2. Delta Pumping Plant Fish Protection Agreement ("Four Pumps Agreement", 1986);
3. Delta Smelt Biological Opinion of 2005;
4. Delta Smelt Action Plan of 2005;
5. Bay-Delta Conservation Plan;
6. Pelagic Fish Action Plan of 2007;
7. Adaptive Management Process;
8. Interagency Ecological Program;
9. Delta Risk Management Study;
10. Delta Vision; and
11. The NOAA Fisheries Biological Opinion of 2004.

The standards of significance established for this proposed project require that a significant impact be identified for any proposed project-related action that will have a substantial adverse effect, either directly or through habitat modifications, on any species protected under the State or federal Endangered Species acts or considered a candidate, or special-status by the USFWS, CDFG, or NOAA Fisheries. For the future impact analysis, compared to baseline conditions, potential exists for the proposed project to have an adverse impact on Delta fish species by increasing salvage at the Skinner facility as a result of higher pumping at Banks during certain periods when San Luis Reservoir would otherwise be full. This is a *potentially significant cumulative impact.*

Mitigation Measure

Implementation of the following mitigation measure would substantially limit the proposed project's contribution and this would be a ***less-than-significant cumulative impact***.

10.1-2 *Implement Mitigation Measure 7.3-5.*

Mitigation Measure 7.3-5 requires the Department to implement operational assets that could be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon that would limit any adverse impact resulting from the proposed project on special status Delta fish species as a result of higher pumping at Banks during periods when San Luis Reservoir, absent of the proposed project, would be full.

Terrestrial Biological Resources

The cumulative context for terrestrial resources includes the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Feather River, Sacramento River, San Joaquin River, Sacramento-San Joaquin Delta and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur at Castaic Lake.

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Therefore, the pond and plug and stream bank stabilization and channel form projects, in combination with the Plumas County Watershed Forum watershed improvement projects would result in a beneficial effect for special-status species and therefore, no cumulative impact would occur.

10.1-3 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect special-status terrestrial biological resources in the southern San Joaquin Valley.

The southern San Joaquin Valley portion of Kern and King's County was once comprised of tule marsh, San Joaquin saltbush and California prairie habitats. These supported a variety of endemic species adapted to xeric conditions, including the now federally-listed San Joaquin kit fox (*Vulpes macrotis mutica),* blunt nosed leopard lizard (*Gambelia sila*), and Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*). Though the value of agricultural land is generally lower than that of natural habitat to wildlife, some species have adapted and have extended their range into converted agricultural habitats. Rodents such as voles and ground squirrels, for example, can take advantage of increased food availability and water supply in agricultural lands to increase their populations, which in turn can provide a larger prey base for predators such as raptors. Grain and row crops (and the insects that feed on them) can support bird and mammal populations that would otherwise be constrained by the absence of such food resources in more xeric habitats. Conversely, increased levels of human activity, the plowing and tilling of soils, and the application of fertilizers, pesticides and herbicides to stimulate agricultural production can adversely affect native wildlife resulting in displacement or avoidance.

Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The reliability and availability of agricultural water supplies is one factor that could contribute to the amount and types of crops that farmers decide to plant.

The existing trend of replacing irrigated annual crops with permanent crops is expected to continue in the future. While it is possible that additional land could be converted to permanent crops as a result of the increased availability and reliability of water, no clear trend can be discerned. To the extent that some land would be converted to permanent crops, this would not prohibit San Joaquin kit fox migration, but could adversely impact Swainson's hawk, as this habitat is not suitable for foraging. However, there is only one recorded occurrence of Swainson's hawk within the water district boundaries that total almost 75,000 acres. The Swainson's hawk recorded occurrence was documented within the Tulare Lake Basin WSD. Additionally, the Tulare Lake Basin WD is subject to periodic flooding which makes it unsuitable for anything but annual crops and not permanent crops.

With the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. Even though the creation of new recharge ponds would periodically create open water and wetland habitat for waterfowl, the conversion of land for use as groundwater banking facilities could result in the loss of special-status species habitat.

The KWBA manages lands within the Kern Fan Element property in accordance with an approved HCP/NCCP. Because the Kern Fan Element property is under a HCP/NCCP, the KWBA is required to follow specific guidelines to prevent take of special-status species and to enhance and preserve the natural habitat currently present. Under the conditions of the HCP/NCCP, the KWBA is required to prepare annual reports summarizing activities within the Kern Fan Element property including updates on the water management and related activities; any amendments to the HCP/NCCP; a summary of any take occurrences; land and habitat management and mitigation measures; monitoring programs and studies; mitigation measures and cooperation with wildlife agencies; and the status of conservation credits. The KWBA also set aside a 435-acre mitigation easement.

While no incidental take has occurred since the KWBA's development of the Kern Water Bank (with exception of San Joaquin woolly threads), it is possible that cumulative development could result in take during construction, operation and maintenance, through collapsed burrows, road kills, crushed by grading equipment, harassment, habitat loss, drowning, etc.

Therefore, the proposed project, in combination with other cumulative water development and water reallocation projects, could result in significant impacts to biological resources in the southern San Joaquin Valley due to the construction of additional groundwater storage facilities and the project's contribution to this impact could be considerable. Therefore, this would be a *potentially significant cumulative impact*.

Mitigation Measures

Implementation of Mitigation Measure 7.4-3 is currently implemented by the KWBA as required by the Kern Water Bank HCP/NCCP cumulative impacts to special-status species at the Kern Water Bank would be reduced to a less than significant level.

Implementation of Mitigation Measure 7.4-2 would reduce the project's contribution to this cumulative impact but not to a less-than-significant level. Impacts to terrestrial biological resources in the southern San Joaquin Valley portion of Kern and King's Counties would be reduced through the following mitigation measures; however because the Department has no jurisdiction over local agency decisions and cannot enforce implementation of Mitigation Measure 7.4-2, and the impacts of individual activities are unknown at this time cumulative impacts to terrestrial biological resources would remain a ***potentially significant and unavoidable cumulative impact***.

10.1-3 *Implement Mitigation Measures 7.4-2 and 7.4-3.*

Mitigation Measure 7.4-2 would prevent any adverse impact to special-status species through avoidance of the species and their habitat. If avoidance is not possible, then consultation with the resource agencies would be required to determine appropriate mitigation. However, even though impacts to terrestrial biological resources in the San Joaquin Valley would be reduced, because the impacts of individual activities are unknown at this time, the cumulative impact would remain significant and unavoidable.

Mitigation Measure 7.4-3 would require the use of a biological monitor, special construction activities and on-going practices that would result in a heightened awareness and education regarding sensitive biological resources. In addition, the use of a project representative as a liaison between the project and the resource agencies would expedite notification regarding any take of a listed species. This mitigation measure also outlines avoidance protocol to further reduce the likelihood of take.

10.1-4 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect special-status terrestrial biological resources at San Luis Reservoir, Feather River, Sacramento River, San Joaquin River, and Sacramento-San Joaquin Delta.

<u>San Luis Reservoir</u>

Changes in the amount of water stored at San Luis Reservoir attributed to cumulative projects (including Monterey Plus) would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Therefore, cumulative impacts to riparian habitat and special-status species habitat would not be significant.

<u>Feather, Sacramento and San Joaquin Rivers</u>

The effects of the proposed project on flow in the Feather and Sacramento rivers would be immeasurable and would not contribute to cumulative impacts. Therefore, stream flow changes resulting from the proposed project in combination with other cumulative projects are so small that they would not substantially affect any special status terrestrial species or their habitat.

<u>Sacramento-San Joaquin Delta</u>

The cumulative effect of the proposed project and the expected increased pumping by the SWP would be to reduce Delta outflow to San Francisco Bay primarily in wet months of wetter years. Most of the time, water diversion by the SWP and CVP is already at its maximum consistent with environmental regulations and so there would be no cumulative effect. Therefore, flow changes resulting from the proposed project in combination with other cumulative projects are so small that they would not substantially affect any special status terrestrial species or their habitat.

<u>Impact Summary</u>

Changes in SWP reservoir levels could be impacted by cumulative projects, but such changes would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Changes in the Sacramento-San Joaquin Delta are so small that they would not substantially affect any special status terrestrial species or their habitat. Therefore, this would be a ***less-than-significant cumulative impact*.**

<u>Mitigation Measures</u>

None required.

10.1-5 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect special-status terrestrial biological resources at Lake Perris.

Lake Perris supports a variety of special-status species including the osprey (*Pandion haliaetus*), greater western mastiff bat and Yuma myotis (*Myotis yumanensis*) that use the lake for foraging and water supply. Additionally, two special status species, the double-crested cormorant (*Phalacrocorax auritus*), and the bald eagle, are known to winter at Lake Perris. A reduction in lake levels could reduce overall fish populations, which in turn could adversely affect terrestrial biological resources that use the lake to forage.

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. Draw down of the reservoir to date has reduced the volume by approximately 40 percent. The draw down of Lake Perris is expected to be maintained through 2012.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the drawdown of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. As part of the Department's ongoing seismic repairs at Lake Perris, the Santa Ana Watershed Association is currently conducting quarterly bird surveys to document how that drawdown affects birds in the area. The results of these surveys may provide insight into the effects on the reduction of food resources as a result of future drawdowns. The reduction in fish populations and that is attributed to maintaining a lower pool volume would be significant but short-term. Regardless, a reduction in food resources could result in reduced nesting success for raptors, bats, and waterfowl, which would result in a ***short-term potentially significant and unavoidable cumulative impact.***

<u>Mitigation Measures</u>

None feasible.

10.1-6 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect riparian habitat and the special-status terrestrial species it supports at Lake Perris.

Lake Perris has an extensive lake-dependent riparian corridor located along its eastern margin that supports special-status species including California thrasher (*Toxostoma redivivum*), Cooper's hawk (*Accipiter cooperii*), Lawrence's goldfinch (*Carduelis lawrencei*) least Bell's vireo (*Vireo bellii pusillus*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), white tailed kite (*Elanus leucurus*), and yellow warbler (*Dendroica petechia brewsteri*).

Additionally, in 2007 the California gnatcatcher (*Polioptila californica*) was observed using the riparian corridor.

As described under Impact 10.1-5, the seismic retrofit project in combination with borrowing water under Article 54 as allowed under the proposed project, could result in a drawdown of the reservoir that could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Drastic changes in surface elevation during the growing season or a prolonged drawdown could have substantial impacts on riparian vegetation, which supports a variety of wildlife species, providing food, shelter, and nesting habitat.

As part of the Department's ongoing seismic repairs at Lake Perris, a number of mitigation measures have been initiated to reduce impacts to riparian vegetation. An irrigation system that draws water from Lake Perris and feeds the entire stretch of riparian vegetation has been installed. As of May 2007, the riparian vegetation is irrigated twice per week. The success of this system is being monitored monthly by the California Department of Parks and Recreation and may provide insight into the effects of drawdown on the riparian habitat.

Regardless, the project's contribution to a decline in the riparian vegetation would be considerable and this would be a *potentially significant cumulative impact* because this habitat is considered sensitive by DFG, and it supports special-status species.

Mitigation Measures

Implementation of Mitigation Measure 7.4-6 could reduce the project's contribution to the loss of riparian habitat and the associated special-status species to a less-then-significant level, if the changes in water do not impact the riparian habitat, or if any loss of water is supplemented through the sub-surface or surface irrigation. However, because of the complexity of the system, it is unknown at this time what the real impacts on the riparian habitat would be and therefore, the residual impact cannot be assessed. Therefore, this remains a ***potentially significant and unavoidable cumulative impact***.

10.1-6 *Implement Mitigation Measure 7.4-6*.

Mitigation Measure 7.4-6(a) requires the development of baseline studies to determine what water source is maintaining the riparian habitat. In addition, a qualified biologist would conduct a complete habitat assessment of the riparian habitat documenting the size of the habitat, and all wildlife and plant species that use this habitat, including any special-status species.

Mitigation Measure 7.4-6(b) requires that once a baseline is established, annual monitoring would be required to determine changes in hydrologic activities, changes in the health of the riparian habitat, and changes in the use of said habitat by special-status and other wildlife species.

Mitigation Measure 7.4-6(c) requires that an irrigation system be installed to water the riparian habitat or the existing irrigation system shall be maintained and operated (assuming it is successful in maintaining riparian vegetation during the seismic repairs). In addition, monthly monitoring should be conducted to document any changes in the riparian habitat and allow for a timely adjustment of the watering schedule.

Visual Resources

The cumulative context for visual resources includes viewsheds in the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Therefore, the pond and plug and stream bank stabilization and channel form projects, in combination with the Plumas County Watershed Forum watershed improvement projects would result in a beneficial effect on visual resources and therefore, no cumulative impact would occur.

10.1-7 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect visual resources in southern San Joaquin Valley, San Luis Reservoir and Lake Oroville.

Southern San Joaquin Valley

Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The reliability and availability of agricultural water supplies is one factor that could contribute to the amount and types of crops that farmers decide to plant, which in turn could affect the appearance of the landscape in the southern San Joaquin Valley. Those changes in cropping patterns could alter the appearance of the landscape. Permanent crops are generally taller and provide more visual variety than annual crops. Permanent crops break up the uninterrupted views across miles of flat land, prevalent where annual crops are grown in the southern San Joaquin Valley.

The existing trend of replacing irrigated annual crops with permanent crops is expected to continue in the future. While it is possible that additional land could be converted to permanent crops as a result of the increased availability and reliability of water, no clear trend can be discerned. Therefore any change in agricultural practices would not be expected to result in a dramatic change in visual character. Furthermore, any changes would be seen by a limited number of viewers and probably noticed by even fewer.

The conversion of land for use as groundwater banking facilities (including the expansion of the Semitropic water storage facilities) could also alter the visual appearance of the land; however, it would not result in a substantial change in the visual character because these projects would occur in areas of Kern County that already include groundwater storage facilities.

San Luis Reservoir and Lake Oroville

Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels and changes in the visual character at these two facilities would not be apparent.

Impact Summary

As described above, potential changes in cropping patterns and the conversion of land to groundwater banking facilities would not represent a substantial change in the existing visual character. Because changes in the amount of water stored at San Luis Reservoir and Lake Oroville would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels, changes in the visual character at these two facilities would not be apparent. Therefore, visual resource cumulative impacts would be ***less than cumulatively significant***.

Mitigation Measures

None required.

10.1-8 Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially affect visual resources at Lake Perris.

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. Draw down of the reservoir to date has reduced the volume by approximately 40 percent. When the reservoir volume is reduced there is a band of soil or rock exposed around the perimeter. The perimeter band is initially devoid of vegetation and includes tree stumps and other debris that are not visible when the reservoir is full. The appearance of the perimeter band is often initially in sharp contrast to the reservoir pool and surrounding vegetation making it a prominent visual feature. However, natural succession of vegetation around the reservoir edge results in some shoreline areas with emergent vegetation. Visual quality is temporarily degraded when water levels in the reservoirs are lowered; however, visual quality is generally restored when water levels are raised.

The draw down of Lake Perris and change in the visual character of the reservoir is expected to be maintained through 2012. Vegetation will re-establish once the reservoir is full and operating under normal conditions. This change in visual character that is attributed to maintaining a lower pool volume would be significant but short-term.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce all visual impacts at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the visual effects of drawdown would be temporary, the project's contribution to this cumulative impact would be considerable and this is considered a ***short-term potentially significant and unavoidable cumulative impact***.

Mitigation Measures

None available.

Agricultural Resources

The cumulative context for agricultural resources is lands in agricultural production in the southern San Joaquin Valley.

10.1-9 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect the area of irrigated cropland and special-status farmland in southern San Joaquin Valley.

Implementation of the proposed project, combined with other cumulative water development and reallocation projects, could result in a reduction of average annual deliveries of SWP water to agricultural contractors. However, there would be little or no impact on the acreage of irrigated land in the southern San Joaquin Valley. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land and would not be converted to urban uses. Under the proposed project, no Prime, Unique or Farmland of Statewide Importance would be converted to non-agricultural uses nor would a conflict be created with respect to existing agricultural zoning or Williamson Act contracts. Therefore, the project's contribution to cumulative conversion of special-status agricultural lands would not be considerable and this would be a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

Air Quality

The cumulative context for air quality would be the SVAB (southern San Joaquin Valley and San Luis Reservoir), SCAB (Lake Perris and Castaic Lake), NSVAB (Lake Oroville) and the Mountain Counties Air Basin (Plumas County).

Because none of the projects on the cumulative list would change water levels in Castaic Lake there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur for Castaic Lake.

10.1-10 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially increase PM_{10}, NO_x and ROG emissions in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville and Plumas County.

Southern San Joaquin Valley

Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The reliability and availability of agricultural water supplies is one factor that could contribute to the amount and types of crops that farmers decide to plant, which in turn could affect associated land disturbance activities. Agricultural activity, especially activity associated with the disturbance of soil, such as discing, can be a source of PM_{10}, which is a criteria pollutant.

It is possible that the existing trend towards conversion to permanent crops could be attributed to an increase in water reliability and availability, and that changes in agricultural practices could reduce the frequency and type of land disturbance in the southern San Joaquin Valley. Soils in the southern San Joaquin Valley are characterized as having slight to very slight potential to experience wind-generated erosion. Consequently, associated PM_{10} emissions could be limited or reduced.

The conversion of land for use as groundwater banking facilities, however, could result in land disturbance and pump operation which could generate cumulative increases in PM_{10}, NO_x and diesel TAC emissions. With the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. Because the proposed project and other cumulative projects in the SJVAB would be required to implement SJVAPCD PM_{10} control measures, short-term PM_{10} construction emissions would not exceed SJVAPCD thresholds on an annual basis. Pumps associated with groundwater banking facilities are electric; however, backup pumps are generally diesel. Diesel engines would emit ozone precursors, including ROG and NO_x; however, these emissions would be infrequent and temporary.

<u>San Luis Reservoir and Lake Oroville</u>

Recreational boats with engines contribute approximately nine percent of the total ROG emissions from off-road sources. The amount of recreational boat use usually increases with increasing water levels in reservoirs that support recreational activities. Conversely, boating decreases when water levels are lower. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels and therefore, boat emissions would not be expected to significantly change and therefore, would not exceed thresholds. Similarly, cumulative vehicle emissions associated with recreational trips to and from at San Luis Reservoir and Lake Oroville would also not be expected to significantly increase.

Exposed shoreline along reservoirs due to decreased water levels would expose soils to increased rates of wind erosion which would increase particulate matter emissions. As noted above, changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Therefore, the amount of shoreline exposed to wind erosion, which would be a source of particulate dust emissions would not be expected to significantly change.

<u>Plumas County</u>

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting), which could require the use of heavy-duty construction equipment. The heavy equipment would be a source of diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities could also generate

PM_{10}. The number and size of watershed improvement projects that would result from the proposed project in combination with cumulative watershed improvement projects are relatively small, and the number of pieces of heavy equipment operating at any one time and the amount of acreage disturbed on a daily basis would be commensurately limited. Therefore, emissions would not be substantial. Further, air emissions would be temporary and would occur only as long as the construction activities, so there would be no adverse, permanent effect on air quality in the region.

Impact Summary

The SJVAB is in non-attainment of federal and state standards for both PM_{10} and ozone. Butte County, located in the NAVSB, is considered "moderate" non-attainment for ozone and PM_{10}. Plumas County, located in the Mountain Counties Air Basin, is in attainment of all the federal standards and is also in attainment of all State standards with the exception of PM_{10}. Therefore, cumulative increases in PM_{10}, NO_x, and ROG emissions in these three air basins could be considered potentially cumulatively significant.

As stated above, it is possible that the existing trend towards conversion to permanent crops could reduce the frequency and type of land disturbance in the southern San Joaquin Valley which could result in limited or reduced PM_{10} emissions. Furthermore, projects, including the project, in the SJVAB would be required to implement SJVAPCD control measures; therefore, construction emissions would not exceed SJVAPCD thresholds on an annual basis. Backup diesel pump engines would emit ozone precursors, including ROG and NO_x; however, these emissions attributed to the proposed project would be infrequent and temporary.

In addition, the amount of shoreline exposed to wind erosion, boat emissions, and vehicle emissions associated with recreational trips to and from at San Luis Reservoir (located in the SJVAB and the SJAPCD) and Lake Oroville (located in the NSVAB and the BCAPCD) attributed to the proposed project would not be expected to significantly increase.

In Plumas County (located in the Mountain Counties Air Basin and the Northern Sierra Air Quality Management District), the number and size of watershed improvement projects that would result from the proposed project would be relatively small, and the number of pieces of heavy equipment operating at any one time and the amount of acreage disturbed on a daily basis would be commensurately limited. Emissions would be temporary and would not be substantial.

Therefore, the emissions attributed to the proposed project would not be expected to result in a net increase in criteria pollutants over SJVAPCD, BCAPCD and Northern Sierra Air Quality Management District thresholds. The project's contribution would not be considerable and this would be a ***less-than-significant cumulative impact.***

Mitigation Measures

None required.

10.1-11 Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially alter the amount of shoreline exposed to wind erosion, which could generate wind-blown particulate emissions.

Lake Perris is located in the SCAB which is in “extreme” non-attainment of the federal one-hour ozone standard and is considered to be in non-attainment of the federal PM_{10} standards.

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. Draw down of the reservoir to date has reduced the volume by approximately 40 percent. When the reservoir volume is reduced there is a band of soil exposed around the perimeter. Soils at Lake Perris are characterized as sandy which would be subject to increased rates of wind-induced soil erosion and associated particulate matter emissions.

The draw down of Lake Perris and the exposed soil around the perimeter of the reservoir is expected to be maintained through 2012. The perimeter will be reduced and vegetation will re-establish once the reservoir is full and operating under normal conditions. This increase in exposure of soil to wind erosion attributed to maintaining a lower pool volume would be significant but short-term.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce PM_{10} emissions at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the increased rate of soil erosion attributed to the drawdown would be temporary, the project’s contribution to this cumulative impact would be considerable and this is considered a ***short-term potentially significant and unavoidable cumulative impact***.

<u>Mitigation Measures</u>

None available.

Geology, Soils and Mineral Resources

The cumulative context for soil erosion would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur at Castaic Lake.

10.1-12 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially increase rates of soil erosion in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville and Plumas County.

<u>Southern San Joaquin Valley</u>

Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The reliability and availability of agricultural water supplies is one factor that could contribute to the amount and types of crops that farmers decide to plant, which in turn could affect associated land disturbance activities. Agricultural activity, especially activity associated with the disturbance of soil, such as discing, can be a source of ground disturbance and associated wind-generated erosion.

It is possible that the existing trend towards conversion to permanent crops could be attributed to an increase in water reliability and availability, and that changes in agricultural practices could reduce the frequency and type of land disturbance in the southern San Joaquin Valley.

With the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. The conversion of land for use as groundwater banking facilities could result in land disturbance which could increase the rate of wind-generated soil erosion.

Soils in the southern San Joaquin Valley are characterized as having slight to very slight potential to experience wind-generated erosion. Consequently, wind-generated erosion associated with changes in agricultural practices and the construction of groundwater banking facilities would be limited.

<u>San Luis Reservoir and Lake Oroville</u>

Exposed shoreline along reservoirs due to decreased water levels would expose soils to increased rates of wind erosion. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Therefore, the amount of shoreline exposed to wind erosion would not be expected to significantly change.

<u>Plumas County</u>

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting) which would expose soils and increase the rate of wind-generated erosion. Soils in Plumas County are dominated by highly erodible granitic and sedimentary deposits.

<u>Impact Summary</u>

The disturbance of land resulting from changing agricultural practices and the conversion of land for use as groundwater banking facilities could result in land disturbance which could increase the rate of wind-generated soil erosion in the southern San Joaquin Valley. The proposed project, in combination with cumulative water development and reallocation projects would contribute to this effect. However, soils in the southern San Joaquin Valley are characterized as having slight to very slight potential to experience wind-generated erosion. In addition, the amount of soil along the shorelines of San Luis Reservoir and Lake Oroville would not be expected to significantly change over existing conditions.

The number and size of watershed improvement projects would be relatively small and would be expected to stabilize soils along stream courses. Temporary exposure of soil during construction activities would be regulated by State water quality regulations.

Therefore, increases in wind-generated soil erosion attributed to the construction and/or operation of cumulative water development and reallocation projects would be considered a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

10.1-13 Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially increase rates of soil erosion.

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. Draw down of the reservoir to date has reduced the volume by approximately 40 percent. When the reservoir volume is reduced there is a band of soil exposed around the perimeter. Soils at Lake Perris are characterized as sandy which would be subject to increased rates of wind-induced soil erosion.

The draw down of Lake Perris and the exposed soil around the perimeter of the reservoir is expected to be maintained through 2012. The perimeter will be reduced and vegetation will re-establish once the reservoir is full and operating under normal conditions. This increase in exposure of soil to wind erosion attributed to maintaining a lower pool volume would be significant but short-term.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Mitigation measures, such as hydroseeding or landscaping, to reduce exposure of soil erosion impacts at Lake Perris are economically and physically infeasible because of the scale of the area to be covered. Therefore, although the increased rate of soil erosion attributed to the drawdown would be temporary, the project's contribution to this cumulative impact would be considerable and this is considered a ***short-term potentially significant and unavoidable cumulative impact***.

Mitigation Measures

None available.

Recreation

The cumulative context for recreation resources would be Castaic Lake, Lake Perris, San Luis Reservoir, and Lake Oroville.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.

10.1-14 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect recreational resources at San Luis Reservoir and Lake Oroville.

The amount of recreational boat use usually increases with increasing water levels in reservoirs that support recreational activities. Conversely, boating decreases when water levels are lower. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels. Therefore, this would be a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

10.1-15 Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially affect recreational resources at Lake Perris.

Recent drawdowns in Lake Perris for the Seismic Retrofit Project have resulted in a 40-percent reduction in volume. The drawdowns have reduced the water surface elevations to about 1,563 feet. The decrease in water surface elevation has resulted in reduced recreational capacity and availability of facilities. One public boat launch, both personal water craft launches, the ADA fishing dock, and one swim beach have become inoperable. Speed limits around Allesandro Island have been reduced. In addition, waterfowl hunting, permitted at near maximum full pool, is currently not allowed due to safety and animal cover issues. The lower water levels also reduced access to shore fishing potentially reduced fish access to quality habitat for spawning. While having no direct impact on trails, the draw down exposes water features that may be unattractive to nature enthusiasts, hikers, bikers, and horse back riders, potentially diminishing the reservoir’s recreational value. The reductions in multiple facilities and activities have contributed to the overall decline in attendance.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions.

A multi-agency MOU signed by the Departments of Water Resources, Parks and Recreation, Boating and Waterways, and Fish and Game along with MWDSC, establish the “Lake Perris Operations Guidelines” which provide for recreational resource protection, benefits to fishery resources and protection of water quality at Lake Perris. Never the less, because the proposed project, in combination with the Seismic Retrofit Project, could result in a worst-case scenario where the reduction in elevation and the associated decrease in the availability of recreational facilities could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project, and the project's contribution would be considerable, this is considered a ***short-term potentially significant cumulative impact***.

Mitigation Measures

Implementing the following mitigation measures would ensure that the project's contribution to impacts to recreation resulting from Article 54 extended drawdowns would be reduced. However, because these mitigation measures would not guarantee the restoration of recreation opportunities, this would remain a ***short-term potentially significant and unavoidable cumulative impact***.

10.1-15 *Implement Mitigation Measure 7.9-1(a) through (d).*

Mitigation Measure 7.9-1 requires the Department to notify the public at the onset of the loss of recreational resources due to Article 54 drawdowns at Lake Perris until the withdrawal is repaid.

In addition, to the extent feasible, the Department would install, extend, or upgrade existing facilities (including lifeguard towers and emergency assistance equipment) to allow safe access to lower lake levels during multi-year drawdowns.

The Department would also be required to monitor water quality during drawdown periods and when swimming is allowed using the current full-body contact criteria and laboratory methods adopted by the California Department of Health Services or the U.S. Environmental Protection Agency, as applicable.

Finally, Mitigation Measure 7.9-1 would require the Department to prepare and provide funding for a management plan to control invasive plant species that could expand into recreational areas during extended drawdown periods.

Land Use and Planning

The cumulative context for land use and planning is the southern San Joaquin Valley.

10.1-16 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially change land use designations in the southern San Joaquin Valley, thereby physically dividing an established community.

Implementation of the proposed project, combined with other cumulative water development and reallocation projects, could result in a reduction of average annual deliveries of SWP water to agricultural contractors. In addition, operation of cumulative water conveyance and storage projects could contribute to increased water transfers related to improved CVP and SWP storage and conveyance capabilities. As a result, there could be temporary or permanent conversions of agricultural land to non-agricultural uses. However, there would be little or no impact on the acreage of irrigated land in the southern San Joaquin Valley. If any land was to be taken out of irrigated production it would remain in agricultural use as dry farmed or fallow land and would not be converted to urban uses.

The trend of replacing irrigated annual crops with permanent crops is expected to continue in the future with or without the proposed project. While it is possible that additional land could be converted to permanent crops as a result of the proposed project, no clear trend can be attributable to the proposed project that can be discerned for the historical analysis period. Because agricultural use would continue, there would be no change in land use. If the land use planning authority were to change existing land use designations and zoning, the appropriate environmental review would be under taken to approve such a change at that time.

In addition, with the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. While construction of these facilities could alter land use patterns, land use designations would not change and these uses would be compatible with existing land uses. No commercial, retail, office, residential or other uses that would support population have been designated, and an established community has not been divided. Therefore, this would be considered a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

Hazards and Hazardous Materials

The cumulative context for hazards and hazardous materials would be the southern San Joaquin Valley and Plumas County.

10.1-17 Construction of the proposed project in combination with construction of cumulative water development and reallocation projects could potentially expose workers or the public to previously unidentified hazards or hazardous materials in Southern San Joaquin Valley and Plumas County.

Southern San Joaquin Valley

The proposed project in combination with other water development and reallocation projects would result in construction activities at locations in the southern San Joaquin Valley portion of Kern County. Approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. Ground disturbing activities associated with cumulative projects could expose construction workers to residual chemicals associated with past and present agricultural practices. Construction activities would also involve the use of heavy equipment that could contain fuels and lubricants which contain hazardous compounds.

Plumas County

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting), which could expose previously unidentified soil and/or groundwater contamination. In addition, heavy-duty used during construction could contain fuels and lubricants which contain hazardous compounds.

Impact Summary

This cumulative risk of exposure would be temporary in nature and regulated by federal and state laws that govern the storage, application and disposal of these chemicals to minimize risk of exposure. Therefore, this is considered a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

Noise

The cumulative context for increases in noise levels would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur at Castaic Lake.

10.1-18 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially increase noise levels in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, Lake Perris and Plumas County.

Southern San Joaquin Valley

Implementation of the proposed project, in combination with other water development and reallocation projects could alter agricultural practices in southern San Joaquin County. Changes in agricultural practices could alter traffic volumes and use of agricultural equipment. An increase in vehicle trips and use of agricultural equipment could contribute to a significant increase in noise levels. However, the numbers of vehicle trips to fields and use of agricultural equipment at fields with permanent crops would likely be the same or less than trips to fields with annual crops.

With the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. The cumulative construction of groundwater banking facilities could also require construction of new or altered access roads. Construction activities would include the use of heavy equipment which would generate short-term increases in ambient noise levels. Operation of groundwater banking facilities would also require use of pumps. Increased noise levels associated with the construction and operation of new banking facilities would be temporary and would impact uses in the immediate vicinity.

San Luis Reservoir and Lake Oroville

The amount of recreational boat use usually increases with increasing water levels in reservoirs that support recreational activities. Increased boat use would increase noise levels. Conversely, boating decreases when water levels are lower. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels and therefore, noise levels associated with increased boat use would not be expected to significantly change. Similarly, cumulative vehicle noise levels associated with recreational trips to and from at San Luis Reservoir and Lake Oroville would also not be expected to significantly change.

Lake Perris

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. The reductions in reservoir volumes has limited access to multiple facilities and reduced boating activities.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions.

A multi-agency MOU signed by the Departments of Water Resources, Parks and Recreation, Boating and Waterways, and Fish and Game along with MWDSC, establish the “Lake Perris Operations Guidelines” which provide for recreational resource protection, benefits to fishery resources and protection of water quality at Lake Perris. Never the less, the proposed project, in combination with the Seismic Retrofit Project, could result in a worst-case scenario where the reduction in elevation and the associated decrease in the availability of recreational facilities could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Therefore, it is anticipated that there could be a short-term reduction in noise levels associated with boating activities and vehicle trips to and from the reservoir under cumulative conditions.

Plumas County

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Construction activities could result in ground disturbance (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting) and the use of heavy-duty equipment. The number and size of watershed improvement projects would be relatively small and the construction activities temporary. In addition, the improvements are likely to occur in locations where little or no sensitive receptors are present.

Impact Summary

An increase in vehicle trips and use of agricultural equipment could contribute to a significant increase in noise levels. The proposed project would have little or no impact on the acreage of irrigated land in southern San Joaquin Valley. Further, while implementation of the proposed project in combination with other cumulative projects could contribute towards the conversion of annual crops to permanent crops this is an existing trend and the land would remain in agricultural production. Increased noise levels associated with the construction and operation of new banking facilities would be temporary and would impact uses in the immediate vicinity. If sensitive receptors are located close to these facilities this could be a significant cumulative impact. New banking facilities attributed to the proposed project would likely not expose sensitive receptors to increased noise levels because the facilities would be sited in relatively remote areas. Furthermore, increases in construction and operational noise levels would be temporary and intermittent. Therefore, the project's contribution would not be considerable.

Cumulative noise levels, including those contributed by the proposed project, associated with boat use and vehicle trips to and from at San Luis Reservoir and Lake Oroville would not be expected to significantly change and they could be reduced at Lake Perris. Therefore, this would be a less than significant cumulative impact.

The number and size of watershed improvement projects to be constructed in Plumas County would be relatively small and the construction activities temporary. In addition, the improvements are likely to occur in locations where little or no sensitive receptors are present. Therefore, this would be a less than significant cumulative impact.

While cumulative noise levels attributed to the construction and/or operation of cumulative water development and reallocation projects could increase, the proposed project's contribution to cumulative noise levels would not be considerable and this would be a ***less-than-significant cumulative impact***.

<u>Mitigation Measures</u>

None required.

Cultural and Paleontological Resources

The cumulative context for cultural and paleontological resources would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur at Castaic Lake.

10.1-19 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially damage or destroy cultural and paleontological resources in the southern San Joaquin Valley.

Water development projects which contribute to the availability and reliability of water supplies could contribute to the existing trend toward replacing annual crops with permanent crops in the southern San Joaquin Valley. The reliability and availability of agricultural water supplies is one factor that could contribute to the amount and types of crops that farmers decide to plant, which in turn could affect associated land disturbance activities. Agricultural activity, especially activity associated with the disturbance of soil, such as discing, can be a source of ground disturbance. It is possible that the existing trend towards conversion to permanent crops could be attributed to an increase in water reliability and availability, and that changes in agricultural practices could reduce the frequency and type of land disturbance in the southern San Joaquin Valley.

Ground disturbance associated with agricultural activity has the potential to damage or destroy prehistoric or archeological artifacts or paleontological deposits. Since much of the area has been actively farmed, it is likely that many artifacts and deposits have already been disturbed or destroyed. However, the continued trend from annual crops to permanent crops would likely reduce ground disturbance which would reduce the potential for impacts to cultural and paleontological resources.

With the proposed project, approximately 1,200 acres of ponds would be developed in the Kern Fan Element and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. The cumulative construction of groundwater banking facilities could also require construction of new or altered access roads. Prehistoric sites have been identified in both the Semitropic and Arvin-Edison project areas and on the Kern Fan Element property. Increased construction of banking facilities could increase the risk of damage or destruction of known or previously unidentified cultural resources.

The Kern Delta WD identified the potential for cultural resources to be adversely affected as a result of implementation of the Kern Delta WD Water Banking and In-Lieu Water Supply Project. The EIR for this project included mitigation measures which required development and implementation of a Cultural Resources Treatment Plan to ensure that if previously unidentified archaeological resources were discovered, that work would cease and a qualified archaeologist would examine the discovery and make appropriate recommendations for data recovery.

Increased construction of banking facilities could increase the risk of damage or destruction of known or previously unidentified cultural resources. Therefore, this is considered a potentially significant cumulative impact. The project’s contribution would be considerable because it would include construction of groundwater banking facilities in Kern County, including on the Kern Fan Element property which could contribute to the exposure of cultural resources to damage or destruction. Therefore, the potential for damage or destruction of cultural and paleontological resources is considered a *potentially significant cumulative impact*.

Mitigation Measures

Implementation of the following mitigation measure would substantially limit the project’s contribution and this cumulative impact but it would remain significant and unavoidable because the Department can not guarantee the implementation or monitoring of Mitigation Measure 7.13-2. Therefore, the potential to damage or destroy cultural resources in southern San Joaquin Valley would remain a ***potentially significant and unavoidable cumulative impact***.

10.1-19 *Implement Mitigation Measures 7.13-2(a) though (c) and 7.13-3(a) through (d).*

Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost.

Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost.

Implementation of Mitigation Measure 7.13-2(c) would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.

Mitigation Measures 7.13-3(a) through (d) were outlined in the Initial Study and Addendum to the Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP. Under the Settlement Agreement, the parties recognize that the Addendum has been completed and agree not to challenge the mitigation measures (Settlement Agreement, III.F). The measures require that prior to any ground disturbing work on the Kern Water Bank that qualified professionals conduct a pedestrian survey and that any cultural resources identified during a survey be recorded, evaluated and mitigated pursuant to Section 106 of the National Historic Preservation Act. The measures also include a requirement to evaluate, consistent with Section 106 the eight recorded archeological sites on the Kern Water Bank and that if any human remains are found that work would be halted and the Kern County Coroner notified.

10.1-20 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially damage or destroy cultural and paleontological resources in San Luis Reservoir, Lake Oroville, Lake Perris and Plumas County.

San Luis Reservoir and Lake Oroville

Exposed shoreline along reservoirs due to decreased water levels would expose known or unknown cultural resources. However, changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels.

Lake Perris

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. Draw down of the reservoir to date has reduced the volume by approximately 40 percent. When the reservoir volume is reduced there is a band of soil exposed around the perimeter which could increase the potential for known and/or unknown cultural or paleontological resources to be subject to damage. One recorded site could be exposed under drawdown conditions.

The draw down of Lake Perris and the exposed soil around the perimeter of the reservoir is expected to be maintained through 2012. The perimeter will be reduced once the reservoir is full and operating under normal conditions. Therefore, the potential increase in exposure of cultural or paleontological resources to damage due to maintaining a lower pool volume would be significant but short-term.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions. If this worst-case scenario were to occur, the area exposed around the perimeter of the reservoir could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project.

Plumas County

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. Construction activities could result in ground disturbance activities (grading or excavation for bank stabilization, ground disturbance for soil enrichment or planting).

Portions of Plumas County were occupied in prehistoric and historic times by several Native American groups, and many of these areas have not been surveyed for cultural resources. Much of the proposed restoration and stabilization work would occur in or near stream channels, which tended to be common areas for Native American settlement. Evidence of these activities, as well as the historically or culturally significant sites themselves, is likely to be present. Consequently, to the extent that construction activities could result in ground disturbance, archaeological resources, including human burials, which could be present in these areas, could be damaged or destroyed.

Portions of Plumas County, particularly near Lake Oroville and the Feather River, are underlain by the Monte de Oro rock formation, which contains a variety of fossils. Tertiary plant and vertebrate fossils have been observed in bluffs along rivers and streams and may also be present along the Feather River. Proposed restoration and stabilization work would occur in or near stream channels, which are locations in which fossils have been observed and ground disturbance could damage or destroy paleontological resources.

Impact Summary

The potential for damage or destruction of cultural resources attributed to changes in reservoir levels in San Luis Reservoir and Lake Oroville would be cumulatively less than significant because water surface elevations are not anticipated to significantly change and the chance of uncovering resources currently below the normal operating water surface elevations is minimal.

Drawdown of Lake Perris and the construction of watershed projects in Plumas County could increase the risk of damage or destruction of known or previously unidentified cultural resources. Therefore, this is considered a potentially significant cumulative impact. The project's contribution would be considerable because it could include extended drawdown of Lake Perris under Article 54 and construction of watershed improvement projects in Plumas County, all of which could contribute to the exposure of cultural resources to damage or destruction. Therefore, the potential for damage or destruction of cultural and paleontological resources is considered a ***potentially significant cumulative impact***.

Mitigation Measures

Implementation of the following mitigation measure would substantially limit the project's contribution and this would be a ***less-than-significant cumulative impact***.

10.1-20 *Implement Mitigation Measures 7.13-2(a) through (c) and 7.13-3(a) through (d).*

Implementation of Mitigation Measure 7.13-2(a) would reduce potentially significant impacts on archaeological resources to a less-than-significant level by requiring identification of known or suspected archaeological resources and requiring the analysis, protection, or scientific recovery and evaluation of any archaeological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding history or prehistory is not lost.

Implementation of Mitigation Measure 7.13-2(b) would reduce potentially significant impacts on paleontological resources to a less-than-significant level by requiring identification of known or suspected resources and requiring the analysis, protection, or scientific recovery and evaluation of any paleontological resources that could be encountered, which would ensure that important scientific information that could be provided by these resources regarding the past is not lost.

Implementation of Mitigation Measure 7.13-2(c) would reduce this potentially significant impact to a less-than-significant level by ensuring appropriate examination, treatment, and protection of human remains, consistent with the applicable provisions of State law.

Mitigation Measures 7.13-3(a) through (d) were outlined in the Initial Study and Addendum to the Monterey Amendment EIR of the KWBA, Kern Water Bank HCP/NCCP. Under the Settlement Agreement, the parties recognize that the Addendum has been completed and agree not to challenge the mitigation measures (Settlement Agreement, III.F). The measures require that prior to any ground disturbing work on the Kern Water Bank that qualified professionals conduct a pedestrian survey and that any cultural resources identified during a survey be recorded, evaluated and mitigated pursuant to Section 106 of the National Historic Preservation Act. The measures also include a requirement to evaluate, consistent with Section 106 the eight recorded archeological sites on the Kern Water Bank and that if any human remains are found that work would be halted and the Kern County Coroner notified.

Public Services and Utilities

None of the proposed project elements would directly result in changes in population that would generate a need for new or expanded government facilities or an increase in demand for public services and utilities. Because there would be no impact, there would be no combined effect with other cumulative projects. Therefore, ***no cumulative impact*** would occur. Impacts associated with the potential for the proposed project to cumulative growth are discussed in Chapter 8 Growth Inducement.

Traffic and Transportation

The cumulative context for increases in noise levels would be the southern San Joaquin Valley, Castaic Lake, Lake Perris, San Luis Reservoir, Lake Oroville, and Plumas County.

Because none of the projects on the cumulative list would change water levels in Castaic Lake, there would be no combined effect with the proposed project. Therefore, no cumulative impact would occur.

10.1-21 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect traffic and circulation in southern San Joaquin Valley, San Luis Reservoir, Lake Oroville, Lake Perris and Plumas County.

<u>Southern San Joaquin Valley</u>

Implementation of the proposed project, in combination with other water development and reallocation projects could alter agricultural practices in southern San Joaquin County.

Changes in agricultural practices could alter traffic volumes. The numbers of vehicle trips to fields at fields with permanent crops would likely be the same or less than trips to fields with annual crops. An increase in vehicle trips could contribute to decreased levels of service on local roads.

With the proposed project, approximately 1,200 acres of ponds would be developed on the Kern Fan Element property and approximately 500 acres of ponds as part of other groundwater storage facilities in Kern County. In addition, the Semitropic Water Storage District is proposing to construct the Stored Water Recovery Unit. The cumulative construction of groundwater banking facilities could increase the number of vehicle trips during construction and to perform routine maintenance. The increases in vehicle trips would have little effect on traffic flow on affected local roads.

San Luis Reservoir and Lake Oroville

The amount of recreational boat use usually increases with increasing water levels in reservoirs that support recreational activities. Conversely, boating decreases when water levels are lower. Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels and therefore, vehicle trips on local and regional roads would not be expected to significantly change.

Lake Perris

The seismic retrofit project at Lake Perris would reduce the total volume of the reservoir. The reductions in reservoir volumes has limited access to multiple facilities and reduced recreational activities and associated vehicle trips to and from the reservoir.

Article 54 of the Monterey Amendment allows SWP contractors to borrow water from Lake Perris under certain conditions. Such borrowing could further reduce reservoir water levels if implemented concurrent with the seismic retrofit project draw down. The effects of borrowing of water on water surface elevations would depend on the extent to which MWDSC makes use of Article 54, Department approval, the season of us, other operational factors and future hydrologic conditions.

A multi-agency MOU signed by the Departments of Water Resources, Parks and Recreation, Boating and Waterways, and Fish and Game along with MWDSC, establish the “Lake Perris Operations Guidelines” which provide for recreational resource protection, benefits to fishery resources and protection of water quality at Lake Perris. Never the less, the proposed project, in combination with the Seismic Retrofit Project, could result in a worst-case scenario where the reduction in elevation and the associated decrease in the availability of recreational facilities could potentially be equal to or greater than what would have occurred in the absence of the seismic retrofit project. Therefore, it is anticipated that there could be a short-term reduction in vehicle trips to and from the reservoir under cumulative conditions.

Plumas County

Watershed improvement projects take many forms but most involve actions to prevent erosion and restore wildlife habitat along streams and rivers. In general, projects of this type improve the appearance of stream banks by returning them to a more natural condition. The number and size of watershed improvement projects would be relatively small and the construction activities temporary; therefore, the associated increase of vehicle trips on local roads would also be anticipated to be limited and temporary.

Impact Summary

An increase in vehicle trips could contribute to decreased levels of service on local roads. However, the numbers of vehicle trips to fields at fields with permanent crops would likely be the same or less than trips to fields with annual crops. Implementation of the proposed project in combination with other cumulative projects could contribute towards the conversion of annual crops to permanent crops; however, this is an existing trend and the land would remain in agricultural production. Therefore, it is unlikely that there would be any increase in vehicle trips, and if there was it would have little effect on traffic flow on affected local roads.

Changes in the amount of water stored at San Luis Reservoir and Lake Oroville attributed to the proposed project in combination with other cumulative projects would not be anticipated to have a significant effect on water surface elevations compared to normal operating levels and therefore, vehicle trips on local and regional roads would not be expected to significantly change. Furthermore, there would be an anticipated short-term reduction in vehicle trips to and from Lake Perris under cumulative conditions.

Finally, vehicle trips associated with the construction and maintenance of watershed improvement projects in Plumas County would be temporary and limited.

Therefore, increased vehicle trips attributed to the construction and/or operation of cumulative water development and reallocation projects would result in a ***less-than-significant cumulative impact***.

Mitigation Measures

None required.

Energy

The cumulative context for energy would be SWP hydroelectric facilities (including, but not limited to Thermalito Diversion Dam, Hyatt-thermalito, Gianelli, Alamo, Warne, Mojave Siphon, and Devil Den) and other energy providers in California, the Northwest and the Southwest which the Department has agreements to sell, buy or exchange energy.

10.1-22 Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially increase energy demand.

Implementation of the proposed project in combination with other cumulative water development and reallocation projects would increase energy use associated with increased pumping and water distribution. Increased energy use would increase the demand at existing SWP hydroelectric facilities and other facilities that provide energy for the SWP. An increase in energy demand could result in the need to expand or construct new energy production and distribution facilities. This would be considered a significant cumulative impact.

The power analysis for proposed project energy consumption projected that there would be a minimal increase (2.02 percent) in the long term net power requirements of the SWP (see Table 7.16-2 in Section 7.16).

In the future, some of the SWP hydroelectric power plants would generate less energy (Alamo, Mojave, and Devil Canyon), some would produce the same amount of energy (Gianelli, Oroville and Thermalito), and some would produce more energy (Warne and Castaic) (see Table 7.16-3 in Section 7.16). An overall increase of 128 GWh in energy loads at the pumping plants is also projected; about 75 percent of this increase occurs at South Bay and Edmonston Pumping Plants. Four other pumping plants show a decrease in energy loads: Banks, Dos Amigos, Las Perillas, and Badger Hill (see Table 7.16-3).

SWP pumping facilities are designed to meet the anticipated demands to deliver SWP water to the SWP Contractors, and this rated capacity would not be exceeded by implementation of the proposed project. The amount of additional power required would be within the limits of the planned power supply, and no expansion or construction of new facilities to generate power would be required. No new long-term or short-term contracts would be necessary under future conditions. Additionally, with a total long-term net load increase of 2.02 percent, the project's contribution to increased energy demand would not be considerable and therefore, this would be a ***less-than-significant cumulative impact***.

<u>Mitigation Measures</u>

None required.

Growth-Inducement

As described in Chapter 8, Growth-Inducing Impacts, in order to comply with CEQA, an EIR must discuss the ways in which the proposed project could affect economic or population growth in the vicinity of the project and how the characteristics of the project could result in other activities with adverse impacts to the environment. Also discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment. This discussion summarizes potential cumulative growth-inducing impacts attributed to water development projects, including the proposed project, and the project's contribution to this cumulative growth.

The proposed project in combination with other water development projects could support population growth in California. As identified in Chapter 8, by 2020, the additional water supply that would be made available by the Monterey Amendment through average annual Table A deliveries to eight M&I contractors could support a maximum increase in population of approximately 392,808 to 561,684 (depending on the future scenario) in their service areas. Average annual Table A and Article 21 deliveries to seven M&I contractors could support a maximum increase in population of approximately 405,104 to 561,685. California's population in 2000 was estimated to be 34,088,135 and is estimated to be 48,110,700 by 2030.[1] This represents an increase in population of 14,022,565 by 2030. The project's contribution to state-wide population growth would represent a maximum of .04 percent of the estimate increase in population. It is reasonable to assume that the actual population growth in 2020 in the state and supported by the project would be less than that estimated for 2030. The effects of this cumulative increase in population are discussed below.

Environmental Impacts

Because there could be a cumulative increase in population in the State and the project would contribute to this increase, existing undeveloped land could be converted to urban uses or current urbanization could be intensified, which could have secondary (or indirect) environmental effects such as impacts on special-status species and their habitat, changes in storm water quality and quantity due to increased impervious surface cover, reduction in air quality, increased traffic and noise levels, reduction in public service and utility levels of service, etc.

The specific environmental effects associated with increased population are too speculative to predict or evaluate since the exact location and manner of potential future development cannot be determined. However, this Program EIR provides an independent but generalized analysis of secondary impacts based on the known environmental effects of urban development in California. This analysis is presented below. The cumulative environmental impacts of implementing the proposed project are evaluated in this chapter of the EIR.

The conversion of land to urban uses could result in a variety of different environmental impacts. Land that would be converted to urban uses along transportation routes and on the fringes of existing urban and suburban areas is typically undeveloped or used for agriculture. Conversion to urban uses of agricultural lands removes this land permanently from being available for agricultural production. In addition, conversion of agricultural or undeveloped lands eliminates most of the wildlife habitat value of these lands. Landform and drainage patterns could be altered, with natural drainage channels largely replaced by engineered storm water systems. Impermeable roofs, parking lots, and roadways could replace permeable surfaces with a consequent increase in storm water runoff and a decrease in groundwater recharge. Various substances associated with homes, yards, and vehicle use (paints, pesticides, plasticizers, oil and grease, brake dust, pet wastes, etc) could be deposited on urban surfaces and conveyed to natural waterways. The introduction of people and vehicles into previously unpopulated or lightly populated areas could increase traffic, noise levels, air pollutant emissions, the generation of sanitary wastewater and solid waste, and the demand for local services.

Conclusions

The additional water supply that would be made available by cumulative water development projects, including the proposed project, would support projected state-wide population growth. It is unlikely that all of the population growth potentially supported by future water development would occur because some of the water would be used for other purposes such as improving the reliability of water supplies, or that any growth that did occur could be attributed solely to water supply development.

Increases in population can result in new development that causes adverse impacts to the environment. This discussion concludes that some of the impacts are potentially significant and cannot be avoided. Neither the Department nor other water supply agencies make local decisions regarding growth and where it will occur. Cities and counties in the contractor service areas affected by the increased population are responsible for considering the environmental effects of their growth and land use planning decisions. When new developments are proposed, the cities and counties prepare environmental documents pursuant to CEQA. Where appropriate, they must consider mitigation measures, alternatives and overriding considerations.

ENDNOTES

1. California Department of Water Resources, California Water Plan Update 2005, Volume 3, Figure 1-1, page 1.ii.

10.2 SIGNIFICANT AND UNAVOIDABLE IMPACTS

10.2 SIGNIFICANT AND UNAVOIDABLE IMPACTS

The following is a summary of potentially significant and unavoidable impacts identified and discussed in the technical sections of this EIR contained in Chapter 7. CEQA Guidelines Section 15126.2(b) states that an EIR must include a description of those impacts identified as potentially significant and unavoidable should the proposed action be implemented. These impacts are unavoidable because it has been determined that either no mitigation, or only partial mitigation, is feasible. The final determination of significance of impacts and of the feasibility of mitigation measures would be made by the Department as part of the certification action.

The potential environmental impacts that would result from implementation of the proposed project are presented in Chapter 7 of this Draft EIR and summarized in the Executive Summary. Those impacts that cannot be feasibly mitigated to a less-than-significant level would remain as potentially significant and unavoidable adverse impacts. Impacts found to be potentially significant and unavoidable will require adoption of a Statement of Overriding Considerations by the Department prior to adoption of the EIR. Those impacts found to be potentially significant and unavoidable include

7.4-2 Implementation of the proposed project could potentially affect special-status terrestrial biological resources in the southern San Joaquin Valley portion of Kern County (excluding the Kern Fan Element property) resulting from construction of new groundwater storage facilities. (FUTURE)

7.4-5 Implementation of the proposed project could potentially affect special-status terrestrial biological resources at Lake Perris. (FUTURE)

7.4-6 Implementation of the proposed project could potentially affect riparian habitat and the special-status terrestrial species it supports at Lake Perris. (FUTURE)

7.5-4 Implementation of the proposed project could affect visual resources at Castaic Lake and Lake Perris. (FUTURE)

7.7-6 Fluctuation in water surface elevations at Castaic Lake and Lake Perris as a result of flexible storage and extended carryover practices could potentially alter the amount of shoreline exposed to wind erosion, which could generate wind-blown particulate emissions. (FUTURE)

7.8-4 Implementation of the proposed project could potentially affect rates of erosion at Castaic Lake and Lake Perris. (FUTURE)

7.9-1 Implementation of the proposed project could potentially affect recreational resources at Castaic Lake and Lake Perris. (FUTURE)

7.13-2 Groundwater banks developed or expanded in response to opportunities to store groundwater outside service areas under Article 56 could potentially damage or destroy cultural and paleontological resources in the southern San

Joaquin Valley portion of Kern County (excluding the Kern Fan Element). (FUTURE)

7.13-6 **Implementation of the proposed project and its alternatives could result in potential damage and/or destruction of cultural and paleontological resources in Plumas County as a result of watershed improvement projects. (FUTURE)**

10.1-3 **Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect special-status terrestrial biological resources in the southern San Joaquin Valley. (CUMULATIVE)**

10.1-5 **Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect special-status terrestrial biological resources at Lake Perris. (CUMULATIVE)**

10.1-6 **Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially affect riparian habitat and the special-status terrestrial species it supports at Lake Perris. (CUMULATIVE)**

10.1-8 **Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially affect visual resources at Lake Perris. (CUMULATIVE)**

10.1-11 **Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially alter the amount of shoreline exposed to wind erosion, which could generate wind-blown particulate emissions. (CUMULATIVE)**

10.1-13 **Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially increase rates of soil erosion. (CUMULATIVE)**

10.1-15 **Implementation of the proposed project in combination with the Lake Perris Seismic Retrofit Project could potentially affect recreational resources at Lake Perris. (CUMULATIVE)**

10.1-19 **Implementation of the proposed project in combination with cumulative water development and reallocation projects could potentially damage or destroy cultural and paleontological resources in the southern San Joaquin Valley. (CUMULATIVE)**

10.3 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL IMPACTS

10.3 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL IMPACTS

Section 15126.2(c) of the CEQA Guidelines requires a discussion of any potentially significant irreversible environmental changes that would be caused by the proposed project. Section 15126.2(c) states:

> Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible, since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and, particularly, secondary impacts (such as highway improvement which provides access to a previously inaccessible area) generally commit future generations to similar uses. Also, irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.

Generally, a project would result in potentially significant irreversible environmental changes if:

- The primary and secondary impacts would generally commit future generations to similar uses;
- The project would involve uses in which irreversible damage could result from any potential environmental accidents associated with the project;
- The project would involve a large commitment of nonrenewable resources;
- The proposed consumption of resources is not justified (e.g., the project involves the wasteful use of energy).

Implementation of the proposed project would not directly commit future generations to similar uses because its primary effect is the reallocation of SWP water supplies. However, as discussed in Chapter 8, additional water supply that would be made available through average annual Table A deliveries to eight M&I contractors could support increased population in their service areas. Increased population can result in new development. However, at the statewide level, no change in population growth levels would result from the proposed project. Further, neither the California Department of Water Resources nor local water supply agencies make local decisions regarding growth and where it will occur. Cities and counties in the contractor service areas affected by the increased population are responsible for considering the environmental effects of their growth and land use planning decisions. Future urban development could commit future generations to similar uses because restoration back to a less developed condition is not generally feasible depending on the degree of disturbance and level of capital involvement.

The CEQA Guidelines also require a discussion of the potential for irreversible environmental damage caused by an accident associated with construction of groundwater storage facilities. While construction of such facilities could result in the use, transport, storage, and disposal of hazardous wastes, as described in Chapter 7.11, Hazardous and Hazardous Materials, all activities would comply with applicable state and federal laws related to hazardous materials, which significantly reduces the likelihood and severity of accidents that could result in irreversible environmental damage.

As discussed above, growth-inducing effects of the proposed project at the local level could result in the long-term commitment of resources to urban development. The most notable significant irreversible impacts are alteration of the visual character of a site (or area), increased generation of pollutants, and the short-term commitment of non-renewable and/or slowly renewable natural and energy resources. Operations associated with future urban development could also consume natural gas and electrical energy. Compliance with all applicable building codes, as well as mitigation measures, planning policies, and standard conservation features, would ensure that natural resources are conserved to the maximum extent possible. In addition, implementation of the proposed project would include the need for increased pumping of SWP water which would also require additional consumption of energy. It is assumed that the amount and rate of consumption of these resources would not result in the unnecessary, inefficient, or wasteful use of resources and would be accomplished in a manner consistent with applicable laws and regulations. It is also possible that new technologies or systems will emerge, or will become more cost-effective or user-friendly, to further reduce the reliance upon nonrenewable natural resources. Resources would also be consumed during the construction of groundwater storage facilities. Construction activities related to the proposed project would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline for automobiles and construction equipment.

10.4 ENVIRONMENTAL JUSTICE

10.4 ENVIRONMENTAL JUSTICE

10.4.1 INTRODUCTION

The concept of environmental justice embraces the principles of fair treatment of all people regardless of race, color, nation of origin, or income and meaningful involvement of people within communities. Environmental justice communities are commonly identified as those where residents are: (1) predominantly minorities or low-income; (2) excluded from the environmental policy setting or decision-making process; (3) subject to a disproportionate impact from one or more environmental hazards; and (4) subject to disparate implementation of environmental regulations, requirements, practices and activities. Environmental justice efforts attempt to address the inequities of environmental protection within these communities. Legal authorities to support these efforts include both statutory and common-law protections. Both the federal government and the State of California have taken formal steps in recent years to address this issue. Environmental justice considerations associated with the proposed project are presented below. Potential effects related to growth inducement are discussed in Chapter 8.

10.4.2 ENVIRONMENTAL SETTING

Because the communities that could be affected by the proposed project are located in the areas served by the SWP and corresponding contractor service areas, vital statistics such as race, ethnic origin, and poverty status were obtained for a large number of communities spanning the State from Plumas County in the north to Kern County in the south. As described in Chapters 4 and 6, and in Section 7.1 in this EIR, the proposed project would result in changes in Table A deliveries of SWP water to state water contractors and changes in the management of water supplies through a variety of articles in the Monterey Amendment. Population, race/origin, and poverty data collected for this section of the EIR is based on the 2003 update to the 2000 U.S. Department of Commerce's Census Bureau.

In general, water supplied by the SWP is considered to be more reliable and affordable than alternative water sources and thus, improves the economy where businesses are located. Actions associated with the proposed project could make additional water supplies available for delivery to SWP contractors, particularly during drier conditions when deficiencies may occur.

10.4.2.1 Regional Setting

The regional setting is defined by those SWP service areas affected by the project: the Bay service area (Solano, Napa, Alameda, and Santa Clara counties), the Central Coast service area (San Luis Obispo and Santa Barbara counties), the San Joaquin Valley service area (Kings and Kern counties), and the Southern California service area (Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties). Additionally, Plumas and Butte counties, and Yuba City are included in the regional setting. The same information for the State of California is presented for comparison.

The service area with the highest minority percentage of population is the Bay service area, which has a 41.2% minority population (Table 10.4-1). The service areas with the lowest minority populations are Butte and Plumas counties, Yuba City, and the Central Coast service

TABLE 10.4-1

RACE/ORIGIN CHARACTERISTICS IN 2003 BY SERVICE AREA[1] (%)

Total Population	White	Black	Amer. Indian	Asian	Haw'n/ Pacific Isl.	Other	Multi	Hispanic Origin	Total percent	Total Minority
2,629,024	55.2	4.7	0.7	20.5	0.4	10.3	4.7	20.8	96.4	41.2
1,034,696	55.1	5.6	1.6	2.7	0.1	26.0	3.9	41.1	95.0	40.0
504,898	73.7	1.9	1.1	3.6	0.2	12.8	4.0	29.1	97.3	23.5
20,734,887	53.7	6.9	0.8	9.9	0.3	19.1	4.5	36.9	95.2	41.5
264,698	81.0	1.2	1.9	3.0	0.1	6.1	3.7	12.3	97.0	16.0
61,390	65.4	2.6	1.5	9.5	0.3	11.4	4.7	19.9	95.4	29.9
68,823	89.4	0.7	2.4	0.6	0.1	1.8	3.1	5.9	98.1	8.7

Notes:
Percentages may add to more than 100% because individuals may report more than one race. "Hispanic" is considered an origin by the Census Bureau. Therefore, those of Hispanic Origin are also counted in one of the race categories.
1. Statistics are for the entire county, even if only a portion is included in the service area.
Source: U.S. Department of Commerce, Census Bureau, 2003.

areas, with 16.0%, 29.9%, 8.7%, and 23.5% minority populations, respectively. For comparison, the State of California had a 40.5% minority population in the same year.

The service areas with the largest Hispanic origin population are the Central Valley service area and the Southern California service area, which had 41.1% and 36.9% Hispanic origin populations, respectively. The lowest Hispanic origin population from a regional environmental setting was in Plumas County, with 5.9%. During the same year, the State of California had a 32.4% Hispanic origin population.

The service areas with the highest poverty levels were the Yuba City, Central Valley, and Southern California service areas, with higher percentages of households below the poverty level than the State as a whole. The Bay service area and the Central Coast service area had poverty levels below the State average of 13.2% (see Table 10.4-2).

TABLE 10.4-2

POVERTY STATISTICS IN 2003

	Service Areas							
	Bay	Central Coast	Central Valley	Southern California	Butte County	Plumas County	Yuba County	State of California
Percent Below Poverty Level	9	9.4	17.7	12.4	15.2	9.8	18.1	13.2

Source: U.S. Department of Commerce, Census Bureau, 2003.

10.4.2.2 Regulatory Setting

Federal

Executive Order 12898

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", requires that each federal agency, to the greatest extent practical and permitted by law, shall "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions…" Thus, federal agencies are to ensure that their actions do not result directly of indirectly in discrimination on the basis of color, race, or national origin, and that potential impacts on minority or low-income populations be taken into account during preparation of environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by federal agencies.

State

California Government Code Section 65040.12

California Government Code, Section 65040.12(e), defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation and enforcement of environmental laws, regulations, and policies." California Government Code, Section 65040.12(a) designates the Governor's Office of Planning and Research (OPR) as the coordinating agency in state government for environmental justice programs, and requires OPR to develop guidelines for incorporating environmental justice into general plans.

Title 14 California Code of Regulations (CCR) Section 15131

Title 14, CCR Section 15131 provides that economic or social information may be included in an EIR, but those economic or social effects shall not be considered as significant effects on the environment. In an EIR, the lead agency can trace the chain of cause and effect from the proposed decision on the project through anticipated economic or social changes resulting from the project that, in turn, lead to physical changes in the environment. Identified potential economic/social changes also can be used to determine the significance of the physical changes on the environment.

10.4.3 METHOD OF ANALYSIS AND SIGNIFICANCE CRITERIA

The proposed project could be expected to alter conditions affecting local water supply reliability, revenue generating mechanisms to support future improvements (e.g., flood control and water supply projects), and water supply management and reliability for state water contractors. Water deliveries contribute important economic benefits that are experienced by residential water users, as well as by the owners, employees, and customers of a wide variety of agricultural, municipal, and industrial businesses. Municipal water utilities and irrigation districts receive water deliveries then provide water to individual residents and businesses for direct consumption and use.

Although the environmental justice approaches contained within Executive Order 12898 and California Government Code Section 65040.12 differ, the underlying intention of both regulations is the fair and equal treatment of all races, cultures, and incomes. In addition, the CEQA Guidelines, Section 15131, provide guidance in determining potential environmental justice impacts, and although the CEQA Guidelines do not recognize an economic or social change as a significant impact, social change may be considered as it relates to determining the significance of a physical change on the environment. The analysis of environmental justice impacts examines the extent to which each alternative would affect a local economy and the different socioeconomic groups participating in the local economy. For the purposes of this chapter, qualitative methods were used to evaluate whether the proposed project would result in fair and equal treatment of minorities and low-income persons in the state water contractors' service areas.

Concerns associated with environmental justice relate to minority and low-income populations that could be disproportionately affected by implementation of a proposed project. Environmental justice impacts would be considered potentially significant if implementation of the proposed project would result in direct or cumulative impacts on the natural or physical environment that would result in a proportionately high or adverse impact on a minority or low-income population, considering the population levels or income levels of all affected groups.

10.4.4 IMPACT ANALYSIS

The proposed project would provide more flexibility with regard to SWP water deliveries available to state water contractors for delivery to communities in their service area and also water supply management measures that would result in more reliable water supplies during dry years. Because existing water supplies would not be reduced for any specific community based on race, origin, or economic status as part of the proposed project, and would likely be more reliable in the future during dry years, potential impacts that could constrain water supply availability, preclude use, or cause other environmental justice effects would not be expected to occur as a result of the proposed project.

Therefore, the proposed project would not result in unfair or unequal treatment of any socioeconomic group within the regional context described above and would not result in any disproportionately high or adverse impacts on minority or low-income communities.

10.4.4.1 Cumulative Impacts

The proposed project would not result in any environmental justice impacts and, therefore, would not contribute to cumulative impacts.

10.4.4.2 Mitigation Measures

The proposed project would not result in impacts to minority or low-income communities and, thus, no mitigation measures are required.

11. ALTERNATIVES

11. ALTERNATIVES

11.1 INTRODUCTION

CEQA Guidelines, Section 15126.6(a) state that an EIR must describe and evaluate a reasonable range of alternatives to the proposed project that would feasibly attain most of the project's basic objectives, but that would avoid or substantially lessen any significant adverse environmental effects of the project. An EIR is not required to consider every conceivable alternative to a proposed project. Rather, it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation. In addition to any other alternatives considered, an EIR must include an evaluation of "no project" to allow decision-makers to compare the results of approving or disapproving the proposed project (CEQA Guidelines, Section 15126.6(e)).

11.1.1 No Project Alternatives

If the Monterey Amendment had not been implemented in 1995, management of the SWP might have proceeded in any number of ways. It is, of course, impossible to know which path management would have been followed and so, in the following analysis, several possibilities rather than a single path were examined. The several versions of "no project" examined in this EIR encompass a range within which all reasonable possibilities lie. They are listed and briefly described below.

- **No Project Alternative 1 (NPA1)**. Under this alternative, none of the elements of the proposed project (Monterey Amendment and Settlement Agreement) would be implemented. The Kern Fan Element property would remain in state ownership and a state-owned but locally operated water bank would be developed there to improve reliability of SWP deliveries in dry periods. The water bank would have a storage capacity of 350,000 acre-feet in 2003 and 500,000 acre-feet in 2020.[1]
- **No Project Alternative 2 (NPA2)** Under this alternative all Monterey Amendment actions that took place between 1995 and 2003 would occur. The actions include the Table A transfers and retirements that occurred between 1995 and 2003, the altered water allocation procedures, the water supply management practices, including out-of-service area storage, and the transfer of the Kern Fan Element property to KCWA. In 2003, some of the water supply management practices and the altered water allocation procedure would be discontinued. Flexible storage in Castaic Lake and Lake Perris, extended carryover storage in San Luis Reservoir and the turnback pool would be discontinued. Storage outside contractor's service areas would still be permitted but would be limited to those programs in place in 2003. No new or expanded out-of-service area storage programs would take place. Beginning in 2003, water would be allocated in accordance with pre-Monterey Amendment allocation rules. The Settlement Agreement and the post-2003 Monterey Amendment Table A transfers would not take place.
- **Court-Ordered No Project Alternative 3 (CNPA3)** In September 2000, the court in PCL v. DWR ordered the Department to prepare a new EIR on the Monterey Amendment that contained an analysis of a no project alternative that included invocation of Article 18(b) of the pre-Monterey Amendment long-term water supply

contracts. Under CNPA3, Article 18(b) of the pre-Monterey Amendment long-term water supply agreements would be invoked and the sum of the Table A amounts would be reduced from 4.23 to 1.9 million acre-feet. The sum of the Table A amounts for CNPA3 was estimated based on the initial requirement that the SWP be able to deliver the sum of the Table A amounts in almost all years. It was estimated, and discussed with the EIR Committee's modeling subcommittee, that the SWP can deliver 1.9 million acre-feet with its existing facilities and within the current regulatory framework in all but one year in the 73-year hydrologic record. Under this alternative none of the elements of the Monterey Amendment would be implemented. In years when available supplies are equal to or less than 1.9 million acre-feet, water would be allocated in accordance with pre-Monterey Amendment Article 18(a) provisions for temporary shortages. In years when available supplies exceeded 1.9 million acre-feet, surplus water would be allocated proportional to contractor's Table A amounts. The Kern Fan Element property would remain in state ownership and a water bank would be developed there as planned by the Department. It would have a storage capacity of 350,000 acre-feet in 2003 and 500,000 acre-feet in 2020. The Settlement Agreement would not be implemented.

- **Court-Ordered No Project Alternative 4 (CNPA4)** CNPA4 is similar to CNPA3. Because there is uncertainty about how water available in excess of the estimated 1.9 million acre-feet sum of the reduced Table A amounts would be allocated by the Department after invocation of Article 18(b), CNPA4 includes a different water allocation method from CNPA3. Under CNPA4, preference would be given to agricultural and groundwater replenishment use in the allocation of surplus water. Otherwise it would the same the same as CNPA3.

11.1.2 Other Alternatives

With respect to alternatives other than the no project alternative, the approach taken with the Monterey Plus EIR was to first analyze the environmental effects of the proposed project and determine whether the proposed project had any significant adverse environmental impacts. If the proposed project had no significant adverse environmental effects there would be no need to analyze alternatives other than the required no project alternative. The analysis indicates that the proposed project could have potentially significant adverse effects on fisheries resources in the Sacramento San Joaquin Delta and on environmental resources at Castaic Lake and Lake Perris, in the San Joaquin Valley portion of Kern County and in Plumas County. It follows that alternatives other than the no project alternative must be examined to determine whether an alternative could meet most of the objectives of the proposed project but with lesser adverse environmental impacts.

Some members of the advisory committee suggested alternatives for evaluation in the EIR. The Department reviewed the suggested alternatives and determined whether they should be analyzed in detail in the EIR using the screening criteria listed below. Alternatives were selected for detailed analysis if they:

- met most of the proposed project's objectives;
- lessened the significant environmental impacts resulting from the proposed project; and,
- are sufficiently technically, financially and institutionally feasible to be implemented in a reasonable period of time.

None of the alternatives suggested met all the screening criteria but one alternative was selected for detailed analysis. The selected alternative is described below:

- **Alternative 5** would be the same as the proposed project except that the Monterey water supply management practices would not be implemented. It would include the same Table A transfers and retirements as the proposed project, the altered water allocation procedures and the transfer of the Kern Fan Element lands and conveyance of non-project water. Although there is doubt about the institutional feasibility of Alternative 5 it was decided that it should be analyzed because it would lessen the adverse environmental impacts of the Monterey Amendment. This is because most of the impacts of the Monterey Amendment stem from the Monterey water supply management practices that are excluded from Alternative 5.[2]

Some members of the advisory committee suggested alternatives and alternative project features that are analyzed in this EIR. The plaintiff's suggestions were contained in a letter to the Department dated December 18, 2006. The plaintiffs suggested that an alternative be considered that involves the invocation of Article 18(b) of the pre-Monterey Amendment long-term water supply contracts. This possibility is represented by CNPA3 and CNPA4, both of which are examined in detail in this chapter of the EIR. The plaintiffs suggested an alternative in which the Department would retain ownership of the Kern Fan Element property and would develop a state-owned water bank there, which would be used to improve dry year reliability of SWP deliveries. A state-owned water bank on the Kern Fan Element property is a part of NPA1, CNPA3 and CNPA4. The plaintiffs suggested an alternative that does not include the transfer of 41,000 acre feet of Table A amount from KCWA to Castaic Lake WA that occurred in 2000 but which was subsequently challenged in the courts. The KCWA to Castaic Lake WA transfer is not included in NPA1, CNPA3 and CNPA4.

The contractors' indicated that, in their view, many elements of the Monterey Amendment that were implemented between 1996 and 2003 cannot practically be reversed. The elements of the Monterey Amendment that the contractors believe cannot be reversed are included in NPA2. NPA2 includes the Table A transfers and retirements and water supply management practices that occurred between 1996 and 2003 and the transfer of the Kern Fan Element property for local development and use as a water bank, all of which the contractors consider to be irreversible.

The plaintiffs also suggested that an alternative should be considered that takes account of the effects of climate change on California's hydrology and SWP deliveries. The Department agreed that climate change should be considered in the EIR but that it did not represent an alternative to the proposed project because it is a condition that affects the proposed project and all of the alternatives. The topic is discussed in detail in Chapter 12.

11.2 ALTERNATIVES CONSIDERED BUT REJECTED

Some members of the advisory committee suggested alternatives that were rejected from further consideration by the Department because they did not meet the screening criteria described above. Some of the suggestions were for complete alternatives to the proposed project; others were for project features that might be incorporated into an alternative. The two types of suggestions are described separately below.

11.2.1 Buildout SWP Alternative

When the long-term water supply contracts were executed the Department intended to build sufficient storage and conveyance facilities to reliably deliver 4.2 million acre-feet of water to the contractors in all but the most extreme droughts. As discussed in Chapter 2, for a variety of reasons the Department has not been able to build several of the storage and conveyance facilities envisaged when the SWP was planned. Consequently, the Department is currently unable to reliably deliver as much water as originally planned.

This alternative would involve completing sufficient new state-owned water supply facilities to provide completely reliable delivery of approximately 4.2 million acre-feet per year of SWP water in all but the driest years. It would meet some of the objectives of the Monterey Amendment but not in a reasonable amount of time. The Department's efforts to complete new storage and conveyance facilities have had limited success since the early 1970s. Even if political obstacles can be overcome, several decades of planning, permitting, engineering and construction would be required to add the water supply facilities necessary to provide a high level of reliability. The alternative was not evaluated in detail in the EIR because it could not be implemented within a reasonable period of time.

It is useful to note that in the Department's water planning the concept of firm yield (a set amount of water that can be delivered almost every year) has been replaced by water reliability curves that show the likelihood of full Table A deliveries by the SWP under different hydrologic conditions.[3] Furthermore, the Department is encouraging contractors to develop multiple water supply sources so that they can take advantage of years when more water is available from the SWP and supplement SWP water when it is scarce.

11.2.2 Urban Preference and Dry Year Reliability Alternative

This alternative would use pre-Monterey water allocation procedures (urban preference in dry years) but would require the Department to introduce a new level of water management by the state that would enable it to guarantee water to urban contractors in multiple year droughts and prevent the proposed project from inducing new urban growth. Under this alternative, the SWP would be re-operated to store wet year water in groundwater banks and surface reservoirs within and outside the SWP service area in order to guarantee water to urban development during multiple year droughts. It would require monitoring of water suppliers and local government to assure that the proposed project would result in drought reliability not urban growth.

As an alternative, it would specify favorable delivery priority for SWP contractors with low drought reliability and would require a 75 to 100 percent reliability standard for water supplies used to support urban growth. This would be similar in some ways the Buildout SWP Alternative which also seeks to achieve 100 percent reliability of the SWP. The alternatives would not meet most, if any, of the objectives of the Monterey Amendment including resolving the initial issue that brought the contractors to the table – problems for agricultural contractors during droughts. This alternative would not meet most of the objectives of the Monterey Amendment.

In addition, the alternative would fundamentally change the relationship between the Department and its contractors introducing new monitoring and control measures not contemplated in the Burns-Porter Act nor provided for in the long-term water supply contracts in either their pre- or post-Monterey Amendment form. These measures would require Departmental control over local water supplies and control over SWP supplies after they are delivered to contractors in order to ensure that water was used in a way that conformed with the goals of the alternative. They would also require Departmental control over local land use decisions to address the growth limitations outlined in the alternative. State policy has consistently left such decisions to local entities, including determining what is an appropriate standard of reliability.

The expansion of state powers through legislation that would be needed to implement this alternative is not likely to be acceptable to state, regional or local entities. The alternative was deemed infeasible and was not considered in detail in the EIR.

Plaintiffs have concerns regarding the relationship between local permitting of new urban developments and the availability of adequate water supplies. The Monterey Amendment is not an appropriate tool for dealing with these concerns. There are other places where these concerns are or could be discussed and can be resolved in a more organized process. These include the Department's Bulletin 160 process which looks at water needs and supplies from a statewide perspective and the legislature where each year bills are introduced to extend or modify the urban water management process and its relationship to local planning.

11.2.3 No Urban Preference and Dry Year Reliability Alternative

This alternative would use post-Monterey water allocation procedures (no preference for either urban or agricultural contractors) but would require the Department to introduce a new level of water management by the state that would enable it to guarantee water to urban contractors in multiple year droughts. This alternative would not meet most, if any, of the objectives of the Monterey Amendment. Furthermore, it is similar to the "Urban Preference and Dry Year Reliability Alternative", in that it would require an expansion of state powers not likely to be feasible as described under that alternative, above. The alternative was not considered in detail in the EIR for this reason.

11.2.4 Improved Reliability through Environmental Enhancement Alternative

This alternative would involve the Department reducing stress on fishery resources in the Delta by directly implementing water use efficiency measures, water recycling, storm water capture and other local water system enhancements that stabilize water demand and improve SWP reliability. It is not clear whether this alternative proposes a mandatory reduction in pumping based on a theoretical demand reduction produced by such measures (the proposal suggests 50 percent) or whether it assumes the implementation of these measures would automatically lead to such a reduction. It was suggested that the Department use Article 56 funds to partially finance these water supply enhancements. SWP funds are not used to fund local water supply projects. These are locally funded programs in which the Department has no involvement or control.

Plaintiffs would like to see more aggressive "local water enhancement" such as those measures listed above which they think would stabilize water demand and improve water supply reliability in the SWP service area. This EIR examines the effect on water supplies of reducing Table A amounts in CNPA3 and CNPA4 which include implementation of Article 18(b). It also examines the effect of climate change-induced reductions in SWP water supply of up to 10 percent in Chapter 12. The Monterey Amendment is not an appropriate tool for mandating "local water enhancements". There are other forums where these concerns can be discussed as part of a comprehensive process. These include private, administrative and legislative efforts to institute best management practices for water use efficiency.

The Department funds water efficiency measures proposed by local water agencies through grant programs. The ability of water efficiency programs to reduce demands on the Delta is one of the considerations in the grant process.

It was also suggested that the Department allocate 50 percent of Article 21 water for environmental purposes. Such an action would be in conflict with one of the basic premises of both the pre- and post- Monterey Amendment terms of the long-term water supply contracts, which view Article 21 water as water that goes to the contractors when it is available. It is not extra water, which can be given away for other purposes.

The alternative was not considered in detail in the EIR because it would not meet any of the objectives of the Monterey Amendment. Furthermore, it would be in conflict with the basic terms of the long-term water supply contracts.

The plaintiffs are concerned about the health of the Delta and would like to see more water available for in-Delta uses. The Monterey Amendment is not an appropriate tool for mandating that SWP water be used to benefit the Delta environment. The SWP already operates in compliance with the Delta water quality and flow objectives established by the SWRCB and as constrained by the need to protect threatened and endangered fish species listed pursuant to federal and state Endangered Species Acts. There are several forums where the health of the Delta is being discussed and any remedial actions developed can be pursued as part of a more comprehensive process. These include the Delta Vision Process, the Delta NCCP and the state and federal endangered species processes.

11.2.5 Coordinated CVP-SWP Systems Alternative

It was suggested that the SWP and CVP be more closely coordinated and reoperated beyond the current coordination under the Coordinated Operating Agreement to capture water in wet years and maximize export of water from the Delta by the SWP and CVP. This is similar to a proposal that arose from meetings between the Department, Reclamation and their respective contractors in Napa in the spring of 2003. The proposal was that the CVP would provide some storage benefits to the SWP and the SWP would provide some Delta pumping and conveyance capacity to the CVP. The proposal was contingent on increasing pumping at the Banks Pumping Plant to 8,500 cfs. The proposal has not been implemented because of concerns over fisheries resources in the Delta and the related lack of progress with obtaining approval for increased pumping at the Banks Pumping Plant.

The alternative was dropped from detailed consideration in the EIR because it would not achieve any of the objectives of the proposed project and it would not lessen the impacts on Delta fish populations, identified as one of the potential effects of the Monterey Amendment.

11.2.6 Kern Fan Transfer with Trust Conditions Alternative

Under this alternative the Kern Fan Element lands would be transferred from state to local ownership but a trust arrangement would require that water banked in the Kern Water Bank would provide statewide environmental benefits. This alternative would not meet the objectives of the Monterey Amendment. The alternative was not considered in detail in the EIR for this reason.

The plaintiffs are concerned about the health of the environment and would like to see more water available for environmental purposes. The Monterey Amendment is not an appropriate tool for finding or mandating SWP water to be used for such purposes. Using a state owned water bank in the Kern Fan Element for environmental purposes would involve finding an appropriate funding source and reaching agreement with local entities.

11.3 ASSUMPTIONS AND ANALYTICAL METHODS

As discussed in Chapters 5 and 6, two analytical methods were used to characterize SWP operations with alternatives to the proposed project in place, CALSIM II simulations of SWP operations and analysis of historical data. CALSIM II can be used to estimate SWP deliveries with different Table A amounts and different water allocation methods but it cannot simulate the Monterey water management practices. CALSIM II alone was used to estimate SWP deliveries of Table A and Article 21 water for NPA1, CNPA3 and CNPA4 and Alternative 5 because they do not include the Monterey water supply management practices. NPA2 includes the water supply management practices and so in this case CALSIM simulations were supplemented by an analysis using historical data.

CALSIM II output was post-processed to estimate deliveries of Table A and Article 21 water to individual contractors. A report describing the CALSIM II simulations and associated post-processing is contained in Appendix F.

The Table A amounts in the long-term water supply agreements increase over time. Although most contractors' Table A amounts had reached their maximum value by 1995 when the Monterey Amendment was executed, some contractors' Table A amounts had not. Under the baseline scenario and all alternatives, Table A amounts would continue to increase after 1995 in accordance with the long-term water supply contracts.

The Monterey Amendment-related transfers and retirements of Table A amounts that actually occurred between 1995 and 2003 were assumed to occur under NPA2. These transfers and retirements of Table A amounts together with expected future Monterey Amendment-related transfers were assumed to occur under Alternative 5. The transfers and retirements of Table A amounts assumed for each of the alternatives analyzed in detail are shown in Table 11-1. Table A amounts for each of the alternatives are shown in Table 11-2. The Table A amounts reflect both the increases called for in the long-term water supply contracts and assumed transfers between contractors.

11.4 SWP DELIVERIES FOR NO PROJECT ALTERNATIVES

The following discussion provides information on collective SWP deliveries to agricultural and M&I contractors assuming implementation of the no project alternatives. The proportional deliveries to the two contractor groups under 2003 conditions with the no project alternatives in place are shown in Tables 11-3 and 11-4. The proportional deliveries under the baseline scenario and with the proposed project for the two groups are included in the tables for comparative purposes. Table 11-3 shows Table A deliveries. Table 11-4 shows total deliveries; that is, the sum of Table A and Article 21 deliveries. Tables 11-5 and 11-6 show proportional deliveries to the two contractor groups under 2020 conditions.

Table A deliveries to individual contractors under 2003 and 2020 conditions assuming implementation of the no project alternatives are shown in Tables 11-7 through 11-14. Total deliveries (Table A + Article 21) to individual contractors under 2003 and 2020 conditions assuming implementation of the no project alternatives are shown in Tables 11-15 through 11-22.

TABLE 11-1

TABLE A TRANSFERS (AF)

Transferor	Transferee	Baseline/ No Project Alternative 1	No Project Alternative 2	Court-Ordered No Project Alternative 3	Court-Ordered No Project Alternative 4	Proposed Project/ Alternative 5	Applicable Levels of Development
KCWA	Mojave WA	0	25,000	0	0	25,000[1]	2003, 2020
KCWA	Alameda Co., Zone 7	0	7,000	0	0	7,000[1]	2003, 2020
KCWA	Alameda Co., Zone 7	0	15,000	0	0	15,000[1]	2003, 2020
KCWA	Castaic Lake WA	0	41,000	0	0	41,000[1]	2003, 2020
KCWA	Palmdale WD	0	4,000	0	0	4,000[1]	2003, 2020
KCWA	Alameda Co., Zone 7	0	10,000	0	0	10,000[1]	2003, 2020
KCWA	Alameda Co., Zone 7	0	2,219	0	0	2,219[1]	2003, 2020
KCWA	Napa Co.	0	4,025	0	0	4,025[1]	2003, 2020
KCWA	Solano County WA	0	5,756	0	0	5,756[1]	2003, 2020
KCWA	Coachella VWD	0	0	0	0	12,000[1]	2020
KCWA	Desert WA	0	0	0	0	4,000[1]	2020
Tulare LB WSD	AVEK WA	3,000	3,000	3,000	3,000	3,000	2003, 2020
Tulare LB WSD	Dudley Ridge WD	3,973	3,973	3,973	3,973	3,973	2003, 2020
Tulare LB WSD	Alameda Co., Zone 7	400	400	400	400	400	2003, 2020
Tulare LB WSD	County of Kings	5,000	5,000	5,000	5,000	5,000	2003, 2020
Tulare LB WSD	Coachella VWD	9,900	9,900	9,900	9,900	9,900	2003, 2020
MWDSC	Coachella VWD	88,100	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	11,900	11,900	11,900	11,900	11,900	2020

Note:
1. This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers.

TABLE 11-2

TABLE A AMOUNTS FOR ALTERNATIVES (AF)

SWP Contractor	2003 No Project 1	2020 No Project 1	2003 No Project 2	2020 No Project 2	2003 Court-Ordered No Project 3 & 4	2020 Court-Ordered No Project 3 & 4	2003 Proposed Project	2020 Proposed Project
County of Butte	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	46,400	46,400	80,619	80,619	21,132	20,902	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	9,000	9,000	9,000	9,000	4,099	4,054	9,000	9,000
Dudley Ridge WD	61,673	61,673	61,673	61,673	28,087	27,783	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
KCWA (M&I)	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
KCWA (Ag)	1,018,800	1,018,800	904,800	904,800	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	96,227	96,227	96,227	96,227	43,824	43,349	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	141,400	141,400	141,400	141,400	64,397	63,698	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	82,500	82,500	18,900	18,695	82,500	82,500
Coachella Valley WD	33,000	121,100	33,000	121,100	15,029	54,554	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	50,000	38,100	50,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,100	2,011,500	1,911,500
Palmdale WD	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,207,100	1,207,100	1,093,100	1,093,100	549,744	543,779	1,048,100	1,032,100
Total M&I	2,964,826	3,010,586	3,078,826	3,124,586	1,350,256	1,356,221	3,078,826	3,140,586
Total	4,171,926	4,217,686	4,171,926	4,217,686	1,900,000	1,900,000	4,126,926	4,172,686

TABLE 11-3

PROPORTIONAL TABLE A DELIVERIES TO AGRICULTURAL AND M&I CONTRACTORS IN 2003 UNDER VARIOUS ALTERNATIVES

	Baseline	Proposed Project [a]	Alternatives				
			NPA1	NPA2[a]	CNPA3	CNPA4	A5
Wet Year							
Agricultural Contractors	36.6	33.1	36.6	33.1	37.0	37.3	33.1
M&I Contractors	63.4	66.9	63.4	66.9	63.0	62.7	66.9
Critical Year							
Agricultural Contractors	23.6	26.3	23.4	26.3	26.0	27.5	26.3
M&I Contractors	76.4	73.7	76.6	73.7	74.0	72.5	73.7
Average All							
Agricultural Contractors	32.6	30.8	32.6	30.8	34.7	35.7	30.8
M&I Contractors	67.4	69.2	67.4	69.2	65.3	64.3	69.2

Note:
a. Does not include effects of water supply management practices.

TABLE 11-4

PROPORTIONAL TOTAL DELIVERIES TO AGRICULTURAL AND M&I CONTRACTORS IN 2003 UNDER VARIOUS ALTERNATIVES

	Baseline	Proposed Project [a]	Alternatives				
			NPA1	NPA2[a]	CNPA3	CNPA4	A5
Wet Year							
Agricultural Contractors	38.5	33.3	38.5	33.3	38.9	39.2	33.3
M&I Contractors	61.5	66.7	61.5	66.7	61.1	60.8	66.7
Critical Year							
Agricultural Contractors	24.4	26.7	24.2	26.7	26.7	28.1	26.7
M&I Contractors	75.6	73.3	75.8	73.3	73.3	71.9	73.3
Average All							
Agricultural Contractors	33.9	31.2	33.9	31.2	35.9	37.1	31.2
M&I Contractors	66.1	68.8	66.1	68.8	64.1	62.9	68.8

Note:
a. Does not include effects of water supply management practices.

TABLE 11-5

PROPORTIONAL TABLE A DELIVERIES TO AGRICULTURAL AND M&I CONTRACTORS IN 2020 UNDER VARIOUS ALTERNATIVES

	Baseline	Proposed Project [a]	Alternatives				
			NPA1	NPA2[a]	CNPA3	CNPA4	A5
Wet Year							
Agricultural Contractors	27.2	24.1	27.2	23.7	28.0	28.7	24.1
M&I Contractors	72.8	75.9	72.8	76.3	72.0	71.3	75.9
Critical Year							
Agricultural Contractors	20.4	25.0	20.6	17.3	24.2	28.8	25.0
M&I Contractors	79.6	75.0	79.4	82.7	75.8	71.2	75.0
Average All							
Agricultural Contractors	25.1	24.5	25.1	22.0	27.9	31.0	24.5
M&I Contractors	74.9	75.5	74.9	78.0	72.1	69.0	75.5

Note:
a. Does not include effects of water supply management practices.

TABLE 11-6

PROPORTIONAL TOTAL DELIVERIES TO AGRICULTURAL AND M&I CONTRACTORS IN 2020 UNDER VARIOUS ALTERNATIVES

	Baseline	Proposed Project [a]	Alternatives				
			NPA1	NPA2[a]	CNPA3	CNPA4	A5
Wet Year							
Agricultural Contractors	28.4	24.6	28.3	25.1	29.1	29.8	24.6
M&I Contractors	71.6	75.4	71.7	74.9	70.9	70.2	75.4
Critical Year							
Agricultural Contractors	21.3	25.6	21.5	18.5	24.9	29.2	25.6
M&I Contractors	78.7	74.4	78.5	81.5	75.1	70.8	74.4
Average All							
Agricultural Contractors	26.1	24.9	26.0	23.0	28.7	31.7	24.9
M&I Contractors	73.9	75.1	74.0	77.0	71.3	68.3	75.1

Note:
a. Does not include effects of water supply management practices.

TABLE 11-7

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 1

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff
Napa County FC&WCD	6.8	6.8	0	4.7	4.9	4	6.5	6.5	0
Solano County WA	37.7	37.7	0	17.8	18.3	3	34.2	34.3	0
Alameda Co. FC&WCD, Zone 7	46.4	46.4	0	19.9	20.4	7	41.1	41.2	0
Alameda County WD	35.2	35.2	0	16.8	17.3	3	31.9	32.0	0
Santa Clara Valley WD	84.7	84.7	0	40.1	41.3	3	76.6	76.8	0
Oak Flat WD	5.3	5.3	0	1.6	1.7	6	4.4	4.4	0
County of Kings	8.6	8.6	0	2.5	2.6	4	7.0	7.0	0
Dudley Ridge WD	57.0	57.0	0	17.5	17.9	2	47.2	47.3	0
Empire West Side ID	2.8	2.8	0	0.9	0.9	0	2.3	2.3	0
KCWA (Ag)	938.5	938.5	0	289.9	295.2	2	778.3	779.5	0
KCWA (Muni)	134.6	134.6	0	57.8	59.3	3	119.4	119.8	0
Tulare Lake Basin WSD	87.3	87.3	0	27.4	27.9	2	73.0	73.1	0
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.6	3	4.3	4.3	0
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	20.2	4	25.2	25.3	0
Antelope Valley-East Kern WA	64.9	64.9	0	46.0	47.6	3	61.8	62.1	1
Castaic Lake WA (Ag)	11.7	11.7	0	3.6	3.7	3	9.7	9.7	0
Castaic Lake WA (Muni)	41.5	41.5	0	17.8	18.3	3	36.8	36.9	0
Coachella Valley WD	19.3	19.3	0	9.2	9.5	3	17.5	17.5	0
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	31.2	31.2	0	15.1	15.5	3	28.3	28.4	0
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.4	2	13.0	13.1	1
Metropolitan WDSC	1,272.5	1,272.5	0	771.5	792.7	3	1,310.1	1,314.3	0
Palmdale WD	14.9	14.9	0	7.0	7.2	3	13.5	13.5	0
San Bernardino Valley MWD	69.8	69.8	0	38.1	39.2	3	64.4	64.6	0
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.7	3	16.8	16.9	1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,039.7	3,039.7	0	1,457.3	1,494.5	3	2,830.1	2,837.5	0
Total Agricultural Contractors	1,111.2	1,111.2	0	343.5	349.7	2	921.8	923.2.	0
Total Municipal Contractors	1,928.4	1928.4	0	1,113.9	1,144.8	3	1,908.3	1,914.3	0

TABLE 11-8

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 2

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff
Napa County FC&WCD	6.8	6.8	0	4.7	4.8	2	6.5	6.5	0
Solano County WA	37.7	37.7	0	17.8	18.1	2	34.2	34.3	0
Alameda Co. FC&WCD, Zone 7	46.4	66.5	43	19.9	26.5	34	41.1	57.7	40
Alameda County WD	35.2	35.2	0	16.8	17.0	1	31.9	31.9	0
Santa Clara Valley WD	84.7	84.7	0	40.1	40.7	1	76.6	76.8	0
Oak Flat WD	5.3	5.4	2	1.6	1.8	13	4.4	4.5	2
County of Kings	8.6	8.8	2	2.5	2.9	16	7.0	7.2	3
Dudley Ridge WD	57.0	53.9	-5	17.5	18.2	4	47.2	45.2	-4
Empire West Side ID	2.8	2.8	0	0.9	1.0	11	2.3	2.4	4
KCWA (Ag)	938.5	804.2	-14	289.9	274.1	-5	778.3	677.5	-13
KCWA (Muni)	134.6	134.6	0	57.8	58.6	1	119.4	120.1	1
Tulare Lake Basin WSD	87.3	89.3	2	27.4	30.5	11	73.0	75.3	3
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.6	3	4.3	4.3	0
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	19.9	2	25.2	25.2	0
Antelope Valley-East Kern WA	64.9	64.9	0	46.0	46.8	2	61.8	61.9	0
Castaic Lake WA (Ag)	11.7	12.0	3	3.6	4.0	11	9.7	10.0	3
Castaic Lake WA (Muni)	41.5	68.6	65	17.8	26.6	49	36.8	59.0	60
Coachella Valley WD	19.3	19.3	0	9.2	9.4	2	17.5	17.5	0
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	31.2	31.2	0	15.1	15.3	1	28.3	28.4	0
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.2	0	13.0	13.0	0
Metropolitan WDSC	1,272.5	1,272.5	0	771.5	787.2	2	1,310.1	1,315.3	0
Palmdale WD	14.9	14.9	0	7.0	7.1	1	13.5	13.5	0
San Bernardino Valley MWD	69.8	69.8	0	38.1	38.7	2	64.4	64.5	0
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.6	2	16.8	16.8	0
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.6	0	4.9	4.9	0
Total All Contractors	3,039.7	2,952.0	-3	1,457.3	1,481.9	2	2,830.1	2,775.7	-2
Total Agricultural Contractors	1,111.2	976.4	-12	343.5	332.4	-3	921.8	822.1	-11
Total Municipal Contractors	1,928.4	1,975.6	2	1,113.9	1,149.5	3	1,908.3	1,953.6	2

Note: Does not include effects of water supply management practices.

TABLE 11-9

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND COURT- ORDERED NO PROJECT ALTERNATIVE 3

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	C-A NPA3	% Diff	Baseline	C-A NPA3	% Diff	Baseline	C-A NPA3	% Diff
Napa County FC&WCD	6.8	6.8	0	4.7	4.5	-4	6.5	6.4	-2
Solano County WA	37.7	37.6	0	17.8	18.5	4	34.2	33.4	-2
Alameda Co. FC&WCD, Zone 7	46.4	45.7	-2	19.9	18.5	-7	41.1	38.8	-6
Alameda County WD	35.2	35.0	-1	16.8	16.8	0	31.9	30.9	-3
Santa Clara Valley WD	84.7	84.1	-1	40.1	40.0	0	76.6	74.2	-3
Oak Flat WD	5.3	5.3	0	1.6	1.8	13	4.4	4.6	5
County of Kings	8.6	8.7	1	2.5	2.8	12	7.0	7.4	6
Dudley Ridge WD	57.0	57.7	1	17.5	19.7	13	47.2	50.4	7
Empire West Side ID	2.8	2.8	0	0.9	1.0	11	2.3	2.4	4
KCWA (Ag)	938.5	949.3	1	289.9	327.5	13	778.3	830.7	7
KCWA (Muni)	134.6	132.6	-1	57.8	53.9	-7	119.4	112.6	-6
Tulare Lake Basin WSD	87.3	88.4	1	27.4	31.2	14	73.0	78.0	7
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.5	0	4.3	4.2	-2
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	20.0	3	25.2	25.2	0
Antelope Valley-East Kern WA	64.9	64.9	0	46.0	46.9	2	61.8	61.8	0
Castaic Lake WA (Ag)	11.7	11.8	1	3.6	4.1	14	9.7	10.4	7
Castaic Lake WA (Muni)	41.5	40.9	-1	17.8	16.6	-7	36.8	34.7	-6
Coachella Valley WD	19.3	19.2	-1	9.2	9.2	0	17.5	17.0	-3
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	31.2	31.0	-1	15.1	15.2	1	28.3	27.5	-3
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.3	1	13.0	13.1	1
Metropolitan WDSC	1,272.5	1,264.4	-1	771.5	767.8	-1	1,310.1	1,273.7	-3
Palmdale WD	14.9	14.8	-1	7.0	6.9	-1	13.5	13.0	-4
San Bernardino Valley MWD	69.8	69.8	0	38.1	38.7	2	64.4	63.5	-1
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.6	2	16.8	16.6	-1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,039.7	3,039.6	0	1,457.3	1,494.5	3	2,830.1	2,837.5	0
Total Agricultural Contractors	1,111.2	1,124.0	1	343.5	388.0	13	921.8	983.9	7
Total Municipal Contractors	1,928.4	1,915.6	-1	1,113.9	1,106.5	-1	1,908.3	1,853.6	-3

TABLE 11-10

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 4

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	C-A NPA4	% Diff	Baseline	C-A NPA4	% Diff	Baseline	C-A NPA4	% Diff
Napa County FC&WCD	6.8	7.6	12	4.7	5.6	19	6.5	7.2	11
Solano County WA	37.7	35.9	-5	17.8	15.7	-12	34.2	30.6	-11
Alameda Co. FC&WCD, Zone 7	46.4	44.9	-3	19.9	17.7	-11	41.1	37.6	-8
Alameda County WD	35.2	34.3	-3	16.8	16.1	-4	31.9	30.0	-6
Santa Clara Valley WD	84.7	82.5	-3	40.1	38.2	-5	76.6	72.0	-6
Oak Flat WD	5.3	5.3	0	1.6	1.9	19	4.4	4.7	7
County of Kings	8.6	8.7	1	2.5	2.9	16	7.0	7.6	9
Dudley Ridge WD	57.0	58.1	2	17.5	20.8	19	47.2	51.8	10
Empire West Side ID	2.8	2.8	0	0.9	1.0	11	2.3	2.5	9
KCWA (Ag)	938.5	956.7	2	289.9	345.5	19	778.3	854.9	10
KCWA (Muni)	134.6	130.2	-3	57.8	51.3	-11	119.4	108.8	-9
Tulare Lake Basin WSD	87.3	90.7	4	27.4	34.9	27	73.0	81.9	12
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.5	0	4.3	4.2	-2
Santa Barbara Co. FC&WCD	26.3	26.0	-1	19.5	19.5	0	25.2	24.6	-2
Antelope Valley-East Kern WA	64.9	64.4	-1	46.0	47.0	2	61.8	61.6	0
Castaic Lake WA (Ag)	11.7	11.9	2	3.6	4.3	19	9.7	10.7	10
Castaic Lake WA (Muni)	41.5	40.1	-3	17.8	15.8	-11	36.8	33.5	-9
Coachella Valley WD	19.3	18.9	-2	9.2	9.1	-1	17.5	16.7	-5
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	31.2	30.6	-2	15.1	14.9	-1	28.3	27.1	-4
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.3	1	13.0	13.1	1
Metropolitan WDSC	1,272.5	1,263.6	-1	771.5	753.9	-2	1310.1	1257.1	-4
Palmdale WD	14.9	14.5	-3	7.0	6.6	-6	13.5	12.6	-7
San Bernardino Valley MWD	69.8	69.3	-1	38.1	38.8	2	64.4	63.3	-2
San Gabriel Valley MWD	18.1	18.0	0	10.4	10.6	2	16.8	16.6	-1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,039.7	3039.6	0	1,457.3	1,494.5	3	2,830.1	2,837.5	0
Total Agricultural Contractors	1,111.2	1134.7	2	343.5	411.5	20	921.8	1,014.4	10
Total Municipal Contractors	1,928.4	1905.0	-1	1,113.9	1,083.0	-3	1,908.3	1,823.1	-4

TABLE 11-11

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 1

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff
Napa County FC&WCD	24.4	24.4	0	8.9	9.2	3	20.1	20.2	11
Solano County WA	41.2	41.2	0	15.0	15.6	4	33.9	34.1	0
Alameda Co. FC&WCD, Zone 7	45.5	45.5	0	16.5	17.1	4	37.5	37.6	1
Alameda County WD	41.2	41.2	0	15.0	15.6	4	33.9	34.1	0
Santa Clara Valley WD	98.2	98.2	0	35.7	37.0	4	80.8	81.1	0
Oak Flat WD	5.1	5.1	0	1.3	1.3	0	3.8	3.8	0
County of Kings	8.3	8.3	0	2.0	2.1	5	6.1	6.1	0
Dudley Ridge WD	55.8	55.8	0	13.8	14.6	6	41.2	41.3	0
Empire West Side ID	2.7	2.7	0	0.7	0.7	0	2.0	2.0	0
KCWA (Ag)	919.7	919.7	0	228.6	240.6	5	679.0	681.9	0
KCWA (Muni)	132.1	132.1	0	48.1	49.8	4	108.8	109.2	0
Tulare Lake Basin WSD	85.9	85.9	0	21.6	22.7	5	63.7	64.0	1
San Luis Obispo Co. FC&WCD	24.5	24.5	0	8.9	9.3	4	20.2	20.3	1
Santa Barbara Co. FC&WCD	44.6	44.6	0	16.2	16.8	4	36.8	36.9	0
Antelope Valley-East Kern WA	138.7	138.7	0	50.1	52.0	4	113.9	114.4	0
Castaic Lake WA (Ag)	11.5	11.5	0	2.8	3.0	7	8.5	8.5	0
Castaic Lake WA (Muni)	40.7	40.7	0	14.8	15.4	4	33.5	33.7	1
Coachella Valley WD	118.5	118.5	0	41.9	43.5	4	96.7	97.0	0
Crestline-Lake Arrowhead WA	5.7	5.7	0	2.1	2.1	0	4.7	4.7	0
Desert WA	49.1	49.1	0	17.9	18.5	3	40.4	40.6	1
Littlerock Creek ID	2.3	2.3	0	0.8	0.9	13	1.9	1.9	0
Mojave WA	49.9	49.9	0	18.1	18.8	4	41.1	41.2	0
Metropolitan WDSC	1,876.3	1,876.3	0	682.8	707.8	4	1545.0	1551.1	0
Palmdale WD	17.0	17.0	0	6.2	6.4	3	14.0	14.0	0
San Bernardino Valley MWD	100.7	100.7	0	36.6	38.0	4	82.9	83.3	1
San Gabriel Valley MWD	28.3	28.3	0	10.3	10.7	4	23.3	23.4	0
San Gorgonio Pass WA	17.0	17.0	0	6.2	6.4	3	14.0	14.0	0
Ventura County FCD	19.6	19.6	0	7.1	7.4	4	16.2	16.2	0
Total All Contractors	4,004.6	4,004.6	0	1,330.2	1,383.4	4	3,203.8	3,216.6	0
Total Agricultural Contractors	1,089.7	1,089.1	0	270.8	285.0	5	804.3	807.7	0
Total Municipal Contractors	2,915.5	2,915.5	0	1,059.4	1,098.3	4	2,399.5	2,408.9	0

TABLE 11-12

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND ALTERNATIVE 2

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff
Napa County FC&WCD	24.4	28.3	16	8.9	10.09.8	12	20.1	23.0	14
Solano County WA	41.2	46.7	13	15.0	16.6	11	33.9	38.0	12
Alameda Co. FC&WCD, Zone 7	45.5	78.0	71	16.5	24.5	48	37.5	61.2	63
Alameda County WD	41.2	41.2	0	15.0	15.3	2	33.9	34.1	1
Santa Clara Valley WD	98.2	98.2	0	35.7	36.5	2	80.8	81.2	0
Oak Flat WD	5.1	5.2	2	1.3	1.3	0	3.8	3.8	0
County of Kings	8.3	8.4	1	2.0	2.0	0	6.1	6.1	0
Dudley Ridge WD	55.8	51.8	-7	13.8	12.7	-8	41.2	38.5	-7
Empire West Side ID	2.7	2.7	0	0.7	0.7	0	2.0	2.0	0
KCWA (Ag)	919.7	774.9	-16	228.6	191.6	-16	679.0	577.0	-15
KCWA (Muni)	132.1	132.1	0	48.1	49.2	2	108.8	109.3	0
Tulare Lake Basin WSD	85.9	86.1	0	21.6	21.3	-1	63.7	64.2	1
San Luis Obispo Co. FC&WCD	24.5	24.5	0	8.9	9.1	2	20.2	20.3	0
Santa Barbara Co. FC&WCD	44.6	44.6	0	16.2	16.6	2	36.8	36.9	0
Antelope Valley-East Kern WA	138.7	138.7	0	50.1	51.2	2	113.9	114.5	1
Castaic Lake WA (Ag)	11.5	11.5	0	2.8	2.8	0	8.5	8.5	0
Castaic Lake WA (Muni)	40.7	79.6	96	14.8	24.3	64	33.5	62.0	85
Coachella Valley WD	118.5	118.5	0	41.9	42.8	2	96.7	97.1	0
Crestline-Lake Arrowhead WA	5.7	5.7	0	2.1	2.1	0	4.7	4.7	0
Desert WA	49.1	49.1	0	17.9	18.3	2	40.4	40.6	0
Littlerock Creek ID	2.3	2.3	0	0.8	0.8	0	1.9	1.9	0
Mojave WA	49.9	73.6	47	18.1	24.1	33	41.1	58.5	42
Metropolitan WDSC	1,876.3	1,876.3	0	682.8	698.3	2	1,545.0	1552.2	0
Palmdale WD	17.0	20.8	22	6.2	7.2	16	14.0	16.8	20
San Bernardino Valley MWD	100.7	100.7	0	36.6	37.5	2	82.9	83.3	0
San Gabriel Valley MWD	28.3	28.3	0	10.3	10.5	2	23.3	23.4	0
San Gorgonio Pass WA	17.0	17.0	0	6.2	6.3	2	14.0	14.0	0
Ventura County FCD	19.6	19.6	0	7.1	7.3	3	16.2	16.2	0
Total All Contractors	4,004.6	3,964.1	-1	1,330.2	1,341.0	1	3,203.8	3,189.3	0
Total Agricultural Contractors	1,089.7	940.5	-14	270.8	232.4	-14	804.3	700.1	-13
Total Municipal Contractors	2,915.5	3,023.6	4	1,059.4	1,108.6	5	2,399.5	2,489.3	4

Note: Does not include effects of water supply management practices.

TABLE 11-13

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 3

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	C-A NPA3	% Diff	Baseline	C-A NPA3	% Diff	Baseline	C-A NPA3	% Diff
Napa County FC&WCD	24.4	24.2	-1	8.9	8.8	-1	20.1	19.4	-3
Solano County WA	41.2	40.8	-1	15.0	14.8	-1	33.9	32.8	-3
Alameda Co. FC&WCD, Zone 7	45.5	45.1	-1	16.5	16.4	-1	37.5	36.2	-3
Alameda County WD	41.2	40.8	-1	15.0	14.8	-1	33.9	32.8	-3
Santa Clara Valley WD	98.2	97.1	-1	35.7	35.3	-1	80.8	78.1	-3
Oak Flat WD	5.1	5.3	4	1.3	1.6	23	3.8	4.2	11
County of Kings	8.3	8.6	4	2.0	2.5	25	6.1	6.8	11
Dudley Ridge WD	55.8	57.4	3	13.8	17.1	24	41.2	45.9	11
Empire West Side ID	2.7	2.8	4	0.7	0.8	14	2.0	2.2	10
KCWA (Ag)	919.7	945.6	3	228.6	283.1	24	679.0	757.6	12
KCWA (Muni)	132.1	130.7	-1	48.1	47.6	-1	108.8	105.6	-3
Tulare Lake Basin WSD	85.9	88.3	3	21.6	26.7	24	63.7	71.1	12
San Luis Obispo Co. FC&WCD	24.5	24.3	-1	8.9	8.8	-1	20.2	19.5	-3
Santa Barbara Co. FC&WCD	44.6	44.2	-1	16.2	16.1	-1	36.8	35.5	-4
Antelope Valley-East Kern WA	138.7	137.3	-1	50.1	49.7	-1	113.9	110.3	-3
Castaic Lake WA (Ag)	11.5	11.8	3	2.8	3.5	25	8.5	9.4	11
Castaic Lake WA (Muni)	40.7	40.3	-1	14.8	14.7	-1	33.5	32.4	-3
Coachella Valley WD	118.5	117.6	-1	41.9	42.0	0	96.7	94.4	-2
Crestline-Lake Arrowhead WA	5.7	5.6	-2	2.1	2.0	-1	4.7	4.5	-4
Desert WA	49.1	48.6	-1	17.9	17.7	1	40.4	39.0	-3
Littlerock Creek ID	2.3	2.2	-4	0.8	0.8	0	1.9	1.8	-5
Mojave WA	49.9	49.3	-1	18.1	17.9	-1	41.1	39.7	-3
Metropolitan WDSC	1,876.3	1,856.2	-1	682.8	675.4	-1	1,545.0	1,492.0	-3
Palmdale WD	17.0	16.8	-1	6.2	6.1	-2	14.0	13.5	-4
San Bernardino Valley MWD	100.7	99.6	-1	36.6	36.3	-1	82.9	80.1	-3
San Gabriel Valley MWD	28.3	28.0	-1	10.3	10.2	-1	23.3	22.5	-3
San Gorgonio Pass WA	17.0	16.8	-1	6.2	6.1	-2	14.0	13.5	-4
Ventura County FCD	19.6	19.4	-1	7.1	7.1	0	16.2	15.6	-4
Total All Contractors	4,004.6	4,004.6	0	1,330.2	1,384.1	4	3,203.8	3,216.0	0
Total Agricultural Contractors	1,089.7	1,119.7	3	270.8	335.4	24	804.3	897.4	12
Total Municipal Contractors	2,915.5	2,884.9	-1	1,059.4	1,048.7	-1	2,399.5	2,318.6	-3

TABLE 11-14

ESTIMATED AVERAGE TABLE A DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 4

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	C-A NPA4	% Diff	Baseline	C-A NPA4	% Diff	Baseline	C-A NPA4	% Diff
Napa County FC&WCD	24.4	23.6	-3	8.9	7.7	-13	20.1	17.6	-12
Solano County WA	41.2	39.7	-4	15.0	12.8	-15	33.9	29.4	-13
Alameda Co. FC&WCD, Zone 7	45.5	43.9	-4	16.5	14.2	-14	37.5	32.6	-13
Alameda County WD	41.2	39.8	-3	15.0	13.0	-13	33.9	29.7	-12
Santa Clara Valley WD	98.2	94.7	-4	35.7	31.0	-13	80.8	70.8	-12
Oak Flat WD	5.1	5.4	6	1.3	1.8	38	3.8	4.7	24
County of Kings	8.3	8.8	6	2.0	3.0	50	6.1	7.5	23
Dudley Ridge WD	55.8	58.9	6	13.8	20.4	48	41.2	51.1	24
Empire West Side ID	2.7	2.9	7	0.7	1.0	43	2.0	2.5	25
KCWA (Ag)	919.7	969.7	5	228.6	336.2	47	679.0	842.4	24
KCWA (Muni)	132.1	127.1	-4	48.1	41.1	-15	108.8	94.2	-13
Tulare Lake Basin WSD	85.9	90.5	5	21.6	31.8	47	63.7	79.1	24
San Luis Obispo Co. FC&WCD	24.5	23.6	-4	8.9	7.6	-15	20.2	17.5	-13
Santa Barbara Co. FC&WCD	44.6	42.9	-4	16.2	13.9	-14	36.8	31.8	-14
Antelope Valley-East Kern WA	138.7	137.5	-1	50.1	49.1	-2	113.9	109.8	-4
Castaic Lake WA (Ag)	11.5	12.1	5	2.8	4.2	50	8.5	10.5	24
Castaic Lake WA (Muni)	40.7	39.2	-4	14.8	12.7	-14	33.5	29.0	-13
Coachella Valley WD	118.5	118.0	0	41.9	42.0	0	96.7	94.6	-2
Crestline-Lake Arrowhead WA	5.7	5.5	-4	2.1	1.8	-14	4.7	4.1	-13
Desert WA	49.1	48.6	-1	17.9	17.4	-3	40.4	38.7	-4
Littlerock Creek ID	2.3	2.2	-4	0.8	0.7	-13	1.9	1.6	-16
Mojave WA	49.9	50.8	2	18.1	19.8	9	41.1	43.2	5
Metropolitan WDSC	1,876.3	1,836.6	-2	682.8	632.7	-7	1545.0	1423.8	-8
Palmdale WD	17.0	16.3	-4	6.2	5.3	-15	14.0	12.1	-14
San Bernardino Valley MWD	100.7	102.6	2	36.6	40.1	10	82.9	87.2	5
San Gabriel Valley MWD	28.3	28.8	2	10.3	11.2	9	23.3	24.5	5
San Gorgonio Pass WA	17.0	16.3	-4	6.2	5.3	-15	14.0	12.1	-14
Ventura County FCD	19.6	18.9	-4	7.1	6.1	-14	16.2	14.0	-14
Total All Contractors	4,004.6	4,004.6	0	1,330.2	1,384.0	4	3,203.8	3,216.0	0
Total Agricultural Contractors	1,089.7	1,148.3	5	270.8	398.3	47	804.3	997.8	24
Total Municipal Contractors	2,915.5	2,856.4	-2	1,059.4	985.7	-7	2,399.5	2218.2	-8

TABLE 11-15

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 1

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff
Napa County FC&WCD	8.9	8.5	-4	4.9	5.1	4	7.5	7.3	-3
Solano County WA	40.0	39.6	-1	18.1	18.6	3	35.2	35.2	0
Alameda Co. FC&WCD, Zone 7	48.8	48.7	0	20.2	20.7	2	42.2	42.3	0
Alameda County WD	38.1	38.0	0	17.1	17.6	3	33.3	33.3	0
Santa Clara Valley WD	95.3	94.6	-1	41.3	42.5	3	81.6	81.5	0
Oak Flat WD	5.3	5.3	0	1.6	1.7	6	4.4	4.4	0
County of Kings	8.6	8.6	0	2.5	2.6	4	7.0	7.0	0
Dudley Ridge WD	61.3	61.2	0	18.0	18.4	2	49.4	49.4	0
Empire West Side ID	6.1	5.9	-3	1.3	1.3	0	3.9	3.8	-3
KCWA (Ag)	1,138.8	1,135.0	0	311.7	317.0	2	879.5	878.6	0
KCWA (Muni)	134.6	134.6	0	57.8	59.3	3	119.4	119.8	0
Tulare Lake Basin WSD	141.2	139.6	-1	33.2	33.7	2	99.7	98.7	-1
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.6	3	4.3	4.3	0
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	20.2	4	25.2	25.3	0
Antelope Valley-East Kern WA	68.4	68.3	0	46.4	48.0	3	63.5	63.8	0
Castaic Lake WA (Ag)	11.7	11.7	0	3.6	3.7	3	9.7	9.7	0
Castaic Lake WA (Muni)	43.8	43.4	-1	18.1	18.6	3	37.8	37.8	0
Coachella Valley WD	25.6	25.1	-2	9.9	10.2	3	20.5	20.3	-1
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	45.5	44.3	-3	16.6	17.0	2	35.2	34.6	-2
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.4	2	13.0	13.1	1
Metropolitan WDSC	1,487.6	1,464.0	0	806.4	827.6	3	1,429.9	1,430.7	0
Palmdale WD	14.9	14.9	0	7.0	7.2	3	13.5	13.5	0
San Bernardino Valley MWD	69.8	69.8	0	38.1	39.2	3	64.4	64.6	0
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.7	3	16.8	16.9	1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,563.2	3,550.2	0	1,525.9	1,563.1	2	3,103.9	3,102.7	0
Total Agricultural Contractors	1,373.0	1,367.5	0	372.0	378.2	2	1,053.5	1,051.6	0
Total Municipal Contractors	2,190.1	2,182.6	0	1,154.0	1,184.9	3	2,050.3	2,051.1	0

TABLE 11-16

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 2

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff	Baseline	NPA2	% Diff
Napa County FC&WCD	8.9	9.0	1	4.9	5.1	4	7.5	7.3	0
Solano County WA	40.0	40.3	1	18.1	18.4	2	35.2	35.5	1
Alameda Co. FC&WCD, Zone 7	48.8	69.2	42	20.2	26.9	33	42.2	59.0	40
Alameda County WD	38.1	38.5	1	17.1	17.4	2	33.3	33.5	1
Santa Clara Valley WD	95.3	96.7	1	41.3	42.2	2	81.6	82.5	1
Oak Flat WD	5.3	5.4	2	1.6	1.8	13	4.4	4.5	2
County of Kings	8.6	8.8	2	2.5	2.9	16	7.0	7.2	3
Dudley Ridge WD	61.3	58.4	-5	18.0	18.7	4	49.4	47.5	-4
Empire West Side ID	6.1	6.3	3	1.3	1.5	15	3.9	4.2	8
KCWA (Ag)	1,138.8	1,016.6	-11	311.7	297.4	-5	879.5	784.8	-11
KCWA (Muni)	134.6	134.6	0	57.8	58.6	1	119.4	120.1	1
Tulare Lake Basin WSD	141.2	150.3	6	33.2	37.4	13	99.7	105.4	6
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.6	3	4.3	4.3	0
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	19.9	2	25.2	25.2	0
Antelope Valley-East Kern WA	68.4	68.6	0	46.4	47.2	2	63.5	63.7	0
Castaic Lake WA (Ag)	11.7	12.0	3	3.6	4.0	11	9.7	10.0	3
Castaic Lake WA (Muni)	43.8	71.5	63	18.1	27.0	49	37.8	60.3	60
Coachella Valley WD	25.6	25.8	0	9.9	10.1	2	20.5	20.7	1
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	45.5	45.9	1	16.6	17.0	2	35.2	35.6	0
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.2	0	13.0	13.0	0
Metropolitan WDSC	1,487.6	1,489.1	0	806.4	830.2	3	1,429.9	1,433.4	0
Palmdale WD	14.9	14.9	0	7.0	7.1	1	13.5	13.5	0
San Bernardino Valley MWD	69.8	69.8	0	38.1	38.7	2	64.4	64.5	0
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.6	2	16.8	16.8	0
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.6	0	4.9	4.9	0
Total All Contractors	3,563.2	3,500.5	-2	1,525.9	1,562.0	2	3,103.9	3,069.7	-1
Total Agricultural Contractors	1,373.0	1,257.8	-8	372.0	363.5	-8	1,053.5	963.7	-9
Total Municipal Contractors	2,190.1	2,242.8	2	1,154.0	1,198.6	4	2,050.3	2,106.0	3

TABLE 11-17

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 3

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	CNPA3	% Diff	Baseline	CNPA3	% Diff	Baseline	CNPA3	% Diff
Napa County FC&WCD	8.9	8.5	-4	4.9	4.7	-4	7.5	7.2	-4
Solano County WA	40.0	39.5	-1	18.1	18.8	4	35.2	34.2	-3
Alameda Co. FC&WCD, Zone 7	48.8	48.0	-2	20.2	18.8	-7	42.2	39.9	-5
Alameda County WD	38.1	37.8	-1	17.1	17.1	0	33.3	32.2	-3
Santa Clara Valley WD	95.3	86.0	-10	41.3	41.2	0	81.6	78.9	-3
Oak Flat WD	5.3	5.3	0	1.6	1.8	13	4.4	4.6	4
County of Kings	8.6	8.7	1	2.5	2.8	12	7.0	7.4	6
Dudley Ridge WD	61.3	61.9	9	18.0	20.2	12	49.4	52.5	6
Empire West Side ID	6.1	5.9	-3	1.3	1.4	8	3.9	3.9	0
KCWA (Ag)	1,138.8	1,145.8	1	311.7	349.3	12	879.5	929.8	6
KCWA (Muni)	134.6	132.6	-1	57.8	53.9	-7	119.4	112.6	-6
Tulare Lake Basin WSD	141.2	140.7	0	33.2	37.0	11	99.7	103.6	4
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.5	0	4.3	4.2	-2
Santa Barbara Co. FC&WCD	26.3	26.3	0	19.5	20.0	3	25.2	25.2	0
Antelope Valley-East Kern WA	68.4	68.6	0	46.4	47.3	2	63.5	63.5	0
Castaic Lake WA (Ag)	11.7	11.8	1	3.6	4.1	14	9.7	10.4	7
Castaic Lake WA (Muni)	43.8	42.8	-2	18.1	16.9	-1	37.8	36.6	-3
Coachella Valley WD	25.6	25.0	-2	9.9	9.9	0	20.5	19.8	-3
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	45.5	44.1	-3	16.6	16.7	1	35.2	33.7	-4
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.3	1	13.0	13.1	0
Metropolitan WDSC	1,487.6	1,475.9	-1	806.4	802.7	0	1,429.9	1,390.1	-3
Palmdale WD	14.9	14.8	-1	7.0	6.9	-1	13.5	13.0	-4
San Bernardino Valley MWD	69.8	69.8	0	38.1	38.7	0	64.4	63.5	-1
San Gabriel Valley MWD	18.1	18.1	0	10.4	10.6	2	16.8	16.6	-1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,563.2	3,550.1	0	1,525.9	1,563.1	2	3,103.9	3,102.7	0
Total Agricultural Contractors	1,373.0	1,380.3	0	372.0	416.5	12	1,053.5	1,112.3	6
Total Municipal Contractors	2,190.1	2,169.8	-1	1,154.0	1,146.6	-1	2,050.3	1,990.4	-3

TABLE 11-18

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2003 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 4

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	CNPA4	% Diff	Baseline	CNPA4	% Diff	Baseline	CNPA4	% Diff
Napa County FC&WCD	8.9	9.3	4	4.9	5.8	18	7.5	8.0	7
Solano County WA	40.0	37.8	-6	18.1	16.0	-12	35.2	31.5	-10
Alameda Co. FC&WCD, Zone 7	48.8	47.2	-3	20.2	18.0	-11	42.2	38.7	-8
Alameda County WD	38.1	37.1	-3	17.1	16.4	-4	33.3	31.3	-6
Santa Clara Valley WD	95.3	92.4	-3	41.3	39.4	-5	81.6	76.7	-6
Oak Flat WD	5.3	5.3	0	1.6	1.9	19	4.4	4.7	7
County of Kings	8.6	8.7	1	2.5	2.9	16	7.0	7.6	9
Dudley Ridge WD	61.3	62.3	2	18.0	21.3	18	49.4	53.9	9
Empire West Side ID	6.1	5.9	-3	1.3	1.4	8	3.9	4.0	3
KCWA (Ag)	1,138.8	1,153.2	1	311.7	367.3	18	879.5	954.0	8
KCWA (Muni)	134.6	130.2	-3	57.8	57.3	-1	119.4	108.8	-9
Tulare Lake Basin WSD	141.2	143.0	1	33.2	40.7	23	99.7	107.5	8
San Luis Obispo Co. FC&WCD	4.4	4.4	0	3.5	3.5	0	4.3	4.2	-2
Santa Barbara Co. FC&WCD	26.3	26.0	-1	19.5	19.5	0	25.2	24.6	-2
Antelope Valley-East Kern WA	68.4	67.8	-1	46.4	47.4	2	63.5	63.3	0
Castaic Lake WA (Ag)	11.7	11.9	1	3.6	4.3	19	9.7	10.7	10
Castaic Lake WA (Muni)	43.8	42.0	-4	18.1	16.1	-11	37.8	34.4	-9
Coachella Valley WD	25.6	24.7	-3	9.9	9.8	-1	20.5	19.5	-5
Crestline-Lake Arrowhead WA	1.9	1.9	0	1.7	1.7	0	1.9	1.9	0
Desert WA	45.5	43.7	-4	16.6	16.4	-1	35.2	33.3	-5
Littlerock Creek ID	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0
Mojave WA	13.2	13.2	0	12.2	12.3	1	13.0	13.1	1
Metropolitan WDSC	1,487.6	1,475.1	-1	806.4	788.8	-2	1,429.9	1,373.5	-4
Palmdale WD	14.9	14.5	-3	7.0	6.6	-6	13.5	12.6	-7
San Bernardino Valley MWD	69.8	69.3	-1	38.1	38.8	2	64.4	63.3	-2
San Gabriel Valley MWD	18.1	18.0	-1	10.4	10.6	2	16.8	16.6	-1
San Gorgonio Pass WA	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0
Ventura County FCD	5.0	5.0	0	4.6	4.7	2	4.9	4.9	0
Total All Contractors	3,563.2	3,550.1	0	1,525.9	1,563.1	2	3,103.9	3,102.7	0
Total Agricultural Contractors	1,373.0	1,390.5	1	372.0	440.0	18	1,053.5	1,151.2	9
Total Municipal Contractors	2,190.1	2,159.2	-1	1,154.0	1,123.1	-3	2,050.3	1,951.5	-5

TABLE 11-19

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 1

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff	Baseline	NPA1	% Diff
Napa County FC&WCD	24.5	24.4	0	9.3	9.6	3	20.2	20.3	0
Solano County WA	41.3	41.2	0	15.4	16.0	4	34.1	34.2	0
Alameda Co. FC&WCD, Zone 7	45.8	45.6	0	17.0	17.6	3	37.8	37.8	0
Alameda County WD	41.9	41.8	0	15.5	16.1	4	34.4	34.5	0
Santa Clara Valley WD	100.3	99.7	-1	37.5	38.8	3	82.3	82.2	0
Oak Flat WD	5.1	5.1	0	1.3	1.3	0	3.8	3.8	0
County of Kings	8.3	8.3	0	2.0	2.1	5	6.1	6.1	0
Dudley Ridge WD	57.6	57.5	0	14.3	15.1	6	42.3	42.3	0
Empire West Side ID	3.9	3.7	-5	1.2	1.2	0	2.7	2.6	-4
KCWA (Ag)	999.1	992.3	-1	251.3	263.3	5	727.1	726.2	0
KCWA (Muni)	132.1	132.1	0	48.1	49.8	3	108.8	109.2	0
Tulare Lake Basin WSD	85.9	102.5	-3	28.4	29.5	4	75.5	74.3	-2
San Luis Obispo Co. FC&WCD	24.5	24.5	0	8.9	9.3	5	20.2	20.3	0
Santa Barbara Co. FC&WCD	44.6	44.6	0	16.2	16.8	4	36.8	36.9	0
Antelope Valley-East Kern WA	139.7	139.6	0	50.6	52.5	4	114.6	115.0	0
Castaic Lake WA (Ag)	11.5	11.5	0	2.8	3.0	7	8.5	8.5	0
Castaic Lake WA (Muni)	40.8	40.7	0	15.2	15.8	4	33.7	33.8	0
Coachella Valley WD	120.4	120.2	0	42.8	44.4	4	98.0	98.1	0
Crestline-Lake Arrowhead WA	5.7	5.7	0	2.1	2.1	0	4.7	4.7	0
Desert WA	52.7	52.5	0	20.0	20.6	3	46.1	42.7	0
Littlerock Creek ID	2.3	2.3	0	0.8	0.9	13	1.9	1.9	0
Mojave WA	49.9	49.9	0	18.1	18.8	4	41.1	41.2	0
Metropolitan WDSC	1,956.7	1,941.4	-1	728.2	753.2	3	1597.1	1595.1	0
Palmdale WD	17.0	17.0	0	6.2	6.4	3	14.0	14.0	0
San Bernardino Valley MWD	100.7	100.7	0	36.6	38.0	4	82.9	83.3	1
San Gabriel Valley MWD	28.3	28.3	0	10.3	10.7	4	23.3	23.4	0
San Gorgonio Pass WA	17.0	17.0	0	6.2	6.4	3	14.0	14.0	0
Ventura County FCD	19.6	19.6	0	7.1	7.4	4	16.2	16.2	0
Total All Contractors	4,196.9	4,169.9	-1	1,413.4	1,466.6	4	3,324.6	3,322.6	0
Total Agricultural Contractors	1,191.1	1,181.0	-1	301.3	315.5	5	865.9	863.9	0
Total Municipal Contractors	3,005.9	2,988.9	-1	1,112.2	1,151.1	4	2,458.7	2,458.7	0

TABLE 11-20

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND NO PROJECT ALTERNATIVE 2

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	**NPA2**	**% Diff**	**Baseline**	**NPA2**	**% Diff**	**Baseline**	**NPA2**	**% Diff**
Napa County FC&WCD	24.5	28.4	16	9.3	10.4	2	20.2	23.1	14
Solano County WA	41.3	46.8	12	15.4	17.0	10	34.1	38.2	12
Alameda Co. FC&WCD, Zone 7	45.8	78.4	71	17.0	25.0	47	37.8	61.5	63
Alameda County WD	41.9	41.9	0	15.5	15.8	2	34.4	34.8	1
Santa Clara Valley WD	100.3	100.4	0	37.5	38.2	2	82.3	82.7	0
Oak Flat WD	5.1	5.2	2	1.3	1.3	0	3.8	3.8	0
County of Kings	8.3	8.4	1	2.0	2.0	0	6.1	6.1	0
Dudley Ridge WD	57.6	53.6	-7	14.3	13.2	-8	42.3	39.5	-6
Empire West Side ID	3.9	3.9	0	1.2	1.2	0	2.7	2.7	0
KCWA (Ag)	999.1	852.9	-15	251.3	214.3	-15	727.1	623.8	-14
KCWA (Muni)	132.1	132.1	0	48.1	49.2	2	108.8	109.3	0
Tulare Lake Basin WSD	85.9	105.7	0	28.4	28.1	-1	75.5	76.2	1
San Luis Obispo Co. FC&WCD	24.5	24.5	0	8.9	9.1	2	20.2	20.3	0
Santa Barbara Co. FC&WCD	44.6	44.6	0	16.2	16.6	2	36.8	36.9	0
Antelope Valley-East Kern WA	139.7	139.7	0	50.6	51.7	2	114.6	115.1	0
Castaic Lake WA (Ag)	11.5	11.5	0	2.8	2.8	0	8.5	8.5	0
Castaic Lake WA (Muni)	40.8	79.8	95	15.2	24.8	63	33.7	62.2	85
Coachella Valley WD	120.4	120.4	0	42.8	43.7	2	98.0	98.3	0
Crestline-Lake Arrowhead WA	5.7	5.7	0	2.1	2.1	0	4.7	4.7	0
Desert WA	52.7	52.6	0	20.0	20.4	2	46.1	42.9	0
Littlerock Creek ID	2.3	2.3	0	0.8	0.8	0	1.9	1.9	0
Mojave WA	49.9	73.6	47	18.1	24.1	33	41.1	58.5	42
Metropolitan WDSC	1,956.7	1,956.6	0	728.2	743.7	2	1597.1	1603.4	0
Palmdale WD	17.0	20.8	22	6.2	7.2	16	14.0	16.8	20
San Bernardino Valley MWD	100.7	100.7	0	36.6	37.5	2	82.9	83.3	0
San Gabriel Valley MWD	28.3	28.3	0	10.3	10.5	2	23.3	23.4	0
San Gorgonio Pass WA	17.0	17.0	0	6.2	6.3	2	14.0	14.0	0
Ventura County FCD	19.6	19.6	0	7.1	7.3	3	16.2	16.2	0
Total All Contractors	4,196.9	4,155.0	-1	1,413.4	1,424.2	1	3,324.6	3,308.0	0
Total Agricultural Contractors	1,191.1	1,041.0	-12	301.3	262.9	-13	865.9	760.6	-12
Total Municipal Contractors	3,005.9	3,114.0	3	1,112.2	1,161.4	4	2,458.7	2,547.5	4

TABLE 11-21

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 3

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	CNPA3	% Diff	Baseline	CNPA3	% Diff	Baseline	CNPA3	% Diff
Napa County FC&WCD	24.5	24.2	-1	9.3	9.2	-1	20.2	19.5	-3
Solano County WA	41.3	40.8	-1	15.4	15.2	-1	34.1	32.9	-3
Alameda Co. FC&WCD, Zone 7	45.8	45.2	-1	17.0	16.9	-1	37.8	36.4	-4
Alameda County WD	41.9	41.4	0	15.5	15.3	1	34.4	33.1	-4
Santa Clara Valley WD	100.3	98.6	-2	37.5	37.1	0	82.3	79.3	-4
Oak Flat WD	5.1	5.3	4	1.3	1.6	23	3.8	4.2	10
County of Kings	8.3	8.6	4	2.0	2.5	25	6.1	6.8	11
Dudley Ridge WD	57.6	59.1	3	14.3	17.6	23	42.3	46.9	11
Empire West Side ID	3.9	3.8	-3	1.2	1.3	8	2.7	2.8	4
KCWA (Ag)	999.1	1,018.2	2	251.3	305.8	22	727.1	801.9	10
KCWA (Muni)	132.1	130.7	-1	48.1	47.8	-1	108.8	105.1	-3
Tulare Lake Basin WSD	85.9	105.3	0	28.4	33.5	18	75.5	81.5	8
San Luis Obispo Co. FC&WCD	24.5	24.3	-1	8.9	8.8	-1	20.2	19.5	-3
Santa Barbara Co. FC&WCD	44.6	44.2	-1	16.2	16.1	-1	36.8	35.5	-3
Antelope Valley-East Kern WA	139.7	138.2	-1	50.6	50.2	-1	114.6	110.9	-3
Castaic Lake WA (Ag)	11.5	11.8	3	2.8	3.5	25	8.5	9.4	11
Castaic Lake WA (Muni)	40.8	40.3	-1	15.2	15.1	-1	33.7	32.5	-4
Coachella Valley WD	120.4	119.3	-1	42.8	42.9	0	98.0	95.5	-3
Crestline-Lake Arrowhead WA	5.7	5.6	-2	2.1	2.0	-5	4.7	4.5	-4
Desert WA	52.7	52.0	-1	20.0	19.8	-1	46.1	41.1	-11
Littlerock Creek ID	2.3	2.2	-4	0.8	0.8	0	1.9	1.8	-5
Mojave WA	49.9	49.3	-1	18.1	17.9	-1	41.1	39.7	-3
Metropolitan WDSC	1,956.7	1,921.9	-2	728.2	720.8	-1	1597.1	1,536.3	-4
Palmdale WD	17.0	16.8	-1	6.2	6.1	-2	14.0	13.5	-4
San Bernardino Valley MWD	100.7	99.6	-1	36.6	36.3	-1	82.9	80.1	-3
San Gabriel Valley MWD	28.3	28.0	-1	10.3	10.2	-1	23.3	22.5	-3
San Gorgonio Pass WA	17.0	16.8	-1	6.2	6.1	-2	14.0	13.5	-4
Ventura County FCD	19.6	19.4	-1	7.1	7.1	0	16.2	15.6	-4
Total All Contractors	4,196.9	4,170.9	-1	1,413.4	1,467.3	4	3,324.6	3,322.6	0
Total Agricultural Contractors	1,191.1	1,212.1	2	301.3	365.9	21	865.9	953.7	10
Total Municipal Contractors	3,005.9	2,958.9	-2	1,112.2	1,101.5	-1	2,458.7	2,368.8	-4

TABLE 11-22

ESTIMATED AVERAGE TOTAL DELIVERIES UNDER 2020 CONDITIONS FOR BASELINE SCENARIO AND COURT-ORDERED NO PROJECT ALTERNATIVE 4

SWP Contractors	Average Wet Year			Average Critically Dry Year			Average Year		
	Baseline	CNPA4	% Diff	Baseline	CNPA4	% Diff	Baseline	CNPA4	% Diff
Napa County FC&WCD	24.5	23.6	-4	9.3	8.1	-14	20.2	17.7	-12
Solano County WA	41.3	39.7	-4	15.4	13.2	-14	34.1	29.5	-13
Alameda Co. FC&WCD, Zone 7	45.8	45.0	-2	17.0	14.7	-13	37.8	32.8	-13
Alameda County WD	41.9	40.4	-4	15.5	13.5	-13	34.4	30.1	-13
Santa Clara Valley WD	100.3	96.2	-4	37.5	32.8	-13	82.3	72.0	-13
Oak Flat WD	5.1	5.4	6	1.3	1.8	38	3.8	4.7	24
County of Kings	8.3	8.8	6	2.0	3.0	50	6.1	7.5	23
Dudley Ridge WD	57.6	60.6	5	14.3	20.9	53	42.3	52.1	23
Empire West Side ID	3.9	3.9	0	1.2	1.5	25	2.7	3.1	15
KCWA (Ag)	999.1	897.1	-10	251.3	358.9	43	727.1	886.7	22
KCWA (Muni)	132.1	127.1	-4	48.1	41.1	-14	108.8	94.2	-13
Tulare Lake Basin WSD	85.9	107.5	2	28.4	38.6	36	75.5	89.5	19
San Luis Obispo Co. FC&WCD	24.5	23.6	-4	8.9	7.6	-15	20.2	17.5	-13
Santa Barbara Co. FC&WCD	44.6	42.9	-4	16.2	13.9	-14	36.8	31.8	-14
Antelope Valley-East Kern WA	139.7	138.4	-1	50.6	49.6	-4	114.6	110.4	-4
Castaic Lake WA (Ag)	11.5	12.1	5	2.8	4.2	50	8.5	10.5	24
Castaic Lake WA (Muni)	40.8	39.2	-4	15.2	13.1	-17	33.7	29.1	-14
Coachella Valley WD	120.4	119.7	-1	42.8	42.9	0	98.0	95.7	-2
Crestline-Lake Arrowhead WA	5.7	5.5	-3	2.1	1.8	-4	4.7	4.1	-13
Desert WA	52.7	52.0	-1	20.0	19.5	-3	46.1	40.8	-11
Littlerock Creek ID	2.3	2.2	-4	0.8	0.7	-13	1.9	1.6	-16
Mojave WA	49.9	50.8	2	18.1	19.8	9	41.1	43.2	5
Metropolitan WDSC	1,956.7	1,902.3	-3	728.2	678.1	-7	1597.1	1468.1	-8
Palmdale WD	17.0	16.3	-4	6.2	5.3	14	14.0	12.1	-14
San Bernardino Valley MWD	100.7	102.6	2	36.6	40.1	10	82.9	87.2	5
San Gabriel Valley MWD	28.3	28.8	2	10.3	11.2	9	23.3	24.5	5
San Gorgonio Pass WA	17.0	16.3	-4	6.2	5.3	-14	14.0	12.1	-14
Ventura County FCD	19.6	18.9	-4	7.1	6.1	-14	16.2	14.0	-14
Total All Contractors	4,196.9	4,170.9	-1	1,413.4	1,467.2	4	3,324.6	3,322.5	0
Total Agricultural Contractors	1,191.1	1,240.7	4	301.3	428.8	42	865.9	1,054.1	22
Total Municipal Contractors	3,005.9	2,930.4	-3	1,112.2	1,038.5	-7	2,458.7	2,268.4	-8

The estimated proportional deliveries shown in Tables 11-3 through 11-6 and estimated deliveries to individual contractors shown in Tables 11-7 through 11-22 include the effects of the Table A transfers and retirements and the altered water allocation procedures but not the effects of the water supply management practices. This is of no consequence for NPA1, CNPA3, CNPA4 and Alternative 5 because they do not include the water supply management practices. CNPA2 includes some water supply management practices.

11.4.1 No Project Alternative 1

Deliveries under 2003 Conditions

As shown in Tables 11-3 and 11-4, the agricultural and M&I contractors proportional Table A and total deliveries for NPA1 and the baseline scenario under 2003 conditions are almost the same. This is because the only difference between the baseline scenario and NPA1 is that the latter includes a state-owned water bank in the Kern Fan Element with a capacity of 350,000 AF. A state-owned water bank would have a minor effect on total SWP deliveries, reducing deliveries slightly in wet years and increasing them slightly in dry years. The effects of the state-owned water bank are described in more detail in Section 11.6.

Future Deliveries

As shown in Tables 11-5 and 11-6, the agricultural and M&I contractors proportional Table A and total deliveries for NPA1 and the baseline scenario under 2020 conditions are almost the same. This is because the only difference between the baseline scenario and NPA1 is that the latter includes a state-owned water bank in the Kern Fan Element with a capacity of 500,000 AF. A state-owned water bank would have a minor effect on total SWP deliveries, reducing total deliveries slightly in wet years and increasing them slightly in dry years.

11.4.2 No Project Alternative 2

Deliveries under 2003 Conditions

NPA2 for the period 1996 through 2003 contains the same components as the proposed project. Consequently, deliveries under NPA2 under 2003 conditions would be the same as for the proposed project. As shown in Tables 11-3 and 11-4, proportional deliveries to the agricultural and M&I contractors would be the same for NPA2 as they are for the proposed project.

Future Deliveries

NPA 2 for the period 2003 through 2020 contains some of the same components as the proposed project. It does not included the Table A transfers totaling 16,000 AF from KCWA to Desert WA and Coachella Valley WD that are part of the proposed project or most of the water supply management practices. It does not include the altered allocation method, the turnback pool, expanded carryover storage in San Luis Reservoir, flexible storage in Castaic Lake and Lake Perris. It does include out-of-service area storage in groundwater banks developed prior to 2003.

As shown in Table 11-5, the agricultural contractors share of Table A deliveries under NPA2 would be less than under the baseline scenario or with the proposed project in average, average wet and critically dry years. As shown in Table 11-6, the agricultural contractors share of Table A deliveries under NPA2 would be less than under the baseline scenario in average, average wet and critically dry years and less than the proposed project in average and critically dry years.

11.4.3 Court-Ordered No Project Alternative 3

Deliveries under 2003 Conditions

As shown in Tables 11-3 and 11-4, the agricultural contractors' proportional Table A and total deliveries for CNPA3 are greater than those for the baseline scenario under 2003 conditions in average, average wet and average critically dry years. This is because the total Table A amount is reduced to 1.9 million AF under this alternative and allocation procedures for water available in excess of 1.9 million AF is more favorable to agricultural contractors than the pre-Monterey Amendment allocation procedures.

Future Deliveries

As shown in Tables 11-5 and 11-6, the agricultural contractors' proportional Table A and total deliveries for CNPA3 are greater than those for the baseline scenario under 2020 conditions in average, average wet and average critically dry years. This is because the total Table A amount is reduced to 1.9 million AF under this alternative and allocation procedures for water available in excess of 1.9 million AF is more favorable to agricultural contractors than the pre-Monterey Amendment allocation procedures.

11.4.4 Court-Ordered No Project Alternative 4

Deliveries under 2003 Conditions

As shown in Tables 11-3 and 11-4, the agricultural contractors' proportional Table A and total deliveries for CNPA4 are greater than those for the baseline scenario under 2003 conditions in average, average wet and average critically dry years. This is because the total Table A amount is reduced to 1.9 million AF under this alternative and allocation procedures for water available in excess of 1.9 million AF is more favorable to agricultural contractors than the pre-Monterey Amendment allocation procedures. The agricultural contractors' proportional Table A and total deliveries for CNPA4 are greater than those for the CNPA3 because the method of allocation of water in excess of 1.9 million AF is more favorable to the agricultural contractors under CNPA4 than under CNPA3.

Future Deliveries

As shown in Tables 11-5 and 11-6, the agricultural contractors' proportional Table A and total deliveries for CNPA4 are greater than those for the baseline scenario under 2020 conditions in average, average wet and average critically dry years. This is because the total Table A amount is reduced to 1.9 million AF under this alternative and allocation procedures for water available in excess of 1.9 million AF is more favorable to agricultural contractors than the pre-Monterey Amendment allocation procedures. Table A and total deliveries for CNPA4 are greater than Table A and total deliveries for the CNPA3. This is because the method of allocation for water in excess of 1.9 million AF is more favorable to the agricultural contractors under CNPA4 than it is under CNPA3.

11.5 SWP DELIVERIES FOR ALTERNATIVE 5

Deliveries under 2003 Conditions

As shown in Tables 11-3 and 11-4, the agricultural contractors' proportional Table A and total average annual deliveries for Alternative 5 are less than those for the baseline scenario under 2003 conditions. This is because the transfer of 114,000 AF of Table A amount from agricultural to M&I contractors reduces deliveries to agricultural contractors in most years. However, deliveries to agricultural contractors increase in critically dry years relative to the baseline scenario because of the altered water allocation procedures.

Total deliveries to contractors under Alternative 5 were similar to but slightly less than with the proposed project under 2003 conditions. Between 1996 and 2004, the Department determined from historical date that all elements of the Monterey Amendment except the Table A transfers increased deliveries to contractors by 44,000 AF for the nine year period (see Chapter 6 for details). Alternative 5 does not include the water supply management practices, the element of the Monterey Amendment primarily responsible for the 44,000 AF increase, and so deliveries under Alternative 5 would have been about 5,000 AF less than deliveries with the proposed project.

Future Deliveries

As shown in Tables 11-5 and 11-6, the agricultural contractors' proportional Table A and total deliveries for Alternative 5 are less than those for the baseline scenario under 2020 conditions in average and average wet years and greater than those for the baseline scenario in average critically dry years. This is because the transfer of 130,000 AF of Table A amount from agricultural to M&I contractors reduces deliveries to agricultural contractors in most years but the altered allocation procedures increase deliveries to agricultural contractors in critically dry years.

Total deliveries to contractors under Alternative 5 would be less than with the proposed project under 2020 conditions. The Department estimated that the water supply management practices that are a part of the proposed project would increase deliveries to contractors by 50,000 AF per year in the future (see Chapter 6 for details). Alternative 5 does not include the water supply management practices and so deliveries under Alternative 5 would be about 50,000 AF per year less than deliveries with the proposed project.

11.6 EFFECTS OF STATE-OWNED KERN WATER BANK ON SWP DELIVERIES

The effects of a state-owned water bank on the Kern Fan Element property were examined by comparing NPA1 to the baseline scenario. NPA1 is almost identical to the baseline scenario. None of the elements of the proposed project would be implemented and the Table A amounts for the two scenarios would be the same. The only difference between the two scenarios is that under NPA1 the Department would develop a water bank on the Kern Fan Element property.

In 1988, the Department purchased approximately 20,000 acres of land in Kern County with the intention of constructing a groundwater bank that would be a part of the SWP. As part of the Monterey Amendment, ownership of these lands, known as the Kern Fan Element property, was transferred to KCWA, and subsequently transferred to the KWBA. It was assumed in NPA1 that if the Department had retained ownership of the Kern Fan Element property it would have constructed a state-owned, locally operated water bank on the property.

The CALSIM II model was used to estimate the effect of a state-owned water bank on the Kern Fan Element property on SWP water allocations. Various assumptions were made regarding operations of the water bank. The assumptions were based on the information contained in the Department's feasibility report for a water bank on the Kern Fan Element property. It was assumed that the water bank would have a storage capacity of 350,000 acre-feet in 2003 and a capacity of 500,000 acre-feet in 2020. Initial storage of SWP water in the bank in 1995 was assumed to be 83,000 acre-feet and that the maximum recharge rates would be 10,500 acre-feet per month in 2003 and 15,000 acre-feet per month in 2020. Maximum extraction rates were assumed to be 6,200 acre-feet per month in 2003 and 8,900 acre-feet per month in 2020. Because extraction of water from the water bank would be expensive it was assumed that the Department would only do so in years when the total Table A allocation was less than 60 percent. More details on assumed operating parameters for the state-owned water bank are contained in Appendix F.

Table 11-7 shows total SWP Table A deliveries to contractors under the baseline scenario and with NPA1 in wet, critically dry and average years under 2003 conditions with and without a state-owned water bank. The existence of the bank with NPA1 would reduce total deliveries to contractors in wet years by about 0.5 percent because water that would otherwise be delivered to contractors as Article 21 water would instead be placed in storage in the water bank. The existence of the bank would increase deliveries to contractors in critically dry years by about 2.5 percent because the Department would be able to withdraw water from the bank to supplement deliveries of Table A water to contractors from its other sources. The existence of the bank would have no effect on total deliveries to contractors averaged over the 73-period of hydrologic record.

Table 11-11 shows total SWP Table A deliveries to contractors under the baseline scenario and with NPA1 in wet, critically dry and average years under 2020 conditions with and without a state-owned water bank. The existence of the bank would reduce total deliveries to contractors in wet years by about 0.6 percent and would increase total deliveries to contractors in critically dry years by about 4 percent. The operation of the bank would have no effect on deliveries to contractors averaged over the 73-period of hydrologic record.

11.7 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The more significant impacts of the proposed project would be felt in four areas, the Sacramento-San Joaquin Delta, at Lake Perris and Castiac Lake, in the San Joaquin Valley portion of Kern County, and in Plumas County. The proposed project would result in increased pumping of water from the Delta in wet months of wet years under certain circumstances which could have an adverse impact on already declining Delta fisheries. The increased pumping would be a consequence of several of the water supply management practices included in the Monterey Amendment, particularly the practice that enables contractors to store SWP water outside their service areas.

Another Monterey water management practice, flexible storage in Castaic Lake and Lake Perris, allows certain contractors to borrow water from the terminal reservoirs. The practice could result in water levels in Castaic Lake and Lake Perris being drawn down for a longer period of time than has occurred in the past. Prolonged drawdown could adversely affect recreation, riparian vegetation, resident fish and raptors that forage over the lakes. It could also result in increased erosion, increased airborne dust and make any usually submerged cultural resources vulnerable to disturbance.

Storage of SWP water outside contractors' service areas, a Monterey water management practice, encourages the development of groundwater banks. Groundwater banks that rely on active recharge of water involve the construction and operation of large areas of percolation ponds. If ponds are built in undeveloped areas they may have adverse effects on terrestrial wildlife and vegetation and cultural resources. Construction of groundwater banks would be the subject of project-level CEQA documents that would analyze the impacts of the construction impacts of the banks and develop appropriate mitigation measures.

The Settlement Agreement provides funds for environmental restoration in Plumas County. Although restoration projects benefit the environment in the long-term they typically have adverse environmental effects during and immediately following the construction period.

Table 11-23 summarizes the impacts of the proposed project and the alternatives to the proposed project relative to the baseline scenario. NPA1, CNPA3 and CNPA4 would avoid all of the adverse environmental impacts of the proposed project with the exception of those associated with the construction and operation of groundwater banking facilities on the Kern Fan Element property. NPA1, CNPA3 and CNPA4 include a state-owned water bank on the Kern Fan Element property. Construction of a state-owned bank would have similar impacts to those that occurred when the Kern Water Bank Authority constructed its groundwater banking facilities on the property.

NPA2 would have the same effects as the proposed project for 1996 through 2003. In the future, NPA2 would have lesser effects than the proposed project on Delta fisheries and in the San Joaquin Valley portion of Kern County. It would have no effects on environmental resources at Castaic Lake and Lake Perris and in Plumas County. Alternative 5 would avoid all of the adverse environmental impacts of the proposed project except those in Plumas County.

TABLE 11-23

ENVIRONMENTAL IMPACTS OF ALTERNATIVES

	Proposed Project	NPA1	NPA2	CNPA3/CNPA4	Alternative 5
Impacts of Delta fisheries	Increased Delta pumping could adversely affect Delta fisheries	No Impact	1996-2003: same as proposed project. Future: similar to but less than proposed project	No Impact	No Impact
Impacts on environmental resources at Lake Perris and Castaic Lake	Extreme drawdown of reservoirs at times could harm fish, wildlife, culture resources, etc.	No Impact	1996-2003: same as proposed project. Future: No Impact	No Impact	No Impact
Impacts on environmental resources in San Joaquin Valley portion of Kern County	Impacts associated with construction of percolation ponds and conversion of annual to permanent crops	Similar to but less than proposed project	1996-2003: same as proposed project. Future: similar to but less than proposed project	Similar to but less than proposed project	No Impact
Impacts on environmental resources in Plumas County	Impacts associated with stream restoration facilities	No Impact	No Impact	No Impact	Same as proposed project

ENDNOTES

1. Some SWP contractors believe that the Department would not have built a state-owned water bank on the Kern Fan Element. To do so, the Department would have needed the approval of local water agencies and some believe that that approval would not have been forthcoming.

2. There are doubts about the institutional feasibility of Alternative 5 because the Monterey Amendment was approved as an integrated package of amendments to the long-term water supply contracts that balanced the interests of the signatories in an acceptable manner. If some elements of the package were removed it is unlikely that it would acceptable to all signatories.

3. California Department of Water Resources, 2006. The State Water Project Delivery Reliability Report 2005.

12. CLIMATE CHANGE

12. CLIMATE CHANGE

12.1 INTRODUCTION

Global climate change is playing an increasingly important role in scientific and policy debates related to water management. The most consequential impacts of climate change on water resources in the United States are likely to occur in the mid-latitudes of the west, where the runoff cycle is largely determined by snow accumulation and subsequent melt patterns. It is well documented that the effects of warmer climates on the timing of runoff in these regions likely will shift a portion of spring and summer runoff to periods earlier in the year. Despite the high degree of regulation in many water supply systems throughout the western United States, the resultant effects of these shifts on runoff seasonality generally are considered to be undesirable, because the amount of water stored in snowpack can be substantial and, under normal (i.e., historical) conditions, this stored water is relied upon to augment low stream flows during the relatively dry summers.[1]

Developing evidence indicates global climate change will have a marked effect on water resources in California. More than 150 peer-reviewed scientific articles on climate and water issues in California have been published to date, with many more in preparation, addressing a range of considerations from proposed improvements in the downscaling of general circulation models to understanding how reservoir operations might be adapted to new conditions.[2] Rising temperatures and sea levels, and changes in hydrological systems are recognized as potential threats to California's economy, public health and environment. In addition to the need for better understanding of the potential implications associated with these changes, it also is recognized that more research is necessary to identify which systems are most vulnerable.[3]

Various gases in the Earth's atmosphere, classified as atmospheric greenhouse gases (GHGs), play a critical role in determining the Earth's surface temperature. Solar radiation enters Earth's atmosphere from space, and a portion of the radiation is absorbed by the Earth's surface. The Earth emits this radiation back toward space, but the properties of the radiation change from high-frequency solar radiation to lower-frequency infrared radiation. GHGs, which are transparent to solar radiation, are effective in absorbing infrared radiation. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This phenomenon is known as the greenhouse effect.

Among the prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), ozone (O_3), water vapor, nitrous oxide, and chlorofluorocarbons (CFCs). Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for enhancing the greenhouse effect. Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors.[4] In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation.[5] A byproduct of fossil fuel combustion is CO_2. Methane, a highly potent GHG, results from offgassing associated with agricultural practices and landfills. Processes that absorb and accumulate CO_2, often called CO_2 "sinks," include uptake by vegetation and dissolution into the ocean.

As the name implies, global climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern, respectively. If California were a country, it would rank as the 12th to 16th largest emitter of CO_2 in the world. California produced 492 million gross metric tons of carbon dioxide equivalents in 2004.[6] Carbon dioxide equivalents is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse effect. This potential, known as the global warming potential of a GHG, is also dependent on the lifetime, or persistence, of the gas molecule in the atmosphere. For example, CH_4 is a much more potent GHG than CO_2. As described in the General Reporting Protocol of the California Climate Action Registry,[7] one ton of CH_4 has the same contribution to the greenhouse effect as approximately 21 tons of CO_2. Expressing GHG emissions in carbon dioxide equivalents takes the contribution of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted. Consumption of fossil fuels in the transportation sector was the single largest source of California's GHG emissions in 2004, accounting for 40.7% of total GHG emissions in the state.[8] This category was followed by the electric power sector (including both in-state and out-of-state sources) (22.2%) and the industrial sector (20.5%).[9]

12.2 REGULATORY SETTING

While there are numerous regulations related to air quality and emission in California standards, several recent State regulations specifically address global climate change. A description of these regulations is presented.

12.2.1 Assembly Bill 1493

In 2002, then-Governor Gray Davis signed Assembly Bill (AB) 1493. AB 1493 requires that the California Air Resources Board (CARB) develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty truck and other vehicles determined by the CARB to be vehicles whose primary use is noncommercial personal transportation in the state."

12.2.2 Executive Order S-3-05

Governor Schwarzenegger of California signed Executive Order S-3-05 on June 1, 2005. The Order recognizes California's vulnerability to climate change, noting that increasing temperatures could potentially reduce snowpack in the Sierra Nevada, which serves as one of the State's primary sources of water. Additionally, according to the Order, climate change could influence human health, coastal habitats, microclimates, and agricultural yield. To address these potential impacts, the Order mandates GHG emission reduction targets. More specifically, by 2010, GHG emissions are expected to be reduced to 2000 levels; by 2020, emissions are expected to reach 1990 levels; and by 2050, emissions are expected to be 80 percent below 1990 levels. The Secretary of the State Environmental Protection Agency (Secretary) will oversee the reduction program targets and coordinate efforts to meet these provisions with numerous State agencies, such as the Resource Agency, which includes the California Department of Water Resources (Department). The Secretary will also provide biannual reports to the Governor and the State Legislature regarding: (1) progress toward meeting the GHG emissions targets; (2) the ongoing impacts of global warming in the State, including impacts to water supply and the environment; and (3) potential mitigation and adaptation plans to combat these impacts. In order to achieve the climate change emission targets, in June 2005, the

Secretary formed the Climate Action Team, which is comprised of administrators from numerous state agencies.

12.2.3 Assembly Bill 32 – California Global Warming Solutions Act

The California Global Warming Solutions Act of 2006 (AB 32) was signed into law on September 27, 2006. With the Governor's signing of AB 32, the Health and Safety Code (Section 38501, Subdivision (a)) now states the following:

> "Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."

The bill requires the CARB, in coordination with State agencies as well as members of the private and academic communities, to adopt regulations to require the reporting and verification of statewide GHG emissions and to monitor and enforce compliance with this program. Similar to Executive Order S-3-05, under the provisions of the bill, by 2020, statewide GHG emissions will be limited to the equivalent emission levels in 1990. By January 2008, the CARB will determine the statewide GHG emission level in 1990 through review of the best available scientific, technological, and economic information, as well as provide opportunities for public review and comment. To achieve the 2020 reduction goal, by January 2011, the CARB shall adopt emission limits and reduction measures, which may include a system of market-based declining annual aggregate emission limits for sources or categories of sources that emit GHGs. It is anticipated that limits and emission standards adopted by the CARB will become operative beginning January 2012. In addition, the Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 is expected to continue its role coordinating overall climate policy.

12.2.4 Senate Bill 1368

Senate Bill (SB) 1368 is the companion bill of AB 32 and was signed by Governor Schwarzenegger in September 2006. SB 1368 requires the California Public Utilities Commission (PUC) to establish a GHG emission performance standard for baseload generation from investor-owned utilities by February 1, 2007. The California Energy Commission (CEC) must establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the GHG emission rate from a baseload combined-cycle natural gas fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the PUC and CEC.

12.3 POTENTIAL IMPACTS TO ENVIRONMENTAL RESOURCES IN CALIFORNIA RESULTING FROM GLOBAL CLIMATE CHANGE

Global climate change has the potential to impact numerous environmental resources in California through potential, though uncertain, impacts related to future air temperatures and precipitation patterns, and the resulting implications to surface water runoff rates and timing, water temperatures, reservoir operations, and sea levels. Although current models are broadly consistent in predicting probable increases in global air temperatures and levels of GHG's resulting from human activities, there are considerable uncertainties about precipitation estimates. For example, many regional modeling analyses conducted for the western United States indicate that overall precipitation will increase, but uncertainties remain due to differences among larger-scale General Circulation Models (GCMs).[10] Some researchers believe that climate warming might push the storm track on the West Coast further north, which would result in drier conditions in California. At the same time, relatively newer GCMs, including those used in the National Water Assessment, predict increases in California precipitation.[11] Similarly, two popular climate models, including HadCM2 developed by the U.K. Hadley Center and PCM developed by the U.S. National Center for Atmospheric Research also predict very different future scenarios. The HadCM2 predicts wetter conditions while the PCM predicts drier conditions in the greater Central Valley.[12]

While much variation exists in projections related to future precipitation patterns, all available climate models predict a warming trend in California resulting from the influence of rising levels of GHGs in the atmosphere.[13] In 2004, the Intergovernmental Panel on Climate Change (IPCC) stated that it is very likely that hot extremes, heat waves, and heavy precipitation events will be more frequent.[14] The potential effects of a warmer climate on the seasonality of runoff from snowmelt in California's Central Valley have been well-studied and results suggest that melt runoff would likely shift from spring and summer to earlier periods in the water year.[15] Currently, snow accumulation in the Sierra Nevada acts as a natural reservoir for California by delaying runoff from winter months when precipitation is high.[16] Despite the uncertainties about future changes in precipitation rates, it is generally believed that higher temperatures will lead to changes in snowfall and snowmelt dynamics. Higher atmospheric temperatures will likely increase the ratio of rain to snow, shorten and delay the onset of the snowfall season, and accelerate the rate of spring snowmelt, which would lead to more rapid and earlier seasonal runoff relative to current conditions.[17] Studies suggest that the spring streamflow maximum could occur about one month earlier by 2050.[18] Further, droughts have been and are expected to increase in duration and frequency in the future.[19]

12.4 CLIMATE CHANGE CASE STUDIES IN THE CALIFORNIA CENTRAL VALLEY

Projecting the regional impacts of climatic change and variability relies first on GCMs, which develop large-scale scenarios of changing climate parameters, usually by comparing scenarios with different concentrations of GHGs in the atmosphere. However, information provided by the GCMs is typically too coarse of a scale to make accurate regional assessments.[20] Consequently, recent efforts have resulted in reducing the scale and increasing the resolution of climate models by downscaling or integrating regional models into the global models.

Both GCMs and hydrologic models (i.e., CALSIM) have been utilized in a number of California climate change studies. Many of these studies focus on stream flow response to shifts in the timing and form of precipitation, and do not address inter-annual variability or scaling issues inherent in mapping GCM model output to more detailed watershed hydrologic models.[21] As a result, such studies do little more than make qualitative statements about the implications of these changes to environmental impacts (e.g., water quality, agriculture, fisheries).[22] However, other investigations have attempted to quantify impacts to environmental resources, particularly water supply.

Such efforts have focused attention on the issues of water management in California associated with potential hydrologic changes that may occur as a result of climate change. More recently, there has been progress in modeling climate change and its effects on a regional basis. Although there are still differences in some model projections (e.g., amount and timing of annual precipitation), projections on other variables are becoming more consistent (e.g., reduced snowpack, shift of snowmelt timing to an earlier time period, rises in sea level, and warmer weather patterns). Though differences in the hydrological response to climate change exist among model projections, these differences can be used to bracket the magnitude of expected changes allowing managers to develop different response scenarios. Some of the key findings of recent research efforts in the Central Valley of California are described below.

12.5 2005 UPDATE TO THE DEPARTMENT'S CALIFORNIA WATER PLAN

The 2005 update to the *California Water Plan*[23] contains an analysis of future water demands resulting from population growth, and additionally attempts to address potential impacts resulting from global climate change, as discussed below. The Department has developed preliminary estimates of water demands that could reasonably be expected to occur by 2030. These preliminary estimates represent the expected water demands under three different future scenarios. The three future scenarios are defined as follows:

Scenario 1 – Current Trends: Recent trends for population growth and development patterns, agricultural and industrial production, environmental water dedication, and naturally occurring conservation measures (e.g., plumbing code changes, natural replacement, actions water users take on their own, etc.).

Scenario 2 – Less Resource Intensive: Recent trends for population growth, higher agricultural and industrial production, more environmental water dedication, and higher naturally occurring conservation.

Scenario 3 – More Resource Intensive: Higher population growth rate, higher agricultural and industrial production, no additional environmental water dedication, and lower naturally occurring conservation.

The greater urban water demand projected under all three scenarios presents significant challenges to water managers. Under the Current Trends scenario, the Department estimates an additional 3.6 million acre-feet of urban and environmental water demand per year in 2030. Though there may be commensurate reductions in agricultural demand, this demand reduction would occur in the Central Valley, while much of the additional urban demand would occur in the southern part of the State, and the ability to transfer additional water there could be constrained by conveyance facilities, area-of-origin issues, environmental impacts, and other third party effects. Although these projections describe additional water demands in California by 2030, they do not consider the capability of the water management system to meet those demands under different hydrologic conditions such as those predicted by climate change models.

The 2005 *California Water Plan* also attempts to address concerns related to climate change. More specifically, the Department recognizes the potential for significant impacts associated with climate change, and these impacts warrant an examination regarding the ability of existing water supply infrastructure and natural systems to accommodate or adapt to climatic change. The 2005 *California Water Plan* identified the following needs:

- The major tool for evaluating the impact on major water project systems is CALSIM, a model developed jointly by Reclamation and the Department. CALSIM currently relies on historic monthly hydrological data to assess project impacts. The development of modified input to CALSIM from the climate models is a major task and will require help from the research community. Enabling CALSIM to utilize data from climate models will allow for more proactive planning and development of strategies and options for improving water supply and quality;

- The linking of climate and hydrologic models is a major task but will provide a tool for evaluating multipurpose reservoir flood control aspects. The screening of climate models by experts in the field will be required to select those that provide the most plausible future scenarios. Because there will be competition between flood control and other purposes at the large multipurpose reservoirs due to earlier peak snowmelt runoff, an examination of space criteria allocated for flood control in the spring is required;
- Because of a general warming in California's climate, it is expected that increases in water requirements for crops, wildlands and landscaping will likely occur. In order to properly measure these changes, the monitoring of evapotranspiration rates will be required. The goal is to develop likely changes in evapotranspiration rates for the 2050 and 2100 scenarios. Projections of future weather including precipitation during the growing season are required to provide projected increases in plant water requirements;
- Existing models for water temperature on the major rivers in the Sacramento River Basin will likely require improvement as the job of maintaining suitable downstream temperatures for anadromous salmonids becomes more difficult; and
- Monitoring the effects of climate change on regions near California is also important. The Colorado River region is important to California and may have potential impacts on both water supply and hydropower. The Columbia River Basin is an important source of hydropower for California. Monitoring the results of research and studies in these areas is important for future planning studies.

Because only limited data and tools exist to provide answers to important questions for decision makers, water managers and resource planners, the Department is working in conjunction with others to develop a new analytical approach for the preparation of *California Water Plan Update* 2009. The Department has determined that designing this quantitative approach will best be achieved through a consortium of public and private entities, with State leadership and input from stakeholders. The purpose of the consortium is to prepare a long-term plan to review data and analytical tools, as well as to develop decision-support systems to make complex technical information more accessible to decision makers and resource managers. Because time is needed to develop this new approach, most of the quantitative work will be published in 2010.

12.6 PRELIMINARY CLIMATE CHANGE IMPACTS ASSESSMENT FOR CVP/SWP OPERATIONS AND THE DELTA

On July 9, 2006, the Department released a report entitled *Progress on Incorporating Climate Change into Management of California's Water Resources* (Report).[24] The Report was prepared in response to Executive Order S-3-05 by the Governor in June 2005 and as a first step in addressing the limitations presented above. The Report describes the Department's progress toward incorporating climate change modeling into existing water resources planning and management tools and methodologies. While the Report describes numerous efforts, Chapters 4 and 5 of the report present the potential impacts of climate change scenarios on CVP/SWP operations and deliveries, and Delta water quality and water levels using the hydrologic models CALSIM II and DSM2, respectively. Each impact analysis considers four scenarios predicted by pairings of two global climate models (i.e., PCM and GFDL) and two carbon dioxide emissions rates (A2 and B1), and illustrate projected hydrologic conditions centered around 2050 (i.e., 2035 through 2064). All four climate change scenarios predict a general warming trend for California; however, three of the four scenarios predict modestly drier climates, while one (i.e., PCM-B1) predicts a weak precipitation increase. Monthly river inflow data for use as CALSIM II input is generated by downscaling and adapting global climate model results, using a regional hydrologic model, derivation of climate change runoff perturbation ratios, and application of these perturbations ratios to CALSIM II historic reservoir inflows. The hydrologic estimates associated with each climate change scenario are then compared to a base scenario, which is designated as the 2020 level of development outlined in U.S. Bureau of Reclamation's *Long-Term Operations Criteria and Plan* (OCAP).[25]

The results of the analysis for CVP/SWP operations and deliveries indicate several potential impacts related to global climate change. For example, during the three drier year climate scenarios, there are a significant number of months in which Shasta and Folsom reservoirs fall to dead storage, with these occurrences concentrated during critical and drought-year conditions. During these months, stream flow requirements in the Sacramento and American rivers could not be met, and the CVP was unable to meet its share of water for the Coordinated Operations Agreement. In contrast, the base scenario had only one month which resulted in attainment of dead storage in these locations. These reservoir shortages influence the remaining analyses within the model, and hence, CVP/SWP system deliveries also are influenced by global climate change. Relative to the base scenario, changes in annual average south-of-Delta SWP Table A and CVP deliveries ranged from slight increases associated with the wetter-climate scenario up to about 10 percent reductions for drier year scenarios. In addition, carryover storage for both the CVP and SWP reservoir is negatively impacted under the drier climate scenarios and mildly increased under the wetter-climate scenario. Additional reservoir operations impacts are evident by a reduction in the CVP/SWP power generation capacity during summer months and warming of water temperatures in rivers downstream of CVP/SWP reservoirs under the drier-climate scenarios.

Using the same methodology and reservoir operation output described above, the Report also describes potential impacts of climate change on Delta water quality and water levels. The CALSIM II output reflecting adjustments in reservoir operation and Delta exports due to shifting precipitation and runoff patterns are utilized in the DSM2 model for each of the four scenarios. Because one of the key assumptions in the CALSIM II model prioritizes Delta water quality standards, the impact assessment for the Delta inherently mitigates for climate change by modifying upstream system operations to maintain Delta water quality standards. Hence, Delta water quality effects for all four climate change scenarios are relatively minor. When considering a one-foot rise in sea level, either alone or combined with the effects of climate change, Delta water quality standards are met about 90 percent of the time, particularly during dry and critical years. In real time, operational adjustments would be required and translate into impacts to the CVP and SWP, although these impacts cannot yet be quantified. Finally, the Report predicts that levee overtopping could be an issue during a one-foot sea level rise scenario, although no overtopping events are predicted for the current sea level condition.

As noted in the Report, the purpose of the study is to demonstrate how various analysis tools currently used by management agencies could be used to address issues related to climate change. The Report explicitly cautions that all results presented are preliminary, incorporate several assumptions, reflect a limited number of climate change scenarios, and do not address the likelihood of occurrence for potential impacts, and as such, are not sufficient by themselves to make policy decisions. In addition, the study contains several key assumptions that may not reflect operational realities. For instance, the study assumes that no changes will be made to system structures or facilities, reservoir operating rules, stream flow requirements, water quality standards, or operations to account for sea level rise or salt water encroachment. Future work will focus on further elucidating not only the magnitude, but also probability, of potential impacts, as well as investigating possible changes in system operations to avoid these impacts.

Some of the projected effects of climate change on California's water resources and the consequences of those effects are summarized in Table 12-1.

TABLE 12-1

POTENTIAL EFFECTS OF CLIMATE CHANGE ON CALIFORNIA'S WATER RESOURCES AND EXPECTED CONSEQUENCES

Potential Water Resource Impact	Expected Consequence
Reduction of the State's average annual snowpack	• Potential loss of 5 million acre-feet or more of average annual water storage in the State's snowpack • Increased challenges for reservoir management and balancing the competing concerns of flood protection and water supply
Changes in the timing, intensity, location, amount, and variability of precipitation	• Potential increased storm intensity and increased potential for flooding • Possible increased potential for droughts
Long-term changes in watershed vegetation and increased incidence of wildfires	• Changes in the intensity and timing of runoff • Possible increased incidence of flooding and increased sedimentation
Sea level rise	• Inundation of coastal marshes and estuaries • Increased salinity intrusion into the Sacramento-San Joaquin River Delta • Increased potential for Delta levee failure • Increased potential for salinity intrusion into coastal aquifers (groundwater) • Increased potential for flooding near the mouths of rivers due to backwater effects
Increased water temperatures	• Possible critical effects on listed and endangered aquatic species • Increased environmental water demand for temperature control • Possible increased problems with foreign invasive species in aquatic ecosystems • Potential adverse changes in water quality, including the reduction of dissolved oxygen levels
Changes in urban and agricultural water demand	• Changes in demand patterns • Changes in evapotranspiration rates

Some of the main results of the Report related to impacts on the SWP and CVP are as follows:

- In three of the four climate scenarios simulated, there were significant shortages predicted in CVP north-of-Delta reservoirs during droughts. In future studies, operational changes are necessary to avoid these shortages. At this time, it is not clear whether the necessary changes in operations will be insignificant or substantial.
- Estimated changes in annual average SWP south-of-Delta Table A deliveries ranged from a slight increase of about one percent for a wetter scenario to about a 10 percent reduction for one of the drier climate change scenarios.
- Estimated increased winter runoff and lower Table A allocations resulted in slightly higher annual average Article 21 deliveries in the three drier climate change scenarios. However, the boosts in Article 21 did not offset losses to Table A. The wetter scenario with higher Table A allocations resulted in fewer Article 21 delivery opportunities and slightly lower annual average Article 21 deliveries.
- Estimated changes in annual average CVP south-of-Delta deliveries ranged from increases of about 2.5 percent for a wetter scenario and decreases of as much as 10 percent for drier climate change scenarios. The CVP results of the drier climate change scenarios are in question due to the north-of-Delta shortages mentioned above. These shortages will have to be addressed in future climate change studies.

- For both the SWP and CVP, estimated carryover storage was adversely impacted in the drier climate change scenarios and somewhat increased in the wetter climate change scenario.

Sea level rise effects on water project operations to repulse greater salt water intrusion under these conditions were not examined due to lack of existing tools for that type of analysis. Surrogates to provide an indication of the increased operation challenges from sea level rise are discussed in the report; future work in this area will include the development of the necessary tools to quantify the impacts of sea level rise on saltwater intrusion and the incremental water supply impacts to repulse greater saltwater intrusion forces into the Delta.

Some of the main results of the climate change report related to estimated impacts on the Delta include:

- For the four climate change scenarios, Delta inflows typically increase during the late winter and early spring and decrease during the summer and fall. On average, Delta exports are reduced with the largest reductions occurring during the summer and fall. Inflows and exports are most sensitive to climate change during extremely wet or extremely dry periods.
- Flexibility in the system to modify reservoir operations and Delta exports for the climate change scenarios at present sea level results in minor impacts to compliance with chloride standards at municipal and industrial intakes.
- A one foot rise in sea level without any changes to the system operations would result in estimated chloride concentrations below the 250 milligram per liter (mg/l) threshold 90 percent of the time at Old River in Rock Slough. In real time, operational adjustments will take place so these effects will translate into water supply impacts to the SWP and CVP. As stated above these impacts to water supply cannot be quantified at this time. Maintaining chloride concentrations below the 150 mg/l threshold was also more challenging during critical and dry years. These results indicate the need to develop a tool to quantify the additional water supplies that would need to be dedicated to repulse sea water in order to maintain Delta water quality under sea level rise conditions.
- There was complete compliance with the chloride standards at the SWP and CVP for the climate change at present sea level scenarios. Chloride concentrations remained below threshold values for the sea level rise and combined climate change and sea level rise scenarios.
- Chloride mass loadings at the municipal and industrial intakes are typically reduced for the climate change only scenarios due to lower export rates. Increased intrusion of salt water from the ocean from the sea level rise and combined climate change and sea level rise scenarios lead to increased chloride mass loadings at the municipal and industrial intakes.
- For a one foot rise in sea level, maximum daily water levels exceeded the minimum levee crest elevation on Sherman Island twice during the 16-year analysis period. Water levels did not exceed the minimum crest elevation for present sea level conditions.

12.7 AREAS OF FURTHER RESEARCH AND ONGOING ACTIVITIES

One of the most important areas of research associated with the potential impacts of climate change on California's water resources is the further development of tools to predict changes in the timing or amount of future water availability. Currently, CALSIM serves as the primary operations and planning model for CVP and SWP operations. The model simulates CVP and SWP operations within the geographical area affected by CVP and SWP facilities, including the Delta, on a monthly time-step over a range of historical hydrologic conditions. CALSIM routes water through the system on a monthly basis using operational decisions, which consider delivery and storage targets, and adhere to operating rules and constraints such as instream flow requirements, downstream water quality objectives and contract deliveries to agricultural and M&I water users. The end-of-month storages from each month's operations are used as initial conditions for the following month's operations. Model outputs include monthly reservoir releases, river flows, reservoir stored water volumes, Delta export activities, indicators of Delta water quality, and water deliveries.[26] A baseline version of the model is set up to perform monthly operations decisions for a 73-year simulation period based on the 1922 to 1994 period of hydrologic record. For comparative studies, water demands, system infrastructure, and/or operations are modified to represent CVP and SWP operations under alternate conditions.

Another simulation model that has been used for studies in the Central Valley is Central Valley Model (CVMod). CVMod was developed by the University of Washington and operates similarly to CALSIM. The primary input to CVMod is monthly streamflow which comes from either observed historic streamflows or from Variable Infiltration Capacity (VIC) simulations of potential future streamflows; VIC is a regional hydrologic model implemented for the Sacramento-San-Joaquin basins.[27] In a comparison of CALSIM with CVMod, it was shown that CALSIM was better able to predict end-of-month storage volumes in the major Central Valley Reservoirs. The period of analysis for the comparison was October of 1979 through June of 1994.[28]

A third model used in some Central Valley studies is California Value Integrated Network (CALVIN). CALVIN was developed at University of California Davis and is a prescriptive optimization model that operates surface and groundwater resources and allocates water over the historical hydrologic record.[29] CALVIN maximizes the economic values of agricultural and urban water use statewide, within physical, environmental and policy constraints. Besides the Central Valley, CALVIN incorporates parameters from southern California SWP contractors, California users of the Colorado River, the Owens Valley and Mono Basin and also groundwater sources, making it the model with the broadest coverage of water users in California. Monthly operations and allocation decisions are made based on the 1922 to 1993 hydrologic period assuming perfect foresight of future inflows.

To effectively assess the potential impacts of climate change on California's water system, a model is needed that represents the operation of the system and has the ability to accept input from climate change impact studies related to the Central Valley. The model requires a descriptive, rather than prescriptive approach.[30] A descriptive approach would use observed data in the model without regulatory limits on operations to represent a more realistic view of the operation of California's water system. A purely prescriptive approach would include presumed operational limitations to show how the system works with adherence to those limitations. Of the three models described above, CALSIM provides the most robust representation of the current system in terms of coverage, spatial representation and operational rules. CALSIM's major fault is its inability to utilize hydrologic data not related to the 73 years of historical data for which the model has been validated. CVMod has the ability to accept any hydrologic inputs, however, its weakness is that some of the operations rules, and hence, the results from the model, are potentially much different from how the system is actually run. The CALVIN model is prescriptive rather than descriptive.

Projecting regional impacts of climate change is a multi-step process. First, GCMs are used to develop large-scale scenarios of changing climate parameters. Because this information is at too coarse a scale to make regional assessments, efforts are currently being made to reduce the scale and increase the resolution of GCMs by downscaling or integrating regional models into the GCMs. VanRheenen *et al.* (2004) were able to incorporate output data from PCM models into CVMod to examine the Central Valley water resources, under five different PCM scenarios, by developing a technique to downscale PCM model output to a scale suitable for CVMod input. Dettinger *et al.* (2004) was able to utilize a downscaled PCM model output to simulate streamflow and water balances in the American River basin by use of the Precipitation-Runoff Modeling System (PRMS), a model that predicts changes to runoff based on land use and climate changes. Zhu[31] utilized CALVIN to process 12 climate change scenarios developed by the Lawrence Berkeley National Laboratory (LBNL). In this study, LBNL data was used to alter the CALVIN base hydrology, consisting of monthly time series of rim inflows, reservoir evaporation rates, local accretions and groundwater inflows, to simulate projected hydrology under different climate change scenarios.

Although significant differences among GCMs currently exist in projected future climate scenarios, the research described above indicates that substantial progress has been made in developing methodologies to integrate hydrologic models with climate models. Ideally, the ability to integrate GCM output with CALSIM will provide a tool to allow the proactive planning and development of options to improve water supply and quality under different climate change scenarios. Integration of the GCMs with CALSIM will likely require several intermediate steps that will include downscaling of the GCMs and may include features from CALVIN, CVMod and PRMS. The Report has made significant strides in integrating GCMs into CALSIM, although several limitations remain.

Both government agencies and the private sector have recognized the potentially adverse impacts associated with climate change. Businesses in the private sector are voluntarily cutting their GHG emissions while state and local governments are responding with efforts to cut emissions within their jurisdictions.[32] Additionally, the federal government has set a goal of reducing GHG intensity by 18 percent over the next decade. GHG intensity is a measure of green house gas emissions per defined unit. For example, GHG intensity could be reported as tons of GHG emissions per capita or per million dollars of gross domestic product.

Within California, the Climate Action Team established by Executive Order S-3-05, coordinates all State-level actions relating to climate change. Under the umbrella of the Climate Action Team, the different state resource agencies are actively engaged in various activities specifically related to climate change. For example, the Department is helping the State prepare for climate change through its water resource planning and forecasting activities; CDFG is addressing the issue of adaptation to climate change with regional conservation planning, watershed planning, fisheries management and restoration, and biological assessment; and the California Energy Commission's Public Interest Energy Research (PIER) program is addressing climate change by leading the development of a long term climate change research program for California and is seeking to improve understanding of the implications of climate change by supporting research on potential impacts and possible adaptation and mitigation measures. Additionally, several campuses of the University of California are actively engaged in climate change research.

Through development of a functional water management tool capable of incorporating climate change data, reductions in GHG emissions, and proper resource planning, California will continue preparing for climate change impacts.

12.8 CLIMATE CHANGE AND SWP DELIVERIES WITH PROPOSED PROJECT

The implications of climate change for the proposed project and this EIR are dependent on changes in temperatures and rainfall in California. As noted earlier, in some scenarios, there could be future decreases in Table A allocations in the drier scenarios and fewer opportunities for Article 21 deliveries. The degree to which these effects will be felt between now and 2020 has not been studied and remains unknown. Therefore, climate change was not incorporated into the CALSIM II modeling for this EIR for this reason and because of the limitations stated previously. As new tools are developed and additional trends identified, analytical tools will become available to conduct such analyses.

The analyses prepared to date suggest that there could be a decline of up to 10 percent in the long-term (2035 to 2064) average Table A supplies to SWP contractors, assuming no changes in existing SWP facilities and operations, as a result of climate change. While that decline is not projected to become evident until well beyond the time frame of this EIR, it is nonetheless an important finding with respect to dependence on SWP supplies in the long term.

The process used by the Department to allocate water among its contractors is already structured to deal with Table A supplies that are less than full Table A amounts. The Department routinely allocates annual supplies less than 100 percent of Table A. If the amount of water available to allocate each year declined by an average of 10 percent, the various allocation methods evaluated in this EIR could all still be applied in their present form. The relative allocations among contractors would remain the same with lower Table A allocations, although each contractor would get less, and under the allocation methods for the no project alternatives, agricultural contractors would get much smaller allocations more often. Therefore, allocation methods which eliminated the agriculture-first shortage provision, as does the proposed project, have helped agricultural contractors better deal with the potential effects of climate change.

SWP supplies are likely to become less reliable over the long term, assuming current SWP facilities remain unchanged. The shortened runoff period is likely to result in greater difficulty in filling San Luis Reservoir. This phenomenon will reduce the frequency of times when added water can be pumped from the Delta to provide water for storage outside of contractor’s service areas, and thus impacts of the proposed project on the Delta may be less than predicted elsewhere in this EIR.

According to the Department’s Report, there could be additional times when Article 21 water would be available, but that added (and intermittent) supply would not be sufficient to offset declines in Table A allocations. Because there may be fewer years when San Luis Reservoir fills, there may be fewer years when Article 21 water can be offered. There would be increased winter runoff at times when the snow level is higher and the runoff more copious than past periods, but if San Luis Reservoir cannot be refilled from its low point within the available window when permitted pumping exceeds contractor demand (the total pumping rate is constrained by environmental and water quality regulations as well as fish protection measures), the total amount of Article 21 water that can be delivered could also decline, contrary to indications in the Department’s Report.

It is possible to provide a representation of the impacts of climate change on the baseline and proposed project scenarios described in Chapter 6 by using allocation data developed under scenario GFDL B1 as computed in the Department climate change Report. This climate change scenario has been developed by first computing the annual differences in SWP allocations computed using CALSIM under climate change Scenario GFDL B1 compared to those in the baseline runs for the climate change report. Those differences were then applied to the allocations computed in the model runs for the baseline scenario and the proposed project. The results are shown in Table 12-2. Table A deliveries would decrease by 10 to 25 percent under the baseline scenario and with the proposed project with the greatest effects occurring in critically dry years. The differences between the baseline scenario and the proposed project are negligible, indicating that the Table A transfers and altered water allocation procedures have no effect on the SWP's vulnerability to climate change.

TABLE 12-2

POTENTIAL EFFECTS OF CLIMATE CHANGE ON TABLE A DELIVERIES IN THE FUTURE (2020) BY WATER YEAR TYPE[a]

Year Type	Baseline	Baseline with Climate Change	% Reduction	Proposed Project	Proposed Project with Climate Change	% Reduction
Average	3203.8	2866.2	10.5	3189.3	2853.0	10.5
Wet	4004.6	3826.2	4.5	3964.1	3787.3	4.5
Above Normal	3893.4	3528.4	9.4	3865.1	3502.2	9.4
Below Normal	3553.9	3093.1	13.0	3560.0	3097.7	13.0
Dry Years	2763.4	2326.2	15.8	2756.2	2323.8	15.7
Critical Years	1330.2	998.0	25.0	1341.0	1007.6	24.9

Note:
a. The reduction levels are based on the Department's Report which represents potential changes centered around 2050 (see page 12-12).

The main conclusion of this analysis is that there would be less reliability for all SWP contractors overall, assuming no changes in current SWP facilities. The largest reductions would tend to occur in the drier years. In addition, under the agriculture-first shortage alternatives, there would be greater dry year impacts on agricultural contractors and more water available to urban contractors in those dry years than with the proposed project.

Sea level rise would also affect the ability of the Department to allocate Table A supplies while meeting Delta water quality standards, especially salinity standards. As sea levels gradually rise (both from warming of the oceans and melting ice caps), and the land within Delta islands continues to oxidize and the islands drop lower below current sea level, the risk of catastrophic failure of islands increases.

Without robust and extensive emergency response planning and action, such catastrophic failure of multiple Delta levees would draw in seawater to the Delta that might take up to a year or more to repulse with fresh water. During such periods, the SWP would be unlikely to be able to provide any water supplies to the 24 contractors located downstream of the Banks pumps, leaving those agencies to rely exclusively on local and other imported water supplies. The CVP contractors served from the Jones (formerly Tracy) pumps would similarly be unable to obtain normal Delta supplies, and would draw heavily on groundwater.

Climate change would increase pressure on other local and imported supplies to meet demand, and would also tend to intensify conservation measures as water supplies became less reliable. Catastrophic loss of Delta water supplies would have widespread impact on water availability, would increase groundwater extraction and exacerbate groundwater overdraft, would have economic impacts on agriculture, industry, and quality of life, and would further impact local and imported supplies.

Overall, given current SWP facilities, SWP water supplies will become less reliable under the trends that have been identified with climate change with or without the Monterey Amendment. As noted by the Department's director, current and future droughts are likely to be deeper and longer than historical droughts and conservation efforts need to be redoubled.[33]

12.9 PROPOSED PROJECT GREENHOUSE GAS EMISSIONS

The proposed project could result in some added GHG emissions as a result of post-Monterey Amendment SWP operations. The generation of power to supply the added pumping at SWP facilities would require additional consumption of energy from power plants in the western U.S. that emit GHGs (see Section 7.16, Energy). The Department is reducing its reliance on fossil-fuel power and exploring alternative power options. For example, by a recent letter addressed to the Nevada Power Company, the Department has stated that it will not renew its existing contract for power from the coal-fired Reid Gardner power plant when that contract expires in July 2013.[34] The power from this plant is primarily used for operations to pump water to SWP contractors. The Department is currently seeking replacement of this power supply with alternative power sources. In addition, in an effort to reduce the Department's carbon footprint, it has recently filed an intent to register with the California Climate Action Registry to complete a full assessment of energy use and GHG emissions from the SWP and to plan its future energy portfolio.[35] Further, future power use trends could be partly offset if SWP deliveries decline, requiring less purchased power to operate the SWP, although clean hydropower generation at Oroville and other SWP facilities would also decline somewhat under a lower delivery scenario.

Also, to the extent that the proposed project has allowed or will allow additional urban growth, that growth could also result in additional on-going emissions of GHGs. Because any such emissions become part of the atmosphere and are disbursed globally, the relevant issue is whether the growth in the areas affected by the proposed project would result in greater or lesser impacts than alternate locations for housing and employment development. At present, there is no mechanism to develop such a comparison. However, much of California's urban development is highly dependent on land use planning decisions made at the local level and the use of automobiles for transportation. As such, there may be a net increase in emissions of GHGs from development in California. As discussed in Chapter 8, the proposed project may result in changes in growth patterns at the local level, but would have no effect on statewide population growth. Thus, within the SWP service area as a whole, the proposed project would not result in any changes in GHG emission due to growth.

Neither the CARB nor any air district in California has identified significance thresholds for GHG emissions or a methodology for analyzing air quality impacts related to GHG emissions. The state has identified 1990 emission levels as a goal through adoption of AB 32. To meet this goal, California would need to generate lower levels of GHG emissions than current levels. However, no standards have yet been adopted quantifying 1990 emission targets. It is recognized that for most projects there is no simple metric available to determine if a single project would help or hinder meeting the AB 32 emission goals. In addition, at this time AB 32 only applies to stationary source emissions. Yet, consumption of fossil fuels in the transportation sector accounted for over 40% of the total GHG emissions in California in 2004. Current standards for reducing vehicle emissions considered under AB 1493 call for "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty trucks and other vehicles," and do not provide a quantified target for GHG emissions reductions for vehicles.

Emitting CO_2 into the atmosphere is not itself an adverse environmental affect. It is the increased concentration of CO_2 in the atmosphere resulting in global climate change and the associated consequences of climate change that results in adverse environmental affects (e.g., sea level rise, loss of snowpack, severe weather events). Although it is possible to generally estimate a project's incremental contribution of CO_2 into the atmosphere, it is typically not possible to determine whether or how an individual project's relatively small incremental contribution might translate into physical effects on the environment. Given the complex interactions between various global and regional-scale physical, chemical, atmospheric, terrestrial, and aquatic systems that result in the physical expressions of global climate change, it is impossible to discern whether the presence or absence of CO_2 emitted by the proposed project would result in any altered conditions.

While it is not possible to determine whether the proposed project individually will have a significant impact on global warming or climate change, it is evident that the project will contribute to cumulative GHG emissions in California. The SWP's total GHG emissions are currently estimated at 0.6 percent of statewide emissions. As described in Section 7.16, the proposed project will increase SWP power use by approximately 2.02 percent over existing power use, thus an increase of 2.02 percent in the SWP's GHG emissions is possible. This would still be only a tiny fraction of the statewide GHG emissions, and would not make it substantially more difficult for the State to achieve the GHG reductions required by AB 32. However, without the necessary science and analytical tools for project-level effect, it is not possible to determine with certainty, whether the project's GHG emissions will be cumulatively considerable, within the meaning of CEQA Guidelines Sections 15065(a)(3) and 15130.

CARB is currently in the process of designing regulations to monitor, limit, and ultimately reduce California GHG emissions but there are as yet no clear standards for assessing the significance of cumulative impacts from projects. Under CEQA, the more severe the environmental problem, the lower the threshold for treating a project's contribution to cumulative impacts as significant. It is possible, in the future when GHG emissions guidance is forthcoming, that the contributions to climate change from projects of similar scale to this one will be considered cumulatively considerable. Given the findings of AB 32, incorporated into California law, stating that global warming poses serious threats to health and the environment the requirements of CEQA for the lead agency to determine that a project not have a cumulatively considerable contribution, the lack of guidance for determining the significance of cumulative impacts to climate change from projects, and out of an overabundance of caution, the proposed project's emissions could be considered cumulatively considerable. This determination is based upon a lack of clear scientific and regulatory criteria for determining the level of significance of the project's contribution.

The Department is already committed to reducing GHG emissions from operations of the SWP, which would offset the minor increases in GHG emissions from the proposed project and help the State achieve the goals of AB 32. These commitments include registering with the California Climate Action Registry, replacing power purchased from the coal-fired Reid Gardner Power Plant with cleaner energy sources, and other measures to reduce the SWP's carbon footprint. The significant reductions anticipated in GHG emissions from the SWP will more than mitigate the relatively minor increase in GHG emissions and cumulatively considerable impact attributable to the proposed project.

12.10 CONCLUSIONS

According to a recently published California Energy Commission report titled, *Climate Change and California Water Resources: A Survey and Summary of the Literature*:[36]

> "Managing water resources to address climate change impacts could prove to be different than managing for historical climate variability for several reasons, including: (1) climate changes could produce hydrologic conditions and extremes of a different nature than current systems were designed to manage; (2) they may produce similar kinds of variability, but that are outside of the range for which current infrastructure was designed; (3) traditional water resource management assumes that sufficient time and information will be available before the onset of large or irreversible climate impacts to permit managers to respond appropriately; and (4) traditional management assumes that no special efforts or plans are required to protect against surprises or uncertainties."

Although considerable uncertainties regarding the exact impacts of climate change on California hydrology and water resources will remain until there is more accurate and consistent information about how precipitation patterns, timing, and intensity will change, considerable progress is being made to develop methodologies and tools to incorporate future climate change scenarios into current hydrologic models. Additionally, one of the most important results for water managers also has been the one most consistently predicted to occur. It is quite likely that there will be increases in winter runoff, decreases in spring and summer flows and higher peak flows. Therefore, managing water resources with a changing climate will likely prove different than managing for historic variability. Climate changes could produce hydrologic conditions and extremes of a different nature than current systems were designed to manage.

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14. REPORT PREPARATION

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APPENDICES

A. NOTICE OF PREPARATION

NOTICE OF PREPARATION

NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT REPORT FOR THE MONTEREY AMENDMENT TO THE STATE WATER PROJECT CONTRACTS (INCLUDING KERN WATER BANK TRANSFER) AND OTHER CONTRACT AMENDMENTS AND ASSOCIATED ACTIONS AS PART OF A PROPOSED SETTLEMENT AGREEMENT IN PLANNING AND CONSERVATION LEAGUE V. DEPARTMENT OF WATER RESOURCES

INTRODUCTION

To satisfy California Environmental Quality Act (CEQA) requirements (California Public Resources Code Section 21000 et seq), the California Department of Water Resources (DWR) will prepare an Environmental Impact Report (EIR) for the Monterey Amendment to the State Water Project (SWP) contracts (including Kern Water Bank transfer) and other contract amendments and associated actions as part of a proposed settlement agreement in Planning and Conservation League v. Department of Water Resources (83 Cal. App. 4th 892 (2000) (PCL v. DWR) (proposed project or Monterey Plus). During the preparation of the EIR, DWR will solicit comments from interested stakeholders through a series of scoping meetings.

Several terms with precise definitions are used in this Notice of Preparation. The Monterey Agreement is a set of principles agreed to by DWR and the SWP contractors. The Monterey Amendment is the amendment made to the contracts for state water as a result of the Monterey principles. The settlement agreement is the agreement proposed between the DWR, PCL, Citizens Planning Association of Santa Barbara, and Plumas County Flood Control and Water Conservation District (Plumas) that if executed would result in settlement of the litigation in connection with the 1995 Monterey Agreement EIR.

The EIR will evaluate the potential environmental impacts of changes to SWP operations that are a consequence of the Monterey Amendment. The EIR will also evaluate the additional actions set forth in an agreement to settle litigation regarding the 1995 Monterey Amendment EIR. See the project description below for more details.

In general, the EIR will serve as a Project EIR (CEQA Guidelines Section 15161). That is, the EIR will address the SWP contract amendments and the settlement agreement actions at a project-level of detail where no subsequent actions are expected and/or where sufficient information on subsequent actions are known or can be generated.

In some cases, subsequent actions that stem from the contract amendments or settlement actions may require additional environmental review prior to implementation. In these cases, the EIR will serve as a program EIR (CEQA Guidelines Section 15168) and will provide information and analysis that could provide a foundation for subsequent, site-specific environmental review.

BACKGROUND INFORMATION

In 1994, DWR and certain representatives of the SWP contractors agreed to a set of principles, known as the Monterey Agreement, to settle long-term water allocation disputes, and to establish a new water management strategy for the SWP. The disputes focused on the phrasing of Article 18 of the SWP contracts. Article 18 addresses the allocation of shortages in water supply, and particularly under what circumstances the initial reductions to agricultural use should be imposed prior to reducing allocations to urban contractors. Article 18(a) deals with temporary shortages that occur due to droughts and other temporary causes. Article 18(b) deals with the possibility of specified types of permanent shortages of supply of project water. The Monterey Agreement Statement of Principles, executed on December 1, 1994, resolved the allocation controversy by proposing contract revisions to eliminate initial agricultural use cutbacks and specifying that all project water was to be allocated in proportion to contract amounts (as shown in Table A).[1] The principles provided that the individual SWP contracts would be amended to conform to the principles and CEQA compliance would begin to evaluate the potential impacts of implementing the Monterey Agreement.

Pursuant to CEQA, in May 1995, a Draft EIR was prepared by the Central Coast Water Authority (CCWA) acting as Lead Agency. The Final EIR for the Monterey Agreement was completed in October 1995. CCWA certified the Final EIR in November 1995 and issued findings and mitigation measures. Subsequently, DWR relied on the EIR as a responsible agency and drafted a contract amendment. Twenty seven of the 29 SWP contractors (all except Plumas County and Empire West Side Irrigation District) executed the Monterey Amendment. DWR has been operating the SWP consistent with the provision of the Monterey Amendment since 1996. Certain actions provided for under the Monterey Amendment have undergone separate project-level environmental review where necessary (including several permanent water transfers and development of the Kern Water Bank).

On December 27, 1995, PCL filed a lawsuit against DWR and CCWA challenging the adequacy of the 1995 Monterey Agreement EIR. The Citizens Planning Association of Santa Barbara and Plumas County Flood Control and Water Conservation District joined the lawsuit.

Ultimately, on September 15, 2000, the Third District Court of Appeal ruled that DWR had the statutory duty to serve as Lead Agency in assessing environmental consequences of the Monterey Agreement. The appellate court further held that the 1995 Monterey Agreement EIR failed to adequately analyze the impacts of deleting Article 18(b) (the provision for reallocation of water among contractors in the event of a defined permanent water shortage) and directed that a new EIR be prepared. The court held the lack of an environmental analysis of eliminating Article 18(b) deprived public agencies and the public of information essential to understanding the environmental consequences of the provision's elimination, including the potential effect on land use planning decisions.

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1 Table A is contained in all SWP documents. It lists the amounts of SWP water made available each year. Under certain conditions, the contractor may receive a lesser amount.

WRITTEN COMMENTS

Within 30 days after receiving the Notice of Preparation, each Responsible Agency shall provide the Lead Agency with specific detail about the scope, significant environmental issues, reasonable alternatives, and mitigation measures related to the Responsible Agency's area of statutory responsibility that will need to be explored in the Draft EIR. In accordance with CEQA Guidelines Section 15082(b)(1)(B), responsible and trustee agencies should indicate their respective level of responsibility for the project in their response.

Comments from individual respondents, including names and home addresses of respondents, will be made available for public review. Individual respondents may request that their home address be withheld from public disclosure, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold a respondent's identity from public disclosure, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public disclosure in their entirety.

Written comments on the scope of the EIR should be sent to Ms. Delores Brown, Chief, Mitigation and Restoration Branch, Department of Water Resources, 3251 S Street, Sacramento, CA 95816 or by e-mail at delores@water.ca.gov. Additional information on the Monterey Amendment EIR process can be found on the DWR web page http://www.water.ca.gov/.

Original Signed by Barbara McDonnell on January 24, 2003

Barbara McDonnell
Chief, Division of Environmental Services
Department of Water Resources

Date ____________________

Financial Restructuring

- Use SWP funds to establish an SWP operating reserve
- Establish a program of water rate management which, when SWP cash flow permits, provides for a credit in charges to urban contractors, as well as agricultural contractor trust funds for rate management

Proposed Settlement Agreement

- Establish a watershed forum for Plumas to pursue watershed restoration and provide for amending Plumas' SWP contract regarding shortages
- Impose additional restrictions on use of the Kern Water Bank lands
- Amend and clarify SWP contracts to substitute in certain instances "Table A Amount" for "entitlement"
- Implement new procedures for disclosure of SWP delivery capabilities
- Issue guidelines on permanent Table A transfers
- Establish procedures for public participation in certain contract amendment negotiations
- Provide certain funding to the plaintiffs for multiple purposes, including watershed restoration

PROJECT AREA AND FACILITIES

The location of the proposed project includes the SWP facilities and service areas. The proposed project area is the SWP service area (including the Kern Water Bank lands) and the SWP contractors' service areas (see Figure 1). In addition, depending on SWP contractor actions under the proposed project, the area of influence could extend beyond the service areas.

The SWP is the largest state-built water project in the United States. Major catchments and facilities include dams, reservoirs, pumping plants, power plants, and canals and tunnels including the facilities listed below (see Figure 1):

- Lake Oroville and three other reservoirs in the Feather River watershed;
- Silverwood Lake
- San Luis Reservoir;
- Terminal Reservoirs (Lake Del Valle in the north and Castaic Lake and Lake Perris in the south);
- Harvey O. Banks Delta Pumping Plant;
- California Aqueduct;
- North Bay Aqueduct;
- Coastal Branch; and
- South Bay Aqueduct.

ENVIRONMENTAL BASELINE

CEQA Guidelines Section 15125 states that an EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the Notice of Preparation is published, or if no Notice of Preparation is published, at the time environmental analysis is commenced, from both a local and regional perspective. This environmental setting will normally constitute the baseline physical conditions by which a Lead Agency determines whether an impact is significant. Normally, the environmental baseline is the same as existing conditions. However, since completion of the 1995 Monterey Agreement EIR, DWR has operated under the terms of the Monterey Amendment provisions, and certain subsequent actions provided for under the Monterey Amendment have already been implemented. Therefore, in order to ensure that the whole of the action (proposed project) is adequately evaluated, it may be necessary to refine the existing conditions. Further analysis will determine what the appropriate environmental baseline will be for the project.

ALTERNATIVES

CEQA Guidelines Section 15126.6 states that an EIR shall describe a range of reasonable alternatives to the project, which would feasibly attain most of the basic objective of the project but would avoid or substantially lessen any of the significant adverse environmental effects of the project, and evaluate the comparative merits of the alternatives. An EIR is not required to consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation.

DWR has not identified the reasonable range of alternatives to implementation of the proposed project. Feasible alternatives that meet most of the basic project objectives and avoid or substantially lessen any of the significant effects of the project will be explored according to CEQA requirements in response to Notice of Preparation comments, scoping meetings and through subsequent environmental analysis.

However, DWR has identified a No Project Alternative, required under CEQA Guidelines Section 15126.6(e), with the following scenarios that will be evaluated in the EIR:

- No implementation of the Monterey Amendment with a permanent water shortage and implementation of Article 18(b); and
- No implementation of the Monterey Amendment without a permanent water shortage and no implementation of Article 18(b).

PROBABLE ENVIRONMENTAL EFFECTS

The EIR will analyze resources that could be affected by the project, including but not limited to aesthetics, agricultural resources, air quality, biological resources, cultural resources, cumulative impacts, geology and soils, growth-inducement, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation and traffic, utilities and service systems.

Subsequent comments on the Notice of Preparation, comments from the scoping meetings and subsequent analyses will identify additional environmental impacts, if any.

SCOPING MEETINGS

Scoping meetings will be held in February in the following locations:

February 3, 2003
10:00 AM – Noon
Resources Building Auditorium
First Floor, 1416 Ninth Street
Sacramento, CA

February 4, 2003
7:00 PM – 9:00 PM
Supervisors' Board Room
4080 Lemon Street
14th Floor
Riverside, CA

February 5, 2003
7:00 PM – 9:00 PM
Board of Supervisors Hearing Room
Hall of Administration
800 South Victoria Avenue
Ventura, CA

February 6, 2003
7:00 PM – 9:00 PM
Supervisors' Board Room
1115 Truxtun Avenue
5th floor
Bakersfield, CA

February 13, 2003
2:30 PM – 5:00 PM
Supervisors Board Room
Third floor Court House
520 Main Street
Quincy, California

Please note that the formal presentation and public comment will begin approximately 30 minutes from the start of each meeting. Anyone interested in more information concerning the EIR process, or anyone who has information concerning the study or suggestions as to significant issues, should contact Delores Brown as provided below.

WRITTEN COMMENTS

Within 30 days after receiving the Notice of Preparation, each Responsible Agency shall provide the Lead Agency with specific detail about the scope, significant environmental issues, reasonable alternatives, and mitigation measures related to the Responsible Agency's area of statutory responsibility that will need to be explored in the Draft EIR. In accordance with CEQA Guidelines Section 15082(b)(1)(B), responsible and trustee agencies should indicate their respective level of responsibility for the project in their response.

Comments from individual respondents, including names and home addresses of respondents, will be made available for public review. Individual respondents may request that their home address be withheld from public disclosure, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold a respondent's identity from public disclosure, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public disclosure in their entirety.

Written comments on the scope of the EIR should be sent to Ms. Delores Brown, Chief, Mitigation and Restoration Branch, Department of Water Resources, 3251 S Street, Sacramento, CA 95816 or by e-mail at delores@water.ca.gov. Additional information on the Monterey Amendment EIR process can be found on the DWR web page http://www.water.ca.gov/.

Original Signed by Barbara McDonnell on January 24, 2003

Barbara McDonnell
Chief, Division of Environmental Services
Department of Water Resources

Date ______________________

EIP ASSOCIATES

Source:
State of California Department of Water Resources "Management of the CA State Water Project" and the CDWR website

Project Number: 10680

Figure 1
State Water Project and Water Supply Contractors' Service Areas

C. EXAMPLE OF MONTEREY AMENDMENT LONG-TERM WATER SUPPLY CONTRACT

STATE OF CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

WATER SUPPLY CONTRACT

BETWEEN

THE STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AND

KERN COUNTY WATER AGENCY

November 15, 1963

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CONTENTS—Continued

CONTENTS—Continued

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND

FOR A WATER SUPPLY

THIS CONTRACT, made this 15th day of November, 1963, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency

a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency".

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, funds will be provided under the California Water Resources Development Bond Act for the construction of said facilities; and

WHEREAS, the Agency is desirous of obtaining a supply of water from the State;

NOW THEREFORE, it is mutually agreed as follows:

A. INTRODUCTORY PROVISIONS

1. DEFINITIONS

When used in this contract, the following terms shall have the meanings hereinafter set forth:

(a) Bond Act

"Bond Act" shall mean the California Water Resources Development Bond Act, comprising Chapter 8 (commencing at Section 12930) of Part 6 of Division 6 of the Water Code.

(b) System

"System" shall mean the State Water Resources Development System as defined in Section 12931 of the Water Code.

(c) Delta

"Delta" shall mean the Sacramento-San Joaquin Delta as defined in Section 12220 of the Water Code on November 8, 1960.

(d) Contractor

"Contractor" shall mean any entity contracting with the State for a dependable supply of water made available by the System, except such water as is made available by the facilities specified in Section 12934(d)(6) of the Water Code.

(e) Project Facilities

"Project facilities" shall mean those facilities of the System which will, in whole or in part, serve the purposes of this contract by conserving water and making it available for use in and above the Delta and for export from the Delta, and by conveying water to the Agency. Said project facilities shall consist specifically of "project conservation facilities" and "project transportation facilities", as hereinafter defined.

(f) Project Conservation Facilities

"Project conservation facilities" shall mean such project facilities as are presently included, or as may be added in the future, under (g) and (h) below.

(g) Initial Project Conservation Facilities

"Initial project conservation facilities" shall mean the following project facilities specified in Section 12934(d) of the Water Code:

(1) All those facilities specified in subparagraph (1) thereof.

(2) Those facilities specified in subparagraph (3) thereof to the extent that they serve the purposes of water conservation in the Delta, water supply in the Delta, and transfer of water across the Delta.

(3) A reservoir near Los Banos in Merced County as specified in subparagraph (2) thereof.

(4) The reach of the San Joaquin Valley-Southern California Aqueduct extending from the Delta to a reservoir near Los Banos in Merced County, to the extent required for water conservation through conveyance of water diverted from the Delta to offstream storage in said reservoir as determined by the State.

(5) Those facilities specified in subparagraph (5) thereof which are incidental to the facilities included under (1), (2), (3), and (4) above.

(6) Those facilities specified in subparagraph (7) thereof which are necessary and appurtenant to the facilities included under (1), (2), (3), (4), and (5) above.

(h) Additional Project Conservation Facilities

"Additional project conservation facilities" shall mean those project facilities provided for in Section 12938 of the Water Code which will serve the purpose of preventing any reduction in the minimum project yield, as hereinafter defined.

(i) Project Transportation Facilities

"Project transportation facilities" shall mean those project facilities:

(1) Specified in Water Code Section 12934(d)(2) which are described in Table H of this contract;

(2) Specified in Water Code Section 12934(d)(5) which are incidental to the facilities included under (1) above;

(3) Specified in Water Code Section 12934(d)(7) which are necessary and appurtenant to the facilities included under (1) and (2) above.

(j) Project Water

"Project water" shall mean water made available for delivery to the contractors by project conservation facilities and the transportation facilities included in the System.

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,000,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year 1990, and the characteristic distributions of demands for these two uses throughout the year.

(2) An allowable reduction in the agricultural use portion of the minimum project yield, due to drought, of not to exceed fifty percent (50%) in any one year, nor a total of one hundred percent (100%) of one year's supply in any series of seven consecutive years.

(3) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

(l) Annual Entitlement

"Annual entitlement" shall mean the amount of project water to be made available to a contractor during the respective year, at the delivery structures provided for such contractor, under the terms of its contract with the State.

(m) Maximum Annual Entitlement

"Maximum annual entitlement" shall mean the maximum amount of project water to be made available to a contractor in any one year, at the delivery structures provided for such contractor, under the terms of its contract with the State.

(n) Supplemental Conservation Facilities

"Supplemental conservation facilities" shall mean those facilities provided for in Section 12938 of the Water Code which will serve the purpose of supplying water in addition to the minimum project yield, and for meeting local needs.

(o) Supplemental Water

"Supplemental water" shall mean water made available by supplemental conservation facilities, in excess of the minimum project yield.

(p) Year

"Year" shall mean the 12-month period from January 1 through December 31, both dates inclusive.

(q) Year of Initial Water Delivery

"Year of initial water delivery" shall mean the year when project water will first be available for delivery to a contractor pursuant to its contract with the State.

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average of the interest rates paid by the State on bonds issued under the Bond Act without regard to any premiums received on the sale thereof. Until bonds are issued and sold under the Bond Act, the project interest rate shall be four percent (4%) per annum, and after said bonds have been issued said rate shall be computed as a decimal fraction to five places.

(s) Capital Costs

"Capital costs" shall mean all costs incurred subsequent to authorization of a facility for construction by the Legislature or by administrative action pursuant to Section 11290 of the Water Code and to the Bond Act, including those so incurred prior to the beginning of the project repayment period as herein defined and any accrued unpaid interest charges thereon at the rates specified herein, which are properly chargeable to the construction of and the furnishing of equipment for the facilities of the System, including the costs of surveys, engineering studies, exploratory work, designs, preparation of construction plans and specifications, acquisition of lands, easements and rights-of-way, relocation work, and essential administrative work in connection therewith, all as shown upon the official records of the Department of Water Resources.

(t) Project Repayment Period

"Project repayment period" shall mean that period of years commencing on January 1, 1961, and extending until all bonds secured by the pledge of revenues provided for by the Bond Act have been repaid.

(u) Municipal Use

"Municipal use" shall mean all those uses of water common to the municipal water supply of a city, town, or other similar population group, including uses for domestic purposes, uses for the purposes of commerce, trade or industry, and any other use incidental thereto for any beneficial purpose.

(v) Manufacturing Use

"Manufacturing use" shall mean any use of water primarily in the production of finished goods for market.

(w) Agricultural Use

"Agricultural use" shall mean any use of water primarily in the production of plant crops or livestock for market, including any use incidental thereto for domestic or stock-watering purposes.

(x) Subject to Approval by the State

"Subject to approval by the State" shall mean subject to the determination and judgment of the State as to acceptability.

(y) Area of Origin Statutes

"Area of origin statutes" shall mean Sections 10505 and 11460 through 11463 of the Water Code as now existing or hereafter amended.

2. TERM OF CONTRACT

This contract shall become effective on the date first above written and shall remain in effect throughout the project repayment period, or for seventy-five (75) years, whichever period is longer.

3. VALIDATION

Within one (1) year after the effective date of this contract, the Agency shall submit this contract to a court of competent jurisdiction for determination of its validity by a proceeding in mandamus or other appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment. In the event that this contract is determined to be invalid by such final decree or judgment, the State shall make all reasonable efforts to obtain validating legislation at the next session of the Legislature empowered to consider such legislation, and within six (6) months after the close of such session, if such legislation shall have been enacted, the Agency shall submit this contract to a court of competent jurisdiction for redetermination of its validity by appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment.

4. OPTION FOR CONTINUED SERVICE

By written notice to the State at least six (6) months prior to the expiration of the term of this contract, the Agency may elect to receive continued service after expiration of said term under the following conditions unless otherwise agreed to:

(1) Service of water in annual amounts up to and including the Agency's maximum annual entitlement hereunder.

(2) Service of water at no greater cost to the Agency than would have been the case had this contract continued in effect.

(3) Service of water under the same physical conditions of service, including time, place, amount and rate of delivery, as are provided for hereunder.

(4) Retention of the same chemical quality objective provision as is set forth herein.

(5) Retention of the same options to utilize the project transportation facilities as are provided for in Articles 18(b) and 18(c), to the extent such options are then applicable.

Other terms and conditions of the continued service shall be reasonable and equitable and shall be mutually agreed upon. In the event that said terms and conditions provide for continued service for a limited number of years only, the Agency shall have the same option to receive continued service here provided for upon the expiration of that and each succeeding period of continued service.

5. PLEDGE OF REVENUES

This contract is entered into for the direct benefit of the holders and owners of all general obligation bonds issued under the Bond Act, and the income and revenues derived from this contract are pledged to the purposes and in the priority set forth in that act.

B. WATER SERVICE PROVISIONS

6. ANNUAL ENTITLEMENTS

(a) Year of Initial Water Delivery

The year of initial water delivery to the Agency is presently estimated to be 1968. To the extent practicable, the State shall notify the Agency of any change in this estimate.

(b) Agency's Annual Entitlements to Water

Commencing with the year of initial water delivery to the Agency, the State each year shall make available for delivery to the Agency the amounts of project water designated in Table A of this contract, which amounts are referred to in this contract as the Agency's annual entitlements.

(c) Obligation of State to Complete Facilities

Subject to the availability of funds, the State shall make all reasonable efforts consistent with sound fiscal policies, reasonable construction schedules, and proper operating procedures to complete the project facilities necessary for delivery of project water to the Agency in such manner and at such times that said delivery can commence in or before the year specified in subdivision (a) of this article, and continue in the amounts designated in Table A of this contract.

7. CHANGES IN ANNUAL ENTITLEMENTS; MAXIMUM ANNUAL ENTITLEMENT

(a) Changes in Annual Entitlements

The Agency may, at any time or times during the term of this contract, by timely written notice furnished to the State, request that project water be made available to it thereafter in annual amounts greater or less than the annual entitlements designated in Table A of this contract. Subject to approval by the State of any such request, the State's construction schedule shall be adjusted to the extent necessary to satisfy the request, and the requested increases or decreases in said annual entitlements shall be incorporated in said Table A by amendment thereof: *Provided*, That no such change shall be approved if in the judgment of the State it would impair the financial feasibility of the project facilities.

(b) Maximum Annual Entitlement of Agency

The maximum amount of project water to be made available to the Agency in any one year under this contract shall be that specified in Table A of this contract and in said table designated as the Agency's "Maximum Annual Entitlement." In no event shall such maximum amount of project water to be made available to the Agency be increased over this amount, except as is otherwise provided in this contract.

8. OPTION TO INCREASE MAXIMUM ANNUAL ENTITLEMENT

In the event that the maximum annual entitlements under all contracts executed by the State on or before December 31, 1963, do not aggregate the amount of the minimum project yield as herein defined, the State shall immediately notify the Agency and all other contractors, and the Agency may elect to become entitled to the uncontracted for portion of the minimum project yield in or up to an amount which bears the same ratio to such uncontracted for portion as the Agency's maximum annual entitlement bears to the total of the maximum annual entitlements of all contractors as of that date: *Provided*, That such option may be exercised only to the extent that the water involved can be put to beneficial use within a reasonable period of time. Such option shall become effective on the date that the Agency receives said notice from the State and shall remain in effect through September 30, 1964. If the full amount of such uncontracted for portion of the minimum project yield is not preempted by the Agency under this option and by other contractors through the exercise of similar options on or before September 30, 1964, the Agency may request that it become entitled to any amount of such water not so preempted. Such request shall be subject to approval by the State and shall be considered in the light of all similar requests from other contractors. The State shall approve such request only to the extent that the water involved can be put to beneficial use within a reasonable period of time. Upon the exercise of such option or upon the approval of such request the Agency's maximum annual entitlement in Table A of this contract shall be increased by the amount of the additional entitlement thereby obtained by amendment of that table, and the Agency shall become obligated and hereby agrees to pay to the State a proportionate share of the costs attributable to such increase in accordance with cost allocation principles and procedures set forth in this contract. The service of and payment for said increased entitlement shall in all respects be subject to the terms and conditions of this contract.

9. DELIVERY POINTS

Project water made available to the Agency pursuant to Article 6 shall be delivered to the Agency by the State at the delivery structures established in accordance with Article 10.

10. DELIVERY STRUCTURES

(a) Determination of Size and Location of Delivery Structures

Project water made available to the Agency pursuant to this contract shall be delivered to the Agency at such locations and times and through delivery structures of such capacities as are requested by the Agency and approved by the State.

(b) Agency Requests as to Initial Delivery Structures

Pursuant to subdivision (a) of this article, the Agency shall furnish to the State on or before February 1, 1964, its written requests as to:

(1) The location of delivery structures for delivery of project water to it.

(2) The time at which project water is first to be delivered through each such delivery structure.

(3) The maximum instantaneous flow capacity in cubic feet per second to be provided in each such delivery structure.

(4) The maximum amount of water in acre-feet to be delivered in any one month through each such delivery structure.

(5) The total combined maximum instantaneous flow capacity in cubic feet per second to be provided by all such delivery structures.

(6) The total maximum amount of water in acre-feet to be delivered in any one month through all such delivery structures.

(c) Requests by Agency for Additional Delivery Structures

From time to time the Agency may request delivery structures in addition to those requested pursuant to subdivision (b) of this article.

(d) Agency to Advance Funds for Delivery Structures

The Agency shall pay all of the costs of delivery structures for the delivery of project water to it, and shall deposit with the State, prior to the commencement of construction of any such delivery structure, an amount of money estimated by the State to be sufficient to cover the costs thereof.

11. MEASUREMENT OF WATER DELIVERED

(a) Measurement by State

The State shall measure all project water delivered to the Agency and shall keep and maintain accurate and complete records thereof. For this purpose, the State shall install, operate, and maintain at all delivery structures for delivery of project water to the Agency such measuring devices and equipment as are satisfactory and acceptable to both parties. Said devices and equipment shall be examined, tested, and serviced regularly to insure their accuracy. At any time or times, the Agency or any other contractor may inspect such measuring devices and equipment, and the measurements and records taken therefrom.

(b) Agency to Advance Funds for Measuring Devices

The Agency shall pay all of the costs of acquiring and installing the measuring devices and equipment provided for in subdivision (a) of this article, and shall deposit with the State, prior to such acquisition and installation, an amount of money estimated by the State to be sufficient to cover such costs.

12. DELIVERY SCHEDULES

(a) Procedure for Determining Water Delivery Schedule

The amounts, times, and rates of delivery of project water to the Agency during any year shall be in accordance with a water delivery schedule for that year, such schedule to be determined in the following manner:

(1) On or before October 1 of each year, the Agency shall submit in writing to the State a preliminary water delivery schedule, subject to the provisions of this article and Articles 6(b), 7(b), 10 and 17, indicating the amounts of water desired by the Agency during each month of the succeeding five (5) years.

(2) Upon receipt of a preliminary schedule the State shall review it and, after consultation with the Agency, shall make such modifications in it as are necessary to insure that the amounts, times, and rates of delivery to the Agency will be consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors. On or before December 1 of each year, the State shall determine and furnish to the Agency the water delivery schedule for the next succeeding year which shall show the amounts of water to be delivered to the Agency during each month of that year.

(3) A water delivery schedule may be amended by the State upon the Agency's written request. Proposed amendments shall be submitted by the Agency within a reasonable time before the desired change is to become effective, and shall be subject to review and modification by the State in like manner as the schedule itself.

(b) Limit on Peak Deliveries of Water

In no event shall the State contract to deliver to any contractor from the project transportation facilities downstream from Pumping Plant VI (Tehachapi Pumping Plant) in any one month of any year a total amount of project water greater than eleven percent (11%) of such contractor's annual entitlement for that year; or to deliver to any contractor from the project transportation facilities upstream from said Pumping Plant VI in any one month of any year a total amount of project water greater than the sum of eighteen percent (18%) of that portion of such contractor's annual entitlement for that year to be put to agricultural use, as determined by the State, and eleven percent (11%) of that portion of such contractor's annual entitlement for that year to be put to municipal use, as determined by the State: *Provided*, That if the State delivers project water to any contractor through delivery structures both downstream and upstream from said Pumping Plant VI, the foregoing limitations shall be based on an appropriate apportionment of such contractor's annual entitlement for the respective year to the respective portions of such contractor's service area to which delivery is made from the project transportation facilities downstream from said Pumping Plant VI and from the project transportation facilities upstream therefrom: *Provided further*, That the percentages set forth hereinabove may be revised for a particular contractor by amendment of this subdivision after submission to the State of that contractor's requests with respect to maximum monthly deliveries, such revision being subject to approval by the State and subject to advancement to the State by the contractor of funds sufficient to cover any additional costs of the project transportation facilities occasioned thereby, the amount of such funds to be determined pursuant to Article 24(d).

(c) Limit on Rate of Delivery to Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding 2820 cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

(d) Delivery of Water Not Delivered in Accordance With Schedule

If in any year the State, as a result of causes beyond its control, is unable to deliver any portion of the Agency's annual entitlement for such year under Table A of this contract as provided for in the delivery schedule established for that year, the Agency may elect to receive the amount of water which otherwise would have been delivered to it during such period at other times during the year or succeeding years, to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors.

13. RESPONSIBILITIES FOR DELIVERY AND DISTRIBUTION OF WATER

(a) State Not Liable for Operation Beyond Delivery Structures

Neither the State nor any of its officers, agents, or employees shall be liable for the control, carriage, handling, use, disposal, or distribution of project water supplied to the Agency after such water has passed the delivery structures established in accordance with Article 10; nor for claim of damage of any nature whatsoever, including but not limited to property damage, personal injury or death, arising out of or connected with the control, carriage, handling, use, disposal or distribution of such water beyond said delivery structures; and the Agency shall indemnify and hold harmless the State and its officers, agents, and employees from any such damages or claims of damages.

(b) Agency Not Liable for Operation Upstream From Delivery Structures

Neither the Agency nor any of its officers, agents, or employees shall be liable for the control, carriage, handling, use, disposal, or distribution of project water before such water has passed the delivery structures established in accordance with Article 10; nor for claim of damage of any nature whatsoever, including but not limited to property damage, personal injury or death, arising out of or connected with the control, carriage, handling, use, disposal, or distribution of such water before it has passed said delivery structures.

14. CURTAILMENT OF DELIVERY FOR MAINTENANCE PURPOSES

(a) State May Curtail Deliveries

The State may temporarily discontinue or reduce the delivery of project water to the Agency hereunder for the purposes of necessary investigation, inspection, maintenance, repair, or replacement of any of the project facilities necessary for the delivery of project water to the Agency. The State shall notify the Agency as far in advance as possible of any such discontinuance or reduction, except in cases of emergency, in which case notice need not be given.

(b) Agency May Receive Later Delivery of Water Not Delivered

In the event of any discontinuance or reduction of delivery of project water pursuant to subdivision (a) of this article, the Agency may elect to receive the amount of water which otherwise would have been delivered to it during such period under the water delivery schedule for that year at other times during the year or succeeding years to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors.

15. AREA SERVED BY AGENCY

(a) State Approval of Sale of Water by Agency Outside Boundaries

Project water delivered to the Agency pursuant to this contract shall not be sold or otherwise disposed of by the Agency for use outside the Agency without the prior written consent of the State.

(b) State Approval of Change in Boundaries or Organization of Agency

While this contract is in effect no change shall be made in the Agency either by inclusion or exclusion of lands, by partial or total consolidation or merger with another district, by proceedings to dissolve, or otherwise, except with the prior written consent of the State or except by act of the Legislature.

(c) Map of Agency

The Agency shall provide the State with a map satisfactory to the State indicating the major existing distribution facilities and the boundaries of the Agency at the time the contract is signed and supplementary maps whenever a boundary change is made.

16. CONTINUITY AND DEPENDABILITY OF WATER SUPPLY

(a) Limit on Total of all Maximum Annual Entitlements

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,000,000 acre-feet of project water.

(b) State to Perfect Water Rights

The State shall make all reasonable efforts to perfect and protect water rights necessary for the System and for the satisfaction of water supply commitments under this contract.

(c) State to Report on Ability to Meet Future Water Demands

Commencing within two (2) years from the year of initial project water delivery to the Agency, the State shall submit to the agency at not more than five-year intervals a report on the State's ability to meet future demands for project water and for supplemental water, and on the State's plans for constructing additional project conservation facilities and supplemental conservation facilities. Such reports shall include all estimates, projections, and other data which the State deems relevant thereto.

(d) Construction of Additional and Supplemental Conservation Facilities

Bond funds required to be expended for the construction of additional facilities of the System under the provisions of Section 12938 of the Water Code shall be expended only for construction of additional project conservation facilities as defined herein, and related, appurtenant facilities necessary and desirable to meet local needs: *Provided*, That if at any time after 1985 the State finds that a part or all of such bond funds are not then required for the above purpose, and will not be so required within the next succeeding ten (10) years, such bond funds may be used, to the extent permitted in the Bond Act, to construct supplemental conservation facilities as defined herein.

(e) Furnishing of Supplemental Water

In planning and designing supplemental conservation facilities the State shall give consideration to the requirements and demands for supplemental water of the Agency and others who have contracted for project water. Entitlements to supplemental water shall be obtained, and repayment therefor shall be arranged, in contracts separate from contracts for project water.

17. CONSTRUCTION OF PROJECT FACILITIES

(a) Determination of Aqueduct Capacities

Subject to the rights of the Agency under subdivision (b) of this article and the other provisions of this contract, the State shall provide in each aqueduct reach of the project transportation facilities such maximum monthly delivery capability for the transport and delivery of project water to the Agency as, in the judgment of the State, will best serve the interests of the Agency and all other contractors entitled to delivery of project water from or through said facilities: *Provided*, That within three (3) months after the effective date of this contract the Agency shall furnish to the State a written request specifying such maximum monthly delivery capabilities, and the State shall give full consideration to such request in planning and designing said facilities.

(b) Criteria for Determining Capacity of Transportation Facilities

Subject to Article 45, the State shall design and construct the project transportation facilities so as to provide in each reach thereof, including reservoirs, the capacity necessary to enable delivery of project water in each year to the Agency and to other contractors in the maximum monthly amounts and at the locations, times, and maximum rates specified or provided for in their respective contracts for such year, and shall include in each such reach such capacity as is economically justified in the judgment of the State to compensate for scheduled outages for purposes of necessary investigation, inspection, maintenance, repair or replacement of project facilities, and for losses of water due to evaporation, leakage, seepage, or other causes: *Provided*, That regulatory storage reservoirs included in the project transportation facilities may be utilized in conjunction with conveyance capacity provided in said facilities for delivery to the Agency of the foregoing monthly amounts.

(c) Inspection of Project Plans and Specifications

The Agency shall have a reasonable opportunity to inspect and study the State's plans and specifications for all project facilities and may make comments and recommendations thereon to the State. Such privilege shall also extend to any plans and specifications in connection with the use by the State, in conjunction with the project facilities, of facilities owned by an entity other than the State. The State shall not enter into any such agreement which would impair the State's ability to perform fully its obligations under this contract.

(d) Restriction on Bond Sales

No bonds shall be sold nor funds expended under the authority of the Bond Act for the construction of any aqueduct or appurtenance thereto included in the System unless and until contracts are executed which will insure the recovery by the State of at least seventy-five percent (75%) of those capital costs of the particular aqueduct and any appurtenances thereto which shall be reimbursable by the contractors as determined by the State; nor shall any bonds be sold or funds expended under the authority of the Bond Act for the construction of any project conservation facility or supplemental conservation facility, unless and until contracts are executed which, together with estimated revenues from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, will insure the recovery by the State of at least seventy-five percent (75%) of those capital costs of the particular facility which shall be reimbursable by the contractors as determined by the State: *Provided,* That the foregoing limitations shall not apply with respect to: (1) surveys, engineering studies, exploratory work, designs, preparation of construction plans and specifications, acquisition of lands, easements and rights of way, relocation work, and essential administrative work in connection therewith; (2) construction for which appropriations had been made prior to approval of the Bond Act by the voters of the State of California; and (3) construction of facilities pursuant to an agreement between the State and the United States.

(e) Failure to Complete Facilities

In the event that the State fails or is unable to complete construction of any portion or portions of the project transportation facilities necessary to deliver water to the Agency as provided in this contract, and gives the Agency written notice thereof, or by reason of such failure or inability construction of said facilities has ceased for a period of two and one-half (2½) years, the Agency, if it be not then in default and without exclusion of such other rights as it may have under this contract, may exercise the following options:

(1) The Agency may provide funds to the State in such amounts and at such times as may be necessary to enable the State to complete construction of such incompleted portion or portions of the project transportation facilities to the extent necessary for the transport and delivery of water to the Agency as provided for in this contract: *Provided,* That the State shall be and remain the owner of such project transportation facilities or portions thereof constructed in whole or in part with funds provided by the Agency, and shall be and remain obligated to operate, maintain, repair and replace such facilities to the full extent contemplated in this contract: *Provided further,* That the amount of any funds so provided by the Agency shall be credited by the State against the Agency's payment obligation under the capital cost component of the Transportation Charge, but the Agency shall be and remain obligated to pay its share of any capital costs of the above-described facilities not paid for with such funds, together with its proportionate share of the operation, maintenance, power and replacement costs of such facilities.

(2) The Agency may at its own expense, and on a joint venture basis if such an arrangement is made with other contractors having similar options, connect to the project transportation facilities constructed by the State for the purpose of receiving project water to which it is entitled under this contract. In such event and notwithstanding any other provisions of this contract, the structures for delivery of project water to the Agency pursuant hereto shall thereafter be deemed to be located at such point of connection. Specific arrangements for acquiring, constructing, operating, maintaining and replacing the Agency's facilities at the point of connection thereof with the State's facilities shall be in accordance with terms and conditions mutually agreed upon by the parties: *Provided,* That the State shall be and remain the owner of all facilities constructed by it to said point of connection, and the Agency shall be and remain obligated to pay its proportionate share of the costs thereof.

18. SHORTAGE IN WATER SUPPLY

(a) Temporary Shortages; Delivery Priorities

In any year in which there may occur a shortage due to drought or other temporary cause in the supply of project water available for delivery to the contractors, with the result that such supply is less than the total of the annual entitlements of all contractors for that year, the State shall, before reducing deliveries of project water to all contractors, reduce the delivery of project water to each contractor using such water for agricultural purposes by a percentage, not to exceed fifty percent (50%) in any one year or a total of one hundred percent (100%) in any series of seven consecutive years, of that portion of the contractor's annual entitlement for the respective year which is to be put to agricultural use as determined by the State: *Provided*, That such percentage shall be the same for all such contractors. The maximum total reduction in deliveries allowable under the above provision shall be made before any reduction is made in project water deliveries for other uses. Any necessary reduction in deliveries of project water beyond said maximum total reduction allowable under the foregoing provision shall be apportioned among all contractors irrespective of the uses to which such water is to be put. In such event, the State shall reduce deliveries to each contractor in an amount which bears the same proportion to the total amount of such necessary further reduction that the contractor's annual entitlement bears to the total of the annual entitlements of all contractors for that year, all as determined by the State: *Provided*, That the State may apportion on some other basis if such is required to meet minimum demands for domestic supply, fire protection, or sanitation during the year. The foregoing provisions of this subdivision shall be inoperative to the extent that a contractor's annual entitlement for the respective year reflects established rights under the area of origin statutes precluding a reduction in deliveries to such contractor.

(b) Permanent Shortage; Reduction of Entitlements

In the event that the State is unable to construct sufficient additional conservation facilities to prevent a reduction in the minimum project yield, or if for any other reason there is a reduction in the minimum project yield, which, notwithstanding preventive or remedial measures taken or to be taken by the State, threatens a permanent shortage in the supply of project water to be made available to the contractors:

(1) The annual entitlements and the maximum annual entitlements of all contractors, except to the extent such entitlements may reflect established rights under the area of origin statutes, shall, by amendment of Table A of this contract, be reduced proportionately by the State to the extent necessary so that the sum of the revised maximum annual entitlements of all contractors will then equal such reduced minimum project yield: *Provided*, That appropriate adjustment in the contractors' respective financial obligations to the State under the Transportation Charge shall be made in accordance with such reduced entitlements if such reductions have not been strictly proportionate throughout.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such reduction in the minimum project yield are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That except to the extent such limitation in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof.

(c) Permanent Shortage; Contracts for Areas-of-Origin

In the event that the State, because of the establishment by a party of a prior right to water under the provisions of Sections 11460 through 11463 of the Water Code, enters into a contract with such party for a dependable supply of project water, which contract will cause a permanent shortage in the supply of project water to be made available to the Agency hereunder:

(1) The State shall: (i) equitably redistribute the costs of all transportation facilities included in the System among all contractors for project water, taking into account the diminution of the supply to the Agency and other prior contractors and the payments theretofore made by the Agency and other prior contractors in accordance with the terms of their contracts, and (ii) revise the Agency's annual entitlements and maximum annual entitlement, by amendment of Table A of this contract, to correspond to the reduced supply of project water to be made available to the Agency: *Provided*, That such redistribution of costs of transportation facilities shall not be made until there has been reasonable opportunity for the Agency to exercise the option provided for in (2) below, and for other prior contractors to exercise similar options.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such permanent shortage in the supply of project water to be made available to the Agency are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That, except to the extent such limitation

in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof. This option shall terminate upon a redistribution of costs of transportation facilities by the State pursuant to (1) above. In the event that this option is exercised, the State shall take such fact into account in making such redistribution of costs, and shall offset such use as is made of the project transportation facilities pursuant thereto against any reduction in the Agency's payment obligation hereunder resulting from such redistribution of costs.

(d) Reinstatement of Entitlements

If after any revision of annual entitlements and maximum annual entitlements pursuant to subdivisions (b) or (c) of this article, circumstances arise which, in the judgment of the State, justify a revision upward of the same, the State shall, with the consent of the affected contractor, reinstate proportionately the previously reduced entitlements of such contractor to the extent deemed justified, and shall equitably redistribute the costs of the project transportation facilities if inequities would otherwise occur as a result of such reinstatement of entitlements.

(e) Advance Notice of Delivery Reductions

The State shall give the Agency written notice as far in advance as possible of any reduction in deliveries to it under subdivision (a) of this article and, to the extent possible, shall give the Agency written notice five (5) years in advance of any reduction in its annual entitlements and maximum annual entitlement under subdivisions (b) or (c) of this article. Reports submitted to the Agency pursuant to Article 16 (c) may constitute such notices.

(f) No Liability for Shortages

Neither the State nor any of its officers, agents, or employees shall be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available for delivery to the Agency under this contract caused by drought, operation of area of origin statutes, or any other cause beyond its control.

19. WATER QUALITY

(a) Table of Water Quality Objectives

It shall be the objective of the State and the State shall take all reasonable measures to make available, at all delivery structures for delivery of project water to the Agency, project water of such quality that the following constituents do not exceed the concentrations stated as follows:

Constituent	*Unit*	*Monthly Average*	*Average for any 10-year Period*	*Maximum*
Total Dissolved Solids	ppm.	440	220	—
Total Hardness	ppm.	180	110	—
Chlorides	ppm.	110	55	—
Sulfates	ppm.	110	20	—
Boron	ppm.	0.6	—	—
Sodium Percentage	%	50	40	—
Fluoride	ppm.	—	—	1.5
Lead	ppm.	—	—	0.1
Selenium	ppm.	—	—	0.05
Hexavalent Chromium	ppm.	—	—	0.05
Arsenic	ppm.	—	—	0.05
Iron and Manganese together	ppm.	—	—	0.3
Magnesium	ppm.	—	—	125
Copper	ppm.	—	—	3.0
Zinc	ppm.	—	—	15
Phenol	ppm.	—	—	0.001

(b) Records of Water Quality

The State shall regularly take samples of water at each delivery structure for delivery of project water to the Agency, and shall make chemical and physical analyses and tests of such samples. The State shall keep accurate and complete records of all such analyses and tests, which records shall be available for inspection by the Agency at any time or times.

(c) No Liability for Failure to Meet Quality Objectives

If through no negligence of the State or its officers, agents, or employees, the State is unable to attain the quality objectives set forth in subdivision (a) of this article, neither the State nor any of its officers, agents, or employees shall be liable in any manner whatsoever for such deviation from said quality objectives.

20. SUSPENSION OF SERVICE UPON DEFAULT

In the event of any default by the Agency in the payment of any money required to be paid to the State hereunder, the State may, upon not less than six months' notice to the Agency, suspend deliveries of water under this contract for so long as such default continues: *Provided,* That during such period the Agency shall remain obligated to make all payments required under this contract. Action taken pursuant to this article shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

21. SALE OF SURPLUS WATER

If during any year the supply of project water, after appropriate allowance for holdover storage, exceeds the total of annual entitlements of all contractors for that year, the State shall offer to sell and deliver such surplus water for periods expiring not later than the end of such year, without right of renewal, and in a manner and at prices which will return to the State the largest net revenues practicable, and at the minimum, revenues equal to the variable operation, maintenance and power costs incurred in such service of surplus water: *Provided*, That such service of surplus water shall not interfere with the delivery of their respective annual entitlement to those contractors which do not receive surplus water in such year: *Provided further*, That not until a contractor either pays or incurs a payment obligation for its annual entitlement in accordance with the payment provisions of its contract, shall surplus water be sold to such contractor at prices less than those which would result under the application of the payment provisions of its contract: *Provided further*, That if, in the judgment of the State, the annual entitlement of a contractor desiring to purchase surplus water is unrealistically low for the year in which such purchase is to be made, the State shall, for the purpose of pricing such water in accordance with the second proviso above, consider such annual entitlement to be an increased amount determined by the State to accurately correspond to such contractor's actual requirements for project water in that year. All net revenues from the service of surplus water shall be applied in such manner that all contractors which contribute to the payment of the costs of any System facilities by which surplus water was conserved and transported in connection with such service will receive credit for a share of such net revenues in the proportion that each such contractor contributes to payment of such costs. The service of surplus water shall, in every case, be subject to the paramount right and obligation of the State to discontinue the same, in whole or in part, when required for service of project water to contractors.

C. PAYMENT PROVISIONS

22. DELTA WATER CHARGE

(a) Payment of Reimbursable Costs of Project Conservation Facilities

The payments to be made by each contractor for project water shall include an annual charge designated as the Delta Water Charge. This charge, together with the total revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities, shall return to the State during the project repayment period all costs of the project conservation facilities including capital, operation, maintenance, power, and replacement costs, which are allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article during the project repayment period. Wherever reference is made, in connection with the computation or determination of the Delta Water Charge, to the costs of any facility or facilities included in the System, such reference shall be only to those costs of such facility or facilities which are reimbursable by the contractors as determined by the State.

(b) Delta Water Rate Until 1970; Components of Rate Thereafter

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of \$3.50 and the contractor's annual entitlement to project water for the respective year. After that date, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power, and replacement component; and a variable operation, maintenance, power and replacement component.

(c) Computation of the Components of the Delta Water Rate

The capital cost, the minimum operation, maintenance, power, and replacement, and the variable operation, maintenance, power, and replacement components of the Delta Water Charge, together with that portion of the revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities which is allocated by the State to repayment of the respective category of costs, shall return to the State during the project repayment period, respectively, the following categories of the costs allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article: (1) capital costs; (2) operation, maintenance, power, and replacement costs incurred irrespective of the amount of project water delivered to the contractors; and (3) operation, maintenance, power, and replacement costs incurred in an amount which is dependent upon and varies with the amount of project water delivered to the contractors: *Provided*, That each of the above categories of costs shall be inclusive of the appropriate costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities. Each component of the Delta Water Charge shall be computed on the basis of a rate which, when charged during the project repayment period for each acre-foot of the sum of the yearly totals of annual entitlements of all contractors, will be sufficient, together with that portion of the revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities which is allocated by the State to repayment of the respective category of costs, to return to the State during the project repayment period all costs included in the respective category of costs covered by that component. Each such rate shall be computed in accordance with the following formula:

$$\frac{(c_1 - r_1)(1 + i)^{-1} + (c_2 - r_2)(1 + i)^{-2} + \ldots + (c_n - r_n)(1 + i)^{-n}}{e_1(1 + i)^{-1} + e_2(1 + i)^{-2} + \ldots + e_n(1 + i)^{-n}}$$

Where:

i = The project interest rate.

c = The total costs included in the respective category of costs for the respective year of the project repayment period.

r = That portion of the revenues derived from the sale or other disposal of electrical energy allocated by the State to repayment of the costs included in the respective category for the respective year of the project repayment period.

1, 2, and n appearing below c and r = The respective year of the project repayment period for which costs are included in the respective category, n being the last year of the project repayment period.

e = With respect to the capital cost and minimum operation, maintenance, power, and replacement components, the total of annual entitlements to project water of all contractors for the respective year of the project repayment period.

e = With respect to the variable operation, maintenance, power, and replacement component, the total of the amounts of project water delivered to all contractors for the respective year of the expired portion of the project repayment period, together with the total of annual entitlements to project water of all contractors for the respective year of the unexpired portion of the project repayment period.

1, 2, and n appearing below e = The respective year of the project repayment period in which the annual entitlements or project water deliveries occur, n being the last year of the project repayment period.

n used as an exponent = The number of years in the project repayment period.

(d) Application of Component Rates

The capital cost and minimum operation, maintenance, power, and replacement components of the Delta Water Charge shall be the product of the appropriate rate computed under subdivision (c) of this article, and the contractor's annual entitlement to project water for the respective year. The variable operation, maintenance, power, and replacement component of the charge shall be the product of the appropriate rate computed under subdivision (c) of this article and the number of acre-feet of project water delivered to the contractor during the respective year: *Provided,* That when project water has been requested by a contractor and delivery thereof has been commenced by the State, and, through no fault of the State, such water is wasted as a result of failure or refusal by the contractor to accept delivery thereof, said variable component during such period shall be the product of said rate per acre-foot and the sum of the number of acre-feet of project water delivered to the contractor and the number of acre-feet wasted.

(e) Allocations to Project Purposes

Prior to the time that additional project conservation facilities or supplemental conservation facilities are constructed, the Delta Water Charge shall be determined on the basis of an allocation to project purposes, by the separable cost-remaining benefits method, of all projected costs of all those initial project conservation facilities located in and above the Delta, and upon an allocation to the purposes of water conservation and water transportation, by the proportionate use of facilities method, of all projected costs of the following project facilities located below the Delta: The aqueduct intake facilities at the Delta, Pumping Plant I (Delta Pumping Plant), the aqueduct from the Delta to San Luis Forebay, San Luis Forebay, and San Luis Reservoir: *Provided,* That all of the projected costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities shall be allocated to the purpose of water conservation in, above, and below the Delta: *Provided further,* That allocations to purposes the costs of which are to be paid by the United States shall be as determined by the United States. Commencing in the year in which the State first incurs capital costs for construction of additional project conservation facilities, the Delta Water Charge shall be determined on the basis of the foregoing allocations and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to the foregoing provisos, of all projected costs of such additional project conservation facilities.

(f) Yearly Recomputation of Rates After 1970

The rates to be used in determining the components of the Delta Water Charge pursuant to subdivision (d) of this article and to become effective on January 1, 1970, shall be computed by the State in accordance with subdivision (c) of this article prior to that date. Such computation shall include an adjustment which shall account for the difference, if any, between revenues received by the State under the Delta Water Charge prior to January 1, 1970, and revenues which would have been received under the charge prior to that date had it been computed and charged in accordance with subdivisions (c) and (d) of this article. Upon such computation, a document establishing such rates shall be prepared by the State and attached to this contract as an amendment of this article. The State shall recompute such rates each year thereafter, and each such recomputation shall take account of and reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project conservation facilities described in subdivision (e) of this article, annual entitlements, deliveries of project water, project interest rate, revenues from the sale or other disposal of electrical energy, and all other factors which are determinative of such rates. In addition, each such recomputation shall include an adjustment of the rates for succeeding years which shall account for the differences, if any, between projections of costs used by the State in determining said rates for all preceding years, and actual costs incurred by the State during such years. Upon each such recomputation, an appropriately revised copy of the document establishing such rates shall be prepared by the State and attached to this contract as an amendment of this article.

(g) Supplemental Conservation Facilities

Upon the construction of supplemental conservation facilities, the Delta Water Charge shall be paid by all contractors for supplemental water, as well as by contractors for project water, and, together with revenues derived from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, shall return to the State, in addition to those costs of the project conservation facilities allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article, all costs of such supplemental conservation facilities, including capital, operation, maintenance, power, and replacement costs, which are allocated to the purpose of water conservation in, above, and below the Delta pursuant hereto. Commencing in the year in which the State first incurs capital costs for construction of supplemental conservation facilities, the Delta Water Charge shall be determined on the basis of the allocations made pursuant to subdivision (e) of this article, and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to provisos corresponding to those contained in said subdivision (e), of all projected costs of such supplemental conservation facilities. Commencing in the same year, the computation of the rates to be used in determining the components of the Delta Water Charge shall include the annual entitlements to water under all contracts for supplemental water. If the repayment period of any bonds sold to construct supplemental conservation facilities extends beyond the project repayment period, the Delta Water Charge shall be determined and redetermined on the basis of such extended repayment period as the State determines to be appropriate.

23. TRANSPORTATION CHARGE

The payments to be made by each contractor entitled to delivery of project water from the project transportation facilities shall include an annual charge under the designation Transportation Charge. This charge shall return to the State during the project repayment period those costs of all project transportation facilities necessary to deliver project water to the contractor including capital, operation, maintenance, power, and replacement costs, which are allocated to the contractor during the project repayment period in accordance with the cost allocation principles and procedures herein after set forth. Wherever reference is made, in connection with the computation, determination, or payment of the Transportation Charge, to the costs of any facility or facilities included in the System, such reference shall be only to those costs of such facility or facilities which are reimbursable by the contractors as determined by the State. The Transportation Charge shall consist of a capital cost component; a minimum operation, maintenance, power, and replacement component; and a variable operation, maintenance, power, and replacement component, as these components are defined in and determined under Articles 24, 25, and 26, respectively. For the purpose of allocations of costs pursuant to said articles, the project transportation facilities shall be segregated into such aqueduct reaches as are determined by the State to be necessary for such allocations of costs. Subject to such modifications as are determined by the State to be required by reason of any request furnished by the Agency to the State pursuant to Article 17(a) of this contract, or by reason of contracts entered into by the State with other contractors, the aqueduct reaches of the project transportation facilities are established as set forth in Table I of this contract: *Provided,* That those costs of the aqueduct reaches from the Delta through the outlet of San Luis Reservoir which are allocated to the purpose of water conservation in, above, and below the Delta for the purpose of determining the Delta Water Charge, as hereinbefore set forth, shall not be included in the Transportation Charge.

24. TRANSPORTATION CHARGE—CAPITAL COST COMPONENT

(a) Method of Computation

The capital cost component of the Transportation Charge shall be sufficient to return to the State those capital costs of the project transportation facilities necessary to deliver water to the contractor which are allocated to the contractor pursuant to subdivision (b) of this article. The amount of this component shall be determined in two steps as follows: (1) an allocation of capital costs to the contractor, and (2) a computation of annual payment of such allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, to be made by the contractor.

(b) Allocation of Capital Costs Among Contractors

In the first step, the total amount of capital costs of each aqueduct reach to be returned to the State shall be allocated among all contractors entitled to delivery of project water from or through the reach by the proportionate use of facilities method of cost allocation and in accordance with (1) and (2) below. The measure of the proportionate use of each contractor of each reach shall be the average of the following two ratios: (i) the ratio of the contractor's maximum annual entitlement to be delivered from or through the reach to the total of the maximum annual entitlements of all contractors to be delivered from or through the reach; and (ii) the ratio of the capacity provided in the reach for the transport and delivery of project water to the contractor to the total capacity provided in the reach for the transport and delivery of project water to all contractors served from or through the reach. Allocations of capital costs to the Agency pursuant hereto shall be on the basis of relevant values which will be set forth in Table B of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach of the project transportation facilities for the transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That these values shall be subject to redetermination by the State in accordance with Article 28: *Provided further*, That the principles and procedures set forth in this subdivision shall be controlling as to allocations of capital costs to the Agency.

(1) The total amount of capital costs allocated to a contractor shall be the sum of the products obtained when there is multiplied, for each aqueduct reach necessary to deliver water to the contractor, the total amount of the capital costs of the reach to be returned to the State under the Transportation Charge by the average of the two foregoing ratios for such reach as said average is set forth in the appropriate table included in its contract.

(2) In the event that excess capacity is provided in any aqueduct reach for the purpose of making project water available in the future to an agency or agencies with which the State has not executed contracts at the time of any allocation of costs pursuant to this subdivision, the prospective maximum annual entitlement or entitlements to be supplied by such excess capacity, as determined by the State, shall be deemed to be contracted for by said agency or agencies for the purpose of such allocation of costs, to the end that the capital costs of providing such excess capacity are not charged to any contractor entitled by virtue of an executed contract to the delivery of project water from or through that aqueduct reach at the time of such allocation. Where additional capacity is provided in any aqueduct reach to compensate for loss of water due to evaporation, leakage, seepage, or other causes, or to compensate for scheduled outages for purposes of necessary investigation, inspection, maintenance, repair or replacement of the facilities of the project facilities, then, for the purpose of any allocation of costs pursuant to this subdivision: (i) the maximum annual entitlement to be delivered from or through the reach of each contractor entitled to delivery of project water from or through the reach shall be increased by an amount which bears the same proportion to the maximum annual delivery capability provided by such additional capacity that the contractor's maximum annual entitlement to be delivered from or through the reach bears to the total of the maximum annual entitlements to be delivered from or through the reach under all contracts; and (ii) the capacity provided in the reach for each contractor entitled to delivery of project water from or through the reach shall be increased in the same proportion that the contractor's maximum annual entitlement to be delivered from or through the reach is increased pursuant to (i) above.

(3) The projected amounts of capital costs to be allocated annually to the Agency under the capital cost component of the Transportation Charge shall be determined by the State in accordance with the cost allocation principles and procedures set forth in this subdivision, which principles and procedures shall be controlling as to allocations of capital costs to the Agency. Such amounts will be set forth in Table C of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be

provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided,* That these amounts shall be subject to redetermination by the State in accordance with Article 28.

(c) Annual Payments of Allocated Capital Costs

In the second step, the Agency's annual payment of its allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, shall be determined in accordance with a payment schedule established by the State and determined in accordance with the principles set forth in (1), (2), and (3) below, which principles shall be controlling as to the Agency's payment of its allocated capital costs. The Agency's payment schedule will be set forth in Table D of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided,* That the amounts set forth in Table D shall be subject to redetermination by the State, pursuant to Article 28.

(1) The Agency's annual payment shall be the sum of the amounts due from the Agency on the Agency's allocated capital costs for the then current year and for each previous year where each such amount will pay, in not more than fifty (50) equal annual installments of principal and interest, the Agency's allocated capital costs for the respective year and interest thereon, computed at the project interest rate and compounded annually.

(2) The Agency may make payments at a more rapid rate if approved by the State.

(3) Such annual payments shall cease when all allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, are repaid.

(d) Payment in Advance for Excess Peaking Capacity

In the event that any contractor, pursuant to Article 12(b), requests delivery capacity in any aqueduct reach which will permit maximum monthly deliveries to such contractor in excess of the percentage amounts specified in said Article 12(b) for the uses designated therein, such contractor shall furnish to the State, in advance of the construction of such aqueduct reach, funds sufficient to cover the costs of providing such excess capacity, which funds shall be in an amount which bears the same proportion to the total capital costs of such reach, including the costs of providing such excess capacity, as such excess capacity bears to the total capacity of such reach, including such excess capacity. For the purpose of any allocation of costs pursuant to subdivision (b) of this article, the total capital costs of such aqueduct reach shall be allocated among all contractors entitled to delivery of project water from or through the reach in the following manner:

(1) The costs which would have been incurred for such reach had no such excess capacity been provided shall be estimated by the State and allocated among all such contractors in the manner provided in said subdivision (b); and

(2) The amount of the difference between said estimated costs and the projected actual costs of such reach shall be allocated to the contractor or contractors for which such excess capacity is provided.

Where such excess capacity is provided for more than one contractor, the costs allocated to them under (2) above shall be further allocated between or among them in amounts which bear the same proportion to the total of said allocated costs as the amount of such excess capacity provided for the respective contractor bears to the total of such excess capacity provided in such reach. In the event that the funds advanced by a contractor pursuant to this subdivision are more or less than the costs so allocated to such contractor under (2) above, the account of such contractor shall be credited or debited accordingly.

(e) Costs Incurred Prior to Date of Contract

The Agency's allocated capital costs for the year preceding the year of initial payment of the capital component of the Transportation Charge, pursuant to subdivision (c) of this article, shall consist of the sum of the Agency's allocated capital costs for each year through such year preceding the year of initial payment, and interest thereon, computed at the project interest rate and compounded annually.

25. TRANSPORTATION CHARGE—MINIMUM OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT

(a) Method of Computation

The minimum operation, maintenance, power, and replacement component of the Transportation Charge shall return to the State those costs of the project transportation facilities necessary to deliver water to the contractor which constitute operation, maintenance, power, and replacement costs incurred irrespective of the amount of project water delivered to the contractor and which are allocated to the contractor pursuant to (b) below: *Provided,* That to the extent permitted by law, the State may establish reserve funds to meet anticipated minimum replacement costs; and deposits in such reserve funds by the State: (1) shall be made in such amounts that such reserve funds will be adequate to meet such anticipated costs as they are incurred, and (2) shall be deemed to be a part of the minimum replacement costs for the year in which such deposits are made.

(b) Allocation of Costs

The total projected minimum operation, maintenance, power, and replacement costs of each aqueduct reach of the project transportation facilities for the respective year shall be allocated among all contractors entitled to delivery of project water from said facilities by the proportionate use of facilities method of cost allocation, in the same manner and upon the same bases as are set forth for the allocation of capital costs in Article 24: *Provided,* That such minimum operation, maintenance, power, and replacement costs as are incurred generally for the project transportation facilities first shall be allocated to each aqueduct reach in an amount which bears the same proportion to the total amount of such general costs that the amount of the costs incurred directly for the reach bears to the total of all direct costs for all aqueduct reaches.

(c) Payment Table

The amount to be paid each year by the Agency under the minimum operation, maintenance, power, and replacement component of the Transportation Charge shall be determined in accordance with subdivision (b) of this article on the basis of the relevant values to be set forth for the respective aqueduct reaches in Table B of this contract: *Provided,* That these values shall be subject to redetermination by the State in accordance with Article 28. Such amounts and any interest thereon shall be set forth by the State in Table E of this contract as soon as designs and cost estimates have been prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided,* That the amounts set forth in Table E shall be subject to redetermination by the State in accordance with Article 28.

26. TRANSPORTATION CHARGE—VARIABLE OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT

(a) Method of Computation

The variable operation, maintenance, power, and replacement component of the Transportation Charge shall return to the State those costs of the project transportation facilities necessary to deliver water to the contractor which constitute operation, maintenance, power, and replacement costs incurred in an amount which is dependent upon and varies with the amount of project water delivered to the contractor and which are allocated to the contractor pursuant to (1) and (2) below: *Provided,* That to the extent permitted by law, the State may establish reserve funds to meet anticipated variable replacement costs; and deposits in such reserve funds by the State: (1) shall be made in such amounts that such reserve funds will be adequate to meet such anticipated costs as they are incurred, and (2) shall be deemed to be a part of the variable replacement costs for the year in which such deposits are made. The amount of this component shall be determined as follows:

(1) There shall be computed for each aqueduct reach of the project transportation facilities a charge per acre-foot of water which will return to the State the total projected variable operation, maintenance, power, and replacement costs of the reach for the respective year. This computation shall be made by dividing said total by the number of acre-feet of project water estimated to be delivered from or through the reach to all contractors during the year.

(2) The amount of the variable component shall be the sum of the products obtained when the charges per acre-foot of water, determined under (1) above, for each aqueduct reach necessary to deliver water to the contractor are multiplied by the number of acre-feet of project water delivered to the contractor from or through that reach during the year: *Provided,* That when project water has been requested by a contractor and delivery thereof has been commenced by the State, and, through no fault of the State, such water is wasted as a result of failure or refusal by the contractor to accept delivery thereof, the amount of said variable component to be paid by such contractor during such period shall be the product of the above sum and the sum of the number of acre-feet of project water delivered to the contractor and the number of acre-feet wasted.

(b) Revenue From Aqueduct Power Recovery Plants

There shall be credited against the amount of the variable component to be paid by each contractor, as determined pursuant to subdivision (a) of this article, a portion of the projected net value of any power recovered during the respective year at project aqueduct power recovery plants located upstream on the particular aqueduct from the delivery structures for delivery of project water to the contractor. Such portion shall be in an amount which bears the same proportion to said projected net value that the number of acre-feet of project water delivered to the contractor through said plants during the year bears to the number of acre-feet of project water delivered to all contractors through said plants during the year.

(c) Payment Table

The amount to be paid each year by the Agency under the variable operation, maintenance, power, and replacement component of the Transportation Charge shall be determined in accordance with subdivision (a) of this article for the respective aqueduct reaches in Table B of this contract. Such amounts and any interest thereon shall be set forth by the State in Table F of this contract as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That the amounts set forth in Table F shall be subject to redetermination by the State in accordance with Article 28.

27. TRANSPORTATION CHARGE—PAYMENT SCHEDULE

The amounts to be paid by the Agency for each year of the project repayment period under the capital cost and minimum operation, maintenance, power, and replacement components of the Transportation Charge, and under the variable operation, maintenance, power, and replacement component of said charge on the basis of then estimated deliveries, shall be set forth by the State in Table G of this contract as soon as designs and cost estimates have been prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a). Table G of this contract shall constitute a summation of Tables D, E, and F of this contract: *Provided*, That each of the amounts set forth in Table G shall be subject to redetermination by the State in accordance with Article 28: *Provided further*, That the principles and procedures set forth in Articles 24, 25, and 26 shall be controlling as to such amounts. Such amounts shall be paid by the Agency in accordance with the provisions of Article 29.

28. TRANSPORTATION CHARGE—REDETERMINATION

The State shall redetermine the values and amounts set forth in Tables B, C, D, E, F and G of this contract in the year following the year in which the State commences construction of the project transportation facilities and each year thereafter in order that the Transportation Charge to the Agency and the components thereof may accurately reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project transportation facilities described in Table I of this contract annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges. In addition, each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for the differences, if any, between projections of costs used by the State in determining the amounts of said components for all preceding years and actual costs incurred by the State during such years. Upon each such redetermination, appropriately revised copies of Tables B, C, D, E, F and G shall be prepared by the State and attached to this contract as amendments of those tables.

29. TIME AND METHOD OF PAYMENT

(a) Initial Payment—Delta Water Charge

Payments by the Agency under the Delta Water Charge shall commence in the year of initial water delivery to the Agency.

(b) Initial Payment—Transportation Charge: Capital Component

Payments by the Agency under the capital cost component of the Transportation Charge shall commence in the year following the year in which the State commences construction of the project transportation facilities. If such construction has already commenced when this contract is executed, such payments shall begin in the year following the year of execution.

(c) Initial Payment—Transportation Charge: Minimum Component

Payments by the Agency under the minimum operation, maintenance, power, and replacement component of the Transportation Charge shall commence for each aqueduct reach in the year following the year in which construction of that reach is completed.

(d) Initial Payment—Transportation Charge: Variable Component

Payments by the Agency under the variable operation, maintenance, power, and replacement component of the Transportation Charge shall commence in the year of initial water delivery to the Agency.

(e) Statement of Charges

The State shall, on or before July 1 of each year, commencing with the year preceding the year in which payment of the respective charge is to commence pursuant to this article, furnish the Agency with a written statement of: (1) the charges to the Agency for the next succeeding year under the capital cost and minimum operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge; (2) the unit charges to the Agency for the next succeeding year under the variable operation, maintenance, power, and replacement components of said Delta Water Charge and Transportation Charge; and (3) the total charges to the Agency for the preceding year under the variable operation, maintenance, power, and replacement components of said Delta Water Charge and Transportation Charge: *Provided*, That through December 31, 1969, the Delta Water Charge shall be based upon a unit rate of $3.50 per acre-foot and shall be paid by the contractors on the basis of their respective annual entitlements to project water, as provided in Article 22(b): *Provided further,* That the first such statement shall be provided by the State as soon after the execution of this contract as is feasible. All such statements shall be accompanied by the latest revised copies of the document amendatory to Article 22 and of Tables B, C, D, E, F and G of this contract, together with such other data and computations used by the State in determining the amounts of the above charges as the State deems appropriate. The State shall, on or before the fifteenth day of each month of each year, commencing with the year of initial water delivery to the Agency, furnish the Agency with a statement of the charges to the Agency for the preceding month under the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge. Such charges shall be determined by the State in accordance with the relevant provisions of Articles 22 and 26 of this contract, upon the basis of metered deliveries of project water to the Agency, except as otherwise provided in those articles.

(f) Times of Payment—Capital Components

The Agency shall pay to the State, on or before January 1 of each year, commencing with the year in which payment of the respective charge is to commence pursuant to this article, one-half (½) of the charge to the Agency for the year under the capital cost component of the Delta Water Charge and one-half (½) of the charge to the Agency for the year under the capital cost component of the Transportation Charge, as such charges are stated pursuant to subdivision (e) of this article; and shall pay the remaining one-half (½) of each of said charges on or before July 1 of that year.

(g) Times of Payment—Minimum Components

The Agency shall pay to the State, on or before the first day of each month of each year, commencing with the year of initial water delivery to the Agency, one-twelfth (1/12) of the sum of the charges to the Agency for the year under the minimum operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge, respectively, as such charges are stated pursuant to subdivision (e) of this article.

(h) Times of Payment—Variable Components

The Agency shall pay to the State on or before the fifteenth day of each month of each year, commencing with the year of initial water delivery to the Agency, the charges to the Agency under the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge, respectively, for which a statement was received by the Agency during the preceding month pursuant to subdivision (e) of this article, as such charges are stated in such statement.

(i) Contest of Accuracy of Charges

In the event that the Agency contests the accuracy of any statement submitted to it pursuant to subdivision (e) of this article, it shall give the State notice thereof at least ten (10) days prior to the day upon which payment of the stated amounts is due. To the extent that the State finds the Agency's contentions regarding the statement to be correct, it shall revise the statement accordingly, and the Agency shall make payment of the revised amounts on or before the due date. To the extent that the State does not find the Agency's contentions to be correct, or where time is not available for a review of such contentions prior to the due date, the Agency shall make payment of the stated amounts on or before the due date, but may make the contested part of such payment under protest and seek to recover the amount thereof from the State.

30. SURCHARGE FOR PROJECT WATER USED ON EXCESS LAND

(a) Definitions: "Surcharge"; "Excess Land"

As used herein the term "surcharge" shall mean an amount equivalent to the power credit per acre-foot of water, as such credit is determined under and established by subdivision (b) of this article, to be charged to water users other than the United States or the State of California, as hereinafter provided and to the extent permitted by law, for each acre-foot of project water put to agricultural or manufacturing use on excess land. As used herein the term "excess land" shall mean that part of any land held in single beneficial ownership within a contractor's boundaries, or, where project water is delivered to water users by a retail agency as hereinafter defined, that part of any such land within the service area of such retail agency, which is in excess of 160 acres; or in the case of joint ownership by husband and wife that part of any such land which is in excess of 320 acres.

(b) Definition: "Power Credit"

As used herein, the term "power credit" shall mean the net value accruing to the State from revenues derived from the sale or other disposal of electrical energy generated in connection with operation of initial project conservation facilities after deducting from said revenues the amount necessary to repay the investment properly chargeable to energy generation and for operation, maintenance, and replacement of the electrical generation facilities. The power credit per acre-foot of water shall be computed in accordance with the following formula:

$$\frac{c_1(1+i)^{-1} + c_2(1+i)^{-2} + \ldots + c_n(1+i)^{-n}}{e_1(1+i)^{-1} + e_2(1+i)^{-2} + \ldots + e_n(1+i)^{-n}}$$

Where:

i = The project interest rate.

c = The projected annual power credit accrued during the respective year of the project repayment period.

1, 2, and n appearing below c = The respective year of the project repayment period during which the power credit is accrued, n being the last year of the project repayment period.

e = The total of annual entitlements to project water of all contractors for the respective year of the project repayment period.

1, 2, and n appearing below e = The respective year of the project repayment period in which the annual entitlements occur, n being the last year of the project repayment period.

n used as exponent = The number of years in the project repayment period.

The power credit per acre-foot of water is hereby established as $2 until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation. The State shall redetermine the power credit per acre-foot of water each year thereafter in order that it may accurately reflect increases or decreases from year to year in the power credit as defined herein. Each such redetermination shall be in accordance with the method of computation set forth in this subdivision, and upon each such redetermination, a document showing the revised amount of the power credit per acre-foot of water shall be attached to this contract as an amendment of this subdivision.

(c) Definition: "Retail Agency"

As used herein the term "retail agency" shall mean any agency which delivers directly to the users thereof, project water made available by, through, or under a contractor.

(d) Payment of Surcharge

Each contractor, to the extent that it delivers project water directly to the users thereof, shall require on behalf of the State that each such user on or before June 1 of each year, commencing with the year following the year of initial water delivery: (1) certify in writing to the contractor on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use, and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; and (2) pay to the contractor for the account of the State a surcharge for the amount of water so certified. Each contractor, to the extent that it delivers project water to a retail agency or to another agency by, through, or under which such water is delivered to a retail agency, shall require on behalf of the State that each water user served by such retail agency be required to, on or before May 1 of each year, commencing with the year following the year of initial water delivery: (1) certify in writing to the retail agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; and (2) pay to the retail agency for the account of the State a surcharge for the amount of project water so certified. Each contractor and retail agency shall be entitled to rely upon the certifications furnished them by water users pursuant to this subdivision, unless notified by the State as to the inaccuracy of any such certification. Payments made to the contractor pursuant to this subdivision, together with the certifications supporting such payments, shall be forwarded to the State on or before July 1 of the year in which they are received. Payments made to a retail agency pursuant to this subdivision, together with the certifications supporting such payments, shall on behalf of the State be required to be forwarded to the contractor, which shall in turn forward them to the State on or before July 1 of the year in which they are received; except that where project water has been delivered to the retail agency by, through, or under an agency or agencies other than the contractor, such payments and certifications shall on behalf of the State be required to be forwarded by the retail agency to the agency from which it received project water and by that agency, et seq., to the contractor, which shall forward them to the State on or before July 1 of the year in which they are received.

(e) Commingling of Project and Nonproject Water

In the event that a contractor, retail agency, or water user commingles project water with water from another source in a common distribution system, the contractor shall, in complying with the provisions of this article, adhere to the following rules, and, where project water is delivered by it to a retail agency or to another agency by, through or under which project water is delivered to a retail agency, as contemplated in subdivision (d) of this article, shall require on behalf of the State that such retail agency adhere or be required to adhere to the same rules.

(1) If the amount of nonproject water applied in any year within the area served with project

water by the contractor or retail agency is equal to or greater than the amount of water put to agricultural or manufacturing use on all excess land within that area during such year, it shall be presumed that the water put to agricultural or manufacturing use on such excess land is nonproject water, and there shall be no surcharge to water users in that area.

(2) If the amount of nonproject water applied in any year within the area served with project water by the contractor or retail agency is less than the amount of water put to agricultural or manufacturing use on all excess land within that area during such year, it shall be presumed, for the purpose of determining the payments to be made under the surcharge by water users in that area, that the amount of project water put to agricultural or manufacturing use on excess land of a particular ownership within that area during such year bears the same proportion to the total amount of water so used on that excess land during such year as the total amount of project water applied within that area during such year bears to the total amount of water applied within that area during such year.

(3) Project water which reaches the underground prior to delivery to or pumping by a water user shall not be subject to a surcharge under this article.

(f) Failure of Retail Agency to Perform Obligations

Subject to subdivision (g) of this article, a contractor shall not be liable for the failure of any retail agency or other agency to perform the obligations imposed upon it in accordance with subdivision (d) of this article.

(g) State May Enforce Surcharge

In the event that any retail agency or other agency by, through or under which project water is delivered to a retail agency, fails to perform the obligations imposed upon it in accordance with subdivision (d) of this article, the State may take such action in a court of competent jurisdiction, in the name of the contractor and/or agency or agencies by, through or under which project water is delivered to such retail agency, as it deems necessary to compel the performance of such obligations, and in such action the State shall be subrogated to the rights of such contractor and/or such other agency or agencies against such retail agency or other agency. In the event that any certification furnished by a water user in accordance with subdivision (d) of this article is found by the State to inaccurately represent facts of water use or land ownership, with the result that such user is avoiding payment under the surcharge provided for herein, the State may take such action in a court of competent jurisdiction, in the name of the contractor and/or the retail agency and/or any other agency or agencies by, through, or under which project water is delivered to such water user, as it deems necessary to collect full payment under the surcharge from such water user and to compel the performance of all obligations imposed upon such water user in accordance with said subdivision (d), and in such action the State shall be subrogated to the rights of such contractor and/or such retail agency and/or such other agency or agencies against such water user. Where project water is delivered by a contractor to a retail agency or to another agency by, through, or under which project water is delivered to a retail agency, as contemplated in subdivision (d) of this article, the contractor shall require on behalf of the State that such retail agency or other agency and all agencies by, through, or under which project water is delivered to a retail agency permit or be required to permit the State to bring the foregoing actions in their respective names and be subrogated to their respective rights as set forth above.

(h) State to Defend and Indemnify Against Claims

Should the application of any of the provisions of this article in the manner provided for herein result in claims of any nature against a contractor, retail agency, or other agency by, through, or under which project water is delivered to a retail agency, the State shall defend the contractor, retail agency, or other agency against such claims, and shall indemnify them for any liability with respect thereto arising from activities required by the State under this article.

(i) Separability

This article shall be separable from all other provisions in this contract, and in the event that any or all of the provisions of this article are in any manner or to any extent held to be invalid by final judgment or decree of a court of competent jurisdiction, such holding and such invalidity shall in no way affect the validity of, or make invalid, any other provision of this contract.

31. ADJUSTMENT FOR OVERPAYMENT OR UNDERPAYMENT

If in any year, by reason of errors in computation or other causes, there is an overpayment or underpayment to the State by the Agency of the charges provided for herein, which overpayment or underpayment is not accounted for and corrected in the annual redetermination of said charges, the amount of such overpayment or underpayment shall be credited or debited, as the case may be, to the Agency's account for the next succeeding year and the State shall notify the Agency thereof in writing.

32. DELINQUENCY IN PAYMENT

(a) Agency to Provide for Punctual Payment

The governing body of the Agency shall provide for the punctual payment to the State of payments which become due under this contract.

(b) Interest on Overdue Payments

Upon every amount of money required to be paid by the Agency to the State pursuant to this contract which remains unpaid after it becomes due and payable, interest shall accrue at the rate of one-half (½) of one (1) percent per month of the amount of such delinquent payment from and after the due date until it is paid, and the Agency hereby agrees to pay such interest: *Provided*, that no interest shall be charged to or be paid by the Agency unless such delinquency continues for more than thirty (30) days.

33. OBLIGATION OF AGENCY TO MAKE PAYMENTS

(a) Refusal of Water Does Not Affect Obligation

The Agency's failure or refusal to accept delivery of project water to which it is entitled under Article 6(b) shall in no way relieve the Agency of its obligation to make payments to the State as provided for in this contract. The State, however, shall make reasonable efforts to dispose of any water made available to but not required by the Agency and any net revenues from such disposal shall be credited pursuant to Article 21.

(b) Character of Obligation

The Agency as a whole is obligated to pay to the State the payments becoming due under this contract, notwithstanding any individual default by its constituents or others in the payment to the Agency of assessments, tolls, or other charges levied by the Agency.

34. OBLIGATION OF AGENCY TO LEVY TAXES AND ASSESSMENTS

(a) When Obligated

If in any year the Agency fails or is unable to raise sufficient funds by other means, the governing body of the Agency shall levy upon all property in the Agency not exempt from taxation, a tax or assessment sufficient to provide for all payments under this contract then due or to become due within that year.

(b) Enforcement by Officers of Agency

Taxes or assessments levied by the governing body of the Agency pursuant to subdivision (a) of this article shall be enforced and collected by all officers of the Agency charged with the duty of enforcing and collecting taxes or assessments levied by the Agency.

(c) Deposit in Separate Fund

All money collected for taxes or assessments under this article shall be kept in a separate fund by the treasurer or other officer of the Agency charged with the safekeeping and disbursement of funds of the Agency, and, upon the written demand of the State, the treasurer or other officer shall pay over to the State all such money in his possession or control then due the State under this contract, which money shall be applied by the State to the satisfaction of the amount due under this contract.

(d) Enforcement of Levy

In the event of failure, neglect, or refusal of any officer of the Agency to levy any tax or assessment necessary to provide payment by the Agency under this contract, to enforce or to collect the tax or assessment, or to pay over to the State any money then due the State collected on the tax or assessment, the State may take such action in a court of competent jurisdiction as it deems necessary to compel the performance in their proper sequence of all such duties. Action taken pursuant hereto shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

D. GENERAL PROVISIONS

35. REMEDIES NOT EXCLUSIVE

The use by either party of any remedy specified herein for the enforcement of this contract is not exclusive and shall not deprive the party using such remedy of, or limit the application of, any other remedy provided by law.

36. AMENDMENTS

This contract may be amended at any time by mutual agreement of the parties, except insofar as any proposed amendments are in any way contrary to applicable law. The State shall promptly furnish the Agency with copies of all contracts now or hereafter executed by the State for a dependable supply of project water, and of any amendments thereof.

37. AGENCY NOT ESTOPPED TO CHALLENGE STATE LAWS

Nothing herein contained shall be construed as estopping or otherwise preventing the Agency or any person, firm, association, corporation, or public body or agency claiming by, through, or under the Agency from contesting by litigation or other lawful means the validity, constitutionality, construction or application of any law of this State, including laws referred to in the Bond Act, or as preventing or prejudicing the amendment or repeal of any such law, and each contract executed by the State for a dependable supply of project water shall contain a similar reservation with respect to State laws.

38. OPINIONS AND DETERMINATIONS

Where the terms of this contract provide for action to be based upon the opinion, judgment, approval, review, or determination of either party hereto, such terms are not intended to be and shall never be construed as permitting such opinion, judgment, approval, review, or determination to be arbitrary, capricious, or unreasonable.

39. CONTRACTING OFFICER OF THE STATE

The contracting officer of the State shall be the Director of Water Resources of the State of California and his successors, or their duly authorized representatives. The contracting officer shall be responsible for all discretionary acts, opinions, judgments, approvals, reviews, and determinations required of the State under the terms of this contract.

40. SUCCESSORS AND ASSIGNS OBLIGATED

This contract and all of its provisions shall apply to and bind the successors and assigns of the parties hereto.

41. ASSIGNMENT

No assignment or transfer of this contract or any part hereof, rights hereunder, or interest herein by the Agency shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose.

42. WAIVER OF RIGHTS

Any waiver at any time by either party hereto of its rights with respect to a default or any other matter arising in connection with this contract, shall not be deemed to be a waiver with respect to any other default or matter.

43. NOTICES

All notices that are required either expressly or by implication to be given by one party to the other under this contract shall be signed for the State by its contracting officer, and for the Agency by such officer as it may, from time to time, authorize in writing to so act. All such notices shall be deemed to have been given if delivered personally or if enclosed in a properly addressed envelope and deposited in a United States Post Office for delivery by registered or certified mail. Unless and until formally notified otherwise, all notices shall be addressed to the parties at their addresses as shown on the signature page of this contract.

44. MAINTENANCE AND INSPECTION OF BOOKS, RECORDS, AND REPORTS

During regular office hours, each of the parties hereto and their duly authorized representatives shall have the right to inspect and make copies of any books, records, or reports of the other party pertaining to this contract or matters related hereto. Each of the parties hereto shall maintain and make available for such inspection accurate records of all of its costs, disbursements and receipts with respect to its activities under this contract and the Bond Act.

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45. SPECIAL PROVISIONS

(a) Capacity in Transportation Facilities.

The State shall provide sufficient capacity in the transportation facilities, subject to the provisions of Article 17(b), to deliver 18 percent of the portion of the Agency's annual entitlement to be put to agricultural use in any month and to deliver 11 percent of the portion of the Agency's annual entitlement to be put to municipal use in any month.

(b) Payment of Capital Cost Component of the Transportation Charge.

The Agency shall completely pay its total allocated capital cost component of the Transportation Charge, together with interest thereon, within the project repayment period.

(1) The projected portions of the Agency's annual entitlement which will be put to agricultural use and that will be put to municipal use during each year of the project repayment period shall be determined by the State and set forth in Table A(1) of this contract: Provided, That the amounts set forth in Table A(1) shall be subject to redetermination by the State pursuant to Article 28. The projected amounts of capital costs to be attributed annually to agricultural use and to municipal use under the capital cost component of the Transportation Charge shall be determined by the State by the method utilized in Article 24(b) for the allocation of such capital costs between contractors and shall be set forth in Table C of this contract: Provided, That the amounts set forth in Table C shall be subject to redetermination by the State pursuant to Article 28.

(2) Notwithstanding any conflicting provisions in

Articles 24(c), 24(e), and 29(b), the Agency's payments under that portion of the capital cost component of the Transportation Charge which is attributed by the State to agricultural use of project water shall be determined as follows: the State shall determine a unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement to be put to agricultural use, will return to the State, during the project repayment period, the portion of the capital cost component of the Transportation Charge allocated to the Agency that has been attributed to agricultural use and interest thereon, computed at the project interest rate and compounded annually: Provided, That all unpaid interest shall be accumulated at the project interest rate, compounded annually, and added to the Agency's allocated capital costs. The Agency's annual payment for such portion of the capital cost component shall be the product of the unit rate and the projected portion of the Agency's annual entitlement to be put to agricultural use. The Agency's repayment schedule for the portion of the capital cost component attributed to agricultural use and the unit rate shall be set forth in Table D of this contract: Provided, That the amounts set forth in Table D shall be subject to redetermination by the State pursuant to Article 28. Payments by the Agency under the capital cost component of the Transportation Charge attributed to agricultural use shall commence in the year of initial water delivery.

(3) The portion of the capital cost component of the Transportation Charge for the Agency attributed to municipal use shall be determined and paid in accordance with Articles 24 and 29 of this contract and the repayment schedule for such portion

shall also be set forth in Table D of this contract: Provided, That the amounts set forth in Table D shall be subject to redetermination by the State pursuant to Article 28: Provided further, That payments by the Agency under the capital cost component of the Transportation Charge attributed to municipal use shall commence in 1965.

(c) Surplus Water.

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available in any year, in an amount which bears the same ratio to the total amount of surplus water available in that year as the sum of the annual entitlements, set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors requesting surplus water: Provided, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. For the purpose of computing the portion of the surplus water for agricultural and ground water replenishment use to which each contractor is entitled, the State shall determine the amounts of water used for agricultural and ground water replenishment use by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

Surplus water for agricultural and ground water replenishment use shall be furnished at prices which will return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in such service of surplus water as determined by the State. A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract. Contracts made pursuant to this subdivision may exceed one year in duration.

Except as herein modified, the provisions of Article 21 of this contract are hereby confirmed, and all surplus water not specifically allocated pursuant to this subdivision shall be sold under the provisions of Article 21.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

(d) Surcharge Credit.

Notwithstanding other provisions of this contract, the State may include provisions in water supply contracts allowing a credit to a contractor not to exceed the surcharge to be paid by such contractor: Provided, That such credit shall be utilized to reduce the cost of water for agricultural use on other than excess land at a uniform rate per acre-foot not to exceed two dollars ($2) per acre-foot. Any contract including provisions pursuant to this subdivision shall assure that the reductions in the contractors' obligations authorized by this subdivision are made available exclusively for the benefit of agricultural use on land other than excess land and are not directly or indirectly made available for the benefit of agricultural use on excess land.

For the purpose of this contract, the surcharge credit shall be determined and applied in the following manner:

(1) The Agency or any retail agency shall reduce the toll for each acre-foot of project water put to agricultural use on other than excess land by a surcharge credit which shall be determined by dividing the total amount of the surcharge collected by the agency in any year by the total number of acre-feet of project water put to agricultural use on other than excess land within the agency: Provided, That the surcharge credit shall not exceed two dollars ($2).

(2) For the purpose of preventing any reduction in the cost of project water put to use on excess land the tolls charged by the Agency or any retail agency for project water put to agricultural use on other than excess land shall be less than the tolls charged for project water put to use on excess land by an amount equal to the sum of the surcharge and the surcharge credit, and the Agency agrees not to take any action with respect to the taxing or assessment of property which will nullify or tend to nullify the differential in tolls required by this subdivision.

(3) In the event that a water user commingles project water with water from other sources or receives a commingled water supply from the Agency or a retail agency that has commingled project water with water from another source, the quantity of water upon which the surcharge credit is to be determined shall be the product of the amount of water used by the water user from the commingled supply and the ratio of the amount of project water in the commingled supply to the total amount of commingled water, from which product shall be subtracted the amount of project water, if any, for which the water user is required to make payment of a surcharge under the provisions of Article 30(e)(2) of this contract.

(4) Article 30(d) of this contract is modified to read as follows:

The Agency, to the extent that it delivers project water directly to the users thereof, shall require on behalf of the State that each such user on or before February 1 of each year, commencing with the year following the year of initial water delivery: (i) certify in writing to the Agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use, and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; (ii) pay to the Agency for the account of the State a surcharge for the amount of water so certified; and (iii) certify in writing to the Agency on forms prescribed and furnished by the State the description of the land other than excess land owned by such user upon which project water is put to agricultural use, and the amount of project water put to agricultural use on such land during the preceding year. The Agency to the extent that it delivers project water to a retail agency or to another agency by, through, or under which such water is delivered to a retail agency, shall require on behalf of the State that each water user served by such retail agency be required to, on or before January 15 of each year, commencing with the year following the year of initial water delivery: (i) certify in writing to the retail agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; (ii) pay to the retail agency for the account of the State a surcharge for the amount of project water so certified; and (iii) certify in writing to the Agency on forms prescribed and furnished by the State the description of the land other than excess land owned by such user upon which project water is put to agricultural use, and the amount of project water put to agricultural use on such land during the preceding year. The Agency and retail agency shall be entitled to rely upon the certifications furnished them by water users pursuant to this subdivision, unless notified by the State as to the inaccuracy of any such certification. Payments made to the Agency pursuant to this subdivision, together with the certifications supporting such payments, shall be forwarded to the State on or before March 1 of the year in which they are received. Payments made to a retail agency pursuant to this subdivision, together with the certifications supporting such payments, shall on behalf of the State be required to be forwarded to the Agency, which shall in turn forward them to the State on or before March 1 of the year in which they are received; except that where project water has been delivered to the retail agency by, through, or under an agency or agencies other than the Agency, such payments and certifications shall on behalf of the State be required to be forwarded by the retail agency to the agency from which it received project water and by that agency, et seq., to the Agency, which shall forward them to the State on or before March 1 of the year in which they are received.

(5) Commencing with the year following the year of initial water delivery, the State shall include in the written statement of charges furnished to the Agency for the succeeding year a reduction of charges equal to the total amount of the surcharge credit to which water users within the Agency were entitled during the year preceding the year in which such statement is made. After receiving such statement, the Agency shall credit the

accounts of or make refunds to the water users of one-half of the surcharge credit due them effective not later than February 1 of the succeeding year and the balance not later than August 1 of that year.

(6) The remedies provided in Article 30(g) of this contract shall also be available to the State for the enforcement of this subdivision as against any retail agency or other agency by, through, or under which project water is delivered to a retail agency, or any water user.

(7) Where project water is delivered by the Agency to a retail agency or to another agency by, through, or under which project water is delivered to a retail agency, the Agency shall include the provisions of this subdivision 45(d) in any such contract and shall require its inclusion by any such agency in contracts under which it furnishes water to other agencies to the end that such provisions shall be included in any contract through which project water is furnished to a retail agency.

(8) This subdivision 45(d) shall be separable from all other provisions in this contract, and in the event that any or all of the provisions of this subdivision are in any manner or to any extent held to be invalid by final judgment or decree of a court of competent jurisdiction, such holding and such invalidity shall in no way affect the validity of, or make invalid, any other provision of this contract.

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Thousands of Acre-feet
1	87.0
2	95.7
3	145.1
4	159.6
5	232.3
6	264.5
7	293.3
8	324.1
9	363.8
10	406.9
11	449.9
12	491.9
13	534.8
14	584.0
15	630.2
16	682.4
17	730.2
18	776.9
19	822.5
20	870.1
21	921.2
22	958.9
23	1,000.0
and each succeeding year thereafter, for the term of this contract as a Maximum Annual Entitlement:	1,000.0

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY

Year	Agricultural Use	Municipal Use
1		
2		
3		
4		
5		
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7		
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TABLE B

ALLOCATED PROPORTION OF COSTS OF PROJECT TRANSPORTATION FACILITIES

KERN COUNTY WATER AGENCY

Aqueduct Reach	Total for project transportation facilities				Agency participation				
	Total of maximum annual entitlements of all contractors, thousands of 4/ acre-feet per year 1/	Total of maximum capacities, cubic feet 1/ per second 4/	Total capital cost, thousands of dollars	Minimum annual operating cost, thousands of dollars 2/	Maximum annual entitlement, thousands of acre-feet per year 1/	Ratio of maximum annual entitlement to total of maximum annual entitlements	Maximum capacity, cubic feet per second 1/	Ratio of maximum capacity to total capacity	Average of ratios
CALIFORNIA AQUEDUCT									
Delta to Discharge Delta Pumping Plant: 3/									
Discharge Delta Pumping Plant to San Luis Forebay: 3/									
San Luis Forebay: 3/									
San Luis Forebay to Kettleman City:									
Kettleman City to Avenal Gap:									
Avenal Gap to Buena Vista Pumping Plant:									
Buena Vista Pumping Plant to Wheeler Ridge Pumping Plants I and II:									
Wheeler Ridge Pumping Plants I and II to Tehachapi Pumping Plant:									
Tehachapi Pumping Plant to North Portal Tehachapi Tunnel No. 1									
COASTAL AQUEDUCT									
Avenal Gap to Discharge Pumping Plant C-3:									
Discharge Pumping Plant C-3 to Pumping Plant C-4:									
Pumping Plant C-4:									

1/ As increased by an allowance to compensate for losses as provided in Article 24(b) (2).

2/ Based on values as of the end of the construction period.

3/ Costs allocated to water transportation.

4/ State capacity only.

TABLE C

PROJECTED ALLOCATIONS OF CAPITAL
COST OF PROJECT TRANSPORTATION FACILITIES TO
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Agricultural Use	Municipal Use	Total
1*			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
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30			
31			

* Year in which State commenced construction of project transportation facilities, 1959.

TABLE D

TRANSPORTATION CHARGE-CAPITAL COST COMPONENT
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Municipal Use: Annual Payment of Principal	Municipal Use: Annual Interest Payment	Agricultural Use*: Annual Payment of Principal	Agricultural Use*: Annual Interest Payment	Total Annual Payment by Agency
1**					
2					
3					
4					
5					
6					
7***					
8					
9					
10****					
11					
12					
13					
14					
15					
16					
17					
18					
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21					
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24					
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26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					

TABLE D (Continued)

TRANSPORTATION CHARGE-CAPITAL COST COMPONENT
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Municipal Use: Annual Payment of Principal	Municipal Use: Annual Interest Payment	Agricultural Use: Annual Payment of Principal	Agricultural Use: Annual Interest Payment	Total Annual Payment by Agency
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
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72					
73					
74					
75					
76					
77					
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79					
80					

* Unit rate: $______________.

** Year in which State commenced construction of project transportation facilities, 1959.

***: Year of first payment, municipal use.

**** Year of first payment, agricultural use.

TABLE E
TRANSPORTATION CHARGE - MINIMUM OPERATION
MAINTENANCE, POWER, AND REPLACEMENT COMPONENT
KERN COUNTY WATER AGENCY

Year	Total Annual Payment by Agency* (In thousands of dollars)
1**	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
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29	
30	
31 and each succeeding year thereafter, for the term of this contract.	

* Payment shall start with respect to each aqueduct reach in the year following the year in which the State completes construction of the respective reach.

** Year in which the State commenced construction of the project transportation facilities, 1959.

TABLE F

TRANSPORTATION CHARGE - ESTIMATED VARIABLE OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT
KERN COUNTY WATER AGENCY

Year	Total Annual Payment by Agency* (In thousands of dollars)
1**	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
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25	
26	
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29	
30	
31 and each succeeding year thereafter, for the term of this contract.	

* Payments start with year of initial water delivery.

** Year in which State commenced construction of project transportation facilities, 1959.

TABLE G

PAYMENT SCHEDULE
KERN COUNTY WATER AGENCY
(In thousands of dollars)

	Transportation Charge			
Year	Capital Cost Component	Minimum Component	Variable Component	Total
1*				
2				
3				
4				
5				
6				
7**				
8				
9				
10***				
11				
12				
13				
14				
15				
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33				
34				
35				
36				
37				
38				
39				
40				
41				
42				

TABLE G (Continued)

PAYMENT SCHEDULE
KERN COUNTY WATER AGENCY
(In thousands of dollars)

	Transportation Charge			
Year	Capital Cost Component	Minimum Component	Variable Component	Total
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
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75				
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77				
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80				

* Year in which State commenced construction of project transportation facilities, 1959.

** Year of first payment, capital cost component, municipal use.

*** Year of first payment, capital cost component, agricultural use.

TABLE I

AQUEDUCT REACHES
KERN COUNTY WATER AGENCY

Aqueduct Reach	Major Features of Reach
Delta to Discharge Delta Pumping Plant:	Intake Canal Fish Protective Facilities Delta Pumping Plant (Pumping Plant I)
Discharge Delta Pumping Plant to San Luis Forebay:	Aqueduct
San Luis Forebay:	San Luis Foreby and Forebay Dam
San Luis Forebay to Kettleman City	Aqueduct Mile 18 Pumping Plant
Kettleman City to Avenal Gap:	Aqueduct
Avenal Gap to Buena Vista Pumping Plant	Aqueduct
Buena Vista Pumping Plant to Wheeler Ridge Pumping Plants I and II:	Buena Vista Pumping Plant Aqueduct
Wheeler Ridge Pumping Plants I and II to Tehachapi Pumping Plant:	Wheeler Ridge Pumping Plant I Wheeler Ridge Pumping Plant II Aqueduct
Tehachapi Pumping Plant to North Portal Tehachapi Tunnel No. 1:	Tehachapi Pumping Plant (Pumping Plant VI)
COASTAL AQUEDUCT	
Avenal Gap to Discharge Avenal Pumping Plant:	Aqueduct Avenal Pumping Plant (Pumping Plant C-3)
Discharge Avenal Pumping Plant to Pyramid Pumping Plant:	Aqueduct
Pyramid Pumping Plant	Pyramid Pumping Plant (Pumping Plant C-4)

TABLE H
PROJECT TRANSPORTATION FACILITIES
KERN COUNTY WATER AGENCY

A San Joaquin Valley-Southern California Aqueduct extending to the North Portal of Tehachapi Tunnel No. 1, to the extent such aqueduct is determined by the State to be required for water transportation.

A Coastal Aqueduct extending to the Discharge Pumping Plant C-4 to the extent such Aqueduct is determined by the State to be required for water transportation.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

____
Chief Counsel
Department of Water
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By______________________
Director

____
Governor

Attest:

____
Secretary
Kern County Water Agency
1100 26th Street
Bakersfield, California

KERN COUNTY WATER AGENCY

By______________________
President

By______________________
Director

By______________________
Director

By______________________
Director

By______________________
Director

By______________________
Director

By______________________
Director

Approved as to form:

____
Counsel

Approved:

____
Engineer-Manager

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 1 TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 28th day of September 1964, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency,"

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated November 15, 1963, providing that the State shall supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the maximum annual entitlements under all contracts executed by the State on or before December 31, 1963, did not aggregate the amount of the minimum project yield as defined in such water supply contract; and

WHEREAS, the Agency has elected to become entitled to a certain amount of the uncontracted for portion of the minimum project yield under the provisions of Article 8 of the above-mentioned contract and the State has determined that the Agency can put the water involved to beneficial use within a reasonable period of time; and

WHEREAS, the State and the Agency are desirous of making certain other changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (k) of Article 1 is amended to read as follows:

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,230,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year

1990, and the characteristic distribution of demands for these two uses throughout the year.

(2) An allowable reduction in the agricultural use portion of the minimum project yield, due to drought, of not to exceed fifty percent (50%) in any one year, nor a total of one hundred percent (100%) of one year's supply in any series of seven consecutive years.

(3) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

2. Table A entitled "Annual Entitlements Kern County Water Agency" is amended to read as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Acre-Feet
1	87,000
2	95,700
3	145,100
4	190,300
5	270,700
6	310,500
7	347,000
8	385,500
9	432,800
10	483,600
11	534,300
12	583,900
13	634,500
14	691,400
15	745,300
16	805,100
17	860,600
18	915,000
19	968,200
20	1,023,500
21	1,074,600
22	1,112,300
23	1,153,400
and each succeeding year thereafter, for the term of this contract:	1,153,400

3. Subdivision (c) of Article 12 is amended to read as follows:

(c) Limit on Rate of Delivery to Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding three thousand two hundred seventy seven (3,277) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

4. Subdivision (a) of Article 16 is amended to read as follows:

(a) Limit on Total of all Maximum Annual Entitlements

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,230,000 acre-feet of project water.

5. Subdivision (c) of Article 45 is amended to read as follows:

(c) Surplus Water

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water and to the provisions of the next succeeding paragraph, to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available in any year, in an amount which bears the same ratio to the total amount of surplus water available in that year as the sum of the annual entitlements set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors requesting surplus water: Provided, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. For the purpose of computing the portion of the surplus water for agricultural and ground water replenishment use to which each contractor is entitled, the State shall determine the amounts of water used for agricultural and ground water replenishment use by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

The provisions of this paragraph shall be applicable only to contractors in the San Joaquin Valley Service Area, contractors in the Southern California Service Area, and contractors in the Central Coastal Service Area. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural and ground water replenishment use in accordance with the following formula: contractors in the San Joaquin Valley Service Area shall have a right to contract for sixty-nine percent (69%) of the surplus water available at the Mile 18 Pumping Plant; contractors in the Southern California Service Area shall have a right to contract for twenty-nine percent (29%) of such water; and contractors in the Central Coastal Service Area shall have a right to contract for two percent (2%) of such water: Provided, That within each of these service areas, each contractor shall have the right to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available to that service area in any year, in an amount which bears the same ratio to the total amount of surplus water available to the service area in that year as the sum of the annual entitlements, set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors in that service area requesting surplus water: Provided, further, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. As used in this paragraph, "contractors in the San Joaquin Service Area" shall mean: Devil's Den Water District, Dudley Ridge Water District, Empire West Side Irrigation District, Hacienda Water District, Kern County Water Agency, and Tulare Lake Basin Water Storage District; "contractors in the Southern California Service Area" shall mean: Antelope Valley-East Kern Water Agency, City of West Covina, Coachella Valley County Water District, Crestline-Lake Arrowhead Water Agency, Desert Water Agency, Littlerock Creek Irrigation District, Mojave Water Agency, Palmdale Irrigation District, San Bernardino Valley Municipal Water District, San Gabriel Valley Municipal Water District, San Gorgonio Pass Water Agency, The Metropolitan Water District of Southern California, Upper Santa Clara Valley Water Agency, and Ventura County Flood Control District; "contractors in the Central Coastal Service Area" shall mean: San Luis Obispo County Flood Control and Water Conservation District and Santa Barbara County Flood Control and Water Conservation District.

The provision of this paragraph shall be applicable only to a contractor to which the delivery of project water for municipal use as of 1990 is estimated by the State to be in excess of fifty percent (50%) of such contractor's maximum annual entitlement. For the purpose of fixing such contractor's right to delivery of surplus water, water from a watershed not tributary to the contractor's area which is delivered within the contractor's boundaries for agricultural or ground water replenishment use shall be deemed to be part of the contractor's annual entitlement delivered for such use in computing the quantity of surplus water to which the contractor is entitled under this subdivision: Provided, That the contractor shall not be deemed to have used more than its annual entitlement, as set forth in Table A, for such use. Surplus water shall be deemed to be used by the contractor for agricultural or ground water replenishment use if an equal quantity of water imported from a watershed not tributary to the contractor's area is delivered within the contractor's boundaries for such use.

In providing for the delivery of surplus water to contractors pursuant to this subdivision, the State shall refuse to deliver such surplus water to any contractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor which would be dependent upon the sustained delivery of water in excess of the contractor's maximum annual entitlement. In no event shall the quantity of surplus water made available in any year prior to 1986 to any contractor under this subdivision exceed the difference between its annual entitlement for that year and its maximum annual entitlement, except that, subject to provisions of the immediately preceding sentence, with respect to any contractor which under Table A of its contract is scheduled to receive its maximum annual entitlement prior to 1978, the quantity of surplus water made available in any year prior to 1986 under this subdivision may exceed such difference by not more than 3,000 acre-feet.

Surplus water for agricultural and ground water replenishment use shall be furnished at prices which will return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in such service of surplus water as determined by the State. Surplus water delivered under this subdivision shall be limited to the quantity of water which can be delivered without adversely affecting the reliability, or increasing the cost, of service to meet annual entitlements. A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract. Contracts made pursuant to this subdivision may exceed one year in duration.

Except as herein modified, the provisions of Article 21 of this contract are hereby confirmed, and all surplus water not specifically allocated pursuant to this subdivision shall be sold under the provisions of Article 21. Nothing in this subdivision shall limit the right of the Agency to increase its annual entitlements as otherwise provided in this contract.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

6. Within thirty (30) days of the date of execution of this amendment, the Agency shall submit this amendment to a court of competent jurisdiction for determination of its validity by a proceeding in mandamus or other appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

V. G. Towne
Chief Counsel
Department of Water
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By William E. Warne
Director

KERN COUNTY WATER AGENCY

By Jack G. Thomson
President

Attest:

Edna M. Runnings
Secretary
Kern County Water Agency
1100 - 26th Street
Bakersfield, California

By Roland Curran
Director

By Kenneth M. Smith
Director

Approved as to form:

Stanley W. Kronick
Counsel

By David M. Bryant
Director

By Pete Gianopulos
Director

Approved:

Dal Ogilvie
Engineer-Manager

By Henry C. Garnett
Director

By Allen Bottorff
Director

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 2 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 10th day of October, 1966, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated November 15, 1963, as amended September 28, 1964, providing that the State shall supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the annual entitlement for the first year of water deliveries under the Agency's contract is 87,000 acre-feet; and

WHEREAS, the Agency will not furnish water to as large a service area during the first year of water deliveries as was contemplated when the Agency's water supply contract was executed by reason of the fact that the California Aqueduct will not be completed on January 1, 1968, to a point as far south in Kern County as was originally planned; and

WHEREAS, the Agency has requested that its annual entitlement for the first year of water deliveries be reduced to 46,600 acre-feet; and

WHEREAS, the State has determined that allowing such a reduction in entitlement will not impair the financial feasibility of the project facilities;

NOW THEREFORE, it is mutually agreed that the following change is hereby made to the Agency's water supply contract with the State:

Table A entitled "Annual Entitlements Kern County Water Agency" is amended to read as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Acre-Feet
1	46,600
2	95,700
3	145,100
4	190,300
5	270,700
6	310,500
7	347,000
8	385,500
9	432,800
10	483,600
11	534,300
12	583,900
13	634,500
14	691,400
15	745,300
16	805,100
17	860,600
18	915,000
19	968,200
20	1,023,500
21	1,074,600
22	1,112,300
23	1,153,400
And each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:	1,153,400

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

Attest:

Secretary

KERN COUNTY WATER AGENCY

By ______________________
President

Kern County Water Agency
1415 18th Street
Bakersfield, California 93301

By ______________________
Director

Approved as to form:

By ______________________
Director

Counsel

By ______________________
Director

Approved:

By ______________________
Director

Engineer-Manager

By ______________________
Director

By ______________________
Director

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1968, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963, (herein referred to as the "Amended Contract") providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, all of such facilities are not installed and in operation; and

WHEREAS, the power credit of two dollars appears to be grossly excessive, in light of presently estimated power costs and revenues incurred and received and to be incurred and received attributable to initial project conservation facilities, but no accurate redetermination of the power credit can be made at this time;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit shall not be effective as to water deliveries during the years ending December 31, 1967, 1968 and 1969. Prior to March 1, 1970, the State shall determine the power credit to be used for water deliveries during the year ending December 31, 1970, which credit shall be determined in accordance with the formula set forth in Article 30(b) of the Amended Contract.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

By ______________________
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Acting Director

Attest:

By ______________________
(Title) Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By ______________________
(Title) President

Approved as to form
and execution:

By ______________________
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 4 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1969, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency
herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year and that beginning in the year 1970, the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until after the year 1970 and to fix the rate for computing the Delta Water Charge for the year 1970 at $6.65; and

WHEREAS, the payments to be made by the Agency to the State include interest calculated at the "project interest rate" defined in Article 1(r) of such water supply contract to mean the weighted average of the interest rates paid by the State on bonds issued under the Water Resources Development Bond Act (Bond Act) disregarding premiums received on the sale of such bonds; and

WHEREAS, the underlying assumption upon which the "project interest rate" was established was that all of the initial facilities of the State Water Resources Development System (Project) would be financed principally with proceeds of bonds issued under the Bond Act or from other sources on which the interest rate would not exceed that of the bonds issued under the Bond Act; and

WHEREAS, the State already has financed the Oroville-

Thermalito power facilities through Central Valley Project Revenue Bonds and may finance other portions of the project facilities through additional revenue bond issues, bonds issued under other authority granted by the Legislature or the voters, bonds issued by other state agencies, advances from contractors, and other methods under which the financing costs relate to interest rates that may exceed the interest rate of the bonds issued under the Bond Act; and

WHEREAS, either the State or contractors making advances to the State may be subject to interest rates, or other financing costs that relate to interest rates, which will be greater than the "project interest rate" as presently defined in the contracts; and

WHEREAS, the parties desire that (1) the interest costs hereafter incurred by or on behalf of the State in financing the construction of project facilities by means other than the use of moneys provided under the Bond Act will be reflected in appropriate adjustments of the "project interest rate" (excepting the interest costs incurred for the Central Valley Project Revenue Bonds issued prior to the date of this amendment); (2) appropriate credit will be given to any contractor having made an advance of funds to the State corresponding to the bond service obligation payable by such contractor by reason of such advance or if bonds were not used to obtain funds for such advance, then to the net interest cost which would have resulted if the contractor had sold bonds for the purpose of funding the advance; and (3) if any sources of funds other than those provided under the Bond Act are employed to finance the construction of specific project facilities and the interest or other costs of such financing are greater than the cost would have been if bonds issued under the Bond Act had been used, appropriate adjustments to the charges to contractors will be made with respect to such facilities so that the charges to contractors taking water through reaches which include such facilities will be the same after such adjustments as such charges would have been if such facilities had been financed by the use of proceeds of bonds issued under the Bond Act, except insofar as the "project interest rate" has been adjusted pursuant to (1) in this recital:

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (b) of Article 22 is amended to read as follows:

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. For each contractor receiving project water in the year 1970, the Delta Water Charge shall be the product of $6.65 and the contractor's annual entitlement to project water for that year. The $6.65 rate for the year 1970 shall consist of a capital cost component of $5.04 and a minimum operation, maintenance, power and replacement component of $1.61. After December 31, 1970, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power and replacement component; and a variable operation, maintenance, power and replacement component.

2. Subdivision (r) of Article 1 is amended to read as follows:

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or non-profit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing

by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities (except advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

3. Subdivision (f) of Article 17 is added to the contract to read as follows:

(f) Adjustments Due to Supplemental Financing Costs

(1) If a contractor, with approval of the State, advances funds to the State to assist the State in financing construction of project facilities (not including delivery structures, measuring devices and excess capacity), such advance shall be amortized by means of annual credits to the contractor having made such advance of funds to the State, with such credits being equal to the actual bond service obligations payable by such contractor by reason of such advance or, if no bonded debt was incurred, then such credits shall be sufficient to cover the repayment of principal and interest costs which would have resulted if the contractor had sold bonds for the purpose of funding the advance as determined by the State.

(2) If, after May 1, 1969, any source of funds other than those provided by the Bond Act is employed to finance

construction of specific project facilities, any additional costs incurred because of such financing will not be charged to the contractors, except for adjustments to the "project interest rate".

Approved as to legal form and sufficiency:

P. G. Towner

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

By W. H. Gianelli
Director

Attest:

Edna M. [illegible]

Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By Gerald Kuyper[illegible]
President

Approved as to form and execution:

Edward J. Tiedeman

Counsel

AMENDMENT NO. 5

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this **22nd** day of **December**, 1970, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963 (herein referred to as the "Amended Contract"), providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit were suspended as to water deliveries during the years ending not later than December 31, 1969 pending the first redetermination of the power credit; and

WHEREAS, the power credit of two dollars is and will be grossly excessive for the year 1970 and thereafter, the estimated surcharge payments and surcharge credits, based on a redetermination of the power credit, would be relatively small and the associated administrative costs of the State and its contractors would be large; and

WHEREAS, the State and water contractors are in the process of reevaluating the power credit and such surcharge and surcharge credit provisions;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the surcharge and surcharge credit shall not be effective as to water deliveries during the year ending December 31, 1970.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form
and sufficiency:

By P. G. Torres
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W R Gianelli
Director

Attest:

By Edna M. [illegible]
Secretary
(Title)

KERN COUNTY WATER AGENCY

By [illegible]
President
(Title)

Approved as to form
and execution:

By Stanley W. Kronick
Counsel
(Title)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 5 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December , 1970, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency,
herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract, as amended, provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year, that for the year 1970 the Delta Water Charge shall be the product of $6.65 and the Agency's annual entitlement for that year, and that beginning in the year

1971 the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until after the year 1971 and to fix the rate for computing the Delta Water Charge for the year 1971 at $7.24;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (b) of Article 22 is amended to read as follows:

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. For each contractor receiving project water in the year 1970, the Delta Water Charge shall be the product of $6.65 and the contractor's annual entitlement to project water for that year. The $6.65 rate for the year 1970 shall consist of a capital cost component of $5.04 and a minimum operation, maintenance, power and replacement component of $1.61. For each contractor receiving project water in the year 1971, the Delta Water Charge shall be the product of $7.24 and the contractor's annual entitlement to project water for that year. The $7.24 rate for the year 1971 shall consist of a capital cost component of $5.44 and a minimum operation, maintenance, power and replacement component of $1.80. After December 31, 1971, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power and replacement component; and a variable operation, maintenance, power and replacement component.

Approved as to legal form and sufficiency:

[signature]
Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

By [signature]
Director

Attest:
[signature]
Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY
By [signature]
President

Approved as to form and execution:
[signature]
Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 7 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 6th day of July, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Agency takes delivery of project water from the Coastal Branch and from various reaches of the California Aqueduct downstream from its bifurcation with the Coastal Branch; and

WHEREAS, pursuant to Article 17(a) of the water supply contract the Agency initially requested certain deliveries from the Coastal Branch and the various reaches of the California

Aqueduct between Avenal Gap and the Carley V. Porter Tunnel and accordingly the State designed and constructed the project transportation facilities to provide certain capacity in such facilities sufficient to permit delivery of water to the Agency for agricultural use at 18 percent peaking and for municipal and industrial use at 11 percent peaking; and

WHEREAS, the Agency has not been able to market its water in the manner contemplated when such requests of deliveries were made and certain changes in deliveries to the Agency already have been approved by the State and are reflected in Table B-1 of Department of Water Resources Bulletin No. 132-70; and

WHEREAS, the Agency now requests that it be allowed to take delivery of an additional 50,000 acre-feet of its annual entitlement from the Coastal Branch (making a total of 155,100 acre-feet) and to reduce its deliveries in certain reaches of the California Aqueduct by a like amount; and

WHEREAS, the State is willing to approve such request provided that no changes will be made in the allocations of Capital and Minimum Transportation Costs of any of the reaches of the California Aqueduct or the Coastal Branch as a result of such change of deliveries and provided that such change shall not cause any decrease in service or increase in costs to any other water contractor;

NOW, THEREFORE, it is mutually agreed that the following addition is hereby made to the Agency's water supply contract with the State:

Subdivision (e) of Article 45 is added to the contract as follows:

(e) Change of Entitlement Deliveries

(1) The maximum amount of annual entitlement to be delivered to the Agency from the Coastal Branch in any one year shall be 155,100 acre-feet and the maximum instantaneous flow capacity available in the Coastal Branch for the Agency's deliveries shall be 283 cubic feet per second.

(2) Notwithstanding the provisions of Article 24(b) and 28 of this contract the factors for the allocation of capital costs and minimum operation, maintenance, power and replacement costs to the Agency in all reaches of the California Aqueduct and the Coastal Branch shall be as shown in Table B-2 of Department of Water Resources Bulletin No. 132-70.

(3) If (i) the annual entitlement deliveries provided for in this subdivision (e) of this contract, or (ii) peak rates of delivery through any pumping plant exceeding 11 percent for municipal and industrial deliveries or 18 percent for agricultural deliveries (or 11 percent from the Coastal Branch) cause an increase to other contractors in any charges for operating the California Aqueduct or Coastal Branch over the charges which would have been incurred had the Agency taken delivery from the Coastal Branch of the amounts of entitlement water shown on that certain schedule furnished the State on March 9, 1971, entitled "Kern County Water Agency Estimated

Entitlement To Be Delivered From The Coastal Branch Of The California Aqueduct", then the Agency shall pay to the State an extra service charge equal to the State's estimate of such increased charges.

(4) Within 30 days of the execution of this amendment, the Agency shall furnish the State a new schedule of entitlement water deliveries from the Coastal Branch covering each of the remaining years of the project repayment period.

Approved as to legal form and sufficiency:

By P. C. Towne
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. R. Gianelli
Director

Attest:

By Edna M. Simmons
Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By [signature]
President

Approved as to form and execution:

By Walter W. Kenick
Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 8 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 27th day of December, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract, as amended, provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year, that for the year 1970 the Delta Water Charge shall be the product of $6.65 and the

Agency's annual entitlement for that year, that for the year 1971 the Delta Water Charge shall be the product of $7.24 and the Agency's annual entitlement for that year, and that beginning in the year 1972 the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until the happening of certain events;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (e) of Article 22 is amended to read as follows:

Prior to the time that additional project conservation facilities or supplemental conservation facilities are constructed, the Delta Water Charge shall be determined on the basis of an allocation to project purposes, by the separable cost-remaining benefits method, of all actual and projected costs of all those initial project conservation facilities located in and above the Delta, and upon an allocation to the purposes of water conservation and water transportation, by the proportionate use of facilities method, of all actual and projected costs of the following project facilities located below the Delta: The aqueduct intake facilities at the Delta, Pumping Plant I (Delta Pumping Plant), the aqueduct from the Delta to San Luis Forebay (O'Neill Forebay), San Luis Forebay (O'Neill Forebay), and San Luis Reservoir: Provided, That all of the actual and projected costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities shall be allocated to the purpose of water conservation in, above, and below the Delta: Provided further, That allocations to purposes the cost of which are to be paid by the United States shall be as determined by the United States.

Commencing in the year in which the State first awards a major construction contract for construction of a major feature of additional project conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of additional project conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the foregoing allocations and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to the foregoing provisos, of all projected costs of such feature of the additional project conservation facilities: Provided, That if the agreement with such federal agency allows repayment of costs of a portion of a facility to be deferred, the associated costs of such portion shall be excluded from the Delta Water Charge computations until repayment of such deferred costs or interest thereon is commenced by the State: Provided further, That all costs of additional project conservation facilities incurred prior to the award of a major construction contract, shall be included in the Delta Water Charge computations in the year in which they are incurred.

2. Subdivision (g) of Article 22 is amended to read as follows:

Upon the construction of the supplemental conservation facilities, the Delta Water Charge shall be paid by all contractors for supplemental water, as well as by contractors for project water, and, together with revenues derived from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, shall return to the State, in addition to those costs of the project conservation facilities allocated to the purpose of water conservation, in, above, and below the Delta pursuant to subdivision (e) of this article, all costs of such supplemental conservation facilities, including capital, operation, maintenance, power, and replacement costs which are allocated to the purpose of water conservation, in, above, and below the Delta pursuant hereto. Commencing in the year in which the State first awards a major construction contract for construction of a major feature of any supplemental conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of supplemental conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the allocations made pursuant to subdivision (e) of this article, and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to provisos corresponding to those contained in said subdivision (e), of all projected costs of such feature of the supplemental conservation facilities. Commencing in the same year, the computation of the rates to be used in determining the components of the Delta Water Charge shall include the annual entitlements to water under all contracts for supplemental water. If the repayment period of any bonds sold to construct supplemental conservation facilities or the repayment period under any agreement with a federal agency for repayment of the costs of supplemental conservation facilities constructed by such federal agency extends beyond the repayment period of the contract, the Delta Water Charge shall be determined and redetermined on the basis of such extended repayment period as the State determines to be appropriate: Provided, That if the agreement with such federal agency allows repayment of costs of a portion of a facility to be deferred, the associated costs of such portion shall be excluded from the Delta Water Charge computations until repayment of such deferred costs or interest thereon is commenced by the State.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

By P. C. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. R. Gianelli
Director

Attest:

By Edna M. Simmons
(Title) Secretary

KERN COUNTY WATER AGENCY

By [signature]
(Title) President

Approved as to form and execution:

By Stanley W. Kronick
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 9 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 22nd day of December, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit have been suspended as to water deliveries during the years ending December 31, 1970; and

WHEREAS, the State and water contractors are still in the process of reevaluating the power credit and such surcharge and surcharge credit provisions;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit shall not be effective as to water deliveries during the year ending December 31, 1971.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form
and sufficiency:

By P. A. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W R Gianelli
Director

Attest:

By Edna M. Parsons
(Title) Secretary

KERN COUNTY WATER AGENCY

By [signature]
(Title) President

Approved as to form and
execution:

By Edward J. Tiedemann
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 10 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 15th day of October, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963 (herein referred to as the "Amended Contract) providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the allowance, on specified terms and conditions, of the amount of such surcharge as a credit to the Agency; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit have been suspended as to water deliveries during the years prior to 1972 pending redetermination of the power credit and a reevaluation of the merits of such contract provisions; and

WHEREAS, estimates indicate that the power credit will be relatively negligible in amount and that administrative costs associated with the power credit, surcharge and surcharge credit provisions will be excessively burdensome to the State, the Agency and its water users; and

WHEREAS, the power credit, surcharge and surcharge credit provisions rest on unclear, confused or mistaken premises and should no longer be retained;

NOW, THEREFORE, it is mutually agreed as follows:

There are hereby deleted from the Amended Contract the following:

1. Article 30 entitled "Surcharge for Excess Use of Project Water".

2. The next-to-the-last sentence of the fifth paragraph of subdivision (c) of Article 45, entitled "Surplus Water", which sentence reads as follows:

> "A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract".

3. Subdivision (d) of Article 45 entitled "Surcharge Credit".

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form and sufficiency:

By P. C. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. Gianelli
Director

Attest:

By Edna M. Zimmerman
(Title) **Secretary**

KERN COUNTY WATER AGENCY

By Jack G. Thomson
(Title) **President**

Approved as to form and execution:

By Stanley W. Kronick
(Title) STANLEY W. KRONICK,
COUNSEL
KERN COUNTY WATER AGENCY

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 11 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 26th day of December, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 28 of such water supply contract provides that the State shall redetermine the annual amounts of the Transportation Charge in order that the charges to the Agency may accurately reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State, annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges; and

WHEREAS, Article 28 also provides that each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for differences, if any, between projections used by the State in determining the amounts of such components for all preceding years and actual costs incurred by the State during such years, but does not specify the computational details or the method of payment of such adjustments; and

WHEREAS, the State has been including such adjustments as "one-shot" credits or additional charges to be subtracted from or added to the Transportation Charge to be paid by the Agency in the year following the redetermination; and

WHEREAS, the magnitude of such adjustments together with changes in other determinants of charges may be significantly different in comparison with the amounts projected by the State under previous determinations and could impair the planned fiscal operations of the Agency, depending on the method of payment, and the parties desire to amend the contract to provide a method of amortizing the payment of the amounts of such differences over two or more years, depending on the magnitude of the differences; and

WHEREAS, bookkeeping will be simplified if the amortization of the payments of the amounts of such differences is reflected solely in the capital cost component of the Transportation Charge; and

WHEREAS, the method of payment should apply regardless of whether the adjustments tend to increase or to decrease the Transportation Charge;

NOW THEREFORE, it is mutually agreed that effective January 1, 1973:

1. Article 28 of the Agency's Water Supply Contract with the State is amended to read as follows:

28. Transportation Charge - Redetermination

(a) Determinative Factors Subject to Retroactive Change

The State shall redetermine the values and amounts set forth in Tables B, C, D, E, F, and G of this contract in the year following the year in which the State commences construction of the project transportation facilities and each year thereafter in order that the Transportation Charge to the Agency and the components thereof may accurately reflect the increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project transportation facilities described in Table I of this contract, annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges. In addition, each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for the differences, if any, between those factors used by the State in determining the amounts of such components for all preceding years and the factors as then currently known by the State. Such adjustment shall be computed by the State and paid by the Agency or credited to the Agency's account in the manner described in (b) and (c) below or in Article 45(b)(4) if the Agency elects that option.

(b) Adjustment: Transportation Charge-Capital Cost Component

Adjustments for prior underpayments or overpayments of the capital cost component of the Transportation Charge to the Agency, together with accrued interest charges or credits thereon computed at the then current project interest rate on the amount of the underpayment or overpayment and compounded annually for the number of years from the year the underpayment or overpayment occurred to and including the year following the redetermination, shall be paid in the year following the redetermination: Provided, That the Agency may elect to exercise the option whereby when the redetermined Transportation Charge for the following year, with adjustments, including adjustments of the operation, maintenance, power, and replacement components provided for in subdivision (c) of this article, is more or less than the last estimate of the Charge provided pursuant to Article 27 for the corresponding year, without adjustments, an amount equal to the total of such difference shall be deducted from or added to the adjusted capital cost component for that year and paid or credited in accordance with the following schedule:

Percent that Transportation Charge differs from last estimate (+ or -)	Period, in years, for amortizing the difference in indicated charge
for 10% or less	no amortization
more than 10%, but not more than 20%	2
more than 20%, but not more than 30%	3
more than 30%, but not more than 40%	4
more than 40%.	5

Such payments or credits shall be in equal semiannual amounts of principal and interest on or before the 1st day of January and the

1st day of July, with interest computed at the project interest rate and compounded annually, during varying amortization periods as set forth in the preceding schedule: Provided, That for the purpose of determining the above differences in the Transportation Charge, the variable operation, maintenance, power, and replacement component shall be computed on the basis of the same estimated project water deliveries as was assumed in computing pursuant to Article 26(c).

(c) Adjustment: Transportation Charge-Minimum and Variable Components

One-twelfth of the adjustments for prior underpayments or overpayments of the Agency's minimum and variable operation, power, and replacement components for each year shall be added or credited to the corresponding components to be paid in the corresponding month of the year following the redetermination, together with accrued interest charges or credits thereon computed at the then current project interest rate on the amount of the underpayment or overpayment and compounded annually for the number of years from the year the underpayment or overpayment occurred to and including the year following the redetermination.

(d) Exercise of Option

The option provided for in subdivision (b) above and in Article 45(b)(4) shall be exercised in writing on or before the January 1 due date of the first payment of the capital cost component of the Transportation Charge for the year in which the option is to become effective.

Such option, once having been exercised, shall be applicable for all of the remaining years of the project repayment period.

2. Article 45(b)(4) is added to the contract to read as follows:

(4) Notwithstanding any conflicting provisions in Article 28, and as an alternative to the option for further adjustment of the capital cost component as provided for in subdivision (b) thereof, the Agency may elect to exercise an option whereby all adjustments of the capital cost component of the Transportation Charge for the Agency which is attributed by the State to agricultural use of project water thereafter shall be included in the determination of the unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement to be put to agricultural use, will return to the State, during the project repayment period, the portion of the capital cost component of the Transportation Charge allocated to the Agency that has been atributed to agricultural use, including adjustments pursuant to Article 28, and interest thereon, computed at the project interest rate and compounded annually: Provided, That the Agency may elect to exercise the option described in this subdivision with respect to water put to agricultural use whether or not the Agency elects to exercise the option pursuant to Article 28 to amortize charges for water put to municipal and manufacturing use.

IN WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

By P. G. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. Gianelli
Director

Attest:

By ______________________
(Title) Secretary

KERN COUNTY WATER AGENCY

By ______________________
(Title) President

Approved as to form and execution:

By Stanley W. Kronick
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 12 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 28th day of August, 1974, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State; and

WHEREAS, the State and the Agency included in such contract a subarticle, hereinafter referred to as the agricultural and ground water replenishment provision, which entitles the Agency to obtain from the State a supply of surplus water for agricultural and ground water replenishment use when available; and

WHEREAS, Article 21 of such contract also provides for the sale by the State of a supply of surplus water when available; and

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the sale and purchase of surplus water;

NOW, THEREFORE, it is mutually agreed as follows:

1. Subdivision (c) of Article 45 of the Agency's water supply contract is deleted.

2. Article 21 of the Agency's water supply contract is amended to read as follows:

21. Sale of Surplus Water.

(a) Definitions. When used in this article:

(1) "Noncontractor" shall mean a person or entity that is not a contractor as that term is defined in Article 1 of this contract.

(2) "Surplus water" shall mean water which can be furnished to contractors and noncontractors, subject to the provisions of Article 14(a) of this contract, without interfering with:

(i) The delivery of annual entitlements of all contractors as specified in Table A and the meeting of the quality criteria of Article 19 of their respective water supply contracts including any modifications of Table A pursuant to Articles 7(a), 12(d), 14(b), 18(b), or 18(c) of the water supply contracts or to any other provisions in such contracts which permit changes in the delivery of annual entitlements;

(ii) The furnishing of water required for use in construction of the System or in exchange for local water used in construction of the System;

(iii) Operational requirements regarding recreation and fish and wildlife uses;

(iv) Generation of power by the System or furnishing of project water required by power contracts;

(v) The exchange of water and the filling, retention, and release of storage in System reservoirs necessary for operational flexibility and to meet the requirements of paragraphs (i) through (iv) of this subdivision.

(vi) Losses of water due to evaporation, leakage, seepage, or other causes to meet the requirements of paragraphs (i) through (v) of this subdivision.

(3) "Ground water replenishment use" shall mean the use of project water exclusively for recharge of ground water basins by direct application to spreading basins, streambeds, or through other means of direct artificial recharge.

(4) "Contractors in the San Joaquin Service Area" shall mean those contractors which are furnished water through delivery structures from the California Aqueduct between Dos Amigos Pumping Plant and the South Portal of the Carley V. Porter Tunnel and from the Coastal Branch, California Aqueduct, from its junction with the California Aqueduct to the site for Devil's Den Pumping Plant.

(5) "Contractors in the Southern California Service Area" shall mean contractors for which water is delivered from the California Aqueduct downstream from the South Portal of the Carley V. Porter Tunnel.

(6) "Contractors in the Central Coastal Service Area" shall mean contractors for which water is delivered from the Coastal Branch, California Aqueduct, downstream from the site for Devil's Den Pumping Plant.

(7) "Deferred entitlement" shall mean those portions of annual entitlements to project water deferred in accordance with Article 7(e) of the contract with Alameda County Flood Control and Water Conservation District, Zone 7, Article 7(e) of the contract with Alameda County Water District, Article 7(e) of the contract with Santa Clara Valley Water District, Article 45(f) of the contract with Empire West Side Irrigation District, Article 45(e) of the contract with Hacienda Water District, Article 45(f) of the contract with County of Kings, Article 45(e) of the contract with Oak Flat Water District, and Article 45(e) of the contract with Tulare Lake Basin Water Storage District.

(b) Priorities. The State shall furnish surplus water in accordance with the following priorities:

(1) First, to contractors for agricultural use or for ground water replenishment use.

(2) Second, to contractors for other uses.

(3) Third, to noncontractors for any beneficial use.

These priority groups shall be referred to as first priority, second priority, and thir priority respectively.

(c) Reductions in Requested Deliveries. If requests for surplus water cannot be met, the following reductions in requested deliveries shall be made:

(1) First, the quantity of surplus water to be delivered to noncontractors shall be limited to the quantity available in excess of the requests under the first priority and the second priority.

(2) Second, if there is not sufficient surplus water in excess of the requests under the first priority to meet the requests of contractors under the second priority, the quantity of water to be delivered under the second priority shall be limited to the quantity available in excess of the requests under the first priority and that quantity shall be apportioned in proportion to the amounts of the contractors' current annual entitlements that are to be used for purposes other than agricultural and ground water replenishment uses as determined by the State. If any contractor decides not to use the surplus water available to it under this provision, such surplus water shall be offered on a similar basis to other contractors for such uses.

(3) If there is not sufficient surplus water to meet the requests of contractors under the first priority, the quantity of water to be delivered under that priority shall be limited to the quantity available, and such quantity shall be apportioned to areas upstream and downstream from Dos Amigos Pumping Plant in proportion to the contractors' current annual entitlements that are to be used in such areas for agricultural and ground water replenishment purposes as determined by the State. The quantity of such water available upstream from Dos Amigos Pumping Plant shall be apportioned to contractors upstream from Dos Amigos Pumping Plant in proportion to the amounts of the contractors' current annual entitlements that are to be used for agricultural and ground water

replenishment purposes as determined by the State. If any such contractor decides not to use the surplus water available to it, such surplus water shall first be offered on a similar basis to other contractors upstream from Dos Amigos Pumping Plant and second offered to contractors downstream from Dos Amigos Pumping Plant. The quantity of surplus water available at Dos Amigos Pumping Plant for delivery to contractors downstream from that plant shall be apportioned 69 percent to the San Joaquin Service Area, 29 percent to the Southern California Service Area, and 2 percent to the Central Coastal Service Area. Within each such service area, surplus water shall be apportioned to contractors in proportion to the amounts of the contractors' current annual entitlements that are to be used for agricultural and ground water replenishment purposes as determined by the State. If any such contractor decides not to use the surplus water available to it, such surplus water, on a similar basis, shall first be offered to other contractors in such service area and second offered to contractors in the other such service areas.

(d) Schedules. On or before October 1 of each year, concurrently with the schedule submitted pursuant to the provisions of Article 12, the contractor shall submit in writing to the State a preliminary water delivery schedule, indicating the desired amounts of surplus water for each month of the subsequent six-year period beginning January 1 of the next succeeding year. The last five years of this preliminary surplus water delivery schedule shall be used by the State for planning and operations studies. If a contractor commits itself in writing at the time it submits its October 1 schedule to guarantee payment of the cost of power required in the judgment of the State to furnish surplus water to it, the contractor shall have a prior right to have such power utilized for furnishing surplus water otherwise available to it pursuant to this article at a cost no higher than that which the State is obligated to pay at the time it orders such power, but it shall have no greater right or priority to receive surplus water. A contractor's commitment may be for any part of the six-year period of its schedule, and the contractor will become bound by such commitment and become entitled to the prior right provided for in the preceding sentence only when the State, after consultation with the contractor, notifies the contractor in writing that it has ordered power based on the contractor's commitment.

(e) Rates.

(1) Surplus water (except further surplus water as described in subdivision (e)(4) of this article) shall be furnished to a contractor for agricultural use and for ground water replenishment use at rates which will return to the State all power costs as defined in subdivision (f) of this article and all incremental operation, maintenance, and replacement costs, and any other incremental costs, incurred in the conservation and transportation of such surplus water as determined by the State, which rates shall include an administrative charge to be determined by the State for each acre-foot of surplus water scheduled for delivery during the year. The amount of such administrative charge shall be credited to general operating costs of the System prior to the allocation of such costs. Incremental costs shall mean those costs which would not be incurred if surplus water were not scheduled for or delivered to the contractor.

(2) Surplus water furnished to a contractor for purposes other than agricultural use or ground water replenishment use shall be sold at rates determined on the same basis as those charged for surplus water for agricultural use and for ground water replenishment use plus an amount equal to one-half of the current Delta water rate.

(3) Surplus water furnished to a noncontractor shall be at rates, as determined by the State, which will return to the State not less than the charges specified for a contractor for surplus water for agricultural use and for ground water replenishment use plus an amount equal to the current Delta water rate plus an appropriate share of the capital and the minimum operation, maintenance, power and replacement costs of the transportation facilities of the System utilized in conveying such surplus water to the noncontractor.

(4) To the extent that the combined volume of entitlement water and surplus water furnished to a contractor in any year for agricultural use and for ground water replenishment use exceeds 150 percent of such contractor's maximum annual entitlement, such further surplus water shall be sold to the contractor at a rate equal to the rate for surplus water sold for agricultural use and for ground water replenishment use specified in subdivision (e)(1) of this article plus an amount equal to one-quarter of the current Delta water rate.

For years prior to 1990, notwithstanding the provisions of the preceding sentence, an amount up to 3,000 acre-feet of further surplus water may be delivered in any year at the charges provided for in subdivisions (e)(1) and (2) of this article to any contractor which, under Table A of its contract, is scheduled to receive its maximum annual entitlement prior to 1978 and every year thereafter.

(5) Any revenues in excess of operation, maintenance, power and replacement costs and the administrative charge derived from sales of surplus water shall be credited as follows: The Delta water rate or portion thereof paid in accordance with subdivisions (e)(2), (e)(3), or (e)(4) of this article shall be credited to the cost of project conservation facilities, and the balance of such excess revenues, if any, shall be apportioned and credited, as appropriate, to the capital and to the minimum operation, maintenance, power and replacement costs of reaches of the transportation facilities of the System utilized for conveying such water to the purchasers.

(6) The rates and charges for surplus water shall be subject to redetermination by the State to reflect actual costs incurred and the difference shall be promptly credited or debited to the contractor that purchased such surplus water.

(f) Power Costs. Power costs for pumping surplus water shall consist of the cost of capacity, energy and additional transmission service required for the delivery of surplus water, including but not limited to the following:

(1) To the extent utilized for pumping surplus water:

(i) The cost of power purchased for pumping entitlement water,

(ii) The value of project recovery plant generation scheduled for pumping entitlement water, and

(iii) The value of project recovery plant generation not scheduled for pumping entitlement water; and

(2) Power purchased specifically for pumping surplus water including power ordered pursuant to subdivision (d) of this article.

The cost and value of power in (1)(i) and (ii) of this subdivision shall be credited to the pumping plant power cost attributable to annual entitlement water; the value of power in (1)(iii) that is generated by entitlement water shall be added to the net value of power attributable to such entitlement water; and the value of power in (1)(iii) that is generated by surplus water shall be credited to the costs incurred in pumping such surplus water.

The State shall determine the cost of power for pumping surplus water so that sufficient revenue will be available to the State to cover both the cost of purchased power and the value of recovery plant generation.

(g) <u>Restrictions on Deliveries</u>.

(1) In providing for the delivery of surplus water pursuant to this article, the State shall refuse to deliver such surplus water to any contractor or noncontractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor or noncontractor which would be dependent upon the sustained delivery of surplus water.

(2) Surplus water shall not be scheduled to a contractor in a year unless an amount of project water equal to its annual entitlement set forth for that year in Table A of its

contract (disregarding any amendments reducing such Table A executed after July 1, 1974) is first scheduled and unless all of its deferred entitlements are first scheduled: Provided, That at the request of the contractor surplus water may be scheduled in lieu of deferred entitlements and the right to receive such deferred entitlements shall be reduced accordingly. If at the end of any year delivery of scheduled surplus water has prevented any annual entitlement or deferred entitlement from being delivered during that year, then for the purpose of charging for water delivered, deliveries during the year shall be considered first as annual entitlement water to the extent of the annual entitlement, and the balance as deferred entitlement or surplus water in accordance with the option of the contractor previously exercised pursuant to the first sentence of this subdivision.

(3) Before a contractor can receive surplus water under its contract in an amount greater than its annual entitlement for the year as shown in its Table A, it shall first increase its annual entitlement for such year to an amount equivalent to the surplus water scheduled, but it shall not be required to increase its annual entitlement to an amount in excess of 75 percent of its maximum annual entitlement.

(4) The State shall not sell surplus water to a contractor or noncontractor for use directly or indirectly within the boundaries of any other contractor without the written consent of such other contractor, nor shall the State authorize any contractor to supply surplus water for use outside such contractor's boundaries and within the boundaries of any other contractor without the written consent of such other contractor: Provided, That where

a contractor's boundaries include an area within the boundaries of another contractor, only the written consent of the contractor that serves the overlapping area with water under its annual entitlements need be obtained.

(h) Water from Nontributary Source. The provisions of this subdivision shall be applicable only to a contractor to which the delivery of project water for municipal use as of 1990 is estimated by the State to be in excess of 50 percent of such contractor's maximum annual entitlement. For the purpose of fixing such contractor's right to delivery of surplus water, water from a watershed not tributary to the contractor's area which is delivered within the contractor's boundaries for agricultural or ground water replenishment use shall be deemed to be part of the contractor's annual entitlement delivered for such use in computing the quantity of surplus water to which the contractor is entitled under this article: Provided, That the contractor shall not be deemed to have used more than its annual entitlement, as set forth in Table A, for such use. Surplus water shall be deemed to be used by the contractor for agricultural or ground water replenishment use if an equal quantity of water imported from a watershed not tributary to the contractor's area is delivered within the contractor's boundaries for such use.

(i) Determination of Use. For the purpose of computing the portion of the surplus water to which each contractor is entitled, the State shall determine the quantities of annual entitlement used for agricultural use and for ground water replenishment use and for other uses by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

(j) Contracts.

(1) To obtain a supply of surplus water, any contractor or noncontractor shall execute a further contract with the State which shall be in conformity with this article and will include at least the following: Further provisions concerning the scheduling of surplus water and provisions as to times and methods of payment.

(2) The State shall not contract to sell surplus water to noncontractors for periods in excess of five years.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By
Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By John R Teerink
Director

KERN COUNTY WATER AGENCY

By J. Elliott Fox
(Title) Secretary

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 13 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
THE KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 16 day of July, 1979, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

RECITALS:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect:

NOW, THEREFORE, it is mutually agreed as follows:

Subdivision (f) of Article 29 of the Agency's Water Supply Contract with the State is amended to read as follows:

(f) Times of Payment-Capital Components

The Agency shall pay to the State, on or before January 1 of each year, commencing with the year in which payment of the respective charge is to commence pursuant to this article, one-half (1/2) of the charge to the Agency for the year under the capital cost component of the Delta Water Charge and one-half (1/2) of the charge to the Agency for the year under the capital cost component of the Transportation Charge, as such charges are stated pursuant to subdivision (e) of this article; and shall pay the remaining one-half (1/2) of each of said charges on or before July 1 of that year.

Notwithstanding the preceding sentence, the Agency may defer all or any portion of any payments of the capital components of the Delta Water Charge and the Transportation Charge for a period not to exceed three months beyond said due dates; Provided that the Agency gives the State written notice of its election to defer all or a portion of such a payment at least twenty-one days prior to the date upon which such payment is otherwise due; and Provided Further, that if the requested deferrals from all contracts would impair the State's cash flow needs for fiscal management of the Project, as determined by the State. the State shall proportion the amount available for deferrals among those contractors that can provide information substantiating a need for such assistance.

The Agency shall pay to the State interest on any amounts deferred pursuant to the preceding paragraph from the due date for such payment until the date such deferred payment is made at a rate equivalent to the average rate earned by the State from its surplus money investment fund during that period of time.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By V. L. Cline
Asst. Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By [signature]
Director

KERN COUNTY WATER AGENCY

By [signature]

(8) "Extra Surplus Water" shall mean water available in the Delta as determined by the State at various times during the year when scheduled project demands are being delivered and project storage requirements for both project water deliveries and water to meet Delta water quality requirements established by the SWRCB are being met. Excepting Articles 21(b), 21(d), and subdivision[redacted] (3) [redacted] of Article 21(g), all provisions of this Article 21 related to surplus water shall apply to extra surplus water.

2. Article 21(b) is amended to read as follows:

(b) Priorities. The State shall furnish surplus water, not including extra surplus water, in accordance with the following priorities:

(1) First, to contractors for agricultural use or for ground water replenishment use.

(2) Second, to contractors for other uses.

(3) Third, to noncontractors for any beneficial use.

The State shall furnish extra surplus water in accordance with the following priorities:

(1) First, for ground water replenishment or for agricultural use in lieu of ground water pumping.

(2) Second, for pre-irrigation to increase soil moisture prior to planting.

3. Add the following to Article 21(d):

The schedules required by this Article 21(d) shall not include amounts of extra surplus water. Scheduling of extra surplus water will be done pursuant to provisions of an annual agreement.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 14 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
THE KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 4th day of January, 1980 pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, The State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (8) is added to Article 21(a) of the Agency's water supply contract to read as follows:

4. Add the following to subdivision (3) of Article 21(g):

Extra surplus water shall not be included in this determination.

5. Subdivisions (5) and (6) are added to Article 21(g) as follows:

(5) Delivery of extra surplus water to a contractor shall not adversely affect deliveries or costs of entitlement and surplus water deliveries to any contractor during the respective year.

(6) No extra surplus water shall be delivered when sufficient surplus water is available to satisfy contractor requests.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

By ______________________
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

KERN COUNTY WATER AGENCY

By ______________________

THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 15 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 22 day of February, 1980 pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State;

1. Subdivision t of Article 1 of the Agency's Water Supply Contract with the State is amended to read as follows:

(t) Project Repayment Period

"Project repayment period" shall mean that period of years commencing on January 1, 1961, and extending until December 31, 2035; Provided, that whenever construction of any project facilities is financed by a bond issue with maturity dates later than December 31, 2035, whether the bonds are issued pursuant to the Bond Act or other authority, repayment of the costs of such facilities shall be extended to end on the date of the latest maturities of the bonds with which construction of such facilities is financed.

2. Article 2 of the Agency's Water Supply Contract with the State is amended to read as follows:

(2) Term of Contract

This contract shall become effective on the date first above written and shall remain in effect for the longest of the following:

1. The project repayment period
2. 75 years
3. The period ending with the latest maturity date of any bond issue used to finance the construction costs of project facilities.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

by ______________________
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

by ______________________
Director

KERN COUNTY WATER AGENCY

by ______________________

Title President, Board of Directors

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 16 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 17 day of February, 1982, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following change and addition is hereby made to the Agency's water supply contract with the State:

1. The term "unscheduled water" shall replace the term "Extra Surplus Water" wherever it appears in

Article 21 of the Water Supply Contract between the State of California Department of Water Resources and the Agency.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

R.G. Towner

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Ronald B. Robie

Ronald B. Robie
Director

KERN COUNTY WATER AGENCY

By Stuart T Pyle Feb 16 1982

Title Engineer - Manager

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 17 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND THE
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 18 day of December, 1984, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(e) is amended to read:

(e) Project Facilities

"Project facilities" shall mean those facilities of the system which will, in whole or in part, serve the purposes of this contract by conserving water and making it available for use in and above the Delta and for export from the Delta and from such additional facilities as are defined in Article 1(h)(2) herein, and by conveying water to the Agency. Said project facilities shall consist specifically of "project conservation facilities" and "project transportation facilities", as hereinafter defined.

2. Article 1(h) is amended to read:

(h) Additional Project Conservation Facilities

"Additional project conservation facilities" shall mean the following facilities and programs which will serve the purpose of preventing any reduction in the minimum project yield as hereinafter defined:

(1) Those project facilities specified in Section 12938 of the Water Code;

(2) Those facilities and programs described in (A), (B), (C), (D), and (E) below which, in the State's determination, are engineeringly feasible and capable of producing project water which is economically competitive with alternative new water supply sources, provided that, in the State's determination, the construction and operation of such facilities and programs will not interfere with the requested deliveries of annual entitlement to any contractor other than the sponsoring contractor, and will not result in any greater annual charges to any contractor other than the sponsoring contractor than would have occurred with the construction at the same time of alternative new water supply

sources which are either reservoirs located north of the Delta or off-Aqueduct storage reservoirs located south or west of the Delta designed to supply water to the California Aqueduct. The following facilities and programs shall hereinafter be referred to as "Local Projects":

(A) On-stream and off-stream surface storage reservoirs not provided for in Section 12938 of the Water Code, that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(B) Ground water storage facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(C) Waste water reclamation facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(D) Water and facilities for delivering water purchased by the State for the System for a period of time agreed to by the sponsoring contractor; provided that the economic test specified herein shall be applied to the cost of these facilities together with the cost of the purchased water; and

(E) Future water conservation programs and facilities that will reduce demands by the sponsoring contractor for project water from the System for a period of time agreed to by the sponsoring contractor and will thereby have the effect of increasing project water available in the Delta for distribution.

(3) Whether a Local Project described in (2) above shall be considered economically competitive shall be determined by the State by comparing, in an engineering and economic analysis, such Local Project with alternative new water supply

sources which are either reservoirs located north of the Delta or off-Aqueduct storage reservoirs located south or west of the Delta designed to supply water to the California Aqueduct. The analysis for such alternative new water supply sources shall use the average cost per acre-foot of yield in the latest studies made for such sources by the State and shall compare those facilities with the proposed Local Project using commonly accepted engineering economics. In the case of a Local Project to be funded in part by the State as part of the System and in part from other sources, the economic analysis specified herein shall be applied only to the portion to be funded by the State as part of the System.

(4) The Local Projects in (2) above shall not be constructed or implemented unless or until:

(A) The sponsoring contractor signs a written agreement with the State which:

(i) Contains the sponsoring contractor's approval of such facility or program.

(ii) Specifies the yield and the period of time during which the water from the Local Project shall constitute project water; and

(iii) Specifies the disposition of such Local Project or of the yield from such Local Project upon the expiration of such period of time; and

(B) All contractors within whose boundaries any portion of such Local Project is located, and who are not sponsoring contractors for such Local Project give their written approval of such Local Project.

(5) "Sponsoring contractor" as used in this Article 1(h) shall mean the contractor or contractors who either will receive the yield from facilities described in 2(A), (B), (C), or (D) above, or agree to reduce demands for project water from the System pursuant to 2(E) above.

(6) In the event of a shortage in water supply within the meaning of Article 18(a), the determination of whether to count, in whole or in part, the yield from facilities described in 2(A), (B), (C), or (D) above, or the reduced demand from future conservation programs described in 2(E) above in the allocation of deficiencies among contractors will be based on a project-by-project evaluation taking into consideration such factors as any limitation on the use of the water from such facilities and whether the sponsoring contractor has access to project water from the Delta as an alternate to such facilities.

3. Article 1(i)(2) is amended to read:

(2) Facilities for the generation and transmission of electrical energy of the following types:

(A) Hydroelectric generating and transmission facilities, whose operation is dependent on the transportation of project water, or on releases to channels downstream of project facilities defined under (1) above. Such facilities shall be called "project aqueduct power recovery plants."

(B) All other generating and associated transmission facilities, except those dependent on water from project conservation facilities, for the generation of power. These facilities shall be called "off-aqueduct power facilities" and shall consist of the State's interest in the Reid-Gardner and any other generating and associated transmission facilities, constructed or financed in whole or in part by the State, which are economically competitive with alternative power supply sources as determined by the State.

4. Article 1(r) is amended to read:

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest

rate earned over the period of such borrowing by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

5. Subdivision (h) is added to Article 22 to read:

(h) The determination of the rate for water under the Delta Water Charge shall be made by including the appropriate costs and quantities of water, calculated in accordance with subdivisions (c), (d) and (e) above, for all additional project conservation facilities as defined in Article 1(h) hereinabove. In the event a Local Project as defined in Article 1(h)(2) will, pursuant to written agreement between the State and the sponsoring contractor, be considered and treated as an additional project conservation facility for less than the estimated life of the facility, the rate under the Delta Water Charge will be determined on the basis of that portion of the appropriate cost and water supply associated with such facility as the period of time during which such facility shall be considered as an additional project conservation facility bears to the estimated life of such facility. No costs for the construction or implementation of any Local

Project are to be included in the Delta Water Charge unless and until the written agreement required by Article 1(h) has been entered into.

6. Subdivision (i) is added to Article 22 to read:

(i) In calculating the rate for project water to be paid by each contractor for the Delta Water Charge under subdivisions (c), (d) and (e) above, the component for operation, maintenance, power and replacement costs shall include, but not be limited to, all costs to the State incurred in purchasing water, which is competitive with alternative sources as determined by the State, for delivery as project water.

7. Subdivision (f) is added to Article 24 to read:

(f) The capital costs of project aqueduct power recovery plants shall be charged and allocated in accordance with this Article 24. The capital costs of off-aqueduct power facilities shall be charged and allocated in accordance with Article 25(d).

8. Subdivision (d) is added to Article 25 to read:

(d) Notwithstanding the provisions of subdivisions (a) and (b) of this article, or of Article 1(s), the costs of off-aqueduct power facilities shall be determined and allocated as follows:

(1) The off-aqueduct power costs shall include all annual costs the State incurs for any off-aqueduct power facility, which shall include, but not be limited to, power purchases, any annual principal and interest payments on funds borrowed by or advanced to the State, annual principal and interest on bonds issued by the State or other agency, or under revenue bond financing contracts, any requirements for coverage, deposits to reserves, and associated operation and maintenance costs of such

facility, less any credits, interest earnings, or other monies received by the State in connection with such facility. In the event the State finances all or any part of an off-aqueduct power facility directly from funds other than bonds or borrowed funds, in lieu of such annual principal and interest payments, the repayment of capital costs as to that part financed by such other funds shall be determined on the basis of the schedule that would have been required under Article 24.

(2) The annual costs of off-aqueduct power facilities as computed in (1) above shall initially be allocated among contractors in amounts which bear the same proportions to the total amount of such power costs that the total estimated electrical energy (kilowatt hours) required to pump through project transportation facilities the desired delivery amounts of annual entitlements for that year, as submitted pursuant to Article 12(a)(1) and as may be modified by the State pursuant to Article 12(a)(2), bears to the total estimated electrical energy (kilowatt hours) required to pump all such amounts for all contractors through project transportation facilities for that year, all as determined by the State.

(3) An interim adjustment in the allocation of the power costs calculated in accordance with (2) above, may be made in May of each year based on April revisions in approved schedules of deliveries of annual entitlement for such year. A further adjustment shall be made in the following year based on actual deliveries of annual entitlement; provided, however, in the event no deliveries are made through a pumping plant, the adjustments shall not be made for that year at that plant.

(4) To the extent the monies received or to be received by the State from all contractors for off-aqueduct power costs in any year are determined by the State to be less than the amount required to pay the off-aqueduct power costs in such year, the State may allocate and charge that amount of off-aqueduct power costs to the Agency and other contractors in the same manner as costs under the capital cost component of the Transportation Charge are allocated and charged. After that amount has been so allocated, charged and collected, the State shall provide a reallocation of the amounts allocated pursuant to this paragraph (4), such reallocation to be based on the allocations made pursuant to (2) and (3) above for that year, or in the event no such allocation was made for that year, on the last previous allocation made pursuant to (2) and (3) above. Any such reallocation shall include appropriate interest at the project interest rate.

9. Subdivision (e) is added to Article 25 to read:

(e) The total minimum operation, maintenance, power and replacement component due that year from each contractor shall be the sum of the allocations made under the proportionate use of facilities method provided in subdivision (b) of this article and the allocations made pursuant to subdivision (d) of this article for each contractor.

10. Subdivision (b) of Article 32 is amended to read:

(b) Interest on Overdue Payments

Upon every amount of money required to be paid by the Agency to the State pursuant to this contract which remains unpaid after it becomes due and payable, interest shall accrue at an annual rate equal to that earned by the Pooled Money Investment Fund, as provided in Government Code Sections 16480, et seq. calculated monthly on the amount of such delinquent payment from and after the due date until it is paid, and the Agency hereby agrees to pay such interest: provided, that no interest shall be charged to or be paid by the Agency unless such delinquency continues for more than thirty (30) days.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By ______________________
Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

KERN COUNTY WATER AGENCY

By ______________________
(Title) President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 18 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, is made this 29 day of February, 1984, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

WHEREAS, the Agency has requested that 15,000 acre-feet of its annual entitlement for the seventeenth (1984) and each succeeding year thereafter, for the term of this contract be reclassified from agricultural use to municipal and industrial use; and

WHEREAS, the State has determined that allowing such a permanent conversion in entitlement use will not impair the financial feasibility of the project;

NOW THEREFORE, the parties agree to the following:

1. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State is amended to read as follows:

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use (San Joaquin Valley-Southern California Aqueduct)	Total Annual Amount
1	13,313	33,287	0	46,600
2	30,303	65,397	0	95,700
3	61,000	55,400	28,700	145,100
4	35,500	119,100	35,700	190,300
5	31,800	199,700	39,200	270,700
6	37,500	229,500	43,500	310,500
7	52,600	246,400	48,000	347,000
8	57,000	301,120	52,700	410,820
9	61,800	324,250	56,100	442,150
10	66,000	357,000	60,600	483,600
11	70,800	399,400	64,100	534,300
12	75,300	441,000	67,600	583,900
13	79,400	484,000	71,100	634,500
14	83,800	532,800	74,800	691,400
15	87,700	578,000	79,600	745,300
16	90,800	630,800	83,500	805,100
17	94,500	662,500	103,600	860,600
18	97,100	709,000	108,900	915,000
19	100,100	754,700	113,400	968,200
20	102,200	802,200	119,100	1,023,500
21	103,800	846,900	123,900	1,074,600
22	104,700	879,400	128,200	1,112,300
23	105,100	913,700	134,600	1,153,400

and each succeeding year thereafter, for the term of this contract.

2. The 15,000 acre-feet entitlement reclassified by this amendment from agricultural use to municipal and industrial use will retain its agricultural priority when deficiencies are determined pursuant to Article 18.

3. The proportionate use factors in Table B will remain at their present value.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By ______________________
Acting Chief Counsel

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

KERN COUNTY WATER AGENCY

By ______________________
President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 19 TO WATER SUPPLY CONTRACT
BETWEEN THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF CALIFORNIA AND
KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 14th day of May, 1987, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the Department of Water Resources of the State of California, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the Agency takes delivery of project water from the Coastal Branch and from various reaches of the California Aqueduct downstream from its bifurcation with the Coastal Branch;

WHEREAS, pursuant to Amendment No. 7 of the water supply contract the Agency requested and the State approved under certain conditions the delivery of an additional 50,000 acre-feet from the Coastal Branch; and

WHEREAS, the State and the Agency are involved in litigation with other State Water Project water contractors relating to Article 45(e)(2) added by Amendment No. 7.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's water supply contract with the State:

1. Subdivisions e(1) and e(2) of Article 45 are deleted.

2. Subdivision (e)(3) of Article 45 is amended and renumbered to read:

(1) If peak rates of delivery through any pumping plant exceeding 11 percent for municipal and industrial deliveries or 18 percent for agricultural deliveries (or 16-1/4 percent from the Coastal Branch) cause an increase to other contractors in any charges for operating the California Aqueduct or Coastal Branch over the charges which would have been incurred had the Agency taken delivery from the Coastal Branch of the amounts of entitlement water shown on that certain schedule furnished the State on March 9, 1971, entitled "Kern County Water Agency Estimated Entitlement To Be Delivered From The Coastal Branch Of The California Aqueduct", then the Agency shall pay to the State an extra service charge equal to the State's estimate of such increased charges.

3. Subdivision e(4) of Article 45 is renumbered subdivision e(2).

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the day first above written.

APPROVED AS TO LEGAL FORM
AND SUFFICIENCY:

By ______________________
Chief Counsel

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

KERN COUNTY WATER AGENCY

By ______________________

Title President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 20 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 4th day of March, 1987, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the State and the Agency wish to provide financing for project facilities with water system revenue bonds and provide for repayment of water system revenue bonds;

WHEREAS, the State and the Agency wish to clarify the definition of the project interest rate without changing the interpretation of Article 1(r), except for the addition of item (7), and to specify that financing costs of water system facilities and East Branch Enlargement facilities shall not be included in calculating the project interest rate; and

WHEREAS, the State is willing to amortize over the remaining repayment period of the contract, the "one-shot" adjustment applied to previous payments resulting from revisions in the project interest rate under conditions defined in this amendment.

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(r) is amended to read:

(r) "Project interest rate" shall mean the weighted average interest rate on bonds, advances, or loans listed in this section to the extent the proceeds of any such bonds, advances, or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities (except off-aqueduct power facilities; water system facilities; advances for delivery structures, measuring devices and excess capacity; and East Branch Enlargement Facilities). The project interest rate shall be calculated as a decimal fraction to five places by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts. The bonds, advances, or loans used in calculating the project interest rate shall be:

(1) General obligation bonds issued by the State under the Bond Act, except that any premium received on the sale of these bonds shall not be included in the calculation of the project interest rate,

(2) Revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) Bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) Bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) Funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State,

(6) Funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Surplus Money Investment Fund of such Treasury invested in securities, and

(7) Any other financing capability available in the Treasury of the State of California at whatever interest rate and other financing costs are provided in the law authorizing such borrowing. However, the use of other financing from the State Treasury is intended to involve only short term borrowing at interest rates and other financing costs no greater than those charged to other State agencies during the same period until such time as the Department can sell bonds and reimburse the source of the short term borrowing from the proceeds of the bond sale.

2. Article 1(cc) is added to read:

(cc) "Water system revenue bonds" shall mean revenue bonds or revenue bond anticipation notes issued by the State under the Central Valley Project Act after January 1, 1987 for water system facilities identified in Article 1(hh).

3. Article 1(gg) is added to read:

(gg) "East Branch Enlargement Facilities" shall mean all of the following:

(1) The facilities remaining to be constructed as part of the East Branch Enlargement construction;

(2) The work done pursuant to the letter agreement between the State and The Metropolitan Water District of Southern California dated November 29, 1966, which consisted of constructing the California Aqueduct between Cottonwood (now known as Alamo) Powerplant and Cedar Springs (now known as Silverwood) Reservoir so that, by future additions to the canal lining, siphons, and additional pumping units at Pearblossom Pumping Plant, the capacity could be increased by a then-estimated approximately 700 cubic feet per second;

(3) That portion of the enlargement of the Pearblossom Pumping Plant Forebay and Cofferdam construction which would not have been constructed but for the proposed East Branch Enlargement and which was done pursuant to the letter agreement between the State and The Metropolitan Water District of Southern California, dated January 19, 1984;

(4) That portion of the canal lining work between Alamo Powerplant and Pearblossom Pumping Plant done pursuant to the letter agreements

between the State and The Metropolitan Water District of Southern California, dated July 2, 1984, and May 15, 1985, which increased the East Branch Aqueduct capacity beyond that set forth in Table B-2 as shown in State Bulletin 132-70;

(5) That portion of Reach 24 (Silverwood Lake) to be determined by reallocation of Reach 24 to reflect the additional use to be made of that reach as a result of the East Branch Enlargement operation; and

(6) That portion of Reach 25 (San Bernardino Tunnel) to be determined by an allocation of total delivery capacity of Reach 25 between the basic East Branch facilities and the East Branch Enlargement as a result of East Branch Enlargement operation.

4. Article 1 (hh) is added to read:

(hh) "Water System Facilities" shall mean the following facilities to the extent that they are financed with water system revenue bonds or to the extent that other financing of such facilities is reimbursed with proceeds from water system revenue bonds:

(1) The North Bay Aqueduct,

(2) The Coastal Branch Aqueduct,

(3) Delta Facilities, including Suisun Marsh facilities, to serve the purposes of water conservation in the Delta, water supply in the Delta, transfer of water across the Delta, and mitigation of the environmental effects of project facilities, and to the extent presently authorized as project purposes, recreation and fish and wildlife enhancement,

(4) Local projects as defined in Article 1(h)(2) designed to develop no more than 25,000 acre-feet of project yield from each project,

(5) Land acquisition for the Kern Fan Element of the Kern Water Bank,

(6) Additional pumps at the Banks Delta Pumping Plant,

(7) The transmission line from Midway to Wheeler Ridge Pumping Plant, and

(8) Repairs, additions, and betterments to conservation or transportation facilities existing as of January 1, 1987, and to all other facilities described in this subarticle (hh) except for item (5).

5. Article 22(j) of the Agency's water supply contract with the State is added as follows:

(j) Notwithstanding provisions of Article 22(a) through (i), the capital cost component and the minimum OMP&R component of the Delta Water Charge shall include an annual charge to recover the Agency's share of the conservation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract.

6. Article 24(g) of the Agency's water supply contract with the State is added as follows:

(g) Notwithstanding provisions of Article 24(a) through (d), the capital cost component of the Transportation charge shall include an annual charge to recover the Agency's share of the transportation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract.

6.5. Article 28(e) of the Agency's water supply contract with the State is added to read:

28(e) Notwithstanding the provisions of Article 28(b), adjustments for prior overpayments and underpayments shall be repaid beginning in the year following the redetermination by application of a unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement will return to the State, during the project repayment period, together with interest thereon computed at the project interest rate and compounded annually, the full amount of the adjustments resulting from financing after January 1, 1987, from all bonds, advances, or loans listed in Article 1(r) except for Article 1(r)(3) and except for bonds issued by the State under the Central Valley Project Act after January 1, 1987 for facilities not listed among the water system facilities in Article 1(hh). Notwithstanding the immediately preceding exception, such amortization shall also apply to any adjustments in this component charge resulting from a change in the project interest rate due to any refunding after January 1, 1986 of bonds issued under the Central Valley Project Act. However, amortization of adjustments resulting from items 1(r)(4) through (7) shall be limited to a period which would allow the Department to repay the debt service on a current basis until such time as bonds are issued to reimburse the source of such funding. In no event shall this amortization period be greater than the project repayment period.

7. Article 28(f) of the Agency's water supply contract with the State is added as follows:

f. Adjustment: Water System Revenue Bond Financing Costs. The use of water system revenue bonds for financing facilities listed in Article 1(hh) would result in adjustments for prior underpayments or overpayments of the capital cost component of the Transportation Charge to the Agency under the provisions of this article; however, in place of making such adjustments, charges to the Agency will be governed by Article 50.

8. Article 50 of the Agency's water supply contract with the State is added as follows:

50. Water System Revenue Bond Financing Costs.

(a) Charges to the Agency for water system revenue bond financing costs shall be governed by provisions of this article. Charges to all contractors for water system revenue bond financing costs shall return to the State an amount equal to the annual financing costs the State incurs in that year for water system revenue bonds (including water system revenue bond anticipation notes). Annual financing costs shall include, but not be limited to, any annual principal and interest on water system revenue bonds plus any additional requirements for bond debt service coverage, deposits to reserves, and annual premiums for insurance or other security obtained pursuant to subdivision (f) of this article. The State shall provide credits to the contractors for excess reserve funds, excess debt service coverage, interest, and other earnings of the State in connection with repayment of such revenue bond financing costs, when and as permitted by the bond resolution. When such credits are determined by the State to be available, such credits shall be promptly provided to the contractors and shall be in proportion to the payments under this article from each contractor. Reserves, bond debt service coverage, interest, and other earnings may be used in the last year to retire the bonds.

(b) Annual charges to recover water system revenue bond financing costs shall consist of two elements.

(1) The first element shall be an annual charge to the Agency for repayment of capital costs of water system facilities as determined under Articles 22 and 24 of this contract with interest at the project interest rate. For conservation facilities, the charge shall be a part of the capital cost component of the Delta Water Charge in accordance with Article 22. For transportation facilities, the charge shall be a part of the capital cost component of the Transportation Charge in accordance with Article 24.

(2) The second element shall be the Agency's share of a Water System Revenue Bond Surcharge to be paid in lieu of a project interest rate adjustment. The total annual amount to be paid by all contractors under this element shall be the difference between the total annual charges under the first element and the annual financing costs of the water system revenue bonds. The amount to be paid by each contractor shall be calculated annually as if the project interest rate were increased to the extent necessary to produce revenues from all contractors sufficient to pay such difference for that year. In making that calculation, adjustments in the Agency's Transportation capital cost component charges for prior overpayments and underpayments shall be determined as if amortized over the remaining years of the project repayment period.

(c) The Water System Revenue Bond Surcharge will be identified by component and charge in the Agency's invoice.

(d) Timing of Payments. Payments shall be made in accordance with Article 29(f) of this contract.

(e) Reduction in Charges. The Water System Revenue Bond Surcharge under Article 50(b)(2) shall cease for each series of water system revenue bonds when that series is fully repaid. However, the annual charge determined pursuant to Article 50(b)(1) shall continue to be collected for the time periods otherwise required under Articles 22 and 24.

After the Department has repaid the California Water Fund in full and after each series of Water System Revenue Bonds is repaid, the Department will reduce the charges to all contractors in an equitable manner in a total amount that equals the amount of the charges under Article 50(b)(1) that the Department determines is not needed for future financing of facilities of the System which, in whole or in part, will serve the purposes of the water supply contract with the Agency.

(f) To the extent economically feasible and justifiable, as determined by the State after consultation with contractors, the State shall maintain insurance or other forms of security protecting bondholders and non-defaulting contractors against costs resulting from the failure of any contractor to make the payments required by this article.

(g) Before issuing each series of water system revenue bonds, the State shall consult with the contractors, prepare a plan for the State's future financing of water system facilities, and give the Agency an opportunity to comment on the plan. The plan shall include but not be limited to the size of any water system revenue bond issuances and the form of any necessary resolutions or supplements.

(h) Defaults. (1) If a contractor defaults partially or entirely on its payment obligations calculated under this article and sufficient insurance or other security protecting the non-defaulting contractors is not provided under Article 50(f), the State shall allocate a portion of the default to each non-defaulting contractor. The Agency's share of the default shall be equal to an amount determined by multiplying the total default amount to be charged to all non-defaulting contractors by the ratio that the Agency's maximum Table A entitlement bears to the maximum Table A entitlements of all non-defaulting contractors. However, such amount shall not exceed in any year 25 percent of the Water System Revenue Bond financing costs that are otherwise payable by the Agency in that year. The amount of default to be charged to non-defaulting contractors shall be reduced by any receipts from insurance protecting non-defaulting contractors and bond debt service coverage from a prior year and available for such purpose.

(2) If a contractor defaults partially or entirely on its payment obligations under this article, the State shall also pursuant to Article 20, upon six months' notice to the defaulting contractor, suspend water deliveries under Article 20 to the defaulting contractor so long as the default continues. The suspension of water deliveries shall be proportional to the ratio of the default to the total water system revenue bond payments due from the defaulting contractor. However, the State may reduce, eliminate, or not commence suspension of deliveries pursuant to this subparagraph if it determines suspension in the amounts otherwise required is likely to impair the

defaulting contractor's ability to avoid further defaults or that there would be insufficient water for human consumption, sanitation, and fire protection. The State may distribute the suspended water to the non-defaulting contractors on terms it determines to be equitable.

(3) During the period of default, credits otherwise due the defaulting contractor shall be applied to payments due from the defaulting contractor.

(4) Except as otherwise provided in Article 50(h)(3), the defaulting contractor shall repay the entire amount of the default to the State with interest compounded annually at the Surplus Money Investment Fund rate before water deliveries that had been suspended shall be fully resumed to that contractor. If the defaulting contractor makes a partial repayment of its default, the Department may provide a proportional restoration of suspended deliveries. The amount of the default to be repaid shall include any amounts previously received by the State from insurance proceeds, bond debt service coverage, or other reserves, and payments from other contractors pursuant to this subparagraph (h). The defaulting contractor shall not be entitled to any make-up water deliveries as compensation for any water deliveries suspended during the period when the contractor was in default.

(5) At such time as the default amount is repaid by the defaulting contractor, the non-defaulting contractors shall receive credits in proportion to their contributions towards the amount of the default with interest collected by the State on the defaulted amount.

(6) In the event there is an increase in the amount a non-defaulting contractor contributes to reserves and/or bond debt service

coverage, such increase shall be handled in the same manner as provided in Article 50(a).

(7) Action taken pursuant to this subarticle shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

(i) Power of Termination.

(1) The Department and the Agency agree to negotiate in good faith the development of a means to provide adequate protection for the Department's cash flow into priorities one and two for revenues under Water Code Section 12937(b) with the goal of obtaining agreement by April 1, 1987. The Department and the Agency agree to continue negotiations beyond April 1, 1987 if necessary to meet their common goal of arriving at agreement.

(2) If such an agreement has not been reached by April 1, 1987, and if the Director of Water Resources determines that adequate progress has not been made toward such an agreement, the Director may give notice to the Agency and other contractors that he intends to exercise the power to terminate provided in this subarticle 50(i). The Director's authority to give such a notice shall terminate on July 1, 1988.

(3) After six months from the date of issuing the notice of intent to terminate, but in no event later than January 1, 1989, the Director may terminate the authority of the Department to issue additional series of water system revenue bonds using the repayment provisions of Article 50. The Department shall promptly notify the Agency and other contractors that the Director has exercised the power of termination.

(4) No additional series of water system revenue bonds shall be issued under the provisions of this Article 50 after the Director has exercised the power to terminate, but Article 50 shall remain in effect as to any series of water system revenue bonds issued prior to the time the Director exercises the power to terminate.

(5) An exercise of the power to terminate provided in this subarticle 50(i) shall also rescind any changes made by this amendment in the schedule of payment of overpayment or underpayment of capital costs resulting from a change in the project interest rate and shall also rescind the addition of item (7) to Article 1(r). However, if the Department has borrowed any funds under Article 1(r)(7), Article 1(r)(7) shall remain in effect as to that and only that borrowing. Upon the exercising of the power to terminate, subarticles 28(e) and (f) shall be rescinded and Article 1(r) shall read as it previously read as shown on Attachment Number 1 to this amendment.

(6) At any time before January 1, 1989, so long as the Director has not already exercised the power of termination, the Director may irrevocably waive his right to exercise the power of termination or may rescind any previously issued notice of intention to terminate.

(7) If the Director does not exercise the power of termination before January 1, 1989, this Subarticle 50(i) shall expire, and the remainder of this Article 50 shall remain in effect. Changes made by this amendment to other articles shall also remain in effect.

IN WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

By ______________________
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By ______________________
Director

Attest:

By ______________________
(Title) Secretary to the Board

AGENCY

By ______________________
(Title) President

4. Article 1(r) is amended to read:

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

032 51431

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 21 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 8th day of December, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as "State," and Kern County Water Agency, herein referred to as the "Agency."

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State;

WHEREAS, a more efficient use of entitlement water may be achieved by deferral of its use from October, November and December of one calendar year into the first three months of the next year.

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the delivery and scheduling of entitlement water to allow, under certain conditions, the carry-over of a portion of the Agency's entitlement deliveries from a respective year into the first three months of the next calendar year.

WHEREAS, the carry-over of entitlement by the Agency is not intended to adversely impact current or future project operations.

WHEREAS, the State Water Project contractors and the Department are aware that the carry-over of entitlement water from one year into the next may increase or decrease the costs to other SWP contractors in either year. The tracking of those costs may be too complex and expensive and does not warrant special accounting procedures to be established; however, any significant identifiable cost shall be charged to those contractors causing such cost, as determined by the Department;

WHEREAS, the carry-over of entitlement water is not to affect the payment provisions of the contract.

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's Water Supply Contract with the State:

1. Article 1(ii) is added to read:

"Carry-over Entitlement Water" shall mean water from a contractor's annual entitlement for a respective year which is made available for delivery by the State in the next year pursuant to Article 12(e).

2. Article 12(e) is added to read:

(e) Delivery of Carry-over Entitlement Water

Upon request of the Agency, the State shall make Carry-over Entitlement Water available for delivery to the Agency during the first three months of the next year, to the extent that such deliveries do not adversely affect current or future project operations, as determined by the State. The State's determination shall include, but not be limited to the operational constraints of project facilities, filling of project conservation storage, flood control releases and water quality restrictions.

Carry-over of entitlement water shall be limited to entitlement water that was included in the Agency's approved delivery schedule for October, November and December, but was not delivered due to:

(1) scheduled or unscheduled outages of facilities within the Agency's service area; or

(2) a delay in the planned application of a contractor's annual entitlement water for pre-irrigation; or

(3) a delay in the planned spreading of the Agency's annual entitlement water for ground water storage.

After determining that the carry-over of entitlement water would not adversely affect project operations, the State shall notify the Agency of the amount of entitlement water to be carried over to the following January through March period. The notification shall include the proposed terms and conditions consistent with this Article 12(e) that would govern the delivery of the Carry-over Entitlement Water.

The Agency agrees to pay all significant identifiable costs associated with its Carry-over Entitlement Water, as determined by the State.

All scheduling and delivery of Carry-over Entitlement Water shall be carried out pursuant to the provisions of this contract.

The Agency agrees to forego the delivery of any Carry-over Entitlement Water that is lost because of project operations or is not delivered by March 31 of the next year.

Any Carry-over Entitlement Water foregone by the Agency will become a part of the current year's total project supply.

WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form and sufficiency:	STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES
Susan N. Weber Chief Counsel Department of Water Resources	Director
Attest:	KERN COUNTY WATER AGENCY
Pam Bosworth Name	Adrienne Jo Mathews Name
Executive Secretary Title	President Title
October 26, 1995 Date	October 26, 1995 Date

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

632.51431

AMENDMENT NO. 22 TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 11th day of APRIL, 1991, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State;

WHEREAS, the State and the Agency included in such contract an article which entitles the Agency to obtain from the State deliveries of surplus water when available;

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the deliveries of surplus water; and

WHEREAS, beginning January 1, 1991 the Agency desires to be charged for the power used for pumping surplus water at the Melded Power Rate as provided herein for the remainder of the project repayment period.

WHEREAS, the parties to this Amendment, and those approving the Amendment, intend no impact upon their positions with respect to the interpretation of any existing contractual provisions.

AGREEMENT:

It is agreed that the following changes are hereby made to the Agency's water supply contract as follows:

1. Purpose and Scope. This Amendment is only intended to define the procedure for determining the charges for power used to pump surplus and unscheduled water. The scope of the Amendment is strictly confined to that purpose.

2. Article 21(d) of the Agency's water supply contract with the State is amended to read:

(d) Schedules. On or before October 1 of each year, concurrently with the schedule submitted pursuant to the provisions of Article 12, the Agency shall submit in writing to the State a preliminary water delivery schedule, indicating the desired amounts of surplus water for each month of the subsequent six-year period beginning January 1, of the next succeeding year. The last five years of this preliminary surplus water delivery schedule shall be used by the State for planning and operations studies.

3. Article 21(f) of the Agency's water supply contract with the State is amended to read:

(f) <u>Power Costs</u>.

(1) Beginning January 1, 1991, the Agency shall pay power charges for pumping surplus water as follows:

(A) If during a calendar month it is either not necessary to purchase power for pumping surplus water, or it is necessary to purchase power for pumping surplus water and the purchased power rate is less than or equal to the Melded Power Rate (defined as the average unit charge for pumping entitlement water during the calendar year for all power resources, including on-aqueduct power resources, off-aqueduct power resources, and any other power resources), then the monthly charges to the Agency for the Net Power (gross power used to pump the surplus water less power generated by the surplus water) used to pump surplus water to the Agency shall be determined using the Melded Power Rate.

(B) If during a calendar month it is necessary to purchase power for pumping surplus water and the purchased power rate is greater than the Melded Power Rate, the monthly charges to the Agency for the Net Power used to pump surplus water for delivery to the Agency shall be determined using a composite rate equal to the sum of:

(i) The monthly average purchased power rate per unit of power so purchased times the power purchased for pumping surplus water and that result divided by the Net Power; plus,

(ii) The Melded Power Rate per unit of power times a quantity which equals the Net Power used for pumping surplus water minus the power purchased for pumping surplus water and that result divided by the Net Power.

(C) In all cases, the power charges shall include the cost of any additional transmission service required for the delivery of surplus water to the Agency.

(2) By receiving surplus or unscheduled water under this Article 21(f), the Agency accepts the responsibility to indemnify, defend, and hold harmless the State, its officers, employees and agents from all liability, expenses, defense costs, attorney fees, claims, actions, liens, and lawsuits of whatever kind, arising out of or related to this article.

(3) Effective January 1, 1991, power charges for delivery of unscheduled water to the Agency shall be calculated in the same manner as provided in this Article 21(f).

4. This Amendment shall take effect on January 1, 1991, only if, by January 31, 1991 an Amendment substantially the same as this one is executed by contractors that together have maximum annual entitlements totaling at least 3,796,007 acre-feet. By February 15, 1991, the State will inform the Agency of whether sufficient contractors had executed the Amendment to cause the Amendment to take effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Acting Chief Counsel
Department of Water Resources

ATTEST:

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

SIGNATURE

Thomas N. Clark
NAME

General Manager
TITLE

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 23 (THE MONTEREY AMENDMENT)
TO WATER SUPPLY CONTRACT BETWEEN THE
STATE OF CALIFORNIA DEPARTMENT OF
WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 13th day of December, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, on December 1, 1994, representatives of the contractors and the State executed a document entitled "Monterey Agreement - Statement of Principles - By the State Water Contractors and the State of California Department of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement"); and

WHEREAS, the contractors and the State have negotiated an amendment to the water supply contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, the State and the Agency desire to implement such provisions by incorporating this Monterey Amendment into the water supply contract;

NOW, THEREFORE, IT IS MUTUALLY AGREED that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. **Article 1(d) is amended to read:**

(d) **Contractor**

"Contractor" shall mean any entity that has executed, or is an assignee of, a contract of the type published in Department of Water Resources Bulletin No. 141 dated November 1965, with the State for a dependable supply of water made available by the System, except such water as is made available by the facilities specified in Section 12934(d)(6) of the Water Code.

2. **Article 1(k) is amended to read:**

(k) **Minimum Project Yield**

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,185,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year 1990, and the characteristic distributions of demands for these two uses throughout the year.

(2) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

3. **Article 1(hh) is amended to read:**

(hh) **Water System Facilities**

(hh) "Water System Facilities" shall mean the following facilities to the extent that they are financed with water system revenue bonds or to the extent that other financing of such facilities is reimbursed with proceeds from water system revenue bonds:

(1) The North Bay Aqueduct,

(2) The Coastal Branch Aqueduct,

(3) Delta Facilities, including Suisun Marsh facilities, to serve the purposes of water conservation in the Delta, water supply in the Delta, transfer of water across the Delta, and mitigation of the environmental effects of project facilities, and to the extent presently authorized as project purposes, recreation and fish and wildlife enhancement,

(4) Local projects as defined in Article 1(h)(2) designed to develop no more than 25,000 acre-feet of project yield from each project,

(5) Land acquisition prior to December 31, 1995, for the Kern Fan Element of the Kern Water Bank,

(6) Additional pumps at the Banks Delta Pumping Plant,

(7) The transmission line from Midway to Wheeler Ridge Pumping Plant,

(8) Repairs, additions, and betterments to conservation or transportation facilities existing as of January 1, 1987, and to all other facilities described in this subarticle (hh) except for item (5),

(9) A project facilities corporation yard, and

(10) A project facilities operation center.

4. Article 1(jj) is added to read:

(jj) **Interruptible water**

"Interruptible water" shall mean project water available as determined by the State that is not needed for fulfilling contractors' annual entitlement deliveries as set forth in their water delivery schedules furnished pursuant to Article 12 or for meeting project operational requirements, including storage goals for the current or following years.

5. Article 1(kk) is added to read:

(kk) **Nonproject water**

"Nonproject water" shall mean water made available for delivery to contractors that is not project water as defined in Article 1(j).

6. Article 1(11) is added to read:

(11) "Monterey Amendments" shall mean this amendment and substantially similar amendments to other contractors' water supply contracts that include, among other provisions, the addition of Articles 51 through 56.

7. Article 4 is amended to read:

4. OPTION FOR CONTINUED SERVICE

By written notice to the State at least six (6) months prior to the expiration of the term of this contract, the Agency may elect to receive continued service after expiration of said term under the following conditions unless otherwise agreed to:

(1) Service of water in annual amounts up to and including the Agency's maximum annual entitlement hereunder.

(2) Service of water at no greater cost to the Agency than would have been the case had this contract continued in effect.

(3) Service of water under the same physical conditions of service, including time, place, amount and rate of delivery, as are provided for hereunder.

(4) Retention of the same chemical quality objective provision as is set forth herein.

(5) Retention of the same options to utilize the project transportation facilities as are provided for in Articles 18 (c) and 55, to the extent such options are then applicable.

Other terms and conditions of the continued service shall be reasonable and equitable and shall be mutually agreed upon. In the event that said terms and conditions provide for continued service for a limited number of years only, the Agency shall have the same option to receive continued service here provided for upon the expiration of that and each succeeding period of continued service.

8. **Article 7(a) is amended to read:**

(a) **Changes in Annual Entitlements**

The Agency may, at any time or times during the term of this contract, by timely written notice furnished to the State, request that project water be made available to it thereafter in annual amounts greater or less than the annual entitlements designated in Table A of this contract. Subject to approval by the State of any such request, the State's construction schedule shall be adjusted to the extent necessary to satisfy the request, and the requested increases or decreases in said annual entitlements shall be incorporated in said Table A by amendment thereof. Requests for changes in annual entitlements for more than one year shall be approved by the State: *Provided*, That no change shall be approved if in the judgment of the State it would impair the financial feasibility of project facilities.

9. **The title of Article 12 is amended to read "Priorities, Amounts, Times and Rates of Deliveries".**

10. Article 12(a)(2) is amended to read:

(2) Upon receipt of a preliminary schedule the State shall review it and, after consultation with the Agency, shall make such modifications in it as are necessary to insure the delivery of the annual quantity allocated to the Agency in accordance with Article 18 and to insure that the amounts, times, and rates of delivery to the Agency will be consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors. On or before December 1 of each year, the State shall determine and furnish to the Agency the water delivery schedule for the next succeeding year which shall show the amounts of water to be delivered to the Agency during each month of that year.

11. Article 12(d) is deleted.

12. Article 12(f) is added to read:

(f) **Priorities**

Each year water deliveries to the contractors shall be in accordance with the following priorities to the extent there are conflicts:

First, project water to meet scheduled deliveries of contractors' annual entitlements for that year.

Second, interruptible water to the extent contractors' annual entitlements for that year are not met by the first priority.

Third, project water to fulfill delivery requirements pursuant to Article 14(b).

Fourth, project water previously stored pursuant to Articles 12(e) and 56.

Fifth, nonproject water to fulfill contractors' annual entitlements for that year not met by the first two priorities.

Sixth, additional interruptible water delivered to contractors in excess of their annual entitlements for that year.

Seventh, additional nonproject water delivered to contractors in excess of their annual entitlements for that year.

13. Article 14 is amended to read:

Curtailment of Delivery

(a) **State May Curtail Deliveries**

The State may temporarily discontinue or reduce the delivery of project water to the Agency hereunder for the purposes of necessary investigation, inspection, maintenance, repair, or replacement of any of the project facilities necessary for the delivery of project water to the Agency, as well as due to outages in, or reductions in capability of, such facilities beyond the State's control or unuseability of project water due to an emergency affecting project facilities. The State shall notify the Agency as far in advance as possible of any such discontinuance or reduction, except in cases of emergency, in which case notice need not be given.

(b) **Agency May Receive Later Delivery of Water Not Delivered**

In the event of any discontinuance or reduction of delivery of project water pursuant to subdivision (a) of this article, the Agency may elect to receive the amount of annual entitlement which otherwise would have been delivered to it during such period under the water delivery schedule for that year at other times during the year or the succeeding year to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of annual entitlement to all contractors.

14. Article 16(a) is amended to read:

(a) **Limit on Total of all Maximum Annual Entitlements**

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,185,000 acre-feet of project water.

15. Article 18 is amended to read:

18. SHORTAGE IN WATER SUPPLY

(a) **Shortages; Delivery Priorities**

In any year in which there may occur a shortage due to drought or any other cause <u>whatsoever</u>, in the supply of project water available for delivery to the contractors, with the result that such supply is less than the total of the annual entitlements of all contractors for that year, the State shall allocate the available supply in proportion to each contractor's annual entitlement as set forth in its Table A for that year and shall reduce the allocation of project water to each contractor using such water for agricultural purposes and to each contractor using such water for other purposes by the same percentage of their respective annual entitlements for that year: *Provided,* that the State may allocate on some other basis if such is required to meet minimum demands of contractors for domestic supply, fire protection, or sanitation during the year. If a contractor is allocated more water than it requested, the excess water shall be reallocated among the other contractors in proportion to their annual entitlements as provided for above. The foregoing provisions of this subdivision shall be inoperative to the extent necessary to comply with subdivision (c) of this article and to the extent that a contractor's annual entitlement for the respective year reflects established rights under the area of origin statutes precluding a reduction in deliveries to such contractor.

(b) - Deleted

(c) **Permanent Shortage; Contracts for Areas-of-Origin**

In the event that the State, because of the establishment by a party of a prior right to water under the provisions of Sections 11460 through 11463 of the Water Code, enters into a contract with such party for a dependable supply of project water, which contract will cause a permanent shortage in the supply of project water to be made available to the Agency hereunder:

(1) The State shall: (i) equitably redistribute the costs of all transportation facilities included in the System among all contractors for project water, taking into account the diminution of the supply to the Agency and other prior contractors in accordance with the terms of their contracts, and (ii) revise the Agency's annual entitlements and maximum annual entitlement, by amendment of Table A of this contract to correspond to the reduced supply of project water to be made available to the Agency: *Provided*, That such redistribution of costs of transportation facilities shall not be made until there has been reasonable

opportunity for the Agency to exercise the option provided for in (2) below, and for other prior contractors to exercise similar options.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such permanent shortage in the supply of project water to be made available to the Agency are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That, except to the extent such limitation in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof. This option shall terminate upon a redistribution of costs of transportation facilities by the State pursuant to (1) above. In the event that this option is exercised, the State shall take such fact into account in making such redistribution of costs, and shall offset such use as is made of the project transportation facilities pursuant thereto against any reduction in the Agency's payment obligation hereunder resulting from such redistribution of costs.

(d) **Reinstatement of Entitlements**

If after any revision of annual entitlements and maximum annual entitlements pursuant to subdivision (c) of this article, circumstances arise which, in the judgment of the State, justify a revision upward of the same, the State shall, with the consent of the affected contractor, reinstate proportionately the previously reduced entitlements of such contractor to the extent deemed justified, and shall equitably redistribute the costs of the project transportation facilities if inequities would otherwise occur as a result of such reinstatement of entitlements.

(e) **Advance Notice of Delivery Reductions**

The State shall give the Agency written notice as far in advance as possible of any reduction in deliveries to it which is to be made under subdivision (a) of this article and, to the extent possible, shall give the Agency written notice five (5) years in advance of any reduction in its annual entitlements and maximum annual entitlement under subdivision (c) of this article. Reports submitted to the Agency pursuant to Article 16(c) may constitute such notices.

(f) **No Liability for Shortages**

Neither the State nor any of its officers, agents, or employees shall be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available for delivery to the Agency under this contract caused by drought, operation of area of origin statutes, or any other cause beyond its control.

16. Old Article 21 "Sale of Surplus Water" is deleted and replaced by new Article 21 "Interruptible Water Service" to read:

21. Interruptible Water Service

(a) **Allocation of Interruptible Water**

Each year from water sources available to the project, the State shall make available and allocate interruptible water to contractors in accordance with the procedure in Article 18(a). Allocations of interruptible water in any one year may not be carried over for delivery in a subsequent year, nor shall the delivery of interruptible water in any year impact a contractor's approved deliveries of annual entitlement or the contractor's allocation of water for the next year. Deliveries of interruptible water in excess of a contractor's annual entitlement may be made if the deliveries do not adversely affect the State's delivery of annual entitlement to other contractors or adversely affect project operations. Any amounts of water owed to the Agency as of the date of this amendment pursuant to former Article 12(d), any contract provisions or letter agreements relating to wet weather water, and any Article 14(b) balances accumulated prior to 1995, are canceled. The State shall hereafter use its best efforts, in a manner that causes no adverse impacts upon other contractors or the project, to avoid adverse economic impacts due to a contractor's inability to take water during wet weather.

(b) **Rates**

For any interruptible water delivered pursuant to this article, contractors shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water as if such interruptible water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State. The State shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if interruptible water were not scheduled for or delivered to the contractor. Only those contractors not participating in the repayment of the capital costs of a reach shall be required to pay any use of facilities charge for the delivery of interruptible water through that reach.

(c) **Contracts**

To obtain a supply of interruptible water, a contractor shall execute a further contract with the State which shall be in conformity with this article and shall include at least provisions concerning the scheduling of deliveries of interruptible water and times and methods of payment.

17. Article 22(j) is amended to read:

(j) Notwithstanding provisions of Article 22(a) through (i), the capital cost component and the minimum OMP&R component of the Delta Water Charge shall include an annual charge to recover the Agency's share of the conservation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract. Charges for the conservation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

18. The first paragraph of Article 24(b) is amended to read:

(b) In the first step, the total amount of capital costs of each aqueduct reach to be returned to the State shall be allocated among all contractors entitled to delivery of project water from or through the reach by the proportionate use of facilities method of cost allocation and in accordance with (1) and (2) below. The measure of the proportionate use of each contractor of each reach shall be the average of the following two ratios: (i) the ratio of the contractor's maximum annual entitlement to be delivered from or through the reach to the total of the maximum annual entitlements of all contractors to be delivered from or through the reach from the year in which charges are to be paid through the end of the project repayment period and (ii) the ratio of the capacity provided in the reach for the transport and delivery of project water to the contractor to the total capacity provided in the reach for the transport and delivery of project water to all contractors served from or through the reach from the year in which charges are to be paid through the end of the project repayment period. Allocations of capital costs to the Agency pursuant hereto shall be on the basis of relevant values which will be set forth in Table B of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach of the project transportation facilities for the transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That these values shall be subject to redetermination by the State in accordance with Article 28: *Provided further*, That the principles and procedures set forth in this subdivision shall be controlling as to allocations of capital costs to the Agency. Proportionate use of facilities factors for prior years shall not be adjusted by the State in response to changes or transfers of entitlement among contractors unless otherwise agreed by the State and the parties to the transfer and unless there is no impact on past charges or credits of other contractors.

19. Article 24(g) is amended to read:

(g) Notwithstanding provisions of Article 24(a) through (d), the capital cost component of the Transportation Charge shall include an annual charge to recover the Agency's share of the transportation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with the provisions of Article 50 of this contract. Charges for the transportation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

20. Article 25(d)(3) is amended to read:

(3) An interim adjustment in the allocation of the power costs calculated in accordance with (2) above, may be made in May of each year based on April revisions in approved schedules of deliveries of project and nonproject water for contractors for such year. A further adjustment shall be made in the following year based on actual deliveries of project and nonproject water for contractors provided, however, in the event no deliveries are made through a pumping plant, the adjustments shall not be made for that year at that plant.

21. Article 50(j) is added to read:

(j) Amounts payable under this article shall not be affected by any reductions in payments pursuant to Article 51.

22. Article 51 is added to read:

51. FINANCIAL ADJUSTMENTS

(a) **General Operating Account**

(1) The State shall maintain a General Operating Account to provide the moneys needed to pay obligations incurred by the State of the types described in Water Code sections 12937(b)(1) and (2) in the event of emergency or cash flow shortages.

(2) An initial deposit of $15 million shall be made available from revenue bond reserves that are no longer required by revenue bond covenants and that would otherwise be credited to the contractors including the Agency. In 1998 or when the funds become available an additional $7.7 million will be deposited in the General Operating Account from revenue bond reserves that are no longer required by revenue bond covenants and that would otherwise be credited to the contractors including the Agency, bringing the deposits to that account under this article to $22.7 million.

(3) The balance in the General Operating Account will increase pursuant to subdivision (e)(3)(v) of this article to an amount determined by the State but not in excess of $32 million. However, after the year 2001, the maximum amount of the fund may increase or decrease annually by not more than the same percentage as the increase or decrease in the charges, other than power charges for pumping water, to all the contractors for the previous year from

the charges for the year before that for obligations under subdivisions (c)(2)(ii) and (iii) of this article.

(b) **State Water Facilities Capital Account**

(1) The State shall establish a State Water Facilities Capital Account to be funded from revenues available under Water Code section 12937(b)(4). Through procedures described in this article and as limited by this article, the State may consider as a revenue need under subdivision (c)(2)(v) of this article and may deposit in the State Water Facilities Capital Account the amounts necessary to pay capital costs of the State Water Facilities for which neither general obligation bond nor revenue bond proceeds are available, including but not limited to planning, reconnaissance and feasibility studies, the San Joaquin Valley Drainage Program and, through the year 2000, the CALFED Bay-Delta Program.

(2) The Director of the Department of Water Resources shall fully consult with the contractors and consider any advice given prior to depositing funds into this account for any purposes. Deposits into this account shall not exceed the amounts specified in subdivision (c)(2)(v) of this article plus any amounts determined pursuant to subdivision (e)(1)(iii) of this article.

(3) The State shall use revenue bonds or other sources of moneys rather than this account to finance the costs of construction of any major capital projects.

(c) **Calculation of Financial Needs**

(1) Each year the State shall calculate in accordance with the timing provisions of Articles 29 and 31 the amounts that would have been charged (but for this article) to each contractor as provided in other provisions of this contract.

(2) Each year the State shall also establish its revenue needs for the following year for the following purposes, subject to the following limitations:

(i) The amount required to be collected under the provisions of this contract, other than this article, with respect to all revenue bonds issued by the State for Project Facilities.

(ii) The amount required for payment of the reasonable costs of the annual maintenance and operation of the State Water Resources Development System and the replacement of any parts thereof as described in Water Code section 12937(b)(1). These costs shall not include operation and maintenance costs of any Federal Central Valley Project facilities constructed by the United States and acquired by the State of California after 1994, other than the State's share of the joint use facilities which include San Luis Reservoir, the San Luis Canal and related facilities.

(iii) The amount required for payment of the principal of and interest on the bonds issued pursuant to the Burns-Porter Act as described in Water Code section 12937(b)(2).

(iv) Any amount required for transfer to the California Water Fund in reimbursement as described in Water Code section 12937(b)(3) for funds utilized from said fund for construction of the State Water Resources Development System.

(v) For the years 1998 and thereafter, the amount needed for deposits into the State Water Facilities Capital Account as provided in subdivision (b) of this article, but (A) not more than $6 million per year for the years 1998, 1999 and 2000, and (B) not more than $4.5 million per year for the years 2001 and thereafter.

(3) Subject to the provisions of subdivision (e) of this article, the State shall reduce the annual charges in the aggregate for all contractors by the amounts by which the hypothetical charges calculated pursuant to subdivision (c)(1) above exceed the revenue needs determined pursuant to subdivision (c)(2) above. The reductions under this article shall be apportioned among the contractors as provided in subdivisions (d), (e), (f) and (g) of this article. Reductions to contractors shall be used to reduce the payments due from the contractors on each January 1 and July 1; *Provided*, however, that to the extent required pursuant to subdivision (h) of this article, each Agricultural Contractor shall pay to the Agricultural Rate Management Trust Fund an amount equal to the reduction allocated to such Agricultural Contractor. Any default in payment to the trust fund shall be subject to the same remedies as any default in payment to the State under this contract.

(4) The State may submit a supplemental billing to the Agency for the year in an amount not to exceed the amount of the prior reductions for such year under this article if necessary to meet unanticipated costs for purposes identified in Water Code section 12937(b)(1) and (2) for which the State can issue billings under other provisions of this contract. Any supplemental billing made to the Agency for these purposes shall be in the same proportion to the total supplemental billings to all contractors for these purposes as the prior reduction in charges to the Agency in that year bears to the total reductions in charges to all contractors in that year and shall be treated as reducing the amount of the reduction made available for that year to the Agency by the amount of the supplemental bill to the Agency.

(5) The State may also submit a supplemental billing to the Agency for the year if necessary to meet unanticipated costs for revenue bond debt service and coverage for which the State can issue a statement of charges under provisions of this contract other than this article. The relative amounts of any supplemental billing made to the Agency and to other contractors for revenue bond purposes shall be governed by such other applicable provisions of this contract.

(6) Payment of any supplemental billing shall be due thirty days after the date of the invoice. Delinquency and interest on delinquent amounts due shall be governed by Article 32.

(d) **Apportionment of Reductions between Agricultural and Urban Contractors**

(1) Reductions available under this article are projected to begin to occur in 1997. The numbers and percentages in this subdivision reflect certain estimates of dollars and sharing of reductions. The actual reductions may vary slightly from the amounts described below. The State shall determine the availability of reductions for each year in accordance with this article.

(2) Reductions shall be phased in as follows:

(i) In 1997 reductions in the amount of $14 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(ii) In 1998 reductions in the amount of $17 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the

Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iii) In 1999 reductions in the amount of $32 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iv) In 2000 reductions in the amount of $33 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(3)(i) In the event that the aggregate amount of reductions in any of the years 1997 through 2000 is less than the respective amount projected for such year in subdivision (d)(2) above, the shortfall shall be taken first from reductions that would have been provided to Urban Contractors. Only after all reductions to Urban Contractors have been eliminated in a given year shall the remaining shortfall be taken from reductions scheduled for Agricultural Contractors. Any projected reductions not made available due to such shortfalls in the years 1997 through 2000 shall be deferred with interest at the project interest rate to the earliest subsequent years when reductions in excess of those projected for those years are available. Such deferred reductions with interest at the project interest rate shall be applied to the charges of the contractors whose reductions have been deferred.

(ii) In the event that the aggregate amount of reductions available in any of the years 1997 through 2000 is greater than the sum of (A) the respective amount projected for such year in subdivision (d)(2) above, plus (B) the amount of any shortfall with accrued interest at the project interest rate, remaining from any prior year to be applied, the excess shall be applied for the purposes and in the amounts per year described in subdivisions (e)(3)(iii), (iv), (v) and (vi) of this article, in that order.

(4) In 2001 and in each succeeding year reductions equal to or in excess of $40.5 million are projected to be available and shall be applied as follows:

(i) If reductions are available in an amount that equals or exceeds $40.5 million, $10 million of reductions shall be apportioned among the Agricultural Contractors, and $30.5 million of reductions shall be apportioned among the Urban Contractors. If reductions are available in an amount greater than $40.5 million, the excess shall be applied as provided in subdivision (e)(3) of this article, subject however to subdivision (e)(1).

(ii) If reductions are available in an amount less than $40.5 million in any of these years, the reductions shall be divided on a 24.7% - 75.3% basis between the Agricultural Contractors and the Urban Contractors respectively. Any such reductions not made due to shortages shall be applied without interest in the next year in which reductions in an amount in excess of $40.5 million are available pursuant to subdivision (e)(3) of this article with any remainder that is not available carried over without interest to be applied in the earliest subsequent years when reductions in excess of $40.5 million are available.

(5) Annual charges to a contractor shall only be reduced prospectively from and after the date it executes the Monterey Amendment to this contract. Apportionments of reductions shall be calculated on the assumption that all contractors have executed such amendment.

(e) **Review of Financial Requirements**

(1) In 2001 and every fifth year thereafter the Director of the Department of Water Resources, in full consultation with the contractors, will review the financial requirements of the State Water Resources Development System and determine the following:

(i) The amount of revenues that are needed for State Water Resources Development System purposes in addition to those needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii), and (iv) of this article;

(ii) If the aggregate amount that would have been charged to all contractors in any year but for this article exceeds the sum of (A) the amount of revenues needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii) and (iv), plus (B) $40.5 million, plus (C) the amount determined pursuant to subdivision (c)(2)(v) of this article, the amount of such excess.

(iii) The amount of the excess determined in subdivision (e)(1)(ii) above that should be collected by the State for additional State Water Resources Development System purposes and the amount of such excess that should be used for further annual charge reductions.

(2) After making the determinations required above, the State may collect the revenues for additional State Water Resources

Development System purposes in the amount determined pursuant to subdivision (e)(1)(iii) above.

(3) If and to the extent that as a result of such determinations, the aggregate amount to be charged to contractors is to be reduced by more than $40.5 million per year, the following priorities and limitations shall apply with respect to the application of such additional reductions:

(i) First, reductions shall be allocated to make up shortfalls in reductions from those projected for the years 1997 through 2000 with interest at the project interest rate pursuant to subdivision (d)(3)(i).

(ii) Second, reductions shall be allocated to make up shortfalls in reductions from those projected for the years beginning with 2001 without interest pursuant to subdivision (d)(4)(ii).

(iii) Third, additional reductions in the amount of $2 million per year shall be apportioned among the Urban Contractors until a total of $19.3 million in such additional reductions have been so applied.

(iv) Fourth, reductions up to an additional $2 million per year shall be allocated to make up any shortfalls in the annual reductions provided for in subdivision (e)(3)(iii).

(v) Fifth, $2 million per year shall be charged and collected by the State and deposited in the General Operating Account to bring the account ultimately up to an amount determined by the State but not in excess of $32 million with adjustments as provided in subdivision (a) of this article. Any amount in the account in excess of this requirement shall be returned to general project revenues.

(vi) Sixth, remaining amounts if any shall be used for reductions divided on a 24.7% - 75.3% basis between the Agricultural Contractors and the Urban Contractors respectively.

(f) **Apportionment of Reductions among Urban Contractors.** Reductions in annual charges apportioned to Urban Contractors under subdivisions (d) and (e) of this article shall be further allocated among Urban Contractors pursuant to this subdivision. The amount of reduction of annual charges for each Urban Contractor shall be based on each Urban Contractor's proportionate share of total allocated capital costs as calculated below, for both project conservation and project transportation facilities, repaid by all Urban Contractors over the project repayment period.

(1) The conservation capital cost component of the reduction allocation shall be apportioned on the basis of maximum annual entitlement. Each Urban Contractor's proportionate share shall be the same as the percentage of that contractor's maximum annual entitlement to the total of all Urban Contractors' maximum annual entitlements.

(2) The transportation capital cost component of the reduction allocation shall be apportioned on the basis of transportation capital cost component repayment obligations, including interest over the project repayment period. Each Urban Contractor's proportionate share shall be the same as the percentage that the contractor's total transportation capital cost component repayment obligation is of the total of all Urban Contractors' transportation capital cost component repayment obligations.

(i) Recalculations shall be made annually through the year 1999. Beginning in the year 2000 recalculations shall be made every five years unless an Urban Contractor requests a recalculation for an interim year and does so by a request in writing delivered to the Department by January 1 of the year in which the recalculation is to take place.

(ii) The transportation capital cost component repayment obligations, for purposes of this Article 51(f), shall be based in the year of recalculation on the then most recent Department of Water Resources Bulletin 132, Table B-15, "Capital Cost Component of Transportation Charge for Each Contractor," or its equivalent, excluding any costs or entitlement associated with transfers of entitlement from Agricultural Contractors pursuant to Article 53.

(3) To reflect the relative proportion of the conservation capital cost component and the transportation capital cost component to the total of all capital cost repayment obligations, the two cost components shall be weighted as follows:

(i) The conservation capital cost component shall be weighted with a thirty percent (30%) factor. The weighting shall be accomplished by multiplying each Urban Contractor's percentage of maximum annual entitlements as calculated in subdivision (f)(1) of this article by thirty percent (30%).

(ii) The transportation capital cost component shall be weighted with a seventy percent (70%) factor. The weighting shall be accomplished by multiplying each Urban Contractor's percentage of transportation capital cost component repayment obligations as calculated in subdivision (f)(2) of this article by seventy percent (70%).

(iii) A total, weighted capital cost percentage shall be calculated for each Urban Contractor by adding the weighted conservation capital cost component percentage to their weighted transportation capital cost component percentage.

(4) The total amount of the annual charges to be reduced to Urban Contractors in each year shall be allocated among them by multiplying the total amount of annual charges to be reduced to the Urban Contractors by the total, weighted capital cost percentages for each such contractor. If the amount of the reduction to an Urban Contractor is in excess of that contractor's payment obligation to the Department for that year, such excess shall be reallocated among the other Urban Contractors.

(5) In the case of a permanent transfer of urban entitlement, the proportionate share of annual charge reductions associated with that entitlement shall be transferred with the entitlement to the buying contractor. In the case of an entitlement transfer by either Santa Barbara County Flood Control and Water Conservation District or San Luis Obispo County Flood Control and Water Conservation District, the reductions in annual charges to that agency shall be allocated (a) on the basis of that entitlement being retained by that agency which bears Coastal Branch Phase II transportation costs, (b) on the basis of that entitlement being retained by that agency which does not bear Coastal Branch Phase II transportation costs, and (c) on the basis of the balance of that agency's entitlement which also does not bear Coastal Branch Phase II transportation costs.

(g) **Apportionment of Reductions Among Agricultural Contractors**

(1) Reductions in annual charges apportioned to Agricultural Contractors under subdivisions (d) and (e) of this article shall be allocated among the Agricultural Contractors pursuant to this subdivision. The amount of reduction of annual charges for each Agricultural Contractor for the years 1997 through 2001 shall be based on each Agricultural Contractor's estimated proportionate share of the total project costs, excluding the variable operation, maintenance, power and replacement components of the Delta Water Charge and the Transportation Charge and also excluding off-aqueduct power charges, to be paid by all Agricultural Contractors for the years 1997 through 2035, calculated without taking into account this article. For purposes of these calculations, Kern County Water Agency's and Dudley Ridge Water District's estimated project costs shall not include any costs associated with the 45,000 acre-feet of annual entitlement being relinquished by those contractors pursuant to subdivision (i) of Article 53. Also, for purposes of these calculations, an Agricultural Contractor's estimated project costs shall not be reduced by the transfer of any of the 130,000 acre-feet of annual entitlements provided for in subdivisions (a) through (i) of Article 53. The proportionate shares for 1997 through 2001 shall be calculated as follows:

(i) Each Agricultural Contractor's statement of charges received on July 1, 1994, shall be the initial basis for calculating the proportionate shares for the five years 1997 through 2001.

(ii) Each Agricultural Contractor's estimated capital and minimum components of the Delta Water Charge and the

Transportation Charge (excluding off-aqueduct power charges) and Water Revenue Bond Surcharge shall be totaled for the years 1997 through 2035.

(iii) Kern County Water Agency and Dudley Ridge Water District totaled costs shall be reduced for the 45,000 acre-feet of annual entitlement being relinquished by them.

(iv) Any reductions in an Agricultural Contractor's totaled costs resulting from the transfer of any of the 130,000 acre-feet of annual entitlement shall be re-added to that contractor's costs.

(v) Each Agricultural Contractor's proportionate share shall be computed by dividing that contractor's total costs by the total costs for all Agricultural Contractors determined pursuant to subparagraphs (ii), (iii) and (iv) above.

(2) The reductions in annual charges, for 1997 through 2001, shall be calculated using the method described in subdivision (g)(1) of this article.

(3) The allocation shall be recalculated using the same method described in subdivision (g)(1) of this article every five years beginning in 2002, if any Agricultural Contractor requests such a recalculation. Any recalculation shall be based on project cost data beginning with the year that the recalculation is to become effective through 2035.

(h) **Agricultural Rate Management Trust Fund**

(1) **Establishment.** Through a trust agreement executed contemporaneously with this amendment, the State and the Agricultural Contractors that sign the Monterey Amendments shall

establish the Agricultural Rate Management Trust Fund with a mutually agreed independent trustee.

(2) **Separate Accounts.** The trustee shall maintain within the trust fund a separate account for each Agricultural Contractor that signs the trust agreement to hold deposits made pursuant to this article.

(3) **Deposits.** Each Agricultural Contractor that signs the trust agreement shall deposit into such contractor's account within the trust fund, at the same time as payments would otherwise be required by this contract to be made to the State, an amount equal to the amount by which such contractor's charges under this contract have been reduced by reason of this article, until the balance in such contractor's account within the trust fund is the same percentage of $150,000,000 as such contractor's percentage share of reductions made available to all Agricultural Contractors as specified in subdivision (g) of this article. In 2002 and every fifth year thereafter, the Agricultural Contractors will review the maximum accumulation in the trust fund (the "Cap") and determine whether the cap should be adjusted. However, the Cap shall not be reduced below an aggregate of $150,000,000 for all Agricultural Contractor accounts.

(4) **Trust Fund Disbursements.**

(i) In any year in which the State's allocation of water to an Agricultural Contractor by April 15th of that year is less than one-hundred percent (100%) of the contractor's requested annual entitlement for that year, the trustee shall, to the extent there are funds in that contractor's account, distribute to the State from such account for the benefit of that contractor an amount equal to the percentage of the total of that contractor's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of that contractor's annual entitlement for that year that was not allocated to it by the State by April 15th of that year.

(ii) In addition to the provisions of subdivision (h)(4)(i) of this article, if on April 15 of any year any of the irrigable land within the Tulare Lake Basin Water Storage District (Tulare) is flooded, and Tulare in writing requests the trustee to do so, the trustee shall, to the extent there are funds in Tulare's account, distribute to the State from such account for the benefit of Tulare an amount equal to the percentage of the total of Tulare's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of the irrigable land within Tulare that is flooded on April 15.

(iii) Each Agricultural Contractor shall remain obligated to make payments to the State as required by other articles in this contract. Any amount to be disbursed pursuant to subdivisions (h)(4)(i) and (h)(4)(ii) shall be paid by the trustee to the State on July 1 of the year involved and shall be credited by the State toward any amounts owed by such respective Agricultural

Contractor to the State as of that date. However, an Agricultural Contractor may direct the trustee to make the disbursement to that Agricultural Contractor which shall in turn make the payment to the State as required by other provisions of this contract. If the amount to be disbursed exceeds the amount owed to the State by such contractor as of July 1, the excess shall be disbursed by the Trustee to the State at the time of and in payment of future obligations owed to the State by such contractor. Alternatively, upon the request of such contractor, all or part of the excess shall be paid by the trustee to that contractor in reimbursement of prior payments by the contractor to the State for that year.

(5) **Payment of Supplemental Bills.** In any year in which a supplemental bill has been submitted to an Agricultural Contractor pursuant to subdivision (c)(4) of this article, such supplemental bill shall be treated as reducing by an equal amount the obligation of such contractor for that year to make payments into the Agricultural Rate Management Trust Fund. To the extent that such contractor has already made payments to the trust fund in an amount in excess of such contractor's reduced trust fund payment obligation, such contractor may request the trustee to use the excess from the trust fund to pay the supplemental bill.

(6) **Discharge of Payment Obligation.** Each payment to the State by the trust fund shall discharge and satisfy the Agricultural Contractor's obligation to pay the amount of such payment to the State. No reimbursement of the trust fund by the Agricultural Contractor for such payments shall be required. However, each Agricultural Contractor shall continue to make deposits to the trust fund matching the amount of each year's reductions as provided in

subdivision (d) of this article so long as the amount in that contractor's account is less than its share of the Cap.

(7) **Distribution of Funds in Excess of the Cap.** Whenever accumulated funds (including interest) in an Agricultural Contractor's account in the trust fund exceed that contractor's share of the Cap, or the estimated remaining payments the contractor is required to make to the State prior to the end of the project repayment period, that contractor may direct the trustee to pay such excess to the contractor.

(8) **Termination of Trust Fund.** At the end of the project repayment period, the Agricultural Rate Management Trust Fund shall be terminated and any balances remaining in the accounts for each of the Agricultural Contractors shall be disbursed to the respective Agricultural Contractors.

(i) **Definitions.** For the purposes of this article, the following definitions will apply:

(1) "Agricultural Contractor" shall mean the following agencies as they now exist or in any reorganized form:

(i) County of Kings,

(ii) Dudley Ridge Water District,

(iii) Empire West Side Irrigation District,

(iv) Kern County Water Agency for 993,300 acre-feet of its entitlement,

(v) Oak Flat Water District,

(vi) Tulare Lake Basin Water Storage District.

(2) "Urban Contractor" shall mean every other agency having a long term water supply contract with the State as they exist as of the date of this amendment or in any reorganized form as well as

Kern County Water Agency for 119,600 acre-feet of its entitlement.

(j) Except as provided in subdivisions (c)(4) and (c)(5), this article shall not be interpreted to result in any greater State authority to charge the contractors than exists under provisions of this contract other than this article.

23. Article 52 is added to read:

52. KERN WATER BANK

(a) The State shall convey to the Kern County Water Agency (KCWA) in accordance with the terms set forth in the agreement between the State of California Department of Water Resources and Kern County Water Agency entitled "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" (the Kern Water Bank Contract), the real and personal property described therein.

(b) Subject to the approval of KCWA, other contractors may be provided access to and use of the property conveyed to KCWA by the Kern Water Bank Contract for water storage and recovery. Fifty percent (50%) of any project water remaining in storage on December 31, 1995, from the 1990 Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program shall be transferred to KCWA pursuant to the Kern Water Bank Contract. The remaining fifty percent (50%) of any such water (approximately 42,828.5 acre-feet) shall remain as project water and the State's recovery of such project water shall be pursuant to the provisions of a separate recovery contract. Any other Kern Water Bank demonstration program water shall remain as project water and the State's recovery of such water shall be pursuant to the provisions of the respective contracts for implementation of such demonstration programs.

24. Article 53 is added to read:

53. PERMANENT TRANSFERS AND REDUCTIONS OF ENTITLEMENT

(a) Article 41 provides that no assignment or transfer of a contract or any part thereof, rights thereunder or interest therein by a contractor shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose. In accordance with State policy to assist water transfers, the State and the County of Kings, Dudley Ridge Water District (DRWD), Empire West Side Irrigation District, Kern County Water Agency (KCWA), Oak Flat Water District and Tulare Lake Basin Water Storage District (for the purposes of this article the "Agricultural Contractors") shall, subject to the conditions set forth in this article, expeditiously execute any necessary documents and approve all contracts between willing buyers and willing sellers until permanent transfers totaling 130,000 acre-feet of annual entitlements of the Agricultural Contractors and, to the extent provided in such contracts, rights in project transportation facilities related to such annual entitlement have been made to other contractors (the "Urban Contractors") or noncontractors in accordance with the provisions of this article. Such approval requirement shall apply to all contracts executed prior to January 1, 2011. KCWA shall be responsible for approval of such transfers for any portion of the 130,000 acre-feet not previously made available under this article by the other Agricultural Contractors. A contract between a willing buyer and a willing seller shall mean a contract between (1) a buyer which is an Urban Contractor or, to the extent provided in subdivision (e) of this article, a noncontractor and (2) a seller which is an Agricultural Contractor or a public entity which obtains project water from an Agricultural Contractor.

(b) The State shall not be obligated to approve any transfer of annual entitlements if in its judgment the transfer would impair the security of the State's bondholders and the State may impose conditions on any transfer as necessary to make the delivery of the water operationally feasible and to assure that the transportation costs associated with the transferred entitlement are fully repaid. Transfers not approved by the State shall not be considered as part of the 130,000 acre-feet of annual entitlements provided for in this article.

(c) KCWA member units shall have 90 days to exercise a right of first refusal to purchase any annual entitlements being offered for sale to Urban Contractors by another KCWA member unit pursuant to this article, other than those annual entitlements made available to Urban Contractors by subdivision (d) of this article, by agreeing to pay the same price offered by the buyer. Any such sales to KCWA member units exercising such right of first refusal shall not be considered a part of the 130,000 acre-feet of annual entitlements provided for in this article.

(d) Any permanent transfers of annual entitlements by Agricultural Contractors to noncontractors, including transfers to KCWA urban member units or to KCWA's Improvement District Number 4, other than transfers pursuant to subdivision (c) of this article, will be considered a part of the 130,000 acre-feet of annual entitlements provided for in this article if the Urban Contractors have been given a right of first refusal to purchase such annual entitlements as well as transportation rights in accordance with the following terms and procedure:

(1) The Agricultural Contractor shall provide the State a copy of a bona fide contract or Proposed Contract (the "Proposed Contract") and the State shall, within five working days of receipt, provide copies of such Proposed Contract to all Urban Contractors together with a Notice of Proposed Contract stating the date on or before which a Notice of Intent to Exercise a Right of First Refusal (NOI) must be delivered to both the State and the seller, which date shall be 90 days from the date the State mails the Notice of Proposed Contract.

(2) The Proposed Contract shall provide for the transfer of rights in project transportation facilities sufficient to deliver to the seller's service area in any one month eleven percent (11%) of the annual entitlement being transferred or such greater amount as the seller determines to sell; *Provided*, however, that sellers shall not be obligated to sell any transportation rights in the Coastal Aqueduct.

(3) To exercise the right of first refusal, an Urban Contractor shall deliver to the State and the seller its NOI within the time period stated in the Notice of Proposed Contract and shall proceed in good faith to try to complete the transfer to the Urban Contractor. If two or more Urban Contractors deliver NOI's to the State, the amount of annual entitlement and transportation rights being sold shall be allocated among those Urban Contractors that are prepared to perform the purchase by the Performance Date provided for herein in proportion to their maximum annual entitlements, or in another manner acceptable to the Urban Contractors delivering the

NOIs. An offer by an Urban Contractor in its NOI to purchase less than the entire annual entitlement and transportation right being transferred shall not be deemed to be an effective exercise of the right of first refusal unless other Urban Contractors submit NOIs to purchase the remainder of the annual entitlement and transportation right or the noncontractor buyer agrees to purchase the remainder at the same unit price and on the same terms and conditions provided for in the Proposed Contract. The Performance Date shall be the date upon which the Urban Contractor is prepared to perform the purchase, which date shall be the later of: (1) 180 days after the delivery of the NOI or (2) the date set forth in the Proposed Contract for the noncontractor buyer to perform the purchase.

The Performance Date shall be extended at the request of the Urban Contractor if a temporary restraining order or preliminary injunction is in effect as a result of a lawsuit challenging the execution of the contract on the basis of noncompliance with the California Environmental Quality Act. Such extensions shall continue until five days after the temporary restraining order or injunction expires or until the Urban Contractor requests it be discontinued, whichever occurs first. The Urban Contractor shall be liable for any damages suffered by the seller as a result of such extensions of the Performance Date.

(4) If the seller and the noncontractor buyer under the Proposed Contract make any substantive changes in the Proposed Contract, such changes shall constitute a new Proposed Contract that cannot be performed without compliance with all of the procedures set forth in this article.

(5) If an Urban Contractor issuing a NOI fails to complete its exercise of the Right of First Refusal by the Performance Date, the seller shall be free to sell its entitlement in substantial conformance with the terms and conditions set forth in the Proposed Contract . An Urban Contractor issuing a NOI may assign its rights to exercise a right of first refusal to another Urban Contractor and the assignee shall have the same rights as the assignor to complete the purchase by the Performance Date.

(6) In exercising the Right of First Refusal, an Urban Contractor, at its option, may either agree to perform the Proposed Contract in its entirety, including all of its terms and conditions, or agree to pay the price offered under the Proposed Contract for the annual entitlement and transportation rights without condition and without being entitled to enforce or being subject to any other provisions of the Proposed Contract.

(e) As used in this article, "price" shall mean the dollar amount of consideration provided for in the Proposed Contract.

(f) Upon the effective date of any such transfer, the seller shall be relieved of and the buyer shall become liable to the State for all prospective Delta Water Charges, the related Transportation Charges and any other charges for the annual entitlements and associated transportation rights transferred unless the seller and buyer provide otherwise in the contract for the transfer and the State approves such other provisions. However, the contractor making the sale shall remain obligated to the State to make the payments if the buyer defaults on its payments to the State related to the water transferred and is not a party to a long term water supply contract of the type contained in Department of Water

Resources Bulletin Number 141. If the contractor making the sale is required to make any payments to the State as a result of the buyer's default, the entitlement transferred to the defaulting buyer shall, if provided for in the Proposed Contract, revert back to the contractor making the sale. The buyer may also be liable for any charges imposed pursuant to subdivision (g) of this article.

(g) A contractor which is a buyer of annual entitlement pursuant to this article may receive deliveries using any portion of the capacity previously provided by the State in each reach of the project transportation facilities for such contractor that is necessary for transporting the entitlement purchased by it on the same basis as any other entitlement provided for in its Table A in effect prior to the date of the Monterey Amendment. Such contractor may also use any transportation rights transferred to it by a seller in the same manner as the seller was entitled to use them and any unused capacity in any of the reaches specified in this paragraph so long as project operations and/or priority of service of water to other contractors participating in repayment of capital costs in such reaches is not adversely affected. The State shall not be responsible for any resulting adverse impacts upon its ability to provide such contractor peaking capacity. The capital cost and minimum, operation, maintenance, power and replacement components of the Transportation Charge allocated to a buying contractor needing transportation capacity in excess of the capacity factors on which its charges are based in any reach shall be determined prospectively based upon the increase in the buying contractor's annual entitlement resulting from the purchase, and service of water to fulfill annual entitlement to other contractors shall not be impaired. The capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charges shall then be reallocated among the other entities participating in repayment of costs of that reach. For the purposes of this determination, all payments received by the State from the seller relating to the annual entitlement sold shall be deemed to have been received from the buying contractor. Any increased Transportation minimum operation, maintenance, power and replacement component charges allocated to the buying contractor pursuant to this subdivision (g) shall begin January 1 of the year following the effective date of the transfer.

(h) Individual contractors may transfer entitlements among themselves in amounts in addition to those otherwise provided for in this article. The State shall expeditiously execute any necessary documents and approve all contracts involving permanent sales of entitlements among contractors, including permanent sales among Urban Contractors. Such sales shall be subject to the provisions of subdivisions (b), (f) and (g) of this article; *Provided*, however, that for a buying contractor needing transportation capacity in excess of the capacity factors on which its charges are based in any reach, reallocation of the Transportation capital cost component charges for transfers other than (i) the 130,000 acre-feet provided for in this article and (ii) the approximate 33,000 acre-feet of transfers proposed from contractors located in Santa Barbara or San Luis Obispo counties, shall be determined both prospectively and retroactively.

(i) On January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until the end of the project repayment period: (i) Kern County Water Agency's (KCWA) annual entitlement for agricultural use as currently designated in Table A-1 of its contract shall be decreased by 40,670 acre-feet; (ii) Dudley Ridge Water District's (DRWD) annual entitlement as currently designated in Table A of its contract shall be decreased by 4,330 acre-feet; and (iii) the State's prospective charges (including any adjustments for past costs) for the 45,000 acre-feet of annual entitlements to be relinquished by KCWA and DRWD thereafter shall be deemed to be costs of project conservation facilities and included in the Delta Water Charge for all contractors in accordance with the provisions of Article 22. If by November 20, 1995 and each October 1 thereafter until the Monterey Amendments of both KCWA and DRWD take effect, KCWA and DRWD at their option notify the State in writing that they will relinquish up to their shares of 45,000 acre-feet of annual entitlements for the following calendar year beginning before the Monterey Amendments take effect, the State, when and if the Monterey Amendments take effect, shall adjust the charges retroactively for the acre-feet relinquished by KCWA and DRWD to January 1 of each year for which water was relinquished. The delivery points for the 45,000 acre-feet of annual entitlement to be relinquished shall be identified for the State by KCWA and DRWD to enable the State to calculate the transportation costs for the 45,000 acre-feet to be included in the Delta Water Charge.

25. **Article 54 is added to read:**

54. Usage of Lakes Castaic and Perris

(a) The State shall permit the contractors participating in repayment of the capital costs of Castaic Lake (Reach 30) and Lake Perris (Reach 28J) to withdraw water from their respective service connections in amounts in excess of deliveries approved pursuant to other provisions of the state water contracts. Each such contractor shall be permitted to withdraw up to a Maximum Allocation from the reach in which it is participating. The contractors participating in repayment of Castaic Lake may withdraw a collective Maximum Allocation up to 160,000 acre-feet pursuant to this article, which shall be apportioned among them pursuant to the respective proportionate use factors from the Department of Water Resources' Bulletin 132-94, Table B-1 upon which capital cost repayment obligations are based, as follows:

Castaic Lake

Participating Contractor	Proportionate Use Factor	Maximum Allocation (Acre Feet)
The Metropolitan Water District of Southern California	0.96212388	153,940
Ventura County Flood Control and Water Conservation District	0.00860328	1,376
Castaic Lake Water Agency	0.02927284	4,684
Total	**1.00000000**	**160,000**

The Metropolitan Water District of Southern California, as the only contractor participating in repayment of Lake Perris, shall be allocated a Maximum Allocation at Lake Perris of 65,000 acre-feet based upon a proportionate use factor of 1.00000000.

The Maximum Allocation totals of 160,000 acre-feet and 65,000 acre-feet shall not be subject to adjustment. The individual contractor's Maximum Allocations shall be adjusted only as agreed to among the contractors desiring to adjust their Maximum Allocations. Adjustments between the contractors shall be subject to approval of the State which approval shall be given unless there are adverse impacts upon another contractor participating in the reach which are unacceptable to such contractor. The participating contractors will, in consultation with the State, cooperate with each other in an effort to promote efficient utilization of Castaic Lake, and to minimize any adverse impacts to each other, through coordination of deliveries pursuant to other provisions of the State Water Contract as well as withdrawals of allocations pursuant to this article.

(b) The State shall operate Castaic and Perris Reservoirs as transportation facilities in a manner consistent with this article. A contractor desiring to withdraw a portion or all of its Maximum Allocation shall furnish the State with a proposed delivery schedule. The proposed schedule may be submitted as part of the preliminary water delivery schedule submitted pursuant to Article 12(a)(1). Upon receipt of a schedule the State shall promptly review it to ensure that the amounts, times and rates of delivery will be consistent with the State's ability to operate the reach. The contractor may modify its proposed delivery schedule at any time, and the modified schedule shall be subject to review in the same manner. If necessary, the State may modify the schedule after consultation with the contractor and other contractors participating in repayment of that reach but may not change the total quantity of water to be withdrawn. As part of the consultation, the State shall advise a contractor if it determines a withdrawal will adversely impact the rate of delivery provided for the contractor in this contract. The State shall not be responsible for any such impacts.

(c) A contractor may withdraw all or a portion of its Maximum Allocation. It shall restore any withdrawn portion of such allocation by furnishing an equivalent amount of replacement water to the reservoir from which the water was withdrawn within five years from the year in which the withdrawal takes place. The unused portion of the allocation, in addition to any replacement water furnished to the reservoir, shall remain available for subsequent withdrawal. The State shall keep an accounting of the contractor's storage withdrawals and replacements. In any year, the State shall permit a contractor to withdraw an amount equivalent to the contractor's Maximum Allocation minus remaining replacement water requirements due to previous withdrawals. If the contractor fails to schedule and replace the withdrawn water within the five-year return period, the State shall provide the replacement water from water scheduled for delivery to the contractor in the sixth year or as soon as possible thereafter. The total amount of scheduled annual entitlement which a contractor can use in any one year for restoring its Maximum Allocation and storing water in surface storage facilities outside of its service area pursuant to Article 56 shall be the sum of the maximum amount the contractor can add to storage that year pursuant to Article 56 and the amount of acre-feet shown in column 2 of the following table, depending on the State's final water supply allocation percentage as shown in column 1.

1. Final Water Supply Allocation Percentage	2. Maximum Acre-Feet of Scheduled Entitlement for Restoring Maximum Allocation*
50% or less	100,000
51%	98,000
52%	96,000
53%	94,000
54%	92,000
55%	90,000
56%	88,000
57%	86,000
58%	84,000
59%	82,000
60%	80,000
61%	78,000
62%	76,000
63%	74,000
64%	72,000
65%	70,000
66%	68,000
67%	66,000
68%	64,000
69%	62,000
70%	60,000
71%	58,000
72%	56,000
73%	54,000
74%	52,000
75 to 99%	50,000
100%	no limit

* Excludes the maximum amount that can be added to storage in a year pursuant to Article 56, which may be used in addition to the amounts in this table to restore Maximum Allocation.

A contractor may use any of this total amount for replacement water but cannot use any more than that provided for in Article 56 to add to storage in project surface conservation facilities and in nonproject surface storage facilities. There shall be no limit under this article on the amount of scheduled annual entitlement a contractor can use to restore its Maximum Allocation in a year when its percentage of annual water supply allocation is one-hundred percent (100%), nor shall there be any limit under this article on the amount of interruptible water, nonproject water or water obtained through an exchange which a contractor can use to restore its Maximum Allocation.

(d) For any replacement water furnished to reservoir storage pursuant to this article, the responsible contractor shall pay the State charges for the conservation, if any, and transportation of such replacement water as are associated with the type of replacement water that is furnished, as if such water were delivered to the turnout at the reservoir to which the replacement water is furnished. Adjustments from estimated to actual costs shall be subject to provisions applicable to the type of replacement water. The State shall not charge contractors for water withdrawn pursuant to this article.

(e) The State shall operate capacity in Castaic and Perris Reservoirs, not required for purposes of Maximum Allocation deliveries, in compliance with the requirement of Article 17(b) of The Metropolitan Water District of Southern California's water supply contract with the State to maintain an amount of water reasonably sufficient to meet emergency requirements of the contractors participating in repayment of that reach. A contractor receiving water pursuant to this article accepts that the State shall not be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available from that reservoir to meet the contractor's actual emergency requirements as a result of prior storage withdrawals by that contractor pursuant to this article. Nothing in this article shall permit or require the State to adjust allocations or deliveries under Article 18.

(f) To the extent a contractor, during a calendar year, uses all or a portion of its Maximum Allocation, the State may, to the extent necessary to service project purposes, reduce that contractor's requested peaking service. Such reduction in peaking service shall only occur to the extent such usage of Maximum Allocation causes the State to be unable to provide all peaking service requested. This paragraph shall not apply to the extent the contractor requested usage of Maximum Allocation as part of the preliminary water delivery schedule submitted pursuant to Article 12(a)(1).

(g) The State may reduce water stored in Castaic Lake and Lake Perris to the extent necessary for maintenance and to respond to emergencies resulting from failure of project transportation facilities or of other supply importation facilities serving the State project service area. The State shall promptly replace water within the Maximum Allocation as soon as the need for the reduction terminates.

26. Article 55 is added to read:

55. Transportation of Nonproject Water

(a) Subject to the delivery priorities in Article 12(f), contractors shall have the right to receive services from any of the project transportation facilities to transport water procured by them from nonproject sources for delivery to their service areas and to interim storage outside their service areas for later transport and delivery to their service areas: *Provided*, that except to the extent such limitation in Section 12931 of the Water Code be changed, a contractor shall not use the project transportation facilities under this option to transport water the right to which was secured by the contractor through eminent domain unless such use be approved by the Legislature by concurrent resolution with the majority of the members elected to each house voting in favor thereof.

(b) For any nonproject water delivered pursuant to this article, contractors shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the conservation and transportation of such water as if such nonproject water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, which may include an administrative or contract preparation charge, all as determined by the State. Incremental costs shall mean those nonpower costs which would not be incurred if nonproject water were not scheduled for or delivered to contractors. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities charge for the delivery of nonproject water from or through that reach. Costs for transporting water placed into interim storage shall be paid in the same manner provided for in subdivision (c)(6) of Article 56.

(c) The amounts, times and rates of delivery of nonproject water shall be provided for pursuant to a water delivery schedule to be issued in the same manner as provided for in Article 12. The costs specified in this article shall be paid for at the same time the corresponding project water costs are paid.

27. Article 56 is added to read:

56. Use, Storage and Sale of Project Water Outside of Service Area and Storage of Water in Project Surface Conservation Facilities

(a) **State Consent to Use of Project Water Outside of Service Area**

Notwithstanding the provisions of Article 15(a), the State hereby consents to the Agency storing project water outside its service area for later use within its service area in accordance with the provisions of subdivision (c) of this article and to the Agency selling project water for use outside its service area in accordance with the provisions of subdivision (d) of this article.

(b) **Groundwater Storage Programs**

The Agency shall cooperate with other contractors in the development and establishment of groundwater storage programs.

(c) **Storage of Project Water Outside of Service Area**

(1) A contractor may elect to store project water outside its service area for later use within its service area, up to the

limits and in accordance with the provisions provided for in this subdivision (c) and any applicable water right laws, by setting forth on the preliminary water delivery schedule submitted to the State on or before October 1 of each year pursuant to Article 12(a) the quantity of project water it wishes to store in the next succeeding year. There shall be no limit on the amount of project water a contractor can store outside its service area during any year in a then existing and operational groundwater storage program. The amount of project water a contractor can add to storage in project surface conservation facilities and in nonproject surface storage facilities located outside the contractor's service area each year shall be limited to the lesser of the percent of the contractor's Table A annual entitlement shown in column 2 or the acre-feet shown in column 3 of the following table, depending on the State's final water supply allocation percentage as shown in column 1. However, there shall be no limit to storage in nonproject facilities in a year in which the State's final water supply allocation percentage is one hundred percent. These limits shall not apply to water stored pursuant to Article 12(e).

1. Final Water Supply Allocation Percentage	2. Maximum Percent of Agency's Annual Entitlement That Can be Stored	3. Maximum Acre-Feet That Can be Stored
50% or less	25%	100,000
51%	26%	104,000
52%	27%	108,000
53%	28%	112,000
54%	29%	116,000
55%	30%	120,000
56%	31%	124,000
57%	32%	128,000
58%	33%	132,000
59%	34%	136,000
60%	35%	140,000
61%	36%	144,000
62%	37%	148,000
63%	38%	152,000
64%	39%	156,000
65%	40%	160,000
66%	41%	164,000
67%	42%	168,000
68%	43%	172,000
69%	44%	176,000
70%	45%	180,000
71%	46%	184,000
72%	47%	188,000
73%	48%	192,000
74%	49%	196,000
75% or more	50%	200,000

(2) Storage capacity in project surface conservation facilities at any time in excess of that needed for project operations shall be made available to requesting contractors for storage of project and nonproject water. If such storage requests exceed the available storage capacity, the available capacity shall be allocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. A contractor may store water in excess of its allocated share of capacity as long as capacity is available for such storage.

(3) If the State determines that a reallocation of excess storage capacity is needed as a result of project operations or because of the exercise of a contractor's storage right, the available capacity shall be reallocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. If such reallocation results in the need to displace water from the storage balance for any contractor or noncontractor, the water to be displaced shall be displaced in the following order of priority:

First, water, if any, stored for noncontractors.

Second, water stored for a contractor that previously was in excess of that contractor's allocation of storage capacity.

Third, water stored for a contractor that previously was within that contractor's allocated storage capacity.

The State shall give as much notice as feasible of a potential displacement.

(4) Any contractor electing to store project water outside its service area pursuant to this subdivision may not sell project water under the provisions of subdivision (d) of this article during the year in which it elected to store project water. This limitation shall not apply to replacement water furnished to Castaic and Perris Reservoirs pursuant to Article 54, nor to the storage of water introduced into a groundwater basin outside a contractor's service area if recovery is intended to occur within that contractor's service area.

(5) The restrictions on storage of project water outside a contractor's service area provided for in this subdivision (c), shall not apply to storage in any project offstream storage facilities constructed south of the Delta after the date of this amendment.

(6) For any project water stored outside its service area pursuant to this subdivision (c), a contractor shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water as the contractor pays for the transportation of annual entitlement to the reach of the project transportation facility from which the water is delivered to storage. If annual entitlement is stored, the Delta Water Charge shall be charged only in the year of delivery to interim storage. For any stored water returned to a project transportation facility for final delivery to its service area, the contractor shall pay the State the same for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water calculated from the

point of return to the aqueduct to the turn-out in the contractor's service area. In addition, the contractor shall pay all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State, which shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if such water were scheduled for or delivered to the contractor's service area instead of to interim storage outside the service area. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities charge for use of a reach for the delivery of water to, or return of water from, interim storage.

(7) A contractor electing to store project water in a nonproject facility within the service area of another contractor shall execute a contract with that other contractor prior to storing such water which shall be in conformity with this article and will include at least provisions concerning the point of delivery and the time and method for transporting such water.

(d) **Sale of Project Water For Use Outside Service Area**

(1) If in any year a contractor has been allocated annual entitlement that it will not use within its service area, the contractor has not elected to store project water in accordance with the provisions of subdivision (c) of this article during that year, and the contractor has not elected to carry over entitlement water from the prior year pursuant to the provisions of Article 12(e), the contractor may sell such annual entitlement for use outside its service area in accordance with the following provisions.

(2) Each year the State shall establish an annual entitlement water pool (the Pool) for contractors wishing to sell or buy project water pursuant to the provisions of this subdivision. The Pool shall constitute the exclusive means of selling portions of annual entitlements not desired by contractors that year. Contractors willing to sell to or buy water from the Pool shall notify the State in writing of their desire to do so indicating the quantity to be sold or purchased. Contractors shall have the first priority to purchase all water placed in the Pool. The State may purchase any water remaining in the Pool not purchased by contractors at the same price available to contractors and use such water for the purpose of providing additional carryover storage for contractors: *Provided*, that the State shall consult with the contractors prior to making any such purchases.

(3) Each year, the price per acre-foot to be paid by the State to contractors selling water placed in the Pool on or before February 15 that is purchased by a contractor requesting such purchase by March 1 or by the State on March 1 shall be equal to fifty percent (50%) of the Delta water rate as of that date. The price per acre-foot to be paid to the State for the purchase of water from the Pool by a contractor placing a request for such purchase on or before March 1 shall be equal to fifty percent (50%) of the Delta water rate as of that date. Any water placed in the Pool on or before February 15 that is not purchased by contractors or the State by March 1 may be withdrawn from the Pool by the selling contractor.

(4) Each year the price per acre-foot to be paid by the State to contractors selling water remaining in the Pool or placed in the Pool after February 15, but on or before March 15 that is purchased by a contractor requesting such purchase by April 1 or by the State on April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of that date. The price per acre-foot to be paid to the State for the purchase of water from the Pool by a contractor placing a request for such purchase between March 2 and April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of the later date. Any water placed in the Pool on or before March 15 that is not purchased by a contractor or the State by April 1 may be withdrawn from the Pool by the selling contractor.

(5) If there are more requests from contractors to purchase water from the Pool than the amount in the Pool, the water in the Pool shall be allocated among those contractors requesting such water in proportion to their annual entitlements for that year up to the amount of their requests. If requests to purchase water from the Pool total less than the amount of water in the Pool, the sale of Pool water shall be allocated among the contractors selling such water in proportion to their respective amounts of water in the Pool.

(6) Any water remaining in the Pool after April 1 that is not withdrawn by the selling contractor shall be offered by the State to contractors and noncontractors and sold to the highest bidder: *Provided*, that if the highest bidder is a noncontractor, all contractors shall be allowed fifteen days to exercise a right of first refusal to purchase such water at the price offered by

the noncontractor. The price to be paid to the selling contractor shall be the amount paid by the buyer exclusive of the amount to be paid by the buyer to the State pursuant to subdivision (d)(7) of this article.

(7) For any water delivered from the Pool to contractors, the buyer shall pay the State the same for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water as if such water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State, which shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if such water were not scheduled for or delivered to the buyer. Only those buyers not participating in the repayment of a reach shall be required to pay any use of facilities charge for the delivery of such water from or through the reach. Adjustments from estimated to actual costs shall be computed by the State pursuant to these provisions and shall be paid by the buyer or credited to the buyer at the times and interest rates described in Article 28(c).

(e) **Continuance of Article 12(e) Carry-over Provisions**

The provisions of this article are in addition to the provisions of Article 12(e), and nothing in this article shall be construed to modify or amend the provisions of Article 12(e). Any contractor electing to sell project water during any year in accordance with the provisions of subdivision (d) of this article, shall not be precluded from using the provisions of

Article 12(e) for carrying over water from the last three months of that year into the first three months of the succeeding year.

(f) **Bona Fide Exchanges Permitted**

Nothing in this article shall be deemed to prevent the Agency from entering into bona fide exchanges of project water for use outside the Agency's service area with other parties for project water or nonproject water if the State consents to the use of the project water outside the Agency's service area. Also, nothing in this article shall be deemed to prevent the Agency from continuing those exchange or sale arrangements entered into prior to September 1, 1995, which had previously received any required State approvals. A "bona fide exchange" shall mean an exchange of water involving a contractor and another party where the primary consideration for one party furnishing water to another is the return of a substantially similar amount of water, after giving due consideration to the timing or other nonfinancial conditions of the return. Reasonable payment for costs incurred in effectuating the exchange and reasonable deductions from water delivered, based on expected storage or transportation losses may be made. A "bona fide exchange" shall not include a transfer of water from one contractor to another party involving a significant payment unrelated to costs incurred in effectuating the exchange. The State, in consultation with the contractors, shall have authority to determine whether transfers of water constitute "bona fide exchanges" within the meaning of this paragraph and not disguised sales.

(g) **Other Transfers**

Nothing in this article shall be deemed to modify or amend the provisions of Article 15(a), or Article 41, except as expressly provided for in subdivisions (c) and (d) of this article.

28. All balances of wet weather and Article 12(d) water otherwise available to any contractor executing the Monterey Amendment shall be eliminated as of the effective date of such amendment and no new balances for such water shall be established.

29. <u>Effective Dates and Phase-in.</u>

(a) No Monterey Amendment to any contractor's water supply contract shall take effect unless and until both of the following have occurred (1) the Monterey Amendments to both the Kern County Water Agency's and The Metropolitan Water District of Southern California's contracts have been executed and no legal challenge has been filed within sixty days of such execution or, if filed, a final judgment of a court of competent jurisdiction has been entered sustaining or validating said amendments; and (2) the State has conveyed the property which constitutes the Kern Fan Element of the Kern Water Bank to Kern County Water Agency pursuant to the Kern Water Bank Contact provided for in Article 52 either on or before October 1, 1996 or, if the conveyance on such date has been prevented by an interim court order, within ninety days after such court order has become ineffective so long as said ninety days expires not later than January 1, 2000. The

October 1, 1996 date and the January 1, 2000 date may be extended by unanimous agreement of the State, Kern County Water Agency and The Metropolitan Water District of Southern California.

(b) The State shall administer the water supply contracts of any contractors that do not execute the Monterey Amendment so that such contractors are not affected adversely or to the extent feasible beneficially by the Monterey Amendments of other contractors' water supply contracts.

(c) If a court of competent jurisdiction issues a final judgment or order determining that any part of a contractor's Monterey Amendment is invalid or unenforceable, all provisions of that amendment shall be of no force or effect as to such contractor, except as provided in subdivisions (e) and (f) of this paragraph.

(d) If any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contracts or if the conveyance of the Kern Fan Element of the Kern Water Bank to the Kern County Water Agency provided for in Article 52 is determined by a court of competent jurisdiction in a final judgment or order to be invalid or unenforceable, the Monterey Amendments of all contractors and the Kern Water Bank Contract shall be of no force and effect except as provided in subdivisions (e) and (f) of this paragraph.

(e) Notwithstanding subdivisions (c), (d) and (f) of this paragraph, if any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contract is determined by a court of competent jurisdiction in a final judgment or order to be invalid or unenforceable, and if Articles 52 and 53 (i) have been implemented (i.e., the property which constitutes the Kern Fan Element of the Kern Water Bank has been conveyed by the State and the 45,000 acre-feet of annual entitlements have been relinquished to the State), the implementation of the relinquishment shall not be reversed unless the implementation of the conveyance is also reversed, and conversely, implementation of the conveyance shall not be reversed unless implementation of the relinquishment is also reversed. Nothing in this subdivision shall affect any party's right to seek additional damages, compensation or any other remedy available at law or in equity.

(f) The total invalidity or unenforceability of one contractor's Monterey Amendment as provided for in subdivision (c) of this paragraph or of all contractor's Monterey Amendments as provided for in subdivision (d) of this paragraph or of the Kern Water Bank Contract as provided for in subdivision (d) of this paragraph may be avoided only if such invalidity or unenforceability is explicitly waived in writing signed by the State, Kern County Water Agency and The Metropolitan Water

District of Southern California. In cases arising under subdivision (c) or (d), the affected contractor whose Monterey Amendment has been determined to be partially invalid or unenforceable must first request the waiver.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form and sufficiency	STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES
Susan N. Weber	
Chief Counsel Department of Water Resources	Director
	KERN COUNTY WATER AGENCY
ATTEST:	
	Adrienne Jo Mathews

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 24 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 13 day of DECEMBER, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the contractors and the State have negotiated an amendment to the water supply contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, the State and the Agency intend to implement such provisions by incorporating this Monterey Amendment into the Agency's water supply contract with the State; and

WHEREAS, subdivision (i) of Article 53 of the Monterey Amendment requires that the Agency, on January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until the end of the project repayment period, decrease its annual entitlement for agricultural use as currently designated in Table A-1 of its contract by 40,670 acre-feet. This reduction will begin in 1997; and;

WHEREAS, subdivision (i) of Article 53 of the Monterey Amendment also provides that if by November 20, 1995, the Agency notifies the State that it will relinquish all or part of the 40,670 acre-feet of its annual entitlement for 1996. the State, shall, if the Monterey Amendment takes effect in 1996, adjust the charges retroactively to January 1, 1996 for the acre-feet relinquished; and

WHEREAS, on or before November 20, 1995, the Agency notified the State in writing that it will relinquish 36,340 acre-feet of its annual entitlement in 1996;

NOW THEREFORE, IT IS MUTUALLY AGREED that the following change is hereby made to the Agency's water supply contract with the State:

1. Table A entitled "ANNUAL ENTITLEMENTS, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State, dated November 15, 1963, is amended to read as follows:

TABLE A
ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year		Total Annual Amount in Acre-Feet
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	401,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	968,200
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
and each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:		1,112,730

2. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State is amended to read as follows:

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENT
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year		Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use (San Joaquin Valley-Southern California Aqueduct)	Total Annual Amount
1	(1968)	13,313	33,287	0	46,600
2	(1969)	30,303	65,397	0	95,700
3	(1970)	61,000	55,400	28,700	145,100
4	(1971)	35,500	119,100	35,700	190,300
5	(1972)	31,800	199,700	43,500	270,700
6	(1973)	37,500	229,500	43,500	310,500
7	(1974)	53,600	246,400	48,000	347,000
8	(1975)	57,000	301,120	52,700	401,820
9	(1976)	61,800	324,250	56,100	442,150
10	(1977)	66,000	357,000	60,600	483,600
11	(1978)	70,800	399,400	64,100	534,300
12	(1979)	75,300	441,000	67,600	583,900
13	(1980)	79,400	484,000	71,100	634,500
14	(1981)	83,800	532,800	74,800	691,400
15	(1982)	87,700	578,000	79,600	745,300
16	(1983)	90,800	630,800	83,500	805,100
17	(1984)	94,500	662,500	103,600	860,600
18	(1985)	97,100	709,000	108,900	915,000
19	(1986)	100,100	754,700	113,400	968,200
20	(1987)	102,200	802,200	119,100	1,023,500
21	(1988)	103,800	846,900	123,900	1,074,600
22	(1989)	104,700	879,400	128,200	1,112,300
23	(1990)	105,100	913,700	134,600	1,153,400
24	(1991)	105,100	913,700	134,600	1,153,400
25	(1992)	105,100	913,700	134,600	1,153,400
26	(1993)	105,100	913,700	134,600	1,153,400
27	(1994)	105,100	913,700	134,600	1,153,400
28	(1995)	105,100	913,700	134,600	1,153,400
29	(1996)	105,100	877,360	134,600	1,117,060
30	(1997)	105,100	873,030	134,600	1,112,730
And each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:					1,112,730

3. Reductions in the Agency's Delta and Transportation charges and water system revenue bond surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 1996 and each year thereafter shall be identified by the State and shown separately on its annual statement of charges to the Agency.

4. This Amendment Number 24 shall become effective only if the Monterey Amendment (Amendment Number 23 to the Agency's water supply contract with the State) becomes effective in 1996.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency

Susan N. Weber
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

ATTEST:

Pam Bosworth
Signature

Executive Secretary
Title

Adrienne Jo Mathews
Signature

President
Title

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 25 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND THE KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 23 day of September, 1996, pursuant to the provisions of the California Water Resources Development Bond Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

WHEREAS, the State and the Agency have entered into, and subsequently amended, a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the annual entitlements of the Agency were increased for the eighth (1975) and ninth (1976) years pursuant to Article 21(g)(3) related to deliveries of surplus water;

WHEREAS, the Agency desires to decrease its annual entitlement for 1986 by 34,554 acre-feet, which is equivalent to the sum of the prior increases in annual entitlements made in the eighth and ninth years; and

WHEREAS, in negotiating the Surplus Water Amendment, the contractors and the Department intended that further contract amendments would result in the increases in annual entitlements related to the delivery of surplus water being matched in later years by equivalent offsetting reductions in Table A annual entitlements which will return to the Agency the increased Delta Water Charges with interest.

NOW THEREFORE, it is mutually agreed as follows:

1. Table A entitled "Annual Entitlements, Kern County Water Agency," as modified by Contract Amendments No. 18, and as may be modified by Amendment No. 24, is further amended for the year 1986 from 968,200 acre-feet to 933,646 acre-feet.

2. The Department will provide a credit for the reduction in annual entitlement made by this Amendment at a future time when the Department determines that the credit could be made without a substantial adverse effect on the Department's cash flow and fund balances.

3. The Agency agrees to indemnify, defend, and hold harmless the State from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising out of or related to the actions implementing this Amendment.

IN WITNESS WHEREOF, the parties have executed this Amendment on the date first above written.

Approved as to legal form and sufficiency:	STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES
Susan N. Weber Chief Counsel Department of Water Resources	Robert Rotte Director
Attest:	KERN COUNTY WATER AGENCY
By Pam Bosworth Pam Bosworth	By Thomas N. Clark Thomas N. Clark
Title Executive Secretary	Title General Manager

632.5/431
KCWA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 26 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of January, 1997, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

AMENDMENT NO. 26
REVISION TO TABLE A

WHEREAS, among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies; and

WHEREAS, the Mojave Water Agency and the Berrenda Mesa Water District have entered into an Agreement to Purchase Berrenda Mesa Water District State Water Project Entitlement to Water (the "Purchase Agreement") executed as of April 12, 1996 to provide for the sale by the Agency on behalf of BMWD to MWA of 25,000 acre-feet per year of the Agency's annual entitlement that has been allocated to BMWD by the Agency under the contract between BMWD and the Agency (the "BMWD/KCWA Contract") dated March 9, 1967, and all amendments thereto; and

WHEREAS, the State and Agency wish to set forth their agreement as to such matters as (i) the 25,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, (iii) the revision of proportionate use of facilities factors set forth in the Water Supply Contract; and

WHEREAS, the State and MWA are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 18 to MWA's Water Supply Contract between MWA and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, (iii) the delivery priority for the purchased entitlement, and (iv) the revision of proportionate use of facilities factors; and

WHEREAS, this Amendment is permitted by the terms of the Water Supply Contract.

NOW, THEREFORE, IT IS MUTUALLY AGREED that the following changes are hereby made to the Agency's Water Supply Contract with the State:

1. Table A-1 entitled "ANNUAL ENTITLEMENTS, KERN COUNTY WATER AGENCY" in the Agency's Water Supply Contract with the State, dated November 15, 1963, is amended to read as follows:

TABLE A
ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year		Total Annual Amount in Acre-Feet
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	401,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
and each succeeding year thereafter, for the term of this contract as an annual entitlement:		1,087,730

2. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's Water Supply Contract with the State is amended to read as follows:

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENT
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	43,500	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	53,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	401,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				1,087,730

3. Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 1998 and each year thereafter shall commence January 1, 1998, and be identified by the State and shown on its annual statement of charges to the Agency.

4. Article 12(c) is amended to read;

(c) <u>Limit on Rate of Delivery to the Agency</u>

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding three thousand eighty-six (3,086) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

5. Article 45(f) is added to read:

(f) Recognizing that MWA will not be using Reach 31A of the Coastal Branch of the California Aqueduct for delivery of any of the 25,000 acre-feet of annual entitlement purchased from the Agency, effective January 1, 1998, the Agency is relieved of and MWA is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 25,000 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A. For movement of water by KCWA in Reach 31A, KCWA shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

6. Article 45(g) is added to read:

(g) All future adjustments in charges and credits of past costs associated with the 25,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 10A of the California Aqueduct and Reach 31A of the Coastal Branch shall be attributable to MWA as if the MWA's annual entitlement and the related transportation capacity had been increased by the 25,000 acre-feet of annual entitlement purchased from KCWA in years prior to January 1, 1998.

7. Attached as Exhibit A hereto are tables showing rounded-off values of data which will be used by the State in implementing the terms of this Amendment.

8. Except as amended herein, the provisions of the Water Supply Contract remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Susan N. Weber

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Robert Potter

Director

ATTEST:

Signature

Title

KERN COUNTY WATER AGENCY

Gene A. Lundquist

Signature

Board President

Title

EXHIBIT A

KERN's ALLOCATED CAPACITY FOR EACH REACH

The capacity rights after the transfer are estimated to be as follows:

California Aqueduct[2]	Existing Annual Entitlement (AF) (1)	Existing Capacity (cfs) (2)	Entitlement Transferred to Mojave WA (AF) (3)	Capacity Transferred to Mojave WA[1] (cfs) (4)	Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2A	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2B	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 3	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 4	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 5	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 6	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 7	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8C	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8D	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 9	1,014,030	2,887	8,059[4]	24[4]	1,005,971	2,863
Reach 10A	967,390	2,747	8,059[4]	24[4]	959,331	2,723
Reach 11B	710,620	1,981			710,620	1,981
Reach 12D	599,655	1,650			599,655	1,650
Reach 12E	595,955	1,639			595,955	1,639
Reach 13B	387,755	1,108			387,755	1,108
Reach 14A	241,755	803			241,755	803
Reach 14B	204,255	691			204,255	691
Reach 14C	177,555	510			177,555	510
Reach 15A	145,055	413			145,055	413
Reach 16A	86,770	239			86,770	239
Reach 17E	5,000	9			5,000	9
Reach 31A[3]	105,100[3]	283[3]	0[3]	0[3]	105,100[3]	283[3]

1. From the Delta to Berrenda Mesa Water District's service area.
2. These numbers apply to the reaches as set forth in Figure B-5, "Repayment Reaches and Descriptions: Project Transportation Facilities."
3. For repayment purposes, the Department will allocate cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. Kern County Water Agency will retain the right to use its original 283 cfs capacity and 105,100 AF in Reach 31A.
4. The Department will allocate cost of 24 cfs capacity and 8,059 acre-feet in Reaches 9 and 10A to Mojave Water Agency for repayment purposes and the right to use the 24 cfs of transportation capacity.

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

SEP 0 2 1997

RECEIVED
TNC JFS LWF GLB SHR SEP 5 1997 SMR RBI JMB JWP ALL
Kern County Water Agency

632 5703
KCWA

Mr. Thomas N. Clark
General Manager
Kern County Water Agency
Post Office Box 58
Bakersfield, California 93302-0058

Dear ~~Mr. Clark~~ Tom:

As discussed among our staff, enclosed for your records is a revised copy of EXHIBIT A to the "Amendment No. 26 to Water Supply Contract Between the State of California, Department of Water Resources and Kern County Water Agency," dated November 15, 1963. EXHIBIT A is referenced in section 7 of the Amendment. The "Existing Annual Entitlement" column (column 1) values for Reaches 14A and 14B have been changed from 241,755 and 204,255 to 275,755 and 238,255 respectively. This change is being made to correct a mathematical error. In addition, language was added to Footnotes 3 and 4 to reference Article 53 of Kern's long-term Water Supply Contract and Footnote 5 was added to clarify that Kern retains its right to use the transportation capacity associated with the 40,670 acre-feet Kern relinquished. If you concur with these changes, please replace the existing EXHIBIT A with the revised version enclosed and sign and date the enclosed copy of this letter and return it to me at State Water Project Analysis Office, Department of Water Resources, State of California, Post Office Box 942836, Sacramento, California 94236-0001.

If you have any questions, please call Dan Flory, at (916) 653-5942.

Sincerely,

Donald R. Long, Chief
State Water Project Analysis Office

CONCUR:

KERN COUNTY WATER AGENCY

____
Name

General Manager
____
Title

September 8, 1997
____
Date

Enclosures

KERN's ALLOCATED CAPACITY FOR EACH REACH

The capacity rights after the transfer are estimated to be as follows:

California Aqueduct[2]	Existing Annual Entitlement[5] (AF) (1)	Existing Capacity[5] (cfs) (2)	Entitlement Transferred to Mojave WA (AF) (3)	Capacity Transferred to Mojave WA[1] (cfs) (4)	Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2A	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2B	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 3	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 4	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 5	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 6	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 7	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8C	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8D	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 9	1,014,030	2,887	8,059[4]	24[4]	1,005,971	2,863
Reach 10A	967,390	2,747	8,059[4]	24[4]	959,331	2,723
Reach 11B	710,620	1,981			710,620	1,981
Reach 12D	599,655	1,650			599,655	1,650
Reach 12E	595,955	1,639			595,955	1,639
Reach 13B	387,755	1,108			387,755	1,108
Reach 14A	275,755	803			275,755	803
Reach 14B	238,255	691			238,255	691
Reach 14C	177,555	510			177,555	510
Reach 15A	145,055	413			145,055	413
Reach 16A	86,770	239			86,770	239
Reach 17E	5,000	9			5,000	9
Reach 31A[3]	105,100[3]	283[3]	0[3]	0[3]	105,100[3]	283[3]

1. From the Delta to Berrenda Mesa Water District's service area.
2. These numbers apply to the reaches as set forth in Figure B-5, "Repayment Reaches and Descriptions: Project Transportation Facilities."
3. For repayment purposes, the Department will allocate cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. Kern County Water Agency will retain the right to use its original 283 cfs capacity and 105,100 AF in Reach 31A as described in Article 53 of Kern's long-term Water Supply Contract.
4. The Department will allocate cost of 24 cfs capacity and 8,059 acre-feet in Reaches 9 and 10A to Mojave Water Agency for repayment purposes and the right to use the 24 cfs of transportation capacity as described in Article 53 of Kern's long-term Water Supply Contract.
5. The amounts under columns (1) and (2) above have been reduced by the 40,670 AF and 121 cfs relinquished by Kern under Article 53(i) of the Monterey Amendment. However, Kern retains its right to use the 121 cfs of transportation capacity as described in Article 53 of Kern's long-term Water Supply Contract.

632 51131
K. CWA
[illegible]. 1A

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 27 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of March, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. This Amendment corrects typographical numerical errors in the current Table A and restores one value in Table A (Year 8, 1975) and three values in Table A-1 (Year 5, 1972, for Municipal Use; Year 7, 1974, for Agricultural Use (Coastal Aqueduct); and Year 8, 1975, for Total Annual Amount) to their correct values.

C. This Amendment is permitted by the terms of the Water Supply Contract, and except as amended herein, the provisions of the Water Supply Contract will remain in full force and effect.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's Water Supply Contract:

1. Article 6(b), Table A, Restoration

   (a) Year 8 (1975) of Table A indicated in Amendment No. 24, December 13, 1995, as 401,820, restored to correct value and amended to read 410,820.

   (b) Year 8 (1975) of Table A indicated in Amendment No. 26, January 31, 1997, as 401,820, restored to correct value and amended to read 410,820.

2. Article 45(b), Table A-1, Restoration

   (a) Year 5 (1972) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Municipal Use, 43,500, restored to correct value and amended to read 39,200.

   (b) Year 7 (1974) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Agricultural Use (Coastal Aqueduct), 53,600, restored to correct value and amended to read 52,600.

(c) Year 8 (1975) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Total Annual Amount, 401,820, restored to correct value and amended to read 410,820.

(d) Year 5 (1972) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Municipal Use, 43,500, restored to correct value and amended to read 39,200.

(e) Year 7 (1974) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Agricultural Use (Coastal Aqueduct), 53,600, restored to correct value and amended to read 52,600.

(f) Year 8 (1975) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Total Annual Amount, 401,820, restored to correct value and amended to read 410,820.

3. Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
~~8~~	~~(1975)~~	~~401,820~~
8	(1975)	**410,820**
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730

And each succeeding year thereafter, for the term of this contract as an annual entitlement: 1,087,730

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
~~5 (1972)~~	~~31,800~~	~~199,700~~	~~43,500~~	~~270,700~~
5 (1972)	31,800	199,700	**39,200**	270,700
6 (1973)	37,500	229,500	43,500	310,500
~~7 (1974)~~	~~53,600~~	~~246,400~~	~~48,000~~	~~347,000~~
7 (1974)	**52,600**	246,400	48,000	347,000
~~8 (1975)~~	~~57,000~~	~~301,120~~	~~52,700~~	~~401,820~~
8 (1975)	57,000	301,120	52,700	**410,820**
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: 1,087,730

4. Except as amended herein, the provisions of the Water Supply Contract remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

for Stephen S. Kashiwada
Director

ATTEST:

Signature

Board Secretary
Title

KERN COUNTY WATER AGENCY

Henry C. Garnett
Signature

President
Title

626.57431
KCWA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 28 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of March, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment").

C. Among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and Agency wish to set forth their agreement as to such matters as (i) the 41,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Water Supply Contract.

E. The State and Castaic Lake Water Agency ("Castaic Lake") are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 18 to Castaic Lake's Water Supply Contract between Castaic Lake and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

F. This Amendment is permitted by the terms of the Water Supply Contract, and except as amended herein, the provisions of the Water Supply Contract will remain in full force and effect.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's Water Supply Contract:

1. Article 12(c), which defines the limits on the instantaneous rate of flow to the Agency based on peaking factors, is modified to delete "three thousand eighty-six (3,086)" and replace it with "two thousand nine hundred sixty-four (2,964)."
2. Article 45(h) is added to read:

   (h) In accordance with Article 53(a) the Agency is decreasing its Table A and Table A-1 annual entitlements by 41,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract through a sale to Castaic Lake Water Agency of 41,000 acre-feet of the 130,000 acre-feet made available to Urban Contractors. As a result of this sale, Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,087,730~~
33	(2000)	**1,046,730**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,087,730~~ **1,046,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~848,030~~	~~134,600~~	~~1,087,730~~
33 (2000)	105,100	**807,030**	134,600	**1,046,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,087,730~~ **1,046,730**

The following apply to this sale:

(1) Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in the annual Statement of Charges to the Agency.

(2) All future adjustments in charges and credits of past costs associated with the 41,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 16A of the California Aqueduct shall be attributable to Castaic Lake as if Castaic Lake's annual entitlement and the related transportation capacity had been increased by the 41,000 acre-feet of annual entitlement purchased from the Agency in years prior to January 1, 2000.

(3) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates. These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing

the terms of this Amendment and in redetermination of Table B of this Water Supply Contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 18, between the State and the Castaic Lake Water Agency. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Stephen S. Kashiwada
for Director

ATTEST:

Signature

Board Secretary
Title

KERN COUNTY WATER AGENCY

Henry C. Garnett
Signature

President
Title

AMENDMENT NO. 28
EXHIBIT A

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

California Aqueduct [1]	Before Transfer		Entitlement Transferred to Castaic Lake [3] (AF) (3)	Capacity Transferred to Castaic Lake [3] (cfs) (4)	After Transfer	
	Annual Entitlement [2] (AF) (1)	Capacity [2] (cfs) (2)			Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 2A	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 2B	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 3	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 4	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 5	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 6	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 7	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 8C	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 8D	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 9	1,005,971	2,863	41,000	122	964,971	2,741
Reach 10A	959,331	2,723	41,000	122	918,331	2,601
Reach 11B	710,620	1,981	41,000	122	669,620	1,859
Reach 12D	599,655	1,650	41,000	122	558,655	1,528
Reach 12E	595,955	1,639	41,000	122	554,955	1,517
Reach 13B	387,755	1,108	41,000	122	346,755	986
Reach 14A	275,755	803	41,000	120	234,755	683
Reach 14B	238,255	691	24,683	77	213,572	614
Reach 14C	177,555	510	12,164	46	165,391	464
Reach 15A	145,055	413	9,547	39	135,508	374
Reach 16A	86,770	239	5,976	25	80,794	214
Reach 17E	5,000	9	0	0	5,000	9
Coastal Aqueduct						
Reach 31A [4]	105,100 [4]	283 [4]	0 [4]	0 [4]	105,100 [4]	283 [4]

[1] These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

[2] The amounts under columns (1) and (2) above have been reduced by the 40,670 AF and 121 cfs relinquished under Article 53(i) of the Monterey Amendment. However, the Agency retains the ability to receive deliveries through the 121 cfs as described in Article 53 of the Water Supply Contract. These amounts are from columns (1) and (2) of Revised Exhibit A to Amendment No. 26.

[3] From the Delta to Wheeler Ridge-Maricopa Water Storage District's service area.

[4] For repayment purposes, the Department allocated the cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. The Agency will retain the ability to receive deliveries through the 283 cfs and 105,100 AF in Reach 31A as described in Article 53 of the Water Supply Contract.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 29 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 29th day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contracts provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and the Agency wish to set forth their agreement as to such matters as (i) the 4,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Palmdale Water District, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 16 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred fifty-seven (2,957) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(i) is added to read:

   (i)(1) In accordance with Article 53(a) and an agreement between Belridge Water Storage District, a member unit of the Agency, and District, the Agency is decreasing its Table A and Table A-1 annual entitlements by 4,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,046,730~~
33	(2000)	**1,042,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,046,730~~ **1,042,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~807,030~~	~~134,600~~	~~1,046,730~~
33 (2000)	105,100	**803,030**	134,600	**1,042,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,046,730~~ **1,042,730**

(i)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in a revised Statement of Charges for the year 2000 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 1999 and prior years attributable to the 4,000 acre-feet of entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by District for 2000 and future years attributable to the 4,000 acre-feet of entitlement shall be paid by or credited to District.

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 16 between the State and the District. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Susan N. Weber

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

ATTEST:

Signature

Title

Date

KERN COUNTY WATER AGENCY

Signature

Board Vice-President
Title

Dec. 20, 1999
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer Annual Entitlement (AF)	Before Transfer Capacity (cfs)	Entitlement Transferred to Palmdale (c (AF)	Capacity Transferred to Palmdale (c (cfs)	After Transfer Total Annual Entitlement (AF)	After Transfer Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 2A	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 2B	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 3	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 4	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 5	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 6	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 7	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 8C	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 8D	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 9	964,971	2,741	4,000	7	960,971	2,734
Reach 10A	918,331	2,601	4,000	7	914,331	2,594
Reach 11B	669,620	1,859	4,000	7	665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	88,159	237			88,159	237

a) Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."
c) From the Delta to Belridge Water Storage District's service area

State Water Project Analysis Office
December 16, 1999

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 30 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 21st day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and Agency wish to set forth their agreement as to such matters as (i) the 7,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "Zone 7," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 19 to Zone 7's Water Supply Contract between Zone 7 and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred thirty-seven (2,937) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(j) is added to read:

(j)(1) In accordance with Article 53(a) and an agreement between Berrenda Mesa Water District, a member unit of the Agency, and Zone 7, the Agency is decreasing its Table A and Table A-1 annual entitlements by 7,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. This reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,042,730~~
33	(2000)	**1,035,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,042,730~~ **1,035,730**

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~803,030~~	~~134,600~~	~~1,042,730~~
33 (2000)	105,100	**796,030**	134,600	**1,035,730**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				~~1,042,730~~ **1,035,730**

(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in the annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 7,000 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2000, the Agency is relieved of and Zone 7 is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 7,000 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 7,000 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the

Off-Aqueduct Power Facilities Charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) All future adjustments in charges and credits of past costs associated with the 7,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 10A of the California Aqueduct and Reach 31A of the Coastal Branch shall be attributable to Zone 7 as if the Zone 7's annual entitlement and the related transportation capacity had been increased by the 7,000 acre-feet of annual entitlement purchased from the Agency in years prior to January 1, 2000.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 19, between the State and Zone 7. If either

amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Susan N. Weber

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

Board Vice-President

Title

Dec. 20, 1999

Date

ATTEST:

Signature

Title

Date

AMENDMENT NO. 30
EXHIBIT A

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer Annual Entitlement (AF)	Before Transfer Capacity (cfs)	Entitlement Transferred to Zone 7 (c (AF)	Capacity Transferred to Zone 7 (c (cfs)	After Transfer Total Annual Entitlement (AF)	After Transfer Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 2A	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 2B	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 3	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 4	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 5	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 6	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 7	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 8C	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 8D	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 9	960,971	2,734	2,257	7	958,714	2,727
Reach 10A	914,331	2,594	2,257	7	912,074	2,587
Reach 11B	665,620	1,852			665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	88,159	237	4,743	13	83,416	224

a) Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."
c) From the Delta to Berrenda Mesa Water District's service area.

State Water Project Analysis Office
December 16, 1999

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 31 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 24th day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contracts provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and the Agency wish to set forth their agreement as to such matters as (i) the 15,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 20 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred ten (2,910) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(k) is added to read:

   (k)(1) In accordance with Article 53(a) and an agreement between Lost Hills Water District, a member unit of the Agency, and Alameda County Flood Control and Water Conservation District, Zone 7, the Agency is decreasing its Table A and Table A-1 annual entitlements by 15,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,035,730~~
33	(2000)	**1,020,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,035,730~~ **1,020,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~796,030~~	~~134,600~~	~~1,035,730~~
33 (2000)	105,100	**781,030**	134,600	**1,020,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,035,730~~ **1,020,730**

(k)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in a revised Statement of Charges for the year 2000 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 1999 and prior years attributable to the 15,000 acre-feet of entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Alameda County Flood Control and Water Conservation District, Zone 7 for 2000 and future years attributable to the 15,000 acre-feet of entitlement shall be paid by or credited to Alameda County Flood Control and Water Conservation District, Zone 7 .

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 20, between the State and the District. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

David B Anderson

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

David B Anderson

Director

DEC 2 8 1999

Date

KERN COUNTY WATER AGENCY

Stephen Michael Rock

Signature

Vice President

Title

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Zone 7 (c	Capacity Transferred to Zone 7 (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 2A	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 2B	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 3	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 4	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 5	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 6	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 7	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 8C	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 8D	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 9	958,714	2,727	15,000	27	943,714	2,700
Reach 10A	912,074	2,587	15,000	27	897,074	2,560
Reach 11B	665,620	1,852			665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	224			83,416	224

a) Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."
c) From the Delta to Lost Hills Water District's service area.

State Water Project Analysis Office
December 16, 1999

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 32 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

632.51431
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8th day of December, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4^{th} 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 10,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 21 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. An environmental impact report was prepared by Belridge Water Storage District, a member unit of the Agency, in compliance with the California Environmental Quality Act and was certified on June 16, 1998. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred ninety-two (2,892) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(l) is added to read:

   (l)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 10,000 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,020,730~~
34	(2001)	**1,010,730**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,020,730~~ **1,010,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~781,030~~	~~134,600~~	~~1,020,730~~
34 (2001)	105,100	**771,030**	134,600	**1,010,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,020,730~~ **1,010,730**

(l)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 10,000 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Alameda County Flood Control and Water Conservation District, Zone 7 for 2001 and future years attributable to the 10,000 acre-feet of annual entitlement shall be paid by or credited to Alameda County Flood Control and Water Conservation District, Zone 7.

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 21, between the State and the District. If either amendment ceases to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer Annual Entitlement (AF) [1]	Before Transfer Capacity (cfs) [2]	Entitlement Transferred to Zone 7 (c (AF) [3]	Capacity Transferred to Zone 7 (c (cfs) [4]	After Transfer Total Annual Entitlement (AF) [5]	After Transfer Total Capacity (cfs) [6]
California Aqueduct						
Reach 1	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 2A	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 2B	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 3	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 4	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 5	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 6	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 7	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 8C	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 8D	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 9	943,714	2,700	10,000	18	933,714	2,682
Reach 10A	897,074	2,560	10,000	18	887,074	2,542
Reach 11B	665,620	1,852	10,000	18	655,620	1,834
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	d) 224			83,416	d) 224

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area.
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 33 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

635.51431
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8TH day of DECEMBER, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4th 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 5,756 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Solano County Water Agency, herein referred to as "Solano," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 17 to the Water Supply Contract between Solano and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. Separate environmental impact reports were prepared by Berrenda Mesa Water District and Belridge Water Storage District, member units of the Agency, in compliance with the California Environmental Quality Act and certified on February 29, 1996 and June 16, 1998, respectively. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred seventy-nine (2,879) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(m) is added to read:

   (m)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 5,756 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,010,730~~
34	(2001)	**1,004,974**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,010,730~~ **1,004,974**

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~771,030~~	~~134,600~~	~~1,010,730~~
34 (2001)	105,100	**765,274**	134,600	**1,004,974**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,010,730~~ **1,004,974**

(m)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 5,756 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2001, the Agency is relieved of and Solano is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 5,756 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 5,756 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities Charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 5,756 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Solano County Water Agency for 2001 and future years attributable to the 5,756 acre-feet of annual entitlement shall be paid by or credited to Solano County Water Agency.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 17, between the State and Solano. If either amendment ceases to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees

that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer Annual Entitlement (AF)	Before Transfer Capacity (cfs)	Entitlement Transferred to Solano (c (AF)	Capacity Transferred to Solano (c (cfs)	After Transfer Total Annual Entitlement (AF)	After Transfer Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 2A	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 2B	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 3	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 4	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 5	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 6	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 7	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 8C	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 8D	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 9	933,714	2,682	4,049	8	929,665	2,674
Reach 10A	887,074	2,542	4,049	8	883,025	2,534
Reach 11B	655,620	1,834	3,237	6	652,383	1,828
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	d) 224	1,707	d) 5	81,709	d) 219

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area (3,237 AF in Reach 11B) and to Berrenda Mesa Water District's service area (812 AF in Reaches 9 and 10A, and 1,707 AF in Reach 31A).
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 34 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

632.5143/
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8th day of December, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the 'Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4th 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 4,025 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Napa County Flood Control and Water Conservation District, herein referred to as the "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 21 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. Separate environmental impact reports were prepared by Berrenda Mesa Water District and Belridge Water Storage District, member units of the Agency, in compliance with the California Environmental Quality Act and certified on February 29, 1996 and June 16, 1998, respectively. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred seventy (2,870) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(n) is added to read:

   (n)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 4,025 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,004,974~~
34	(2001)	**1,000,949**

And each succeeding year thereafter, for the term of this contract as an annual entitlement: ~~1,004,974~~ **1,000,949**

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~765,274~~	~~134,600~~	~~1,004,974~~
34 (2001)	105,100	**761,249**	134,600	**1,000,949**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,004,974~~ **1,000,949**

3. (n)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 4,025 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2001, the Agency is relieved of and the District is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 4,025 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 4,025 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities Charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 4,025 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Napa County Flood Control and Water Conservation District for 2001 and future years attributable to the 4,025 acre-feet of annual entitlement shall be paid by or credited to Napa County Flood Control and Water Conservation District.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

4. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 21, between the State and the District. If either amendment ceases

to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

5. This Amendment shall not be used as precedent.
6. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer Annual Entitlement (AF)	Before Transfer Capacity (cfs)	Entitlement Transferred to Napa (c (AF)	Capacity Transferred to Napa (c (cfs)	After Transfer Total Annual Entitlement (AF)	After Transfer Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 2A	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 2B	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 3	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 4	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 5	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 6	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 7	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 8C	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 8D	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 9	929,665	2,674	2,831	6	926,834	2,668
Reach 10A	883,025	2,534	2,831	6	880,194	2,528
Reach 11B	652,383	1,828	2,263	4	650,120	1,824
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	81,709	d) 219	1,194	d) 3	80,515	d) 216

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area (2,263 AF in Reach 11B) and to Berrenda Mesa Water District's service area (568 AF in Reaches 9 and 10A, and 1,194 AF in Reach 31A).
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

JT, 22

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 35 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

This Amendment is made this 28th day of May, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, hereinafter referred to as the "State," and Kern County Water Agency, hereinafter referred to as the "Agency."

RECITALS

A. The State and the Agency entered into and subsequently amended a water supply contract (the "contract") providing that the State shall supply certain quantities of water to the Agency and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payments.

B. On December 1, 1994, the State and representatives of certain State Water Project contractors executed a document entitled "Monterey Agreement – Statement of Principles – By The State Water Contractors And The State Of

California Department Of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement").

C. The State, the Central Coast Water Authority ("CCWA") and those contractors intending to be subject to the Monterey Agreement subsequently negotiated an amendment to their contracts to implement provisions of the Monterey Agreement, and such amendment was named the "Monterey Amendment."

D. In October 1995, an environmental impact report ("EIR") for the Monterey Amendment was completed and certified by CCWA as the lead agency, and thereafter the Agency and the State executed the Monterey Amendment.

E. The EIR certified by the CCWA was challenged by several parties (the "Plaintiffs") in the Sacramento County Superior Court and thereafter in the Third District Court of Appeal, resulting in a decision in Planning and Conservation League, et al. v. Department of Water Resources, 83 Cal.App.4th 892 (2000), which case is hereinafter referred to as "PCL v. DWR."

F. In its decision, the Court of Appeal held that (i) the Department of Water Resources ("DWR"), not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the State Water Project contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to certain lands to Kern County

Water Agency (the "Validation Cause of Action") and execution of amended State Water Project contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause of Action; (2) issue a writ of mandate vacating the certification of the EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA.

G. The State, the contractors, and the Plaintiffs in PCL v. DWR reached an agreement to settle PCL v. DWR, as documented by that certain Settlement Agreement dated MAY 05 2003, 2003 (the "Settlement Agreement"), and in such Settlement Agreement have agreed that the contracts should be amended, for clarification purposes, to delete terms such as "annual entitlement" and "maximum annual entitlement" so that the public, and particularly land use planning agencies, will better understand the contracts.

H. Pursuant to the Settlement Agreement, the State and the Agency desire to so amend the Agency's contract, with the understanding and intent that the amendments herein with respect to subsections (k), (l), and (m) of Article 1, subsection (b) of Article 6, and subsection (a) of Article 16, and to Table A of the Agency's contract are solely for clarification purposes and that such amendments are not intended to and do not in any way change the rights, obligations or limitations on liability of the State or the Agency established by or set forth in the contract.

I. Pursuant to the Settlement Agreement, the State, the contractors and the Plaintiffs in PCL v. DWR also agreed that the contracts should be amended to include a new Article 58 addressing the determination of dependable annual supply of State Water Project water to be made available by existing Project facilities, and the State and Agency desire to so amend the Agency's contract.

NOW THEREFORE, IT IS MUTUALLY AGREED, as follows:

1. Article 1(l) is amended to read:

(l) Annual Table A Amount

"Annual Table A Amount" shall mean the amount of project water set forth in Table A of this contract that the State, pursuant to the obligations of this contract and applicable law, makes available for delivery to the Agency at the delivery structures provided for the Agency. The term Annual Table A Amount shall not be interpreted to mean that in each year the State will be able to make that quantity of project water available to the Agency. The Annual Table A Amounts and the terms of this contract reflect an expectation that under certain conditions the Agency will receive its full Annual Table A Amount; but that under other conditions only a lesser amount, allocated in accordance with this contract, may be made available to the Agency. This recognition that full Annual Table A Amounts will not be deliverable under all conditions does not change the obligations of the State under this contract, including but not limited to, the obligations to make all reasonable efforts to complete the project facilities, to perfect and protect water rights, and to allocate among contractors the supply available in any year, as set forth in Articles 6(b), 6(c), 16(b) and 18, in the manner and subject to the terms and conditions of those articles and this contract. Where the term "annual entitlement" appears elsewhere in this contract, it shall mean "Annual Table A Amount." The State agrees that in future amendments to this and other contractor's contracts, in lieu of the term "annual entitlement," the term "Annual Table A Amount" will be used and will have the same meaning as "annual entitlement" wherever that term is used.

2. Article 1(m) is amended to read:

(m) Maximum Annual Table A Amount

"Maximum annual entitlement" shall mean the maximum annual amounts set forth in Table A of this contract, and where the term "maximum annual entitlement" appears elsewhere in this contract it shall mean "Maximum Annual Table A Amounts."

3. Article 1(k) is amended to read:

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available assuming completion of the initial project conservation facilities and additional project conservation facilities. The project's capability of providing the minimum project yield shall be determined by the State on the basis of coordinated operations studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon factors including but not limited to: (1) the estimated relative proportion of deliveries for agricultural use to deliveries for municipal use assuming Maximum Annual Table A Amounts for all contractors and the characteristic distributions of demands for these two uses throughout the year; and (2) agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the division of utilization of waters of the Delta or streams tributary thereto.

4. Article 6(b) is amended to read:

(b) Agency's Annual Table A Amounts

Commencing with the year of initial water delivery to the Agency, the State each year shall make available for delivery to the Agency the amounts of project water designated in Table A of this contract, which amounts shall be subject to change as provided for in Article 7(a) and are referred to in this contract as the Agency's Annual Table A Amounts.

5. Article 16(a) is amended to read:

(a) Limit on Total of all Maximum Annual Table A Amounts

The Agency's Maximum Annual Table A Amount hereunder, together with the maximum Table A amounts of all other contractors, shall aggregate no more than 4,185,000 acre-feet of project water.

6. Article 57 is intentionally left blank for future use.

7. Article 58 is added to read:

58. Determination of Dependable Annual Supply of Project Water to be Made Available by Existing Project Facilities.

In order to provide current information regarding the delivery capability of existing project conservation facilities, commencing in 2003 and every two years thereafter the State shall prepare and mail a report to all contractors, and all California city, county, and regional planning departments and agencies within the contractors' project service areas. This report will set forth, under a range of hydrologic conditions, estimates of overall delivery capability of the existing project facilities and of supply availability to each contractor in accordance with other provisions of the contractors' contracts. The range of hydrologic conditions shall include the delivery capability in the driest year of record, the average over the historic extended dry cycle and the average over the long-term. The biennial report will also include, for each of the ten years immediately preceding the report, the total amount of project water delivered to all contractors and the amount of project water delivered to each contractor.

8. Add the following language at the bottom of Table A:

In any year, the amounts designated in this Table A shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

9. Add the following language at the bottom of Table A-1:

In any year, the amounts designated in this Table A-1 shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

10. Except for Article 58, the changes made by this amendment are solely for clarification purposes, and are not intended to nor do they in any way change the rights, obligations or limitations on liability of the State or the Agency established by or set forth in the contract, and this amendment shall be interpreted in accordance with this intent.

11. At the time of execution of this Agreement and thereafter, the effectiveness of this Amendment is dependent upon the effectiveness of the Agency's Monterey Amendment (all provisions therein) and the Kern Fan Element Transaction.

IN WITNESS WHEREOF, the parties hereto have executed this amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER
RESOURCES

Director

KERN COUNTY WATER AGENCY

Name

President

Title

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 36 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of October, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency," and collectively herein referred to as "Parties."

RECITALS:

A. The Parties have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The Parties wish to set forth their agreement as to such matters as (i) the 2,219 acre-feet per year decrease in the Agency's annual Table A amounts,

(ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract. "Table A amounts" shall mean the amount of project water set forth in Table A of the Agency's Water Supply Contract, which the State makes available for delivery to the Agency at the delivery structures provided for the Agency.

C. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as the "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 25 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A amounts described herein, (ii) the transfer of related transportation repayment obligations, (iii) the delivery priority for the permanently transferred Table A amounts, and (iv) the revision of proportionate use of facilities factors.

D. An Initial Study and Negative Declaration was prepared by the District, as lead agency, in compliance with the California Environmental Quality Act and certified on November 20, 2002. It concluded that no significant impacts on the environment will result from this transfer. The Director of the Department of Water Resources, acting as a responsible agency, has reviewed and considered the Initial Study and Negative Declaration prepared by the District prior to approving this agreement.

E. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized Table A amounts from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

F. The State has further concluded that this transfer is operationally feasible, will not impair the security of its bondholders, and provides for full repayment of transportation costs.

NOW, THEREFORE, the Parties agree:

1. Article 12(c) is revised to read as follows:

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred sixty-six (2,866) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(o) is added to read:

In accordance with Article 41, the Agency is decreasing its annual Table A amounts by 2,219 acre-feet beginning in year 2004 and each succeeding year thereafter for the term of the contract. As a result of this reduction, Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL AMOUNTS
KERN COUNTY WATER AGENCY

Year	(acre-feet)
1 (1968)	46,600
2 (1969)	95,700
3 (1970)	145,100
4 (1971)	190,300
5 (1972)	270,700
6 (1973)	310,500
7 (1974)	347,000
8 (1975)	410,820
9 (1976)	442,150
10 (1977)	483,600
11 (1978)	534,300
12 (1979)	583,900
13 (1980)	634,500
14 (1981)	691,400
15 (1982)	745,300
16 (1983)	805,100
17 (1984)	860,600
18 (1985)	915,000
19 (1986)	933,646
20 (1987)	1,023,500
21 (1988)	1,074,600
22 (1989)	1,112,300
23 (1990)	1,153,400
24 (1991)	1,153,400
25 (1992)	1,153,400
26 (1993)	1,153,400
27 (1994)	1,153,400
28 (1995)	1,153,400
29 (1996)	1,117,060
30 (1997)	1,112,730
31 (1998)	1,087,730
32 (1999)	1,087,730
33 (2000)	1,020,730
34 (2001)	1,000,949
35 (2002)	1,000,949
36 (2003)	1,000,949
~~37 (2004)~~	~~1,000,949~~
37 (2004)	**998,730**
And each succeeding year thereafter, for the term of this contract:	**998,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL TABLE A AMOUNTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amounts
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
34 (2001)	105,100	761,249	134,600	1,000,949
35 (2002)	105,100	761,249	134,600	1,000,949
36 (2003)	105,100	761,249	134,600	1,000,949
~~37 (2004)~~	~~105,100~~	~~761,249~~	~~134,600~~	~~1,000,949~~
37 (2004)	105,100	759,030	134,600	998,730

And each succeeding year thereafter,
for the term of this contract as an annual Table A amounts: **998,730**

3. Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual Table A amounts for agricultural use for the year 2004 and each year thereafter shall commence January 1, 2004, and be identified by the State and included in a revised Statement of Charges for the year 2004 and in future annual Statement of Charges to the Agency.

4. Any over and under adjustments to payments made by the Agency for 2003 and prior years attributable to the 2,219 acre-feet of annual Table A amounts shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by the District for 2004 and future years attributable to the 2,219 acre-feet of annual Table A amounts shall be paid by or credited to the District.

5. For cost allocation and repayment purposes, Exhibit A attached hereto shows Table A amounts and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

6. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 25, between the State and the District. If either amendment ceases

to be effective for any reason, the Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

7. DWR agrees to consider the applicability of Article 53(a) to this transfer on or before January 1, 2011, or earlier if any State Water Contractor seeks to enforce Agency's responsibilities under that article.

8. The Agency agrees to indemnify, defend, and hold harmless the State and any of its officers, agents, or employees from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising from or related to this Amendment and associated agreements.

9. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

10. This amendment shall not be used as precedent.

IN WITNESS WHEREOF, the Parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

for Director

KERN COUNTY WATER AGENCY

Signature

President
Title

September 24, 2003
Date

EXHIBIT A

KERN COUNTY WATER AGENCY
ANNUAL TABLE A AMOUNTS AND CAPACITY VALUES FOR EACH REACH a) FOR COST ALLOCATION AND REPAYMENT PURPOSES

The values related to this transfer are estimated to be as follows:

	Before Transfer		Table A	Flow	After Transfer	
Repayment Reach **b)**	Table A Capacity (AF)	Flow Capacity (cfs)	Transferred to Zone 7 **c)** (AF)	Capacity Transferred to Zone 7 **c)** (cfs)	Total Table A Capacity (AF)	Total Flow Capacity (cfs)
California Aqueduct						
Reach 1	1,000,949	2,870	2,219	4	998,730	2,866
Reach 2A	1,000,949	2,870	2,219	4	998,730	2,866
Reach 2B	1,000,949	2,870	2,219	4	998,730	2,866
Reach 3	1,000,949	2,870	2,219	4	998,730	2,866
Reach 4	1,000,949	2,870	2,219	4	998,730	2,866
Reach 5	1,000,949	2,870	2,219	4	998,730	2,866
Reach 6	1,000,949	2,870	2,219	4	998,730	2,866
Reach 7	1,000,949	2,870	2,219	4	998,730	2,866
Reach 8C	1,000,949	2,870	2,219	4	998,730	2,866
Reach 8D	1,000,949	2,870	2,219	4	998,730	2,866
Reach 9	926,834	2,668	2,219	4	924,615	2,664
Reach 10A	880,194	2,528	2,219	4	877,975	2,524
Reach 11B	650,120	1,824	2,219	4	647,901	1,820
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Reach 31A	80,515	**d)** 216			80,515	**d)** 216

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.

b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

c) From the Delta to Belridge Water Storage District's service area.

d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right to use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project
Analysis Office: 12/9/2002

D. SETTLEMENT AGREEMENT

SETTLEMENT AGREEMENT

by and among

Planning and Conservation League, Plumas County Flood Control and Water Conservation District, Citizens Planning Association of Santa Barbara County, Inc.

and

The State of California Department of Water Resources, Central Coast Water Authority, Kern Water Bank Authority and those State Water Project Contractors identified herein.

MAY 0 5 2003
_________________, 2003

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LIST OF ATTACHMENTS AND EXHIBITS

Attachments

Attachment A	Amendment to SWP Contract
Attachment B	Principles Regarding State Water Project Reliability
Attachment C	Transfer Guidelines for Annual Table A Amounts
Attachment D	Principles Regarding Public Participation in SWP Contract Negotiations
Attachment E	Final Permanent Table A Amount Transfers from KCWA Subsequent to the Monterey Amendments

Exhibits

Exhibit 1	Plaintiffs' Expenses Trust Account Agreement
Exhibit 2	Kern Environmental Permits
Exhibit 3-A	Proposed 21168.9 Order
Exhibit 3-B	Proposed Writ of Mandate
Exhibit 4	Section VI Trust Account Agreement

SETTLEMENT AGREEMENT

This SETTLEMENT AGREEMENT is entered into as of MAY 0 5 2003, 2003, by and among Planning and Conservation League, Plumas County Flood Control and Water Conservation District, Citizens Planning Association of Santa Barbara County, Inc., The State of California Department of Water Resources, Central Coast Water Authority, Kern Water Bank Authority and those SWP Contractors who have executed this Settlement Agreement. Certain terms used herein are defined in Section I.

RECITALS

WHEREAS, in 1951, the State of California Legislature authorized the construction of the State Water Project ("**SWP**");

WHEREAS, eight years later, the Legislature authorized the submission for voter approval of a general obligation bond issue to build the SWP, which voters subsequently approved (California Water Code, Section 12930 et seq.);

WHEREAS, commencing in the early 1960's, DWR, as operator of the SWP, entered into certain SWP Contracts with various water districts throughout California;

WHEREAS, in 1994, as a result of disputes arising from water shortages experienced during an extended drought period, DWR and certain of the SWP Contractors entered into an agreement known as the Monterey Agreement and thereafter implemented the terms of the Monterey Agreement by execution of the so-called Monterey Amendments;

WHEREAS, pursuant to CEQA, the environmental impact report for the Monterey Amendments was prepared in 1995 by CCWA as "lead agency," and adopted by DWR as "responsible agency" (as those terms are defined in CEQA) (the "**1995 EIR**");

WHEREAS, on December 27, 1995, PCL filed the PCL Complaint against DWR and CCWA challenging the sufficiency of the 1995 EIR;

WHEREAS, on February 12, 1996, Plaintiffs filed a First Amended Complaint adding the Validation Cause of Action;

WHEREAS, the trial court ultimately determined that although CCWA was not the appropriate lead agency for the 1995 EIR, such designation of CCWA was not fatal to the EIR, and ruled against Plaintiffs with respect to their challenge to the sufficiency of the 1995 EIR. The trial court also granted summary adjudication in favor of DWR and CCWA on the Validation Cause of Action. Plaintiffs appealed the trial court's rulings;

WHEREAS, in <u>Planning and Conservation League v. Department of Water Resources</u>, 83 Cal. App. 4th 892 (2000), the Court of Appeal held that (i) DWR, not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the SWP Contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to the KWB Lands (the Validation Cause of Action) and execution of amended SWP Contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause of Action; (2) issue a writ of mandate vacating the certification of the 1995 EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA;

WHEREAS, since the Court of Appeal ruling, representatives of the Parties to this Settlement Agreement have engaged in extensive settlement negotiations, mediated by retired Judge Daniel Weinstein, with the intent of avoiding further litigation and associated fees and providing for an effective way to cooperate in the preparation of a new environmental impact report and make such other improvements in the operation and responsiveness of the SWP as set forth in this Settlement Agreement;

WHEREAS, on July 22, 2002, an agreement was reached regarding the principles for a settlement; and

WHEREAS, the Parties now desire to formally enter into this Settlement Agreement.

AGREEMENT

NOW, THEREFORE, in exchange for the following covenants and agreements and other valuable and sufficient consideration, the receipt of which is acknowledged, the Parties agree as follows:

I. **Definitions**. Certain terms, as used in this Settlement Agreement, are defined as follows.

A. **"Attachment A Amendments"** means those amendments in the substantive form of Attachment A hereto (conformed to the format of each individual SWP Contract and the parties thereto), to be executed by DWR and the SWP Contractors who are signatories to this Settlement Agreement pursuant to and in accordance with the terms and conditions of this Settlement Agreement.

B. **"Attachment B Principles"** means those principles set forth in Attachment B hereto regarding SWP reliability.

C. **"Attachment C Guidelines"** means the guidelines set forth in Attachment C hereto regarding review of proposed permanent transfers of Annual Table A Amounts (as such latter term is used in the SWP Contracts).

D. **"Attachment D Principles"** means those principles set forth in Attachment D hereto regarding public participation in SWP Contract negotiations.

E. **"Attachment E Transfers"** means those water transfers identified on Attachment E hereto.

F. **"CEQA"** means the California Environmental Quality Act, California Public Resources Code Section 21000 et seq.

G. **"Citizens Planning Association"** means Citizens Planning Association of Santa Barbara County, Inc.

H. **"CCWA"** means Central Coast Water Authority.

I. **"Consent to Entry of Order Discharging Writ"** has the meaning given in Section VII(H)(1).

J. **"DWR"** means The State of California Department of Water Resources.

K. **"EIR Committee"** means a committee of no more than four (4) SWP Contractor representatives, and no more than four (4) Plaintiff representatives, chaired by a DWR representative, which has been formed for the purposes set forth in Section III(B).

L. **"HCP"** means the Habitat Conservation Plan/Natural Community Conservation Plan prepared for the Kern Water Bank Authority and approved through an Implementation Agreement dated October 2, 1997, with the United States Fish and Wildlife Service and California Department of Fish and Game.

M. **"Interim Implementation Order"** has the meaning given in Section VII(C).

N. **"JAMS Trust Account"** means the account established by DWR with, and maintained by, the Mediator for the purpose set forth in Section VI.

O. **"Kern-Castaic Transfer"** means the transfer of 41,000 acre-feet of water from Kern County Water Agency to the Castaic Lake Water Agency approved by DWR on March 31, 1999.

P. **"Kern Environmental Permits"** means the HCP and certain other permits, approvals and agreements relating to the Kern Water Bank, as set forth in and contemplated by the Addendum to the 1995 EIR, including those specified in Exhibit 2 hereto and similar, related permits, approvals and agreements.

Q. **"Kern Fan Element Transaction"** means DWR's transfer of the KWB Lands to Kern County Water Agency, as described in Article 52 of the Monterey

Amendments. Kern County Water Agency subsequently conveyed the KWB Lands to KWBA. Each of the stated conveyances occurred on August 9, 1996, based upon separate agreements dated December 13, 1995.

R. **"KWB Lands"** means the property known as the Kern Fan Element, as more specifically described in that certain Deed, executed by the Kern County Water Agency in favor of KWBA, dated August 9, 1996, and recorded in the Official Records of Kern County as Instrument No. 0196101606.

S. **"KWBA"** means Kern Water Bank Authority.

T. **"Mediator"** means retired Judge Daniel Weinstein, unless Judge Weinstein is unavailable, in which case the Mediator shall be another retired jurist mutually agreed to by DWR and the other members of the EIR Committee with respect to matters referred to the Mediator under Section III(H), and for all other matters another retired jurist approved by agreement of the Parties.

U. **"Mediation Issue"** means any issue relating exclusively to the compliance of the New EIR with any of the following requirements: (a) the requirements of CEQA; (b) the direction of the courts in the underlying litigation; or (c) the terms and conditions of this Settlement Agreement.

V. **"Monterey Agreement"** means the formal agreement, dated as of December 1, 1994, by and among DWR and certain SWP Contractors that memorializes fourteen principles to address the distribution of water during shortages and various other issues under the SWP Contracts.

W. **"Monterey Amendment"** means the amendment to the SWP Contracts entered into by DWR and certain SWP Contractors for purposes of implementing the Monterey Agreement.

X. **"New EIR"** has the meaning given in Section III.

Y. **"Party"** and "**Parties**" mean the signatories, individually and collectively, to this Settlement Agreement.

Z. **"PCL"** means Planning and Conservation League.

AA. **"PCL Complaint"** means the Complaint for Declaratory and Injunctive Relief and Petition for Writ of Mandate filed December 27, 1995, by PCL in the Superior Court, as amended and supplemented by the First Amended Complaint filed February 12, 1996.

BB. **"Plaintiffs"** means PCL, Citizens Planning Association and Plumas.

CC. **"Plaintiffs' Expenses Trust Account"** means the account maintained by JAMS for the purposes set forth in Section III(G).

DD. **"Plumas"** means Plumas County Flood Control and Water Conservation District.

EE. **"Plumas Amendment"** means an amendment to the Plumas SWP Contract to be entered into by DWR and Plumas pursuant to Section IV(C).

FF. **"Plumas Arrearages"** means any amount owed by Plumas to DWR under its SWP Contract that accrued prior to the resumption of payments by Plumas under Section IV(F).

GG. **"Return to Writ"** has the meaning given in Section VII(G).

HH. **"Rossmann"** means the Law Offices of Antonio Rossmann.

II. **"Section VI Trust Account Agreement"** means a trust account agreement regarding the disbursement by JAMS to Plaintiffs of those funds delivered by DWR pursuant to Section VI of this Settlement Agreement, the form of which agreement is attached hereto as Exhibit 4.

JJ. **"Superior Court"** means the Superior Court of the State of California, County of Sacramento.

KK. **"SWP"** means the State Water Project, officially called the State Water Resources Development System, as defined in Water Code Section 12931.

LL. **"SWP Contracts"** means those long-term contracts entered into by and between DWR, as the operator of the SWP, and individual SWP Contractors for the delivery of water from the SWP.

MM. **"SWP Contractors"** for purposes of this Settlement Agreement, means those contracting agencies identified in Table 1-6 of the DWR Bulletin 132-00, dated December 2001. All references to "SWP Contractors who are parties to this Settlement Agreement" are meant to exclude Plumas. Specific issues relating to Plumas are addressed in Section IV.

NN. **"Validation Cause of Action"** means the fifth cause of action of the PCL Complaint.

OO. **"Watershed Forum"** means a newly formed stakeholder group consisting of one or more representatives from each of Plumas, local community-based groups, DWR and the SWP Contractors who are parties to this Settlement Agreement, established for the purposes set forth in Section IV(B).

PP. **"Watershed Programs"** means programs, studies or projects approved by the Watershed Forum and implemented in pursuit of the goals set forth in Section IV, and other such activities approved by the Watershed Forum that are consistent with such purposes and goals.

QQ. **"1995 EIR"** means the Final Programmatic Environmental Impact Report for the Implementation of the Monterey Agreement Statement of Principles by State Water Project Contractors and the State of California Department of Water Resources for Potential Amendments to State Water Supply Contracts, prepared in October, 1995 by CCWA, as lead agency, and reviewed and considered in December 1995, by DWR, as a responsible agency, as each of those terms is defined in CEQA.

II. Administration of the State Water Project Pending New Environmental Impact Report and Discharge of Writ of Mandate.

Pending the Superior Court's issuance of an order discharging the writ of mandate in the underlying litigation, the Parties will jointly request that the Superior Court enter an order approving this Settlement Agreement, and an order, pursuant to California Public Resources Code Section 21168.9, authorizing on an interim basis the administration and operation of the SWP and the Kern Water Bank in accordance with the Monterey Amendments, the terms of this Settlement Agreement and the Attachment A Amendments, as more specifically set forth in Section VII of this Settlement Agreement.

III. New Environmental Impact Report

A. Preparation. As lead agency (as defined in CEQA), DWR shall cause a new environmental impact report to be prepared with respect to the proposed "project" (as that term is defined in Public Resources Code Section 21065 and Section

15378 of the CEQA Guidelines), in accordance with and as further described in Section III(C) below (the "**New EIR**").

B. EIR Committee. To effectuate the desire of the Parties that the New EIR be the product of a cooperative effort and comply with the requirements of CEQA and the direction of the courts in the underlying litigation, the EIR Committee has been formed to provide advice and recommendations to DWR in connection with the preparation of the draft and final versions of the New EIR.

C. New EIR Content. The proposed project to be analyzed in the New EIR will be specifically defined during the scoping process. Under all circumstances, in order to provide DWR, the responsible agencies, and the public with adequate disclosure to consider the potential environmental impacts of the Monterey Amendments, and the additional actions set forth in this Settlement Agreement, the environmental analysis in the New EIR shall evaluate, as components of the proposed project, the Monterey Amendments (including the provisions relating to the transfer of the KWB Lands) and the Attachment A Amendments. DWR shall ensure that the New EIR evaluates all proposed actions that are necessary to implement this Settlement Agreement. The New EIR shall include the following:

1. Information on water deliveries of the SWP over the relevant historical period (at least 1991 -2002), as well as data regarding the deliveries in the last extended drought (1987-1992), to be included in the description of the setting and the background for the proposed project;

2. As part of the CEQA-mandated "no-project" alternative analysis, and in light of the Court of Appeal's opinion, an analysis of the effect of pre-

Monterey Amendment SWP Contracts, including implementation of Article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of Article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts;

3. Analysis of the potential environmental impacts of changes in SWP operations and deliveries resulting from implementation of the proposed project. If the proposed project results in modifications to the water sources relied upon for the SWP, those sources will be identified and the resulting environmental effects will be assessed;

4. Analysis of the potential environmental effects relating to (a) the Attachment E Transfers and (b) the Kern-Castaic Transfer, in each case as actions that relate to the potential environmental impacts of approving the Monterey Amendments; and

5. Analysis of the potential environmental effects relating to the implementation of this Settlement Agreement, including:

   a. Evaluation of the potential environmental impacts arising from the payments to Plumas as described in <u>Section IV</u>; and

   b. Analysis of the potential environmental effects relating to implementation of the provisions of this Settlement Agreement relating to the Kern Water Bank as discussed in <u>Section V</u>.

D. Acknowledgement and Agreement Regarding Attachment E Transfers. With respect to Section III(C)(4)(a), notwithstanding the analysis of the potential impacts of the Attachment E Transfers in the New EIR and without specifically endorsing or opposing those transfers or any prior environmental assessments of them, the Parties recognize that such water transfers are final. Each of the Parties agrees not to, and it shall be a condition to the initial and continuing effectiveness of this Settlement Agreement that Plaintiffs do not, hereafter challenge the effectiveness or validity of such water transfers.

E. Acknowledgement and Agreement Regarding Kern-Castaic Transfer. With respect to Section III(C)(4)(b) regarding the Kern-Castaic Transfer, the Parties recognize that such water transfer is subject to pending litigation in the Los Angeles County Superior Court following remand from the Second District Court of Appeal (*See* Friends of the Santa Clara River v. Castaic Lake Water Agency, 95 Cal. App. 4^{th} 1373, 116 Cal. Rptr. 2d 54 (2002); *review denied* April 17, 2002). The Parties agree that jurisdiction with respect to that litigation should remain in that court and that nothing in this Settlement Agreement is intended to predispose the remedies or other actions that may occur in that pending litigation.

F. Acknowledgement and Agreement Regarding Kern Water Bank. With respect to Section III(C)(5)(b) relating to the Kern Water Bank, the Parties acknowledge that the Kern Water Bank is currently operating under the Kern Environmental Permits, which were entered into based on an Addendum to the 1995 EIR. The Parties recognize that the Addendum has been completed and agree not to challenge it in any manner. KWBA agrees that it will not rely on the Addendum to the 1995 EIR for any new KWBA project to the extent that such reliance is based on data or analysis incorporated into the Addendum from the 1995 EIR. In addition, the New EIR shall include an independent study by DWR, as the lead agency, and the exercise of its judgment regarding the impacts related to the transfer, development, and operation of the Kern Water Bank in light of the Kern Environmental Permits. Such study shall identify SWP and any non-SWP sources of water deliveries to the Kern Water Bank. The views of the trustee agencies, as evidenced by the requirements of the HCP, will be used to provide guidance to DWR. Finally, the Parties agree that this Settlement Agreement is not intended to and shall not affect the continuing effectiveness of the Kern Environmental Permits.

G. Reimbursement of Plaintiffs' Expenses for Participation in the Preparation of New EIR .

1. *DWR Obligation to Reimburse Plaintiffs.* Subject to and in accordance with clauses (2) and (3), DWR will provide up to $300,000 to Plaintiffs for expenses actually incurred as needed to support Plaintiffs' participation in DWR's preparation of the New EIR, including service on the EIR Committee.

2. *Deposit into Trust Account.* The Parties acknowledge that in accordance with the principles of settlement, DWR caused to be deposited $300,000 into the Plaintiffs' Expenses Trust Account at JAMS on August 22, 2002.

3. *Disbursement of Funds to Plaintiffs.* Funds provided by DWR under this Section III(G) are available for disbursement and will be disbursed to

Plaintiffs by JAMS from the Plaintiffs' Expenses Trust Account in accordance with that certain Plaintiff's Expenses Trust Account Agreement dated August 15, 2002, attached hereto as Exhibit 1 and incorporated herein by this reference.

H. Disputes Regarding Mediation Issues.

1. *Referral to Director of DWR*. If the Plaintiffs' or SWP Contractors' representatives on the EIR Committee, or both, disagree with DWR's proposed approach with respect to a Mediation Issue, such representatives may refer the issue in writing to the Director of DWR.

2. *Referral to Mediator*. If (a) two-thirds of Plaintiffs' representatives or (b) three-fourths of the SWP Contractors' representatives, or both, disagree with the DWR Director's written decision with respect to a Mediation Issue (which issue shall have first been referred to the Director pursuant to Section III(H)(1)), such representative(s) may refer the issue in writing for consideration to the Mediator.

3. *Notices to Other Parties*. DWR shall inform the Parties to this Settlement Agreement of any referrals made pursuant to this Section III(H).

4. *Advisory Opinion by Mediator*. In the event of a referral as described above, the Mediator will consider the views of the representatives of the EIR Committee and the DWR Director, and will provide a written advisory opinion on the issue to the EIR Committee and DWR Director.

5. *Final Decision by DWR*. After receipt of an advisory opinion from the Mediator, the DWR Director shall make a final decision on the issue.

6. *Mediator's Costs and Expenses*.

a. *Referrals by Plaintiffs' Representatives*. On any matter referred to the Mediator by Plaintiffs' representatives on the EIR Committee, the costs of the Mediator's services will be borne one-third (1/3) by the Plaintiffs and two-thirds (2/3) by DWR.

b. *Referrals by SWP Contractors' Representatives*. For any referral by the SWP Contractors who are representatives on the EIR Committee, the SWP Contractors who are signatory to this Settlement Agreement will compensate the Mediator for his services.

c. *Frivolous or Harassing Referrals*. In the event of frivolous or harassing matters referred to him/her, the Mediator shall have the authority to award costs to the prevailing party, as well as reasonable attorney fees in accordance with Section IX of this Settlement Agreement.

I. Filing of New EIR upon Completion. Upon completion of the New EIR, in accordance with the procedure set forth in CEQA, and after final consideration by and good faith consultation with the EIR Committee, DWR shall cause the New EIR to be filed with the Superior Court as a return to the writ of mandate issued by such court in connection with this case.

IV. **Plumas Matters.**

A. Monetary Settlement.

1. *Agreement to Pay*. In accordance with the procedures and subject to the conditions described herein, DWR shall pay to Plumas the sum of $8,000,000.

2. *Schedule of Payments*.

a. *Annual Payments*. A total sum of Four Million Dollars ($4,000,000) shall be paid in accordance with this Section IV(A)(2)(a). DWR shall pay to Plumas One Million Dollars ($1,000,000) within 30 days after approval of this Settlement Agreement by the Superior Court (or the first business day after said 30th day if the 30th day is not a business day).
On each anniversary date of the first $1,000,000 payment until (and inclusive of) the third (3rd) anniversary, DWR shall pay to Plumas One Million Dollars ($1,000,000).

b. *Post Notice-of-Determination Payments*. Subject to Section IV(A)(2)(c), the remaining Four Million Dollars ($4,000,000) shall be paid in four annual installments of $1,000,000 each, beginning on the later to occur of: (1) the date that is seventy days after the Notice of Determination (as defined in CEQA) has been filed for the New EIR (or the first business day after said 70th day if the 70th day is not a business day); or (2) the date that is one year after the last payment made under Section IV(A)(2)(a).

c. *Effects of Litigation on Payment Obligation.*

(1) Suspension of Payment Obligation. If litigation is commenced by anyone challenging CEQA compliance for, or the validity of, any Monterey Amendment (or any portion thereof), including matters pertaining to the Kern Fan Element Transaction, the monetary obligations of DWR under Section IV(A)(2)(b) shall be suspended until the date that is forty-five (45) days after final conclusion of that litigation (without further right of appeal) in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. Within thirty (30) days after final conclusion of any such litigation in said manner, DWR shall pay to Plumas any amounts then owed by DWR under this Section IV.

(2) Termination of Payment Obligation. If any such litigation results in a final judgment (without further right of appeal) that invalidates any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, the obligation for payments under Section IV(A)(2)(b) shall automatically terminate.

3. *Use of Funds*.

a. *Funding of Watershed Programs*. Plumas shall apply a majority of all funds received each year pursuant to Section IV(A) to Watershed Programs.

b. *Balance of Funds to General Purposes*. Plumas may apply the balance of funds received each year to other district-related purposes, as determined by Plumas with due consideration for the needs of the Watershed Forum.

c. *Annual Carry-Over*. Funds received but not spent in any given year may be carried over to the succeeding year(s), provided, however, that any such funds shall continue to be subject to the restrictions under Sections IV(A)(3)(a) and (b).

B. Watershed Forum and Programs.

1. *Formation of Watershed Forum*. Prior to the date hereof, the Watershed Forum was formed. The Watershed Forum is locally driven but includes the active and committed participation of the SWP Contractor and DWR members of the Forum.

2. *Purpose and Goals*

a. *Generally*. The Watershed Forum's purpose is to implement watershed management and restoration activities for the mutual benefit of Plumas and the SWP. Forum activities include design of, participation in, implementation of, and review of studies and demonstration projects related to watershed restoration.

b. *Specific Goals*. The specific focus of the Watershed Forum's activities is to implement programs designed to achieve the following benefits:

(1) Improved retention (storage) of water for augmented base-flow in streams;

(2) Improved water quality (specifically, reduced sedimentation), and stream bank protection;

(3) Improved upland vegetative management; and

(4) Improved groundwater retention/storage in major aquifers.

c. *Emphasis on Feather River Watershed*. The Watershed Forum specifically promotes and encourages restoration of the Feather River watershed, with particular focus on the drainages of the three SWP Upper Feather River reservoirs. The Watershed Forum seeks to obtain funding and investments in the Feather River watershed in order to facilitate programs that will generate significant local environmental and water supply benefits.

d. *Technical Advisors*. The Watershed Forum will retain a committee of technical advisors to assist the Watershed Forum in identifying activities that can provide timely and practical benefits based on the best scientific and technical information.

3. *General Watershed Forum Issues*

a. *Cooperation*. The Watershed Forum shall seek to foster mutual cooperation and support among Plumas, DWR and other SWP Contractors in achieving local and state-wide goals.

b. *Dispute Resolution*. Any disputes between members of the Watershed Forum, or between Plumas and the Watershed Forum, with respect to Watershed Forum activities and funding will be resolved by retention of a third party neutral expert reasonably acceptable to all members of the Watershed Forum.

c. *Interruption in Funding*. If payments by DWR are interrupted due to litigation challenging any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, as set forth in Section IV(A)(2)(c), the Parties shall, depending on the success of the watershed work and the litigation situation, give due consideration to the importance of funding watershed work in consecutive years without interruption.

d. *No Limitation on DWR Obligations*. DWR's participation in the Watershed Forum shall not compromise DWR's obligation to be impartial in the distribution of matching funds from public funding sources under its jurisdiction.

C. Plumas Amendment. Upon completion of any necessary environmental review(s), DWR shall offer to Plumas the Plumas Amendment which shall include (1) DWR's agreement that water supplied to Plumas shall be determined based on availability of water supply from Lake Davis, and (2) DWR's agreement that water deliveries to Plumas will not be reduced during SWP shortages so long as sufficient water is available from Lake Davis. The Plumas Amendment shall apply only to the maximum Table A amount in Plumas' SWP Contract on the date that this Settlement Agreement is executed. The Plumas Amendment shall also contain assurances that Plumas' claim to area-of-origin rights will not be affected by the Amendment. The Plumas Amendment may also contain the Monterey Amendment, as modified to reflect current conditions relating to Plumas, and the Attachment A Amendments.

D. Dialogue between Plumas and DWR. Subject to Plumas' execution of this Settlement Agreement and compliance with the terms herein, DWR agrees to confer with Plumas to develop strategies and actions for the management, operation, and control of SWP facilities in Plumas County in order to increase water supply, recreational, and environmental benefits to Plumas from such facilities. In furtherance thereof, DWR and Plumas agree to evaluate and give due consideration to:

1. the potential re-operation of SWP facilities in Plumas County to increase the water supply available to Plumas;
2. the potential release of water from reservoirs, as part of planned operations, for Plumas' benefit; and
3. the appropriateness of certain charges in Plumas' SWP Contract in light of current circumstances and whether amendments thereto are warranted.

E. Future Relations. Upon the Superior Court's approval of this Settlement Agreement, Plumas agrees to maintain a positive relationship with the SWP Contractors and DWR, and to support the Monterey Amendments and the Attachment A Amendments. Plumas reserves the right to review critically the New EIR.

F. Contract Payments. Plumas shall resume and maintain timely payments under its SWP Contract. Such payments shall begin upon the earlier of (1) the first payment under Section IV(A)(2)(a) or (2) the date that Plumas or its member unit resumes taking water from Lake Davis, and shall cover the period beginning January 1 of that same year. DWR will not seek to collect the amount of any Plumas Arrearages.

V. **Kern Water Bank.**

A. Title. KWBA shall retain title to the KWB Lands. KWBA may continue to operate and administer the KWB Lands including the water bank, subject to the restrictions herein.

B. Restrictions on Use of KWB Lands.

1. *Continued Use as Water Bank.* As noted in Section III(F), the KWB Lands are subject to the HCP, which documents a plan to accomplish, among other things, certain water conservation and environmental objectives. Except as provided in Sections V(B)(2) and (3), the KWB Lands shall continue to be used for the operation of a water bank and other uses authorized by the HCP, so long as such use remains legally and economically feasible.

2. *Use of KWB Lands for other SWP Purposes*. If (a) the use of the KWB Lands as a water bank is determined by KWBA to no longer be economically and/or legally feasible, (b) DWR concurs with such determination, (c) the KWB Lands can be feasibly used for any of the SWP purposes provided in California Water Code §12930 et seq., and (d) DWR and KWBA agree on terms and conditions for such use, then the KWB Lands may be so used.

3. *Use of KWB Lands for other than SWP Purposes*. If (a) the KWB Lands can not feasibly be used for any of the SWP purposes provided in California Water Code §12930 et seq., or (b) KWBA and DWR are unable to agree on terms and conditions for such use, or (c) DWR determines not to use the KWB Lands for such purposes, then KWBA may transfer or develop all or a portion of the KWB Lands for alternative use(s), provided that any alternate use will not result in unmitigated environmental impacts. A finding by KWBA that such impacts will not occur will be subject to DWR's concurrence.

4. *The 490 Acres*. The approximately 490 acres currently subject to restrictions in the HCP, permitting use thereof as Conservation Bank Lands (as defined in the HCP), but which may be developed under the HCP, will continue to be subject to the restrictions in the HCP but may not be developed.

5. *Application of HCP Restrictions*. All of the KWB Lands, including the 490 acres, will remain subject to the restrictions contained in the HCP.

The restrictions will remain in effect regardless of amendment to, or termination of, the HCP, unless, in the event of such amendment or termination, DWR, after consultation with Plaintiffs, finds that such amendment or termination will not result in unmitigated environmental impacts. The provisions of this clause shall not apply to "Minor Amendments" to the HCP as that term is utilized in the HCP.

6. *Land Use Changes Subject to CEQA*. Changes to the allowable uses of the KWB Lands shall be subject to appropriate environmental review under CEQA.

C. Transfer/Development Proceeds. If all of the KWB Lands are transferred or developed by KWBA, the proceeds of such transfer or development (net of transaction or development costs) will be used for water management purposes identified by KWBA, subject to concurrence by DWR that such use is for bona fide water management purposes; provided, however, so long as the KWB Lands continue to be used for operation of a water bank, the proceeds (net of transaction or development costs) resulting from the transfer or development of a portion of the KWB Lands (which must be consistent with Section V(B)(5)) will be used for water management purposes identified by KWBA, subject to concurrence by DWR that the expenditure is consistent with such purposes.

D. Consultation with Plaintiffs.

1. Except as provided in Section V(D)(2), with respect to any matter that requires DWR's concurrence pursuant to Section V(B) and (C), DWR

shall consult with Plaintiffs prior to making any decision with respect thereto.

2. In lieu of consulting with Plaintiffs, following the conclusion of all litigation challenging CEQA compliance for, or the validity of, the Monterey Amendments, DWR may first provide notice and opportunity to comment to Plaintiffs and the public, and then, at Plaintiffs' request, shall consult with Plaintiffs.

E. Scope of Restrictions. The foregoing restrictions shall only apply to the KWB Lands and shall not affect the use or disposition of water stored under or withdrawn from the KWB Lands.

F. Effective Date of Restrictions. The foregoing restrictions in this Section V shall not be effective unless and until the court in the above-referenced litigation issues an order approving this Settlement Agreement and the Interim Implementation Order (as defined in Section VII(c)). The restrictions in this Section V shall become final only upon (1) filing of the Notice of Determination following the completion of New EIR, (2) discharge of the writ of mandate in the underlying litigation as provided below, and (3) conclusion of all litigation in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. The continuing effectiveness of the restrictions in this Section V, and the obligations under this Settlement Agreement to comply with these restrictions, are subject to the terms of Section VII(K) below.

VI. Funding To Plaintiffs

A. Agreement to Pay. In accordance with the procedures and subject to the conditions described herein, DWR shall pay to Plaintiffs, collectively, the sum of $5,500,000 (in addition to the $300,000 paid pursuant to Section III(G)).

B. Schedule of Payments.

1. On or before the date that is thirty (30) days after approval of this Settlement Agreement by the Superior Court and issuance of the Interim Implementation Order under Section VII, DWR shall pay to Plaintiffs One Million Eight Hundred Seventy-Five Thousand Dollars ($1,875,000).

2. On or before the first anniversary after the date upon which delivery of funds are made by DWR pursuant to Section VI(B)(1), DWR shall pay to Plaintiffs One Million Eight Hundred Seventy-Five Thousand Dollars ($1,875,000).

3. Subject to Section VI(C), on or before the seventieth (70^{th}) day after the Notice of Determination has been filed for the New EIR (or the first business day after said 70^{th} day if the 70^{th} day is not a business day), DWR shall pay to Plaintiffs One Million Seven Hundred Fifty Thousand Dollars ($1,750,000).

4. All amounts to be paid by DWR under this Section VI(B) shall be paid by wire transfer, in immediately available funds, to a JAMS Trust Account from which funds are to be disbursed therefrom to Plaintiffs in accordance with the Section VI Trust Account Agreement.

C. Effects of Litigation on Payment Obligations.

1. *Suspension of Payment Obligation.* If litigation is commenced by anyone challenging CEQA compliance for, or the validity of, any Monterey Amendment (or any portion thereof), including matters pertaining to the Kern Fan Element Transaction, the monetary obligations of DWR under Section VI(B)(3) shall be suspended until the date that is forty-five (45) days after conclusion of such litigation (without further right of appeal) in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. Within thirty (30) days after final conclusion of any such litigation in said manner, DWR shall pay to Plaintiffs any amounts then owing under this Section VI.

2. *Termination of Payment Obligation.* If any such litigation results in a final judgment that invalidates any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, the obligation for payments under Section VI(B)(3) shall automatically terminate.

D. Use of Funds. The funds paid to Plaintiffs under this Section VI shall be used to implement this settlement, as determined by Plaintiffs in their reasonable judgment, including watershed restoration projects, follow-up actions arising from this settlement, and technical studies.

E. Unrelated to Attorney Fees. The payments under this Section VI are exclusive of, and in addition to, any amounts owing by DWR with respect to Plaintiffs' attorney fees, the latter of which are addressed by Section VIII.

VII. Sequence and Process for Implementation of Settlement

This Section VII addresses the process of implementing the terms of this Settlement Agreement to the extent not already addressed in this Settlement Agreement. All issues relating to the implementation of this Settlement Agreement not addressed by this Section VII or elsewhere herein shall be resolved through good faith discussions and mutual agreement among the Parties. If the Parties are unable to agree, the disputed matter shall be referred to and resolved by the Mediator.

A. Non-Reliance on 1995 EIR. DWR and the SWP Contractors who are signatories to this Settlement Agreement agree that they will not approve any new project or activity in reliance on the 1995 EIR, that was not approved, initiated or implemented prior to March 26, 2001, and the approval, initiation or implementation of which would require a separate environmental impact report or negative declaration under CEQA (other than, or in addition to, the 1995 EIR).

B. Attachment A Amendments. Within sixty (60) days after this Settlement Agreement is executed by all of the Parties, each of the SWP Contractors who are parties to this Settlement Agreement shall cause a duly authorized representative to execute an Attachment A Amendment, and deliver the executed Amendment to DWR. Upon approval of this Settlement Agreement by the Superior Court and issuance of the Interim Implementation Order, as discussed in Section VII(C), DWR shall execute the Attachment A Amendments. Thereupon, the Attachment A Amendments shall be deemed effective on an interim basis, and will not thereafter be modified without the written consent of the Plaintiffs, prior to the discharge of the writ of mandate. The Attachment A Amendments shall become final upon (1) the filing of the Notice of Determination following the completion of the New EIR, (2) discharge of the writ of mandate in the underlying litigation as provided below, and (3) conclusion of all litigation in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

C. Motion for Order Approving Settlement Agreement and Interim Implementation Order. As soon as practical after the execution of this Settlement Agreement, the Parties shall jointly file with the Superior Court a motion for (1) an order approving this Settlement Agreement, and (2) an order (the "**Interim Implementation Order**") specifically authorizing on an interim basis, pursuant to Public Resources Code Section 21168.9, the administration and operation of the SWP and the KWB Lands, pending discharge of the writ of mandate in the underlying litigation, in accordance with the Monterey Amendments (as limited by Section VII(A) above), as supplemented by the Attachment A Amendments and the other terms and conditions of this Settlement Agreement, including the provisions in Section V(B) regarding the KWB Lands. Said motion shall include the proposed Section 21168.9 order attached hereto as Exhibit 3-A, and the proposed writ of mandate referenced therein and attached hereto as Exhibit 3-B. The parties shall jointly move the Superior Court for approval of said order and writ. Subject to Section VII(J), and except as provided in Section VII(I), Plaintiffs shall not seek any further order or writ concerning the Monterey Amendments or the New EIR.

D. Implementation of New Policies, Procedures and Guidelines. DWR has issued a [draft] Report of State Water Project Supply Reliability in response to paragraph 1 of the Attachment B Principles. Upon the Superior Court's approval of this Settlement Agreement, DWR shall issue Contractors' Memos on (1) the Attachment C Guidelines and (2) the Attachment D Principles. After the Superior Court's approval of this Settlement Agreement, and in no event later than January 1, 2004, DWR shall issue Contractors' Memos on the remainder of the Attachment B Principles (i.e., paragraphs 2 and 3). DWR may rely on DWR publications previously issued to comply with paragraph 2 of the Attachment B Principles, if appropriate.

E. Dismissal of Validation Cause of Action. Upon the execution of this Settlement Agreement by all the Parties and execution of the Attachment A Amendments as set forth in Section VII(B) and issuance by DWR of the Contractor Memos referenced in the second sentence of Section VII(D), Plaintiffs shall file a request for dismissal without prejudice of the Validation Cause of Action. So long as such conditions are timely met, Plaintiffs covenant and agree not to refile the Validation Cause of Action, nor any new cause of action relating thereto, nor a new claim challenging the validity of any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

F. Tolling of Statute of Limitations. As between Plaintiffs, DWR and the SWP Contractors who are signatories to this Settlement Agreement, it is agreed that the statute of limitations relating to the Validation Cause of Action shall be tolled as to Plaintiffs until the date that is forty-five (45) days after the filing of the Notice of Determination for the New EIR.

G. Notice of Determination, Return to Writ and Motion for Order Discharging Writ. Upon completion of the New EIR, DWR will file with the Superior Court (1) a Notice of Determination including a copy of the New EIR, (2) a return to writ of mandate (the "**Return to Writ**"), (3) a request for an order discharging the writ of mandate previously issued by the Superior Court in the underlying case and (4) any other information required by the Superior Court for a discharge of writ.

H. Consent to Entry of Order Discharging Writ.

1. *Obligation to File.* Concurrent with DWR's filings referenced in Section VII(G), subject only to Sections VII(H)(2) and (3), and provided Plaintiffs have not challenged the Return to Writ (under the procedures set forth in Section VII(I)), Plaintiffs shall file with the Superior Court a pleading consenting to entry of an order discharging the writ of mandate (the "**Consent to Entry of Order Discharging Writ**").

2. *Conditions Precedent to Filing.* Plaintiffs' obligation to file the Consent to Entry of Order Discharging Writ shall be subject to, and conditioned upon, satisfaction of the requirement set forth in Section VII(B).

3. *Earliest Effective Date of Discharge of Writ.* The discharge of the writ of mandate shall not be effective until at least forty-five (45) days after the filing of the Notice of Determination for the New EIR.

I. Subsequent CEQA Challenge.

1. *Limited Basis for Challenge.* Plaintiffs may only challenge the Return to Writ if, during the preparation and review of the New EIR, (a) Plaintiffs

objected to the Mediator based on one or more Mediation Issues, (b) the Mediator upheld that objection in a written advisory opinion as described in Section III(H), (c) DWR rejected such written advisory opinion in its final decision, either expressly or as evidenced by the contents of the final New EIR, and (d) the challenge that Plaintiffs file to the Return to Writ is on the same ground(s) as the objection upheld by Mediator in the advisory opinion. Where such an objection was made to the Mediator and Plaintiffs file such a challenge to the Return to Writ, DWR shall maintain the advisory opinion as a public record. With respect to clause (c) of this subsection (I)(1), if the Parties dispute whether DWR has rejected the Mediator's advisory opinion, such matter shall be referred to the Mediator and (s)he shall make a final determination with respect thereto in accordance with Article IX.

2. *Stipulation to Continued Operations*. In the event of such a challenge, the challenging party will stipulate that, pending compliance with such writ as the court may issue, administration and operation of the SWP may continue in accordance with the Interim Implementation Order.

3. *Order for New EIR*. If such a challenge results in an order that DWR must prepare a new or supplemental environmental impact report, the provisions set out in Section III (regarding preparation of New EIR) shall be followed, and at the conclusion of the process, the provisions of Section VII(H) (filing of a Consent to Entry of Order Discharging Writ) and this Section VII(I) shall apply.

J. No Future Challenges. Except as specifically authorized herein, and as a condition to the initial and continuing effectiveness of this Settlement Agreement, Plaintiffs agree not to initiate any future litigation challenging the validity of any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

K. Mutual Interdependency. On an interim and final basis, the Attachment A Amendments, the Plumas Amendment, the provisions regarding the KWB Lands described in Section V(B), and the continued operations of the SWP based on the Monterey Amendments are mutually interdependent.

L. Implementation Dispute Resolution. Disputes arising in the implementation of this Settlement Agreement shall be addressed in accordance with Section IX.

VIII. **Attorney Fees**

Within forty-five (45) days after the execution of this Settlement Agreement by all Parties, the Parties shall engage in arbitration to determine the amount of attorney fees and costs to be paid to Rossmann as Plaintiffs' counsel. Such arbitration shall be conducted pursuant to the following terms and conditions:

A. The arbitrator will be selected by mutual agreement of the Parties. If the Parties cannot agree on the arbitrator, the Mediator will designate the arbitrator. JAMS arbitration rules will apply, providing for limited and focused discovery, but the arbitrator may be anyone the Parties select regardless of his/her professional affiliation.

B. Within five (5) business days after commencement of the arbitration, Rossmann shall file with the arbitrator a petition for fees. The petition for fees shall identify, in sufficient detail acceptable to the arbitrator, all fees for: (1) past service in the underlying litigation; (2) fees for participation in the settlement mediation to the date thereof; and (3) projected fees for services to be rendered in implementing the Settlement Agreement, including fees incurred in advising Plaintiffs in connection with their participation in, and service on, the EIR Committee.

C. Rossmann may apply for a multiplier on fees earned in the underlying litigation. The award for fees relating to mediation and settlement implementation shall be subject to the lodestar amount and shall not include a multiplier.

D. The costs of the arbitration will be borne one-third (1/3) by Plaintiffs and two-thirds (2/3) by DWR.

E. DWR and CCWA reserve all rights and defenses, except the right to challenge Rossmann's entitlement to fees relating to the mediation and settlement implementation stages.

F. The arbitrator shall determine the amount of the award within thirty (30) days after submission of the fee petition to the arbitrator. The arbitrator's determination shall be binding upon the Parties.

G. DWR shall pay the fee award to Rossmann in accordance with the following schedule:

    1. Sixty percent (60%) within thirty (30) days after the award;

    2. Thirty percent (30%) within thirty (30) days after the filing of the Return to Writ with the Superior Court; and

    3. Ten percent (10%) within thirty (30) days after the Plaintiffs' filing of the Consent to Entry of Order Discharging Writ with the Superior Court.

H. The amount of $100,000 previously paid as attorney fees to Rossmann by DWR will be credited toward the amount owed by DWR hereunder as determined by the arbitrator.

IX. Dispute Resolution

The Parties agree to cooperate in implementing this Settlement Agreement and to try in good faith to resolve any disputes. In addition, until the conclusion of the underlying litigation, as evidenced by the issuance of an order discharging the writ of mandate, the Mediator will decide all unresolved issues involving the interpretation and implementation of this Settlement Agreement and, to the extent permitted by law, will be authorized to enforce its terms, except for those matters properly reserved to the jurisdiction of the Superior Court. Any party may request a conference before the Mediator on seventy-two (72) hours' advance written notice to the Mediator and the other Parties. The Mediator will have the power to award reasonable attorney fees to the prevailing party in the event of frivolous, harassing or untimely motions. The party who initiates a dispute resolution proceeding with the Mediator pursuant to this Section IX shall be solely responsible for the payment of the Mediator's costs and expenses, except as otherwise provided herein.

X. Miscellaneous

A. No Admission. By entering into this Settlement Agreement, the Plaintiffs do not endorse or admit the validity of the Monterey Amendments, and neither DWR, KWBA, nor any of the SWP Contractors who are signatories hereto admit any of the Plaintiffs' allegations in the pending litigation including those concerning the Monterey Amendments and/or the Kern Fan Element Transaction.

B. Compliance with Laws. The Parties agree that nothing in this Settlement Agreement is intended to limit the discretion granted by law, including CEQA, to DWR, as lead agency and as the State agency responsible for administration and operation of the SWP, or the duty of DWR to comply with applicable requirements of law, including those of CEQA and the California Water Code.

C. Authority. Each of the Parties represents that: (1) it has the authority to execute and enter into this Settlement Agreement; (2) the individual executing this Settlement Agreement on behalf of the Party has the authority and has been specifically authorized to execute and deliver this Settlement Agreement on behalf of such Party; (3) upon execution by such person on behalf of the Party, this Settlement Agreement shall be valid and enforceable against such Party in accordance with the terms hereof; (4) the Party is authorized to implement this Settlement Agreement, without further action by the Party or its governing body, board of directors, or any other person or entity, as the case may be; and (5) the execution and entry into this Settlement Agreement and the implementation of its terms by the Party is not in violation of any applicable law or any other contract or agreement by which it is bound or to which it is a party. The Parties acknowledge that although DWR plans to make payments required under this Agreement pursuant to its authority under the State Water Resources Development System (Water Code Sections 12930 et seq.), and that under such authority accruals are continuously appropriated without regard to fiscal years (Water Code Section 12938), any such payments may nevertheless be contingent on the annual Budget Act and, under certain circumstances, payments may be delayed or halted by non-party government authorities. If any payment under this Settlement Agreement is delayed beyond the date it is due, the amount due shall accrue interest at the rate of the State Pooled Money Investment Fund for the first forty-five (45) days after it is due and at eight percent (8%) per annum thereafter. The foregoing does not limit Plaintiff's rights to seek legal or equitable relief in the event of a breach of this Settlement Agreement.

D. Not a General Appearance or Concession to Jurisdiction. The execution of this Settlement Agreement by the SWP Contractors and KWBA does not constitute a general appearance in the underlying litigation, nor does it constitute a concession to jurisdiction of the Superior Court over the SWP Contractors or KWBA other than for the purpose of enforcing the terms of this settlement.

E. Successors and Assigns. This Settlement Agreement shall be binding upon and inure to the benefit of the Parties and their respective heirs, legal representatives, successors and assigns. No Party may assign their rights under this Settlement Agreement without the prior written consent of the other Parties.

F. Governance. This Agreement shall be construed under and enforced in accordance with the substantive laws of the State of California.

G. Entirety of Agreement; No Amendment. This Settlement Agreement sets forth the entire agreement among the Parties and supersedes all prior oral or written agreements, negotiations, discussions, or understandings concerning the subject matter hereof. The terms of this Settlement Agreement may not be altered, amended, waived or modified, except by a further written agreement signed by all Parties.

H. Mutual Preparation. The Parties each cooperated in the drafting and preparation of this Settlement Agreement. Thus, the language of all parts of this Settlement Agreement shall in all cases be construed as a whole, according to its fair meaning, and not strictly for or against any Party as the drafter thereof.

I. Further Acts. Each Party agrees to make, execute and deliver such other instruments or documents, and to do or cause to be done such further or additional acts, as reasonably may be necessary in order to effectuate the purposes or to implement the terms of this Settlement Agreement.

J. No Waiver. No waiver of any breach of any term or provision of this Settlement Agreement shall be construed to be, nor shall be, a waiver of any other breach of this Settlement Agreement. No waiver shall be binding unless in writing and signed by the Party waiving the breach. With respect to any breach of this Settlement Agreement by Plaintiffs, such breach may only be waived in writing by DWR, KCWA and The Metropolitan Water District of Southern California. With respect to any breach of this Settlement Agreement by the non-Plaintiffs, such breach may only be waived in writing by the Plaintiffs.

K. No Representations or Warranties. Each of Parties represents and declares that in executing this Settlement Agreement, it has relied solely upon its own judgment, belief and knowledge, and on the advice and recommendations of its independently selected counsel, concerning the nature, extent and duration of its rights and claims and that it has not been influenced to any extent whatsoever in executing the same by any representations or statements covering any matters made by any of the Parties or by any person representing them or any of them.

Each Party acknowledges that no other Party nor any of their representatives has made any promise, representation or warranty whatsoever, written or oral, as any inducement to enter into this Settlement Agreement, except as expressly set forth in this Settlement Agreement.

L. Independent Investigations. Each Party has made such investigation of the facts pertaining to this settlement and this Settlement Agreement and of all matters pertaining thereto as it deems necessary.

M. Survival. The representations, warranties and covenants contained in this Settlement Agreement are deemed to and shall survive the execution and delivery of this Settlement Agreement by all of the Parties.

N. Headings. All headings in this Settlement Agreement are included for convenience and reference only and shall not constitute a part of this Settlement Agreement for any purpose.

O. Not Binding on Others. This Settlement Agreement is not intended to, nor shall it (1) bind any non-Party persons or entities as to any claims or defenses they may otherwise now or in the future hold, or (2) waive any claims or defenses any Party hereto may have now or in the future against such non-Party persons or entities.

P. Counterparts. This Settlement Agreement may be executed in counterparts, each of which shall constitute an original, but all of which shall constitute one and the same agreement, provided each signing Party shall have received a copy of the signature page signed by every other Party.

Q. Voluntary and Knowing Execution. EACH PARTY REPRESENTS AND WARRANTS THAT IT HAS THOROUGHLY READ AND CONSIDERED

ALL ASPECTS OF THIS SETTLEMENT AGREEMENT, THAT IT UNDERSTANDS ALL PROVISIONS OF THIS SETTLEMENT AGREEMENT, THAT IT HAS HAD THE OPPORTUNITY TO CONSULT WITH COUNSEL THROUGHOUT THIS PROCESS AND THAT IT IS VOLUNTARILY ENTERING INTO THIS SETTLEMENT AGREEMENT OF ITS OWN FREE WILL, WITHOUT DURESS OR COERCION OF ANY KIND.

R. Obligations Dependent on Validity of Monterey Amendments. With respect to any obligation in this Settlement Agreement that terminates or is suspended upon a challenge to or final judgment that invalidates any portion of any Monterey Amendment, such termination or suspension of such obligation may be avoided if such invalidity is explicitly and irrevocably waived in accordance with the procedures set forth in Paragraph 29 of the Monterey Amendments.

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IN WITNESS WHEREOF, the Parties have executed this Settlement Agreement as of the date first set forth above.

PLANNING AND CONSERVATION LEAGUE

By: Sage Sweetwood
Name: Sage Sweetwood
Title: President

PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

By: B J Pearson
Name: B. J. Pearson
Title: Chair, Board of Supervisors
Ex-officio Chair, District Board of Directors

CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC.

By: Louise Boucher
Name: Louise Boucher
Title: President,
Citizens Planning association of Santa Barbara, Inc.

[Remainder of Page Intentionally Blank – Additional Signatures Follow]

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By:

Name: Thomas M. Hannigan
Title: Director

Approved as to legal form and sufficiency:

By:

Name: Peggy Bernardy
Title: Chief Counsel

ALAMEDA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT, ZONE 7

By:

Name: William R. Stevens

Title: President, Board of Directors

Approved as to Form
RICHARD E. WINNIE, County Counsel
By

ALAMEDA COUNTY WATER DISTRICT

By:

Name: John H. Weed

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

ANTELOPE VALLEY-EAST KERN WATER AGENCY

By: Andy D. Rutledge

Name: Andy D. Rutledge

Title: Board President

CASTAIC LAKE WATER AGENCY

By: Dan Masnada

Name: DAN MASNADA

Title: GENERAL MANAGER

CITY OF YUBA

By: William P. Lewis

Name: WILLIAM P. LAWIS

Title: UTILITIES DIRECTOR

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

COACHELLA VALLEY WATER DISTRICT

By: John W. McFadden

Name: John W. McFadden

Title: President of the Board of Directors

COUNTY OF BUTTE

By: R J Beeler

Name: R. J. BEELER

Title: Chairman, Board of Supervisors

COUNTY OF KINGS 3-25-03

By: Joe Neves

Name: JOE NEVES

Title: CHAIRMAN

CRESTLINE-LAKE ARROWHEAD WATER AGENCY

By: James J. McCrory

Name: James J. McCrory

Title: President, Board of Directors

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

DESERT WATER AGENCY

By: Dan M. Ainsworth

Name: Dan M. Ainsworth

Title: General Manager

DUDLEY RIDGE WATER DISTRICT

By: John MacIlvaine

Name: Joe MacIlvaine

Title: President

KERN COUNTY WATER AGENCY

By: Terry Rogers

Name: Terry Rogers

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

LITTLEROCK CREEK IRRIGATION DISTRICT

By: Frances Young

Name: ______________________

Title: President

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

By: Ronald R Gastelum

Name: Ronald R Gastelum

Title: CEO

MOJAVE WATER AGENCY

By: K B

Name: Kirby Brill

Title: General Manager

NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

By: Mike Rippey

Name: Mike Rippey

Title: Vice-Chair

APPROVED 3/18/03
FLOOD CONTROL & WATER
CONSERVATION DISTRICT

~~MARY JEAN MCLAUGHLIN~~
SECRETARY OF THE DISTRICT
BY S. Vattuone Deputy

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

OAK FLAT WATER DISTRICT

By: William D Harrison

Name: WILLIAM D. HARRISON

Title: MANAGER / SECRETARY

PALMDALE WATER DISTRICT

By: Leslie O. Carter

Name: Leslie O. Carter

Title: President, Board of Directors

SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT

By:

Name: C. Patrick Milligan

Title: President

SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT

By:

Name: J. C. Reichenberger

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

SAN GORGONIO PASS WATER AGENCY

By: Stephen P. Stockton

Name: Stephen P. Stockton

Title: General Manager/Chief Engineer

SAN LUIS OBISPO COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

By: Michael P. Ryan

Name: MICHAEL P. RYAN

Title: Chairman of the Board of Supervisors

SANTA BARBARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

By: Naomi Schwartz

Name: __________

Title: __________

APPROVE AS TO ACCOUNTING:
ROBERT W. GEIS, CPA
AUDITOR-CONTROLLER

BY: __________
Deputy

ATTEST:
MICHAEL F. BROWN
CLERK OF THE BOARD

BY: Robert Cohen
Deputy

APPROVED AS TO FORM:
STEPHEN SHANE STARK
COUNTY COUNSEL

BY: __________
Deputy

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

SANTA CLARA VALLEY WATER DISTRICT

By: Stanley M. Williams

Name: Stanley M. Williams

Title: Chief Executive Officer

SOLANO COUNTY WATER AGENCY

By: Don Holdener

Name: Don Holdener

Title: Chairman, Board of Directors

TULARE LAKE BASIN WATER STORAGE DISTRICT

By:

Name: THOMAS R. HURLBUTT

Title: PRESIDENT

VENTURA COUNTY FLOOD CONTROL DISTRICT

By: Jeff Pratt

Name: Jeff Pratt

Title: Director - Watershed Protection

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

CENTRAL COAST WATER AUTHORITY

By: ____________________

Name: William J. Brennan

Title: Executive Director

KERN WATER BANK AUTHORITY

By: ____________________

Name: **William D. Phillimore,** Chairman

Title: **Chairman**

ATTACHMENT A

AMENDMENT TO STATE WATER PROJECT CONTRACT

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. ____ TO THE WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND ____________________

This amendment is made this ____ day of ____________________, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, hereinafter referred to as the "State", and ____, hereinafter referred to as the "District" [or "Agency"].

RECITALS

WHEREAS, the State and the District entered into and subsequently amended a water supply contract (the "contract") providing that the State shall supply certain quantities of water to the District and providing that the District shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payments; and

WHEREAS, on December 1, 1994, the State and representatives of certain State Water Project contractors executed a document entitled "Monterey Agreement – Statement of Principles – By The State Water Contractors And The State Of California Department Of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement"); and

WHEREAS, the State, the Central Coast Water Authority ("CCWA") and those contractors intending to be subject to the Monterey Agreement subsequently negotiated an amendment to their contracts to implement provisions of the Monterey Agreement, and such amendment was named the "Monterey Amendment"; and

WHEREAS, in October 1995, an environmental impact report ("EIR") for the Monterey Amendment was completed and certified by CCWA as the lead agency, and thereafter the District and the State executed the Monterey Amendment; and

WHEREAS, the EIR certified by the CCWA was challenged by several parties (the "Plaintiffs") in the Sacramento County Superior Court and thereafter in the Third District Court of Appeal, resulting in a decision in *Planning and Conservation League, et al. v. Department of*

Water Resources, 83 Cal.App.4th 892 (2000), which case is hereinafter referred to as "PCL v. DWR"; and

WHEREAS, in its decision, the Court of Appeal held that (i) the Department of Water Resources ("DWR"), not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the State Water Project contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to certain lands to Kern County Water Agency (the "Validation Cause of Action") and execution of amended State Water Project contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause of Action; (2) issue a writ of mandate vacating the certification of the EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA; and

WHEREAS, the State, the contractors, and the Plaintiffs in *PCL v. DWR* reached an agreement to settle *PCL v. DWR*, as documented by that certain Settlement Agreement dated _________, 2003 (the "Settlement Agreement"), and in such Settlement Agreement have agreed that the contracts should be amended, for clarification purposes, to delete terms such as "annual entitlement" and "maximum annual entitlement" so that the public, and particularly land use planning agencies, will better understand the contracts; and

WHEREAS, pursuant to the Settlement Agreement, the State and the District desire to so amend the District's contract, with the understanding and intent that the amendments herein with respect to subsections (m), (n), and (o) of Article 1, subsection (b) of Article 6, and subsection (a) of Article 16, and to Table A of the District's contract are solely for clarification purposes and that such amendments are not intended to and do not in any way change the rights, obligations or limitations on liability of the State or the District established by or set forth in the contract; and

WHEREAS, pursuant to the Settlement Agreement, the State, the contractors and the Plaintiffs in *PCL v. DWR* also agreed that the contracts should be amended to include a new Article 58 addressing the determination of dependable annual supply of State Water Project water to be made available by existing Project facilities, and the State and District desire to so amend the District's contract.

NOW THEREFORE, IT IS MUTUALLY AGREED, as follows:

1. Article 1(n) is amended to read:[1]

(n) **Annual Table A Amount**

"Annual Table A Amount" shall mean the amount of project water set forth in Table A of this contract that the State, pursuant to the obligations of this contract and applicable law, makes available for delivery to the District at the delivery structures provided for the District. The term Annual Table A Amount shall not be interpreted to mean that in each year the State will be able to make that quantity of project water available to the District. The Annual Table A Amounts and the terms of this contract reflect an expectation that under certain conditions the District will receive its full Annual Table A Amount; but that under other conditions only a lesser amount, allocated in accordance with this contract, may be made available to the District. This recognition that full Annual Table A Amounts will not be deliverable under all conditions does not change the obligations of the State under this contract, including but not limited to, the obligations to make all reasonable efforts to complete the project facilities, to perfect and protect water rights, and to allocate among contractors the supply available in any year, as set forth in Articles 6(b), 6(c), 16(b) and 18, in the manner and subject to the terms and conditions of those articles and this contract. Where the term "annual entitlement" appears elsewhere in this contract, it shall mean "Annual Table A Amount." The State agrees that in future amendments to this and other contractor's contracts, in lieu of the term "annual entitlement," the term "Annual Table A Amount" will be used and will have the same meaning as "annual entitlement" wherever that term is used.

2. Article 1(o) is amended to read:

(o) Maximum Annual Table A Amount

"Maximum annual entitlement" shall mean the maximum annual amounts set forth in Table A of this contract, and where the term "maximum annual entitlement" appears elsewhere in this contract it shall mean "Maximum Annual Table A Amounts."

3. Article 1(m) is amended to read:

(m) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available assuming completion of the initial project conservation facilities and additional project conservation facilities. The project's capability of providing the minimum project yield shall be determined by the State on the basis of coordinated operations studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon factors including but not limited to: (1) the estimated relative proportion of deliveries for agricultural use to deliveries for municipal use assuming Maximum Annual Table A Amounts

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[1] The number of the articles is not the same for all the Water Supply Contractors. Article 1(n) is intended to be the article presently entitled "Annual Entitlement", whatever its number may be in each District's contract. The article numbers may have to be changed for each contractor to reflect the numbers in its contract.

for all contractors and the characteristic distributions of demands for these two uses throughout the year; and (2) agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the division of utilization of waters of the Delta or streams tributary thereto.

4. Article 6(b) is amended to read:

(b) District's Annual Table A Amounts

Commencing with the year of initial water delivery to the District, the State each year shall make available for delivery to the District the amounts of project water designated in Table A of this contract, which amounts shall be subject to change as provided for in Article 7(a) and are referred to in this contract as the District's Annual Table A Amounts.

5. Article 16(a) is amended to read:

(a) Limit on Total of all Maximum Annual Table A Amounts

The District's Maximum Annual Table A Amount hereunder, together with the maximum Table A amounts of all other contractors, shall aggregate no more than 4,185,000 acre-feet of project water.

6 Article 58 is added to read:

58. **Determination of Dependable Annual Supply of Project Water to be Made Available by Existing Project Facilities.**

In order to provide current information regarding the delivery capability of existing project conservation facilities, commencing in 2003 and every two years thereafter the State shall prepare and mail a report to all contractors, and all California city, county, and regional planning departments and agencies within the contractors' project service areas. This report will set forth, under a range of hydrologic conditions, estimates of overall delivery capability of the existing project facilities and of supply availability to each contractor in accordance with other provisions of the contractors' contracts. The range of hydrologic conditions shall include the delivery capability in the driest year of record, the average over the historic extended dry cycle and the average over the long-term. The biennial report will also include, for each of the ten years immediately preceding the report, the total amount of project water delivered to all contractors and the amount of project water delivered to each contractor.

7. Add the following language at the bottom of Table A:

In any year, the amounts designated in this Table A shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

8. Except for Article 58, the changes made by this amendment are solely for clarification purposes, and are not intended to nor do they in any way change the rights, obligations or

limitations on liability of the State or the District established by or set forth in the contract, and this amendment shall be interpreted in accordance with this intent.

9. At the time of execution of this Agreement and thereafter, the effectiveness of this Amendment is dependent upon the effectiveness of the District's Monterey Amendment (all provisions therein) and the Kern Fan Element Transaction.

IN WITNESS WHEREOF, the parties hereto have executed this amendment on the date first above written.

STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES

By: ______________________________
Name: ______________________________
Title: Director

Approved as to legal form and sufficiency:

By: ______________________________
Name: ______________________________
Title: Chief Counsel

Attest:

__________________ **DISTRICT**

By: ______________________________
Name: ______________________________
Title: ______________________________

ATTACHMENT B

PRINCIPLES REGARDING STATE WATER PROJECT AVAILABILITY

Note: These principles are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Commencing in 2003, and every two years thereafter, the Department of Water Resources (DWR) shall prepare and deliver to all State Water Project (SWP) contractors, all city and county planning departments, and all regional and metropolitan planning departments within the project service area a report which accurately sets forth, under a range of hydrologic conditions, the then existing overall delivery capability of the project facilities and the allocation of that capacity to each contractor. The range of hydrologic conditions shall include the historic extended dry cycle and long-term average. The biennial report shall also disclose, for each of the ten years immediately preceding the report, the total amount of project water delivered and the amount of project water delivered to each contractor. The information presented in each report shall be presented in a manner readily understandable by the public.

2. DWR shall develop and, by January 1, 2004, publish guidelines to assist Municipal and Industrial Contractors in providing accurate information to land-use planning agencies with jurisdiction within the Contractors' respective service areas regarding local and regional programs to manage or supplement SWP supplies. DWR shall consult with the plaintiffs and contractors in developing the guidelines.

3. DWR shall provide assistance to enable all Municipal and Industrial Contractors to provide complete and accurate information to relevant land-use planning agencies to assure that local land-use decisions reflect accurate information on the availability of water from state, local, and other sources.

ATTACHMENT C

DWR GUIDELINES FOR REVIEW OF PROPOSED PERMANENT TRANSFERS OF STATE WATER PROJECT ANNUAL TABLE A AMOUNTS

Note: These guidelines are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Purpose: The purpose of these guidelines is to describe the process for DWR's review of proposed permanent transfers of SWP Annual Table A Amounts and by so doing, provide disclosure to SWP Contractors and to the public of DWR's process and policy on approving permanent transfer of SWP Annual Table A Amounts. Such disclosure should assist contractors in developing their transfer proposals and obtaining DWR review expeditiously, and assist the public in participating in that review.

2. Coverage: These guidelines will apply to DWR's approval of permanent transfers of water among existing SWP Contractors and, if and when appropriate, to permanent transfers of water from an existing SWP Contractor to a new SWP Contractor.

3. Interpretation: These guidelines are in furtherance of the state policy in favor of voluntary water transfers and shall be interpreted consistent with the law, including but not limited to Water Code Section 109, the Burns-Porter Act, the Central Valley Project Act, the California Environmental Quality Act, area of origin laws, the public trust doctrine, and with existing contracts and bond covenants. These guidelines are not intended to change or augment existing law.

4. Format: The guidelines shall be issued by DWR as a "Notice to State Water Contractors."

5. Revisions: Revisions may be made to these guidelines as necessary to meet changed circumstances, changes in the law or long-term water supply contracts, or to address conditions unanticipated when the guidelines are adopted. Revisions shall be in accordance with the settlement agreement reached in *Planning and Conservation League vs. Department of Water Resources*.

6. Distribution: The transfer guidelines shall be published by DWR in the next available edition of Bulletin 132, and also as part of the biennial disclosure of SWP reliability as described in the PCL v. DWR Settlement Agreement.

7. Contract Amendment: Permanent transfers of SWP water are accomplished by amendment of each participating contractor's long-term water supply contract. The amendment consists of amending the Table A upwards for a buying contractor and downwards for a selling contractor. The amendment shall be in conformity with all provisions of the long-term water supply contracts, applicable laws, and bond covenants. Other issues to be addressed in the contract amendment will be subject to negotiation among DWR and the two participating contractors. The negotiations will be conducted in public, pursuant to the settlement agreement in PCL vs. DWR.

8. <u>Financial issues</u>: The purchasing contractor must demonstrate to the DWR's satisfaction that it has the financial ability to assume payments associated with the transferred water. If the purchasing entity was not a SWP Contractor as of 2001, special financial requirements pertain as described below, as well as additional qualifications.

9. <u>Compliance with CEQA</u>: Consistent with CEQA, the State's policy to preserve and enhance environmental quality will guide DWR's consideration of transfer proposals (Public Resources Code Section 21000). Identification of the appropriate lead agency will be based on CEQA, the CEQA Guidelines, and applicable caselaw, including *Planning and Conservation League vs. Department of Water Resources, 83 Cal. App. 4th 892 (2000).* CEQA requires the lead agency at a minimum to address the feasible alternatives to the proposed transfer and its potentially significant environmental impacts (1) in the selling contractor's service area; (2) in the buying contractor's service area; (3) on SWP facilities and operations; and (4) on the Delta and areas of origin and other regions as appropriate. Impacts that may occur outside of the transferring SWP Contractors' service areas and on fish and wildlife shall be included in the environmental analysis. DWR will not approve a transfer proposal until CEQA compliance is completed. The lead agency shall consult with responsible and trustee agencies and affected cities and counties; and when DWR is not the lead agency, shall provide an administrative draft of the draft EIR or Initial Study/Negative Declaration to DWR prior to the public review period. A descriptive narrative must accompany a checklist, if a checklist is used. The lead agency shall conduct a public hearing on the EIR during the public comment period and notify DWR's State Water Project Analysis Office of the time and place of such hearing in addition to other notice required by law.

10. <u>Place of Use</u>: The purchasing contractor must identify the place and purpose of use of the purchased water, including the reasonable and beneficial use of the water. Typically this information would be included in the environmental documentation. If a specific transfer proposal does not fit precisely into any of the alternatives listed below, DWR will use the principles described in these Guidelines to define the process to be followed. The information to be provided under this paragraph is in addition to the CEQA information described in paragraph 9 of these guidelines.

a) If the place of use is within the contractor's service area, the contractor should disclose the purpose of the transferred water, such as whether the water is being acquired for a specific development project, to enhance overall water supply reliability in the contractor's service area, or some other purpose. If the transferred water is for a municipal purpose, the contractor should state whether the transfer is consistent with its own Urban Water Management Plan or that of its member unit(s) receiving the water.

b) If the place of use is outside the contractor's service area, but within the SWP authorized place of use, and service is to be provided by an existing SWP Contractor: In addition to <u>Paragraph 10(a)</u> above, the contractor should provide DWR with copies of LAFCO approval and consent of the water agency with authority to serve that area, if any. In some instances, DWR's separate consent is required for annexations in addition to the approval for the transfer.

c) If the place of use is outside the SWP authorized place of use and service is to be provided by an existing SWP Contractor, the contractor should provide information in Paragraph 10(a) and 10(b). Prior to approving the transfer, DWR will consider project delivery capability, demands for water supply from the SWP, and the impact, if any, of the proposed transfer on such demand. If DWR approves the transfer, DWR will petition State Water Resources Control Board for approval of expansion of authorized place of use. Water will not be delivered until the place of use has been approved by the SWRCB and will be delivered in compliance with any terms imposed by the SWRCB.

d) If the place of use is outside the SWP authorized place of use and service is not to be provided by an existing SWP contractor, DWR will consider the transfer proposal as a proposal to become a new state water contractor. Prior to adding a new SWP Contractor, DWR will consider project delivery capability, demands for water supply from the SWP, and the impact, if any, of the proposed transfer on such demand. DWR will consult with existing SWP Contractors regarding their water supply needs and the proposed transfer. In addition to the information in Paragraph 10(a), 10(b), and 10(c), the new contractor should provide information similar to that provided by the original SWP contractors in the 1960's Bulletin 119 feasibility report addressing hydrology, demand for water supply, population growth, financial feasibility, etc. DWR will evaluate these issues independently and ordinarily will act as lead agency for CEQA purposes. In addition, issues such as area of origin claims, priorities, environmental impacts and use of water will be addressed. The selling contractor may not be released from financial obligations. The contract will be subject to a CCP 860 validation action initiated by the new contractor. If DWR approves the transfer, DWR will petition State Water Resources Control Board for approval of expansion of authorized place of use. Water will not be delivered until the place of use has been approved by the SWRCB and will be delivered in compliance with any terms imposed by the SWRCB.

11, DWR Discretion. Consistent with the long-term water supply contract provisions, CEQA, and other provisions of law, DWR has discretion to approve or deny transfers. DWR's exercise of discretion will incorporate the following principles:

(a) As required by CEQA, DWR as an agency with statewide authority will implement feasible mitigation measures for any significant environmental impacts resulting from a transfer, if such impacts and their mitigation are not addressed by other public agencies and are within DWR's jurisdiction.

(b) DWR will invoke "overriding considerations" in approving a transfer only as authorized by law, including but not limited to CEQA, and, to the extent applicable, the public trust doctrine and area of origin laws.

ATTACHMENT D

PRINCIPLES REGARDING PUBLIC PARTICIPATION PROCESS IN SWP CONTRACT NEGOTIATIONS

Note: These principles are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Policy: Given the importance of the State Water Project to the State of California, and the key role that the long-term water supply contracts play in the administration of the State Water Project, DWR agrees that public review of significant changes to these contracts is beneficial and in the public interest.

2. Types of activities to be covered: Project-wide contract amendments (i.e., contracts with substantially similar terms intended to be offered to all long-term SWP Contractors) and contract amendments to transfer entitlements between existing SWP Contractors will not be offered to the contractors for execution unless DWR has first complied with the public participation process as described in paragraphs (3), (4), (5) and (6).

3. The Public Participation Process.

1) Negotiations will be conducted in public;

2) The public will be provided with advance notice of the time and place of the negotiations; and

3) The public will be provided the opportunity to observe negotiations and comment in each negotiating session

4. Timing of Public Participation: Public participation ordinarily will precede the formulation of the project description in the CEQA process in order to assure that the public participation is meaningful. When DWR is a responsible agency, (e.g., when existing SWP Contractors agree to transfer entitlement between themselves), the public participation will be scheduled to facilitate coordination with the lead agency's CEQA process.

5. Activities that will not be subject to public participation: Informal discussions prior to exchange of formal drafts and discussion of topics that are authorized to be kept confidential by law will not be subject to the public participation process.

6. Contract amendments resulting from litigation: If litigation has been formally initiated, and settlement negotiations result in a proposal to adopt project-wide amendments to settle the litigation, all proposed contract amendments shall be subject to the public participation process before they are approved by DWR.

ATTACHMENT E

FINAL PERMANENT TABLE A AMOUNT TRANSFERS FROM KERN COUNTY WATER AGENCY SUBSEQUENT TO MONTEREY AMENDMENTS (January 1, 2003)

Note: This Exhibit is prepared in connection with the settlement agreement between PCL and DWR.

From (Kern County Water Agency Member Unit)	To	Amount (afy)	Year Effective
Berrenda Mesa Water District	Mojave Water Agency	25,000	1998
Belridge Water Storage District	Palmdale Water Agency	4,000	2000
Berrenda Mesa Water District	Alameda County Flood Control and Water Conservation District Zone 7	7,000	2000
Lost Hills Water District	Alameda County Flood Control and Water Conservation District Zone 7	15,000	2000
Belridge Water Storage District	Alameda County Flood Control and Water Conservation District Zone 7	10,000	2001
Belridge Water Storage District and Berrenda Mesa Water District	Solano County Water Agency	5,756	2001
Belridge Water Storage District and Berrenda Mesa Water District	Napa County Flood Control and Water Conservation District	4,025	2001

EXHIBIT 1

PLAINTIFFS' EXPENSES TRUST ACCOUNT AGREEMENT

This Agreement is entered into this fifteenth day of August 2002, by JAMS and DWR, for the purpose of transferring $300,000 in trust to JAMS for use in accordance with Principles of Settlement in PCL vs. DWR.

WHEREAS, JAMS has acted as mediator between the Department and other parties to the litigation in PCL v. DWR (Superior Court No. 95CS03216).

WHEREAS, the Principles of Settlement as agreed to by the parties on July 22, 2002, provides for the placement of $300,000 in trust with JAMS.

WHEREAS, the money placed in the trust is to be provided to plaintiffs for expenses actually incurred as needed to support plaintiffs' participation in developing the new EIR to be filed as a return to the writ.

WHEREAS, the Principles of Settlement also provides that the funds will be provided based on a budget and participation plan to be submitted by plaintiffs to the mediator specifying the purposes for which the funds will be expended.

The parties agree as follows:

1. JAMS agrees to accept $300,000 in trust in accordance with the Principles of Settlement.

2. JAMS agrees to maintain the monies in trust, and following receipt of a budget and participation plan from plaintiffs, to disburse funds to plaintiffs for actual expenditures incurred for such purpose and pursuant to such schedule, budget, and participation plan, all in conformance with the Principles of Settlement. The funds will be disbursed to the plaintiffs' attorney, Antonio Rossmann, Law Offices of Antonio Rossmann.

3. Costs incurred by JAMS in providing this service will be paid as part of the mediator services as part of the existing contract between JAMS and the California Department of Justice, Office of the Attorney General.

4. This agreement may be amended in writing by agreement of both parties.

5. Funds not disbursed upon termination of the trust shall be returned to DWR.

6. The trust shall terminate upon notice to JAMS by DWR of termination based on the earlier of (a) failure of the parties to the mediation to execute a settlement agreement by January 1, 2003; (b) notice of termination given by the Director of DWR to JAMS and plaintiffs that this trust is terminated, which notice shall not be given without

defendants' consultation with plaintiffs and the mediator; or c) filing of the Notice of Determination on the new EIR.

7. JAMS will incur no liability to DWR arising from any disbursement made pursuant to this agreement.

8. This agreement is not intended to and shall not create any rights in any third party.

APPROVED:

/s/ Steve Macaulay for	8/10/02	/s/ Julie Sager	8/15/02
Thomas M. Hannigan Director	Date	Vice President & CFO JAMS	Date

LA3:1018590.11

EXHIBIT 1

AMENDMENT NO. 1

PLAINTIFFS' EXPENSES TRUST ACCOUNT AGREEMENT

Paragraph 6 of this Agreement is amended to read as follows:

6. The trust shall terminate upon notice to JAMS by DWR of termination based on the earlier of (a) failure of the parties to the mediation to execute a settlement agreement by May 1, 2003, (b) notice of termination given by the Director of DWR to JAMS and plaintiffs that this trust is terminated, which notice shall not be given without defendants' consultation with plaintiffs and the mediator; or (c) filing of the Notice of Determination on the new EIR.

APPROVED:

Thomas M. Hannigan Director	Date	 JAMS	Date

EXHIBIT 2

KERN WATER BANK AUTHORITY
AGREEMENTS AND PERMITS
WHICH MAY HAVE RELIED ON THE KWBA ADDENDUM

AGREEMENT/PERMIT	DATE	OTHER PARTIES
Incidental Take Permit - PRT-828086	2-Oct-97	Department of Interior, U.S. Fish & Wildlife Service
Approval/Management Authorization pursuant to California Endangered Species Act for Implementation of Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan	2-Oct-97	Calif. Department of Fish & Game
Natural Community Conservation Plan/Habitat Conservation Plan Implementation Agreement	2-Oct-97	U.S. Fish & Wildlife Service; Calif Dept of Fish & Game; Kern Water Bank Authority
Approval, Cultural Resources Assessment and Plan for the KWBA Project	January, 1997	N/A
Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program	26-Oct-95	Numerous
Approval of Kern Water Bank Authority Mosquito Abatement Program	26-Oct-95	Mosquito Abatement Districts
Service Contracts for Operations and Maintenance	1996 - current	Numerous Vendors
Grazing Leases (Sheep and Cattle)	1997- current	Various Stockmen
Minor Amendment No. 1: Hunting/Research to the KWBA HCP/NCCP and Implementation Agreement	6/30/1998	California Department of Fish and Game and U.S. Fish and Wildlife Service
State of California Standard Agreement for "Improving Wildlife Habitat for Doves" (annual contract)	1998 - current	Calif. Department of Fish and Game
Conservation Credit Certificates	1998 - current	Conservation Credit Buyers
Construction and Service Contracts for Master Plan Construction Project - KWB Canal, Head-works, Aqueduct Turnout, New Wells, Well Rehabilitation, Pipelines	7/1999 - 8/2002	Numerous Contractors and Vendors
KWB Canal and Buena Vista Main Canal Joint Use Agreement	7/20/1999	Buena Vista Water Storage District

AGREEMENT/PERMIT	DATE	OTHER PARTIES
Business Loan Agreement ($21,000,000)	7/23/1999	Bank of America, N.A.
Agreement for Grant of Easement	September 1999	State of California Acting Through the Department of Parks and Recreation
Agreement for Construction, Operation, and Maintenance of the Kern Water Bank Turnout, a Permanent Turnout Within the California Aqueduct Right of Way	11/9/1999	Department of Water Resources
License Agreement for Kern River Canal Crossing	11/17/1999	City of Bakersfield
Loan Contract No. E75002 Under the "Safe, Clean, Reliable Water Supply Act Water Conservation and Ground Water Recharge Sub account ($5,000,000)	March 2000	State of California, Department of Water Resources, Division of Planning and Local Assistance
Reclamation Board Permit No. 17147-A GM Authorizing Construction of Pedestrian Bridge Across the Outlet Canal within the Kern River Designated Floodway	10/16/2000	State of California - The Resources Agency, Department of Water Resources
Reclamation Board Permit No. 16821 GM (Revised) Authorizing Construction of a 20-foot Wide Unlined Canal and Reinforced Concrete Gated Turnout Structure on the Right (North) Bank of the Designated Floodway and Install a 108-Inch Diameter, 700-foot long, Reinforced Concrete Pipe Across (Under the Kern River	2/26/2001	State of California - The Resources Agency, Department of Water Resources
Grant Awarded Under the "Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act (Proposition 13) - Groundwater Storage Program ($3,375,000)	Jun-02	State of California, Department of Water Resources, Division of Planning and Local Assistance
Service Contracts for Well Testing and Rehabilitation Under the SB5X Program	2002	Various Vendors

EXHIBIT 3-A

PROPOSED 21168.9 ORDER

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SACRAMENTO

PLANNING AND CONSERVATION LEAGUE, a California not for profit corporation, PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, a California public agency; CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC., a California not for profit corporation, Plaintiffs and Petitioners, v. DEPARTMENT OF WATER RESOURCES, a California State Agency, et al., Defendants and Respondents,	Case No: 95CS03216 [PROPOSED] ORDER PURSUANT TO PUBLIC RESOURCES CODE SECTION 21168.9

On remand from the Third District Court of Appeal on January ___, 2003, in Department 53 of the Sacramento Superior Court, the Honorable Loren E. McMaster, presiding, this proceeding came on for a status report and joint motion. Petitioners and Plaintiffs, Planning and Conservation League, Plumas County Flood Control and Water Conservation District, and Citizens Planning Association of Santa Barbara County ("Petitioners"), appeared through Antonio Rossmann and Roger B. Moore. Respondent and Defendant, Central Coast Water Authority (CCWA), appeared through Susan F. Petrovich of the Law Firm of Hatch & Parent. Respondent and Defendant, Department of Water Resources (DWR), appeared through Deputy Attorney General Marian E. Moe. Robert S. Draper of O'Melveny and Myers, LLP and Clifford W. Schulz appeared, respectively, on behalf of the Metropolitan Water District of Southern California and Dudley Ridge Water District, entities that submitted answers to the First

Amended Complaint subsequent to the Court of Appeal's final determination in this action and prior to any further order of this Court on remand.

In light of the direction from the Third District Court of Appeal on remand in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892, this Court hereby makes the following findings:

1. The parties to this lawsuit and other public agencies have engaged in extensive settlement negotiations, mediated by retired Judge Daniel Weinstein of JAMS Dispute Resolution, with the intent to avoid further litigation and associated expenses, to provide for an effective way to cooperate in the preparation of a new environmental impact report (EIR), and to make other specified improvements in the administration and operation of the State Water Project.

2. The mediation has resulted in an executed Settlement Agreement for approval by this Court, attached to this Order as Exhibit A.

3. DWR as lead agency has commenced the preparation of the new EIR.

4. As part of the Settlement Agreement, DWR and the State Water Project (SWP) contractors who are signatories to the Settlement Agreement have agreed that, pending DWR's filing of a return in satisfaction of the Writ of Mandate and this Court's dismissal of the Writ of Mandate, they will not approve any new project or activity (as defined in section VII.A of the Settlement Agreement) in reliance on the 1995 Environmental Impact Report for the Implementation of the Monterey Agreement.

5. This Order is made pursuant to the provisions of Public Resources Code section 21168.9 and pursuant to this Court's equitable powers. This Court finds that the actions described in this Order, including actions taken in compliance with the Writ of Mandate, comprise the actions necessary to assure DWR's compliance with Division 13 of the Public Resources Code. This Court further finds that this Order includes only those mandates necessary to achieve compliance with Division 13.

THEREFORE, IT IS HEREBY ORDERED as follows:

1. This Court's Final Judgment denying the petition for writ of mandate, entered August 15, 1996, is reversed in accordance with the directive of the Third District Court of Appeal's decision in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892.

2. This Court's order granting the summary adjudication on the fifth cause of action, entered June 10, 1996, is vacated.

3. The Settlement Agreement attached as Exhibit A is hereby approved.

4. A Peremptory Writ of Mandate directed to Respondents Central Coast Water Authority and DWR shall issue under seal of this Court in the form attached hereto as Exhibit B.

5. In accordance with the Settlement Agreement and this Order, pending DWR's filing of the return in compliance with the Peremptory Writ of Mandate and this Court's Order discharging the Writ of Mandate, DWR and CCWA shall not approve any new project or activity (as defined section VII.A of the Settlement Agreement) in reliance on the 1995 EIR for the Implementation of the Monterey Agreement.

6. In the interim, until DWR files its return in compliance with the Peremptory Writ of Mandate and this Court orders discharge of the Writ of Mandate, the administration and operation of the State Water Project and Kern Water Bank Lands shall be conducted pursuant to the Monterey Amendments to the State Water Contracts, as supplemented by the Attachment A Amendments to the State Water Contracts (as defined in the Settlement Agreement) and the other terms and conditions of the Settlement Agreement.

7. Plaintiffs and petitioners shall recover such costs and attorney's fees as provided in prior court orders and in an amount as determined in the arbitration procedures agreed to in the Settlement Agreement, or as otherwise agreed to by the parties.

8. Except as provided, the Peremptory Writ of Mandate shall not limit or constrain the lawful jurisdiction and discretion of DWR. This Court retains jurisdiction until DWR files a

return that complies with the terms of the Writ of Mandate, and this Court issues an order discharging the Writ of Mandate.

IT IS SO ORDERED.

Dated: ____________, 2003 __________________ ______________________________

Judge of the Superior Court

EXHIBIT 3-B

PROPOSED WRIT OF MANDATE

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SACRAMENTO

PLANNING AND CONSERVATION LEAGUE, a California not for profit corporation, PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, a California public agency; CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC., a California not for profit corporation,	Case No: 95CS03216
Petitioners,	PROPOSED PEREMPTORY WRIT OF MANDATE (Public Resources Code § 21168.9)
v.	
DEPARTMENT OF WATER RESOURCES, a California State Agency, and CENTRAL COAST WATER AUTHORITY, A Joint Powers Agency	
Respondents.	

TO: Respondents California Department of Water Resources and Central Coast Water Authority:

The Third District Court of Appeal, in its decision in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892, having directed this Court to issue a Peremptory Writ of Mandate,

YOU ARE HEREBY COMMANDED to comply with the following:

1. Respondent Central Coast Water Authority shall set aside its October 26, 1995 certification that the Final Programmatic Environmental Impact Report for Implementation of

the Monterey Agreement (the 1995 Monterey Agreement EIR) was completed in compliance with the California Environmental Quality Act [AR 2183].

2. Respondent Department of Water Resources (DWR) shall:

(a) set aside its December 13, 1995 certification, as responsible agency, that the 1995 Monterey Amendment EIR is adequate under the California Environmental Quality Act [AR 1875]; and

(b) as lead agency, prepare and certify a new EIR. in compliance with the Court of Appeal's decision, the California Environmental Quality Act, and the Settlement Agreement.

3. Upon completion and certification of the new EIR, Respondent DWR shall make written findings and decisions and file a notice of determination identifying the components of the project analyzed in the new EIR**,** all in the manner prescribed by sections 15091 – 15094 of the CEQA Guidelines.

4. Respondent DWR shall, upon the filing of a Notice of Determination, submit the new EIR, the written findings, the Notice of Determination, and such additional documents as this Court may order by way of return to this writ of mandate.

5. This Court shall retain jurisdiction over this proceeding until DWR files a return that complies with this Writ of Mandate, and this Court issues an order discharging this Writ of Mandate. Except as provided, this Writ of Mandate shall not limit or constrain the lawful jurisdiction and discretion of the Department of Water Resources.

Dated: ______________, 2003

____
____

____
Clerk of the Superior Court

Let the foregoing writ issue:

____
Judge of the Superior Court

EXHIBIT 4

SECTION VI TRUST ACCOUNT AGREEMENT

This Section VI Trust Account Agreement (this "Trust Agreement") is entered into this ________ day of _______ 2003, by JAMS and the State of California Department of Water Resources (the "Department"), for the purposes of establishing and describing the trust account in accordance with that certain Settlement Agreement entered into in *Planning & Conservation League v. Department of Water Resources* ("PCL v. DWR").

WHEREAS, Judge Daniel Weinstein (ret.) of JAMS has acted as mediator between the Department and other parties to the litigation in *PCL v. DWR* (Sacramento Superior Court No. 95CS03216).

WHEREAS, the Settlement Agreement provides for the placement over time of $5,500,000 in trust with JAMS at the specific times and under the conditions in the Settlement Agreement.

The parties agree as follows:

1. JAMS will establish a trust account for receipt and disbursal of funds received from the Department for payment pursuant to the Settlement Agreement.

2. All funds deposited with JAMS pursuant to this agreement shall be placed into a trust account and shall be disbursed only in accordance with this Trust Agreement and the Settlement Agreement. Section VI of the Settlement Agreement provides that the funds shall be used to implement the Settlement Agreement, as determined by Plaintiffs in their reasonable judgment, including watershed restoration projects, follow-up actions arising from the Settlement Agreement, and technical studies.

3. JAMS agrees to maintain the monies in trust, and after receipt of a written statement executed by all Plaintiffs (as defined in the Settlement Agreement), to disburse funds to Plaintiffs in conformance with such statement. JAMS will provide a copy of the written statement to: Chief Counsel, The Office of the Chief Counsel, Department of Water Resources, P.O. Box 942836, Sacramento, CA 95814.

4. Costs incurred by JAMS in providing this service will be paid as part of the mediator services as part of the existing contract between JAMS and the California Department of Justice, Office of the Attorney General, or any successor contract.

5. This agreement may be amended only in writing by agreement of both parties.

6. Funds not disbursed before termination of this Trust Agreement shall be returned to DWR immediately upon termination of this Trust Agreement.

7. This Trust Agreement shall terminate if and when DWR notifies JAMS that the agreement is terminated, which notice shall not be given without DWR's consultation with Plaintiffs and the mediator.

8. JAMS will incur no liability to DWR arising from any disbursement made pursuant to this agreement.

9. This Trust Agreement is intended solely for the purposes of establishing and describing the trust account at JAMS and is not intended to and shall not create any rights in any third party.

APPROVED:

_________________________	____________	_________________________	____________
Thomas M. Hannigan Director	Date	 JAMS	Date

E. STUDY OF TRANSFER, DEVELOPMENT, AND OPERATION OF THE KERN WATER BANK

Study of the Transfer, Development, and Operation of the Kern Water Bank

Table of Contents

Introduction

A. Overview of KFE Property

In the early 1980s, the Department began exploring the feasibility of developing a State Water Project (SWP) groundwater storage facility in Kern County, which it called the Kern Water Bank (KWB). As envisioned, the KWB would consist of a series of "elements," which would be geographically separate projects that would be operationally integrated. The largest of these elements, the Kern Fan Element (KFE), was to be developed first, followed by a number of local elements developed with several water districts in Kern County. After evaluating the feasibility of the KFE, in 1988, the Department purchased approximately 20,000 acres of land in the Kern Fan area from Tenneco West, Inc.

However, the Department encountered many legal, institutional, and political impediments to implementation of a groundwater storage facility on the KFE property. SWP contractors also expressed concerns regarding their ongoing costs for feasibility studies and ownership of the KFE property given their assessment of the likelihood of realizing a functional groundwater storage program. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately convinced the Department to halt feasibility studies and design work on the project.[i] The uncertainties included proposed revisions of Delta water quality standards and measures to protect threatened and endangered species, which affected the SWP's ability to pump water from the Delta for recharge on the KFE property. Expected changes in arsenic standards for drinking water also raised questions regarding the ability of the project to meet water quality standards for pump-in to the California Aqueduct.[ii] In addition to environmental and water quality issues, the Department and KCWA could not reach agreement on measures to comply with Water Code Section 11258, which required approval of local agencies for development of the groundwater banks. Later, the Department concluded that these constraints on Delta pumping made development of an SWP groundwater storage facility in the Kern Fan Element infeasible.[iii] In 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized.

In 1994, the Department and representatives of the agricultural and urban contractors negotiated a set of principles known as the Monterey Agreement. As part of these principles, the parties agreed to the Department's sale or lease of the KFE property to designated SWP agricultural contractors, in exchange for the permanent retirement of 45,000 acre-feet (AF) of these contractors' Table A amount. The Monterey Amendment, which was the amendment to the SWP contractors' long-term water supply contracts that implemented the Monterey Agreement principles, provided for the State's transfer of ownership of the KFE property to Kern County Water Agency (KCWA), and then to the Kern Water Bank Authority (KWBA), for local agency development and use as a groundwater bank.

B. Purpose

The purpose of this report is to provide an independent study by the Department of the KWB, as required under the May 5, 2003 Settlement Agreement between the Planning and Conservation

League et al., the Department, and SWP contractors. Section III (F) of the Settlement Agreement requires the Department to prepare an independent study, and exercise "its judgment regarding the impacts related to the transfer, development, and operation of the KWB in light of the Kern Environmental Permits." The agreement also requires that the study "identify SWP and any non-SWP sources of water deliveries to KWB." To evaluate the impacts, the Department used the KFE property conditions and facilities that existed before the Department conveyed the KFE property to KCWA as the baseline for the evaluation.

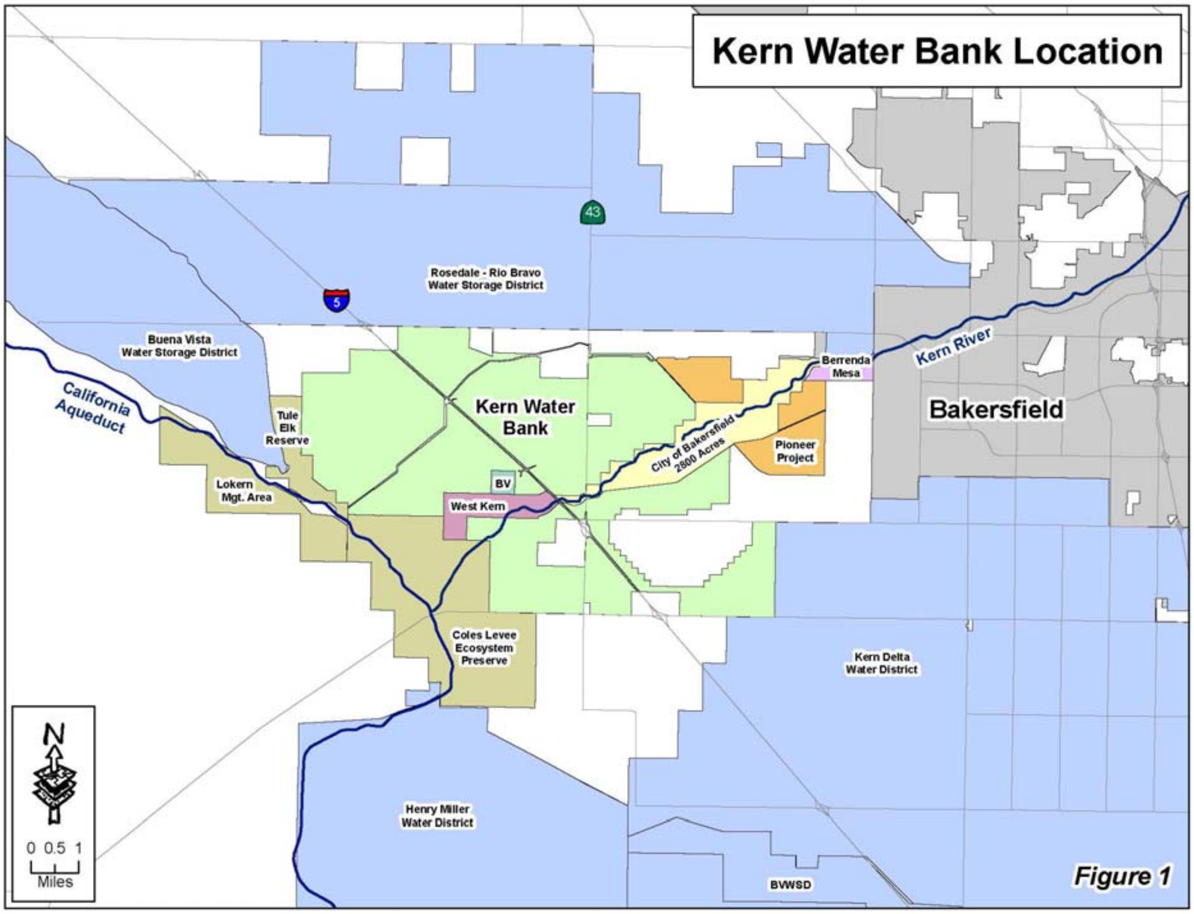
II. Method

Information from three sources was used to evaluate the transfer, development, and operation of the KWB by the Kern Water Bank Authority (KWBA). The first source was the Annual Compliance reports for 1999 through 2005. These reports are prepared each year by the KWBA and submitted to the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS), as required under their environmental permits, and were used in this study to determine what facilities were constructed, how the project is operated (recharge and extraction operation), identify vegetation, terrestrial and aquatic wildlife use of the site, and identify incidences of "take" in light of the Kern Environmental Permits. The second source was staff from KCWA and KWBA, who were consulted to provide additional information on recharge and recovery activities of SWP and non-SWP water at the KWB, and to evaluate where water could have been banked in Kern County in the absence of the KWB. The third source was personnel from CDFG and USFWS, who were contacted to determine if the resources agencies had any concerns with the development or operation of the KWB in light of the KWB environmental permits.

III. Existing Conditions

The KFE property [1] is located in Kern County, about 12 miles southwest of the City of Bakersfield (Figure 1). It consists of approximately 20,000 acres of gently sloping land overlying the Kern River Alluvial Fan. Surrounding lands are used primarily for agriculture, habitat preserves, or other water banking programs. Prior to the development of the KWB, most of the land was used for agriculture, and irrigation water was provided by surface water deliveries by the former James-Pioneer Improvement District of North Kern Water District, and by groundwater pumping. Agricultural water supplies for lands surrounding the KWB are provided by Rosedale – Rio Bravo Water Storage District for most lands to the north, by Kern Delta Water District for lands to the southeast, by Henry Miller Water District for lands to the

[1] The court referred to the KFE property as the KWB in its decision. The KFE property consists of the approximately 20,000 acres acquired by the Department from Tenneco West, Inc. The property was acquired for the purpose of developing the KFE, one of a series of groundwater banking "elements" that together would constitute the KWB. As envisioned, the eight or so elements of the KWB would be geographically separate projects that would be operationally integrated. Therefore, the terms KFE and KWB are not interchangeable, and what is now called the KWB is only a portion of the KWB envisioned by the Department. For simplicity, this document will use the term KWB to refer to the groundwater bank developed by the KWBA on the KFE property, and the term KFE property to refer to the 20,000 acres of land acquired by the Department.

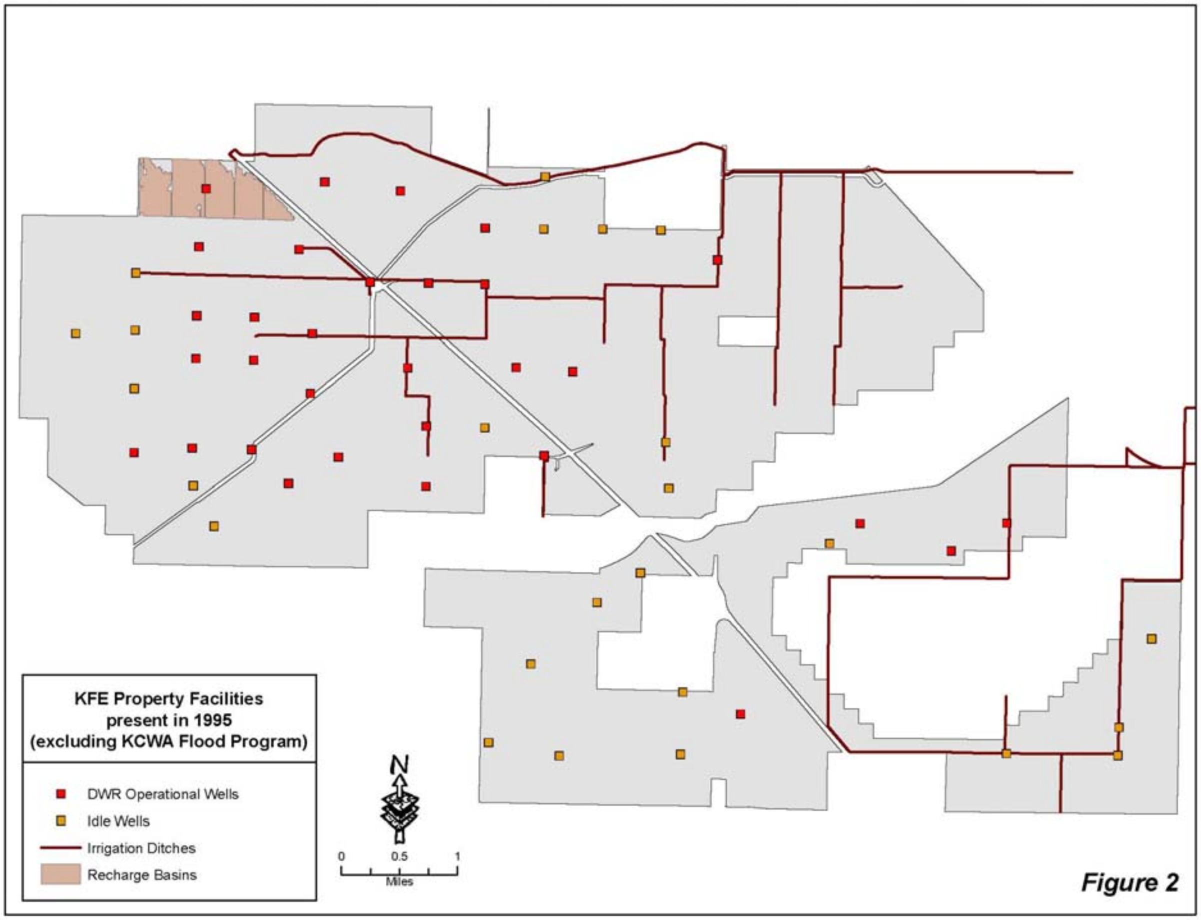


south, and by Buena Vista Water Storage District for lands to the northwest. The Tule Elk State Reserve, Coles Levee Ecosystem Preserve, and Lokern Management Area are located west and south the KWB.

The KWB is one of several groundwater banks in Kern County. Other groundwater banks include: Berrenda Mesa Project (operational since 1983); City of Bakersfield 2,800 Acre Recharge Basin (operational since 1978); Pioneer Project, including Kern River Channel (operational since 1995); West Kern/Buena Vista (operational since 1978); Arvin-Edison Water Storage District (operational for groundwater banking for other districts since 1990); and Semitropic Water Storage District (operational for groundwater banking for other districts since 1990). With the exception of the Arvin-Edison and Semitropic groundwater banks, all of the projects are located adjacent to the KWB on the Kern River Alluvial Fan. While KWB provisions allow for lower priority use by others (see Section V.B.4), such use has only been by KCWA member agencies and has been very limited in scope. The Arvin-Edison and Semitropic banks allow participation by non-Kern County entities; the other banks mentioned above allow participation by Kern County entities only.

A. Existing KFE Property Facilities

The facilities that existed on the KFE property in early 1995 are shown in Figure 2.



1. Recharge

Tenneco constructed approximately 300 acres of recharge ponds in the northwestern portion of the KFE property prior to its acquisition by the Department in 1988. These ponds are known informally as the Stockdale Highway Ponds. The Department did not construct any recharge ponds on the KFE property during its ownership of the property.

2. Recovery

Sixty-five agricultural wells were present on the KFE property when it was acquired by the Department in 1988. During the Department's ownership of the property, it initiated a program of refurbishing some of these existing wells, so that it could recover water it had purchased from La Hacienda, Inc.[2] At the time the property was transferred to KCWA, 31 of the 65 existing

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[2] The purchase was of 98,000 acre-feet of stored Kern River water, which had originally be recharged at the City of Bakersfield's 2800 acre project. (KWB First Stage KFE Feasibility Report, December 1990)

wells were considered operable, although 3 of these were not connected to any conveyance facilities. The remaining 34 were idle wells in various states of disrepair.

3. Conveyance

At the time the Department acquired the KFE property in 1988, the property included a number of conveyance facilities that had been constructed primarily for the delivery of irrigation water for the agricultural activity occurring then and historically on the property. These facilities were not constructed for water bank operations of recharge and recovery, and many were not suitable for these purposes. An exception was the Pioneer Canal, which could have been used to deliver water for recharge to the existing approximately 300 acres of Stockdale Highway Ponds. Other nearby facilities, including the Cross Valley Canal, the City of Bakersfield's Kern River Canal, and Buena Vista WSD's Alejandro Canal, could have been used to convey water recovered from the 31 operable wells on the KFE property. However, these facilities were owned by others and could only have been used for banking purposes when unused capacity was available. During the Department's ownership of the property, the Department constructed conveyance facilities of small capacity to convey water recovered from certain of the individual operable wells to these larger nearby conveyance facilities.

B. KCWA Flood Emergency Program

In 1995, KCWA requested and was granted the use of the KFE property for emergency spreading of water to mitigate projected flooding of agricultural lands due to high flows on the Kern and Kaweah Rivers. KCWA requested use of approximately 3,200 acres of the KFE property for the emergency delivery and controlled spreading of local floodwater flows. KCWA proposed spreading water from the Kern and Kaweah Rivers onto existing Kern County spreading basins (including KCWA's Pioneer Project, the City of Bakersfield's 2,800 acres, Berrenda Mesa Ponds, and Rosedale-Rio Bravo Ponds), and diverting the remaining flood flows (up to 500 cubic feet per second (cfs)) onto a portion of the Department's KFE property. KCWA proposed constructing up to 2,300 acres of recharge ponds on 3,200 acres of the property.

The Department conditioned its approval of KCWA's construction plans upon KCWA satisfaction of the endangered species acts requirements. In consultation with the USFWS and CDFG, KCWA performed biological surveys of the areas that it proposed to flood in order to avoid any threatened or endangered species, in compliance with federal and State endangered species acts. KCWA obtained endangered species agreements with USFWS and CDFG to develop 2,300 acres of spreading ponds. The Department added additional conservation conditions in a separate agreement. KCWA prepared a CEQA Negative Declaration and filed a Notice of Exemption for the project's CEQA compliance. Subsequently, the Department approved[3] a second request by KCWA to divert water onto an additional 1,800 acres of spreading ponds on an additional 5,000 acres of KFE land. The Department also agreed to extend its initial agreement with KCWA to March 31, 1997.[4]

[3] Letter, John J. Silveira, DWR to Thomas Clark, KCWA; June 2, 1995
[4] Letter, Robert G. Potter, DWR to Thomas Clark, KCWA; March 11, 1996

As a result of these agreements, in 1995 KCWA constructed 1,518 acres of recharge ponds on the initial 3,200 acres of KFE property, and 1,516 acres of recharge ponds on the additional 5,000 acres of KFE land (Figure 3). Under the flood emergency program, about 230,000 AF of water was recharged in 1995 and about 144,000 AF in 1996.

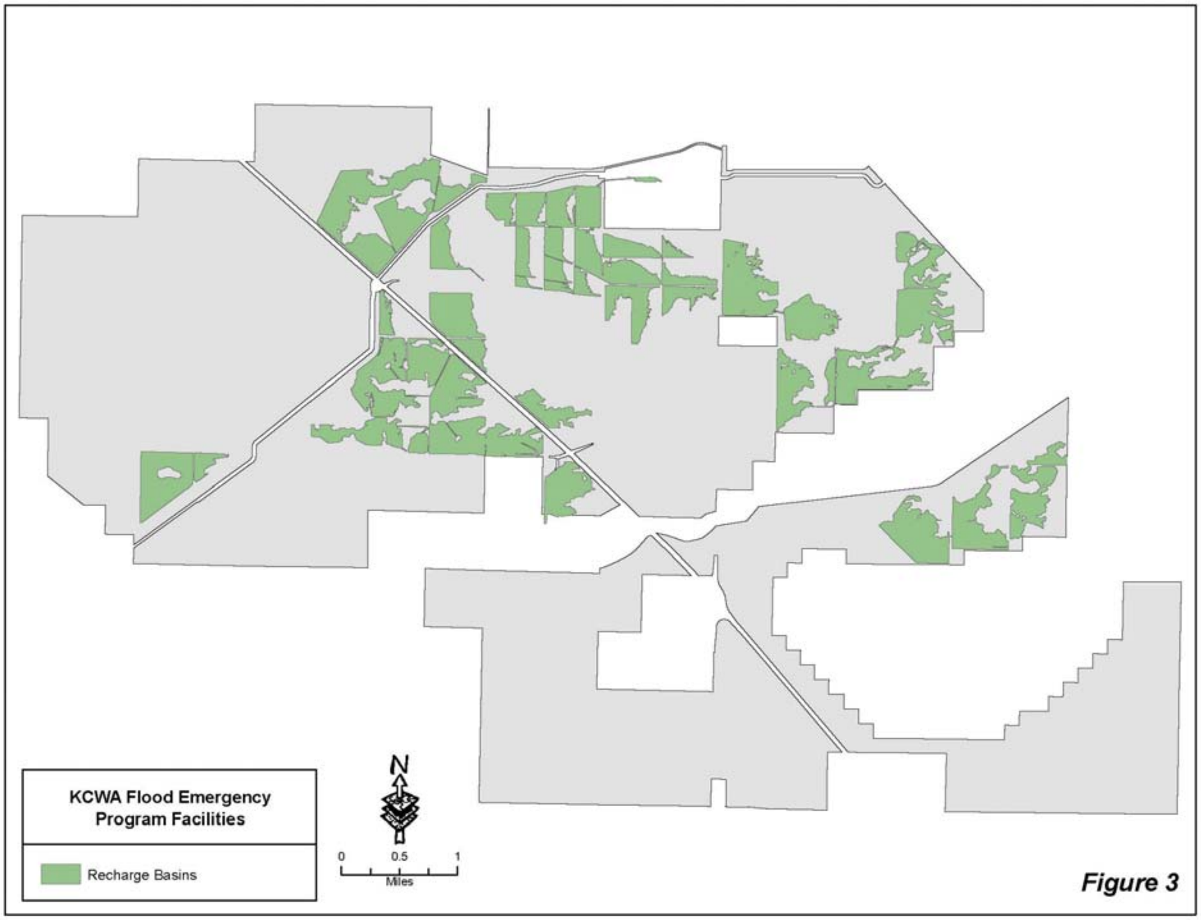
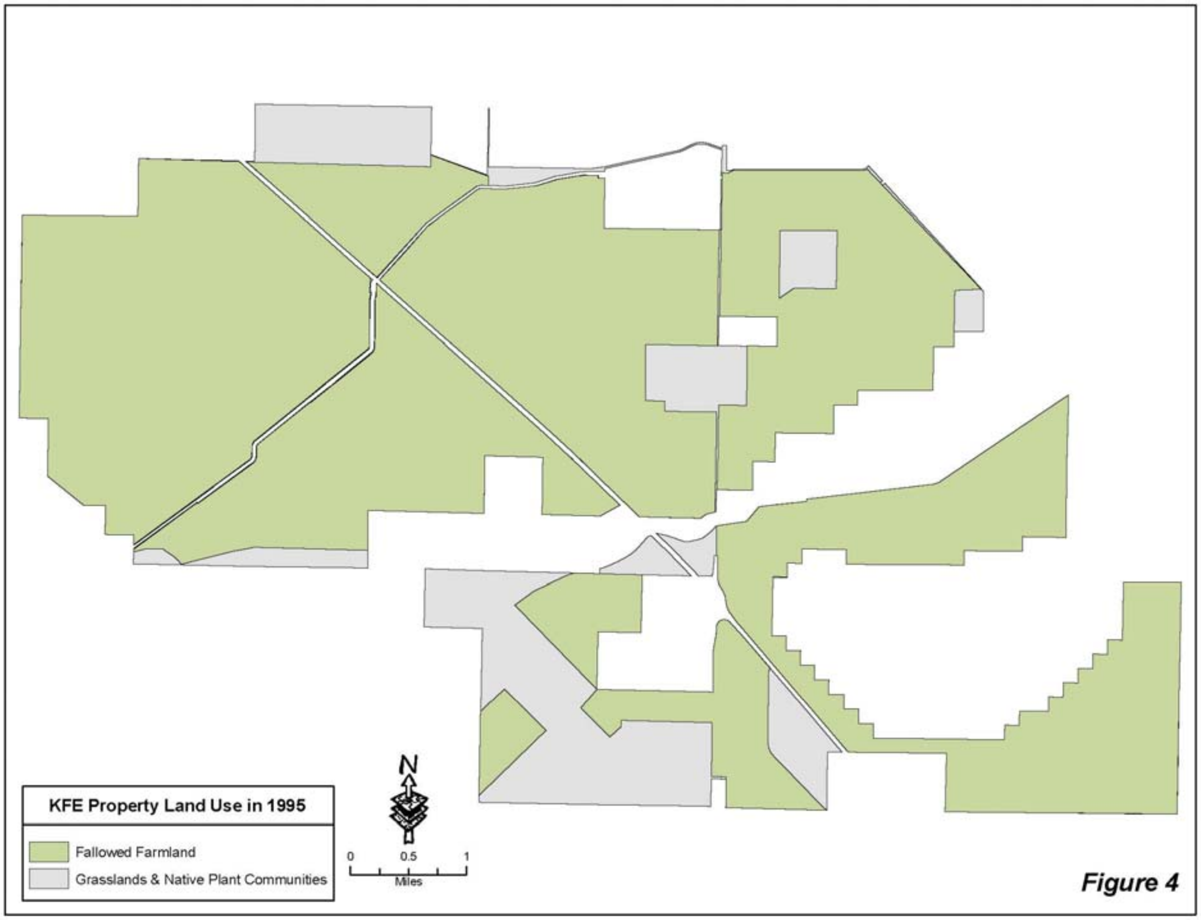


Figure 3

C. Land Use

Prior to the Department's purchase of the KFE property in 1988, approximately 17,068 acres of the property was under extensive cultivation.[iv] The remaining property contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland, which had been leased for oil recovery facilities. No wetland habitat was present in the project area, except for the canals used to convey water for agricultural use.

A Memorandum of Understanding was signed between the Department and KCWA on March 25, 1987, that provided for the phase out of all agricultural production on the KFE property by the end of 1993. In fact, one of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenant leases were terminated, and thereafter the agricultural lands were fallowed. The land use on the KFE property in 1995 is shown in Figure 4.



IV. Transfer of KFE Property from the Department

By 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized. As is described in more detail in Section I.A, by this time the Department had concluded that constraints on Delta pumping and a number of other uncertainties made development of an SWP groundwater storage facility on the KFE property infeasible. In 1994, the Department and representatives of the agricultural and urban contractors negotiated a set of principles, subsequently implemented through the Monterey Amendment, that provided for the State's transfer of the KFE property to KCWA, and then to the KWBA, for local agency development and use as a groundwater bank, as discussed in more detail below.

A. Monterey Amendment

The Department deferred development efforts of the KFE in the early 1990s. Subsequently, the Monterey Amendment provided for the State's transfer of ownership of the KFE property to KCWA for local agency development and use as a groundwater bank, in exchange for the permanent retirement of 45,000 AF of SWP Table A amount by KCWA and Dudley Ridge WD.

Article 52 of the Monterey Amendment states that:

a) The State shall convey to the Kern County Water Agency (KCWA) in accordance with the terms set forth in the agreement between the State of California Department of Water Resource and Kern County Water Agency entitled, "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" (the Kern Water Bank Contract), the real and personal property described therein.

b) Subject to the approval of KCWA, other contractors may be provided access to and use the property conveyed to KCWA by the Kern Water Bank Contract for water storage and recovery. Fifty percent (50 %) of any project water remaining in storage on December 31, 1995, from the 1990 Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program shall be transferred to KCWA pursuant to the Kern Water Bank Contract. The remaining fifty percent (50%) of any such water (approximately 42,828.5 AF) shall remain as project water and the State's recovery of such project water shall be pursuant to the provisions of a separate recovery contract. Any other Kern Water Bank demonstration program water shall remain as project water and the State's recovery of such water shall be pursuant to the provisions of the respective contracts for implementation of such demonstration programs.

Article 53(i) of the Monterey Amendment states, in part, that:

i) On January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until the end of the project repayment period: (i) Kern County Water Agency's (KCWA) annual entitlement for agricultural use as currently designated in Table A-1 of its contract shall be decreased by 40,670 AF; (ii) Dudley Ridge Water District's (DRWD) annual entitlement as currently designated in Table A of its contract shall be decreased by 4,330 AF; and (iii) the State's prospective charges (including any adjustments for past costs) for the 45,000 AF of annual entitlements to be relinquished by KCWA and DRWD thereafter shall be deemed to be costs of project conservation facilities and included in the Delta Water Charge for all contractors in accordance with the provisions of Article 22.

In accordance with the Monterey Amendment, the Department conveyed the KFE property to KCWA in exchange for KCWA and DRWD permanently retiring a total of 45,000 AF of agricultural Table A amounts. On December 13, 1995, the same date the Department executed the Monterey Amendments of KCWA and DRWD, the Department executed the "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" between the Department and KCWA. This agreement provided the specific terms and conditions for the transfer of the KFE property to KCWA.

B. Exchange Agreement between the Department and KCWA

The "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" between the Department and KCWA was executed on December 13, 1995. This agreement provided for the transfer of the KFE acreage and its fixtures from the Department to KCWA in exchange for agricultural contractors' permanent reduction and retirement of 45,000 AF of their SWP Table A amount. The agreement transferred the property to KCWA and identified certain KCWA obligations, covenants, and agreements associated with the property, including KCWA assumption of responsibility for the Department's endangered species agreements, in total.

It was intended that KCWA would transfer the KFE property to a joint powers authority made up of those entities that had retired a portion of their Table A amounts. Therefore, the exchange agreement between the Department and KCWA included a provision that stated that the parties' agreed that KCWA could transfer all or a portion of the property and assign its rights and obligations to transferees who concurrently executed an agreement accepting the transfer and assignment and assumption of KCWA's obligations, covenants, and agreements.

C. Conveyance Agreement from KCWA to KWBA

Simultaneous with the December 13, 1995, execution of the exchange agreement between the Department and KCWA, KCWA executed an agreement between it and the Kern Water Bank Authority (KWBA). This agreement transferred the KFE property from KCWA to the KWBA:[5] to develop, operate, and maintain the KFE property as a local groundwater banking project, which they called the Kern Water Bank (KWB); to develop and improve the KWB for the importation, percolation and storage of water in underground aquifers for later extraction, transportation, and; for the beneficial use of Project Participants.[6] KWBA assumed control of the KFE property and prepared a plan for development fo the property as a groundwater bank and an operating plan to bank available water from three sources – the Kern River, the Central Valley Project's (CVP) Friant-Kern Canal, and the SWP.

V. KWBA's Development of KWB

A. Environmental Documents and Permits

1. CEQA

A final programmatic EIR on the Monterey Agreement ("Monterey Agreement EIR") was issued in October 1995. The Monterey Agreement EIR describes, among other things, the environmental impacts of the development of a groundwater bank on the KFE property, including construction of banking facilities and operation of a groundwater bank. The KWBA, as a responsible agency, approved the Monterey Agreement EIR on October 30, 1995. The principles of the Monterey Agreement were implemented through the Monterey Amendment. As described in Section IV above, upon execution of the Monterey Amendment, the Department

[5] The Kern Water Bank Authority is a joint power authority formed pursuant to California Government Code section 6500 et seq.
[6] The transfer of the KFE property from KCWA to KWBA was made possible by provisions specified in Section 3, subsection 3.3 (Immediate Reconveyance) of the Kern Water Bank Contract, dated December 13, 1995.

transferred the KFE property to KCWA, which simultaneously transferred the property to the KWBA.

The KWBA prepared specific plans for the development and operation of a groundwater bank on the KFE property, referred to by the KWBA as the Kern Water Bank (KWB). The CEQA guidelines indicate that "subsequent activities in a program must be examined in the light of the programmatic EIR to determine whether an additional environmental document must be prepared." A subsequent EIR is only allowed if certain findings are made, which was not the case for the proposed KWB. Instead, an addendum to the Monterey Agreement EIR was prepared pursuant to §15164 of the guidelines. This addendum addressed the environmental issues related to development and construction of the KWB that had not been addressed in the programmatic EIR. The primary focus of the addendum was the Kern Water Bank Habitat Conservation Plan (HCP) and the Natural Community Conservation Plan (NCCP), which primarily address the impacts of the project on endangered species. However, the addendum also addressed the impact on cultural resources, groundwater impacts on surrounding landowners, and mosquito abatement, among other things. The HCP/NCCP is discussed in more detail below.

After completion of the environmental analysis, and establishment of appropriate mitigation measures, the KWBA concluded that the entire project, as revised by the mitigation measures, would have no significant effect on the environment. A Notice of Determination was filed July 4, 1996, and no legal challenge was filed.

2. CESA/ESA

a. Permits

To allow the management and operation of the KWB in accordance with the incidental take of endangered, threatened and certain other listed species, KWBA applied to the USFWS for two permits pursuant to the federal Endangered Species Act, and to the CDFG for two management authorizations pursuant to the California Endangered Species Act and the Natural Community Conservation Planning Act. One permit and one management authorization (the Project Permit/Authorization) is related to the KWB project. The other permit and management authorization (the Master Permit/Authorization) is related to a conservation bank to be used as potential mitigation for activities by third parties within designated areas of the Southern San Joaquin Valley. The conservation bank can be used to provide mitigation for the incidental take of listed species by qualified third parties for activities that take place within Kern County, the Allensworth area of Tulare County, and the Kettleman Hills area of Kings County. Both Permits and both Master Authorizations are for a period of 75 years. The agencies prepared a Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP), an implementation agreement (IA), and a federal environmental assessment (EA) as part of the permit/authorization process.

b. HCP/NCCP

To protect endangered species on the property, the KWBA, the USGWS, and the CDFG developed the HCP/NCCP to preserve and restore habitat for threatened, endangered, and protected species. The HCP/NCCP permits certain uses for the KFE property and designates general areas (referred to as "sectors") and acreages for those uses (Figure 5 and Table 1).

Table 1. HCP/NCCP Land Use Designations

	AREA (In Acres)
Recharge Basins	5,900
Other Water Banking Facilities	481
Compatible Habitat	5,592
Sensitive Habitat	960
Department Mitigation Land	530
Farming (including recharge ponds)	3,170
Conservation Bank	3,267
TOTAL	19,900

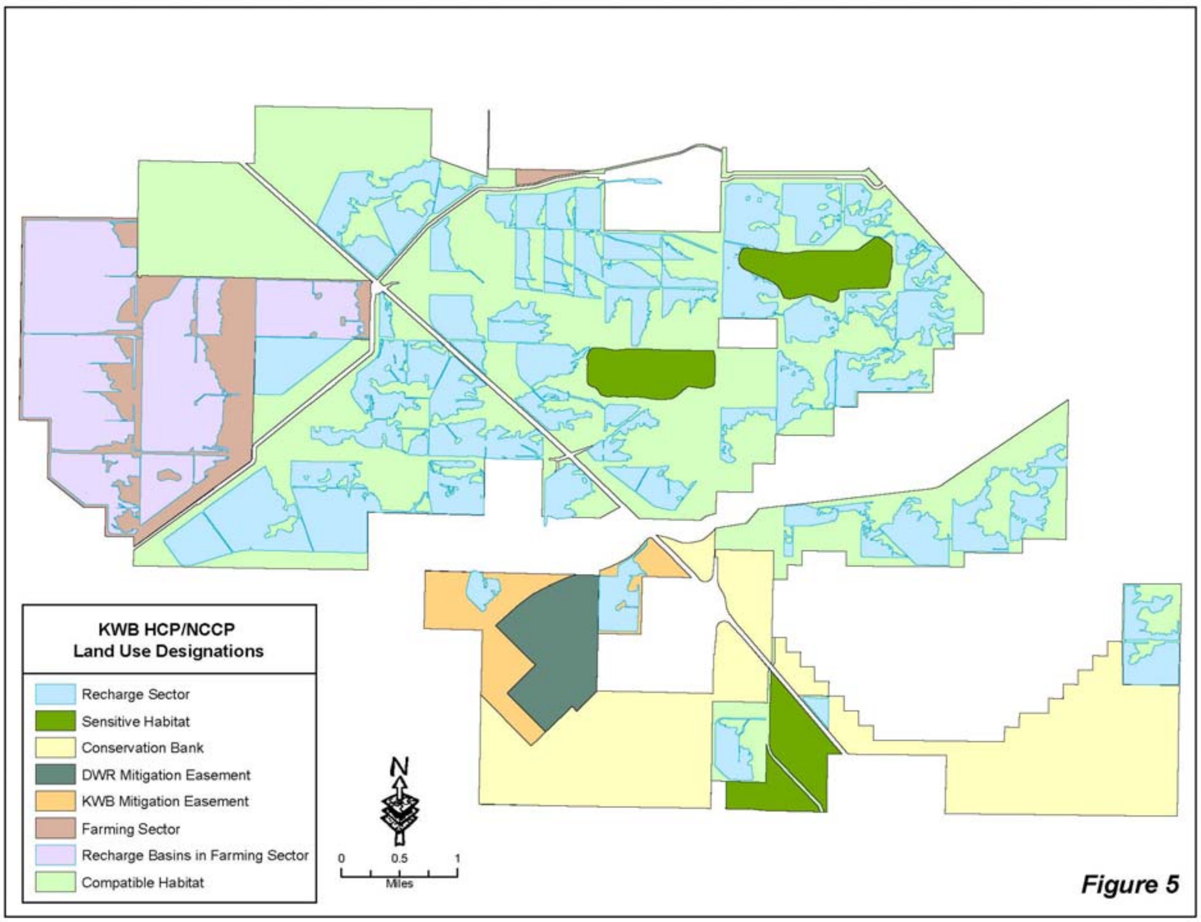


Figure 5

One of the HCP's primary management tools is its Vegetation Management Plan. The Plan incorporates an adaptive management approach to improve upland habitat for the threatened and endangered species that are found on the property. The program uses methods that are compatible with the water banking activities and economically feasible for a large-scale project. Since desert species prefer low-density vegetation, the primary method used to control vegetation has been grazing and burning. To control tumbleweeds (the largest problem), KWBA has timed grazing and burning activities to promote desired native plant growth and retard the growth of the tumbleweeds.

Water banking has also caused a resurgence in wetland habitat and the return of waterfowl to the area. To date, more than 40 new species of birds have been sighted on the KFE property, including the Caspian tern, the white-faced ibis, the double-crested cormorant, and the tri-colored blackbird.

The Implementation Agreement of the KWBA HCP/NCCP requires the KWBA to prepare and submit an Annual Report to the USFWS and the CDFG that includes the following information from the previous year:

- A summary of all activities on the KWB, including construction, and operation and maintenance of water recharge and water extraction facilities;
- A summary of Take of Covered Species and Covered Habitat;
- A summary of mitigation measures implemented;
- Results of studies completed;
- Results from the implementation of monitoring programs;
- Results from the implementation of avoidance and minimization measures;
- A report regarding the status of the Species Viability Fund;
- A copy of the KWBA's financial report evidencing KWBA's ability to fund its affirmative obligations under the KWBA HCP/NCCP and the Implementation Agreement; and
- A certification from a responsible officer of the KWBA.

Exhibit H of the HCP/NCCP requires KWBA to meet the Minimization of Impacts Requirements during construction and repair activities. The following actions are specified in Exhibit H:

- The delineation of all construction zones;
- Oversight of all phases of the construction on a daily basis by KWBA inspectors;
- Compliance with minimum construction standards for canals;
- An orientation program for all KWBA employees and contractors that explains endangered species concerns, notification requirements for dead, injured, or entrapped listed animals, and on-going practices requirements (e.g. construction site review and traffic, food and dog control);
- Monitoring major construction activities by a qualified biologist; and
- Biological surveys to identify San Joaquin kit fox dens, burrows occupied by burrowing owls, and signs of the presence of fully-protected species.

Table 2 shows the amount of land disturbance that was estimated in the HCP/NCCP to accompany the construction of infrastructure on the KWB, and the amount of disturbance that has actually occurred. Land disturbance is tracked in all land use sectors on the KFE property but the Farming Sector.[7] Note that permanent water banking facilities occupy only 258 acres.

Table 2. Estimated versus actual land disturbance resulting from recharge/recovery facilities through December 2005

	KWB HCP/NCCP Estimated Disturbance (acres)	Actual Disturbance (through 12/31/2005) (acres)
Recharge Basins in Recharge Sector*	**5,900**	**4,699**
Permanent Water Banking Facilities		
Recovery Facilities		
Wells - Existing Hooked Up	28	14
Wells - Existing Not Hooked Up	38	6
Wells - Proposed New	66	21
Conveyance Facilities		
Proposed-Lined	87	0
Existing – Unlined	225	117
Supply/Recovery Canal	73	75
Pump Stations	12	2
Kern River Reverse Flow		
Earthwork (levees)	4	0
Pump Stations		
Kern River	10	0
City of Bakersfield	4	0
New Roads	0	23
Subtotal	**547**	**258**
Temporary Disturbed Areas		
Canal Construction	73	68
Recovery Wells	0	16
Pipelines – Proposed	218	144
Subtotal	**291**	**228**
Total	**6,738**	**5,185**
* Does not include 2,415 acres of recharge ponds located in the Farming Sector.		

Source: Kern Water Bank Authority. Annual Report, May1, 2006

B. Other Agreements and Restrictions

1. Statement of Principles – March 1995

A Statement of Principles (SOP) establishing several guidelines for a later agreement amongst the KWB participants on the establishment of a public agency to own, develop, operate and maintain the KWB project was agreed to on March 31, 1995. The key provisions of the SOP are:

[7] Land disturbance in the Farming Sector is not tracked since it was anticipated in the KWB HCP/NCCP to be disturbed from farming or other activities. In fact, with the exception of 45 acres currently farmed for the CDFG for an annual Heritage Game Bird hunt, no farming has occurred in the Farming Sector. Instead, this acreage has developed into exceptional upland and wetland habitat.

- An allocation of the amount of firm SWP Table A amounts to be permanently retired by each of the participants, and a mechanism for other KCWA Member Units to participant in the KWB as the project moved forward;
- A statement that the KWB's primary purpose is to augment water supplies for KWB participants;
- A statement indicating the proposed public agency will be responsible for all KWB costs;
- The establishment of priorities for the use of the KWB by others;
- A statement that the KWB will be operated pursuant to the pending *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program* (see V.B.3. below);
- A mechanism to establish agreements to share Cross Valley Canal capacity amongst other banking projects; and
- The establishment of covenants for the limitation on the future consumptive use of groundwater by the property and restrictions on the future sale, transfer, lease, etc., of the property as long as KCWA has determined that the property can be used economically for groundwater storage and recovery.

2. Joint Powers Agreement – October 1995

The entities that permanently retired a portion of their SWP Table A amounts (i.e., SWP contractors KCWA and Dudley Ridge WD, and KCWA member agencies Semitropic WSD, Tejon-Castac WD, and Wheeler Ridge-Maricopa WSD, and Westside Mutual Water Company, LLC) formed a joint powers authority called the Kern Water Bank Authority on October 16, 1995, with the execution of a Joint Powers Agreement (JPA). The JPA:

- Created the KWBA and established its term, purpose and powers;
- Established the internal organization of the KWBA (i.e., governed by a Board of Directors);
- Established procedures for handling KWBA's finances;
- Described the KWBA's KWB project and established participant rights in the project directly proportional to the amount of Table A water each participant retired to acquire the project;
- Established the relationship between the KWBA and its participants (e.g., indemnities, withdrawals, etc.); and
- Established other procedures necessary to the operation of the KWBA (e.g., amendment procedures, dispute resolution procedures, etc.)

Table 3 lists the Table A amounts retired by each KWBA participants and their corresponding ownership allocations.

Table 3. Kern Water Bank Authority Participants		
Participants	**Table A Amount Retired (AF)**	**Allocation (%)**
Dudley Ridge WD	4,330	9.62
Improvement District 4	4,330	9.62
Semitropic WSD	3,000	6.67
Tejon-Castac WD	900	2.00
Westside Mutual Water Co.[a]	21,625	48.06
Wheeler Ridge-Maricopa WSD	10,815	24.03
Total	45,000	100.00

a. Westside Mutual Water Co. was formed by a landowner that owned land within two KCWA member agencies, for the retirement of a portion of its Table A amounts. The landowner retired 15,335 AF of its Table A amount from Belridge WSD and 6,290 AF of its Table A amount from Lost Hills WD.

3. Operations and Monitoring MOU – October 1995

The KWBA operates the KWB under the requirements of the *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program* (KWB MOU; Appendix B). Negotiation and execution of the KWB MOU was a prerequisite of the KWBA Member Entities' agreement to retire the 45,000 AF of Table A amounts in exchange for the transfer of the KFE lands from the Department for the Member Entities' development of a water bank.

a. Impact Mitigation

The overall objective of the KWB MOU parties (KWBA, its Member Entities, and the districts surrounding the property [Adjoining Entities]) is that the "… design, operation and monitoring of the Project be conducted and coordinated in a manner to insure that the beneficial effects of the Project to the Project Participants [Member Entities] are maximized but that the Project does not result in significant adverse impacts to water levels, water quality or land subsidence within the boundaries of Adjoining Entitles." The adjoining entities include Buena Vista WSD, Rosedale-Rio Bravo WSD, Kern Delta WD, Henry Miller WD, and West Kern WD.

Some of the measures prescribed in the KWB MOU to protect water levels include: 1) spread out recovery area; 2) provide buffer areas between recovery wells and neighboring overlying users; 3) limit the monthly, seasonal, and/or annual recovery rate; 4) provide sufficient recovery wells to allow rotation of use of recovery wells or the use of alternate wells; 5) provide adequate well spacing; 6) adjust pumping rates or terminate pumping to reduce impacts, if necessary; 7) impose time restrictions between recharge and extraction to allow for downward percolation of water to the aquifer; and 8) provide recharge of water that would otherwise not recharge the Kern Fan Basin.

Some of the measures prescribed in the KWB MOU to protect water quality include: 1) giving recharge priority to the best quality water available, 2) removing more salts than are recharged, 3) controlling the migration of poor quality water, and 4) extracting poorer quality groundwater where practicable (and where blending with excellent quality water from elsewhere in the project results in the water quality objectives of downstream users being met).

In order to ensure that the above goals are met, the MOU provides for the establishment of a Monitoring Committee to oversee banking operations and the results of an extensive monitoring program. The committee is made up of several basin stakeholders including KCWA and all adjoining water districts. This committee has completed a number of tasks required by the MOU, including:

- Preparation of a monitoring plan;
- Specification of monitoring wells;
- Preparation of annual water balance studies and other interpretive studies of sources and uses of water within the project area and within adjoining water districts;
- Determination of the impacts of project operations on surrounding areas; and
- Development of criteria for identifying, verifying, avoiding, eliminating, or mitigating significant adverse impacts from project operations.

b. Loss Factors

The KWB MOU prescribes loss factors for banking operations. Evapotranspiration losses are assumed to be 6 percent of the gross amount of all water recharged. A study conducted by the KWBA using a methodology developed by the Department and KCWA for the KFE indicates actual losses by evapotranspiration will typically range from 2 percent to 4 percent. The 6 percent loss factor provides assurance that KWB banking operations will not recover more water than that actually recharged.

The KWB MOU provides that an additional 5 percent loss factor will apply to any sales of water to entities outside of Kern County. This additional water provides an overall benefit to the groundwater basin, and cannot be recovered for other uses.

In addition to these losses, 4 percent of the water recharged and stored in the KWB can be purchased by adjoining groundwater districts for overdraft correction purposes.

4. Covenants, Conditions, & Restrictions between KCWA and KWBA – December 1995

A declaration of covenants, conditions, and restrictions (CC&Rs) on the use of the KFE property was executed by the KWBA for the benefit of the KCWA on December 14, 1995, and subsequently recorded as a covenant running with the property. The CC&Rs provided for several of the provisions of the *Statement of Principles*, including:

- A limitation on consumptive use of groundwater by the KWB project of 0.3 AF/acre;

- Restrictions on the sale, transfer, lease, etc., of parts of the KFE property as long as KCWA has determined that the property can be used economically for groundwater storage and recovery,
- Restrictions on the use of any proceeds from approved KFE property sales, transfers, leases, etc.;
- Remedies for violations of the CC&Rs; and
- Priorities for the use of the KFE property.

The priorities for the use of the KFE property as described in the CC&Rs are as follows: 1st priority – KWBA Member Entities; 2nd priority – KCWA Basic Contract Member Units; 3rd priority – KCWA Non-Basic Contract Member Units; and 4th priority – Kern County entities. Any excess capacity beyond that needed for the first four priorities can be used by others under terms and conditions acceptable to KWBA and KCWA.

5. Limitations of Exports and Sales

All transfers from member districts of KCWA require the approval of KCWA. Current KCWA policy places limitations on the sale of banked SWP water. Department approval is required for conveyance of banked SWP water through SWP facilities. CVP contracts place limitations on potential sales of Friant-Kern CVP water. A place-of-use restriction requires the use of banked Friant-Kern groundwater to be within the CVP place of use. Consequently, these agreements and restrictions limit the classification of water that may be transferred to non-Kern County agencies.

C. Facilities

1. Facilities Development Plans

KWBA's purpose for development of the KWB was to permit the delivery, percolation, and storage of water in aquifers for later extraction, conveyance, and use for the benefit of the project participants.[8] KWBA's construction plans for the KWB included the completion of a Master Plan, the repair and rehabilitation of existing wells under an energy conservation program funded in part by the State of California (SB 583), the expansion of the turnout and channel providing water to the W-4 pond, and the River Area Construction Project, as described in Table 4.

[8] The Kern Water Bank, Dec. 14, 2004, Appendix A, p. 2

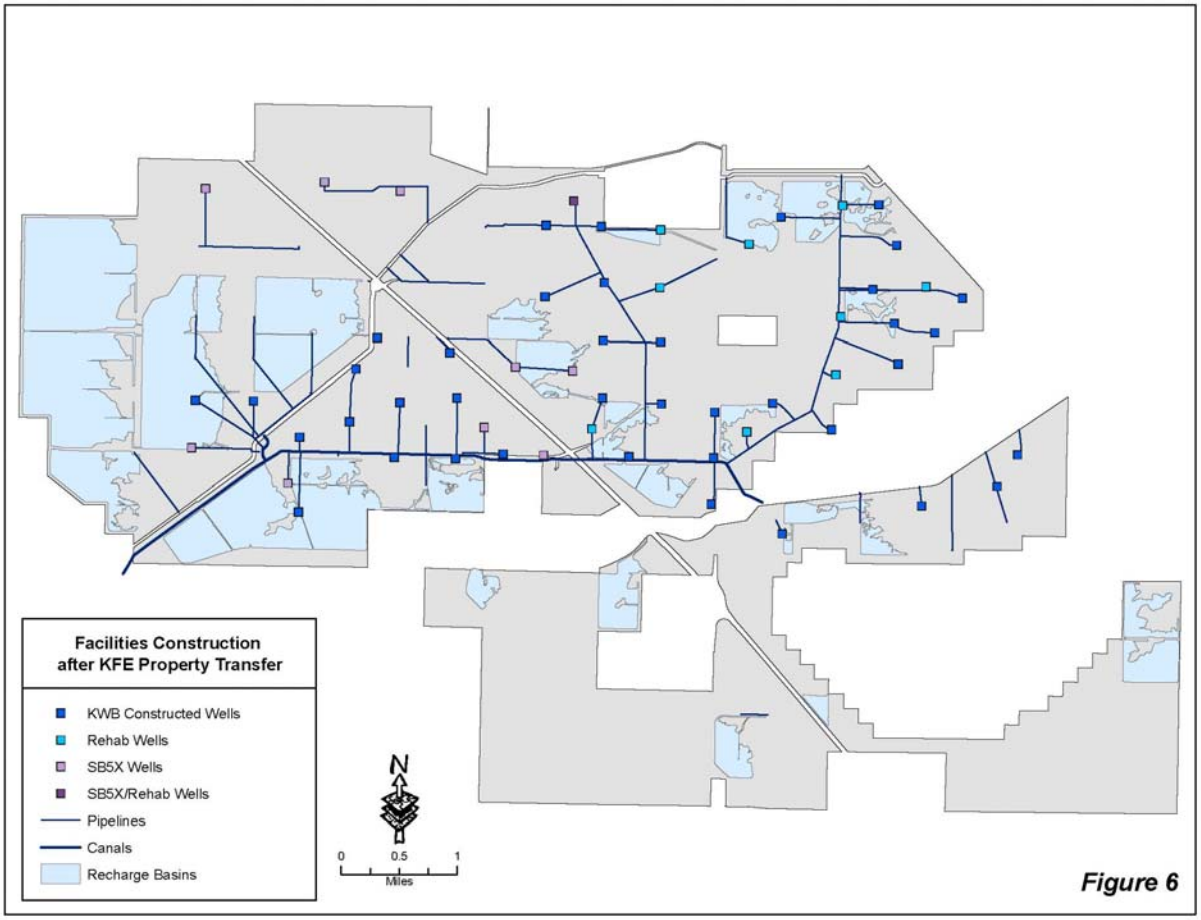
Table 4. KWBA Development Projects		
Project	**Years**	**Activity**
KCWA Flood Emergency Program	1995	Construction of 3,034 acres of recharge ponds.
KWBA pond construction	1998-2002	Construction of 4,080 acres of recharge ponds.
Master Plan	1999-2002	Rehabilitation of 10 existing wells, installation of 31 new wells, installation of pipeline to the new wells, and the construction of the Kern Water Bank Canal, that connects the Kern River and the California Aqueduct.
SB 583 Pump Repair and Well Rehabilitation Program	2002-2003	Repair and/or rehabilitation of 10 existing wells pursuant to this program, including the removal of existing well pumping equipment, well-testing, well-casing rehabilitation of some wells, pump repair or replacement, and the reassembly of the wells.
Expansion of the W-4 Pond Turnout and Channel	2003	Enlarged turnout structures and channel to the W-4 pond.
River Area Construction Project	2004	Construction of eight additional recovery wells, pipelines for these eight wells and an additional seven wells, a conveyance pipeline to route the recovered water from these 15 wells to the Kern Water Bank Canal, and a lift station (100 cfs capacity) to convey water for recharge purposes to River Area ponds.
Source: The Kern Water Bank Authority, HCP/NCCP 2003 Annual Report and 2004-2005 Management Plan. May 1, 2004.		

2. Facilities Constructed

Since the transfer of the KFE property, KWBA has constructed recharge ponds, the Kern Water Bank Canal, extraction wells, and pipelines to convey recovered water from operational wells, and has rehabilitated some existing wells (Figure 6).

a. Recharge Ponds

In 1995, under the KCWA flood emergency program (see Section III.B) and prior to the formation of the KWBA, KCWA and the other future participants of the KWBA constructed 3,034 acres of recharge ponds (Figure 3). From 1998 through 2003, KWBA constructed an additional 4,080 acres of recharge ponds, for a total of 7,114 acres. Of this total, 4,699 acres of the recharge ponds constructed are located within the Recharge Sector and 2,415 acres within the Farming Sector. The ponds consist of low earthen levees that pond water to depths of a few feet. This water percolates into the alluvial fan for recharge into the aquifer. Water flows between the ponds in small channels; operators control the flow with small weir boxes.



b. Recovery Wells

Sixty-five agricultural wells were present on the KFE property when it was acquired by the Department in 1988. At the time the property was transferred to KCWA, 31 of these wells were considered operable, although 3 of these were not connected to any conveyance facilities. The remaining 34 were idle wells in various states of disrepair.

KWBA installed 39 new wells in two phases to accommodate groundwater recovery. The first phase of 31 wells was completed in 2001. Eight additional wells were completed in early 2005. KWBA also rehabilitated ten existing wells and repaired an additional 13 wells. As of December, 2006, a total of 79 wells are operable. All KWB well pumps are electric.

c. Conveyance Facilities

The KWBA constructed the Kern Water Bank Canal from the Kern River to the California Aqueduct; the canal is approximately 6 miles long and 90 feet wide. Associated structures include headworks at the Kern River, a check structure, a 545 cfs pump station, and diversion facilities at the California Aqueduct. The canal is bi-directional and will receive or deliver about 800 cfs from or to the California Aqueduct or from the Kern River. The western reach of the canal is at the same elevation as the California Aqueduct; therefore, conveyance of water through the western reach does not require pumping energy. KWBA began construction of the Kern Water Bank Canal in 1999 and completed the canal in October 2000.[9]

The KWBA installed small diameter (15" to 24") PVC pipelines to transport water recovered from extraction wells to existing canals or to large diameter (60") high-density polyethylene pipelines.

D. Land Use

The KWBA utilizes the lands of the KFE property for various purposes. The KFE property is used primarily as a water recharge and recovery facility. Numerous recharge ponds, wells, conveyance facilities, etc. (see Facilities section above) have been constructed on the property.

In 1997, the KWBA initiated vegetation and restoration programs. The goal of these programs is to protect existing and newly established sensitive habitats for long-term management. Exotic pest plant control is also an important long-term management activity. Annual mowing, livestock grazing (both cattle and sheep), and prescribed burning are all utilized for vegetation management. Limited applications of selective herbicides are used in most years to help control exotic pest plants.

On a limited basis, KWBA has planted various plant species based on the HCP/NCCP. Cottonwoods, willows, and grasses are examples of species planted to enhance percolation within the recharge basins and for wildlife habitat. In retired farm areas that are returning to natural conditions, there is an increase in the number of species and individuals at the KWB, including listed species like Tipton kangaroo rats, and San Joaquin kit foxes.

Under the direction of CDFG, safflower is farmed annually, usually around 70 acres, to enhance dove habitat and to be utilized in an annual dove hunt. In years with sufficient water, there is also a CDFG sponsored waterfowl hunt on designated recharge ponds on the KFE property.

Various oil and gas companies maintain use of parcels on the KFE property to exercise their mineral rights on the property. Since 1996, several oil company-related construction projects have occurred. For example, Chevron Pipeline Company in 1998 removed 44,227 feet of pipeline, of which 27,000 was on the KFE property. Various companies enter the KFE property regularly to conduct maintenance-related surveys of their equipment and to ensure environmental compliance. If environmental issues are observed by the KWBA related to any oil or gas facilities, the representative companies are contacted immediately to ensure proper action.

As part of the monitoring undertaken by the KWBA in compliance with the HCP/NCCP, annual reports are issued summarizing land use by wildlife, any environmental take related to activities on KFE property, and habitat and vegetation restoration efforts. There has been only one occurrence of the take of an endangered species on the KFE property; Tipton kangaroo rats were

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[9] The Kern Water Bank: Infrastructure Development, the Kern Fan Monitoring Committee, and Groundwater Conditions. December 14, 2004

temporarily relocated during the construction of the Kern Water Bank Canal, then placed back in the area alive and well after the construction was complete.

1. Mitigation Lands

The HCP/NCCP establishes permanent mitigation lands on the KWB. These lands include a DWR Mitigation Parcel of 530 acres, and a KWBA Mitigation Parcel of 635 acres (which is part of the Compatible Habitat acreage shown in Table 1). As part of the mitigation effort laid out in the HCP/NCCP, agencies and qualified third parties are allowed to purchase Conservation Credits for projects that may cause temporary or permanent disturbance to lands that includes much of the San Joaquin Valley portions of Kern, Kings, and Tulare counties.[10] For more information on this process, refer to the "Conservation Bank Agreement" included in Volume II of the HCP/NCCP.

VI. KWBA's KWB Operations

A. Overview of Kern County Water Operations

This section provides an overview of general water operations within Kern County. While these operations are not directly related to the KWBA's KWB operations, this is intended to provide some background for general water operations within the county, and some context for how KWB operations fit within that.

1. Water Sources

Kern County residents have historically used surface water primarily from three sources: the Kern River and other local streams, SWP, and CVP. The SWP delivers water from the north via the California Aqueduct. The CVP delivers water from the north via the California Aqueduct and Cross Valley Canal, and from the central Sierra via the Friant-Kern Canal. The Kern River system and other local streams drain the southern Sierra. Local conveyance facilities, including the Kern Water Bank Canal, Cross Valley Canal, and Pioneer Canal, can be used convey water from these primary sources to various parts of the KFE property.

a. Kern River and Other Local Streams

The Kern River has historically been a primary source of surface water to Kern County. North Kern WSD, Kern Delta WD, Buena Vista WSD, KCWA, and the City of Bakersfield are the major holders of Kern River surface water rights.

In most years, water users divert all Kern River flow downstream from its entrance to the valley, northeast of Bakersfield, and as a result the river channel through the KFE property is typically

[10] More information on this process is contained in the "Conservation Bank Agreement" included in Volume II of the HCP/NCCP, on file with the Department.

dry. However, in extremely wet years, the Kern River Intertie diverts Kern River flows into the California Aqueduct to prevent downstream flooding. Since 1978, over 1,000,000 AF of Kern River water has flowed through the Kern River-California Aqueduct Intertie. During the same period, an additional 430,000 AF of Kern River water bypassed the Intertie via the Kern River flood channel. These flood flows have exceeded the available capacity of recharge facilities in Kern County since KCWA constructed the Intertie in 1977.

In very wet years the significant quantities of flood waters that otherwise would be diverted into the Intertie are available for recharge in the KFE area. At other times, other pre-1914 appropriative water right holders can provide Kern River water for recharge in the KWB. Although these right holders are not partners in the KWB, KWBA participants may purchase Kern River water from them for storage in the KWB.

Water users can divert the flows of the Kaweah, Tule, and Kings Rivers stream groups on the east side of the San Joaquin Valley and convey the water via the Friant-Kern Canal to its terminus. From the terminus, water users can release the water into the Kern River channel or through various connections into the Cross Valley Canal. As with Kern River water, pre-1914 appropriative water right holders can provide Kaweah, Tule, and Kings Rivers water for recharge in the KWB. Although these right holders are not partners in the KWB, KWBA participants may purchase water from them for storage in the KWB.

b. SWP

The SWP is a large source of non-local water for Kern County. KCWA has a SWP Table A amount of 998,730 AF. Thirteen Kern County member agencies contract for this water from KCWA, and KCWA has retained a portion for itself and its Improvement District No. 4 (Table 5). Dudley Ridge WD, an SWP contractor located in Kings County, currently has a SWP Table A amount of 57,343 AF.

KCWA and Dudley Ridge WD can recharge SWP Table A and Article 21 water when they have SWP water in excess of their immediate in-district demands. They can also transfer or exchange water with other agencies to increase or reduce their water supplies in a year, or participate in arrangements that change the year of water deliveries.

Table 5. KCWA Member Units That Hold Contracts With KCWA to Receive SWP Table A Water	
Agency	**Contractual Table A Amount (AF)**
Belridge WSD	121,508
Berrenda Mesa WD	108,600
Buena Vista WSD	21,300
Cawelo WD	38,200
Henry Miller WD	35,500
KCWA	8,000
Kern Delta WD	25,500
Lost Hills WD	119,110
Improvement District No. 4	82,946
Rosedale-Rio Bravo WSD	29,900
Semitropic WSD	155,000
Tehachapi-Cummings County WD	19,300
Tejon-Castac WD	5,278
West Kern WD	31,500
Wheeler Ridge-Maricopa WSD	197,088
Total	**998,730**
Source: KCWA, 2006.	

c. CVP

CVP contractors in Kern County may receive water via the Friant-Kern Canal or the Cross Valley Canal, either directly or by exchange or transfer according to contract provisions with Reclamation.[11] Arvin-Edison WSD, Delano-Earlimart ID, Shafter-Wasco ID, and Southern San Joaquin MUD have Friant Division long-term contracts with USBR.

Reclamation's contracts with Friant-Kern contractors include a two-class system of water allocation. Municipal and industrial (M&I) and agricultural water users who have limited access to good-quality groundwater have Class 1 contracts, which are based on a firm water supply. Reclamation delivers the Friant-Kern's first 800 TAF of annual water supply under Class 1 contracts.[12] Class 2 water is a supplemental supply; Reclamation delivers Class 2 water directly for agricultural use or for groundwater recharge, and these are areas that generally experience groundwater overdraft.

In addition to Class 1 and Class 2 water deliveries, Reclamation delivers water that would otherwise be released for flood control purposes. Section 215 of the Reclamation Reform Act of 1982 authorizes the delivery of unstorable irrigation water that would be released in accordance with flood control criteria or unmanaged flood flows. Reclamation's delivery of Section 215

[11] While CVP water can be delivered to the KWB through the Cross Valley Canal, such deliveries are not considered further in this study because, to date, no excess water has been made available for KWB recharge from this source.
[12] USBR and DWR, 2003, Upper San Joaquin River Basin Storage Investigation, Phase 1 Investigation Report

water has enabled contractors to recharge more water for groundwater replenishment than could otherwise be supported with only Class 1 and Class 2 contract deliveries.

In addition to the Class 1, Class 2, and conjunctive management aspects of Friant Division operations, some districts often arrange annual water transfers with other districts. These transfers provide opportunities to improve water management within the Friant service area. In wet years, districts that have water surplus to their needs can transfer water to other districts with the ability to recharge groundwater. Conversely, in dry years, districts that store water can return water to districts with little or no groundwater supply; these arrangements provide an informal groundwater banking program within the Friant Division.

KWBA participants do not have long term contracts for CVP water, but have purchased Section 215 and other flood waters from the CVP system through temporary contracts with Reclamation.

2. Water Management Exchanges and Landowner Transfers

Water transfers and exchanges have historically been and continue to be a regular part of water management in the San Joaquin Valley. Transfers are one-way transactions, where water from one agency is transferred to another, with no future return of that water. For KCWA, transfers with another agency are typically "landowner transfers," where a landowner that owns land within both KCWA and another agency's service area wants to transfer the water available to it from one agency for use on its land in the other agency's service area. Exchanges are two-way transactions, where water from one agency or source is delivered to another agency, in exchange for the return of a specified quantity of water. An exchange may involve a change in the timing of delivery of water (e.g., water from one agency is delivered to another, in exchange for water from the other agency delivered later that year or in a following year), or a change in the source of water delivered (e.g., water from a source available to one agency is delivered to another, in exchange for water from a different source). These transactions can provide a number of benefits, including improved water management, reduced costs for water delivery, and/or improved water quality.

3. Water Sales

Table 6 gives an account of water sales by KCWA member agencies and other entities within Kern County to the Environmental Water Account (EWA) in the years 2000 and 2001. The table gives the SWP water exchange total for both 2000 and 2001, lists the seller and their amount (in AF), the type of water banked, which facility or agency banked the water, and the date the water was released to the EWA. These sales are representative examples of the types of water sales that occur from Kern County groundwater banks.

Table 6. Sales by Kern County Entities to the Environmental Water Account in 2000 and 2001				
Seller	**Amount (AF)**	**Banked Groundwater Type**	**Groundwater Banking Facility or Agency**	**Date Water Released to EWA**
2000 SWP Table A Allocation Exchange Water Purchased and Delivered in 2000				
Kern Water Bank Participants	31,555	Friant-Kern Flood	KWB	7/00
Kern Water Bank Participants	40,725	Kern River Flood	KWB	8/00
2000 SWP Carryover Table A Allocation Exchange Water Purchased and Delivered in 2001				
Arvin-Edison	10,000	Friant-Kern Flood	Arvin-Edison WSD	3/01
Rosedale Rio Bravo	19,036	Friant-Kern Flood	Rosedale Rio Bravo WSD	3/01
Westside Mutual Water Co.	15,000	SWP Table A Allocation	KWB	3/01
2000 SWP Exchange Subtotal		**116,316**		
2000 SWP Table A Allocation Exchange Water Purchased and Delivered in 2001				
KCWA for Nickel Family LLC[1]	10,000	Kern River Flood	Pioneer Project	5/01
KCWA/ID 4	10,000	Kern River Flood	KWB	6/01
Buena Vista/ Rosedale/ West Kern	20,218	SWP Table A Allocation	Buena Vista WSD	5/01
Buena Vista/ Rosedale/ West Kern	1,000	SWP Table A Allocation	Buena Vista WSD	5/01
Buena Vista/ Rosedale/ West Kern	2,500	SWP Table A Allocation	Buena Vista WSD	7/01
Semitropic WSD	10,767	SWP Table A Allocation	KWB	10/01
Semitropic/ Tulare ID	4,233	Friant-Kern[2]	Semitropic WSD	11/01
Westside Mutual/Tejon Castaic	21,000	SWP Table A Allocation	KWB	10/01
Cawelo WD	5,000	SWP Table A Allocation	KWB[3]	11/01
2001 SWP Exchange Subtotal		**84,718**		
2000 & 2001 Total		**201,034**		

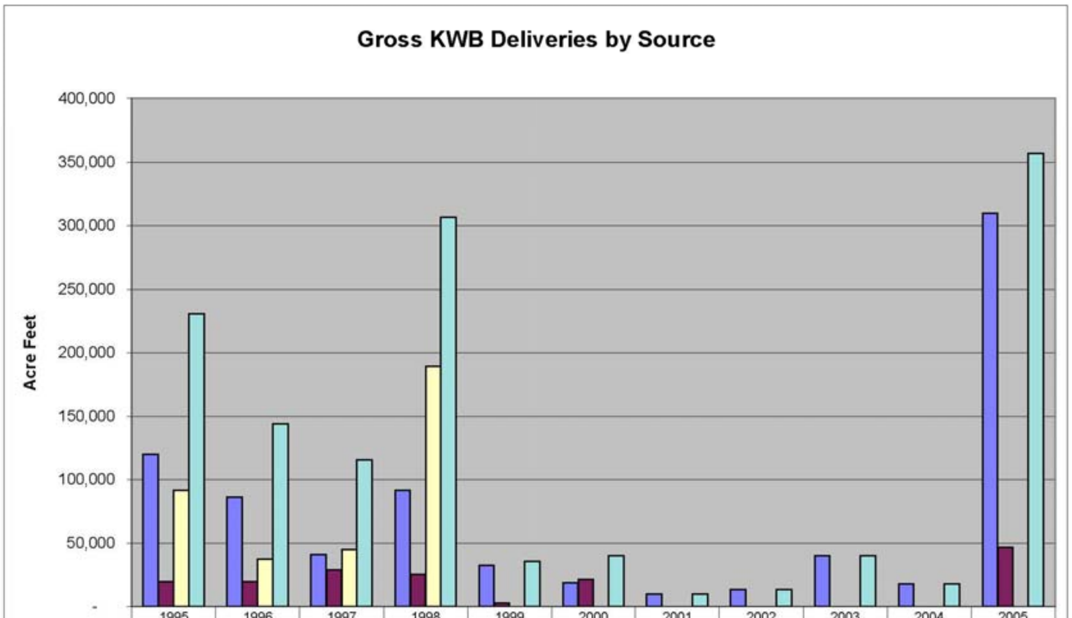
[1] The Nickel Family LLC is a private company primarily invested in farming. Nickel was the owner of a pre-1914 Kern River Water Right, referred to as the Lower River Water Rights. KCWA recently purchased the Lower River Rights from Nickel, and as part of the deal, Nickel is supplied with 10,000 AF of water per year by KCWA. Nickel banks this water in KCWA's portion of the Pioneer Project.
[2] Tulare ID delivered non-CVP water to Semitropic WSD via a Friant-Kern exchange.
[3] Westside Mutual pumped its KWB account in exchange for a like amount of Cawelo's 2800-acre account that was assigned to Belridge on behalf of Westside Mutual.
Source: KCWA 2002

In addition to these types of sales, 4 percent of the water recharged and stored at the KWB can be purchased by adjoining groundwater districts within Kern County for overdraft correction purposes.

B. KWB Banking Operations

1. Recharge Operations

From 1995 through 2005, KWBA delivered approximately 1.3 million AF of water for recharge. Most of this recharge occurred during 1995-1998 and 2005 (see Figure 7). As would be expected, the volumes of water available for recharge are dependant upon California's annual water conditions. Table 7 shows the annual variability of statewide precipitation, Tulare Lake regional precipitation, SWP allocations, and CVP allocations.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
SWP	119,904	86,685	41,259	91,387	32,809	18,925	10,030	13,439	40,374	18,065	309,721
Friant-Kern	19,592	19,692	29,141	25,649	2,875	21,416	-	-	-	-	47,086
Kern River	91,442	37,513	45,190	189,605	-	-	-	-	-	-	-
Total	230,938	143,890	115,590	306,641	35,684	40,341	10,030	13,439	40,374	18,065	356,807

Figure 7

Table 7. California Water Conditions Data Relevant to Kern County					
Year	**State-wide Precipitation (% of average)**	**Tulare Lake Hydrolog. Region Precipitation (% of average)**	**SWP Allocation (% of Table A request)**	**CVP Friant-Kern Allocation (Class 1/ Class 2)**	**Kern River Flows[13] (AF)**
1995	165	165	100	100/100	1,240,895
1996	115	105	100	100/58	953,127
1997	125	130	100	100/60	1,160,099
1998	170	190	100	100/10	1,533,906
1999	95	80	100	100/20	410,403
2000	100	95	90	100/17	465,213
2001	75	60	39	100/5	495,616
2002	75	80	70	100/8	350,547
2003			90	100/5	457,176
2004			65	100/8	421,423

Table 8 provides a summary of gross deliveries for recharge by source, as of December 31, 2005. Sixty percent of the deliveries were SWP water, 27 percent were Kern River water, and 13 percent were Friant-Kern water.

Table 8. Gross Deliveries for Recharge by Source Through December 2005			
SWP (AF)	**Friant - Kern (AF)**	**Kern River (AF)**	**Total (AF)**
782,598	165,451	363,750	1,311,799
60%	13%	27%	na

Water delivered to recharge ponds is subject to losses by evapotranspiration. As prescribed in the KWB MOU, 6 percent evapotranspiration losses are deducted from all gross deliveries to KWB recharge ponds to determine the net amount of these deliveries that is recharged and stored. Annual gross deliveries for recharge and net recharge after losses are shown in Table 9, rows 1 and 2. Other changes to storage accounts, including miscellaneous acquisitions of stored water and exchanges between KWB participants, are shown in rows 3 and 4.

2. Recovery Operations

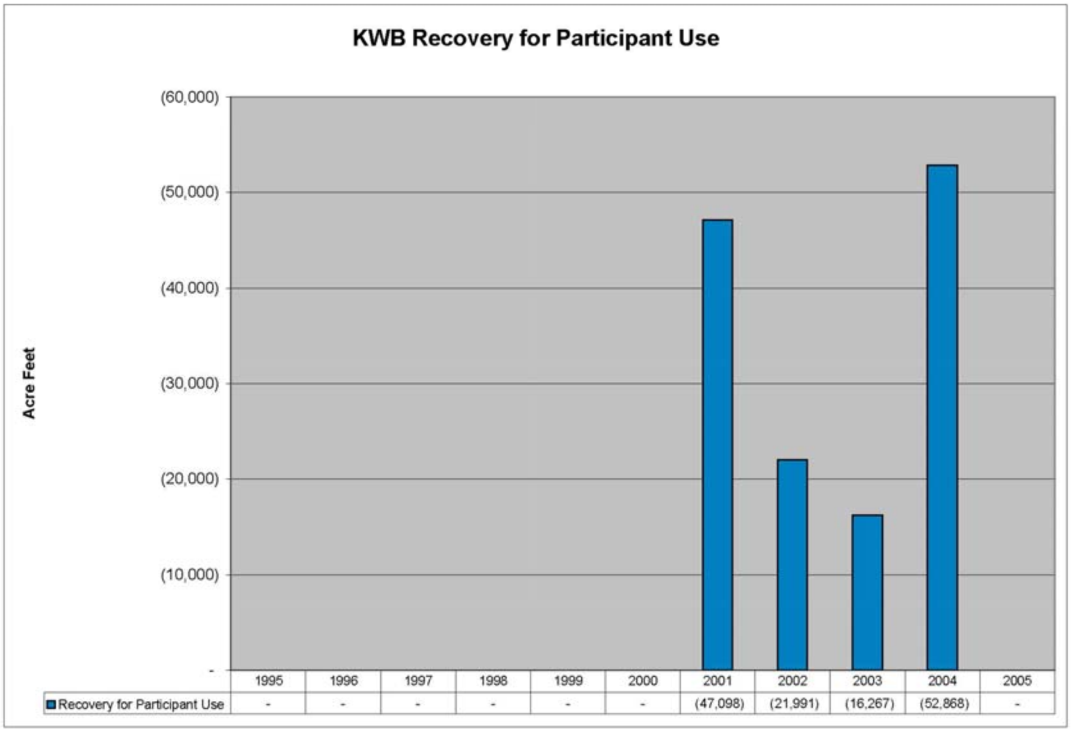
Water stored in the KWB has been recovered by the KWB participants either for their direct use or for sale to others. From 1995 through 2005, recovery for participant use totaled 138,224 AF. All of this water was recovered during the dry years from 2001 through 2004 (see Figure 8). During this same 1995 through 2005 period, water sales totaled 423,320 AF. About three quarters of these sales were to the EWA, with the remaining sales to:

- agricultural entities within the San Joaquin Valley,
- a wildlife refuge,

[13] Kern River downstream of Lake Isabella (Source: CDEC)

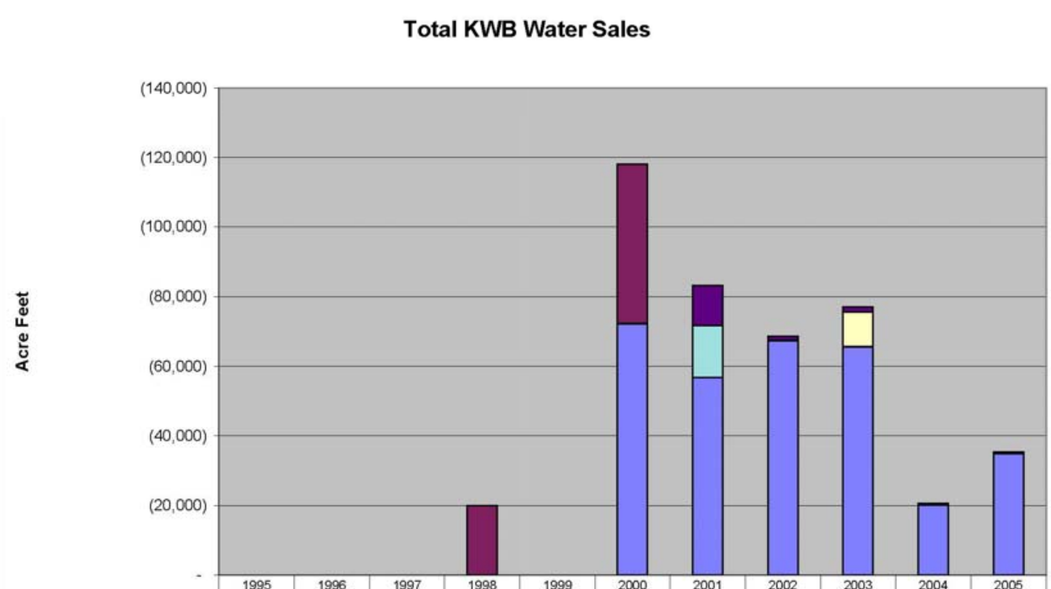
- a power plant located within Kern County,
- and the "4%" water made available to adjoining water districts for overdraft correction pursuant to the KWB MOU (see Figure 9).

All of these sales occurred in 1998 and 2000 through 2005.



Data from Table 9, row 8. Includes Recovery by Pumping for Participant Use and Recovery by Exchange for Participant Use.
See Figure 9 for further explanation for Recovery by Exchange for Participant Use.

Figure 8



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
"4%" Water Sales	-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)
Power Plant in Kern County	-	-	-	-	-	-	(15,000)	-	-	-	-
Wildlife Refuge	-	-	-	-	-	-	-	-	(10,000)	-	-
Agricultural Entities	-	-	-	(20,000)	-	(45,875)	-	-	-	-	-
EWA	-	-	-	-	-	(72,280)	(56,767)	(67,400)	(65,620)	(20,242)	(34,865)

Data from Table 9, rows 14 through 18. Includes Recovery by Exchange for Water Sales.
See Figure 11 for further explanation of Recovery by Exchange for Water Sales.

Figure 9

Water stored in the KWB can be recovered by one of two mechanisms, 1) recovery by pumping or, 2) recovery by exchange. Recovery by pumping entails the physical pumping of water from the aquifer using the KWB's groundwater wells. This type of recovery occurred in the dry years of 2001 through 2004. From 1995 through 2005, a total of 204,639 AF was recovered by pumping. Of this total, 132,099 AF was recovered for participant use and 72,540 AF for water sale (see Table 9, rows 6 and 9).

Stored water can also be recovered by exchange. For example, West Kern WD, which operates a separate banking project adjacent to the KWB, may need to recharge water at times when KWB participants need to recover water. Rather than recharge and recover water at the same time in adjacent projects, West Kern WD's surface water is made available for KWB participant use, and a like amount of KWB stored water is shifted in the groundwater storage accounts from the KWB to West Kern WD. Such exchanges may also occur between KWB participants. These exchanges reduce energy consumption and costs to both parties. From 1995 through 2005, a total of 326,634 AF was recovered by exchange. Of this total, 6,125 AF was recovered for participant use and 320,509 AF for water sales (see Table 9, rows 7 and 10).

3. Water Exchanges

Operational exchanges may be used to increase the efficiency of both recharge and recovery operations. These exchanges can occur at two levels. The first would be a local exchange within Kern County coordinated entirely by KCWA. For example, one of the KWB participants might have Kern River water available to it at the same time that a participant in one of the adjacent Kern Fan banking projects has SWP water available to it. In this situation, the SWP water would be delivered to western banking facilities (e.g., the KWB) to reduce energy consumption costs, and the Kern River water would be delivered to eastern banking facilities (e.g., the Berrenda Mesa Project). However, the water recharged at the KWB would be accounted for as Kern River water, as if the exchange did not occur.

The second level of exchange that can occur uses facilities outside of Kern County, and typically requires the approval of the Department and/or Reclamation. For example, one of the KWBA participants might exchange its SWP Table A water for a like amount of CVP water available to a CVP contractor, such as Westlands Water District (WWD). In this situation, the Department would deliver the SWP Table A water to WWD via Reach 7 of the California Aqueduct in Kings County for use within the SWP service area, and Reclamation would deliver a like amount of CVP water to KCWA via the Friant-Kern Canal for recharge in Kern County banking facilities. As in the case of the local exchange described above, the water would be accounted for as if the exchange did not occur, or in this example, as SWP water.

4. Storage Accounting

The KCWA oversees all water transactions in Kern County and provides important water accounting for the banking projects in the Kern Fan area. An accounting of KWB storage activities from 1995 through 2005 is shown in Table 9. The table shows:

- Additions to Storage
  - Gross deliveries for recharge
  - Net amount recharged, after 6 percent evapotranspiration losses
  - Acquisitions (e.g., the portion of the Hacienda Program water transferred to KCWA as part of the KFE property transfer)
  - Exchanges between KWB participants
- Recovery for Participant Use
  - Recovered by pumping
  - Recovered by exchange (see Figure 10 for an explanation of the accounting for this type of exchange)
- Water Sales
  - Categorized by method of recovery
    - Recovered by pumping

- Recovered by exchange (see Figure 11 for an explanation of the accounting for this type of exchange)
- Placed in trust (15,000 AF of stored water placed in trust for use by a power plant located within the service area of KWBA participant Wheeler Ridge-Maricopa WSD)
- "4%" water sales (4 percent of stored water made available for purchase by water districts adjoining the KWB, for overdraft correction pursuant to the KWB MOU)

o Categorized by use
  - EWA
  - Agricultural entities in San Joaquin Valley
  - Wildlife refuge
  - Power plant located in Kern County (15,000 AF of stored water placed in trust)
  - "4%" water sales

o Losses for water sales (5 percent losses are applied to all sales of water leaving Kern County, for the overall benefit of the groundwater basin pursuant to the KWB MOU)

o Total storage reduction for sales (recovery by pumping for water sale, plus water placed in trust, plus"4%" water sales, plus losses for water sales)

The KWB storage balance is the net of additions to storage, minus recovery for participant use and total reductions for sales. These KWB activities and total storage balances are shown on an annual and cumulative basis in Figures 12 and 13, respectively. As of December 31, 2005, the KWB participants had a total cumulative balance of 1,050,778 AF of water stored in the KWB.

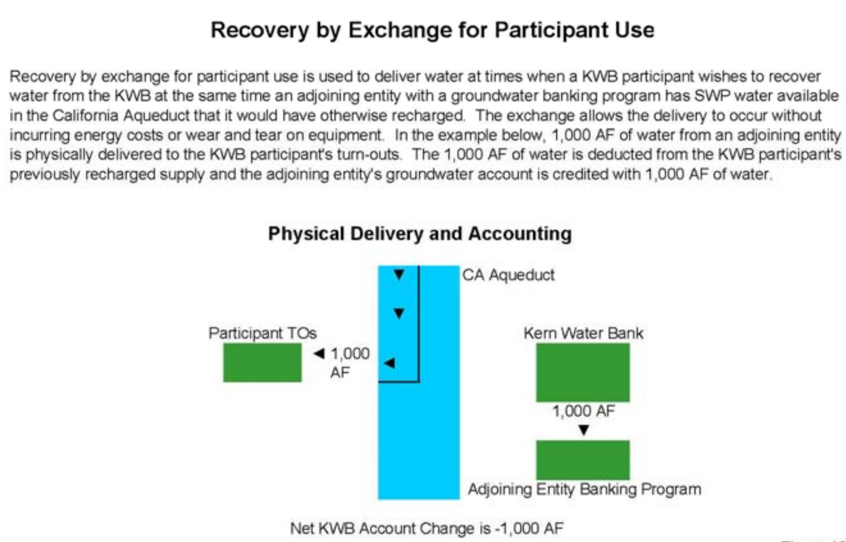


Figure 10

Recovery by Exchange for Water Sale

Recovery by exchange for water sale is used to deliver water at times when a KWB participant wishes to recover an exportable water supply from the KWB for sale to another entity, at the same time it has SWP water available in the California Aqueduct that it would have otherwise recharged. The exchange allows the delivery to occur without incurring energy costs or wear and tear on equipment. In the example below, 1,000 AF of water is physically delivered to the EWA in San Luis Reservoir. The KWB MOU prescribes a 5% loss to the groundwater basin for sales leaving Kern County. Therefore, in this example, a 5% loss of 50 AF is applied. For accounting purposes: 1,000 AF of water is deducted from the KWB Participant's previously recharged exportable supply for "delivery" to San Luis Reservoir, 50 AF is deducted from the KWB Participant's account for the 5% loss factor, and 1,000 AF is added to the KWB Participants account as stored SWP water. In Table 9, the amount exchanged is shown as Recovery by Exchange for Water Sale (row 10), and for sales of water leaving Kern County, the 5% reduction for losses is shown as Losses for Sales (row 20).

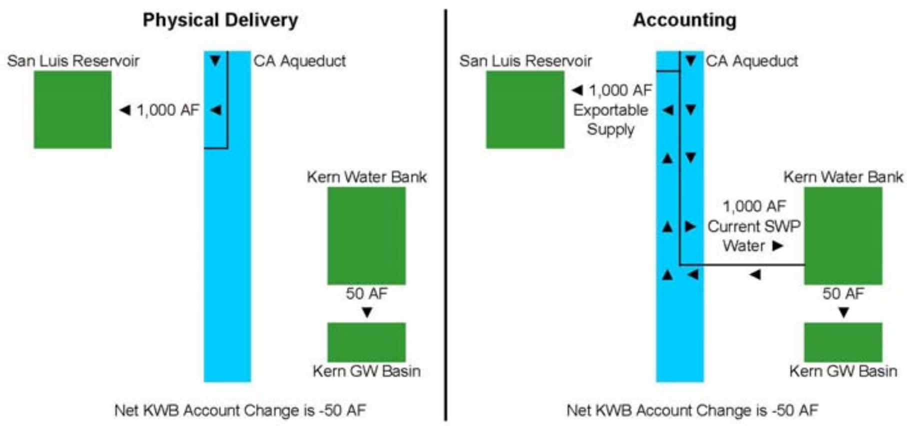
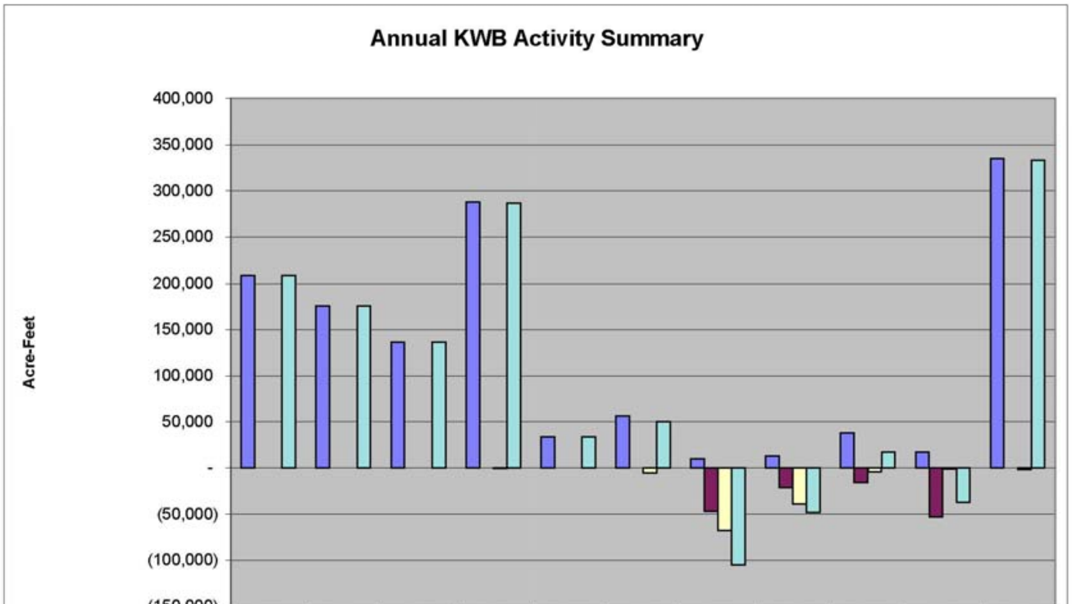


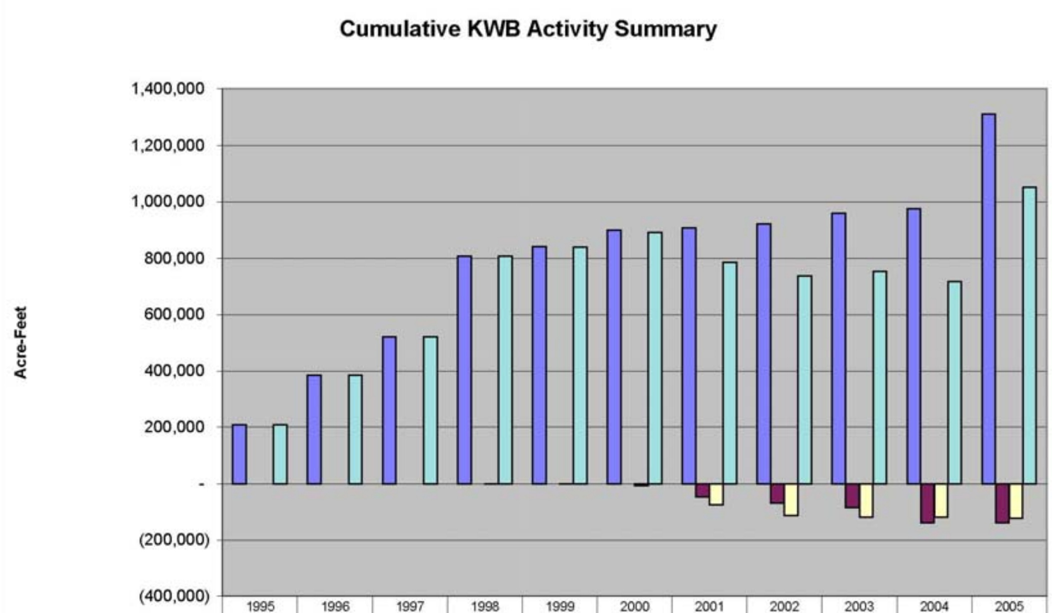
Figure 11



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Additions to Storage	208,882	175,566	136,786	287,916	33,544	55,882	9,429	12,632	37,951	16,981	335,399
Recovery for Participant Use	-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(52,868)	-
Total Reductions for Sales	-	-	-	(1,000)	-	(5,910)	(67,571)	(39,049)	(4,798)	(1,390)	(2,249)
Annual Storage Balance	208,882	175,566	136,786	286,916	33,544	49,972	(105,240)	(48,408)	16,887	(37,277)	333,150

Data from Table 9, row 5, 8, 21, and 22.

Figure 12



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Additions to Storage	208,882	384,448	521,234	809,150	842,694	898,576	908,005	920,637	958,588	975,569	1,310,968
Recovery for Participant Use	-	-	-	-	-	-	(47,098)	(69,089)	(85,356)	(138,224)	(138,224)
Total Reductions for Sales	-	-	-	(1,000)	(1,000)	(6,910)	(74,481)	(113,530)	(118,328)	(119,717)	(121,966)
Cumulative Storage Balance	208,882	384,448	521,234	808,150	841,694	891,666	786,426	738,018	754,905	717,628	1,050,778

Figure 13

Table 9.
KWB Account Summary

	Row	Formula	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[9]	2005[9]	Totals
Additions to Storage														
Recharge														
Gross Deliveries	1		230,938	143,890	115,590	306,641	35,684	40,341	10,030	13,439	40,374	18,065	356,807	1,311,799
Net Recharge (after 6% losses)[1]	2	row 1 x .94	217,082	135,256	108,654	288,243	33,544	37,920	9,429	12,632	37,951	16,981	335,399	1,233,091
Acquisitions	3		-	49,518	28,359	-	-	-	-	-	-	-	-	77,877
Exchanges Between Participants[2]	4		(8,200)	(9,208)	(227)	(327)	-	17,962	-	-	-	-	-	-
Total Additions to Storage	5	rows 2 + 3 + 4	208,882	175,566	136,786	287,916	33,544	55,882	9,429	12,632	37,951	16,981	335,399	1,310,968
Recovery for Participant Use														
Recovery By Pumping for Participant Use[3]	6		-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(46,743)	-	(132,099)
Recovery By Exchange for Participant Use[4]	7		-	-	-	-	-	-	-	-	-	(6,125)	-	(6,125)
Total Recovery for Participant Use	8	rows 6 + 7	-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(52,868)		(138,224)
Water Sales														
Sales by Method														
Recovery By Pumping for Water Sale[3]	9		-	-	-	-	-	-	(38,203)	(34,337)	-	-	-	(72,540)
Recovery By Exchange for Water Sale[4]	10		-	-	-	(20,000)	-	(118,155)	(18,564)	(33,063)	(75,620)	(20,242)	(34,865)	(320,509)
Trust Accounts[5]	11		-	-	-	-	-	-	(15,000)	-	-	-	-	(15,000)
"4%" Water Sales[6]	12		-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)	(15,271)
Total Sales	13	sum rows 9 - 12	-	-	-	(20,000)	-	(118,155)	(83,297)	(68,742)	(77,136)	(20,619)	(35,371)	(423,320)
Sales by Use														
EWA	14		-	-	-	-	-	(72,280)	(56,767)	(67,400)	(65,620)	(20,242)	(34,865)	(317,174)
Agricultural Entities	15		-	-	-	(20,000)	-	(45,875)	-	-	-	-	-	(65,875)
Wildlife Refuge	16		-	-	-	-	-	-	-	-	(10,000)	-	-	(10,000)
Power Plant in Kern County[5]	17		-	-	-	-	-	-	(15,000)	-	-	-	-	(15,000)
"4%" Water Sales[6]	18		-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)	(15,271)
Total Sales	19	sum rows 14 - 18	-	-	-	(20,000)		(118,155)	(83,297)	(68,742)	(77,136)	(20,619)	(35,371)	(423,320)
Losses for Sales[7]	20	out-of-co sales x .05	-	-	-	(1,000)	-	(5,910)	(2,838)	(3,370)	(3,282)	(1,013)	(1,743)	(19,156)
Total KWB Storage Reduction for Sales8	21	rows 9 + 11 + 12 + 20	-	-	-	(1,000)	-	(5,910)	(67,571)	(39,049)	(4,798)	(1,390)	(2,249)	(121,966)
KWB Storage Balance														
Annual Storage Balance	22	rows 5 + 8 + 21	208,882	175,566	136,786	286,916	33,544	49,972	(105,240)	(48,408)	16,887	(37,277)	333,150	1,050,778
Cumulative Storage Balance	23	row 23_0 + row 22_1	208,882	384,448	521,234	808,150	841,694	891,666	786,426	738,018	754,905	717,628	1,050,778	

1 Net Recharge is the amount of Gross Deliveries stored after deducting 6% for evapotranspiration losses. 2 Exchanges between KWB participants using existing KWB storage accounts. Note that there in no net change to KWB storage resulting from these exchanges. 3 Recovery By Pumping is stored water recovered by physically pumping it from wells. 4 Recovery By Exchange is stored water recovered by exchange with surface water available at the same time. See Figures 9 and 11 for further explanation. 5 Stored water placed in Trust for use by a power plant located within the service area of KCWA member agency Wheeler Ridge-Maricopa WSD. 6 "4%" Water Sales is 4% of stored water made available for purchase by water districts adjoining the KWB for overdraft correction, pursuant to the KWB MOU. 7 Losses for Sales are losses of 5% applied to all sales of water leaving Kern County, pursuant to the KWB MOU. 8 9 Data for 2004 and 2005 are preliminary and subject to minor revision. Total KWB Storage Reduction for Sales is Recovery By Pumping for Water Sale + Trust Account + "4%" Water Sales + Losses for Sales. Recovery By Exchange for Water Sale is not included in this total because it is an exchange with surface water supplies and so does not result in physical storage reductions (see Figure 11 for further explanation).

5. Operations Monitoring

As discussed in Section V.B.3, the KWB is operated under the requirements of the *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program,* which provides for the establishment of an extensive monitoring program and a Monitoring Committee to oversee banking operations and the results of said monitoring. The committee is made up of several basin stakeholders including the KCWA and all adjoining water districts.

a. Groundwater Monitoring

KWBA has used extensive monitoring to establish baseline groundwater quality and ensure that groundwater problems are not developing. This monitoring consists of two elements: 1) the regular sampling of 50 dedicated monitoring wells for several potential constituents of concern, and 2) the sampling of all recovery wells according to a Monitoring Schedule developed by the Department of Health Services.

The sampling of the monitoring wells is mandated by the KWB MOU. Under this program, water levels are measured at least semiannually, and water samples are analyzed for several potential constituents of concern at least annually. The results of this monitoring are reported to and reviewed by the Monitoring Committee to ensure that excellent groundwater quality is maintained.

The second element of groundwater monitoring includes sampling the recovery wells according to a DHS Title 22 Monitoring Schedule for wells providing water to municipal purveyors (KCWA, 1997). In addition to providing extensive information regarding groundwater quality, the results of this sampling are used to model expected changes in water quality in conveyance facilities receiving the recovered water.

b. Mitigation

A primary purpose of the Monitoring Committee is to evaluate groundwater information and determine if adverse impacts are likely to occur as a result of project operations. If the Monitoring Committee determines that adverse impacts are likely, then mitigation strategies are developed, as discussed in more detail in Section V.B.3. No mitigation measures have been necessary to date.

C. Maintenance and Other Operations

1. Water Operations Facilities Management

The KWB HCP allows the KWBA to install, construct, repair, maintain, and operate water recharge, water recovery, and water conveyance facilities within the Recharge Basin Sector and the Other Water Banking Facilities Sector of the KWB. The management of these facilities is described in Annual Management Plans submitted to the wildlife agencies. These plans ensure that management activities comply with the HCP's Vegetation Management Plan, the Minimization of Impacts Requirements, and other measures prescribed by the HCP (see Section V.A.2.b.).

Typical activities include grazing, burning, and mowing in conformance with the Vegetation Management Plan, the application of herbicides with hand sprayers at wells and gate structures, road grading, and fence repair.

2. Land Maintenance

The primary tool for managing the habitat and fauna of the Kern Water Bank is the HCPs Vegetation Management Plan, with the primary goal being the minimization of tumbleweed and other noxious non-native plant growth (primarily salt cedar). This in turn encourages native plant growth and the continued conversion of water bank lands into exceptional upland, riparian, and alkali flat habitats. The tools provided in the Vegetation Management Plan include burning, grazing, disking, mowing, and herbicide application. From 1996 through 1999, tumbleweeds were primarily controlled with burning. In 2003, tumbleweeds were primarily controlled with cattle and sheep grazing programs. Other management programs include burning in ditches and chopping old tumbleweed drifts. Chopping removes the dense cover of the drifts and allows for the reestablishment of grasses and forbs which compete with the tumbleweeds. Salt cedar is controlled with herbicide spraying at various locations on an as-needed basis.

3. Habitat Restoration and Enhancement

The creation of the KWB is resulting in the reestablishment and preservation of exceptional wetland and upland habitat that existed historically throughout much of the southwestern San Joaquin Valley. About 17,000 of the 20,000 acres that comprise the KFE property were farmed intensively prior to 1991. Now, the water conservation activities of the KWB are re-creating intermittent wetland habitat. Willows, cottonwoods, sedges, and other wetland vegetation are reemerging, and the recharge basins and basin edges are providing nesting and foraging habitat for waterfowl and other birds. To date, more than 40 species of waterfowl have been sighted on the KFE property, including Caspian terns, the white-faced ibis, double-crested cormorants, and white pelicans.

Recharge activities only occur on about one third of the KFE property; upland habitat is becoming reestablished on the remaining two thirds of the property. Vegetation management in these areas is focusing on regenerating native grasses and plants that help to promote the threatened and endangered species associated with this area. This upland habitat is supporting large populations of raptors, kangaroo rats, rabbits, badgers, bobcats, and coyotes. Of particular importance are the populations of Tipton kangaroo rats, burrowing owls, and tri-colored blackbirds.

4. Clean-up of Areas of Environmental Concern

A *Preliminary Environmental Assessment* report prepared by Luft Environmental Consultants in October 1995 identified “Areas of Potential Environmental Concern” (APECs) on the KFE property. All of the APECs which are KWBAs’ responsibility have been cleaned up, remediated and/or closed. These include:

- *Buena Vista Ranch Headquarters and the HSST Ranch Headquarters:* The pesticides in soil identified at the Buena Vista Ranch Headquarters and the HSST Ranch Headquarters, each an APEC, were remediated by the Kern Water Bank Authority. The scope of the clean-up involved excavating contaminated soil and treating it in a thermal-desorption unit. The Department of Toxic Substances Control certified that the remedial activities were complete in 2001 and that the land could be used for all uses, including the “intended purpose of maintaining a groundwater resource bank.”

- *S&M Farms, Tumbleweed Farms, Red Dirt, Two Tanks:* No significant environmental issues were identified at these sites. The trash at S&M farms and the two tanks have been removed.

- *Underground Storage Tanks:* The Kern Water Bank Authority has also removed two underground storage tanks (USTs) not identified in previous environmental reports. The USTs were uncovered at the Buena Vista Ranch Headquarters on April 30, 1999, and removed May 7, 1999 under a Kern County Environmental Health Services Department permit. No soil contamination was detected beneath the USTs, and the county has indicated the tank closure is complete with no further action necessary.

The balance of the APECs identified in the Luft Report are not the responsibility of KWBA. However, KWBA is tracking these issues and coordinating with the appropriate regulatory agency where appropriate. For example, KWBA has been discussing potential impacts at the former Uhler Fire Training Facility with both Kern County and the Regional Water Quality Control Board. (All of the facilities at this site have been removed, and Kern County is in the process of developing a bid to have soil and groundwater at the site assessed). KWBA is also actively tracking assessment and clean-up activities associated with the former Wait-Midway Pipeline and the Strand Oil Field.

D. HCP/NCCP Mitigation and Monitoring

The HCP/NCCP requires the KWBA to be responsible for establishing, maintaining, and enhancing habitat preserves, carrying out site-specific mitigation measures and for monitoring and reporting the results of management activities to the USFWS and CDFG in Annual Reports. KWBA compiles the annual report with input from professional biologists and botanists.

1. Monitoring Compliance

From 1999 through 2005, with the assistance of wildlife biologists and the cooperation of the USFWS and CDFG, KWBA staff have spent many hours in the field observing, photographing, trapping, and enumerating wildlife to document any instances of "take", either though construction activities or KWB operations. These monitoring activities are, in part, prescribed in the HCP. For example, populations of the San Joaquin Kit fox are surveyed with a nighttime spotlighting program, and Tipton Kangaroo rat populations are surveyed with trapping grids. Other surveys are conducted voluntarily (e.g., waterfowl and tumbleweeds). The only instance of "take" ever reported was the temporary relocation of live Tipton kangaroo rats during the construction of the Kern Water Bank Canal headworks. The kangaroo rats were successfully reintroduced to the area after construction was completed.

2. Mitigation Measures

The HCP prescribes various mitigation measures for construction and repair activities (see Section V.A.2.b.). According to the KWB's annual reports, these measures were adhered to as required.

VII. Alternatives for Recharge at KWB

The following analysis was prepared to determine how much of the SWP water that was recharged in the KWB from 1995 through 2004 could have been recharged in other existing recharge projects in Kern County, assuming no access was available to the KFE property.

A. Method

The amount of SWP water recharged in the KWB was compared to the unused absorptive capacities available in other existing recharge projects in Kern County to which the KCWA had access. If the SWP water was less than the total unused absorptive capacity of the other recharge projects in the Kern Fan area, it was assumed that the SWP water recharged in the KWB could have all been recharged elsewhere. This comparison was done on a monthly basis using delivery records from 1995-2004 and is limited to recharge projects in the Kern Fan area.

The Kern Fan Projects include the: Berrenda Mesa Project (operational since 1983); City of Bakersfield (COB) 2800 Acres (operational since 1978); Pioneer Project, including the Kern River Channel (operational since 1995);[14] and the Kern Water Bank (operational since 1995). The KCWA owns the Pioneer Project, and provides services to operate the KWB, owned by the KWBA, and the Berrenda Mesa Project, owned by the Berrenda Mesa Water District. The KCWA has a contract with the City of Bakersfield for use of the COB 2800 Acres.

[14] The Kern River Channel is part of the Pioneer Project but is also used by others, in accordance with established priorities for its use. To account for higher priority use by others, the Kern River Channel was analyzed separately from the rest of the Pioneer Project.

This analysis does not include KCWA use of certain KWB facilities that existed and had been used by KCWA for recharge prior to 1995. The KWB facilities that existed prior to 1995 included: KWB canals, which DWR allowed KCWA to use for recharge purposes in 1993; and KWB recharge ponds constructed by Tenneco on the KFE property prior to DWR's purchase of the property from Tenneco. The additional absorptive capacity provided by these KWB facilities and the local districts was not included in this analysis since adequate capacity was available in the other Kern Fan Projects to absorb the SWP water recharged on the KWB.

B. Analysis Assumptions

1. Absorptive capacity

   a. The absorptive capacity for each Kern Fan Project was determined based on an initial recharge rate for that project, and during periods of continuous use, assumed rates of decline. Declines were determined based on analysis of historic rate declines. Absorptive capacities were determined by project and by month from 1995 through 2004.
   b. Initial fill rates, based on historic initial recharge rates, were used for the first month of the first recharge period, and for the first month of any subsequent recharge periods if the project had not been operated for three or more months between recharge periods. If the project had not been operated for less than three months, the initial fill rate for the subsequent recharge period was assumed to be 88% of the initial fill rate.
   c. In a month when water had not historically been recharged at a particular Kern Fan Project, the shifting of water that had been recharged on the KWB to that project would trigger a recharge rate decline. The water that had been recharged on the KWB was assumed to be absorbed at the Kern Fan Projects in the following order of priority: 1) Pioneer, 2) COB 2800 Acres, 3) Berrenda Mesa, and 4) Kern River Channel. Recharge rate declines were triggered once that project was needed.
   d. Daily deliveries to each recharge project were reviewed. During certain months when Article 21 water was not available for the entire month, absorptive capacities were further reduced to reflect only the number of days when that water was available.
   e. Details for each of the other Kern Fan Projects on initial fill rates and assumed rates of decline are included at the end of this section.

2. Unused absorptive capacity available

   The unused absorptive capacity available for recharge of the SWP deliveries to the KWB at a project in a given month was calculated as the absorptive capacity that month minus the total of all actual deliveries from all sources to that project in that month.

3. Ability to absorb SWP deliveries to KWB in other recharge projects

   The ability to move SWP water recharged on the KWB in a particular month to other months in that same year depends on the type of SWP water delivered. Table A water or other SWP water that can be scheduled, can be rescheduled and shifted to any other month that year. Article 21 water is unregulated water DWR makes available for only temporary periods, and can only be shifted among those months within a year this water is available. For these water types, the following assumptions were made:

a. An “Article 21 period” was identified during which Article 21 water was delivered to KCWA. The timing and duration of this period was determined using DWR Bulletin 132 and KCWA records. When Article 21 water was available for only part of the month, absorptive capacities were limited to the number of days Article 21 water was available. SWP deliveries to the KWB could be shifted to available capacity in the other Kern Fan Projects in any other month Article 21 water was available during that same year.
b. Months that were not in the Article 21 period were assumed to be “regulated”. Table A or other scheduled SWP water could be shifted to available capacity in the other Kern Fan Projects in any other month during that same year.

Absorptive Capacity Assumption Details in Order of Priority

Pioneer Project

- Jan. – Mar. 1995 - Recharge capacity was only available in the James and Pioneer Canal systems. Initial delivery rates were 85 cfs/day, or 5,226 AF/month. Recharge amounts have been adjusted for the number of days in each month.
- Apr. – Jun. 1995 – New construction completed the Pioneer recharge facilities in June of 1995. Initial delivery rates increased to 260 cfs/day.
- Using historical delivery data to the Pioneer Project, and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 6th month – 12% decline per month (previous month x 0.88)
    - 7th month forward – 1% decline per month (previous month x 0.99)

City of Bakersfield 2800 Acres

- Initial fill rate in COB 2800 Acres – 500 cfs. Assumption based on actual 30-day average of flow rates to the project at start up.
- Using historical delivery data from the COB 2800 Acres and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 8th month – 12% decline per month (previous month x 0.88)
    - 9th – 12th month – 6% decline per month (previous month x 0.94)
    - 13th month forward – 1% decline per month (previous month x 0.99)

Berrenda Mesa Project

- Initial fill rate in Berrenda Mesa Project Ponds – 75 cfs.
- Additionally, initial Kern River losses to COB 2800 Acres – 15 cfs.
- Using historical delivery data to the Berrenda Mesa Project and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:

- 1st month – 100% (initial fill capacity)
  - 2nd month – 6% decline (1st month x 0.94)
  - 3rd - 6th month – 12% decline per month (previous month x 0.88)
  - 7th month forward – 1% decline per month (previous month x 0.99)

Kern River Channel

- Maximum absorptive capacity – 11,900 AF/month (Approximately 200 cfs)
- Assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
  - 1st month – 100% (initial fill capacity)
  - 2nd month – 6% decline (1st month x 0.94)
  - 3rd - 6th month – 12% decline per month (previous month x 0.88)
  - 7th month forward – 1% decline per month (previous month x 0.99)

Note: The absorptive capacity on the Kern River Channel was needed and evaluated only in 1995 and 1996. Use of this capacity was not needed in the remaining years.

C. Results

A summary of the results of this analysis are presented in Table 16. The summary table shows the ability to absorb the SWP supplies recharged on the KWB considering the unused absorptive capacity of Kern Fan Projects (i.e., the Berrenda Mesa Project, the COB 2800 Acres, and the Pioneer Project, including the Kern River Channel).

Table 10 presents results separately for the Article 21 period (when Article 21 water was determined to be available), the regulated period when only scheduled supplies were available, and the total for January through December.

Within Table 10, actual SWP deliveries to the KWB are shown as negative numbers. The positive numbers for the other projects show the unused absorptive capacity. Therefore, if the total shown at the bottom of each table is positive, it means the unused absorptive capacity available exceeded the amount of SWP water delivered to the KWB, so all of that SWP water could have been recharged in these other projects. If the total shown at the bottom of each table is negative, the unused absorptive capacity available was less than the amount of SWP water delivered to the KWB, so some of that SWP water would not have been recharged.

The results show that all SWP deliveries to the KWB from 1995 through 2004 could have been recharged in the other Kern Fan Projects.

Table 10. Kern Fan Banking Project's Ability to Absorb State Water Project Supplies Recharged on Kern Water Bank

YEARLY SUMMARY BY SWP TYPE

NO RECHARGE CAPACITY ON KERN WATER BANK

		ARTICLE 21 PERIOD SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		3,934	4,404	4,363	0	3,983	4,507	1,964	1,785	295	770
2800 Acres		15,412	5,588	3,189	0	12,523	15,149	8,370	13,594	5,441	12,218
Kern Water Bank		0	-17,237	-9,386	0	-5,970	-18,898	-10,030	-6,380	-4,632	-16,151
Pioneer Property		12,374	7,083	1,866	0	20,085	5,833	4,420	3,723	1,452	4,974
Kern River Channel		3,370	3,740	0	0	0	0	0	0	0	0
	Total	35,090	3,579	32	0	30,620	6,591	4,723	12,723	2,556	1,811

		REGULATED SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		5,067	17,376	0	19,800	0	0	0	0	5,234	4,527
2800 Acres		47,425	52,822	33,304	100,868	55,143	40,532	0	0	30,403	0
Kern Water Bank		-70,329	-70,255	-30,663	-51,155	-20,041	-557	0	0	-35,742	-1,914
Pioneer Property		29,481	45,402	47,755	37,795	46,413	44,091	0	0	36,484	18,963
Kern River Channel		13,191	4,163	0	0	0	0	0	0	0	0
	Total	24,835	49,508	50,395	107,309	81,514	84,066	0	0	36,378	21,575

		YEARLY SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		9,002	21,780	4,363	19,800	3,983	4,507	1,964	1,785	5,529	5,297
2800 Acres		62,837	58,411	36,493	100,868	67,665	55,681	8,370	13,594	35,844	12,218
Kern Water Bank		-70,329	-87,492	-40,049	-51,155	-26,011	-19,455	-10,030	-6,380	-40,374	-18,065
Pioneer Property		41,855	52,485	49,620	37,795	66,497	49,925	4,420	3,723	37,935	23,937
Kern River Channel		16,560	7,903	0	0	0	0	0	0	0	0
	Total	59,925	53,087	50,427	107,309	112,134	90,658	4,723	12,723	38,934	23,387

VIII. Effects of KWB Development and Operations

A. Groundwater Hydrology and Quality

1. Existing Conditions in 1995

The Department divides the Central Valley of California into two groundwater basins, the Sacramento Valley Groundwater Basin and the San Joaquin Valley Groundwater Basin. It further divides the San Joaquin Valley Groundwater Basin into subbasins, one of which, the Kern County Subbasin, would be affected by the proposed project. Kern County subbasin lies at the south end of the San Joaquin Groundwater Basin.

The San Joaquin Valley was formed by deposition of sediment in a north-northwestern trending trough. The aquifer system in the valley consists of continental and marine deposits several miles deep. The upper 2,000 feet generally contain fresh groundwater. The sediments that contain the aquifer system are primarily Tertiary– and Quaternary–aged continental sediments derived from the Coast Range to the west and the Sierra Nevada to the east. Overlying these formations are flood plain deposits. A significant hydrogeologic feature is the Corcoran Clay. This clay layer divides the aquifer system into two distinct aquifers, an unconfined to semi-confined upper aquifer above the clay layer and a confined aquifer below it.[v] However, the clay layer is not continuous, and is absent in portions of the Kern County Subbasin.

Historically, the upper aquifer system in the Kern County Subbasin was recharged by precipitation, infiltration from rivers and lakes and lateral inflow along the basin boundaries. The main surface water feature in the Kern County Subbasin is the Kern River. Before European settlement the Kern River flowed to Kern and Buena Vista Lakes and extensive wetlands. During wet periods, the lakes overflowed to Tulare Lake to the north, which itself overflowed into the San Joaquin River watershed. Groundwater levels in the basin varied but reached artesian conditions in the lowest parts of the subbasin.

In the 1860s, ranchers raised livestock and dry farmed wheat in the San Joaquin Valley portion of Kern County. In the 1870s, farmers began diverting the waters of the Kern River to irrigate their crops. For two decades, irrigators relied almost exclusively on surface waters for their water supplies, but in the 1890s, some took advantage of improvements in pumping technology and began turning to more reliable groundwater supplies.[vi] Increasing use of groundwater caused the water table in parts of Kern County to fall by as much as 400 feet by 1960. Groundwater extraction between 1926 and 1970 has caused the ground surface to subside by eight to nine feet in the central part of the Kern County Groundwater Subbasin.[vii]

Surface water imports to the area began in 1949 with the completion of the CVP's Friant-Kern Canal and increased in the 1960s and 1970s, as water from the SWP became available. Many irrigators contracted for deliveries of imported surface water and were able to reduce their use of groundwater. As a result, groundwater levels in some parts of the southern San Joaquin Valley began to rise.

KCWA, the largest of the SWP's agricultural contractors, and other agencies in Kern County, manage surface and groundwater in the San Joaquin Valley portion of Kern County. Their surface water sources include flood flows from the Kern River, CVP deliveries from the Friant-Kern Canal and SWP deliveries from the California Aqueduct. Their groundwater source is the aquifer that underlies much of the land within the KCWA boundaries.

For many years, water agencies in Kern County have practiced conjunctive use of their surface and groundwater sources; that is, they actively manage their surface and groundwater sources to take advantage of the unique characteristics of each type of water source. Kern County agencies utilize in-lieu recharge and direct recharge management practices. In-lieu recharge is a water management practice that modifies the irrigation practices of water users who have access to surface water supplies and groundwater supplies. It substitutes surface water for irrigation in-lieu of normal groundwater pumping to increase groundwater supplies and conserve groundwater for use in future years. Direct recharge (artificial recharge) is a water management practice that applies water to percolation ponds to increase groundwater recharge and store water in an aquifer for later extraction.

When surface waters are available from the Kern River, the CVP or the SWP, farmers use surface waters to irrigate crops. When surface water supplies are insufficient, farmers supplement their surface water supplies with groundwater. When surface water availability exceeds farmer's needs, KCWA and those other water agencies with groundwater recharge facilities percolate the surface water to recharge the groundwater basin. Other agencies that manage groundwater banks with in-lieu recharge will then use any excess surface water in lieu of pumped groundwater, with the objective of allowing the basin to recover and/or storing this water for subsequent withdrawal.

Kern County water agencies manage groundwater banks for use by other agencies as well as their own in-county use. The agencies use direct and in-lieu recharge to bank groundwater for their own later recovery. Some Kern County agencies also offer groundwater banking, which is the storage of a non-Kern County agency's water in Kern County groundwater basins for later recovery. The agencies can recover the water for the non-Kern County agency by direct pumping and conveyance of the water to the non-Kern County agency, or the Kern agencies can recover the water through an in-lieu exchange. Under an in-lieu exchange, the SWP or non-SWP water that would otherwise have been delivered to the Kern County agency would instead be delivered to the non-Kern County agency, and the Kern County agency would pump a like amount of the non-Kern County agency's stored water for use within the Kern County agency's service area. The third party could be a water agency located outside Kern County, or it could be a KCWA member agency that has access to the groundwater basin underlying parts of the KCWA service area. The third party makes an agreement with the groundwater bank operator to store and recover water from the groundwater basin.

Figure 9.2-1 shows total water supplies and water demand in the San Joaquin Valley portion of Kern County between 1970 and 1999. In years when total surface water supplies exceeded demand, the excess supply was added to groundwater storage. In years when total surface water supplies were insufficient to meet demand, groundwater was pumped to meet demand and groundwater storage decreased. Between 1970 and 1995, groundwater storage declined by 6.6

million AF, an average reduction in storage of 264,000 AF per year. Figure 9.2-2 shows cumulative groundwater storage for the period 1970 to 1995. During most of the 1970s, groundwater storage declined as a result of dry conditions and limited access to SWP water due to distribution system limitations. Groundwater storage increased from 1978 until the mid-1980s when a ten-year dry period began, resulting in a decline of approximately 7.3 million AF, compared to 1970 storage levels.[viii]

2. Effects of Transfer, Development, and Operations

For many years, Kern County farmers and water agencies have practiced conjunctive use of surface and groundwater sources. They also practice groundwater banking. Between 1971 and 1994, 1.15 million AF of water was delivered for banking within the San Joaquin Valley portions of Kern County, an average of about 48,000 AFY, using water from local, SWP, and CVP supplies. With a few exceptions, this water was banked for KCWA and its member agencies.

Groundwater banking in Kern County increased after 1995. Between 1995 and 2000, 2.38 million AF of water was delivered for banking within the San Joaquin Valley portions of Kern County, an average of about 397,000 AF per year. There were four reasons for the increase, two of them related to the Monterey Amendment.

A primary reason for increased groundwater banking was recognition by Kern County that they would need to take measures to improve the reliability of their water supplies. The extended drought of 1987 through 1992, including 1991 when agricultural contractors received a zero percent SWP allocation, highlighted the hydrologic uncertainty of SWP supplies. At the same time, the listing in the early 1990s of several Delta fish species as threatened or endangered, along with proposed regulatory and operational constraints to protect them, highlighted the regulatory uncertainty that could further reduce SWP supply reliability. In response, KCWA and its member agencies began aggressive development of banking programs to store wet-year supplies for their use in dry years.

A second reason for increased banking was the series of wet years that followed the drought. Beginning in 1995 and continuing through the late 1990s, these consecutive wet years provided abundant excess water for the contractors and others to store in the Kern County Groundwater Subbasin.

The next two reasons relate to the Monterey Amendment. Although DWR, on a policy basis, had approved out-of-service area banking prior to the Monterey Amendment (i.e., the Semitropic WSD banking program), the Amendment provided a contractual assurance that contractors would be able to store SWP water outside their service areas. Of the total amount delivered for banking within Kern County between 1995 and 2000, about 503,000 AF was provided by contractors for storage outside their service areas in banking programs approved after implementation of the Monterey Amendment. The Monterey Amendment also transferred ownership of the KFE property to local interests, and the KWBA developed percolation ponds and wells on the property for groundwater banking by its participating members. Of the total amount delivered for banking within Kern County between 1995 and 2000, about 873,000 AF was for banking at the KWB. As was shown in Section VII, all of the SWP water banked at the KWB during this period could have been banked in available capacity in other existing banking projects in the Kern Fan area. Therefore, much of the water banked at the KWB would have been banked in Kern County, even without the KFE property transfer.

So while groundwater banking increased in Kern County after 1995, it occurred for a number of reasons. Of the total 2.38 million AF delivered for banking in Kern County between 1995 and 2000, more than half was, or otherwise would have been, banked in existing banking programs unrelated to the Monterey Amendment.

Between 1995 and 2005, KWB participants placed about one million AF more water in groundwater storage in Kern County than they withdrew (see Table 9). KCWA estimates that every 100,000 AF of water placed in storage causes a rise of one foot in the groundwater level in the San Joaquin Valley portion of Kern County. Thus, storage of water in the KWB probably raised groundwater levels by about 10 feet between 1995 and 2005.

During the late 1990s and early 2000s, KWB participants appeared to be setting aside the stored water for use in dry periods rather than using it to increase their average annual deliveries of SWP water. This operating practice would result in water remaining in storage for several years and only being drawn down occasionally. Overall, the effect of the additional groundwater banking facilitated by the KWB was to raise groundwater levels in Kern County by several feet relative to the baseline scenario. Thus, the KWB had a modestly beneficial effect on groundwater levels in Kern County between 1995 and 2005 relative to the baseline, and is therefore a ***less-than-significant impact***.

B. Terrestrial Biological Resources

1. Existing Conditions in 1995

The approximately 19,900 acre KFE property is located in Kern County, about 20 miles west of Bakersfield and 10 miles south of Buttonwillow. Interstate 5 and the Kern River both bisect the area. The KFE property had historically been subject to periodic flooding from the Kern River, and is able to absorb water at an extremely high rate, retaining it in underground aquifers. The land was used for cattle grazing in the 1880s, and then crop production in the 1930s. It was also explored for gas and oil resulting in numerous wells and pipelines. The Department purchased the land in 1988 with the intention of creating a groundwater bank. In 1994, four special-status plants and eleven special-status animals were known to occur on the KFE property (see Table 11) Note: for this study, ADEIR Table 9.4-2 was revised to include only that information relevant to the KFE property).

Prior to the Department's purchase of the KFE property, approximately 17,068 acres of the property was under extensive cultivation.[ix] The remaining property contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland, which had been leased for oil recovery facilities. No wetland habitat was present in the project area, except for the canals used to convey agricultural water.

After the Department acquired the property, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed.

TABLE 11

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY

Species Name	Status(1) Federal/State/CNPS 1994	Status(1) Federal/State/CNPS 2003	Habitat	Kern Fan Element Property
Plants				
Hoover's wolly- star (eriastrum) *Eriastrum hooveri*	T/-/4	D/-/4	Alkali sinks, washes. Usually on silty to sandy soils.	X
Recurved larkspur *Delphinium recurvatum*	C2/-/1B	SC/-/1B	On alkaline soils	X
San Joaquin woollythreads *Monolopia (Lembertia) congdonii*	E/-/1B	E/-/1B	Alkaline or loamy plains, sandy soils	X
Slough thistle *Cirsium crassicaule*	C2/-/1B	SC/-/1B	Sloughs, riverbanks, and marshy areas	X
Amphibians				
Western spadefoot *Scaphiopus hammondii*	C2/CSC	SC/CSC	Primarily grassland habitats, requires vernal pools for breeding and egg-laying.	X
Reptiles				
Blunt-nosed leopard lizard *Gambelia sila*	E/E, FP	E/E, FP	Sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	X
Western pond turtle *Emys marmorata (includes both subspecies)*	C2/CSC	SC/CSC	Permanent or nearly permanent bodies of water; requires basking sites, and suitable nesting sites	X
Birds				
Burrowing owl *Athene cunicularia*	C2/CSC	SC,BCC/CSC	Subterranean nester, dependant upon burrowing mammals, Burrow sites typically in open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation.	X
California thrasher Toxostoma redivivum	-/-	SC/-	Lowland and coastal chaparral, riparian thickets	X
Cooper's hawk *Accipiter cooperii*	-/CSC	-/CSC	Nests in riparian growths of deciduous trees, as in canyon bottoms of river floodplains, within open, interrupted or marginal woodland.	X
Double-crested cormorant Phalacrocorax auritus	-/CSC	-/CSC	Fresh, brackish, and salt water, along coastal regions and inland lakes	X

TABLE 11

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY

Species Name	Status[(1)] Federal/State/CNPS 1994	Status[(1)] Federal/State/CNPS 2003	Habitat	Kern Fan Element Property
Lawrence's goldfinch *Carduelis lawrencei*		SC/	Oak and riparian woodland, chaparral, pinion/juniper woodland, and weedy areas near water.	X
Loggerhead Shrike *Lanius ludovicianus*	C2/CSC	SC,BCC/CSC	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.	X
Northern Harrier *Circus cyaneus*	-/CSC	-/CSC	Breeds in shrubby vegetation within marshes, or grasslands.	X
Swainson's hawk *Buteo swainsoni*	-/T	SC,BCC/T	Breeds in stands with few trees in Juniper-sage flats, riparian areas and oak savannahs. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X
White-tailed (black shouldered) kite *Elanus leucurus*	-/*	SC,MNBMC/ FP	Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. General nesting habitat is rolling foothill/valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland.	X
Mammals				
American badger Taxidea taxus	-/CSC	-/SA (CSC in 2006)	Need friable soils and open, uncultivated ground in drier open stages of most shrub, forest, and herbaceous habitats.	X
Buena Vista Lake shrew *Sorex ornatus relictus*	C1/CSC	E/CSC	Marshlands and riparian areas in the Tulare Basin. Prefers moist soil. Uses stumps, logs and litter for cover.	X
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	C2/T	SC/T	Western San Joaquin Valley on dry, sparsely vegetated loam soils. Need widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes	X
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	E/T	Needs loose-textured sandy soils for burrowing, and suitable prey base, in annual grasslands or grassy open stages with scattered shrubby vegetation.	X

TABLE 11 SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY				
Species Name	Status(1) Federal/State/CNPS		Habitat	Kern Fan Element Property
	1994	2003		
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	E/E	Needs soft friable soils which escape seasonal flooding within saltbrush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley	X
Yuma myotis *Myotis yumanensis*	C2/-/-	SC/	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution in closely tied to the bodies of water. Maternity colonies in caves, mines, buildings or crevices.	X

Notes 1. Status explanation
Federal
E Listed as endangered under the Federal Endangered Species Act.
T Listed as threatened under the Federal Endangered Species Act.
C1 Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.
C2 Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.
SC Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing. In 2006, the USFWS stopped maintaining a Federal Species of Concern list.
D Delisted – Delisted species are monitored for five years after being delisted.
BCC US Fish and Wildlife Service, Bird of Conservation Concern
MNBMC US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern
- No listing

State
E Listed as endangered under the California Endangered Species Act.
T Listed as threatened under the California Endangered Species Act.
CSC California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
FP Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.
* Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution , or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).
SA Taxa found on the July 2003 Special Animals List, which have no legal or protection status.
- No listing.

Other – California Native Plant Society
1B Rare, threatened or endangered in California and elsewhere
4 Plants of limited distribution.

Sources:
USFWS List of Candidate Fauna from California and Nevada as of 31 August 1994 (59 FR 58982)
Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, August 20, 1994.
State and Federal Endangered Animals for California and Listing Dates, Department of Fish and Game, Revised January 1994.
California Department of Fish and Game Natural Diversity Data Base Special Animals, December 1992 (The 1994 version could not be located).

2. Effects of Transfer, Development, and Operations

The Monterey Amendment called for ownership of the KFE property to be transferred from the Department to the KCWA, and then to the KWBA, which was completed in 1996 (upon completion of the title search). In 1995, the KCWA received interim permits/authorizations from the USFWS and CDFG to initiate water banking to take advantage of a high availability of water due to a heavy snow pack in the Sierras. As a condition of the interim permit, KCWA was required to set aside permanent habitat mitigation land, which had moderate habitat value, or natural vegetation, until the long term HCP could be implemented on the KFE property.[x] The interim project was carried out in two stages. The first stage resulted in the rehabilitation of disused canals and inundation of 1,518 acres of former agricultural land. Pre-construction surveys were conducted, and revealed poor habitat values throughout the Stage 1 area, and no suitable habitat for listed species.

The second stage resulted in the inundation of 1,516 acres of grassland and fallow agricultural land, which had the potential to support listed species. Biological surveys were conducted in all areas proposed for disturbance by either construction or flooding and 58 potential San Joaquin kit fox dens were found to be unoccupied and destroyed; the animals did not return prior to construction. Approximately 300 potential Tipton kangaroo rat burrows were located during surveys, but were not monitored for the presence of Tipton kangaroo rat. If any of these burrows were inhabited, then a take may have occurred if the animals were unable to escape. Approximately one-quarter to one-third of a known population of San Joaquin woolly threads were inadvertently covered with excavated soils during project construction. The location of this plant was not identified prior to construction, but upon discovering the damage, the area was flagged and avoided. *[Comment: Could you please provide us with a reference for these statements regarding the Tipton Kangaroo rats and San Joaquin woolly threads. Current KWBA staff are unfamiliar with these incidents and would like to verify their accuracy.]* Construction of the recharge basins resulted in the loss of potential San Joaquin kit fox and Tipton kangaroo rat habitat, the potential take of Tipton kangaroo rat, and the destruction of a portion of the San Joaquin woolly thread population. This was not fully mitigated for prior to project construction, but has been mitigated for through post-construction participation in the KWB HCP/NCCP.

Since 1996, the KWBA has been responsible for land management on the KFE property. Lands have been managed in accordance with a HCP/NCCP approved by USFWS and CDFG in 1997.[xi] The KWB HCP/NCCP documents a plan to accomplish both water conservation and environmental objectives, mitigating project specific impact to less than significant at a regional level. The primary water conservation objective is the storage of water in aquifers during times of surplus for later recovery during times of shortage. The primary environmental objective is to set aside large areas of the KFE property for endangered, threatened and other sensitive species and to implement a program to protect and enhance the habitat.

Under the KWB HCP/NCCP, the 19,900-acre KFE property was divided up for different land uses (see Table 1).

- Recharge Basins and Other Banking Facilities – Permanent operation of the banking facilities included the flooding of basins, constructing facilities for recovery of the water from underground aquifers and maintenance of all project facilities.
- Compatible Habitat – This habitat is largely fallowed agricultural land that has become established as non-native annual grassland that has been preserved and managed around

the banking facilities. It will provide upland habitat for San Joaquin kit foxes and other upland species.

- Sensitive Habitat – Three areas of sensitive habitat containing remnant native saltbush and valley sink scrub habitat have been identified. They are comprised of historic upland habitat and non-farmed locations of the KFE property and will benefit native upland species. These areas will be protected throughout the life of the permit.
- Department Mitigation Land – A 530-acre conservation easement has been established on the KFE property to mitigate other projects carried out by the Department prior to the transfer of this land to the KCWA. This easement will be managed by KWBA in accordance with the management plan established for the area.
- KWBA Mitigation Land – A 435-acre conservation easement has been established in the Kern Fan Element to mitigate KWBA projects on KWB lands. This easement will be managed by KWBA in accordance with the management plan established for the area.
- Farming – 3,170 acres of the project site may be farmed in a manner appropriate to soil conditions found on site. The land may also be used for water recharge and recovery purposes, including recharge basins, levees and related uses.
- Conservation Bank - 3,267 acres of potential and occupied habitat has been designated for a conservation bank. Pursuant to the HCP, KWBA may use, or sell up to 490 acres of this habitat for commercial development. However, KWBA has agreed not to sell or use the 490 acres as a condition of the Monterey Settlement Agreement. Much of this land was pre-approved mitigation land by CDFG and is adjacent to other land preserved in the area. KWBA can use or sell up to 3,267 conservation credits to landowners, developers and others for mitigation for projects within the Master Permit Credit Area.

Between 1998 and 2003, the KWBA built an additional 4,080 acres of shallow recharge basins on the KFE property. Some of acres were located within an area designated for farming.[xii] Of the original 3,267 acres of available conservation credits, 744 acres have been sold as of December 31, 2005.

Several measures were implemented in accordance with the KWB HCP/NCCP, to reduce impacts on native or migratory wildlife using the KFE property, including:

1) Maintaining water levels constant, to the extent possible to prevent impacts on birds nesting in the recharge basins;
2) Slowly refilling basins and canals that have been idle for more than two years, so that any covered animals will be able to escape before drowning;
3) Constructing shallow canal side slopes to allow animals to escape from the interior and extending internal access roads across new canals, which would provide access for animals to cross the canal when wet;
4) Surveying unused canals that will be used in the near future, prior to the burrowing owl nesting season. Any burrows found will be collapsed, in consultation with the Resource Agencies, to prevent nesting in those locations.
5) Vegetation removal from roadways, turnouts, interbasin structures, road crossings and control structures will be accomplished by burning, motor grading (used minimally), mowing, herbicide or hand. Vegetation removed from canals and basins will be

accomplished by hand control, lightweight equipment (weed-eaters), grazing, mowing and burning; and

6) Complying with the "Interim Measures for Use of Rodenticides in Kern County," in order to prevent damage to facilities from rodents and to prevent the poisoning of listed species.

A Vegetation Management Plan was created to describe cost effective vegetation management and restoration practices for the long-term adaptive management and enhancement of the Kern Water Bank. Protection of existing and newly established sensitive habitats, vegetation management of compatible habitat using effective, low-cost adaptive methods and exotic pest plant control are primary goals under this management plan.

Under the HCP, the KWBA has authorization to incidentally take (including harm or harass) 161 covered species that are listed, or may be listed in the future under FESA. Of these species, fourteen special-status plants and animals have recorded occurrences on the KFE property. Since the approval of the HCP/NCCP, only one incidence of take has been reported or is known to have occurred on the KFE property.[xiii] In 1999, during the construction of the KWB Canal, some Tipton kangaroo rats were captured and temporarily relocated to avoid harming them. After construction was complete, they were reintroduced into the area they had originally inhabited.

In addition to the KWB HCP/NCCP, an Initial Study and Addendum was prepared for the KWB, which included mitigation measures to reduce impacts on terrestrial biological resources. These mitigation measures, in addition to measures from the HCP/NCCP have reduced the impact of the KWB to a ***less-than-significant level***, and are incorporated into this document to mitigate for future impacts of the proposed project, as discussed under Impact 9.4-3B.

C. Visual Resources

1. Existing Conditions in 1995

The KFE property consists of about 19,900 acres of land located in Kern County, southwest of Bakersfield. The KFE property lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. The terrain is flat with no more than a few feet of topographical relief. Prior to 1995, there were no major structures on KFE property except for Interstate 5 (I-5), the Cross Valley Canal, some abandoned tanks and other oil-field equipment, and about 300 acres of percolation ponds.

The KFE property was farmed for many years until the mid-1980s. After the Department purchased the land in 1988, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. By 1995, introduced annual grasses and forbs had colonized the land.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xiv] The Kern Water Bank Canal has a uniform cross-section and is confined between earthen levees. It is a prominent feature in the landscape but one that is visually consistent with other waterways in the area including the Cross Valley Canal and the California Aqueduct.

Although these land use changes have altered the appearance of lands within the KFE property, they did not alter the overall visual character of the area. The changes would be seen by a limited number of viewers and would probably be noticed by even fewer. The alteration in visual resources is considered to be a ***less-than-significant impact***.

D. Air Quality

1. Existing Conditions in 1995

Kern and Kings Counties are in the San Joaquin Valley Air Basin (SJVAB). This air basin is in non-attainment of federal and State standards for both PM_{10} and ozone. The SJVAB also has areas where TACs are problematic. In 1995, the SJVAB was designated by the U.S. Environmental Protection Agency (EPA) as being in “serious” non-attainment for the federal one-hour ozone standard. No other federal ozone standard was in place at the time. This led to the preparation of the 1994 Ozone Attainment Plan, which was prepared by the local air agency and was adopted in November of 1994. The SJVAB was also in “serious” non-attainment of the federal PM_{10} standard and developed a plan to bring the basin into attainment of the standard.

In 1995, the State as a whole experienced health impacts from TACs, mostly from diesel particulate matter. At that time, Kern County had several areas where the estimated inhalation cancer risk was greater than 250 per million people.

2. Effects of Transfer, Development, and Operations

By 2003, the air basin’s attainment status had been changed to “severe” nonattainment for the federal ozone standard. The SJVAPCD was also readying to petition the EPA to reclassify the Basin to “extreme” for one-hour ozone standard to allow the Basin more time to attain the standard. The Basin remained a “serious” non-attainment area for the federal PM_{10} standard. The Basin also remained a non-attainment area for State ozone and PM_{10} standards. The SJVAPCD thresholds of significance in 2003 was 10 tons/year of ROG, 10 tons/year NO_x, and an excess cancer risk of 10 in one million from TACs. Risk from diesel particulate matter in the

Basin had improved since 1995, but areas still existed where Toxic Air Contaminants (TAC) risk was high.

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xv]

Construction of the percolation ponds, canal, and other facilities required the use of heavy-duty construction equipment. This equipment generated diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities also generated PM_{10}. Because the proposed project would have implemented all of the SJVAPCD's suggested PM_{10} control measures, PM_{10} construction emissions would be below SJVAPCD thresholds. Based on a conservative assumption of 800 acres per year of soil disturbance to construct the ponds, NO_x and ROG emissions would not have exceeded SJVAPCD thresholds. Further, the duration of construction-generated air pollutant emissions was limited to the construction periods only.

Operation of the facilities requires pumping to convey water to percolation ponds and to extract water from underground. With the KWB, there would have been increased pumping to convey water through the system, as compared to pre-project conditions. While electric pump use would have increased, this would not have increased air emissions, as electric pumps are relatively pollution-free.

Therefore, because the KWB did not result in a net increase in criteria air pollutants over SJVAPCD annual thresholds in a non-attainment area, there would have been no conflict with implementation of the adopted air quality plan for the region. This is considered to be a ***less-than-significant impact***. Further, any construction-related emissions would have been temporary. Operational emissions would not likely have exceeded adopted criteria.

E. Geology and Soils

1. Existing Conditions in 1995

The San Joaquin Valley basin is bordered to the south and east by the Sierra Nevada and Tehachapi mountains, which are composed of crystalline igneous and metamorphic rock. Exposed consolidated marine sedimentary rock from the Coast Range are evident in the layer of sediment above bedrock underlying the San Joaquin basin. The KFE property overlies a large, deep, and asymmetrical sedimentary basin located in the southern portion of the San Joaquin Valley.

The marine sedimentary rock is overlain by a thick series of continental rocks and semi-consolidated to unconsolidated sediments. These sediments are several thousand feet thick under the KFE lands, and encapsulate the primary groundwater basin. The portion of this sediment that is usable for groundwater storage is located above the base of the fresh water in the basin. This area of the groundwater basin is dominated by the alluvial fan and lake material that comprise the KFE lands. Further, groundwater development is limited to the upper portions of the fresh water aquifer system in this basin.

The southern San Joaquin Valley, including the KFE property, is dominated by the alluvial fan deposited by the Kern River, and consists of thick deposits of sand and gravel with extensive but discontinuous silt and clay beds.[xvi] The sand and gravel deposits are remnants of old streambed channels which generally occur in long, winding, and interconnecting stingers and sheets that are prevalent throughout the KFE property, but less evident along its borders. These sand and gravel deposits are highly permeable, but are imbedded with less permeable areas comprised of fine-grained silt and clay deposits. These silt and clay deposits are more extensive along the edges of the alluvial fan and in some areas may intersect with clay beds deposited in lakes. In general, the upper layers of the alluvial fan deposits form an unconfined to semi-confined aquifer system that provides a large amount of groundwater recharge area.

Soils in the southern portion of the San Joaquin Valley, including the KFE lands, range from highly permeable, coarse sandy soils to silty loam with very low permeability.[xvii] In general, the soils present are characterized as deep, well-drained sandy loam that have moderate to rapid permeability with low water retention, and have a slight erosion potential. These soils are interspersed with pockets of clay deposits that are characterized by low-permeability and are often associated with saline-alkali conditions.[xviii]

2. Effects of Transfer and Development and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xix] As previously described, grading was required to construct the percolation ponds. However, construction of the ponds and associated levees occurred on topography that is relatively flat and required only minor grading and compaction of soils. Furthermore, soils on the KFE property can generally be characterized as being slightly erodible. Therefore, although conversion of approximately 7,114 acres of land to percolation ponds changed rates of erosion, this impact is considered ***less than significant***.

F. Land Use and Planning

1. Existing Conditions in 1995

In the 1980s, the Department began exploring the feasibility of developing an SWP groundwater storage facility in Kern County, which it called the KWB. As envisioned, the KWB was to consist of a series of "elements," which would be geographically separate projects that would be operationally integrated. In 1988, Tenneco West sold approximately 20,000 acres of land in the Kern Fan area to the Department, which was intended to be used for development of one of these groundwater storage elements – the KFE. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately convinced the Department to halt feasibility studies and design work on the project.[xx] The uncertainties were created by proposed water quality standards for the Delta and issues associated with the protection of threatened and endangered species, both of which would have reduced the amount of water that could be pumped from the Delta. Later, the Department concluded that these constraints on Delta pumping and other uncertainties made development of an SWP groundwater storage facility on the KFE property not feasible at the time.[xxi] In 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized, and the land on the KFE property remained undeveloped.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxii]

An HCP was developed for the KFE property. The HCP allows developed uses on about 4,000 acres of the KFE property (not including recharge ponds).[xxiii] Developed uses include farming, permanent facilities for the KWB and commerce. Approximately 490 acres of land adjacent to Interstate 5 (I-5) is designated for possible commercial use. However, KWBA has agreed not to sell or use the 490 acres as a condition of the Monterey Settlement Agreement.

Implementation of the KWB has altered the physical use of the land; however, overall land use and designations have not changed. The operation of percolation ponds is compatible with the surrounding existing uses. No commercial, retail, office, residential or other uses were developed, and an established community has not been divided. In addition, development of uses on the KFE property was consistent with the HCP. Therefore, the impact of the KWB on land use is considered to be ***less than significant***.

G. Hazards and Hazardous Materials

1. Existing Conditions in 1995

In the 1980s, the Department began exploring the feasibility of developing an SWP groundwater storage facility in Kern County, which it called the KWB. As envisioned, the KWB was to consist of a series of "elements," which would be geographically separate projects that would be operationally integrated. In 1988, Tenneco West sold approximately 20,000 acres of land in the Kern Fan area to the Department, which was intended to be used for development of one of these groundwater storage elements – the KFE. Prior to the Department acquiring the KFE property, the land was historically used for agricultural production. Once the land was acquired by the Department, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed.

The hazards and hazardous materials setting for the KFE property was described in the Department's 1990 Supplemental EIR for the first stage of the KFE of the KWB project ("1990 Supplemental EIR"). The setting described was generally related to the hazardous materials present in the soils on the KFE property. The 1990 Supplemental EIR described the results of soil sampling done throughout the KFE property to characterize potential contamination. Pesticides, herbicides, and other contaminants were found in soil samples near the pond sites, with isolated pockets of petroleum compounds found near oil pipelines or facilities.[xxiv] Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[xxv]

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal; a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxvi] The construction of percolation ponds resulted in ground-disturbing activities that could have exposed construction workers to residual chemicals associated with past and present agricultural practices involving the use of pesticides, fungicides, and similar agricultural products on crops and soils.

Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[xxvii]

Residues of agricultural chemical products in farmed soils as a result of routine agricultural operations are not typically managed as hazardous waste when used in accordance with adopted laws and regulations. Nonetheless, individuals performing excavation and grading activities would be at a greater risk of exposure to agricultural chemical residues in soil through inhalation of dust from soil movement. Construction of the ponds would also involve the use of heavy equipment that would contain fuels and lubricants. These products contain hazardous compounds, and an accidental release of these materials could injure construction workers, contaminate soil or water, or present a fire/explosion hazard.

Construction contracts included specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as fuels. Title 8 of the CCR also addresses the use of hazardous products in the work environment, which would apply to construction contractors. The potential for inadvertent spills of materials, which could affect nearby surface water bodies or groundwater, was managed through construction site Best Management Practices (BMPs). Therefore, impacts would be ***less than significant***.

H. Noise

1. Existing Conditions in 1995

The KFE property consists of 19,900 acres of land located in Kern County southwest of Bakersfield. The KFE property lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. In 1995, there were no major structures on the KFE property except for I-5, the Cross Valley Canal, and some abandoned tanks and other oil field equipment.

The KFE property was farmed for many years until the mid-1980s. After the Department acquired the property, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. Therefore, vehicular traffic was the primary source of noise throughout the area. The KFE property is primarily bisected by rural roads, SRs 99, 119, 166, and 223, and I-5.

2. Effects of Transfer, Development, and Operations

Between 1995 and 2005, as part of the KWB, approximately 7,114 acres of land were converted to shallow percolation ponds, and a six-mile long earthen canal (the Kern Water Bank Canal) and several wells and pump stations were built. Unpaved roads were built to provide access to the new facilities. However, there were no noise-sensitive land uses located in close proximity to the construction sites that were adversely impacted by daytime construction noise and groundborne vibration levels. Routine maintenance of the new facilities results in temporary noise levels. Operation of the KWB requires pumping to convey water to percolation ponds, to extract water from underground, and to convey water in the Kern Water Bank Canal. Electric motors power the pumps. A representative range of noise levels for pumps is estimated to be 68 to 72 dBA (see Table 12) at 50 feet. *[Comment: Note that the reference to Table 9.12-3 in ADEIR is incorrect; the correct reference is Table 9.12-5.]* The installation and operation of pumps associated with the construction of percolation ponds on the KFE property attributable to the KWB would result in an increase in noise emissions from pumps compared to pre-1995 conditions. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Ongoing maintenance of the new facilities is intermittent and not considered a substantial source of increased noise levels at sensitive land uses. Therefore, these land use changes are considered to have a ***less-than-significant impact***.

TABLE 12

NOISE RANGES OF TYPICAL CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Levels in dBA Leq at 50 feet[1]
Front Loader	73–86
Trucks	82–95
Cranes (moveable)	75–88
Cranes (derrick)	86–89
Vibrator	68–82
Saws	72–82
Pneumatic Impact Equipment	83–88
Jackhammers	81–98
Pumps	68–72
Generators	71–83
Compressors	75–87
Concrete Mixers	75–88
Concrete Pumps	81–85
Back Hoe	73–95
Pile Driving (peaks)	95–107
Tractor	77–98
Scraper/Grader	80–93
Paver	85–88

Note:
1. Machinery equipped with noise control devices or other noise-reducing design features does not generate the same level of noise emissions as that shown in this table.

Source: U.S. EPA 1971 as presented in City of Los Angeles 1998.

I. Cultural and Paleontological Resources

1. Existing Conditions in 1995

Archeological Resources

The Southern Valley Yokuts included a large number of distinct small tribes. The groups depended on diverse resources, but freshwater lake and marsh resources were predominant.[xxviii] Their territory was in the southern end of the San Joaquin Valley, around Tulare, Buena Vista and Kern lakes, and the lower ends of the streams that fed those lakes.[xxix] The *Wechihit* Yokuts lived on the lower Kings River, and undoubtedly traded and intermarried with the *Holkoma* and *Wobonuch* Mono; the *Koyeti* Yokuts lived on the lower Tule River, and probably interacted closely with their relatives, the *Yawdanchi*, upstream. On the Kern River, the *Yawelmani* occupied present-day Bakersfield and the stream course for some distance upstream, as indicated by archaeological evidence. The *Tachi* Yokuts occupied land that comprises present-day Kings County. The KFE property falls within *Yawelmani* Yokuts territory, and sites have been recorded in the area.[xxx]

Paleontological Resources

During the Miocene Epoch, most of Kern County was an ocean bay which extended as far north as Redding and as far south as Bakersfield. The waters lapped against rolling hills that were soon to be pushed up to form the Sierra Nevada Mountains. Northeast of Bakersfield, where the modern Kern River leaves the Sierra Nevada, a river flowed into the bay. The river carried sediments and the remains of plants and animals into the bay. These materials, along with the plentiful remains of marine organisms, sank to the bottom and much of the organic remains were fossilized. Subsequent geologic events pushed up the sediments, and they then eroded to form the rolling hills that include Sharktooth Hill. Exposed in these hills is the bone bed that formed from those fossil-rich sediments. The Sharktooth Hill bone bed encompasses more than 110 square miles, most of it deep underground only exposed east of the Bakersfield area.[xxxi]

This bed is the most fossil-rich Miocene marine bone bed in the world. And, like the great La Brea discoveries in Los Angeles provide for the Pleistocene, the Sharktooth Hill bone bed offers a surprisingly complete view of the marine Miocene period. The bed contains the fossilized remains of all major marine groups of animals.[xxxii]

Kings County is home to Kettleman Hills, which contain three geological rock deposits from the Etchegoin, San Joaquin, and Tulare Formations, with the Etchegoin Formation being the oldest and the Tulare Formation being the youngest.[xxxiii] The Kettleman Hills contain an abundance of invertebrate, vertebrate, and botanical fossils from the Pliocene Epoch (4.5 to 2.0 million years old). The area contains 370 registered fossil localities, while there are a total of approximately 570 registered fossil localities throughout the entire Kings County.[xxxiv] Many of these fossils were preserved and deposited within a complex integrating fresh water, estuarine, and marine conditions directly related to the sea that existed during the Tertiary Period of the Cenozoic Era. The Kettleman Hills continue to produce the well preserved fossils they are famous for today.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxxv]

As previously noted in Impact 9.13-1A, prehistoric sites have been recorded in the Kern Fan Element, and paleontological deposits have been identified in the southern portion of the county. Some of these deposits are exposed while others are underground. Ground disturbance associated with the construction of groundwater storage facilities could expose paleontological resources. Prior to construction, archeological investigations were completed in the Kern Fan Element and for the Kern Water Bank Habitat Conservation Plan/ Natural Community Conservation Plan (HCP/NCCP). Some of these investigations recorded significant archeological sites at or near the Kern Fan Element project area.[xxxvi] Mitigation measures were also adopted to ensure that if previously unidentified archeological resources were discovered during construction activities, that work would cease and a qualified archaeologist would examine the discovery and make recommendations for appropriate data recovery.

Therefore, the proposed project is considered to have had a ***less than significant impact***.

J. Traffic and Transportation

1. Existing Conditions in 1995

The KFE property consists of 19,900 acres of land located in Kern County southwest of Bakersfield. The KFE property was farmed for many years until the mid-1980s. After the Department purchased the land in 1988, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. By 1995, introduced annual grasses and forbs had colonized the land. The area is traversed by I-5, SRs 99, 119, 166, and 223 and paved and unpaved rural roads.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector (see Section V.C.2.a) and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds. KWBA also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.xxxvii Unpaved roads were constructed to provide access to the new facilities. Traffic volumes on some rural roads temporarily increased during the construction period. In addition, routine maintenance of the new facilities resulted in a permanent increase in vehicular traffic. While there had been vehicular traffic related to agricultural activities on the KFE property through the 1991, in the several years prior to 1995, the land now occupied by the ponds lay fallow and generated little or no traffic. The small increases in vehicular movements attributable to construction and operation of the KWB had little adverse effect on traffic flow on the affected rural roads. Consequently, the KWB is considered to have a less-than-significant impact.

IX. Summary

Compliance reports from 1999 through 2005 were reviewed to determine construction activities, recharge and extraction operations, wildlife use of the site, vegetation trends, and identify any incidences of “take” in light of the Kern Environmental Permits. Since 1999, a number of structures have been added to the site (canals, recharge ponds, levees, etc). These structures were developed based on the HCP/NCCP guidelines. Section VI highlights recharge and extraction operations at the Kern Water Bank that was determined from the Annual Reports and from staff at the KWCA.

Several “no take” projects have been authorized on the KWB property. The qualified biologists who spent many hours at the KWB since 1999 observing, photographing, and trapping, have reported no instances of “take” nor have any reports of “take” from staff or third party operators on the site been received. Due to the construction of more recharge ponds and the growth of riparian trees and other native vegetation, waterfowl and other bird species numbers and biodiversity have generally increased since 1999. Other wildlife species have benefited from the restoration and preservation activities at the KWB (coyotes, bobcat, etc.), however; numbers of the endangered San Joaquin kit fox and Tipton kangaroo rat continue to be low.

Based on the Annual Reports, and conversations with staff at the KWBA, the Department of Water Resources concludes that the KWB is operating as intended and within the confines of the HCP/NCCP.

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F. DETAILED RESULTS OF CALSIM II MODELING (STUDY NO. 4)

NOTE TO REVIEWER

Two documents are provided in this appendix. The first document dated 3 May 2007 provides a detailed description of the modeling method. However, the tables of data in the document dated 3 May 2007 reflect an early set of definitions of the proposed project and its alternatives, which are no longer applicable.

The definitions of the proposed project and its alternatives were altered and CALSIM II was rerun to reflect the new definitions. The second document dated 22 August 2007 contains data that reflects the current definitions of the proposed project and its alternatives.

The document dated 3 May 2007 uses names for the alternatives that have been superceded. The current CNPA3, used in the 22 August document, is equivalent to NPB-A with a state-owned water bank in the Kern Fan Element, used in the 3 May document. The current CNPA4, used in the 22 August document, is equivalent to NPB-S with a state-owned water bank in the Kern Fan Element, used in the 3 May document. The current NPA2, used in the 22 August document, is roughly equivalent to NPA, used in the 3 May document.

Monterey Plus EIR
Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines

5/03/2007

1.0. Introduction

This appendix describes the approach, assumptions and results of CALSIM II modeling and associated post-processing that was performed in support of the Monterey Plus EIR. The modeling assisted analysis of some of the Monterey Amendment's impacts on the State Water Project (SWP) and other areas. The analysis included evaluation of a 1994 Baseline and 2003 and 2020 evaluations of a Baseline, the Proposed Project and multiple No Project Alternatives that reflect different interpretations of the pre-Monterey contracts.

2.0. Overview of Impacts Analyses

The EIR analysis of potential effects of the Monterey Plus scenarios on California's surface water system utilizes the output from the CALSIM II model. This section of the appendix describes the CALSIM II model and associated post-processing spreadsheets that were used, the scenarios analyzed, and the model inputs and assumptions for each scenario.

2.1. Water Supply and Hydrology

Simulation of the hydrologic effects of the proposed project and other scenarios on the surface water system was an important tool for water supply analyses, and the water supply and hydrology output also provided data for other parts of the EIR. The surface water system includes natural water bodies (rivers and streams) and constructed facilities (reservoirs and diversions). Water supply effects include total supplies of the SWP, Central Valley Project (CVP), and other Delta water users; individual water supplies of SWP contractors, and operations of the Banks and Tracy pumping plants in the Delta. Hydrologic effects include changes in stream flow, stream water surface elevations, and reservoir levels.

2.1.1. Simulation Tools

The Department of Water Resources (Department), U.S. Bureau of Reclamation (Reclamation), and many other agencies and stakeholder groups currently use CALSIM II to simulate SWP and CVP operations, other water supply entities that interact with the SWP and CVP, the Delta, and other water bodies. For the Monterey Plus EIR, SWP deliveries from CALSIM II are post-processed using Excel spreadsheets to determine deliveries to each contractor in each scenario.

2.1.1.1. CALSIM II Model

The following is a brief overview of the CALSIM II model's approach and assumptions. For more detailed descriptions of the model, please refer to *Benchmark Study Assumptions*[1] (DWR 2002) and *Long-Term Central Valley Project Operations Criteria and Plan CVP-OCAP*[2] (USBR 2004).

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[1] http://modeling.water.ca.gov/hydro/studies/SWPReliability/index2.html
[2] http://www.usbr.gov/mp/cvo/ocap.html

CALSIM II is a planning simulation model developed jointly by the Department and Reclamation to simulate the California water system including the SWP and CVP. The model operates on a monthly time step from water year 1922 through 1994 and utilizes optimization techniques to route water through a network. A linear programming/mixed integer solver determines an optimal set of decisions for each time period given a set of weights and system constraints (DWR 2002).

The modeled geographic area includes the valley floor drainage of the Sacramento and San Joaquin Rivers, the upper Trinity River, and the delivery locations for contractors served by the SWP and CVP. The hydrology in CALSIM II was developed jointly by the Department and Reclamation and includes estimates of water diversion requirements (demands), stream accretions and depletions, rim basin inflows, irrigation efficiency, return flows, non-recoverable losses, and groundwater operations. Sacramento Valley and tributary rim basin hydrologies are developed using a process designed to adjust the historical sequence of monthly stream flows to represent a sequence of flows at a future level of development. Adjustments to historic water supplies are determined by imposing future level land use on historical meteorological and hydrologic conditions. San Joaquin River basin hydrology is developed using fixed annual demands and regression analysis to develop accretions and depletions. The resulting hydrology is used to represent the water supply available from Central Valley streams to the CVP and SWP at a future level of development (DWR 2002).

CALSIM II uses the Department's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates DSM2 model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations. The ANN flow-salinity model estimates electrical conductivity at the following four locations for the purpose of modeling Delta water quality standards: Old River at Rock Slough, San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville. In its estimates, the ANN model considers antecedent conditions up to 148 days, and considers a "carriage-water" type of effect associated with Delta exports (DWR 2002). CALSIM II uses logic for determining deliveries to north-of-Delta and south-of-Delta CVP and south-of-Delta SWP contractors that incorporates runoff forecast information and uncertainty and standardized rule curves (i.e. Water Supply Index versus Demand Index Curve) to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as water supply parameters become more certain. The south-of Delta SWP delivery is determined based upon water supply parameters and operational constraints. The CVP system wide delivery and south-of-Delta delivery are determined similarly upon water supply parameters and operational constraints with specific consideration for export constraints (DWR 2002).

CALSIM II dynamically models CVPIA 3406(b)(2) water and the Environmental Water Account (EWA). CVPIA 3406(b)(2) accounting procedures are based on system conditions under operations associated with regulatory requirements under SWRCB Decisions 1485 and 1641. Similarly, the operating guidelines for selection of actions and allocation of assets under the EWA are based on system conditions under operations associated with a Regulatory Baseline as defined by the CALFED Record of Decision (ROD), which includes SWRCB Decision 1641 and CVPIA 3406(b)(2) among other elements (USBR 2004).

2.1.1.2. Post-Processing Spreadsheet for CALSIM II Output

For each scenario, SWP deliveries to North Bay Aqueduct and South-of-Delta contractors from the CALSIM II studies were post-processed by taking total annual scheduled deliveries and total monthly unscheduled deliveries from the model study and allocating them to individual contractors according to each scenario's assumptions regarding allocation rules and transfers. Post-processing spreadsheets performed this allocation using the following steps.

<u>To Allocate Scheduled Deliveries:</u>

1. Take annual time series of scheduled deliveries from the CALSIM II model output for the period 1922-1994.
2. Determine annual quantities of Table A deliveries made to all agricultural contractors and to all M&I contractors using each scenario's allocation rules before Table A transfers from agricultural to M&I contractors are accounted for.
3. Determine total quantity of agricultural Table A delivery that was delivered to M&I contractors as a result of Table A transfers in each year.
4. For No Project B scenarios only, determine annual quantities of XA Amount deliveries made to all agricultural contractors and to all M&I contractors using each scenario's allocation rules.
5. Using the annual quantities of Table A and XA Amount deliveries determined in Steps 2 and 4 and the transferred quantities determine in Step 3, determine annual quantities of scheduled deliveries made to each individual SWP contractor.
6. Determine monthly deliveries made to each contractor by applying the agricultural and M&I monthly delivery patterns from CALSIM II to the annual quantities.
7. Adjust San Luis Reservoir storage within each year to account for changes in the total project monthly delivery pattern that occur because of changes in the proportion of water delivered to agricultural and M&I contractors relative to the CALSIM II study.

<u>To Allocate Unscheduled Deliveries:</u>

1. Take monthly time series of unscheduled deliveries from the CALSIM II model output for the period 1922-1994.
2. Determine monthly deliveries to each individual SWP contractor using each scenario's allocation rules.

2.2.1. Scenarios

Four basic alternatives were analyzed using CALSIM II and associated post-processing spreadsheets for the Monterey Plus EIR. The basic assumptions used in each alternative are shown in Table 1.

- <u>Baseline</u>: The Baseline represents the conditions at each level of development that are assumed to occur without implementation of the Project. In CEQA, the Baseline is used as a point of comparison from which the effects of the Project, No Project, and Alternatives can be assessed. As such, the Baseline developed for this analysis does not include the Monterey Amendment or the Settlement Agreement. The Baseline does not include invocation of Article 18(b) of the SWP contracts. Additionally, no Table A amount transfers from agricultural to M&I contractors occur in the Baseline. However, the 2003 and 2020 Baseline

Table 1 – Assumptions for Monterey Plus EIR Alternatives

Issue	Baseline	Proposed Project	No Project Alternative A	No Project Alternative B-A (Apportioned XA allocation rules)	No Project Alternative B-S (Surplus XA allocation rules)
Allocation of Table A Water	Uses 1994 contract provisions including Article 18	Uses Monterey Plus provisions	Uses 1994 contract provisions including Article 18	Uses 1994 contract provisions including Article 18	Uses 1994 contract provisions including Article 18
Allocation of Interruptible Water	Uses 1994 contract provisions including Article 21	Uses Monterey Plus provisions	Uses 1994 contract provisions including Article 21	Uses 1994 contract provisions including Article 21	Uses 1994 contract provisions including Article 21
Table A changes	No transfers from TLBWD and KCWA to M&I contractors are included	Includes (1) 22.27 TAF of transfers from TLBWD to M&I contractors in 2003-2007, (2) 114 TAF of transfers from KCWA to M&I contractors in 1998-2003, and (3) 16 TAF of transfers from KCWA to M&I contractors by 2020	Includes (1) 22.27 TAF of transfers from TLBWD to M&I contractors in 2003-2007, (2) 73 TAF of transfers from KCWA to M&I contractors in 1998-2003, and (3) 16 TAF of transfers from KCWA to M&I contractors by 2020	No transfers from TLBWD and KCWA to M&I contractors are included	No transfers from TLBWD and KCWA to M&I contractors are included
SWP conservation storage in Kern Fan Element	No SWP conservation storage in KFE	No SWP conservation storage in KFE	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020
Status of KCWA 40.67 TAF Table A and DRWD 4.33 TAF Table A amounts	KCWA and DRWD retain Table A amounts	Table A amounts are retired in 1996-97	KCWA and DRWD retain Table A amounts	KCWA and DRWD retain Table A amounts	KCWA and DRWD retain Table A amounts
Invocation of Article 18(b)	DWR retains Article 18(b) but does not invoke Article 18(b)	Elimination of Article 18(b)	DWR retains Article 18(b) but does not invoke Article 18(b)	DWR invokes Article 18(b)	DWR invokes Article 18(b)
Allocation rules for XA water	Not applicable	Not applicable	Not applicable	Allocates XA water in proportion to Table A amounts	XA deliveries for ag and gw replenishment uses are given priority

Note: All entries in this table are the same for all levels of development at which each alternative is analyzed.

scenarios include inputs such as increased Table A amounts and water demands to capture immutable and non-discretionary changes that occurred from 1995 to 2003 and that will occur in the future.

- Proposed Project: The Proposed Project is the implementation of the Monterey Amendment and the Settlement Agreement. Up to 153 TAF of Table A transfers from agricultural to M&I contractors are included.

- No Project Alternative A: Neither the Monterey Amendment nor the Settlement Agreement would be implemented. DWR would not invoke Article 18(b) of the SWP contracts. Up to 112 TAF of Table A transfers from agricultural to M&I contractors are assumed to occur.

- No Project Alternative B: Neither the Monterey Amendment nor the Settlement Agreement would be implemented. DWR would invoke Article 18(b) of the SWP contracts and announce new reduced Table A amounts. Based on prior modeling analysis, Table A amounts were assumed to be reduced proportionally among all contractors so that they totaled 1.9 million acre-feet[3]. No Table A transfers from agricultural to M&I contractors are assumed to occur.

  Demands for scheduled water above the reduced Table A amounts have been designated as "XA Amounts". Two alternative ways of allocating XA Amount water are included as different permutations of No Project Alternative B:

  - No Project Alternative B-A: XA Amount deliveries are made using "apportioned allocation" rules, in which deliveries to agricultural and M&I contractors are made in proportion to each contractor's Table A amounts.
  - No Project Alternative B-S: XA Amount deliveries are made using pre-Monterey's Article 21 "surplus water" rules, in which deliveries for agricultural or groundwater replenishment uses are given priority over those for M&I uses.

In addition, No Project Alternatives A, B-A, and B-S have been analyzed with and without a SWP groundwater storage bank in the Kern Fan Element (KFE).

Using these alternatives, scenarios for the 1994, 2003, and 2020 levels of development were analyzed using CALSIM II and the post-processing spreadsheets. For 1994, only a single baseline scenario was simulated. For the 2003 and 2020 levels of development, the EIR analyzed the following scenarios:

- Baseline
- Proposed Project
- No Project A without KFE storage
- No Project A with KFE storage
- No Project B-A without KFE storage
- No Project B-A with KFE storage

[3] The minimum project yield through the worst drought of record, found through iterative modeling studies

- No Project B-S without KFE storage
- No Project B-S with KFE storage

2.6.1.1. State Water Project Table A Amounts

Table 2 shows the Table A amounts assigned to each contractor in each scenario. Table A amounts for each contractor at each level of development are based on the schedule contained in Table B-4 of Appendix B of the Department of Water Resources' Bulletin 132-95[4]. These Table A amounts were modified based on historical Table A transfers and relinquishments.

Historical transfers totaling 100,000 acre-feet originating from the Metropolitan Water District of Southern California (MWDSC) are incorporated into all scenarios at the 2020 level of development. Historical Table A transfers of 22,273 acre-feet originating from Tulare Lake Basin WSD are included in all of the Proposed Project and No Project A Alternatives, but not in the Baseline or No Project B Alternatives.

Transfers from Kern County Water Agency (KCWA) are incorporated into the Proposed Project Alternative, totaling 114,000 acre-feet in 2003 and 130,000 acre-feet in 2020. No Project Alternative A includes 73,000 acre-feet of transfers originating from KCWA in 2003, increasing to 89,000 acre-feet in 2020. No transfers originating from KCWA are included in the Baseline or No Project B Alternatives.

Table 3 shows Table A transfers incorporated into each alternative.

In addition, Dudley Ridge Water District and KCWA have Table A relinquishments in the Proposed Project Alternatives, which are shown in Table 4. These relinquishments are not included in the Baseline and No Project Alternatives.

2.6.1.2. State Water Project Contractors' Water Requests and Demands

2.6.1.2.1. Scheduled Water

For the purposes of this analysis, each SWP contractor's Table A request is defined as the amount that the contractor submits to DWR at the beginning of the contract year. This analysis assumes that each contractor's request will be its full Table A Amount (prior to invocation of Article 18(b) in the case of No Project Alternative B) in each year and that this will be the amount that will be used to determine allocations for the contractor as part of the SWP allocation process.

Demand is defined in this analysis as the amount of water that the contractor would actually like to receive and will physically accept delivery of if the water is available. The demand for each contractor can be less than the request for any contractor in any given year. Demand is an essential CALSIM II input that strongly affects CALSIM II output. Each contractor's demand is related to the contractor's need for water, but the contractor's demand cannot exceed its Table A Amount. In the real world, a contractor's demand varies due to the availability of local water supplies, the contractor service area's demand for water, water costs of SWP water relative to other available water, water quality considerations, and other factors.

[4] http://wwwswpao.water.ca.gov/publications/bulletin/95/chapters_frameset95.html

Table 2 - Table A Amounts in Each Scenario (acre-feet)

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2020 Baseline	2003 No Project A	2020 No Project A	2003 No Project B	2020 No Project B	2003 Proposed Project	2020 Proposed Project
County of Butte	1,200	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,200	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	9,135	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	28,080	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	40,000	46,000	46,000	80,619	80,619	20,950	20,722	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	4,000	4,000	4,000	9,000	9,000	1,822	1,802	9,000	9,000
Dudley Ridge WD	57,700	57,700	57,700	61,673	61,673	26,273	25,933	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
Kern County Water Agency (M&I)	134,600	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
Kern County Water Agency (Agric.)	1,018,800	1,018,800	1,018,800	945,800	929,800	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	118,500	118,500	118,500	96,227	96,227	53,568	53,382	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	138,400	138,400	138,400	141,400	141,400	63,031	62,347	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	41,500	41,500	41,500	18,900	18,695	82,500	82,500
Coachella Valley WD	23,100	23,100	111,200	33,000	133,100	10,520	50,094	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	38,100	50,000	38,100	54,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,080	2,011,500	1,911,500
Palmdale WD	17,300	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	17,300	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,220,400	1,220,400	1,220,400	1,134,100	1,118,100	555,801	549,771	1,048,100	1,032,100
Total M&I	2,933,801	2,951,526	2,997,286	3,037,826	3,099,586	1,344,199	1,350,229	3,078,826	3,140,586
Total	4,154,201	4,171,926	4,217,686	4,171,926	4,217,686	1,900,000	1,900,000	4,126,926	4,172,686

Table 3 - Table A Transfers

Transferor	Transferee	Year	Baseline Amount (AF)	Proposed Project Amount (AF)	No Project Alternative A Amount (AF)	No Project Alternative B Amount (AF)	Applicable Levels of Development
Kern County WA	Mojave Water Agency	1998	0	25,000[1]	25,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2000	0	7,000[1]	7,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2000	0	15,000[1]	15,000	0	2003, 2020
Kern County WA	Castaic Lake WA	2000	0	41,000[1]	0	0	2003, 2020
Kern County WA	Palmdale WD	2000	0	4,000[1]	4,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2001	0	10,000[1]	10,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2001	0	2,219[1]	2,219	0	2003, 2020
Kern County WA	Napa Co. FC&WCD	2001	0	4,025[1]	4,025	0	2003, 2020
Kern County WA	Solano County WA	2001	0	5,756[1]	5,756	0	2003, 2020
Kern County WA	Coachella Valley WD	2006	0	12,000[1]	12,000	0	2020
Kern County WA	Desert WA	2006	0	4,000[1]	4,000	0	2020
Tulare Lake Basin WSD	Antelope Valley-East Kern WA	2002	0	3,000	3,000	0	2003, 2020
Tulare Lake Basin WSD	Dudley Ridge WD	2002	0	3,973	3,973	0	2003, 2020
Tulare Lake Basin WSD	Alameda Co. FC&WCD, Zone 7	2003	0	400	400	0	2003, 2020
Tulare Lake Basin WSD	County of Kings	2003	0	5,000	5,000	0	2003, 2020
Tulare Lake Basin WSD	Coachella Valley WD	2004	0	9,900	9,900	0	2003, 2020
MWDSC	Coachella Valley WD	2005	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	2005	11,900	11,900	11,900	11,900	2020

Notes:
(1) This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers

Table 4 - Table A Relinquishments in the Proposed Project Alternative

Contractor	Year	Amount (AF)	Applicable Levels of Development
Dudley Ridge WD	1996	4,333	2003, 2020
Kern County WA	1996	36,340	2003, 2020
Kern County WA	1997	4,333	2003, 2020

Although the SWP has many categories of deliveries, including Table A, Article 12(d), Article 14(b), Turnback Pool, Carryover, and Article 21 deliveries, CALSIM II categorizes all SWP deliveries as either Table A or Article 21 deliveries. In order to develop an estimate of SWP demand for each contractor at the 1994, 2003, and 2020 levels of development, SWP delivery data has been combined into categories that CALSIM II uses to represent SWP demand. Therefore, historical SWP water delivery categories (Table A, Article 12(d), Article 14(b), Turnback Pool, and Carryover) have been classified as CALSIM II Table A demand for simulation purposes. This categorization is shown in Table 5.

Table 5 - Categorization of State Water Project Demand in CALSIM II

	SWP Demand Categories	**CALSIM II Demand Categories**
Scheduled	Table A Article 12(d) Article 14(b) Turnback Pool Carryover	Table A
Unscheduled	Article 21	Article 21

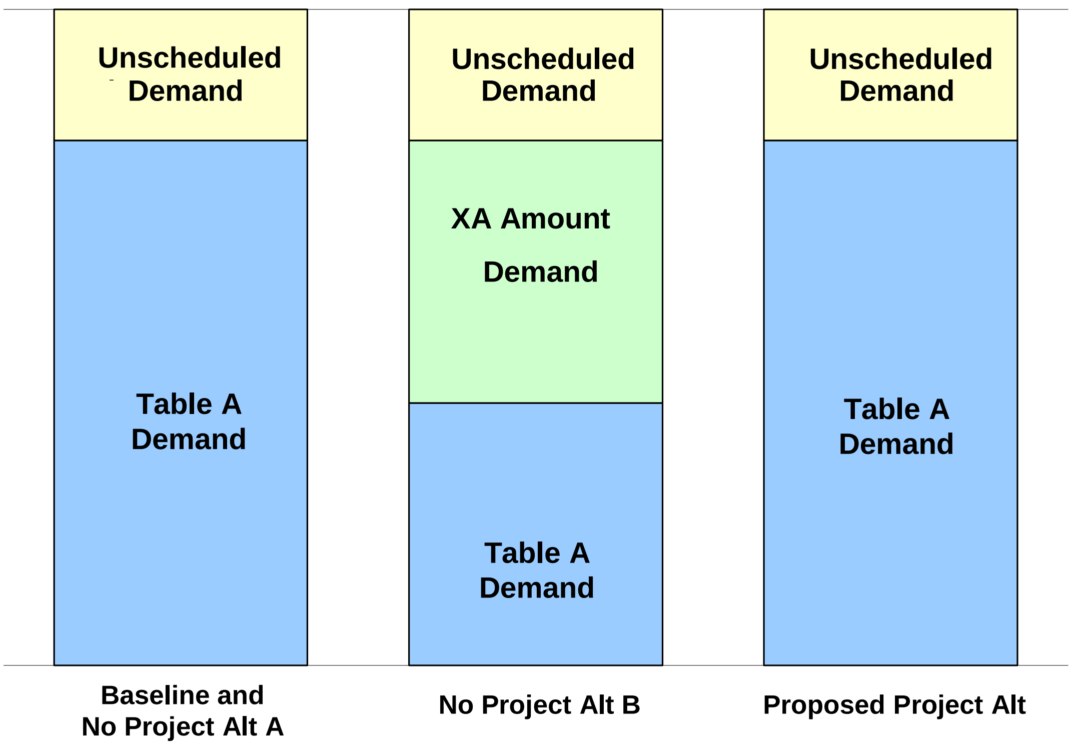
For each level of development, CALSIM II incorporates the historical 73-year period of hydrology, which includes a range of hydrologic year types. For the 2020 level of development, the Department assumed that all SWP M&I contractors would have a scheduled demand equal to their full Table A entitlement in each year of the simulation. In the 1994 and 2003 levels of development, each M&I contractor has historically had a water demand that varies under different local hydrologic and water supply conditions. However, to simplify the analysis the Department decided to use a variable annual demand for only MWDSC; after consultation with the Department, MWDSC staff developed an annual time series of scheduled MWDSC water demands for the Monterey Plus EIR for each level of development.

As recommended by the Monterey Plus EIR Modeling Subcommittee, the Department determined representative scheduled demands for the other M&I contractors for the 1994 and 2003 levels of development using historical Table A delivery and allocation data. For these contractors, historical deliveries from 1993 and 1996-97 were used to estimate demands at the 1994 level of development while deliveries during 2002 and 2003 were used to estimate 2003 level of development demands. These years were used because they were considered to be the most representative of average demand for the 1994 and 2003 levels of development. The demand estimate for each contractor in these two levels of development equaled the average historical deliveries to the contractor during the applicable years. The only exceptions are that the Department excluded 1997 deliveries for County of Kings and Tulare Lake Basin WSD because 1997 was a partial flood year which depressed those contractors' deliveries of SWP water and the Department only included 2003 deliveries to San Gorgonio Pass to approximate the 2003 level of development demand because San Gorgonio did not take any deliveries prior to 2003.

The Department assumed that agricultural contractors would demand their full Table A amount in each year except for years when the agricultural contractors' service areas had abundant precipitation and local water supplies. Consequently both the 1994 and 2003 level of development included full scheduled water demands for all agricultural contractors except when the Kern River Index indicated above normal and wet years. For the 2020 level of development, the Department reduced agricultural demand only when the Kern River Index indicated wet years at the 2020 level of development. These reductions in agricultural demands are of the same quantity and occur in the same water years as the reductions assumed in the U.S. Bureau of Reclamation's Operations Criteria and Plan (OCAP) CALSIM II studies.

Figure 1 depicts how total demand was split between Table A and XA Amount demand under each alternative. All Baseline, No Project Alternative A and Proposed Project scenarios classified all scheduled demand as Table A demand. All No Project Alternative B scenarios, classified all scheduled water demand up to the contractor's reduced Table A amount as Table A demand, with any additional scheduled demand classified as XA Amount demand. The sum of the Table A and XA Amount demand for the No Project Alternative B scenarios equaled the Table A demand for the Baseline scenarios. Total SWP scheduled demand remained the same in all three scenarios.

Figure 1 - Contractor Demand by Category in each Alternative



In the Baseline and No Project Alternatives, each contractor's actual scheduled demand was capped by its Table A amount (prior to invocation of Article 18(b) in the case of No Project Alternative B) plus or minus any Table A transfers the contractor had participated in. For some contractors, the scheduled water demand calculated from historical delivery data at the 1994 or 2003 levels of development was higher than the contractor's Table A amount for that scenario.

Table 6 shows the contractors for whom this was the case at each level of development. For the 1994 level of development, this occurred with Solano County Water Agency, who's Table A increased between 1994 and 1997 as a result of maturation of its original Table A contractual Table A amounts, and Coachella Valley Water District and Desert Water Agency, which had received Turnback Pool deliveries in 1996-97 that are included in the 1994 demand estimates but would not be possible in the Baseline and No Project Alternatives. For the 2003 level of development, this occurred in the Baseline and No Project Alternative B scenarios for Alameda County Flood Control and Water Conservation District, Zone 7 and in all of the Baseline and No Project Alternative scenarios for Castaic Lake Water Agency. Both of the contractors had received increased historical deliveries as a result of Table A amount transfers from KCWA.

Table 6 - Contractors With Capped Demands

Contractor	Level of Development	Scheduled Demand Calculated from Historical Deliveries (acre-feet)	Table A Amount in the Baseline or No Project Alternative (acre-feet)
Solano County WA	1994	31,600	28,080
Coachella Valley WD	1994	51,200	23,100
Desert WA	1994	64,600	38,100
Alameda County FC & WCD, Zone 7	2003	66,500	46,000
Castaic Lake WA	2003	68,600	41,500

In the No Project Alternative A scenarios, Table A transfers from agricultural contractors to M&I contractors were included. In the No Project alternative the Department allocates water for the transferred Table A amounts according to pre-Monterey Article 18(a) provisions that first assign deficiencies first to agricultural contractors. The post-processing classifies Table A amounts that was transferred from agricultural to M&I contractors as agricultural demand for water allocation purposes.

Table A and XA Amount demands are shown for each 1994 and 2003 alternative in Table 7[5]. Demands are shown for the 2020 alternatives in Table 8.

2.6.1.2.2. Unscheduled Water

Table 9 shows monthly unscheduled demands for each contractor at each level of development. The unscheduled demand for each contractor is the same in each scenario and at each level of development. These are the same unscheduled demands that Reclamation used for its OCAP studies, except that the EIR increases monthly MWDSC demand from 50 TAF/month to 100 TAF/month as requested by MWDSC.

[5] Plumas County FC&WCD is not represented in CALSIM II and is therefore not included in this or subsequent tables.

Table 7 - Table A and XA Demands in Each 1994 and 2003 LOD Alternative (acre-feet/year)

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 Proposed Project	2003 No Project A	2003 No Project B	
	Table A	Table A	Table A	Table A	Table A	XA Amount
Butte	200	500	500	500	500	0
Yuba City	900	1,200	1,200	1,200	1,200	0
Napa	4,800	6,800	6,800	6,800	6,800	0
Solano	28,080	37,700	37,700	37,700	18,672	19,028
Zone 7	26,700	46,000	66,500	66,500	20,950	25,050
Alameda	18,000	35,200	35,200	35,200	19,128	16,072
Santa Clara	82,500	84,700	84,700	84,700	45,543	39,157
Oak Flat	4,600-5,700	4,600-5,700	4,420-5,700	4,517-5,700	2,596	2,004-3,104
Kings	3,230-4,000	3,230-4,000	6,979-9,000	7,132-9,000	1,822	1,408-2,178
Dudley Ridge	46,570-57,000	46,570-57,000	46,464-57,343	48,872-61,673	26,273	20,293-30,727
Empire W.S.	2,420-3,000	2,420-3,000	2,326-3,000	2,377-3,000	1,366	1,054-1,834
KCWA (M&I)	134,600	134,600	134,600	134,600	61,300	73,300
KCWA (Agric.)	822,290-1,018,800	822,290-1,018,800	670,049-864,130	749,485-945,800	463,987	358,203-554,813
Tulare	95,640-118,500	95,640-118,500	74,615-96,227	76,254-96,227	53,568	42,072-64,932
SLO	0	4,400	4,400	4,400	4,400	0
Santa Barbara	0	26,300	26,300	26,300	20,715	5,585
AVEK	53,700	64,900	64,900	64,900	63,031	1,869
Castaic (Agric.)	10,250-12,700	10,250-12,700	9,848-12,700	10,064-12,700	5,784	4,466-6,916
Castaic (M&I)	15,100	41,500	68,600	41,500	18,900	22,600
Coachella	23,100	19,300	19,300	19,300	10,520	8,780
Crestline	500	1,900	1,900	1,900	1,900	0
Desert	38,100	31,200	31,200	31,200	17,352	13,848
Littlerock	600	0	0	0	0	0
Mojave	9,800	13,200	13,200	13,200	13,200	0
MWDSC	783,000-1,433,000	706,000-2,011,500	706,000-2,011,500	706,000-2,011,500	706,000-916,088	0-1,095,412
Palmdale	10,400	14,900	14,900	14,900	7,879	7,021
San Bernardino	6,700	69,800	69,800	69,800	46,727	23,073
San Gabriel	15,500	18,100	18,100	18,100	13,116	4,984
San Gorgonio	0	100	100	100	100	0
Ventura	600	5,000	5,000	5,000	5,000	0
Total Agriculture	985,000-1,220,400	985,000-1,220,400	812,700-1,048,100	898,700-1,134,100	555,369	429,631-665,031
Total M&I	1,271,180-1,903,180	1,363,300-2,668,800	1,410,900-2,716,400	1,383,800-2,689,300	1,104,027-1,314,115	259,273-1,354,685
Total	2,238,180-3,123,580	2,348,300-3,889,200	2,223,600-3,763,500	2,281,500-3,823,400	1,659,396-1,869,484	688,904-2,019,716

Table 8 - Table A and XA Demands in Each 2020 LOD Alternative (acre-feet/year)

SWP CONTRACTOR	2020 Baseline	2020 Proposed Project	2020 No Project A	2020 No Project B	
	Table A	Table A	Table A	Table A	XA Amount
Butte	27,500	27,500	27,500	12,388	15,112
Yuba City	9,600	9,600	9,600	4,325	5,275
Napa	24,900	28,925	28,925	11,217	13,683
Solano	42,000	47,756	47,756	18,920	23,080
Zone 7	46,000	80,619	80,619	20,722	25,278
Alameda	42,000	42,000	42,000	18,920	23,080
Santa Clara	100,000	100,000	100,000	45,048	54,952
Oak Flat	4,601-5,700	4,400-5,700	4,500-5,700	2,568	2,033-3,132
Kings	3,228-4,000	6,947-9,000	7,105-9,000	1,802	1,427-2,198
Dudley Ridge	46,570-57,700	44,264-57,343	48,689-61,673	25,933	20,577-31,707
Empire W.S.	2,421-3,000	2,316-3,000	2,316-3,000	1,351	1,070-1,649
KCWA (M&I)	134,600	134,600	134,600	60,635	73,695
KCWA (Agric.)	822,286-1,018,800	654,890-848,130	654,690-929,800	458,953	363,333-559,847
Tulare	95,643-118,500	74,280-96,227	74,280-96,227	53,382	42,260-65,118
SLO	25,000	25,000	25,000	11,262	13,738
Santa Barbara	45,486	45,486	45,486	20,491	24,995
AVEK	138,400	141,400	141,400	62,347	76,053
Castaic (Agric.)	10,250-12,700	9,803-12,700	9,803-12,700	5,721	4,529-6,979
Castaic (M&I)	41,500	82,500	41,500	18,695	22,805
Coachella	111,200	133,100	133,100	50,094	61,106
Crestline	5,800	5,800	5,800	2,613	3,187
Desert	50,000	54,000	54,000	22,524	27,746
Littlerock	2,300	2,300	2,300	1,036	1,246
Mojave	50,800	75,800	75,800	22,885	27,915
MWDSC	1,911,500	1,911,500	1,911,500	861,080	1,050,420
Palmdale	17,300	21,300	21,300	7,793	9,507
San Bernardino	102,600	102,600	102,600	46,220	56,380
San Gabriel	28,800	28,800	28,800	12,974	15,826
San Gorgonio	17,300	17,300	17,300	7,793	9,507
Ventura	20,000	20,000	20,000	9,010	10,990
Total Agriculture	985,000-1,220,400	796,700-1,032,100	882,700-1,118,100	549,771	435,229-670,629
Total M&I	2,994,586	3,137,886	3,096,886	1,349,013	1,645,573
Total	3,979,586-4,214,986	3,934,586-4,169,986	3,979,596-4,214,986	1,898,784	1,663,384-2,316,202

Table 9 - Monthly Unscheduled Demands (acre-feet/month)

Contractor	1994	2003	2020
Napa County FC&WCD	1,000	1,000	1,000
Solano County WA	1,000	1,000	1,000
Alameda Co. FC&WCD, Zone 7	1,000	1,000	1,000
Alameda County WD	1,000	1,000	1,000
Santa Clara Valley WD	4,000	4,000	4,000
Dudley Ridge WD	1,000	1,000	1,000
Empire West Side ID	1,000	1,000	1,000
Kern County WA	50,000	50,000	50,000
Tulare Lake Basin WSD	15,000	15,000	15,000
Antelope Valley-East Kern WA	1,000	1,000	1,000
Castaic Lake WA	1,000	1,000	1,000
Coachella Valley WD	2,000	2,000	2,000
Desert WA	5,000	5,000	5,000
MWDSC (Dec-Mar only)	100,000	100,000	100,000
Total	84-184,000	84-184,000	84-184,000

2.6.2. State Water Project Allocation Rules

As part of the analysis, annual CALSIM II deliveries to SWP contractors on the North Bay Aqueduct and south of Banks Pumping Plant were post-processed to estimate deliveries to each contractor. The County of Butte and City of Yuba were not included in the post-processing because their deliveries are more influenced by local water supply conditions and are not affected by Delta regulatory requirements and export restrictions. Therefore, the Butte and Yuba deliveries were not modified from the CALSIM II results.

The remainder of this section discusses how deliveries were determined for each North Bay Aqueduct and South of Delta contractor in each scenario. Table 10 shows the allocation rules that were used to allocate Table A, XA Amount, and unscheduled deliveries to these contractors.

2.6.2.1. Proposed Project Alternative

In the Proposed Project Alternative, Table A and unscheduled allocations are made in proportion to the requesting contractors' Table A amounts as limited by their demands for delivery.

2.6.2.2. Baseline and No Project Alternatives

For the Baseline and No Project Alternatives, Table A allocations are made to agricultural Table A (AG), which includes Table A that was transferred from agricultural to M&I contractors, and to M&I Table A (M&I) using the following procedure:

- If the total supply available is greater than the sum of AG's and M&I's demands, both AG and M&I receive their full demand and allocation for both is assumed to be 100% with no cuts.
- If the total supply available is less than the sum of AG's and M&I's demands, AG's allocation is reduced until the total AG and M&I delivery equals the available supply or until the maximum AG-specific cut (termed AG deficiency) for the year is reached, whichever comes first. In each year, the AG deficiency is determined as a percentage of AG's Table A amount. This percentage equals the minimum of 50% or (100% minus the sum of the

Table 10 - SWP Allocation Rules for Monterey Plus EIR Alternatives

Delivery Type	Baseline	Proposed Project	No Project Alternative A	No Project Alternative B-A (Apportioned XA allocation rules)	No Project Alternative B-S (Surplus XA allocation rules)
Table A	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural contractors up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other contractors' Table A amounts.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.
XA Amount	Not applicable.	Not applicable.	Not applicable.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other contractors' Table A amounts.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.
Unscheduled	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other requesting contractors' Table A amounts.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.

Note: All entries in this table are the same for all levels of development at which each alternative is analyzed.

previous 6 years' AG deficiencies). The reduction in AG's allocation determined in this step is the AG deficiency for the year for use in subsequent years' calculations.

- If the AG-specific cuts do not reduce the total AG and M&I delivery to the same amount as the available supply, additional cuts are made equally to AG and M&I in proportion to their Table A amounts until the total SWP Table A delivery equals the available Table A supply for the year.

In No Project Alternative B-A, XA Amount allocations are made in proportion to each contractor's Table A amounts. For XA Amount deliveries in No Project Alternative B-S and for unscheduled deliveries in all of the Baseline and No Project Alternatives, the Department developed the following scheduled surplus allocation procedure that separates agricultural (AG), groundwater recharge (GWR) and M&I components of the demands:

1. Divide contractors into two groups depending on whether a contractor is north of Dos Amigos Pumping Plant or south of Dos Amigos Pumping Plant;
2. For north of Dos Amigos Pumping Plant contractors, allocate each year's Scheduled Surplus water supply in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A water use divided by total SWP AG and GWR Table A amount, or
    b. Each contractor's AG and GWR Scheduled Surplus demand,
3. For contractors south of Dos Amigos Pumping Plant, aggregate contractors into separate geographic zones, and allocate the remaining Scheduled Surplus water to the geographic zones - 69% of water to the San Joaquin Valley area, 29% to Southern California area, and 2% to the Central Coast area.
4. For each geographic zone, allocate water to each contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the zone's total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
5. For each geographic zone, if there is remaining water and remaining AG and GWR Scheduled Surplus demand, perform a second water allocations of the zone's remaining Scheduled Surplus water to the zone's contractors in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to zone's total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
6. For each zone, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the zone's Scheduled Surplus water supply or the zone's Scheduled Surplus allocations satisfy the contractors' demands;
7. If a zone has met all demand and has water remaining, make the water available to other south-of-Dos-Amigos zones that have not satisfied all contractors' demands for Scheduled Surplus water. Allocate water to each south-of-Dos-Amigos contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the remaining contractors' total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,

8. For south-of-Dos-Amigos area, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the south-of-Dos-Amigos area's Scheduled Surplus water supply or the south-of-Dos-Amigos area's Scheduled Surplus allocations satisfy the contractors' demands;
9. If the south-of-Dos-Amigos area has met all demand and has remaining unallocated water, make the water available to the north-of-Dos-Amigos contractors that have not satisfied their demands for Scheduled Surplus water for AG use and GWR. Allocate water to each north-of-Dos-Amigos contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the remaining contractors' total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
10. For the north-of-Dos-Amigos area, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the north-of-Dos-Amigos area's Scheduled Surplus water supply or the north-of-Dos-Amigos area's Scheduled Surplus allocations satisfy the contractors' demands;
11. If the north-of-Dos-Amigos area has met all demand and has water remaining, make the water available to all contractors that have not satisfied their demands for Scheduled Surplus water for M&I use. Allocate water to each contractor in proportion to the minimum of either:
    a. Each contractor's M&I Table A water use relative to the remaining contractors' total M&I Table A water use, or
    b. Each contractor's M&I Scheduled Surplus demand,
12. Repeat Scheduled Surplus M&I allocations until the allocations have completely allocated the Scheduled Surplus water supply or the Scheduled Surplus allocations satisfy the contractors' M&I demands.

2.6.3. Kern Fan Element Storage Assumptions

Scenarios were developed for the 2003 and 2020 No Project Alternatives A, B-A, and B-S that incorporate a hypothetical SWP groundwater banking facility in the Kern Fan Element (KFE). The Department developed basic assumptions regarding the facilities and operations of the groundwater banking program using the *Kern Water Bank First Stage Kern Fan Element Feasibility Report* (DWR 1990). This analysis assumes that SWP operations north of Banks Pumping Plant and the operation of San Luis Reservoir would be the same with and without the presence of the KFE.

Table 11 shows the basic operating parameters that were used to model the KFE. The KFE has an initial storage of 83 TAF, which equals the KFE water supply indicated in the 1995 KFE Exchange Agreement between KCWA and DWR. Maximum groundwater storage capacity is 350 TAF at the 2003 level of development and 500 TAF at the 2020 level of development. The maximum recharge is 10.5 TAF per month in 2003 and 15 TAF per month in 2020, with a maximum extraction of 6.2 TAF per month in 2003 and 8.9 TAF per month in 2020. A one-time loss rate of 10% is applied to all recharge amounts to represent all the losses that occur in the KFE's operations.

The analysis assumes that the SWP would extract previously stored water from the KFE to augment Table A deliveries in years when the total Table A allocation is less than 60% without use of the KFE in No Project A. In No Project B, the SWP will extract if allocations are less than 100% without use of the KFE. If the amount of SWP water stored in the KFE at the beginning of the month is greater than 200 TAF, an amount equal to the extraction limit is extracted. However, if the SWP water in storage is less than 200 TAF, a hedging rule has been included that reduces the extraction amount for the month in order to slow down the depletion of remaining storage.

Table 11 - KFE Operating Parameters

Parameter	No Project A		No Project B	
	2003	2020	2003	2020
Storage Capacity (TAF)	350	500	350	500
Initial Storage (TAF)	83	83	83	83
Recharge Limit (TAF/month)	10.5	15	10.5	15
Recharge Loss (%)	10%	10%	10%	10%
Extraction Limit (TAF/month)	6.2	8.9	6.2	8.9
Extraction Threshold (% Table A Allocation)	60%	60%	100%	100%

Recharge into the KFE only occurs in years in which no water is extracted. The analysis assumes that the SWP would recharge the KFE with SWP water that would otherwise be delivered as unscheduled water up to the monthly recharge limit in any month that unscheduled water is available, unless the amount of SWP water already in storage equals the KFE storage capacity.

Once operations of the KFE were determined, the monthly time series of Table A and unscheduled water deliveries in No Project Alternatives A, B-A, and B-S were modified to reflect the operations of the KFE. Table A deliveries were increased by the extraction amount while unscheduled deliveries were reduced by the recharge amount. The revised time series of deliveries were then analyzed in the post-processing spreadsheets for each alternative.

2.6.4. Other CALSIM II Assumptions

Table 12 shows other assumptions that were used for the CALSIM II studies. Assumptions included in this table refer to hydrology, demands, facilities, regulations, and operating criteria at each level of development. The CALSIM II studies used in this analysis for 2003 and 2020 are based on the OCAP_2001D10A_TodayEWA_012104 and OCAP_2020D09D_FutureEWA_012104 studies[6] . The 1994 CALSIM II study was modified from the 2003 study as shown in Table 2 in order to reflect 1994 conditions.

With the exception of SWP Table A amounts and demands, the assumptions for the Baseline, Proposed Project and No Project Alternative model studies were the same at each level of development.

[6] http://www.usbr.gov/mp/cvo/ocap.html

Table 12 – Other CALSIM II Assumptions

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Hydrol-ogy	Period of Simulation		73 years (1922-1994)
	Initial Conditions (reservoir storage)		1922
	Land Use Level of Development		Assume that 1994 is equal to 2001 level (2001 Level from DWR Bulletin 160-98) and that 2003 level is equal to 2001. 2020 Level from DWR Bulletin 160-98
Demands	North of Delta (except American R.)	CVP	1994 and 2003 based on 2001 land use, limited by full CVP contract. 2020 based on 2020 land use.
		SWP—Feather River Service Area	1994 and 2003 based on 2001 land use, 2020 based on 2020 land use. All years limited by full Settlement Contract
		SWP—FVB Cities (Fairfield, Vacaville, and Benicia)	No demand in 1994; contract-specified in 2003 and 2020.
		Non-Project	Based on land use
		CVP Refuges	Firm Level 2
	American River Basin	Water rights	2001 for 1994 and 2003, 2020 for 2020
		CVP	2001 for 1994 and 2003, 2020 for 2020
	San Joaquin River Basin	Friant Unit	Regression of historical
		Lower Basin	Fixed annual demands
		Stanislaus River Basin	1997 New Melones Interim Operations Plan
	South of Delta	CVP	Full Contract
		Contra Costa Water District	124 TAF/YR in 1994 & 2003, 158 TAF/YR in 2020
		SWP (w/ North Bay Aqueduct)	Varies
		SWP Article 21 Demand	Varies
Facilities	CVP		Existing CVP
	SWP	Existing & new facilities	Existing SWP facilities with Coastal Branch Phase II in operation and without the East Branch Enlargement for 1994 & 2003; 2020 adds East Branch Enlargement
		South Bay Aqueduct	Existing Capacity (300 cfs)
		SWP Kern Fan Element	Kern Fan Element facilities not included
		Banks Pumping Plant	1994 Capacity for 1994 & 2003; 2020 adds 8,500 cfs limits

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Regula-tions	Trinity River	Minimum Flow below Lewiston Dam	1994 limit is 340 TAF/Yr, 2003 limit is Interim (369-453 TAF/Yr), and 2020 limit is 369-815 TAF/Yr (Trinity EIS Preferred Alternative)
		Trinity Reservoir End-of-September Minimum Storage	No 1994 limit; 600 TAF as able in 2003 & 2020 (Trinity EIS Preferred Alternative)
	Clear Creek	Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to USFWS and NPS, and USFWS discretionary use of CVPIA 3406(b)(2)
	Upper Sacra-mento River	Shasta Lake End-of-September Minimum Storage	SWRCB WR 1993 Winter-run Biological Opinion (1900 TAF)
		Minimum Flow below Keswick Dam	Flows for SWRCB WR 90-5 and 1993 Winter-run Biological Opinion temperature control, and USFWS discretionary use of CVPIA 3406(b)(2)
	Feather River	Minimum Flow below Thermalito Diversion Dam	1983 DWR, DFG Agreement (600 CFS)
		Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (1000 – 1700 cfs)
	American River	Minimum Flow below Nimbus Dam	SWRCB D-893 and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Flow at H Street Bridge	SWRCB D-893
	Lower Sacra-mento River	Minimum Flow near Rio Vista	SWRCB D-1641
	Mokelumne River	Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100 – 325 cfs)
		Minimum Flow below Woodbridge Diver. Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25 – 300 cfs)
	Stanislaus River	Minimum Flow below Goodwin Dam	1987 USBR, DFG agreement, and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Dissolved Oxygen	SWRCB D-1422
	Merced River	Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 CFS, Nov – Mar), and Cowell Agreement
		Minimum Flow at Shaffer Bridge	FERC 2179 (25 – 100 CFS)
	Tuolumne River	Minimum Flow at La Grange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94 – 301 TAF/YR)
	San Joaquin River	Maximum Salinity near Vernalis	SWRCB D-1641
		Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement
	Sacramento River-San Joaquin River Delta	Delta Outflow Index (Flow and Salinity)	SWRCB D-1641
		Delta Cross Channel Gate Operation	SWRCB D-1641
		Delta Exports	SWRCB D-1641, USFWS discretionary use of CVPIA 3406(b)(2) for 1994, 2003, & 2020; 2003 & 2020 add CALFED Fisheries Agencies discretionary use of EWA

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Operations Criteria	Upper Sacramento River	Flow Objective for Navigation (Wilkins Slough)	Discretionary 3,250 – 5,000 CFS based on Shasta storage condition
	American River	Folsom Dam Flood Control	Variable 400/670 flood control diagram (without outlet modifications)
		Flow below Nimbus Dam	Discretionary operations criteria corresponding to SWRCB D-893 required minimum flow
		Sacramento Water Forum Mitigation Water	No limits in 1994 & 2003; 2020 uses Sacramento Water Forum standard (up to 47 TAF/YR in dry years)
	Stanislaus R.	Flow below Goodwin Dam	1997 New Melones Interim Operations Plan
	San Joaquin River	Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program
	CVP Water Allocation	CVP Settlement and Exchange	100% (75% in Shasta Critical years)
		CVP Refuges	100% (75% in Shasta Critical years)
		CVP Agriculture	100% - 0% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
		CVP Municipal & Industrial	100% - 50% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
	SWP Water Allocation	Feather River Service Area	Specified by Settlement Contract
		Fairfield, Vacaville, and Benicia	No allocation in 1994, specified by Settlement Contract in 2003 & 2020
		South of Delta	Based on SWP supply; varies with EIR alternative
	Delta Pumping	Banks Pumping Plant	1994 & 2003 use 6,680 cfs, can increase up to 8,500 cfs Dec. 15-Mar 15 (min. 300cfs); 2020 uses 8,500 cfs year round (500 cfs reserved for EWA Jul, Aug, Sep)
		Tracy Pumping Plant	1994 & 2003 use 4,200 cfs + deliveries upstream of DMC constriction; 2020 adds CVP-SWP Intertie
	CVP/SWP Coordinated Operations	Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement (FRWP EBMUD and 2/3 of North Bay Aqueduct diversions are considered as Delta Export, 1/3 of the North Bay Aqueduct diversion is considered as In-Basin-Use)
		Sharing of Surplus Flows	1986 Coordinated Operations Agreement
		Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641; use of CVPIA 3406(b)(2) only restricts CVP exports; EWA use restricts CVP and/or SWP as directed by CALFED Fisheries Agencies
		Dedicated CVP Conveyance at Banks	No 1994 or 2003 conveyance; SWP to convey 100,000 af/year of Level 2 refuge water through Banks P.P. (Jul & Aug) in 2020 studies
		North of Delta Accounting Adjustments	No adjustments in 1994 or 2003; in 2020, CVP to provide SWP a maximum of 75,000 AF to meet in-basin requirements through adjustments in COA accounting
		Sharing of Export Capacity for Lesser Priority and Wheeling Related Pumping	Cross Valley Canal wheeling (max of 128 TAF/Yr), CALFED ROD defined Joint-Point-of-Diversion

CALSIM II INPUT		ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
CVPIA 3406(b)2)	Allocation	Per May 2003 Dept of Interior Decision: 800 taf/yr, 700 taf/yr in 40-30-30 dry years, and 600 taf/year in 40-30-30 critical years
	Actions	1995 WQCP, Fish flow objectives (Oct-Jan), VAMP (Apr 15- May 15) CVP export restriction, 3000 CFS CVP export limit in May and June (D1485 Striped Bass cont.), Post (May 16-31) VAMP CVP export restriction, Ramping of CVP export (Jun), Upstream Releases (Feb-Sep)
	Accounting Adjustments	Per May 2003 Interior Decision, no limit on responsibility for non-discretionary D1641 requirements with 500 TAF target, no Reset with the Storage metric and no Offset with the Release and Export metrics
CALFED Environ-mental Water Account	Actions	1994 has none; 2003 and 2020 have export cuts of 50 taf Dec-Feb, VAMP (Apr 15- May 15) export restriction, post (May 16-31) VAMP export restriction, and ramping of export (Jun)
	Assets	1994 has none; 2003 and 2020 have fixed water purchases of 250 TAF/yr, 230 TAF/yr in 40-30-30 dry years, 210 TAF/yr in 40-30-30 critical years. The purchases range from 0 TAF in Wet Years to approximately 153 TAF in Critical Years NOD, and 57 TAF in Critical Years to 250 TAF in Wet Years SOD. Variable assets include the following: used of 50% JPOD export capacity, acquisition of 50% of any CVPIA 3406(b)(2) releases pumped by SWP, flexing of Delta Export/Inflow Ratio (post-processed from CALSIM II results), dedicated 500 CFS pumping capacity at Banks in July to September
	Debt Restrictions	1994 has none; for 2003 and 2020 delivery debt is paid back in full upon assessment; storage debt paid is back over time based on asset/action priorities; SOD and NOD debt carryover is allowed; SOD debt carryover is explicitly managed or spilled; NOD debt carryover must be spilled; and SOD and NOD asset carryover is allowed.

2.6.5. CALSIM II Simulation of SWP Deliveries and Other Hydrology Outputs

The EIR uses post-processing spreadsheet analyses of CALSIM II studies to evaluate the impacts of the scenarios described above; the post-processing spreadsheets apply each scenario's assumed allocation rules and transfers for the scenario. The following CALSIM II simulation studies were performed:

- 1994 Baseline
- 2003 Baseline
- 2003 Proposed Project Alternative
- 2003 No Project Alternative A
- 2020 Baseline
- 2020 Proposed Project Alternative

SWP deliveries from these studies were post-processed by taking total SWP annual South of Delta Table A and Article 21 deliveries from the model study and re-allocating them to individual contractors according to each scenario's assumptions regarding allocation rules and transfers. In addition, deliveries for the 2003 No Project Alternative B scenarios were post-processed using the 2003 Baseline CALSIM II study and deliveries for the 2020 No Project Alternative A and B scenarios were post-processed using the 2020 Baseline CALSIM II study. These alternatives were able to be post-processed from the Baselines because they have the same total annual SWP scheduled and unscheduled demands. A separate model run was performed for 2003 No Project A because the annual SWP scheduled demand differed from the Baseline. During the post-processing, total annual SWP deliveries were unchanged but the monthly pattern of deliveries was modified within each year depending on the proportion of agricultural and M&I deliveries. The San Luis Reservoir storage pattern was also modified to account for this difference. With this approach, CALSIM II results for the Sacramento Valley, San Joaquin Valley, and the Delta were unchanged.

3.0. Results of CALSIM II Simulation Studies

3.1. SWP Deliveries

3.1.1. Total Deliveries

Figures 2 through 4c show total annual scheduled SWP deliveries in each year for each 1994, 2003, and 2020 scenario. In addition, Figures 5 through 7 show frequency plots of total annual scheduled SWP deliveries.

Figures 8 through 13 show the same information for unscheduled deliveries.

At each level of development, all of the scenarios have similar scheduled and unscheduled deliveries in each year. However, the 2020 scenarios tend to have the higher peak scheduled delivery amounts and more years in which higher amounts of deliveries are made than the 2003 scenarios, which in turn tend to have higher scheduled delivery amounts than the 1994 scenario. This reflects the difference in demand levels at the different levels of development and the inclusion of the 8,500 cfs Banks pumping assumption in 2020.

Conversely, the 1994 scenario has the highest unscheduled deliveries, with the 2003 scenarios also having higher unscheduled deliveries than the 2020 scenarios. This occurs because the higher levels of scheduled deliveries at the later level of development results in fewer excess flows being available to be used to make unscheduled deliveries.

Figure 2 - Total Annual Scheduled SWP Deliveries at the 1994 Level of Development

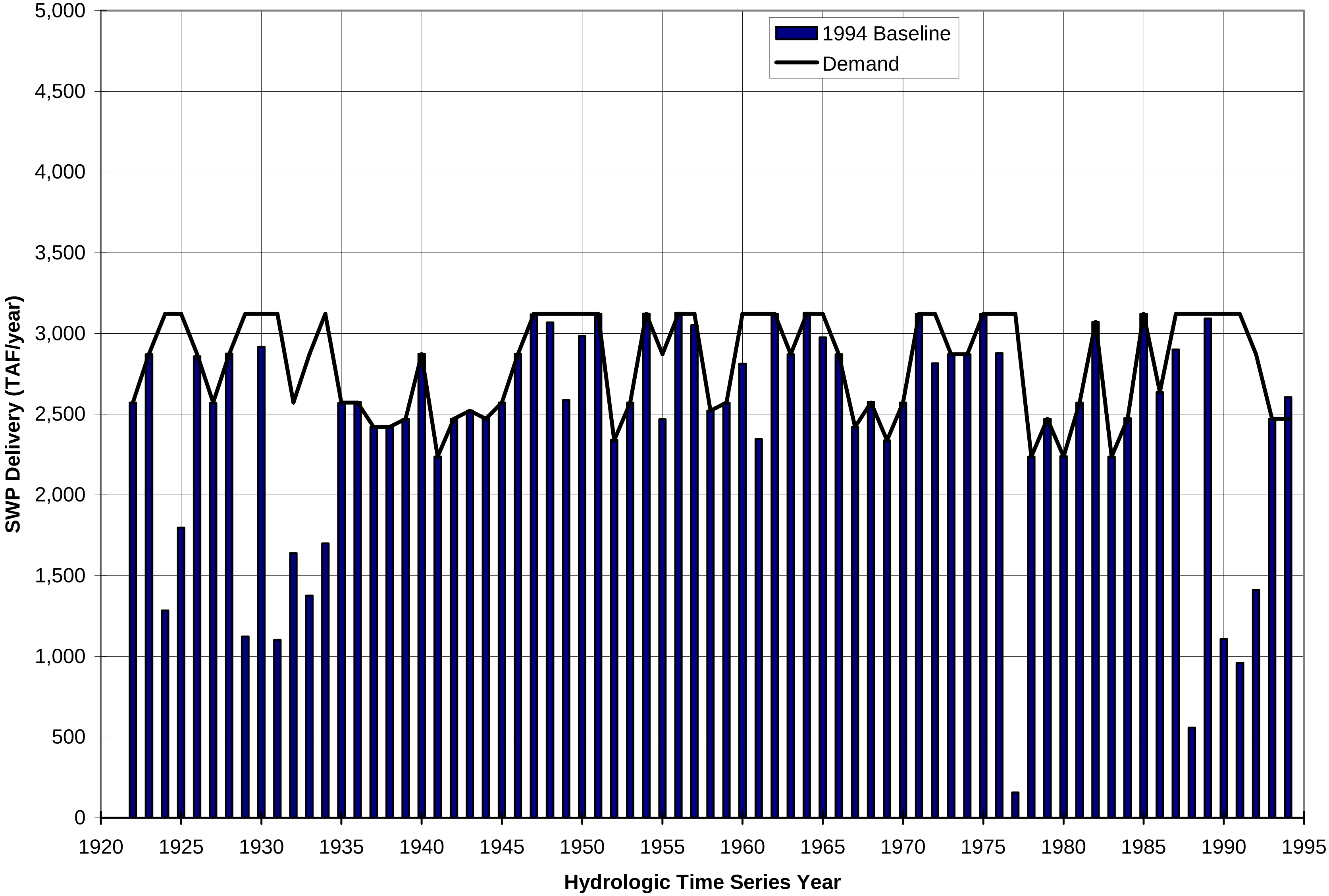


Figure 3a - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development

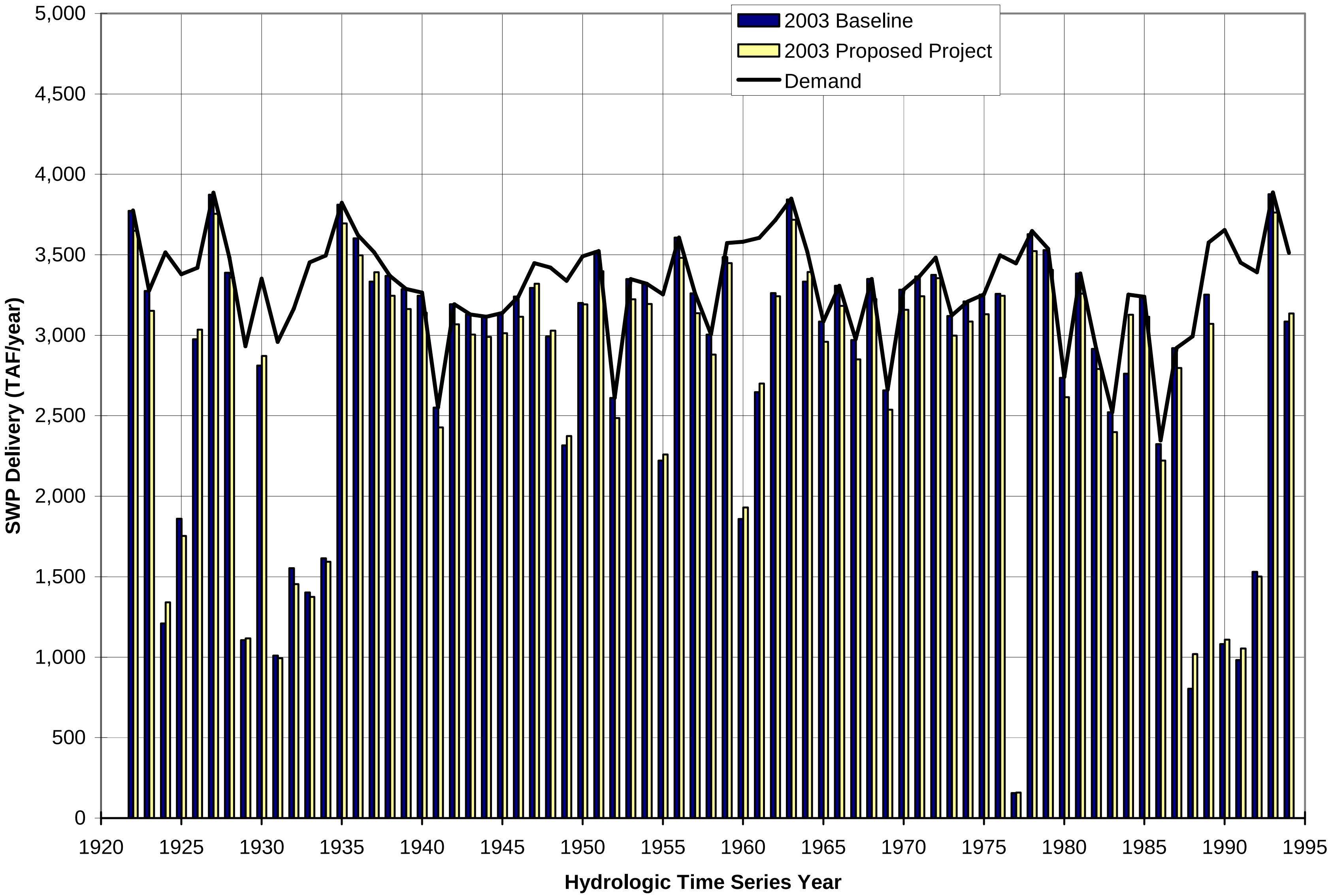


Figure 3b - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development (cont'd)

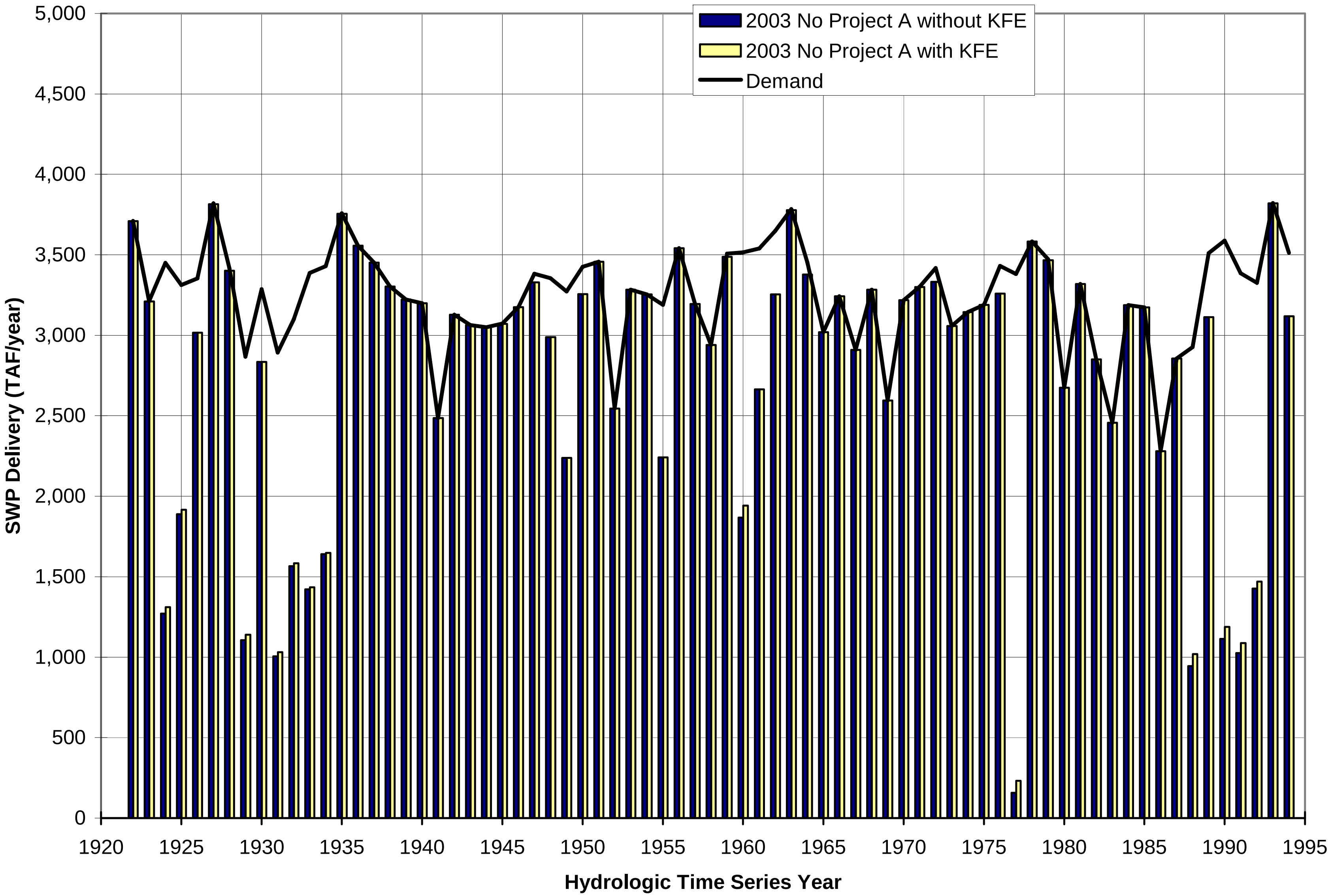


Figure 3c - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development (cont'd)

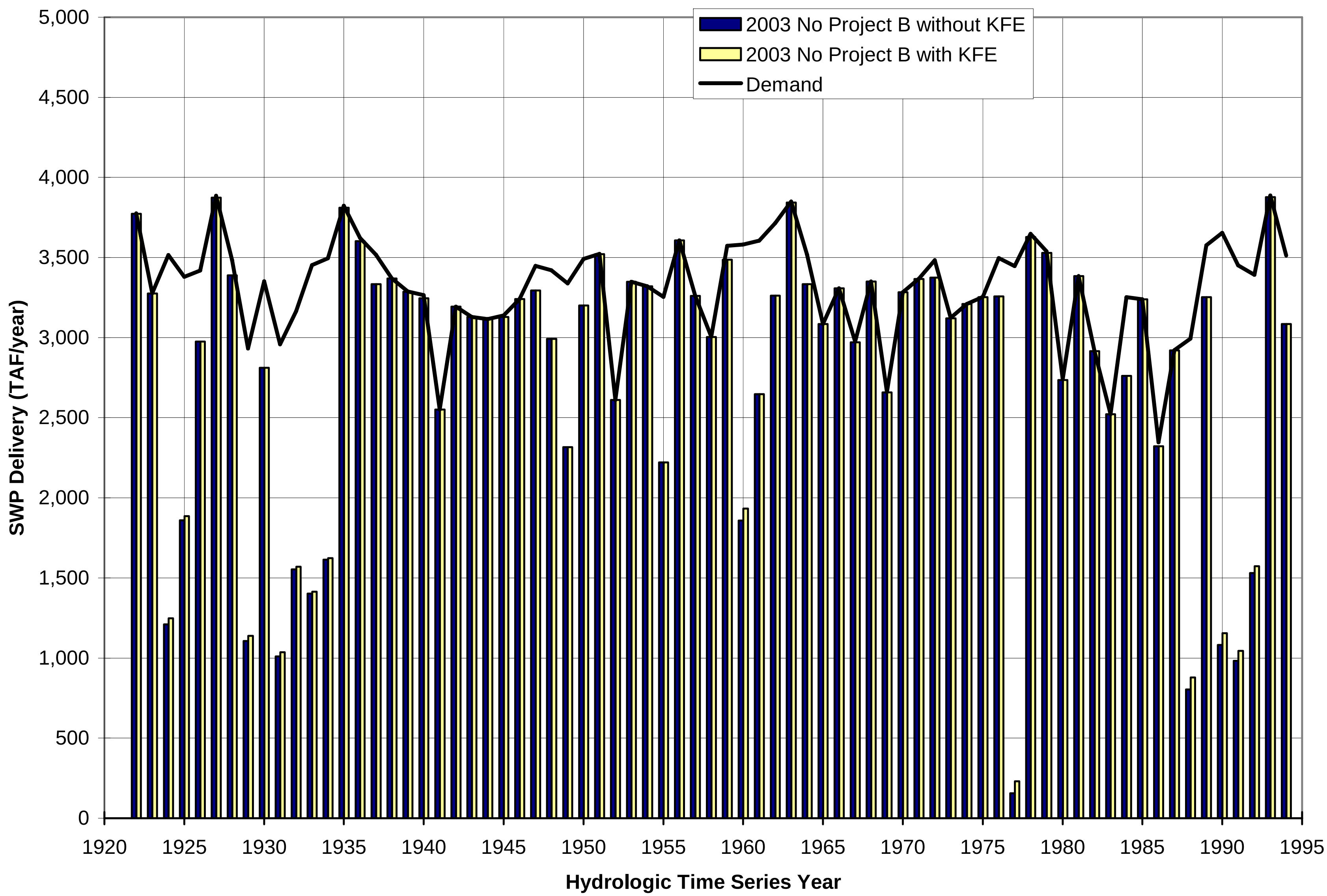


Figure 4a - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development

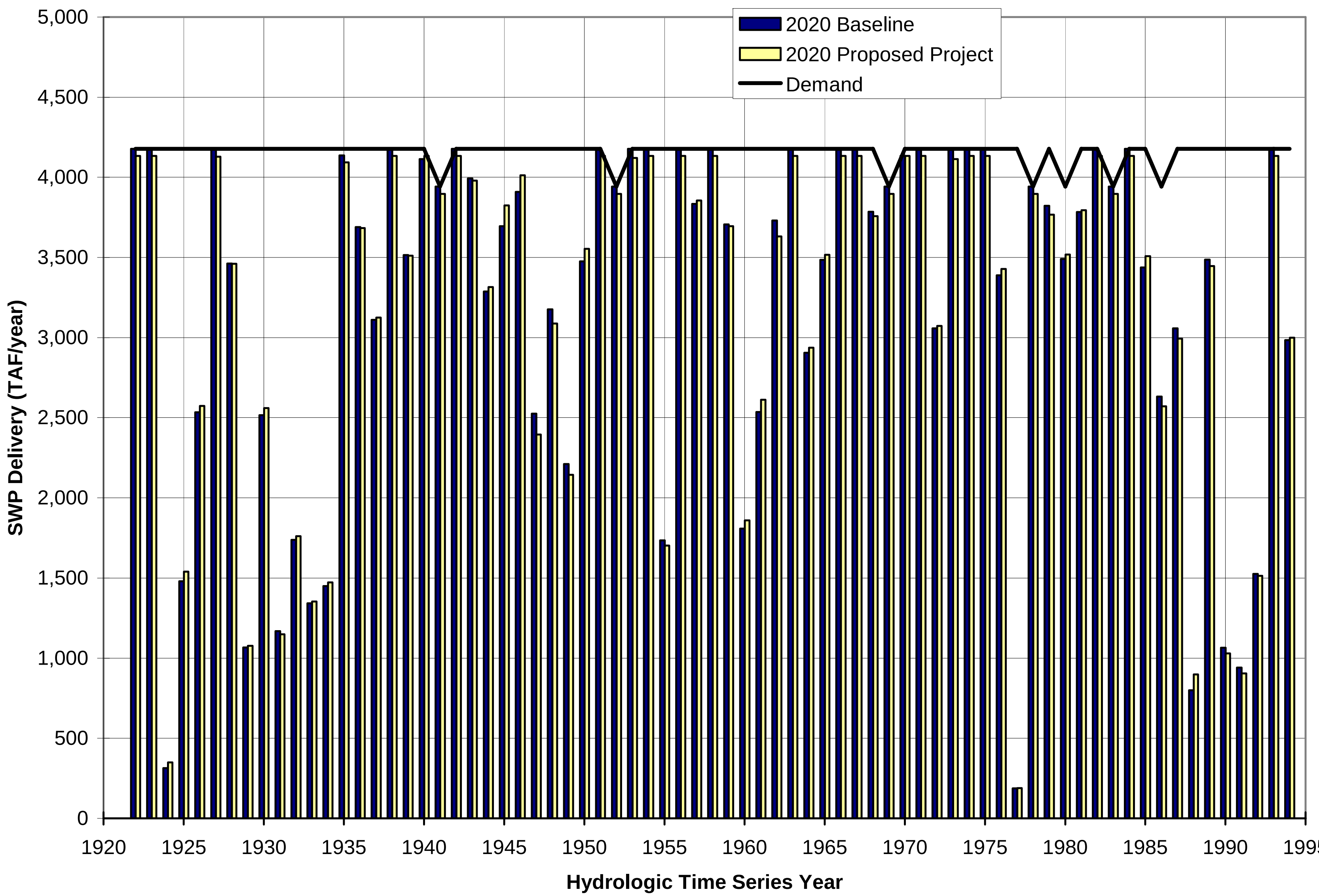


Figure 4b - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development (cont'd)

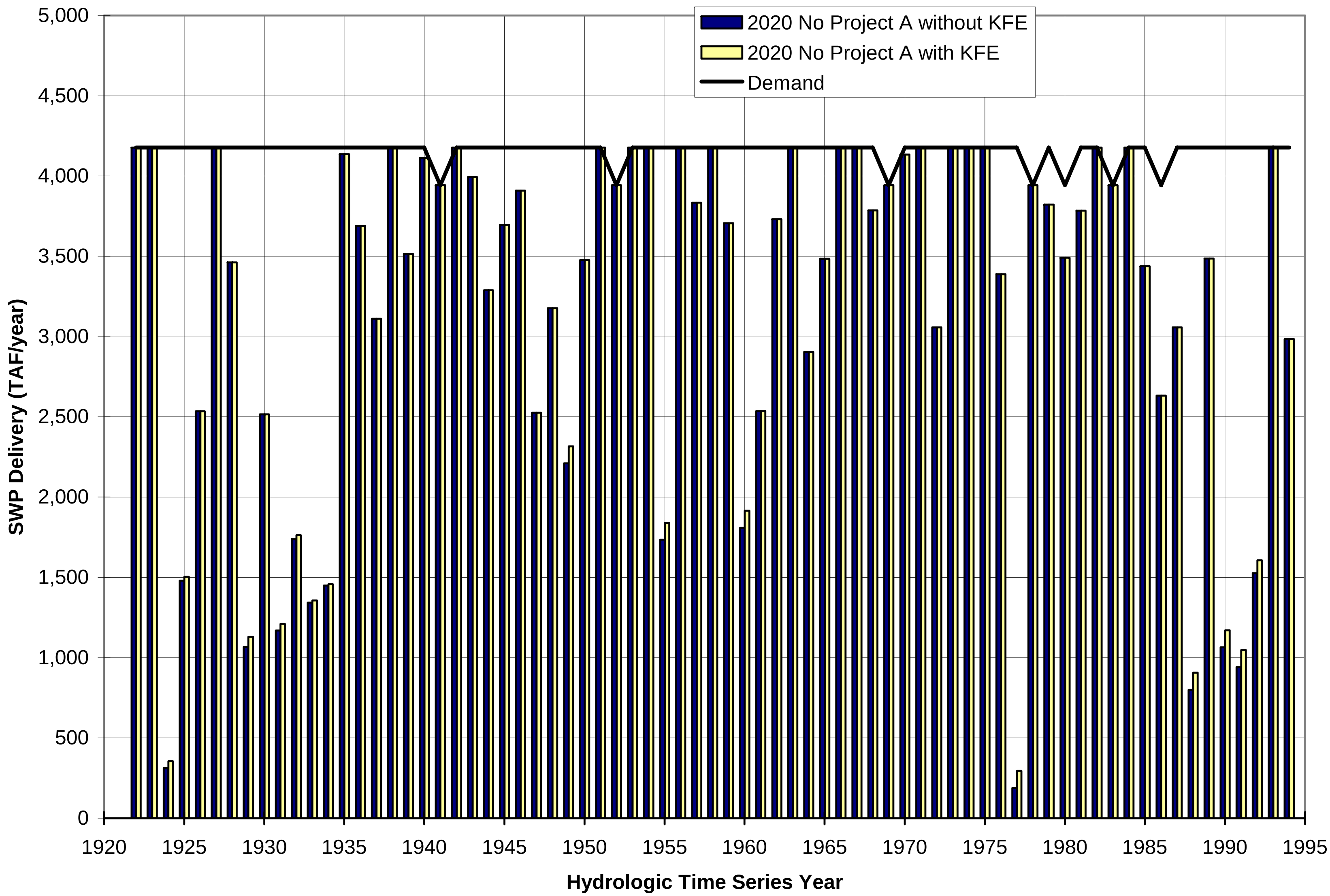


Figure 4c - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development (cont'd)

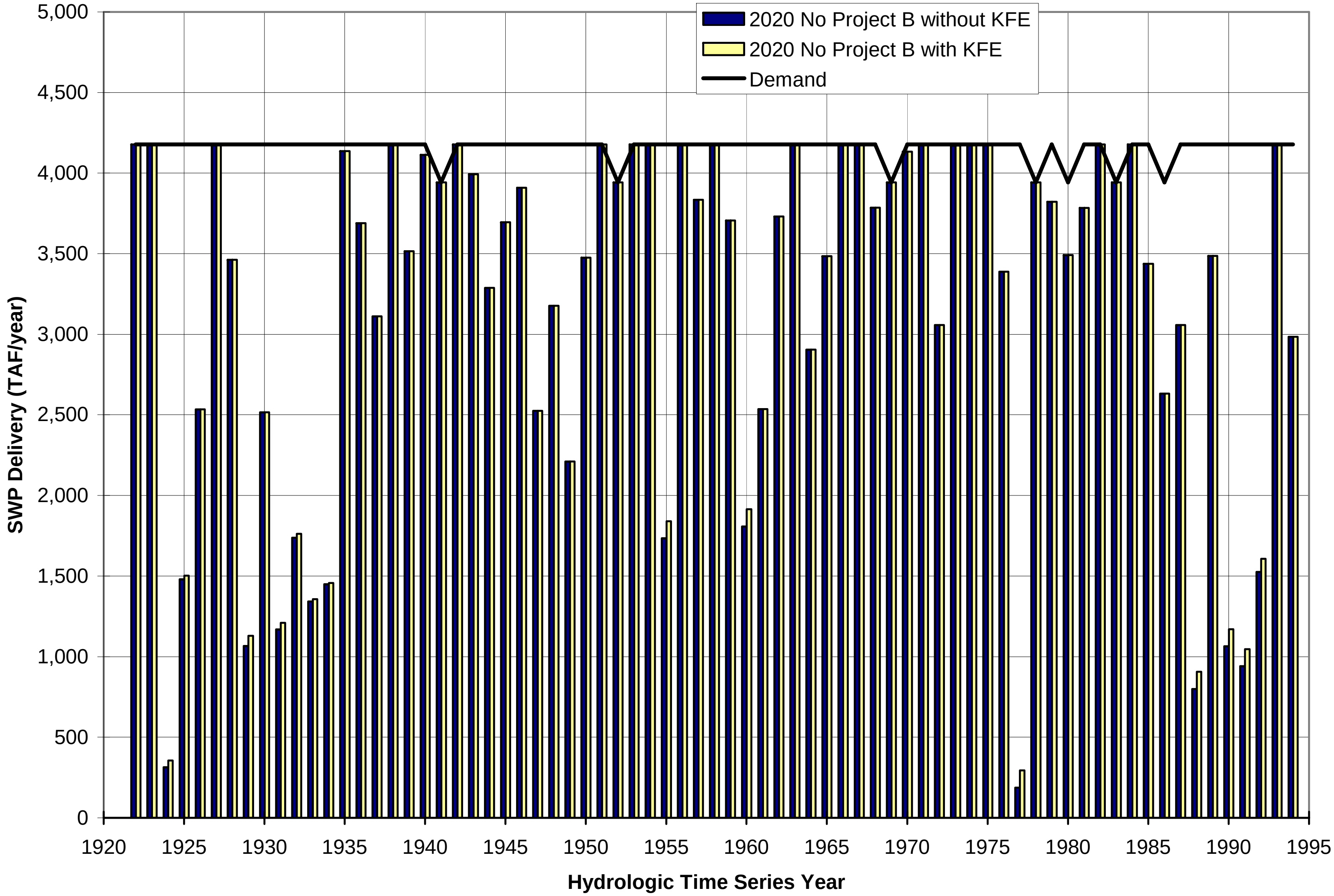


Figure 5 - Frequency of Annual Scheduled SWP Deliveries at the 1994 Level of Development

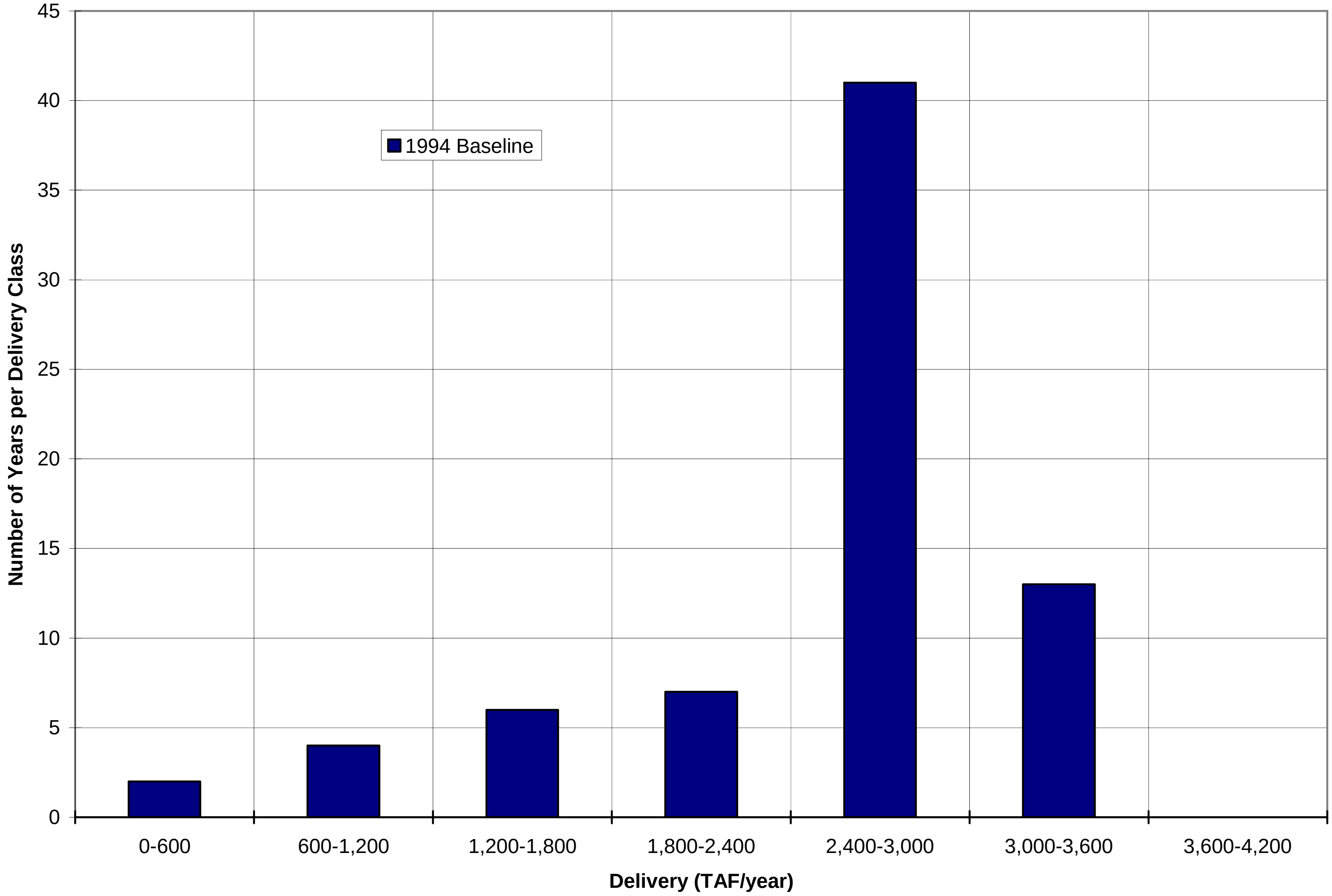


Figure 6 - Frequency of Annual Scheduled SWP Deliveries at the 2003 Level of Development

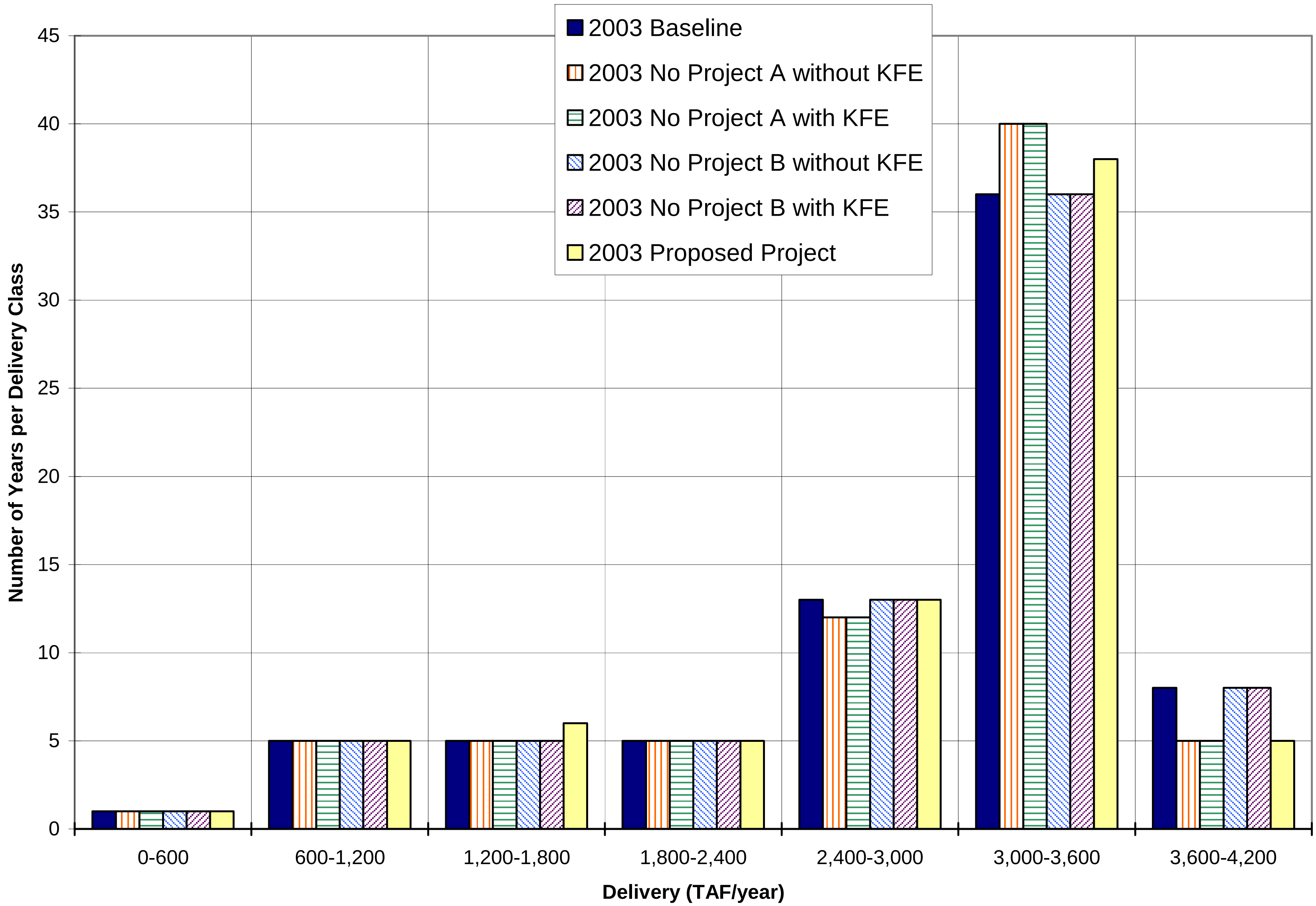


Figure 7 - Frequency of Annual Scheduled SWP Deliveries at the 2020 Level of Development

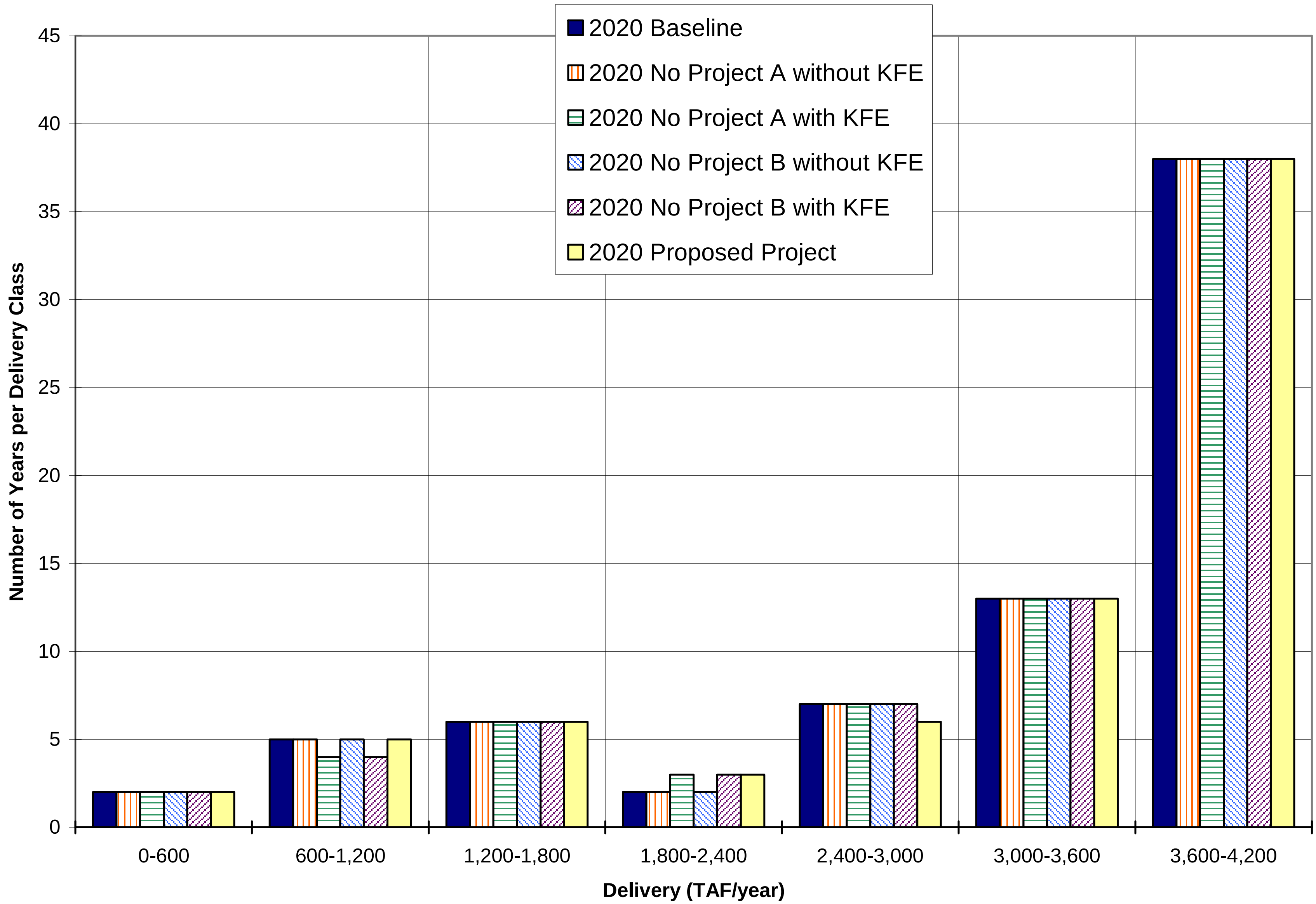


Figure 8 - Total Annual Unscheduled SWP Deliveries at the 1994 Level of Development

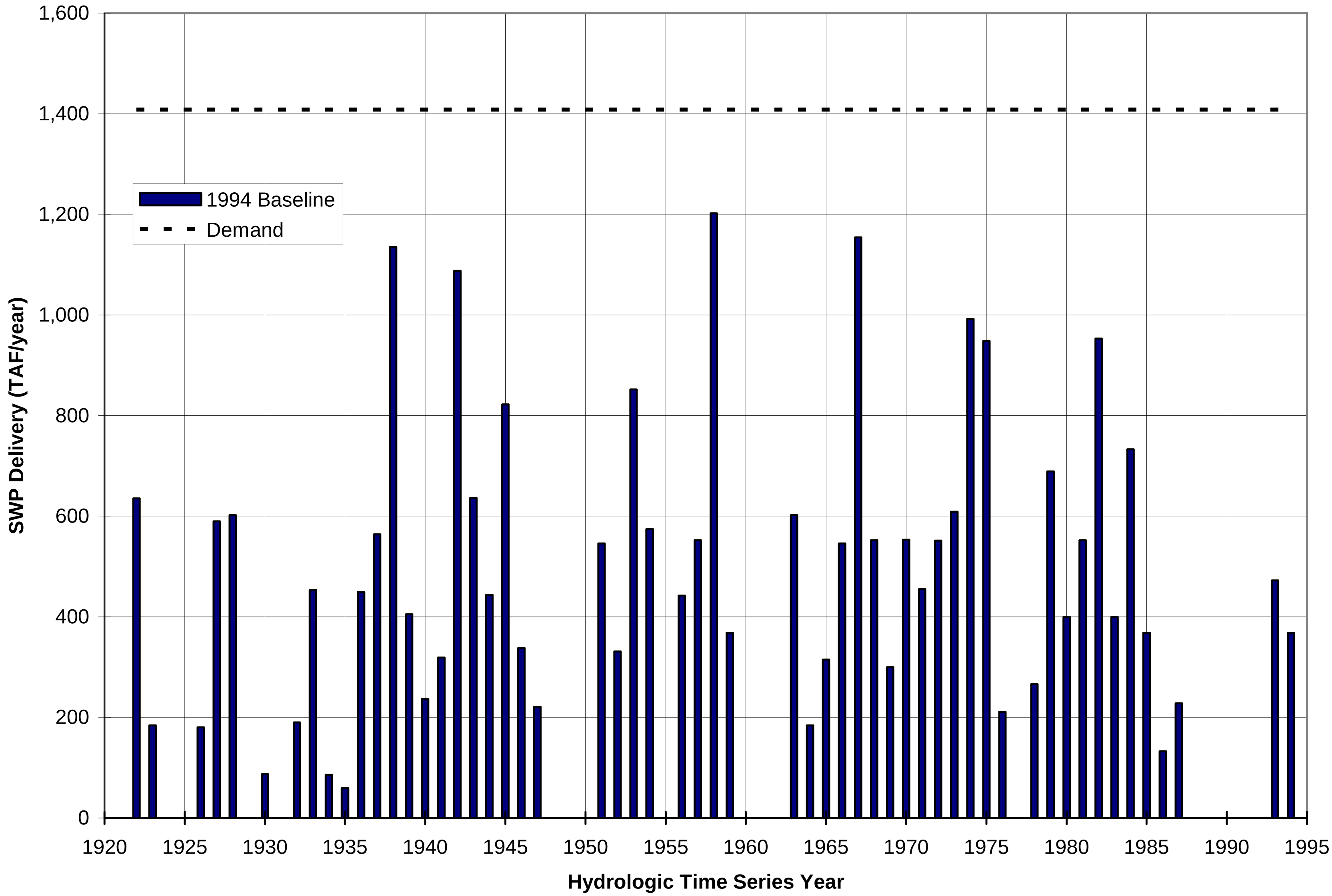


Figure 9a - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development

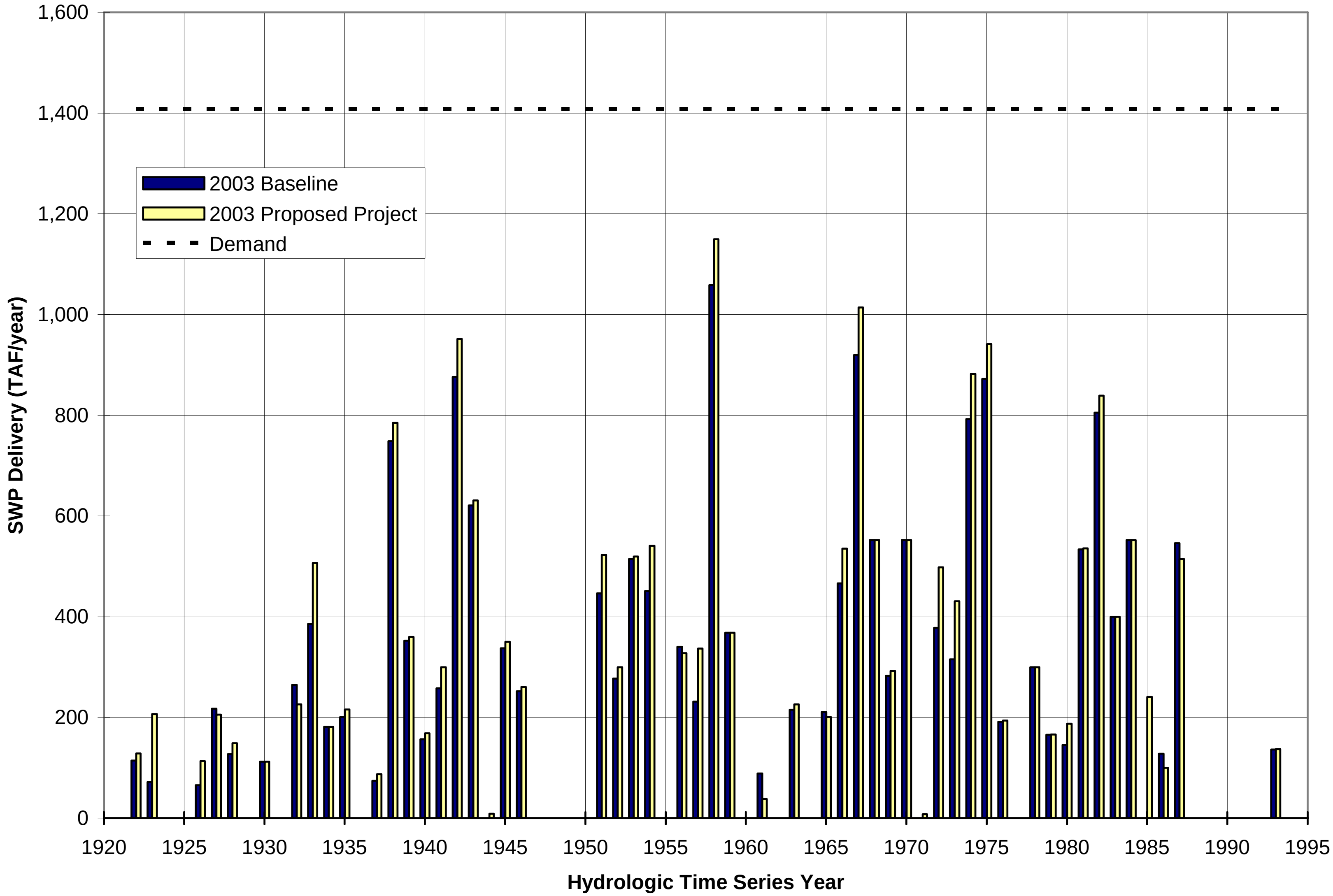


Figure 9b - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development (cont'd)

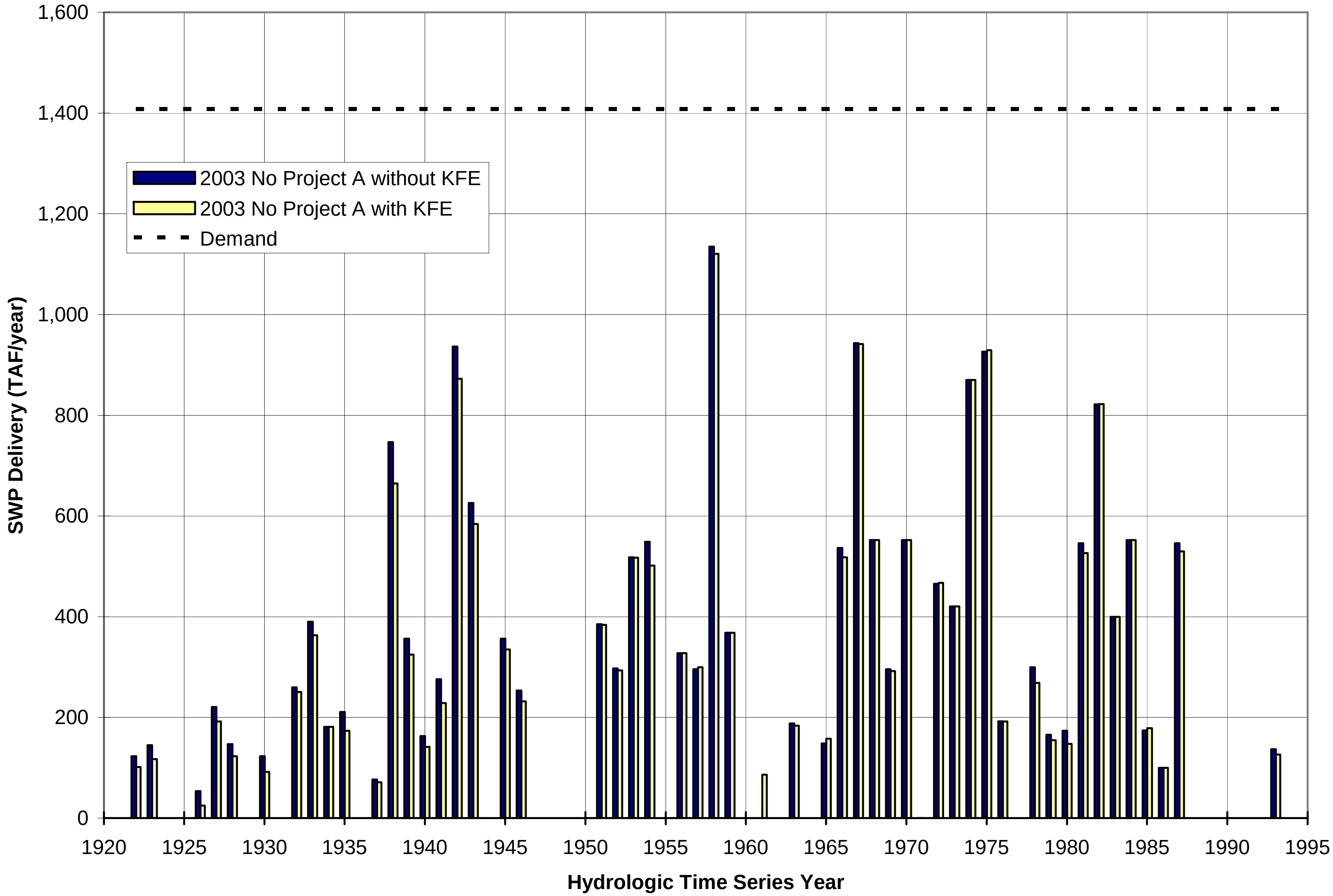


Figure 9c - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development (cont'd)

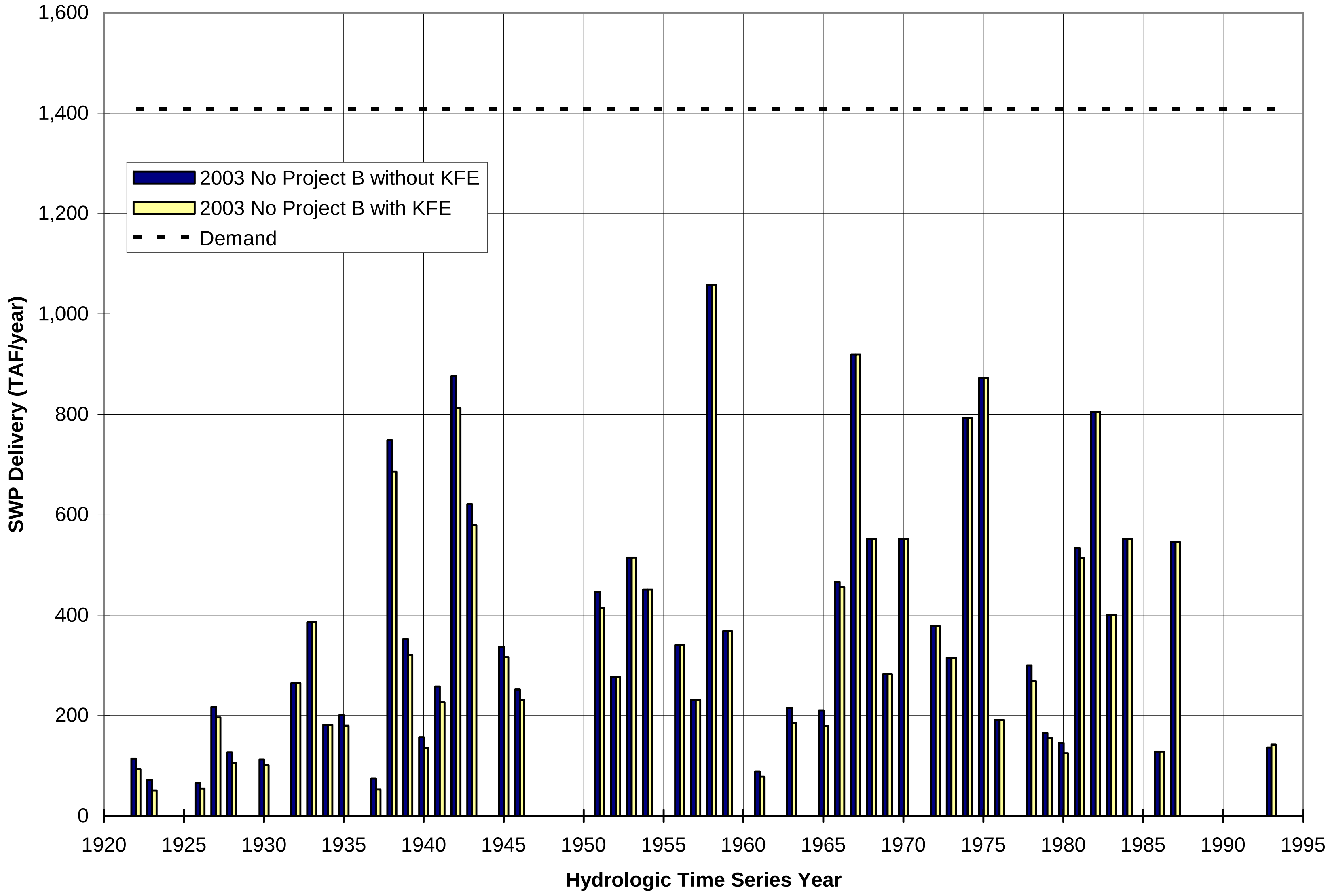


Figure 10a - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development

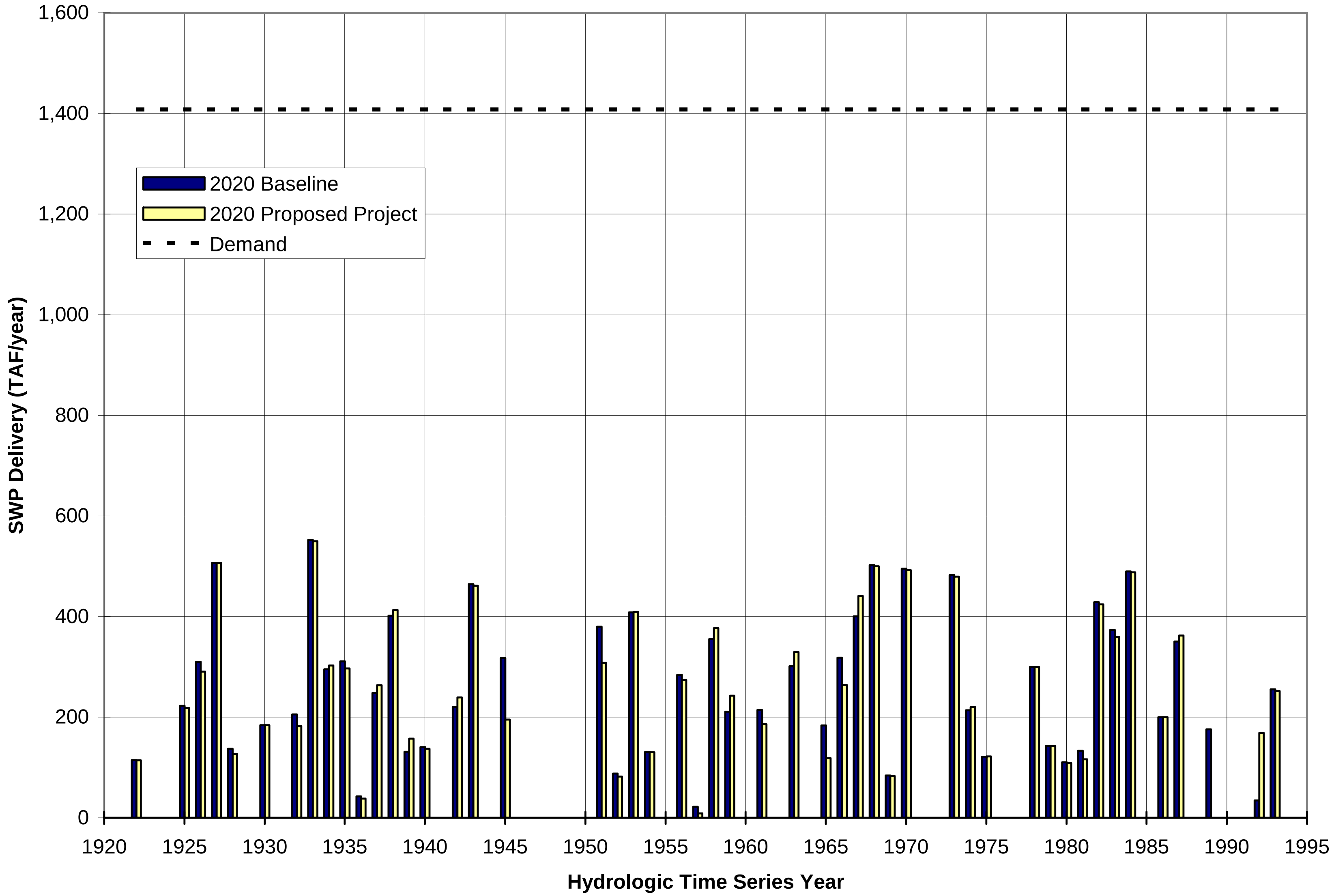


Figure 10b - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development (cont'd)

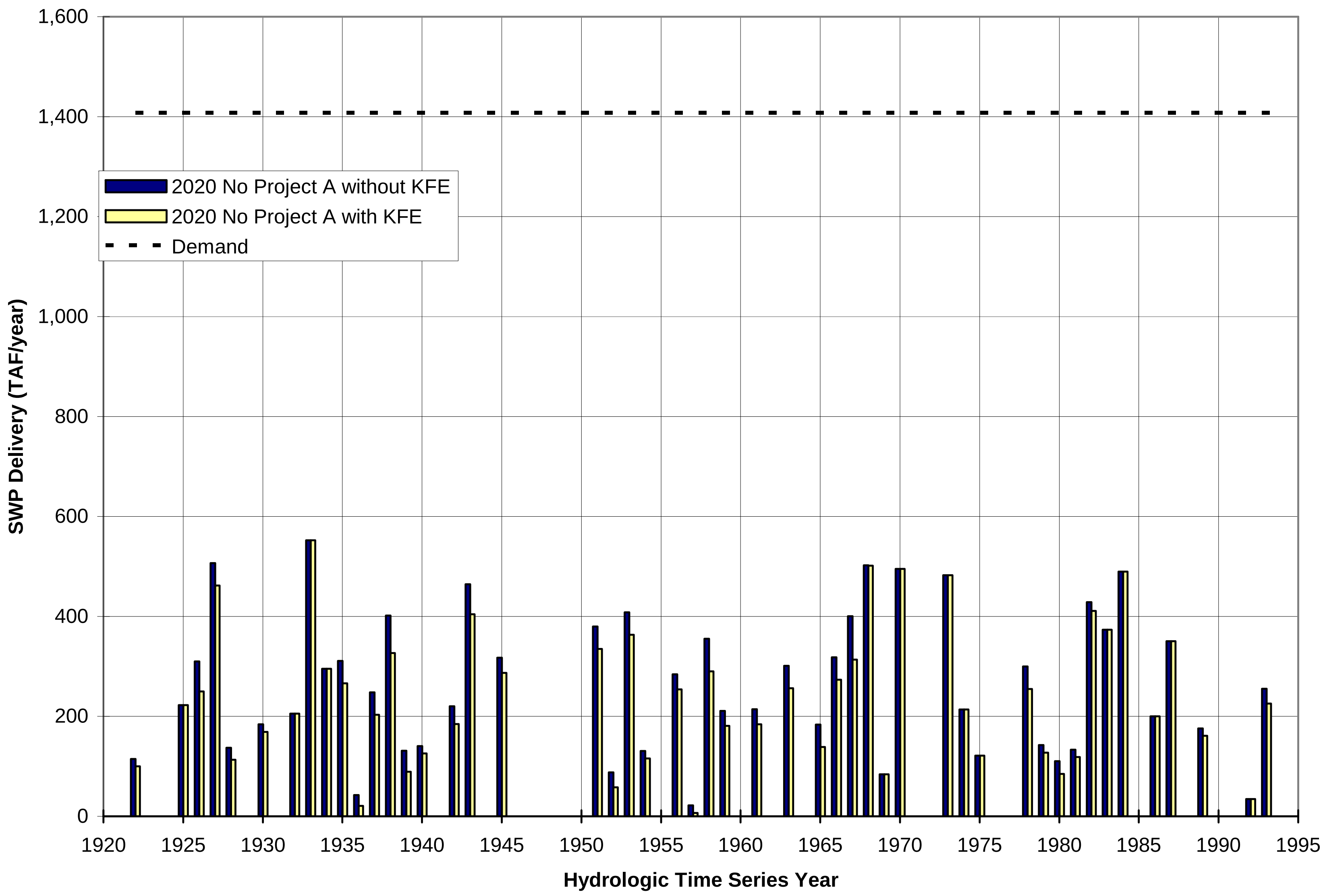


Figure 10c - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development (cont'd)

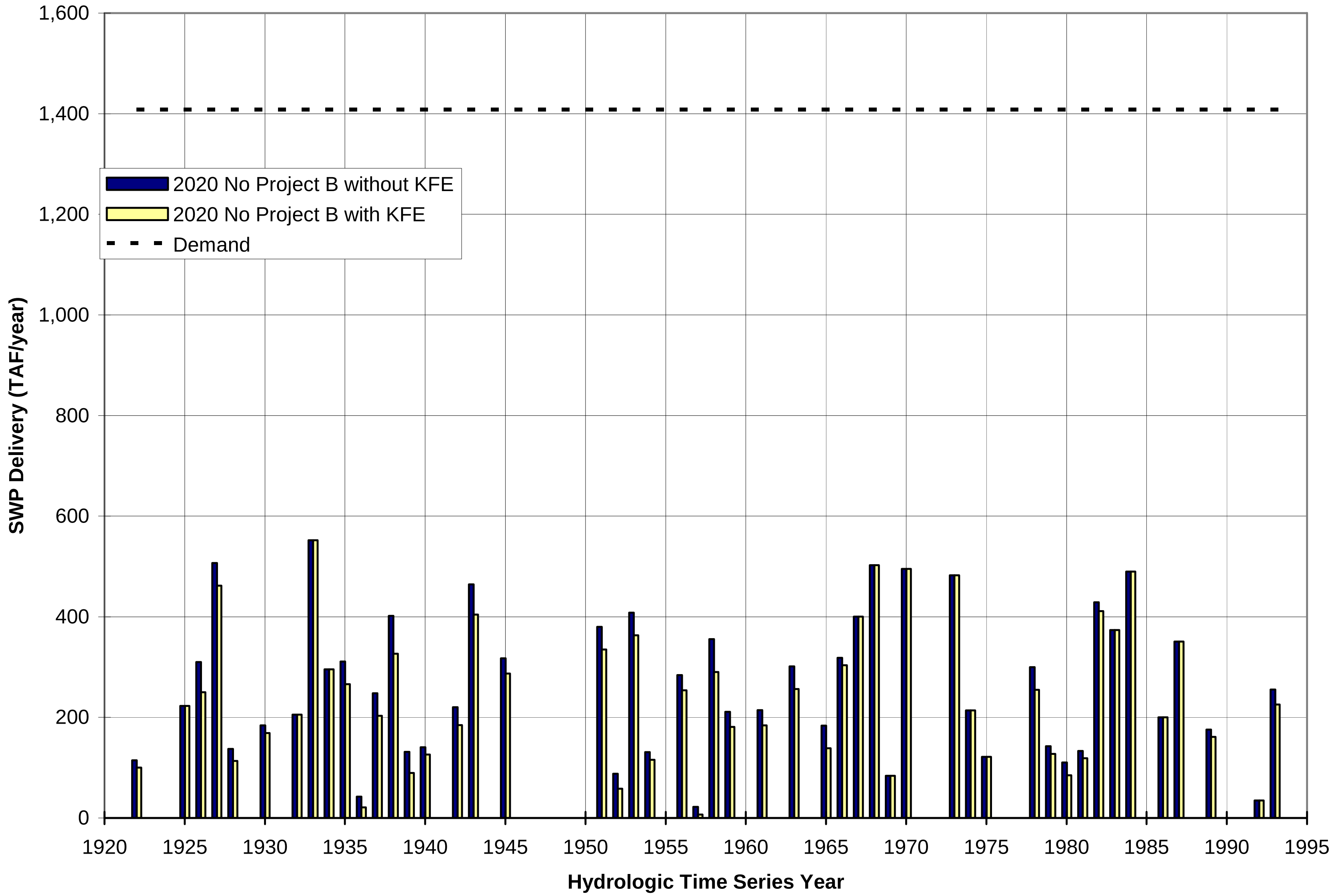


Figure 11 - Frequency of Annual Unscheduled SWP Deliveries at the 1994 Level of Development

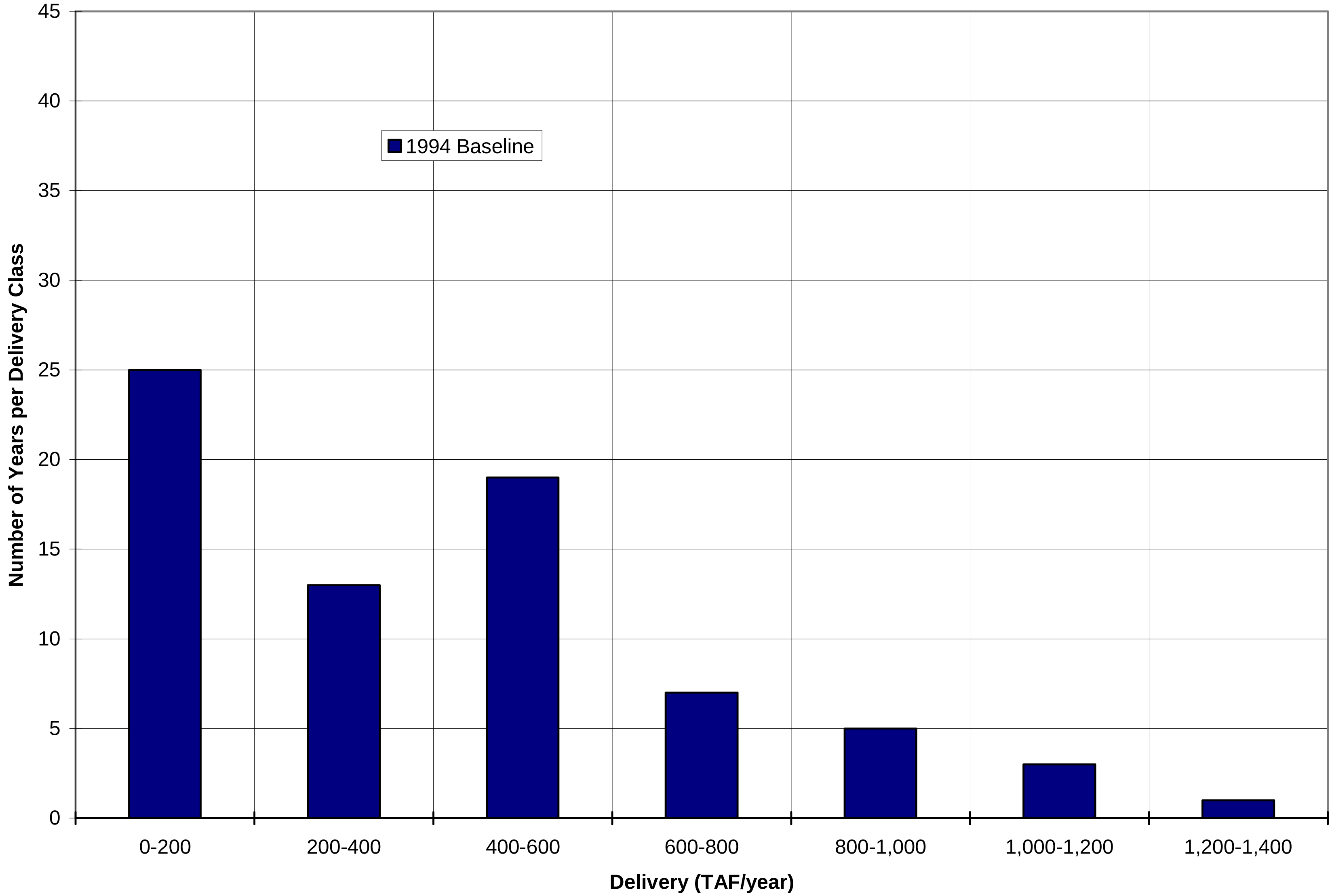


Figure 12 - Frequency of Annual Unscheduled SWP Deliveries at the 2003 Level of Development

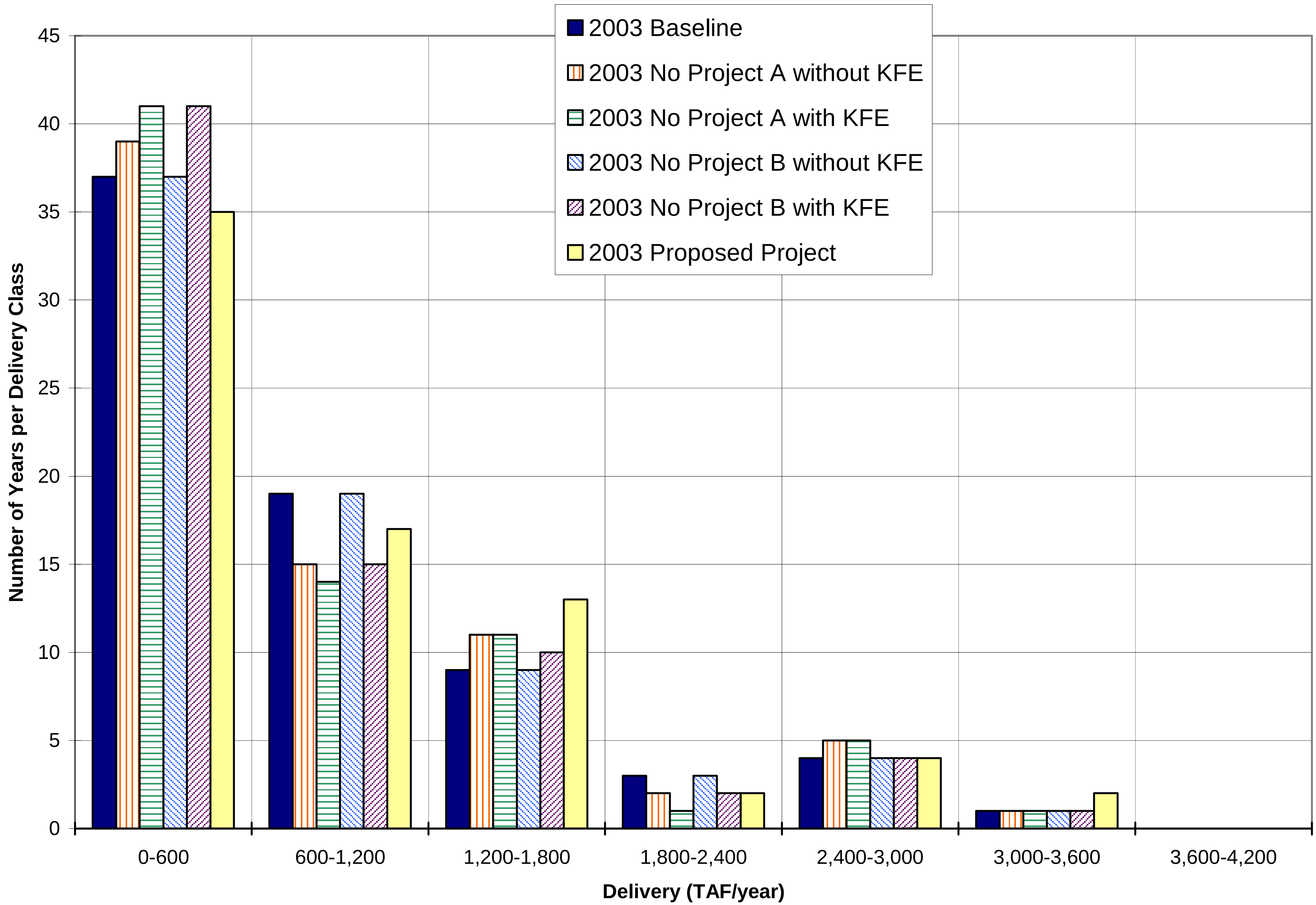
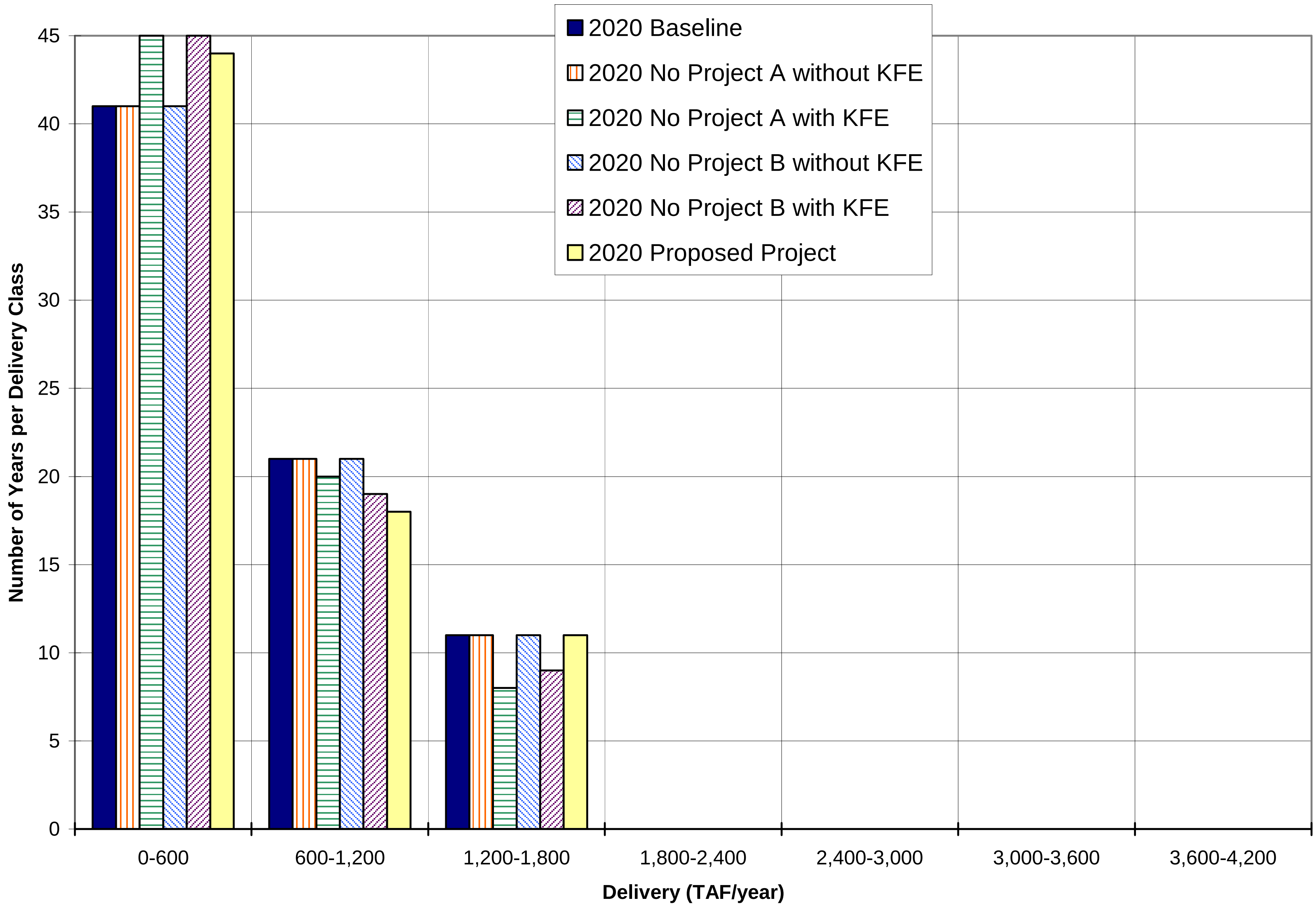


Figure 13 - Frequency of Annual Unscheduled SWP Deliveries at the 2020 Level of Development



3.1.2. SWP Deliveries to Individual Contractors

Tables 13a through 13f show average annual scheduled SWP deliveries at the 1994 and 2003 levels of development to each agricultural and M&I contractor for all years and in years categorized as wet, above normal, below normal, dry, and critical according to the Sacramento River Index. Figures 14a through 14f depict the amounts that are delivered to agricultural and M&I contractors at the 1994 and 2003 levels of development graphically. Tables 14a through 14f and Figures 15a through 15f depict the same information for the 2020 level of development. In order to fully apply the agricultural deficiency requirements in the Baseline and No Project alternatives, the data presented in these tables and figures (and in all subsequent tables and figures in this section) reflects modeled data from 1928 –1994 (i.e. the first six years are excluded from the average).

Total average annual scheduled SWP deliveries are about 2.5 million acre-feet per year in 1994, about 2.8 million acre-feet per year in each of the 2003 scenarios, and about 3.2 million acre-feet in each of the 2020 scenarios. The largest differences in total deliveries between different levels of development occur in wet and above normal years, while in dry and critical years total deliveries are similar in all scenarios. In both 2003 and 2020, agricultural contractors receive the most deliveries in No Project Alternative B-S, while M&I contractors receive the most deliveries in No Project Alternative A. These differences are much greater in 2020 than in 2003. For example, agricultural contractors receive about 60 TAF/year less deliveries in No Project Alternative A than in No Project Alternative B-S in 2003, compared to a difference of about 250 TAF/year in 2020.

Tables 15a through 15f and 16a through 16f and Figures 16a through 16f and 17a through 17f show the same information for unscheduled deliveries.

Total average annual unscheduled SWP deliveries are about 400 TAF per year in 1994, about 270-290 TAF per year in each of the 2003 scenarios, and about 160-180 TAF per year in each of the 2020 scenarios. In both 2003 and 2020, agricultural contractors receive more unscheduled water deliveries in the Baseline and No Project scenarios than in the Proposed Project scenario while M&I contractors received more in the Proposed Project scenario.

Table 13a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.7	6.4	6.5	6.5	6.4	6.4	7.2	7.2	6.4
Solano	26.6	34.2	34.2	34.4	33.3	33.4	30.4	30.5	34.3
Zone 7	25.8	40.8	57.3	57.5	38.3	38.3	36.8	36.8	59.3
Alameda	17.7	31.9	31.9	32.0	30.8	30.9	29.9	29.9	31.3
Santa Clara	78.8	76.6	76.7	76.9	74.0	74.2	71.7	71.8	75.3
Oak Flat	4.5	4.3	4.5	4.5	4.6	4.6	5.2	5.3	4.7
Kings	3.2	3.0	7.1	7.2	3.2	3.3	3.7	3.7	7.3
Dudley Ridge	45.5	43.9	48.2	48.3	46.8	46.9	53.8	53.9	46.8
Empire W.S.	2.4	2.3	2.3	2.3	2.4	2.4	2.8	2.8	2.4
KCWA (M&I)	0.0	119.4	119.5	119.8	111.9	112.2	108.1	108.4	117.8
KCWA (Agric.)	930.0	774.7	736.8	738.0	826.8	828.5	834.2	836.1	705.7
Tulare	93.4	90.1	74.6	74.7	96.2	96.4	110.4	110.6	78.6
SLO	0.0	4.3	4.3	4.3	4.2	4.3	4.2	4.3	4.2
Santa Barbara	0.0	25.2	25.2	25.3	25.1	25.2	24.5	24.6	24.9
AVEK	52.7	61.8	61.8	62.1	61.5	61.8	61.4	61.6	61.3
Castaic (Agric.)	10.0	9.7	9.9	9.9	10.3	10.3	11.8	11.9	10.4
Castaic (M&I)	14.8	36.8	36.8	36.9	34.5	34.6	33.1	33.2	61.1
Coachella	21.8	17.5	17.5	17.6	16.9	17.0	16.6	16.7	17.8
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
Desert	35.9	28.3	28.3	28.4	27.5	27.5	27.0	27.1	27.8
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.7	13.0	13.0	13.1	13.0	13.1	13.0	13.1	13.0
MWDSC	1,062.9	1,310.0	1,311.4	1,315.5	1,268.2	1,271.9	1,250.8	1,254.4	1,284.6
Palmdale	10.1	13.5	13.5	13.5	13.0	13.0	12.5	12.5	13.5
San Bernardino	6.7	64.4	64.5	64.7	63.3	63.5	63.1	63.3	63.5
San Gabriel	15.1	16.8	16.8	16.9	16.6	16.6	16.5	16.6	16.6
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total Agriculture	1,088.9	928.0	883.5	884.9	990.4	992.4	1,021.9	1,024.3	855.9
Total M&I	1,385.0	1,907.7	1,926.1	1,932.2	1,845.3	1,850.7	1,813.8	1,818.9	1,919.7
Total	2,473.9	2,835.7	2,809.7	2,817.2	2,835.7	2,843.2	2,835.7	2,843.2	2,775.7

Table 13b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.6	37.6	35.8	35.8	37.7
Zone 7	26.7	46.0	66.5	66.5	45.2	45.2	44.1	44.1	66.5
Alameda	18.0	35.2	35.2	35.2	34.9	34.9	34.3	34.3	35.2
Santa Clara	82.5	84.7	84.7	84.7	84.1	84.1	82.5	82.5	84.7
Oak Flat	5.3	5.2	5.4	5.4	5.3	5.3	5.9	5.9	5.3
Kings	3.7	3.7	8.8	8.8	3.7	3.7	4.2	4.2	8.4
Dudley Ridge	54.0	53.1	58.3	58.3	53.7	53.7	60.5	60.5	53.4
Empire W.S.	2.8	2.8	2.8	2.8	2.8	2.8	3.1	3.1	2.8
KCWA (M&I)	0.0	134.6	134.6	134.6	132.3	132.3	129.7	129.7	134.6
KCWA (Agric.)	1,087.5	936.9	885.8	885.8	948.4	948.4	935.5	935.5	805.0
Tulare	110.8	109.0	89.3	89.3	110.3	110.3	124.3	124.3	89.6
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.0	26.0	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.4	64.4	64.9
Castaic (Agric.)	11.9	11.7	12.0	12.0	11.8	11.8	13.3	13.3	11.8
Castaic (M&I)	15.1	41.5	41.5	41.5	40.8	40.8	39.8	39.8	68.6
Coachella	23.1	19.3	19.3	19.3	19.2	19.2	18.9	18.9	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	31.0	31.0	30.6	30.6	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,035.5	1,272.5	1,272.5	1,272.5	1,264.0	1,264.0	1,263.3	1,263.3	1,272.5
Palmdale	10.4	14.9	14.9	14.9	14.8	14.8	14.5	14.5	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.3	69.3	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.0	18.0	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,276.1	1,122.3	1,062.3	1,062.3	1,136.0	1,136.0	1,146.9	1,146.9	976.3
Total M&I	1,369.7	1,928.1	1,948.5	1,948.5	1,914.2	1,914.2	1,903.4	1,903.4	1,975.7
Total	2,645.8	3,050.4	3,010.8	3,010.8	3,050.3	3,050.3	3,050.4	3,050.3	2,952.0

Table 13c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.7	37.7	36.6	36.6	37.7
Zone 7	26.7	46.0	66.5	66.5	45.4	45.4	44.5	44.5	66.5
Alameda	18.0	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Santa Clara	82.5	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Oak Flat	5.4	5.4	5.4	5.4	5.4	5.4	6.1	6.1	5.4
Kings	3.8	3.8	8.8	8.8	3.8	3.8	4.3	4.3	8.6
Dudley Ridge	54.8	54.4	59.1	59.1	54.9	54.9	62.1	62.1	54.5
Empire W.S.	2.9	2.8	2.9	2.9	2.9	2.9	3.2	3.2	2.9
KCWA (M&I)	0.0	134.6	134.6	134.6	132.9	132.9	131.1	131.1	134.6
KCWA (Agric.)	1,103.0	960.8	900.4	900.4	969.5	969.5	951.1	951.1	821.0
Tulare	112.6	111.8	91.0	91.0	112.8	112.8	127.6	127.6	91.4
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.1	12.0	12.1	12.1	12.1	12.1	13.7	13.7	12.1
Castaic (M&I)	15.1	41.5	41.5	41.5	41.0	41.0	40.1	40.1	68.6
Coachella	23.1	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,133.0	1,537.7	1,537.7	1,537.7	1,530.2	1,530.2	1,527.2	1,527.2	1,537.6
Palmdale	10.4	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,294.7	1,150.9	1,079.7	1,079.7	1,161.3	1,161.3	1,168.1	1,168.1	995.7
Total M&I	1,467.2	2,193.3	2,213.8	2,213.8	2,182.9	2,182.9	2,176.1	2,176.1	2,240.8
Total	2,761.8	3,344.2	3,293.5	3,293.5	3,344.2	3,344.2	3,344.2	3,344.2	3,236.5

Table 13d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.7	37.7	34.1	34.1	37.7
Zone 7	26.7	46.0	65.1	65.1	42.6	42.6	41.1	41.1	66.5
Alameda	18.0	35.2	35.2	35.2	34.7	34.7	33.7	33.7	35.2
Santa Clara	82.5	84.7	84.7	84.7	83.2	83.2	80.8	80.8	84.7
Oak Flat	5.5	5.1	5.3	5.3	5.5	5.5	6.4	6.4	5.4
Kings	3.9	3.6	8.4	8.4	3.8	3.8	4.5	4.5	8.6
Dudley Ridge	55.7	51.7	57.2	57.2	55.2	55.2	64.9	64.9	54.5
Empire W.S.	2.9	2.7	2.8	2.8	2.9	2.9	3.4	3.4	2.9
KCWA (M&I)	0.0	134.6	134.6	134.6	124.7	124.7	120.9	120.9	134.6
KCWA (Agric.)	1,117.8	912.7	876.5	876.5	975.0	975.0	989.6	989.6	821.8
Tulare	114.4	106.2	89.1	89.1	113.4	113.4	133.4	133.4	91.5
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.2	26.2	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.3	11.4	11.8	11.8	12.2	12.2	14.3	14.3	12.1
Castaic (M&I)	15.1	41.5	41.5	41.5	38.5	38.5	37.0	37.0	68.6
Coachella	23.1	19.3	19.3	19.3	19.0	19.0	18.9	18.9	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	30.9	30.9	30.5	30.5	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,083.0	1,606.5	1,606.5	1,606.5	1,551.1	1,551.1	1,516.6	1,516.6	1,592.1
Palmdale	10.4	14.9	14.9	14.9	14.6	14.6	14.1	14.1	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,312.4	1,093.3	1,051.0	1,051.0	1,167.9	1,167.9	1,216.5	1,216.5	996.7
Total M&I	1,417.2	2,262.1	2,281.2	2,281.2	2,187.5	2,187.5	2,138.9	2,138.9	2,295.3
Total	2,729.6	3,355.4	3,332.2	3,332.2	3,355.4	3,355.4	3,355.4	3,355.4	3,292.1

Table 13e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.6	6.6	7.5	7.5	6.7
Solano	28.1	36.5	36.7	36.8	32.5	32.6	27.4	27.4	35.7
Zone 7	26.7	41.8	55.7	55.8	35.7	35.7	32.8	32.9	60.2
Alameda	18.0	33.7	33.9	34.0	29.9	29.9	27.8	27.8	31.8
Santa Clara	82.5	80.9	81.3	81.6	71.6	71.7	66.5	66.5	76.3
Oak Flat	4.6	3.8	3.9	3.9	4.6	4.6	5.1	5.2	4.5
Kings	3.2	2.7	6.1	6.1	3.2	3.2	3.8	3.8	7.1
Dudley Ridge	46.2	38.4	41.7	41.8	46.6	46.8	54.5	54.7	45.4
Empire W.S.	2.4	2.0	2.0	2.0	2.4	2.4	2.8	2.8	2.4
KCWA (M&I)	0.0	122.4	122.3	122.7	104.3	104.5	96.5	96.5	116.5
KCWA (Agric.)	949.8	678.3	640.0	641.6	823.6	826.3	863.1	867.0	684.3
Tulare	94.8	78.9	65.1	65.3	95.8	96.1	111.8	112.3	76.2
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.1	26.1	23.9	23.9	26.0
AVEK	53.7	64.9	64.9	64.9	63.9	64.0	63.8	63.9	64.0
Castaic (Agric.)	10.2	8.5	8.6	8.6	10.3	10.3	12.0	12.0	10.1
Castaic (M&I)	15.1	37.7	37.7	37.8	32.2	32.2	29.6	29.6	62.0
Coachella	23.1	18.5	18.6	18.6	16.4	16.4	15.8	15.8	18.6
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	30.0	30.1	30.2	26.8	26.8	25.7	25.7	28.3
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,243.7	1,365.1	1,367.6	1,370.8	1,252.4	1,254.9	1,215.7	1,217.2	1,286.5
Palmdale	10.4	14.2	14.3	14.3	12.5	12.5	11.5	11.5	14.0
San Bernardino	6.7	68.9	69.1	69.1	63.8	63.9	63.6	63.7	66.0
San Gabriel	15.5	18.0	18.0	18.0	16.9	17.0	16.9	16.9	17.3
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,111.1	812.5	767.4	769.3	986.6	989.8	1,053.1	1,057.8	830.0
Total M&I	1,577.9	1,990.2	2,007.8	2,012.5	1,816.1	1,819.5	1,749.6	1,751.5	1,934.5
Total	2,689.0	2,802.7	2,775.2	2,781.8	2,802.7	2,809.3	2,802.7	2,809.3	2,764.5

Table 13f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.0	4.5	4.7	4.9	4.5	4.6	5.5	5.6	4.4
Solano	19.1	18.0	17.9	18.4	17.8	18.3	15.1	15.6	19.3
Zone 7	21.2	19.7	26.1	26.7	17.9	18.4	17.0	17.5	30.5
Alameda	15.9	16.8	16.9	17.3	16.3	16.8	15.5	16.0	16.0
Santa Clara	60.1	40.1	40.3	41.5	38.9	40.0	37.0	38.1	38.3
Oak Flat	0.9	1.6	1.7	1.8	1.8	1.8	2.0	2.1	2.1
Kings	0.7	1.1	2.7	2.8	1.2	1.3	1.4	1.5	3.3
Dudley Ridge	9.4	16.3	18.9	19.2	18.0	18.4	20.5	20.9	21.3
Empire W.S.	0.5	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.1
KCWA (M&I)	0.0	57.7	58.0	59.5	52.4	53.8	49.8	51.2	55.3
KCWA (Agric.)	254.6	287.2	290.1	295.2	317.9	324.9	333.7	340.7	321.0
Tulare	19.4	33.4	29.5	30.1	37.0	37.8	42.2	43.0	35.7
SLO	0.0	3.5	3.5	3.6	3.5	3.6	3.5	3.6	3.3
Santa Barbara	0.0	19.5	19.6	20.3	19.3	19.9	18.8	19.4	18.4
AVEK	47.7	46.0	46.3	47.9	45.5	46.9	45.6	47.0	44.2
Castaic (Agric.)	2.1	3.6	3.9	4.0	4.0	4.1	4.5	4.6	4.7
Castaic (M&I)	13.5	17.8	17.9	18.4	16.1	16.6	15.3	15.7	31.4
Coachella	15.1	9.2	9.3	9.5	9.0	9.2	8.8	9.1	11.1
Crestline	0.5	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
Desert	24.8	15.1	15.2	15.6	14.8	15.2	14.5	14.9	14.4
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.2	12.2	12.2	12.4	12.1	12.3	12.1	12.3	12.3
MWDSC	801.4	771.2	776.4	797.6	747.3	766.9	732.6	752.3	733.9
Palmdale	8.7	7.0	7.0	7.2	6.7	6.9	6.4	6.6	7.6
San Bernardino	6.7	38.0	38.3	39.4	37.7	38.7	37.7	38.8	36.2
San Gabriel	13.3	10.4	10.5	10.8	10.3	10.6	10.3	10.6	9.9
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	4.6	4.6	4.7	4.6	4.7	4.6	4.7	4.6
Total Agriculture	287.6	344.1	347.8	354.0	380.8	389.2	405.4	413.8	389.3
Total M&I	1,062.3	1,113.3	1,126.5	1,157.6	1,076.5	1,105.2	1,052.0	1,080.7	1,092.6
Total	1,349.9	1,457.3	1,474.3	1,511.6	1,457.3	1,494.4	1,457.4	1,494.5	1,481.9

Figure 14a - Average Annual Scheduled SWP Deliveries in the 1994 and 2003 Scenarios

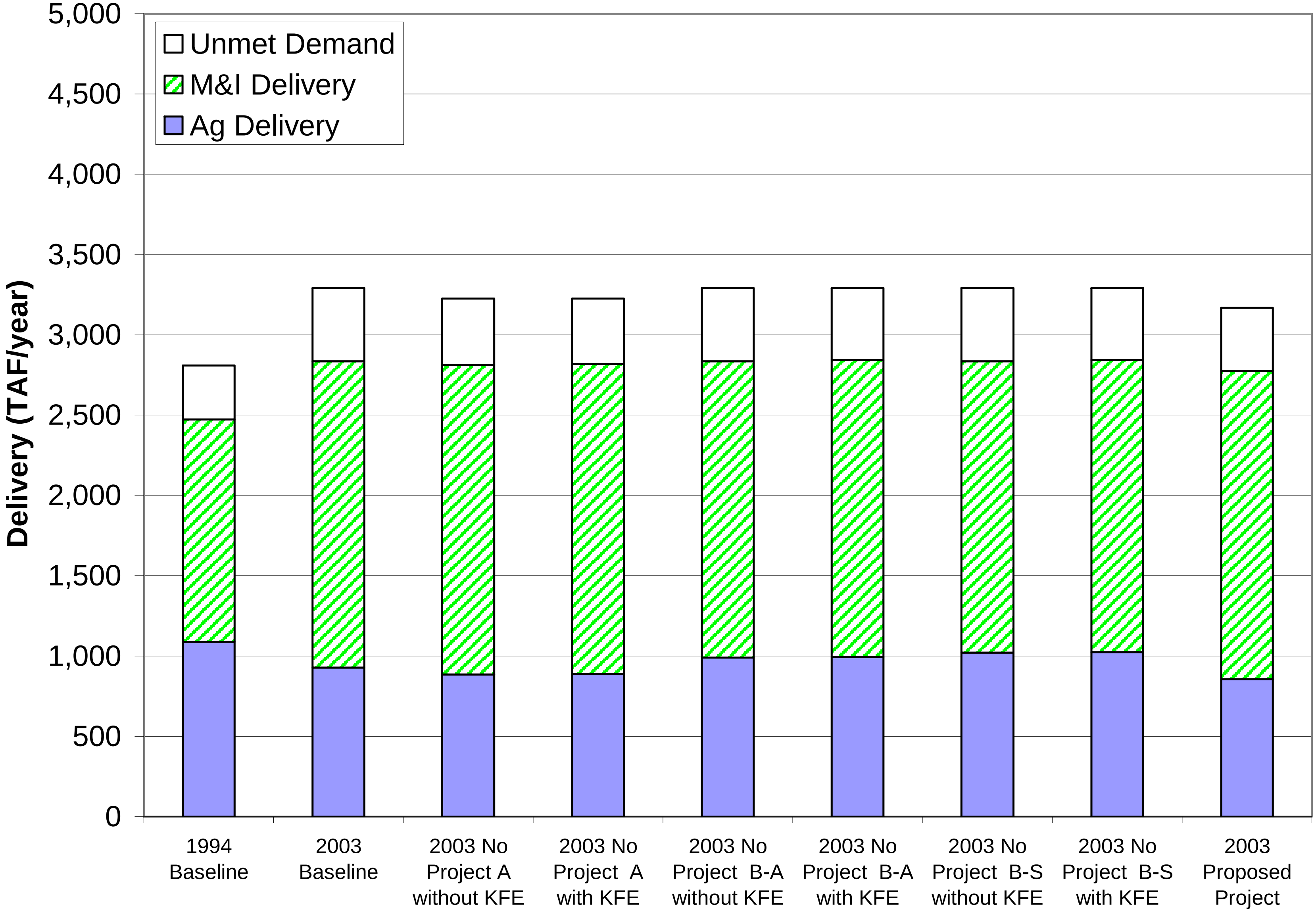


Figure 14b - Average Annual Scheduled SWP Deliveries in Wet Years in the 1994 and 2003 Scenarios

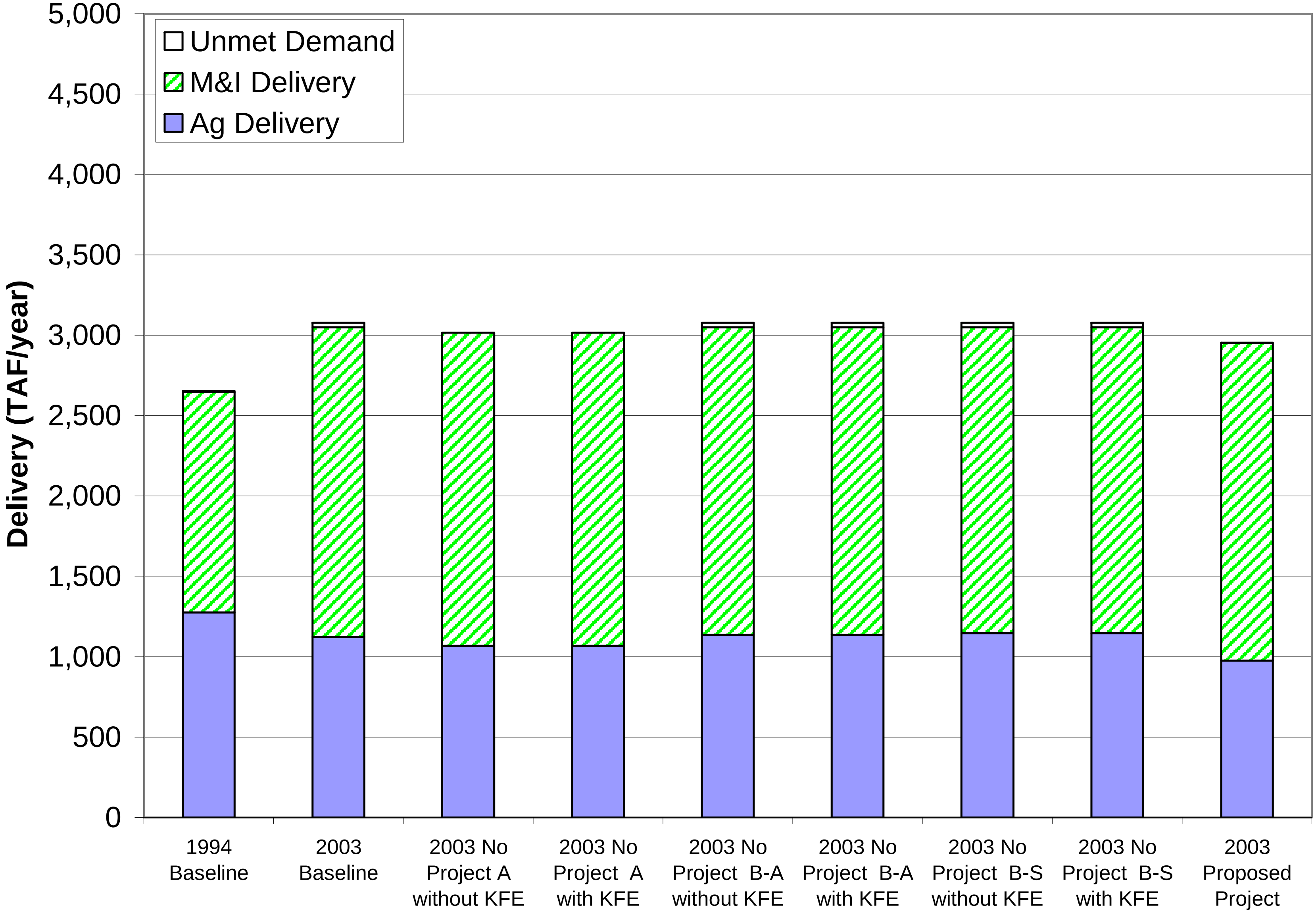


Figure 14c - Average Annual Scheduled SWP Deliveries in Above Normal Years in the 1994 and 2003 Scenarios

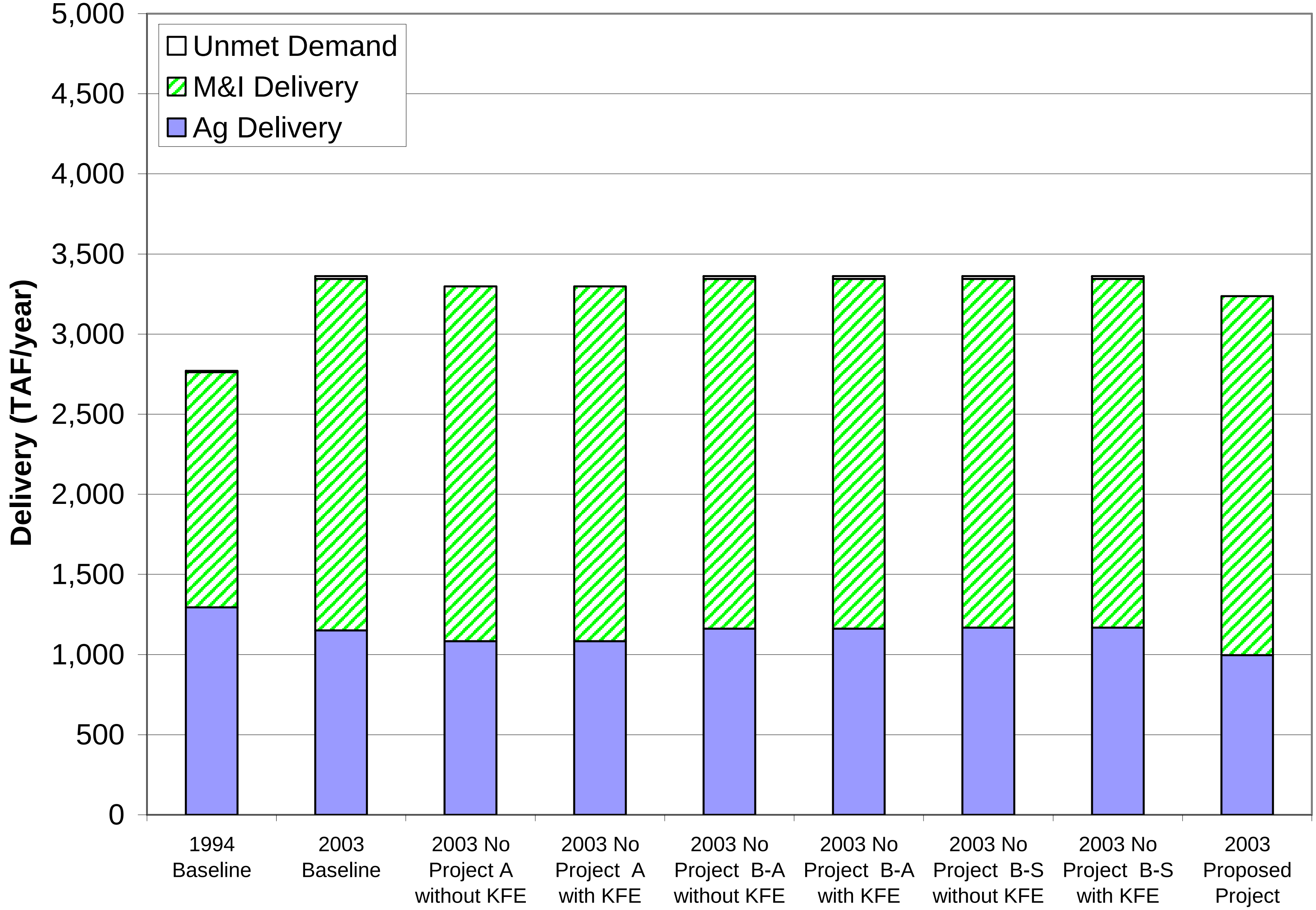


Figure 14d - Average Annual Scheduled SWP Deliveries in Below Normal Years in the 1994 and 2003 Scenarios

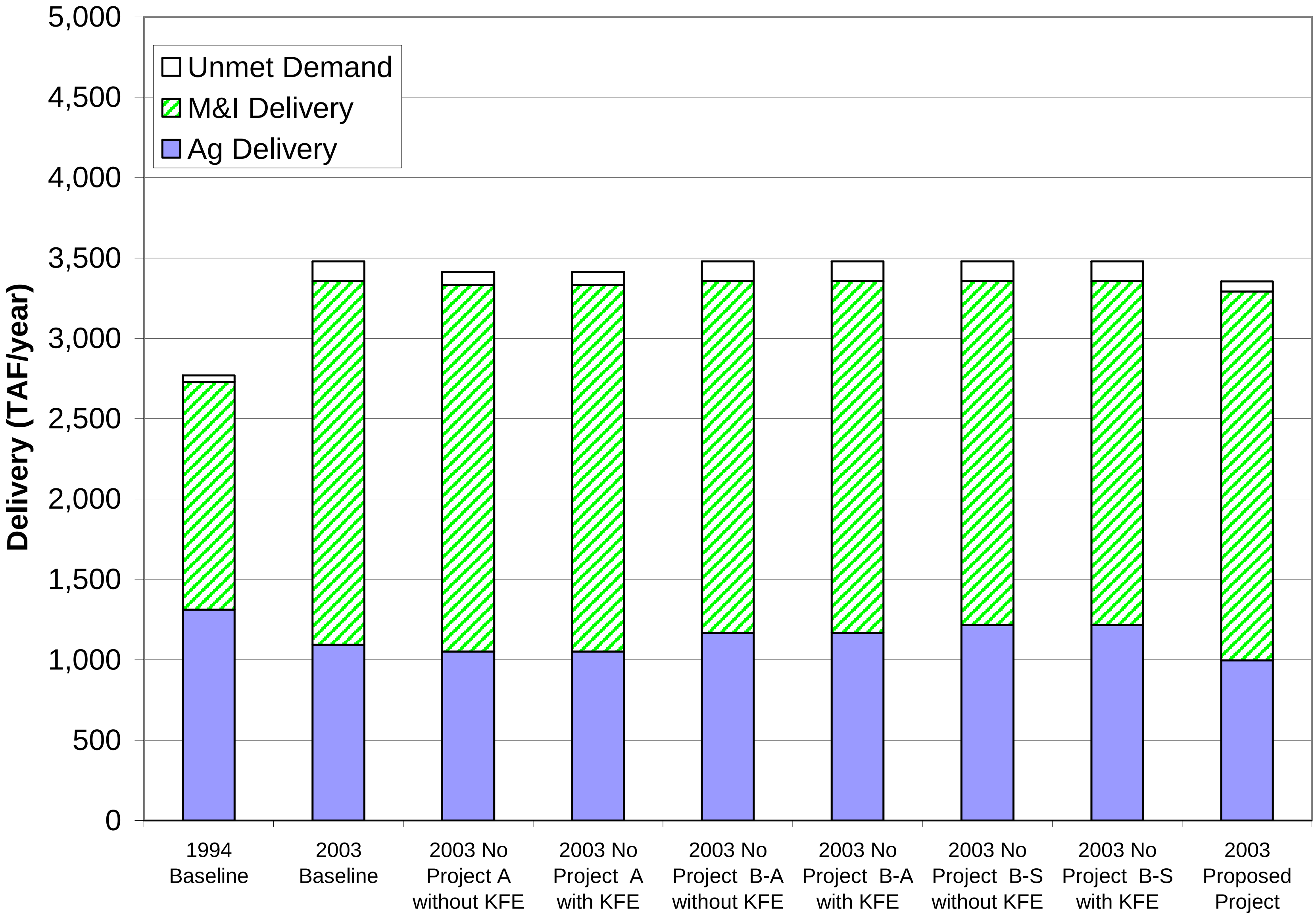


Figure 14e - Average Annual Scheduled SWP Deliveries in Dry Years in the 1994 and 2003 Scenarios

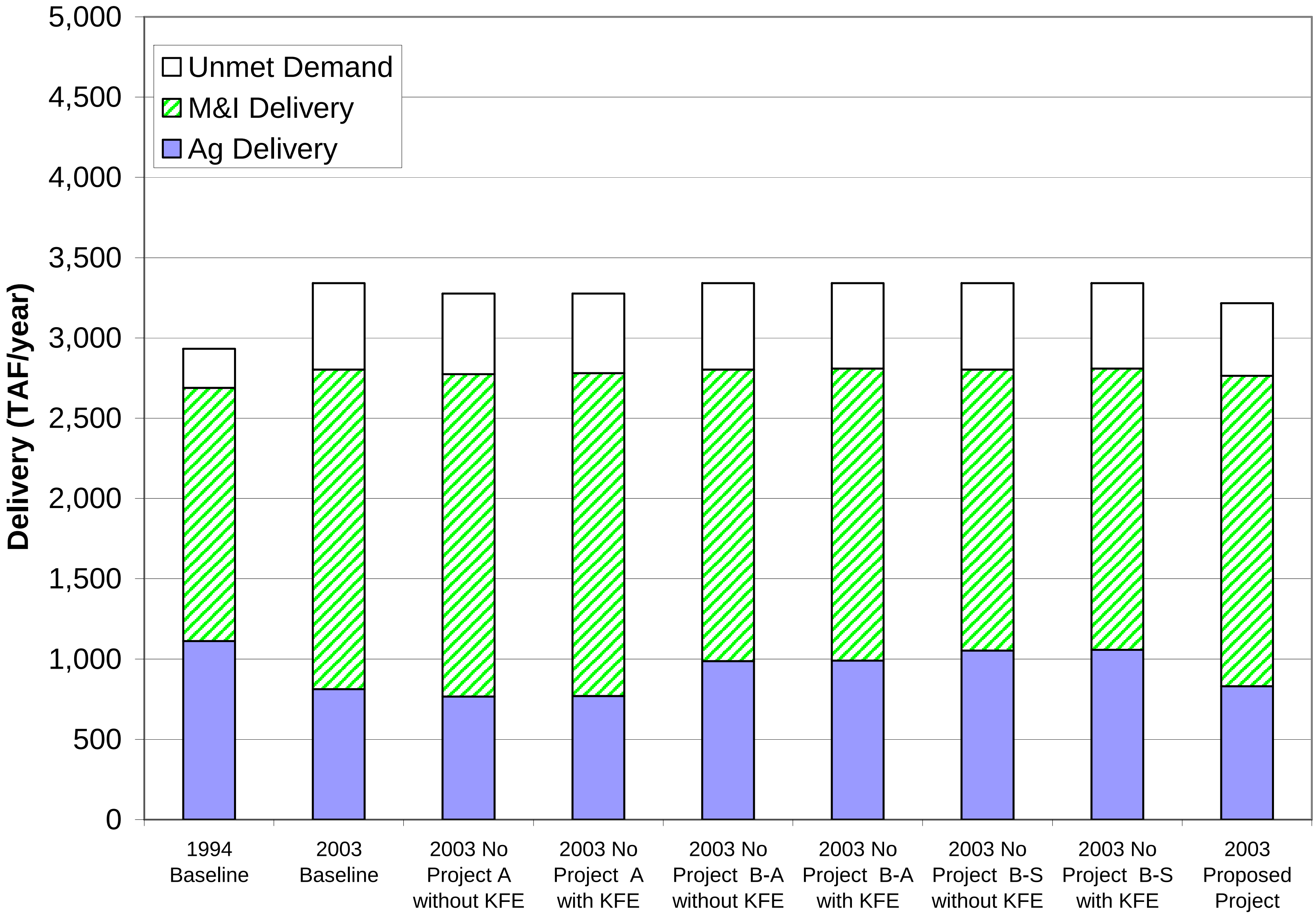


Figure 14f - Average Annual Scheduled SWP Deliveries in Critical Years in the 1994 and 2003 Scenarios

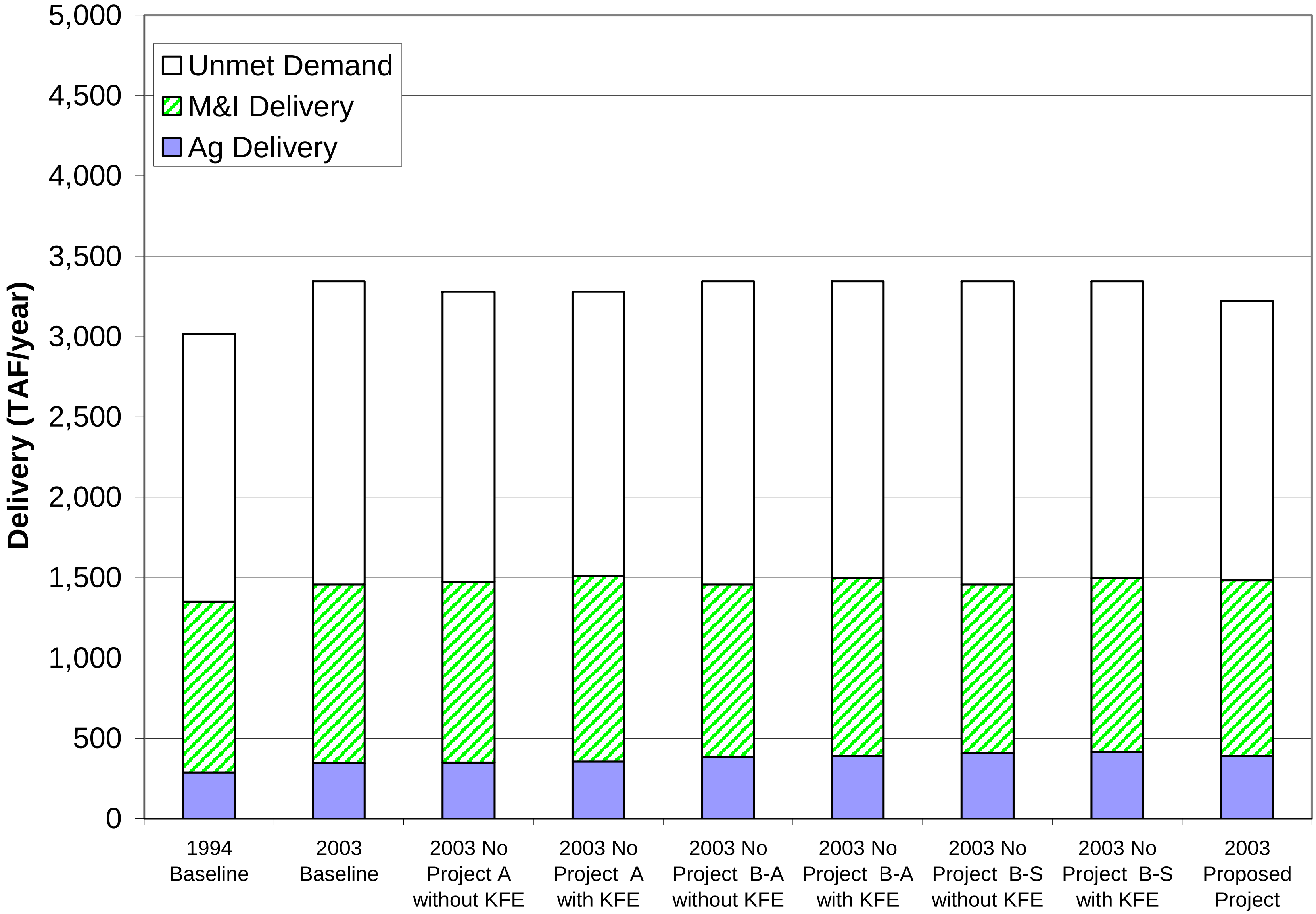


Table 14a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	20.3	23.1	23.2	19.6	19.7	18.0	18.0	22.8
Solano	34.3	38.2	38.4	33.1	33.2	30.0	30.1	37.6
Zone 7	37.6	61.2	61.5	36.2	36.4	32.9	33.1	63.5
Alameda	34.3	34.3	34.5	33.1	33.2	30.3	30.4	33.1
Santa Clara	81.7	81.7	82.1	78.8	79.0	72.2	72.4	78.7
Oak Flat	3.9	3.9	3.9	4.3	4.3	4.7	4.7	4.4
Kings	2.7	6.1	6.2	3.0	3.0	3.3	3.3	6.9
Dudley Ridge	39.3	42.0	42.2	43.4	43.7	47.8	48.0	44.1
Empire W.S.	2.0	2.0	2.1	2.3	2.3	2.5	2.5	2.3
KCWA (M&I)	110.0	110.0	110.5	106.0	106.4	96.2	96.5	106.0
KCWA (Agric.)	694.1	633.5	636.6	767.0	771.4	843.7	848.2	652.0
Tulare	80.7	65.6	65.9	89.2	89.7	98.1	98.7	74.0
SLO	20.4	20.4	20.5	19.7	19.8	17.9	17.9	19.7
Santa Barbara	37.2	37.2	37.3	35.8	35.9	32.5	32.6	35.8
AVEK	113.1	115.1	115.6	109.0	109.4	108.3	108.7	111.3
Castaic (Agric.)	8.7	8.7	8.7	9.6	9.6	10.5	10.6	9.8
Castaic (M&I)	33.9	33.9	34.1	32.7	32.8	29.7	29.8	65.0
Coachella	90.9	105.8	106.3	87.6	87.9	87.0	87.3	104.8
Crestline	4.7	4.7	4.8	4.6	4.6	4.1	4.2	4.6
Desert	40.9	43.6	43.8	39.4	39.5	39.1	39.3	42.5
Littlerock	1.9	1.9	1.9	1.8	1.8	1.7	1.7	1.8
Mojave	41.5	58.5	58.8	40.0	40.1	43.2	43.3	59.7
MWDSC	1,562.0	1,562.0	1,568.8	1,505.6	1,510.6	1,443.8	1,448.7	1,505.1
Palmdale	14.1	16.9	16.9	13.6	13.7	12.4	12.4	16.8
San Bernardino	83.8	83.8	84.2	80.8	81.1	87.3	87.5	80.8
San Gabriel	23.5	23.5	23.6	22.7	22.8	24.5	24.6	22.7
San Gorgonio	14.1	14.1	14.2	13.6	13.7	12.4	12.4	13.6
Ventura	16.3	16.3	16.4	15.8	15.8	14.3	14.3	15.7
Total Agriculture	831.4	761.7	765.5	918.8	924.0	1,010.6	1,016.0	793.5
Total M&I	2,416.8	2,486.5	2,497.3	2,329.5	2,337.2	2,237.6	2,245.2	2,441.6
Total	3,248.2	3,248.2	3,262.8	3,248.2	3,261.2	3,248.2	3,261.2	3,235.0

Table 14b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	24.3	28.0	28.0	24.2	24.2	23.7	23.7	28.1
Solano	41.1	46.3	46.3	40.8	40.8	39.9	39.9	46.4
Zone 7	45.0	76.6	76.6	44.7	44.7	43.7	43.7	78.3
Alameda	41.1	41.1	41.1	40.8	40.8	40.0	40.0	40.8
Santa Clara	97.7	97.7	97.7	97.1	97.1	95.2	95.2	97.2
Oak Flat	5.2	5.2	5.2	5.3	5.3	5.4	5.4	5.3
Kings	3.7	8.2	8.2	3.7	3.7	3.8	3.8	8.3
Dudley Ridge	52.8	56.4	56.4	53.6	53.6	54.9	54.9	53.1
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8
KCWA (M&I)	131.6	131.6	131.6	130.8	130.8	127.9	127.9	130.8
KCWA (Agric.)	932.2	850.7	850.7	946.9	946.9	969.7	969.7	785.4
Tulare	108.4	88.0	88.0	110.1	110.1	112.8	112.8	89.1
SLO	24.4	24.4	24.4	24.3	24.3	23.7	23.7	24.3
Santa Barbara	44.5	44.5	44.5	44.2	44.2	43.2	43.2	44.2
AVEK	135.3	138.0	138.0	134.5	134.5	134.2	134.2	137.4
Castaic (Agric.)	11.6	11.6	11.6	11.8	11.8	12.1	12.1	11.8
Castaic (M&I)	40.6	40.6	40.6	40.3	40.3	39.4	39.4	80.2
Coachella	108.7	128.7	128.7	108.0	108.0	107.8	107.8	129.3
Crestline	5.7	5.7	5.7	5.6	5.6	5.5	5.5	5.6
Desert	48.9	52.5	52.5	48.6	48.6	48.5	48.5	52.5
Littlerock	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Mojave	49.7	72.5	72.5	49.4	49.4	50.3	50.3	73.7
MWDSC	1,868.4	1,868.4	1,868.4	1,857.0	1,857.0	1,838.7	1,838.7	1,857.3
Palmdale	16.9	20.6	20.6	16.8	16.8	16.4	16.4	20.7
San Bernardino	100.3	100.3	100.3	99.7	99.7	101.5	101.5	99.7
San Gabriel	28.2	28.2	28.2	28.0	28.0	28.5	28.5	28.0
San Gorgonio	16.9	16.9	16.9	16.8	16.8	16.4	16.4	16.8
Ventura	19.5	19.5	19.5	19.4	19.4	19.0	19.0	19.4
Total Agriculture	1,116.6	1,023.0	1,023.0	1,134.2	1,134.2	1,161.5	1,161.5	955.8
Total M&I	2,890.8	2,984.4	2,984.4	2,873.2	2,873.2	2,845.9	2,845.9	3,012.9
Total	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	3,968.7

Table 14c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	24.1	27.7	27.7	23.8	23.8	22.9	22.9	27.8
Solano	40.7	45.8	45.8	40.2	40.2	38.4	38.4	45.9
Zone 7	44.6	75.3	75.3	44.0	44.0	42.1	42.1	77.4
Alameda	40.7	40.7	40.7	40.2	40.2	38.6	38.6	40.3
Santa Clara	97.0	97.0	97.0	95.7	95.7	91.8	91.8	96.0
Oak Flat	5.1	5.1	5.1	5.2	5.2	5.5	5.5	5.3
Kings	3.5	8.0	8.0	3.7	3.7	3.8	3.8	8.3
Dudley Ridge	51.2	54.7	54.7	53.0	53.0	55.2	55.2	52.9
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8
KCWA (M&I)	130.5	130.5	130.5	128.7	128.7	123.0	123.0	129.3
KCWA (Agric.)	903.2	824.3	824.3	935.6	935.6	975.1	975.1	783.0
Tulare	105.1	85.3	85.3	108.8	108.8	113.4	113.4	88.8
SLO	24.2	24.2	24.2	23.9	23.9	22.8	22.8	24.0
Santa Barbara	44.1	44.1	44.1	43.5	43.5	41.6	41.6	43.7
AVEK	134.2	136.9	136.9	132.4	132.4	132.4	132.4	135.8
Castaic (Agric.)	11.3	11.3	11.3	11.7	11.7	12.2	12.2	11.7
Castaic (M&I)	40.2	40.2	40.2	39.7	39.7	37.9	37.9	79.2
Coachella	107.8	127.2	127.2	106.4	106.4	106.4	106.4	127.8
Crestline	5.6	5.6	5.6	5.5	5.5	5.3	5.3	5.6
Desert	48.5	52.0	52.0	47.8	47.8	47.8	47.8	51.9
Littlerock	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.2
Mojave	49.3	71.4	71.4	48.6	48.6	50.8	50.8	72.8
MWDSC	1,853.5	1,853.5	1,853.5	1,828.4	1,828.4	1,796.3	1,796.3	1,835.6
Palmdale	16.8	20.3	20.3	16.5	16.5	15.8	15.8	20.5
San Bernardino	99.5	99.5	99.5	98.1	98.1	102.6	102.6	98.5
San Gabriel	27.9	27.9	27.9	27.5	27.5	28.8	28.8	27.7
San Gorgonio	16.8	16.8	16.8	16.5	16.5	15.8	15.8	16.6
Ventura	19.4	19.4	19.4	19.1	19.1	18.3	18.3	19.2
Total Agriculture	1,082.0	991.3	991.3	1,120.8	1,120.8	1,168.1	1,168.1	952.9
Total M&I	2,867.7	2,958.4	2,958.4	2,828.9	2,828.9	2,781.6	2,781.6	2,977.7
Total	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,930.6

Table 14d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	22.9	26.0	26.0	21.8	21.8	18.8	18.8	25.5
Solano	38.6	42.9	42.9	36.7	36.7	31.2	31.2	42.2
Zone 7	42.2	68.8	68.8	40.2	40.2	34.3	34.3	71.2
Alameda	38.6	38.6	38.6	36.7	36.7	31.7	31.7	37.1
Santa Clara	91.8	91.8	91.8	87.4	87.4	75.6	75.6	88.3
Oak Flat	4.4	4.4	4.4	5.0	5.0	5.7	5.7	5.0
Kings	3.1	6.9	6.9	3.5	3.5	4.0	4.0	7.9
Dudley Ridge	44.3	47.3	47.3	50.4	50.4	57.7	57.7	50.6
Empire W.S.	2.3	2.3	2.3	2.6	2.6	3.0	3.0	2.6
KCWA (M&I)	123.6	123.6	123.6	117.7	117.7	100.0	100.0	118.9
KCWA (Agric.)	781.6	713.3	713.3	890.6	890.6	1,018.8	1,018.8	748.9
Tulare	90.9	73.8	73.8	103.6	103.6	118.5	118.5	85.0
SLO	23.0	23.0	23.0	21.9	21.9	18.6	18.6	22.1
Santa Barbara	41.8	41.8	41.8	39.8	39.8	33.8	33.8	40.2
AVEK	127.1	129.4	129.4	121.0	121.0	120.6	120.6	124.9
Castaic (Agric.)	9.7	9.7	9.7	11.1	11.1	12.7	12.7	11.2
Castaic (M&I)	38.1	38.1	38.1	36.3	36.3	30.8	30.8	72.8
Coachella	102.1	118.9	118.9	97.2	97.2	96.9	96.9	117.5
Crestline	5.3	5.3	5.3	5.1	5.1	4.3	4.3	5.1
Desert	45.9	49.0	49.0	43.7	43.7	43.6	43.6	47.7
Littlerock	2.1	2.1	2.1	2.0	2.0	1.7	1.7	2.0
Mojave	46.6	65.8	65.8	44.4	44.4	50.8	50.8	66.9
MWDSC	1,755.3	1,755.3	1,755.3	1,670.9	1,670.9	1,567.2	1,567.2	1,687.8
Palmdale	15.9	19.0	19.0	15.1	15.1	12.8	12.8	18.8
San Bernardino	94.2	94.2	94.2	89.7	89.7	102.6	102.6	90.6
San Gabriel	26.4	26.4	26.4	25.2	25.2	28.8	28.8	25.4
San Gorgonio	15.9	15.9	15.9	15.1	15.1	12.8	12.8	15.3
Ventura	18.4	18.4	18.4	17.5	17.5	14.9	14.9	17.7
Total Agriculture	936.2	857.7	857.7	1,066.8	1,066.8	1,220.4	1,220.4	911.3
Total M&I	2,715.9	2,794.3	2,794.3	2,585.3	2,585.3	2,431.7	2,431.7	2,738.0
Total	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,649.3

Table 14e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	18.1	20.2	20.3	16.6	16.6	13.5	13.5	19.3
Solano	30.5	33.3	33.6	27.9	28.0	22.2	22.2	31.8
Zone 7	33.4	50.6	51.0	30.6	30.6	24.4	24.4	53.7
Alameda	30.5	30.5	30.8	27.9	28.0	22.8	22.8	28.0
Santa Clara	72.7	72.7	73.3	66.5	66.6	54.2	54.2	66.6
Oak Flat	2.8	2.8	2.9	3.7	3.7	4.4	4.5	3.8
Kings	2.0	4.5	4.5	2.6	2.6	3.2	3.2	6.0
Dudley Ridge	28.5	30.5	30.9	37.1	37.9	45.9	46.7	38.2
Empire W.S.	1.5	1.5	1.5	1.9	2.0	2.4	2.4	2.0
KCWA (M&I)	97.8	97.8	98.6	89.5	89.6	71.2	71.2	89.7
KCWA (Agric.)	503.8	459.7	465.2	655.9	668.6	811.3	824.9	564.9
Tulare	58.6	47.6	48.1	76.3	77.8	94.4	95.9	64.1
SLO	18.2	18.2	18.3	16.6	16.6	13.2	13.2	16.7
Santa Barbara	33.1	33.1	33.3	30.3	30.3	24.1	24.1	30.3
AVEK	100.6	102.1	102.9	92.1	92.1	89.6	89.7	94.2
Castaic (Agric.)	6.3	6.3	6.4	8.2	8.3	10.1	10.3	8.5
Castaic (M&I)	30.2	30.2	30.4	27.6	27.6	21.9	21.9	55.0
Coachella	80.8	91.6	92.4	74.0	74.0	72.0	72.0	88.7
Crestline	4.2	4.2	4.2	3.9	3.9	3.1	3.1	3.9
Desert	36.3	38.3	38.6	33.3	33.3	32.4	32.4	36.0
Littlerock	1.7	1.7	1.7	1.5	1.5	1.2	1.2	1.5
Mojave	36.9	49.3	49.7	33.8	33.8	38.9	39.0	50.5
MWDSC	1,389.3	1,389.3	1,400.5	1,271.5	1,272.6	1,146.9	1,147.4	1,273.2
Palmdale	12.6	14.6	14.7	11.5	11.5	9.1	9.1	14.2
San Bernardino	74.6	74.6	75.2	68.2	68.3	78.6	78.7	68.3
San Gabriel	20.9	20.9	21.1	19.2	19.2	22.1	22.1	19.2
San Gorgonio	12.6	12.6	12.7	11.5	11.5	9.1	9.1	11.5
Ventura	14.5	14.5	14.7	13.3	13.3	10.6	10.6	13.3
Total Agriculture	603.4	552.9	559.4	785.7	801.0	971.8	988.0	687.5
Total M&I	2,149.5	2,200.1	2,218.1	1,967.3	1,968.9	1,781.2	1,781.9	2,065.4
Total	2,753.0	2,753.0	2,777.5	2,753.0	2,769.9	2,753.0	2,769.9	2,752.8

Table 14f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	9.9	10.8	11.2	9.2	9.6	8.2	8.6	10.2
Solano	16.7	17.9	18.6	15.5	16.1	13.7	14.4	16.8
Zone 7	18.2	26.0	27.1	17.0	17.7	15.1	15.8	28.4
Alameda	16.7	16.7	17.2	15.5	16.1	13.9	14.5	14.8
Santa Clara	39.7	39.7	41.1	36.9	38.4	33.1	34.6	35.2
Oak Flat	1.3	1.3	1.4	1.7	1.7	1.9	2.0	2.0
Kings	0.9	2.0	2.1	1.2	1.2	1.3	1.4	3.2
Dudley Ridge	13.0	13.9	14.7	16.8	17.4	19.3	19.9	20.2
Empire W.S.	0.7	0.7	0.7	0.9	0.9	1.0	1.0	1.1
KCWA (M&I)	53.4	53.4	55.3	49.6	51.7	44.0	46.1	47.4
KCWA (Agric.)	229.0	209.0	220.9	297.4	307.8	341.3	351.7	298.8
Tulare	26.6	21.6	22.9	34.6	35.8	39.7	40.9	33.9
SLO	9.9	9.9	10.3	9.2	9.6	8.2	8.6	8.8
Santa Barbara	18.0	18.0	18.7	16.8	17.5	14.9	15.6	16.0
AVEK	54.9	55.6	57.6	51.1	53.2	50.6	52.8	49.8
Castaic (Agric.)	2.9	2.9	3.0	3.7	3.8	4.3	4.4	4.5
Castaic (M&I)	16.5	16.5	17.0	15.3	15.9	13.6	14.2	29.1
Coachella	44.1	49.0	50.9	41.0	42.7	40.7	42.4	46.9
Crestline	2.3	2.3	2.4	2.1	2.2	1.9	2.0	2.0
Desert	19.8	20.7	21.5	18.4	19.2	18.3	19.1	19.0
Littlerock	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.8
Mojave	20.1	25.8	26.8	18.7	19.5	20.6	21.3	26.7
MWDSC	758.0	758.0	785.1	705.1	734.2	669.7	698.9	673.5
Palmdale	6.9	7.8	8.1	6.4	6.6	5.7	5.9	7.5
San Bernardino	40.7	40.7	42.1	37.8	39.4	41.5	43.1	36.1
San Gabriel	11.4	11.4	11.8	10.6	11.1	11.7	12.1	10.1
San Gorgonio	6.9	6.9	7.1	6.4	6.6	5.7	5.9	6.1
Ventura	7.9	7.9	8.2	7.4	7.7	6.5	6.8	7.0
Total Agriculture	274.3	251.3	265.7	356.2	368.7	408.9	421.3	363.6
Total M&I	1,172.8	1,195.8	1,239.0	1,090.9	1,136.0	1,038.3	1,083.4	1,092.5
Total	1,447.1	1,447.1	1,504.7	1,447.1	1,504.7	1,447.2	1,504.7	1,456.1

Figure 15a - Average Annual Scheduled SWP Deliveries in the 2020 Scenarios

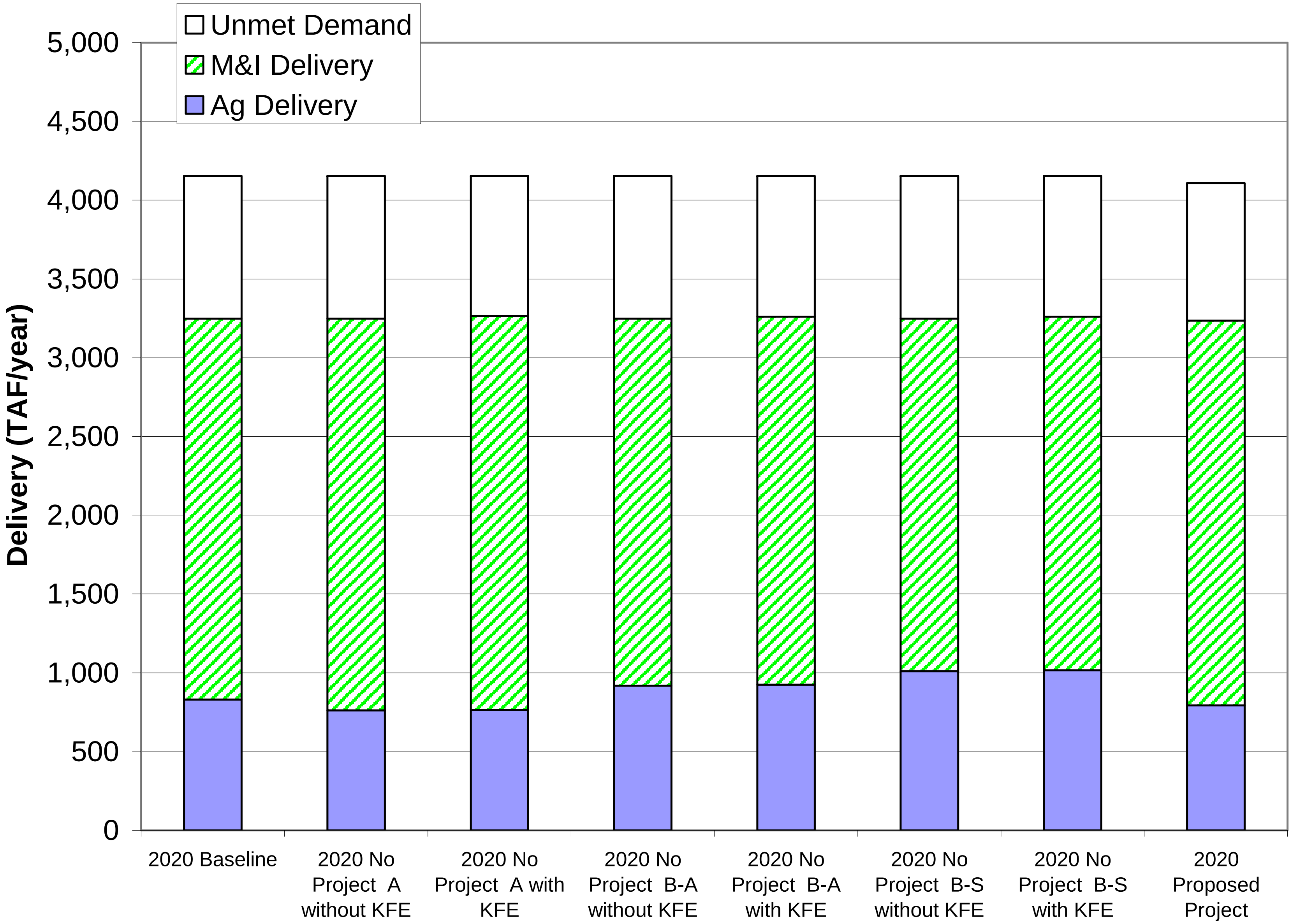


Figure 15b - Average Annual Scheduled SWP Deliveries in Wet Years in the 2020 Scenarios

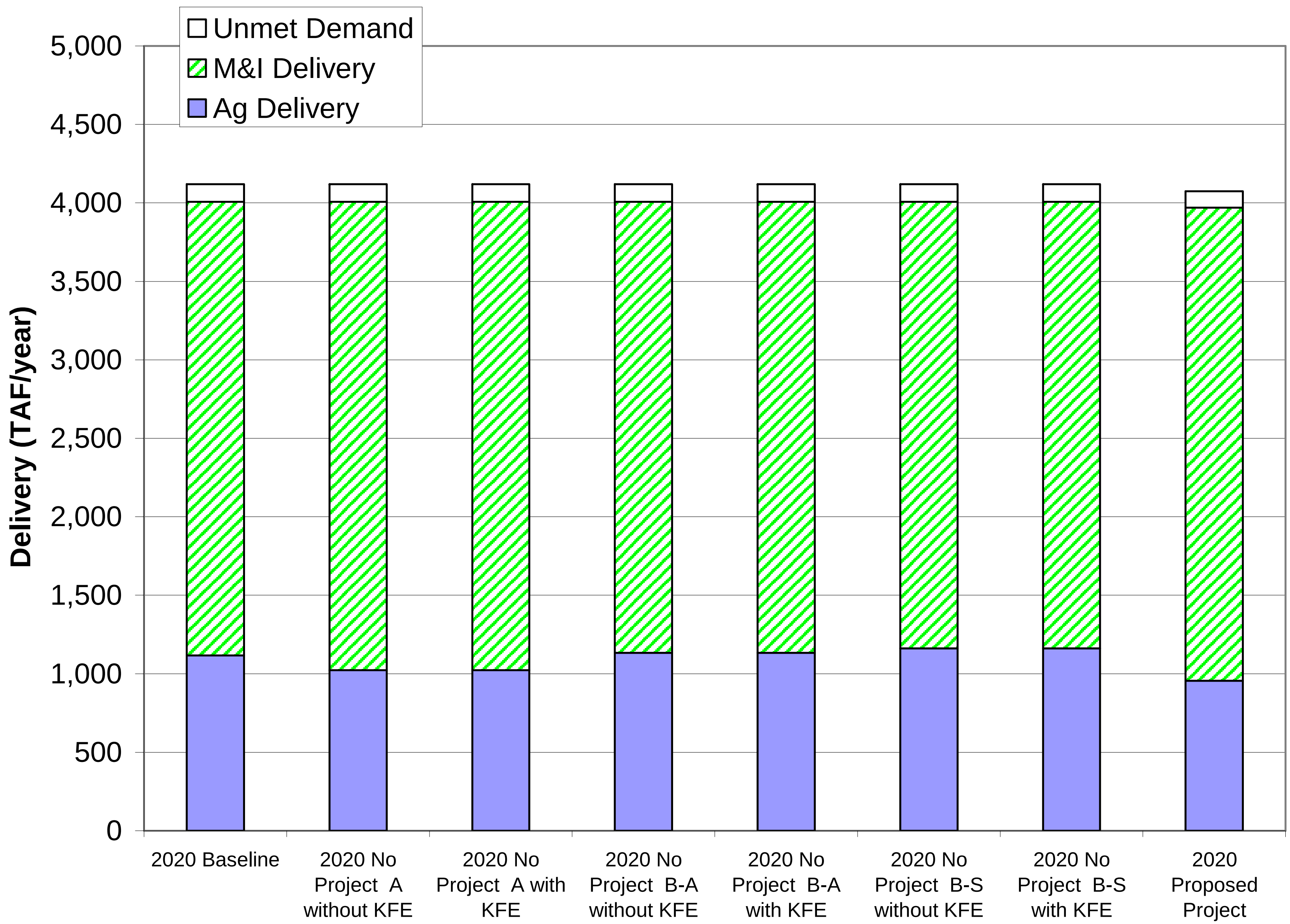


Figure 15c - Average Annual Scheduled SWP Deliveries in Above Normal Years in the 2020 Scenarios

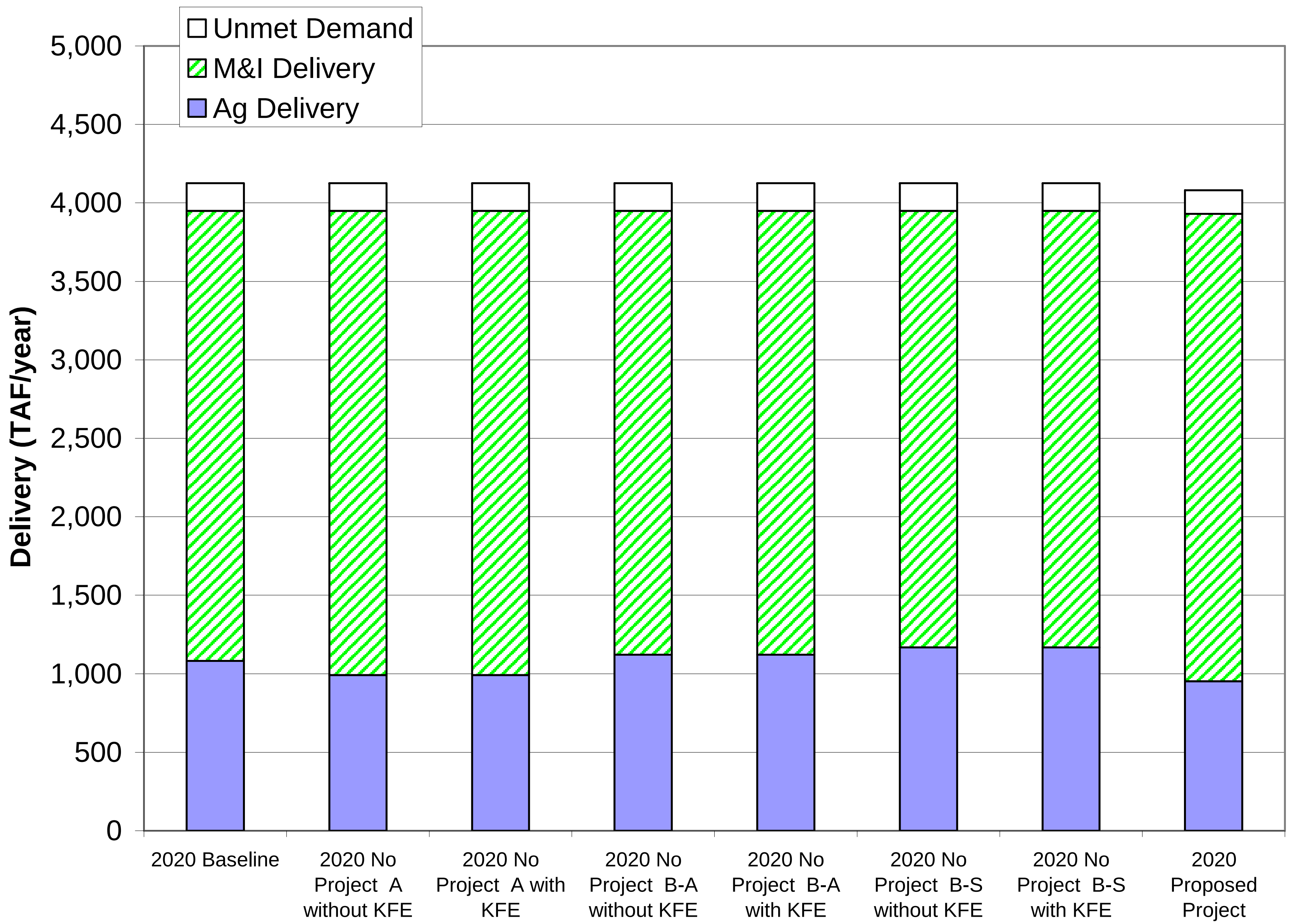


Figure 15d - Average Annual Scheduled SWP Deliveries in Below Normal Years in the 2020 Scenarios

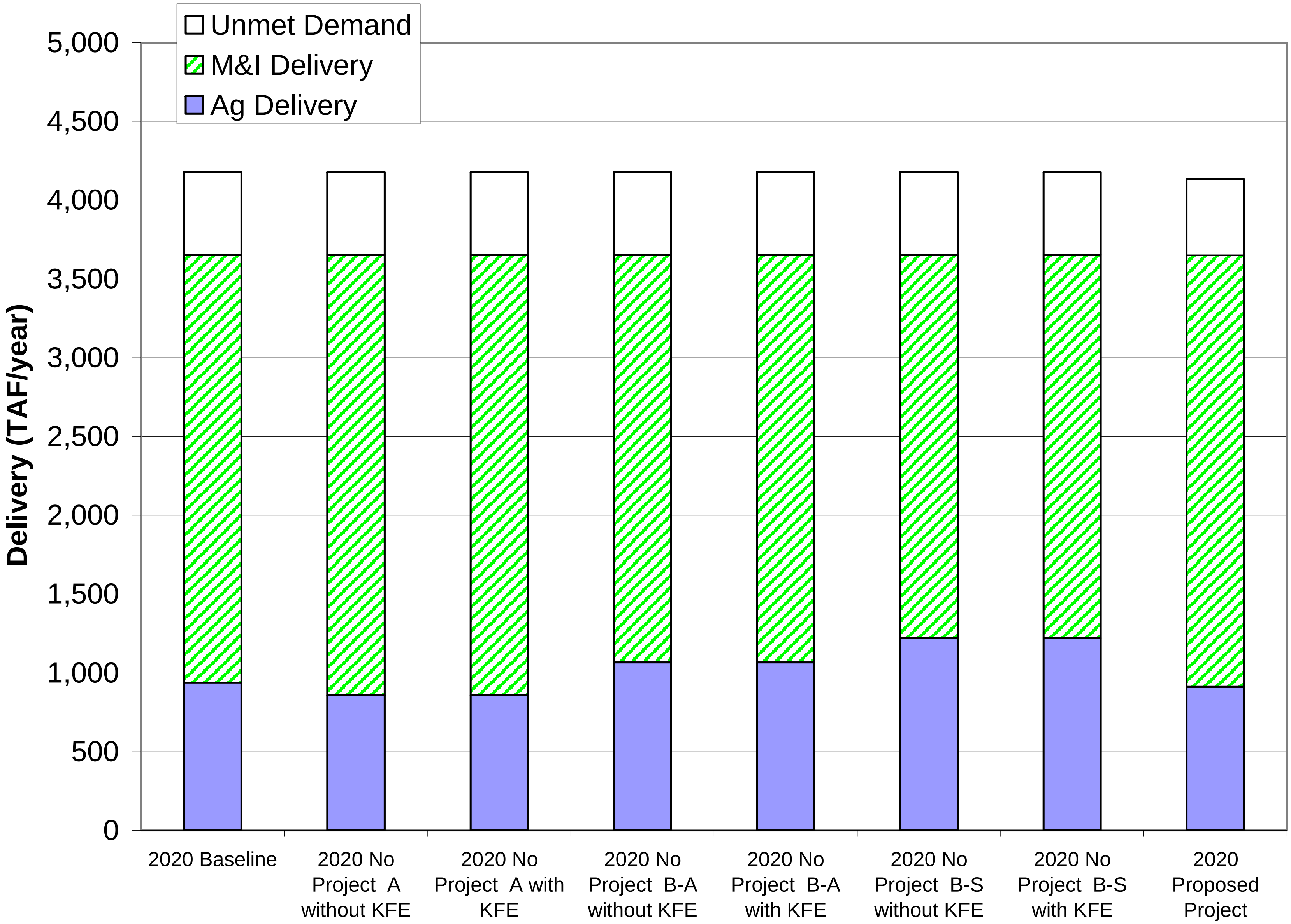


Figure 15e - Average Annual Scheduled SWP Deliveries in Dry Years in the 2020 Scenarios

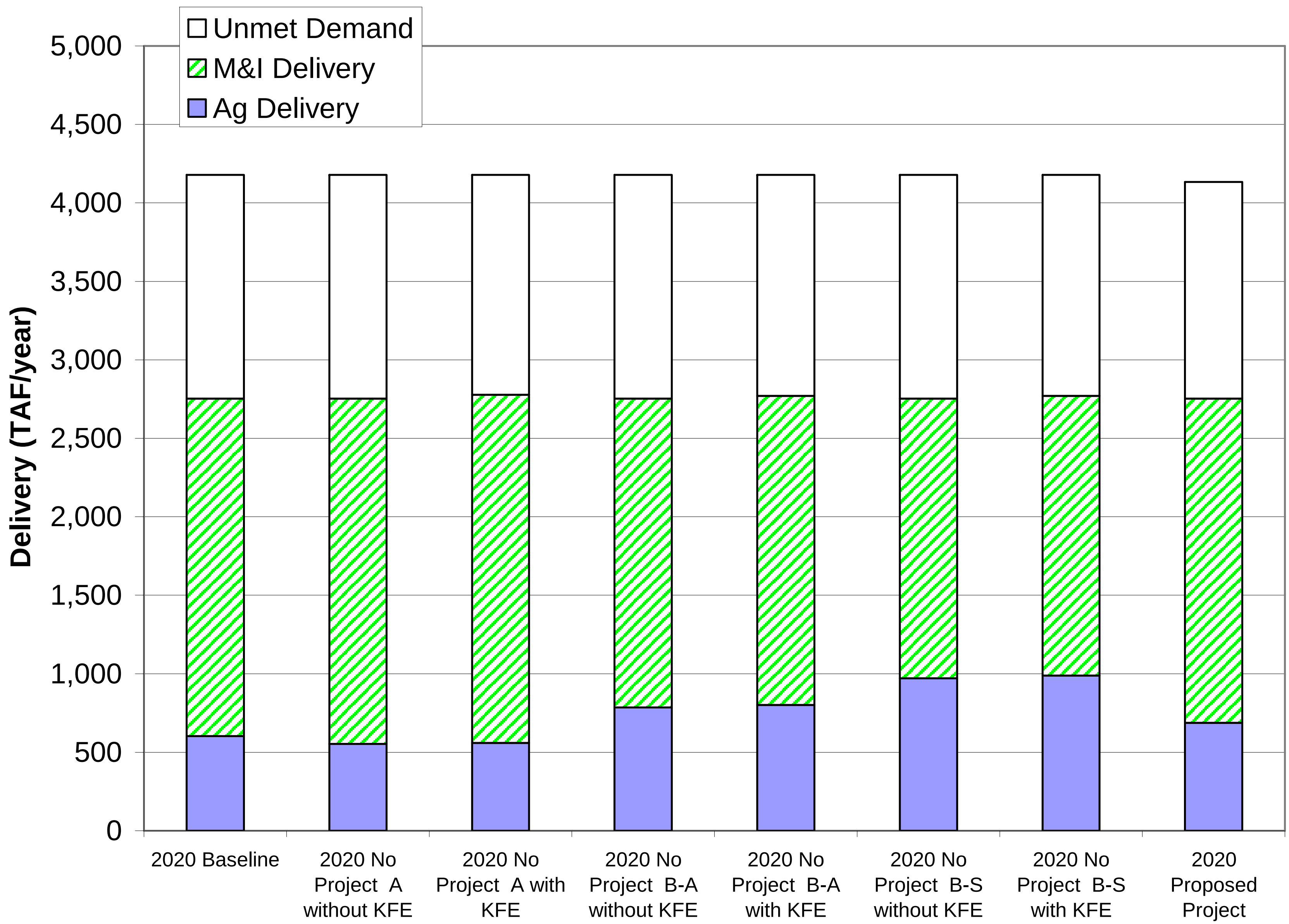


Figure 15f - Average Annual Scheduled SWP Deliveries in Critical Years in the 2020 Scenarios

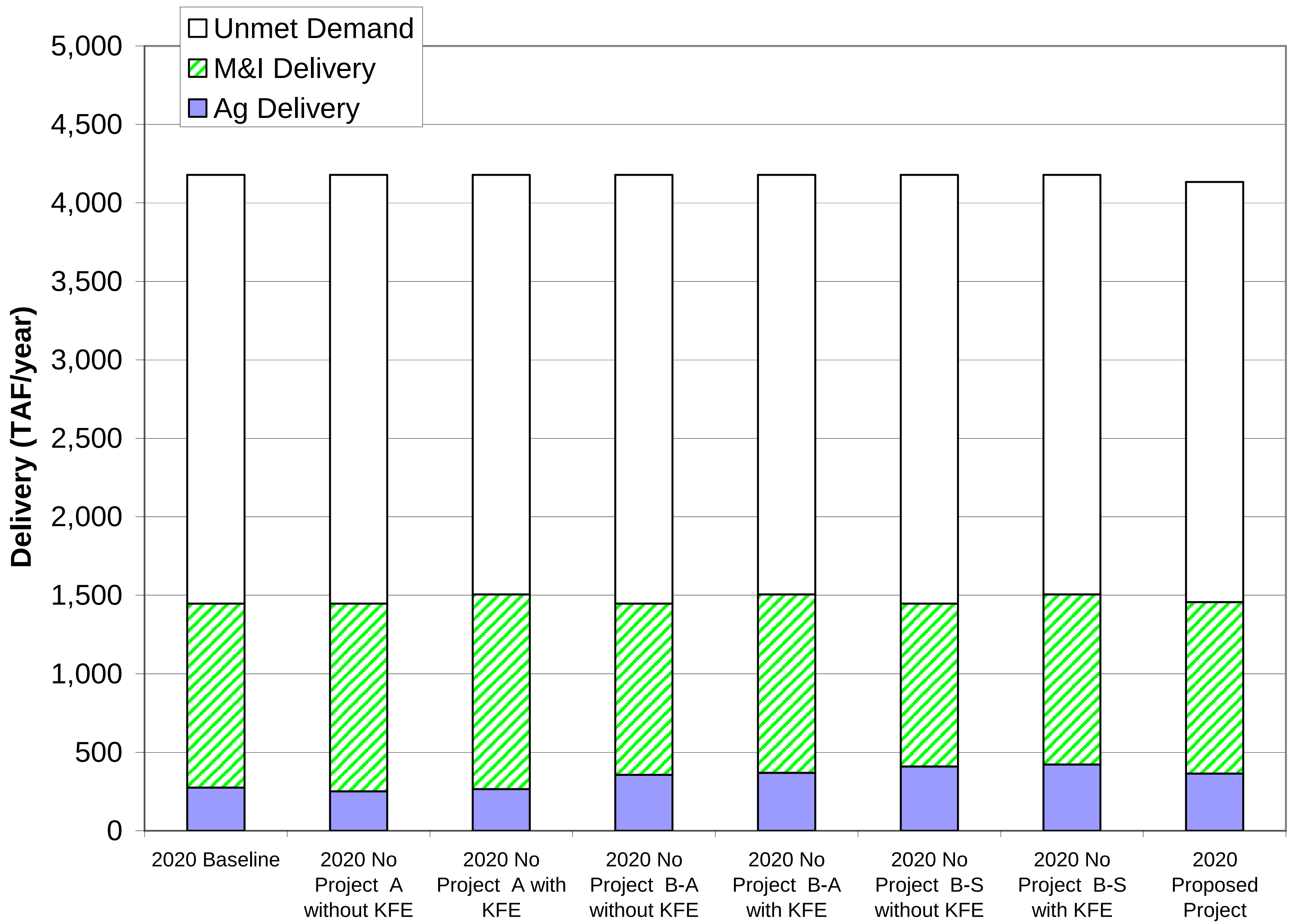


Table 15a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.7	1.0	1.0	0.8	1.0	0.8	1.0	0.8	1.7
Solano	1.8	1.1	1.1	0.9	1.1	0.9	1.1	0.9	2.1
Zone 7	1.9	1.1	1.2	1.1	1.1	1.1	1.1	1.1	2.2
Alameda	2.2	1.4	1.5	1.4	1.4	1.3	1.4	1.3	2.1
Santa Clara	8.2	5.0	5.3	4.8	5.0	4.6	5.0	4.6	7.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	3.1	2.1	2.2	2.2	2.1	2.1	2.1	2.1	2.2
Empire W.S.	2.5	1.6	1.7	1.6	1.6	1.5	1.6	1.5	1.0
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	143.6	99.6	104.1	103.1	99.6	97.4	99.6	97.4	81.8
Tulare	40.3	26.7	28.6	27.6	26.7	25.6	26.7	25.6	16.7
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.5	1.7	1.7	1.7	1.7	1.6	1.7	1.6	2.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.8	1.1	1.1	0.9	1.1	0.9	1.1	0.9	2.2
Coachella	4.5	2.9	3.1	2.8	2.9	2.6	2.9	2.6	2.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	10.6	6.8	6.9	6.3	6.8	6.1	6.8	6.1	5.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	171.1	119.3	123.8	119.6	119.3	116.3	119.3	116.3	164.0
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	189.4	130.1	136.6	134.4	130.1	126.7	130.1	126.7	101.6
Total M&I	206.4	141.3	146.7	140.4	141.3	136.3	141.3	136.3	192.3
Total	395.9	271.4	283.4	274.9	271.4	263.0	271.4	263.0	294.0

Table 15b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	3.1	2.1	2.0	1.7	2.1	1.7	2.1	1.7	3.1
Solano	3.3	2.3	2.3	2.0	2.3	2.0	2.3	2.0	4.2
Zone 7	3.5	2.3	2.4	2.3	2.3	2.2	2.3	2.2	4.3
Alameda	4.1	2.9	3.1	2.9	2.9	2.8	2.9	2.8	4.1
Santa Clara	15.2	10.5	11.0	10.1	10.5	9.8	10.5	9.8	13.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	5.6	4.2	4.3	4.3	4.2	4.1	4.2	4.1	4.3
Empire W.S.	4.6	3.2	3.4	3.2	3.2	3.0	3.2	3.0	1.9
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	265.2	198.2	207.0	203.8	198.2	194.4	198.2	194.4	152.0
Tulare	75.1	53.9	57.9	55.6	53.9	52.5	53.9	52.5	31.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	4.6	3.4	3.5	3.4	3.4	3.4	3.4	3.4	4.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	3.4	2.3	2.3	2.0	2.3	2.0	2.3	2.0	4.4
Coachella	8.4	6.0	6.2	5.8	6.0	5.4	6.0	5.4	4.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	19.6	14.3	14.1	13.0	14.3	12.9	14.3	12.9	11.1
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	261.0	215.4	213.6	210.3	215.4	211.9	215.4	211.9	304.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	350.5	259.6	272.5	267.0	259.6	254.0	259.6	254.0	190.0
Total M&I	326.2	261.6	260.5	253.5	261.6	254.0	261.6	254.0	358.5
Total	676.7	521.2	533.0	520.4	521.2	508.0	521.2	508.0	548.5

Table 15c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.6	0.7	0.7	0.5	0.7	0.5	0.7	0.5	1.8
Solano	1.8	0.7	0.7	0.6	0.7	0.5	0.7	0.5	2.2
Zone 7	2.0	0.7	0.9	0.8	0.7	0.7	0.7	0.7	2.3
Alameda	2.3	1.0	1.2	1.1	1.0	1.0	1.0	1.0	2.2
Santa Clara	8.6	3.6	4.1	3.5	3.6	3.2	3.6	3.2	7.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	3.7	2.3	2.4	2.3	2.3	2.3	2.3	2.3	2.3
Empire W.S.	2.8	1.5	1.8	1.5	1.5	1.2	1.5	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	162.9	101.1	105.8	104.5	101.1	98.0	101.1	98.0	86.5
Tulare	44.5	25.0	28.5	26.1	25.0	22.6	25.0	22.6	15.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.9	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.9	0.7	0.7	0.5	0.7	0.5	0.7	0.5	2.4
Coachella	5.0	2.6	3.0	2.7	2.6	2.2	2.6	2.2	3.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	11.9	5.7	6.5	5.4	5.7	4.8	5.7	4.8	5.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	221.2	109.4	127.8	116.9	109.4	104.2	109.4	104.2	173.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	213.9	130.0	138.5	134.5	130.0	124.0	130.0	124.0	104.7
Total M&I	259.1	126.7	147.2	133.6	126.7	119.3	126.7	119.3	203.4
Total	473.0	256.7	285.6	268.1	256.7	243.3	256.7	243.3	308.1

Table 15d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.8	0.7	0.8	0.6	0.7	0.6	0.7	0.6	1.3
Solano	1.9	0.8	0.9	0.7	0.8	0.7	0.8	0.7	1.4
Zone 7	2.0	0.9	1.1	1.0	0.9	0.8	0.9	0.8	1.5
Alameda	2.2	1.0	1.1	1.0	1.0	0.9	1.0	0.9	1.4
Santa Clara	8.4	3.8	4.2	3.8	3.8	3.5	3.8	3.5	5.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Empire W.S.	2.2	1.2	1.3	1.3	1.2	1.1	1.2	1.1	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	119.4	70.0	72.3	70.5	70.0	67.6	70.0	67.6	65.1
Tulare	34.4	18.8	19.5	19.4	18.8	18.1	18.8	18.1	14.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.3	1.2	1.3	1.2	1.2	1.1	1.2	1.1	1.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	2.0	0.8	0.8	0.7	0.8	0.7	0.8	0.7	1.5
Coachella	4.3	2.0	2.2	2.0	2.0	1.9	2.0	1.9	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	10.2	5.0	5.3	4.8	5.0	4.7	5.0	4.7	4.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	186.1	107.2	117.2	112.5	107.2	103.5	107.2	103.5	130.6
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	158.5	91.5	94.6	92.6	91.5	88.3	91.5	88.3	81.4
Total M&I	221.2	123.4	135.0	128.2	123.4	118.5	123.4	118.5	151.9
Total	379.7	214.9	229.6	220.9	214.9	206.8	214.9	206.8	233.3

Table 15e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	0.5	0.4	0.4	0.3	0.4	0.3	0.4	0.3	0.8
Solano	0.6	0.4	0.4	0.3	0.4	0.3	0.4	0.3	1.0
Zone 7	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1
Alameda	0.9	0.6	0.7	0.6	0.6	0.6	0.6	0.6	1.0
Santa Clara	3.1	2.2	2.3	2.0	2.2	2.0	2.2	2.0	3.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.4	0.9	1.0	1.1	0.9	0.9	0.9	0.9	1.1
Empire W.S.	1.1	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	66.6	46.2	49.9	53.0	46.2	45.6	46.2	45.6	40.7
Tulare	17.7	12.6	13.2	13.2	12.6	11.9	12.6	11.9	7.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.1	0.7	0.8	0.8	0.7	0.7	0.7	0.7	1.1
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.6	0.4	0.4	0.3	0.4	0.3	0.4	0.3	1.1
Coachella	1.7	1.2	1.3	1.2	1.2	1.0	1.2	1.0	1.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.9	2.8	2.8	2.4	2.8	2.3	2.8	2.3	2.7
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	91.5	65.8	68.7	65.5	65.8	63.4	65.8	63.4	81.7
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	86.9	60.5	64.9	68.1	60.5	59.1	60.5	59.1	49.7
Total M&I	104.4	75.0	78.3	73.9	75.0	71.3	75.0	71.3	95.7
Total	191.3	135.5	143.2	142.0	135.5	130.4	135.5	130.4	145.4

Table 15f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.4
Solano	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Zone 7	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Alameda	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Santa Clara	1.8	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	33.3	22.0	22.3	20.8	22.0	22.0	22.0	22.0	22.2
Tulare	9.1	5.9	5.9	5.7	5.9	5.9	5.9	5.9	5.3
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Coachella	1.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.2	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	50.4	35.1	35.2	34.4	35.1	35.1	35.1	35.1	44.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	43.6	28.8	29.1	27.4	28.8	28.8	28.8	28.8	28.2
Total M&I	57.9	40.2	40.3	39.5	40.2	40.2	40.2	40.2	51.9
Total	101.6	69.0	69.4	67.0	69.0	69.0	69.0	69.0	80.1

Figure 16a - Average Annual Unscheduled SWP Deliveries in the 1994 and 2003 Scenarios

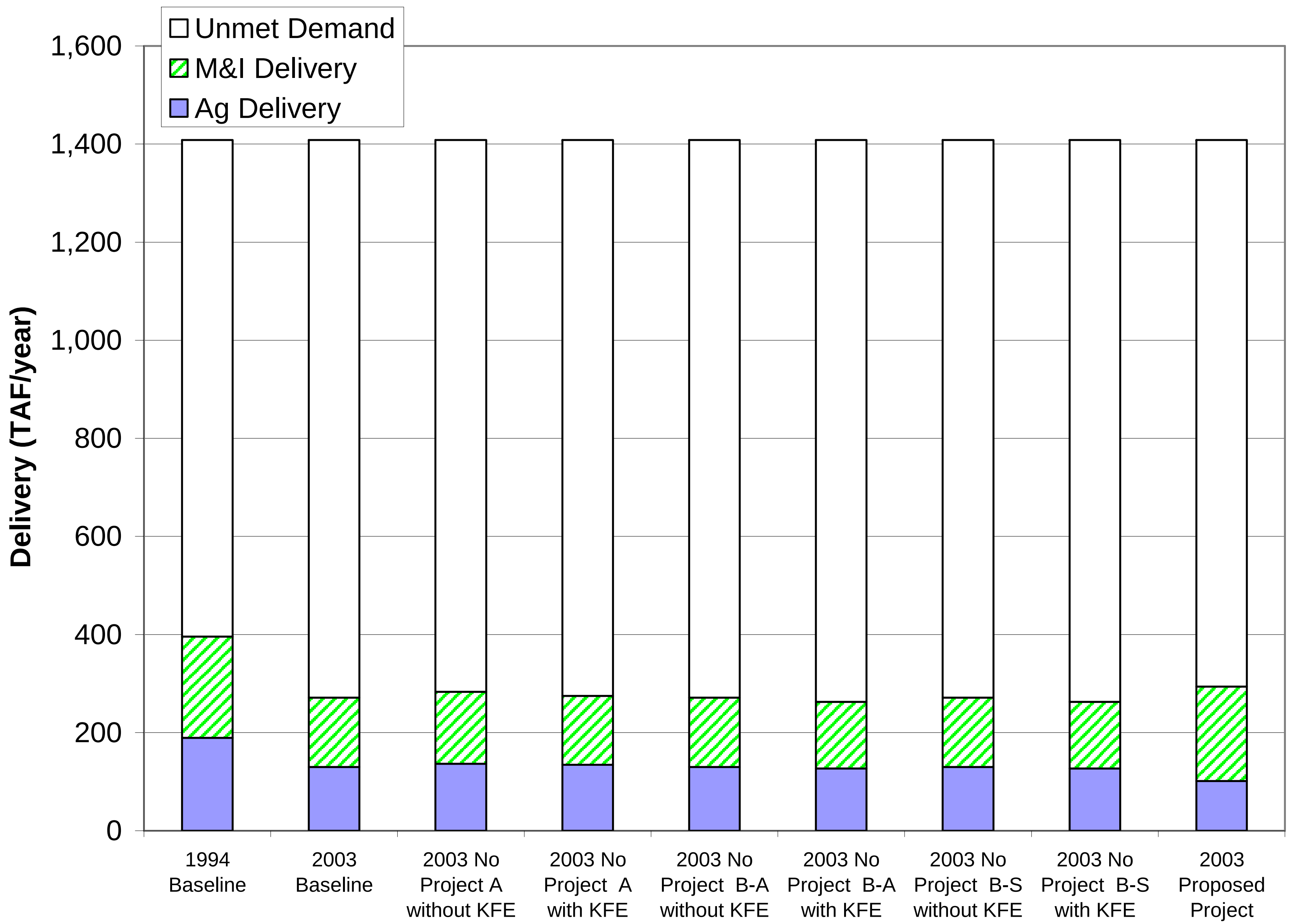


Figure 16b - Average Annual Unscheduled SWP Deliveries in Wet Years in the 1994 and 2003 Scenarios

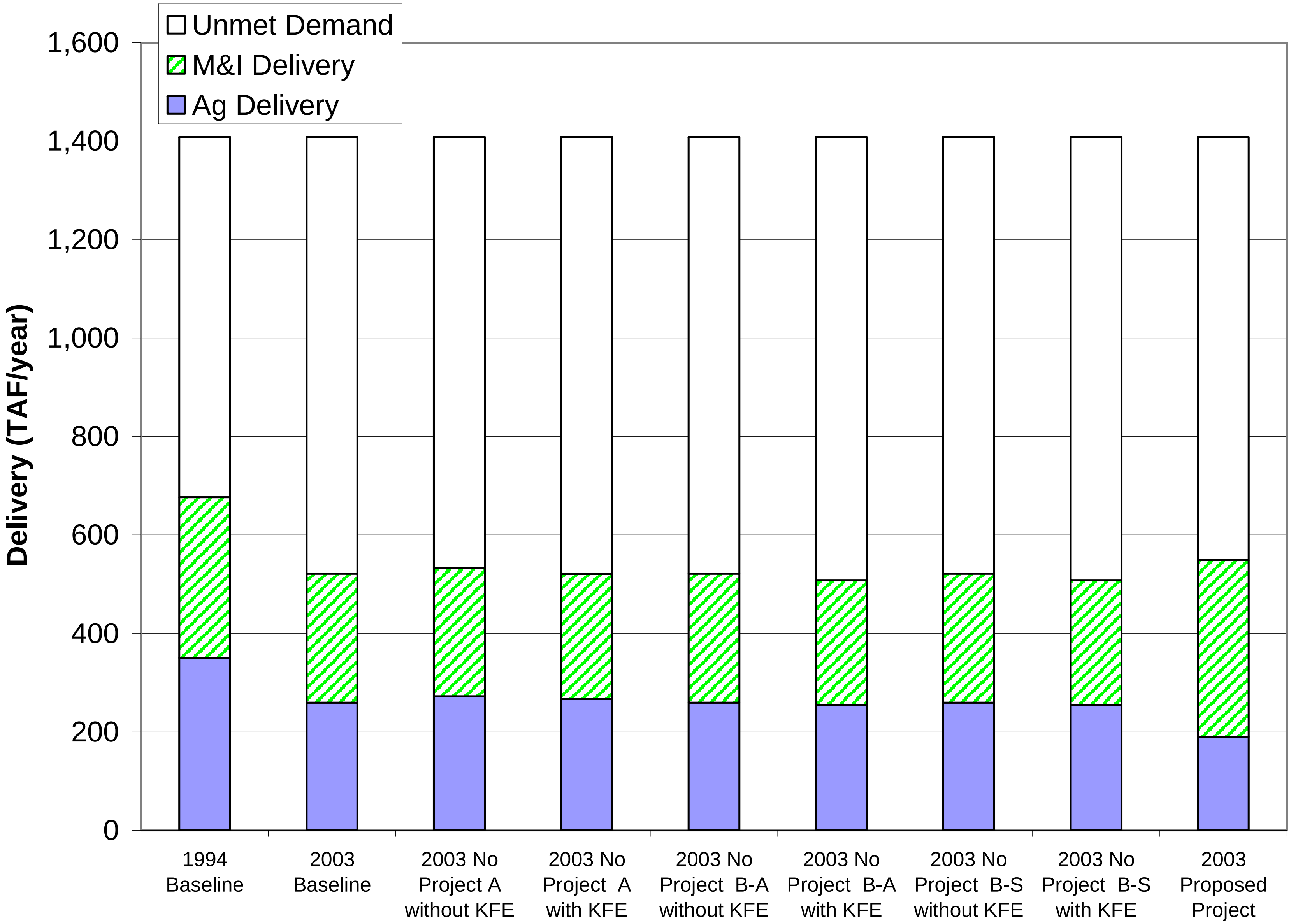


Figure 16c - Average Annual Unscheduled SWP Deliveries in Above Normal Years in the 1994 and 2003 Scenarios

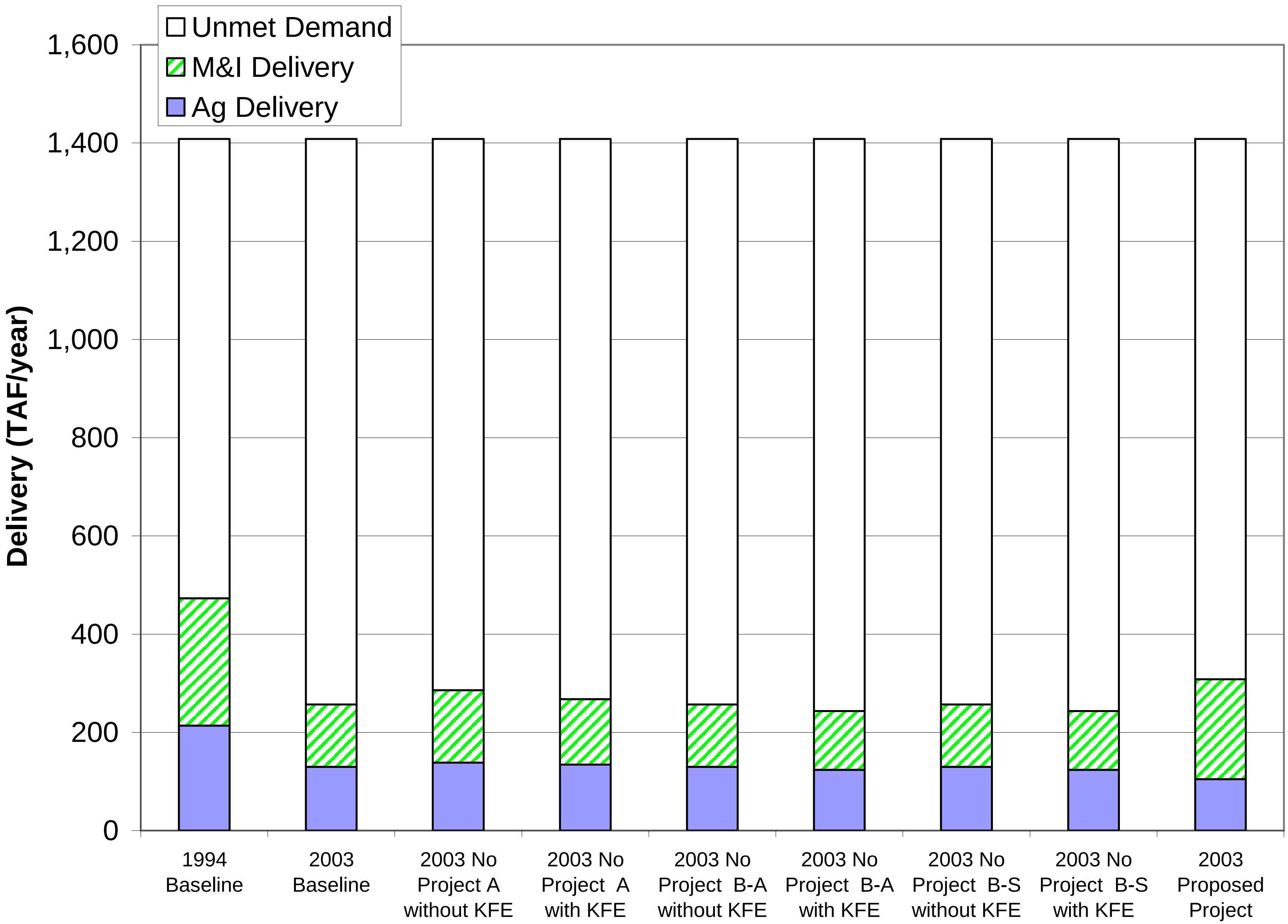


Figure 16d - Average Annual Unscheduled SWP Deliveries in Below Normal Years in the 1994 and 2003 Scenarios

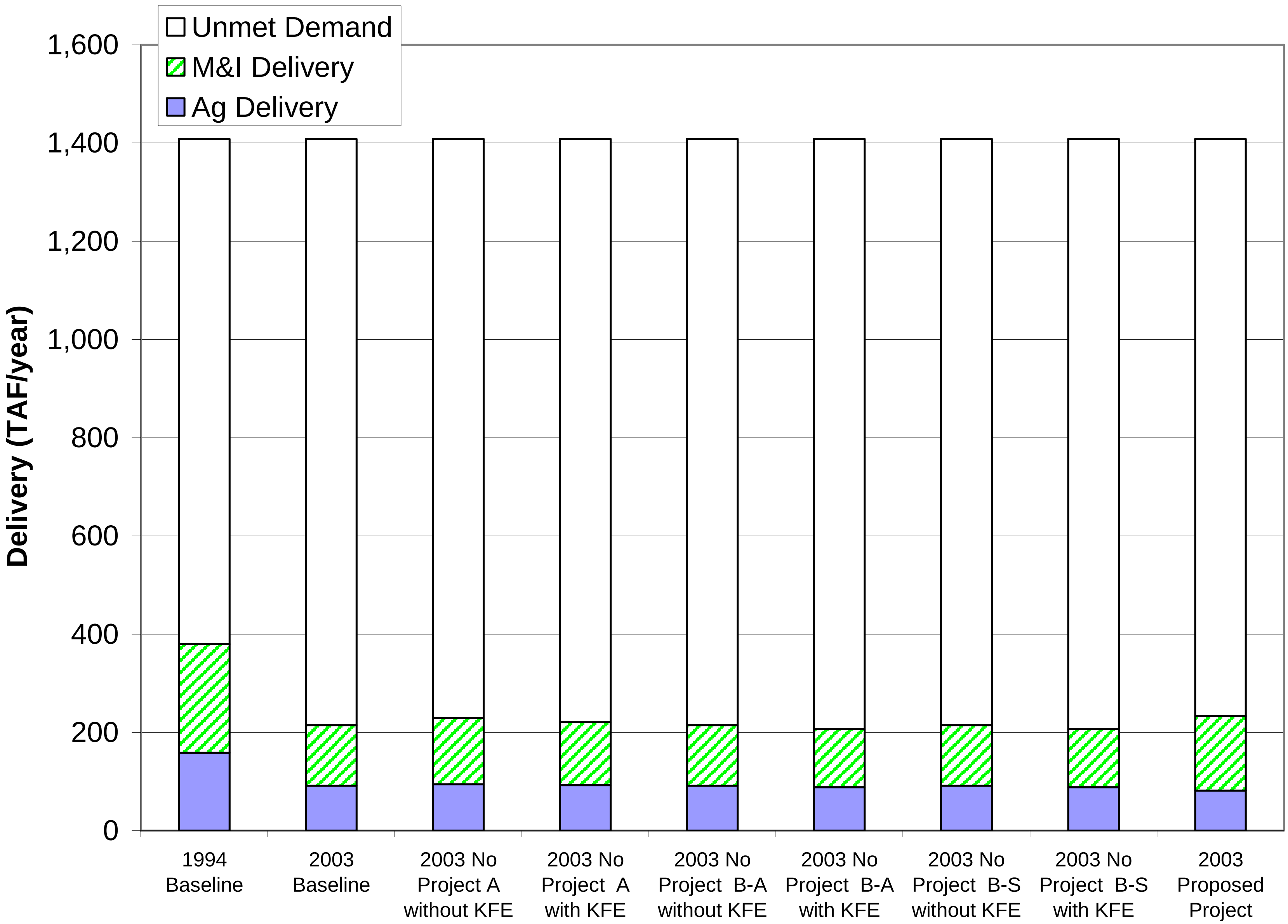


Figure 16e - Average Annual Unscheduled SWP Deliveries in Dry Years in the 1994 and 2003 Scenarios

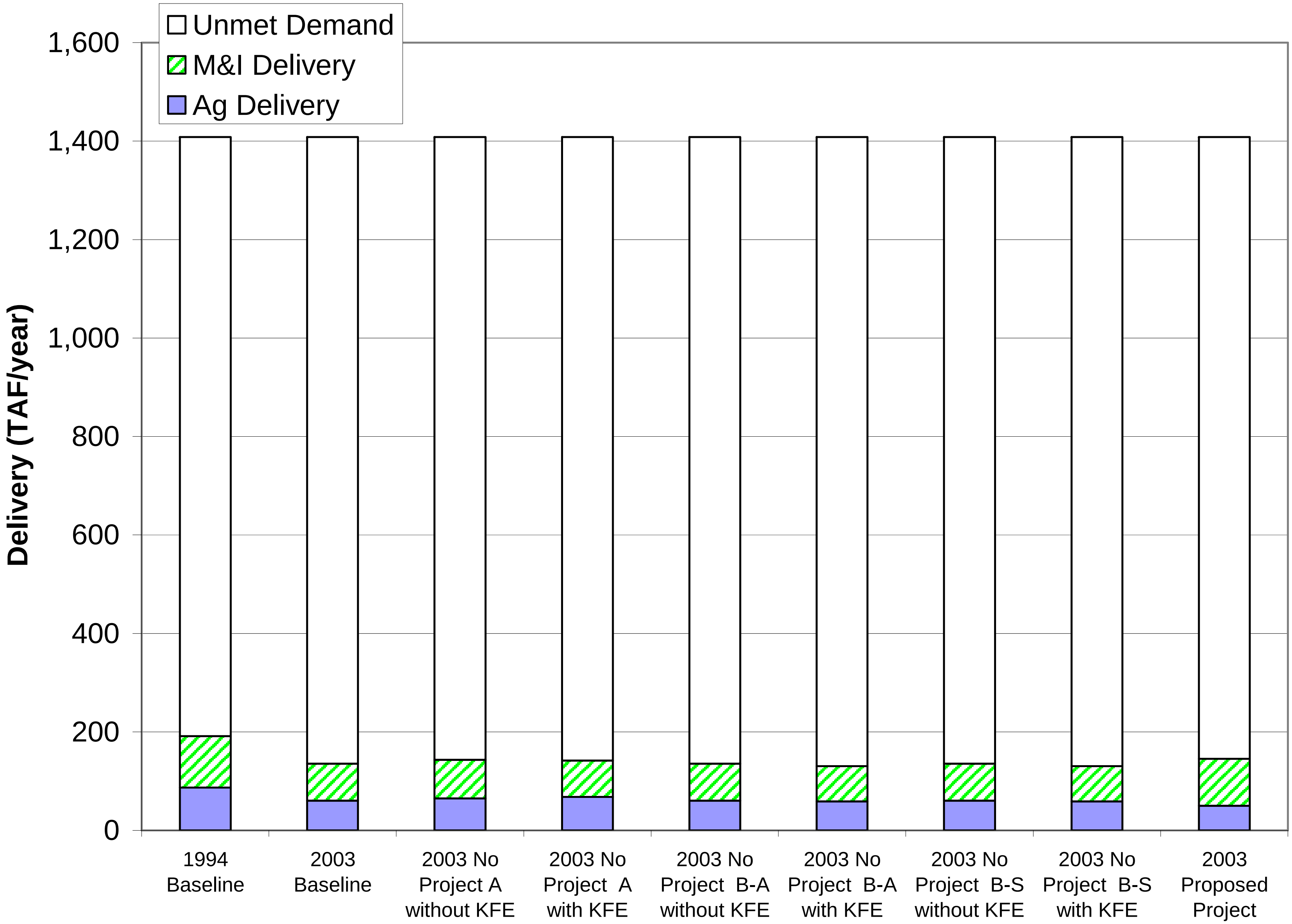


Figure 16f - Average Annual Unscheduled SWP Deliveries in Critical Years in the 1994 and 2003 Scenarios

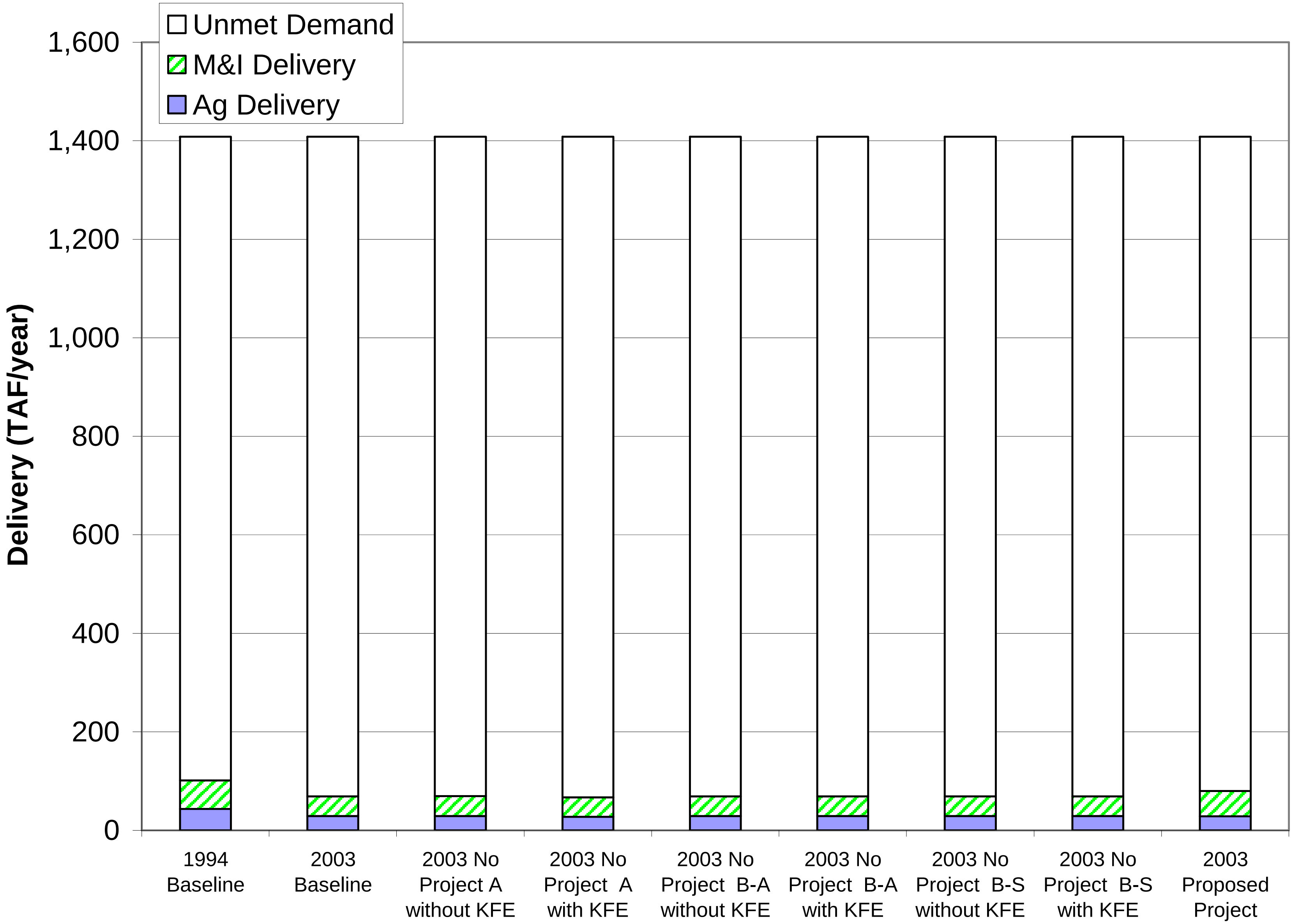


Table 16a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	1.3
Solano	0.3	0.3	0.2	0.3	0.2	0.3	0.2	1.5
Zone 7	0.4	0.5	0.4	0.4	0.3	0.4	0.3	1.6
Alameda	0.7	0.7	0.6	0.7	0.6	0.7	0.6	1.4
Santa Clara	2.2	2.3	1.8	2.2	1.9	2.2	1.9	4.9
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.6	1.6	1.5	1.6	1.5	1.6	1.5	1.5
Empire W.S.	1.1	1.1	1.0	1.1	1.0	1.1	1.0	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	70.7	70.8	66.2	70.7	66.7	70.7	66.7	54.2
Tulare	18.1	17.9	16.2	18.1	16.5	18.1	16.5	7.2
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.6
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.2	0.2	0.3	0.2	0.3	0.2	1.6
Coachella	1.9	2.0	1.7	1.9	1.7	1.9	1.7	3.1
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.6	3.6	3.2	3.6	3.2	3.6	3.2	3.6
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	74.6	74.5	66.4	74.6	67.2	74.6	67.2	88.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	91.5	91.5	84.8	91.5	85.7	91.5	85.7	63.2
Total M&I	85.3	85.3	75.5	85.3	76.4	85.3	76.4	109.0
Total	176.8	176.8	160.4	176.8	162.1	176.8	162.1	172.2

Table 16b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	2.3
Solano	0.3	0.3	0.1	0.3	0.2	0.3	0.2	2.7
Zone 7	0.5	0.6	0.4	0.4	0.3	0.5	0.4	2.9
Alameda	1.1	1.1	0.9	1.1	1.0	1.1	1.0	2.6
Santa Clara	3.3	3.3	2.6	3.3	2.7	3.3	2.7	8.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.7	2.8	2.6	2.7	2.6	2.7	2.6	2.8
Empire W.S.	1.6	1.6	1.5	1.6	1.5	1.6	1.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	118.6	118.9	109.4	118.6	111.2	118.6	111.2	92.5
Tulare	29.2	28.7	25.8	29.2	26.8	29.2	26.8	10.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.8	1.8	1.5	1.8	1.6	1.8	1.6	2.9
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.1	0.3	0.2	0.3	0.2	2.9
Coachella	3.3	3.3	2.9	3.3	3.0	3.3	3.0	5.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.7	5.7	5.1	5.7	5.3	5.7	5.3	6.0
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	107.2	107.0	95.9	107.2	96.8	107.2	96.8	133.9
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	152.1	152.0	139.3	152.1	142.1	152.1	142.1	106.4
Total M&I	123.6	123.6	109.7	123.5	111.1	123.6	111.2	170.3
Total	275.7	275.7	248.9	275.5	253.2	275.7	253.3	276.8

Table 16c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Solano	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.6
Zone 7	0.2	0.3	0.3	0.4	0.3	0.2	0.2	1.7
Alameda	0.7	0.7	0.7	0.7	0.6	0.7	0.6	1.6
Santa Clara	2.1	2.1	1.8	2.1	1.8	2.1	1.8	5.7
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.8	1.8	1.7	1.8	1.7	1.8	1.7	1.6
Empire W.S.	1.6	1.6	1.2	1.6	1.2	1.6	1.2	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	86.1	86.1	82.9	86.1	82.9	86.1	82.9	60.0
Tulare	24.3	24.3	20.4	24.3	20.5	24.3	20.5	5.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.9	1.0	0.9	1.0	0.9	1.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7
Coachella	2.0	2.0	1.8	2.0	1.8	2.0	1.8	3.3
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.7	3.7	3.2	3.7	3.2	3.7	3.2	3.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	94.0	93.9	78.8	94.0	78.9	94.0	78.9	115.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	113.8	113.8	106.2	113.8	106.3	113.8	106.3	67.6
Total M&I	103.8	103.9	87.6	104.0	87.7	103.8	87.5	138.2
Total	217.7	217.7	193.8	217.8	194.0	217.7	193.8	205.8

Table 16d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	1.1
Solano	0.3	0.3	0.1	0.3	0.1	0.3	0.1	1.2
Zone 7	0.4	0.5	0.4	0.4	0.3	0.4	0.3	1.2
Alameda	0.7	0.7	0.6	0.7	0.6	0.7	0.6	1.2
Santa Clara	2.3	2.4	1.7	2.3	1.7	2.3	1.7	4.2
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.2
Empire W.S.	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	61.3	61.4	56.7	61.3	56.7	61.3	56.7	48.3
Tulare	16.1	16.0	14.4	16.1	14.5	16.1	14.5	7.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.8	1.0	0.8	1.0	0.8	1.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.1	0.3	0.1	0.3	0.1	1.3
Coachella	1.8	1.8	1.5	1.8	1.5	1.8	1.5	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.4	3.4	2.8	3.4	2.8	3.4	2.8	3.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	70.9	70.8	61.6	70.9	63.9	70.9	63.9	75.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	79.7	79.7	73.3	79.7	73.5	79.7	73.5	56.8
Total M&I	81.3	81.3	69.8	81.2	72.1	81.3	72.1	92.7
Total	161.0	161.0	143.1	161.0	145.5	161.0	145.5	149.4

Table 16e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.6
Solano	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.6
Zone 7	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.7
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Santa Clara	1.4	1.4	1.2	1.4	1.1	1.4	1.1	2.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	37.4	37.6	35.0	37.4	34.9	37.4	34.9	23.7
Tulare	8.9	8.8	8.5	8.9	8.7	8.9	8.7	4.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.8
Coachella	1.0	1.1	0.9	1.0	0.9	1.0	0.9	1.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.9	1.9	1.6	1.9	1.6	1.9	1.6	1.8
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	45.8	45.7	41.1	45.8	41.2	45.8	41.2	46.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	47.7	47.7	44.9	47.7	44.9	47.7	44.9	28.7
Total M&I	51.9	51.9	46.4	52.0	46.5	51.9	46.4	56.2
Total	99.7	99.7	91.3	99.8	91.4	99.7	91.3	84.8

Table 16f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Solano	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Zone 7	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.5
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Santa Clara	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	24.6	24.6	24.6	24.6	24.6	24.6	24.6	25.9
Tulare	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Coachella	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.1
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	40.7	40.7	40.7	40.7	40.7	40.7	40.7	51.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
Total M&I	47.5	47.5	47.5	47.6	47.5	47.5	47.5	60.1
Total	80.2	80.2	80.2	80.2	80.1	80.2	80.2	92.9

Figure 17a - Average Annual Unscheduled SWP Deliveries in the 2020 Scenarios

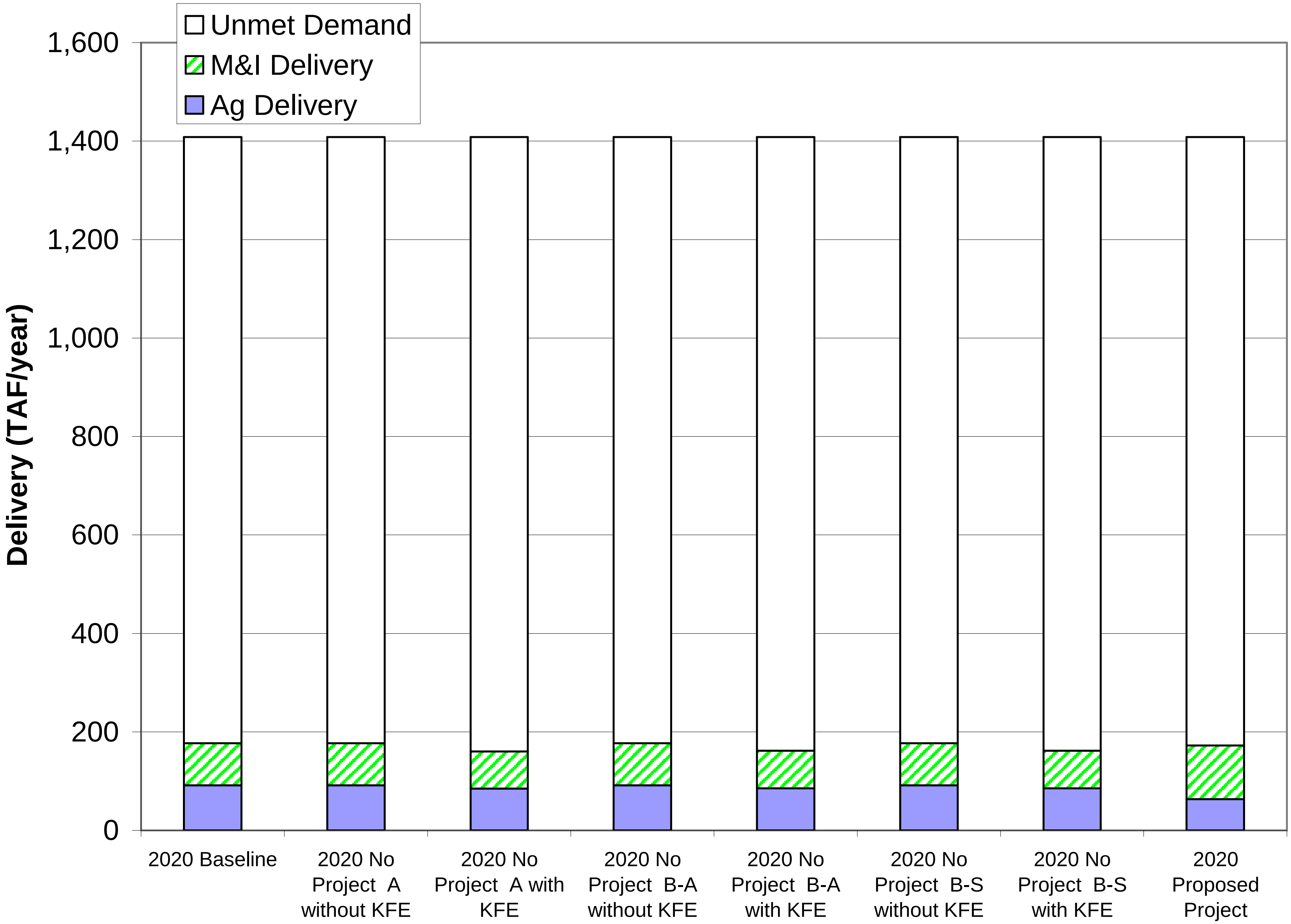


Figure 17b - Average Annual Unscheduled SWP Deliveries in Wet Years in the 2020 Scenarios

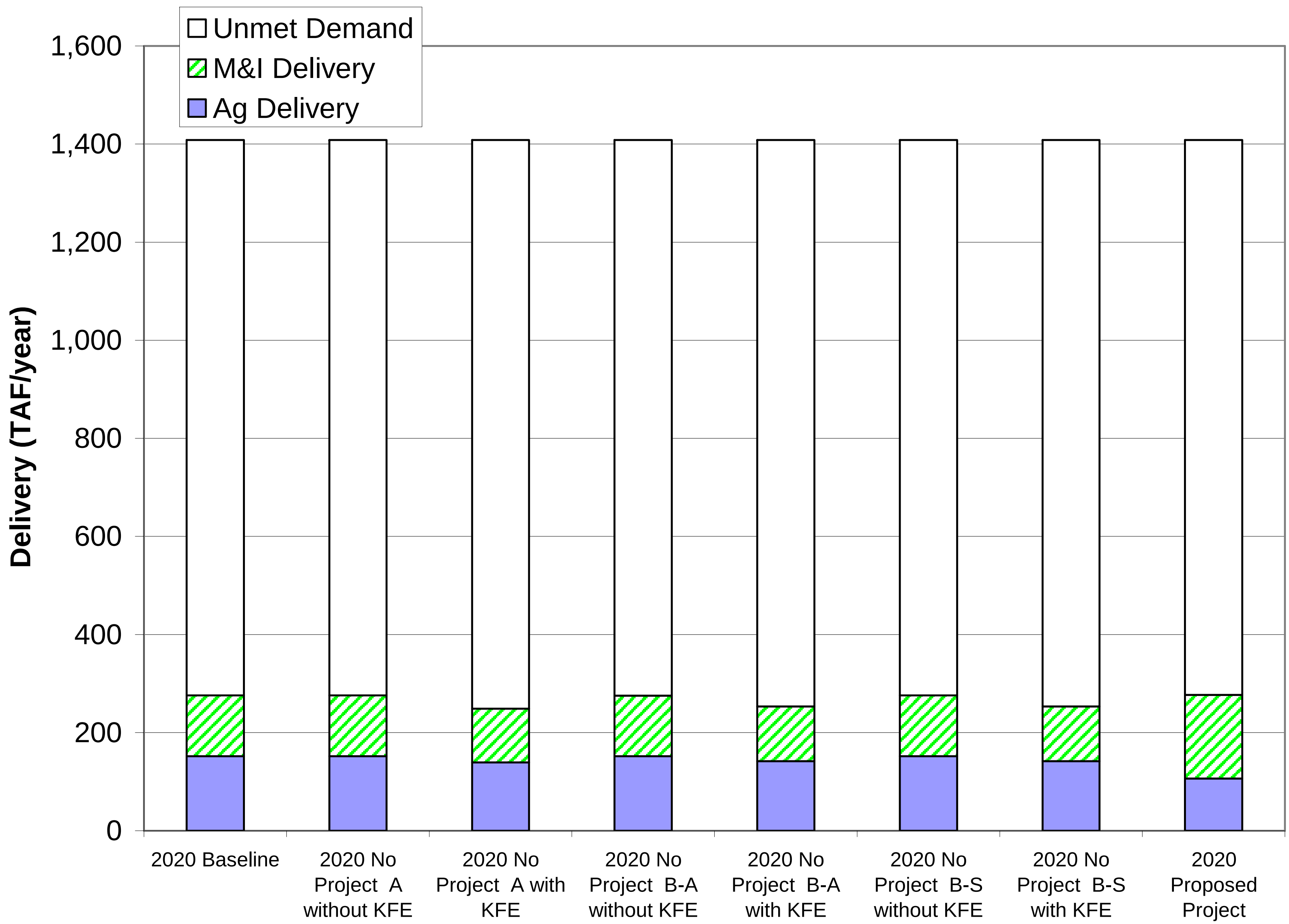


Figure 17c - Average Annual Unscheduled SWP Deliveries in Above Normal Years in the 2020 Scenarios

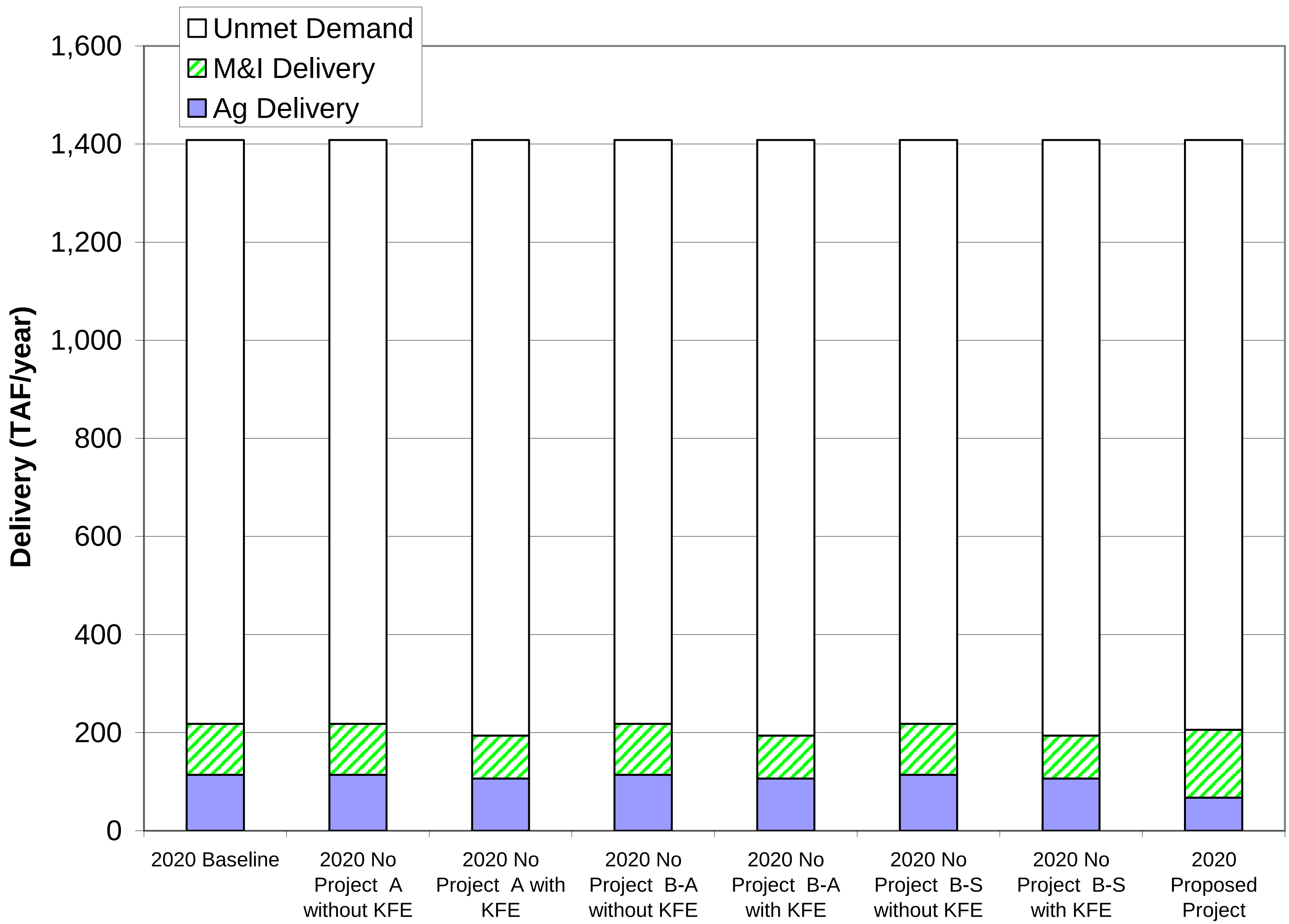


Figure 17d - Average Annual Unscheduled SWP Deliveries in Below Normal Years in the 2020 Scenarios

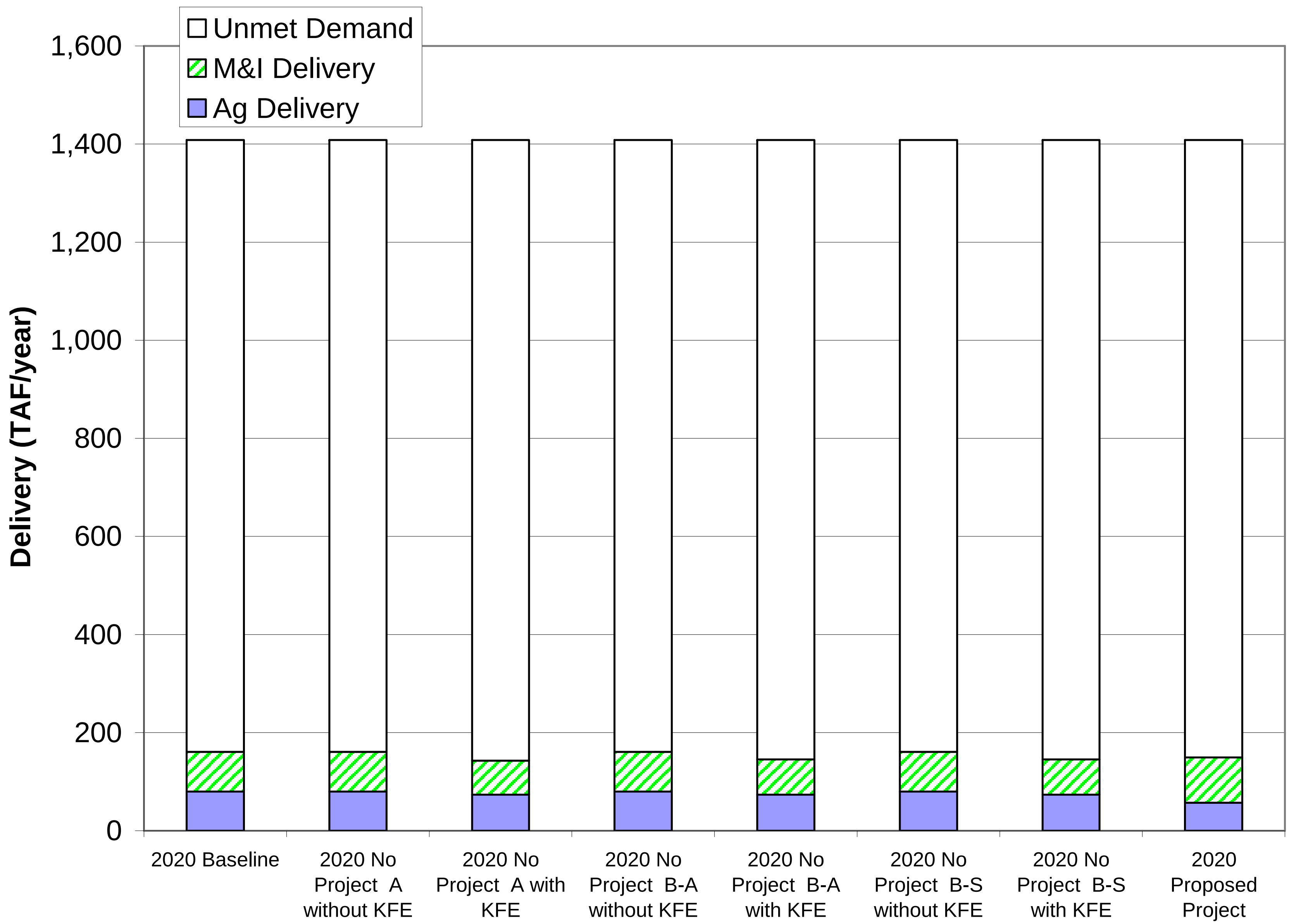


Figure 17e - Average Annual Unscheduled SWP Deliveries in Dry Years in the 2020 Scenarios

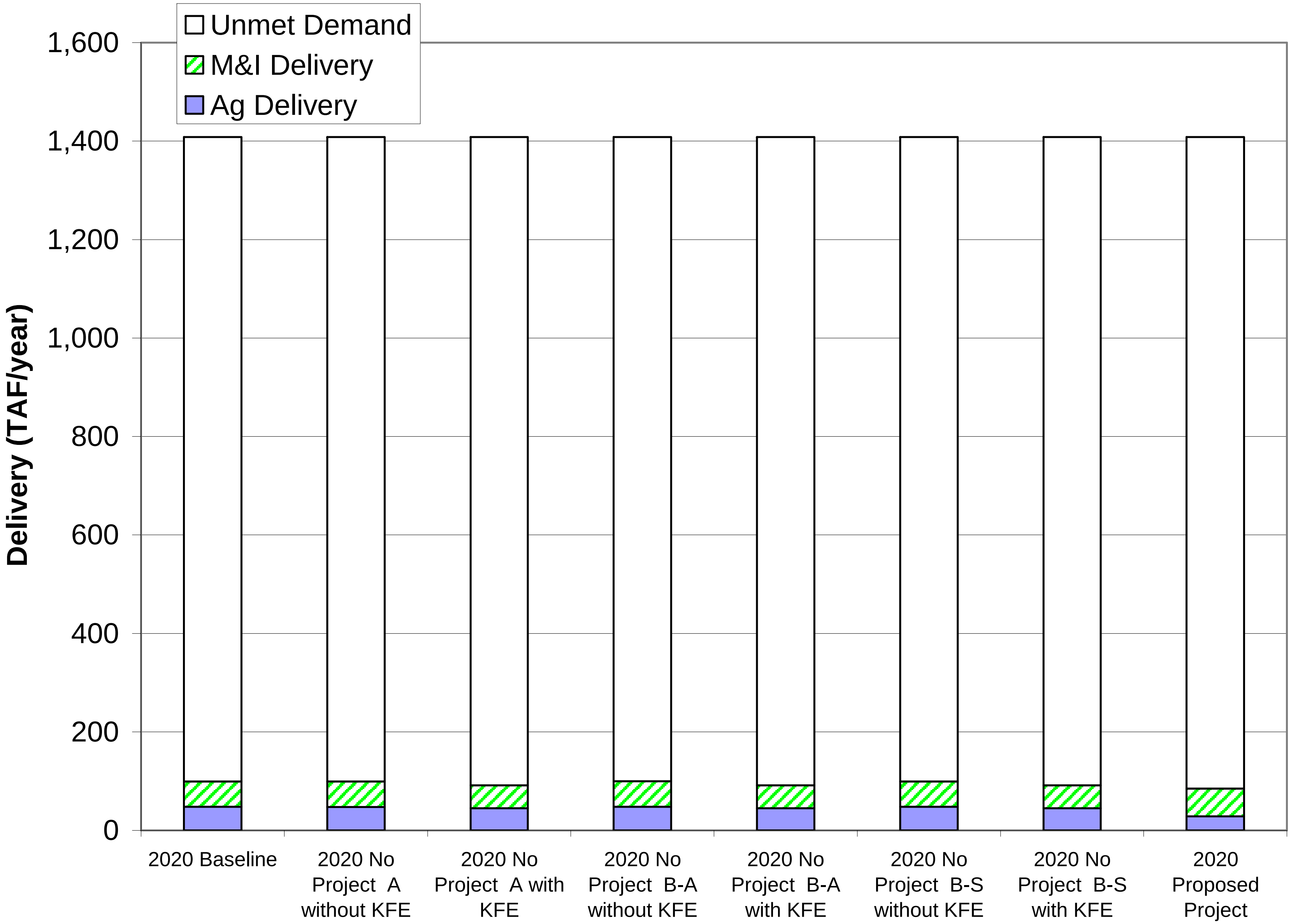
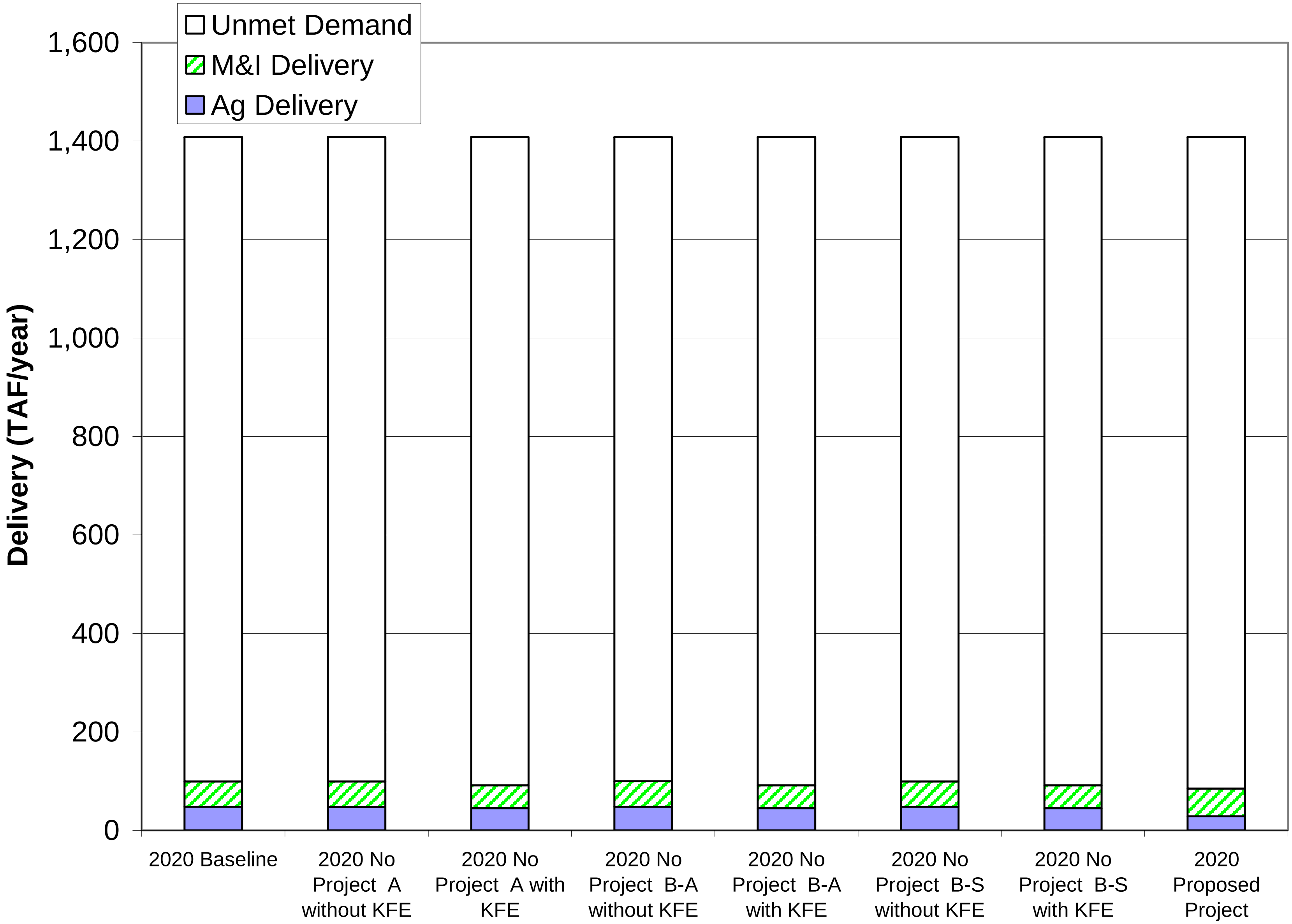


Figure 17f - Average Annual Unscheduled SWP Deliveries in Critical Years in the 2020 Scenarios



3.1.3. Article 18(a) Agricultural Deficiency in No Project Scenarios

Under Article 18(a) in the Baseline and No Project Alternatives, agricultural contractors receive an initial cut in Table A deliveries in years when SWP allocation is less than 100%. This cut can total up to 50% of their Table A amounts in any one year or up to a cumulative total of 100% of their Table A amounts over any seven year period. Table 17 shows the average annual agricultural deficiency in each Baseline and No Project scenario and the number of years in which deficiencies occurred in each scenario. Figures 18a through 18c show the frequency distribution of agricultural deficiencies and Figures 19a through 19c show the cumulative deficiencies throughout the course of the simulation at each level of development.

Table 17 - Agricultural Deficiency in each No Project Scenario

Scenario	Number of Years with Agricultural Deficiency	Average Annual Agricultural Deficiency (TAF/year)
1994 Baseline	19	77.3
2003 Baseline	33	92.4
2003 No Project A without KFE	20	87.4
2003 No Project A with KFE	20	87.4
2003 No Project B without KFE	7	20.9
2003 No Project B with KFE	5	20.7
2020 Baseline	29	148.5
2020 No Project A without KFE	29	148.5
2020 No Project A with KFE	29	148.5
2020 No Project B without KFE	8	23.8
2020 No Project B with KFE	7	21.1

There are larger agricultural deficiencies at the 2020 level of development as compared to the 1994 and 2003 levels of development because M&I demands increase and therefore reduce the amount of water available for delivery to agriculture.

Agricultural deficiencies are similar in the Baseline and No Project Alternative A scenarios at each level of development. In the 2003 level of development, the Baseline has more years with agricultural deficiencies than in No Project Alternative A, but the quantities during these additional years are small, resulting in only minor differences in average and cumulative agricultural deficiencies.

Agricultural deficiencies occur more often in the Baseline and No Project Alternative A as compared to No Project Alternative B. In No Project Alternative B Table A amounts are reduced, which greatly reduces the number of years in which Table A allocations are less than 100%.

Figure 18a - Frequency of Article 18(a) Agricultural Deficiency at the 1994 Level of Development

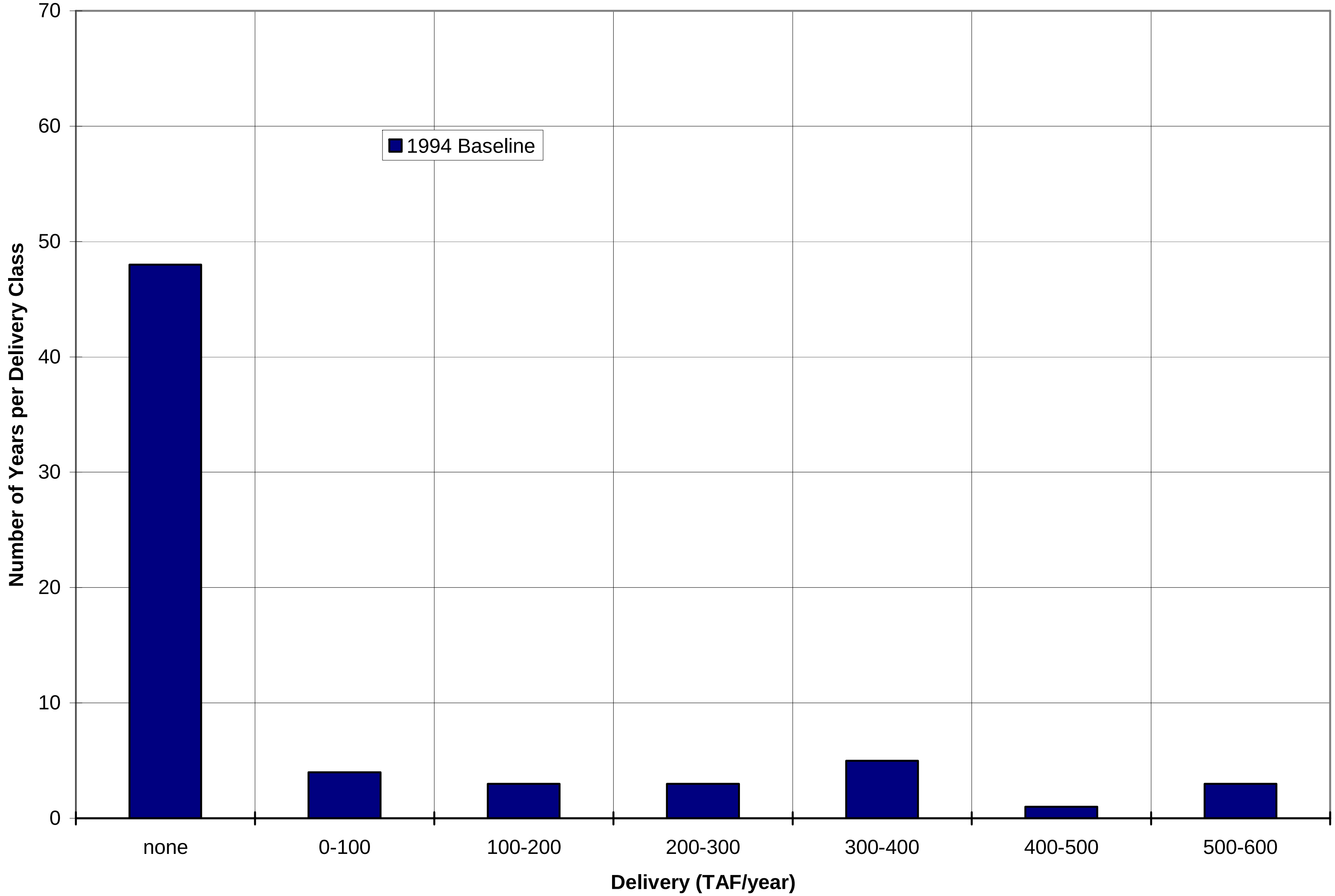


Figure 18b - Frequency of Article 18(a) Agricultural Deficiency at the 2003 Level of Development

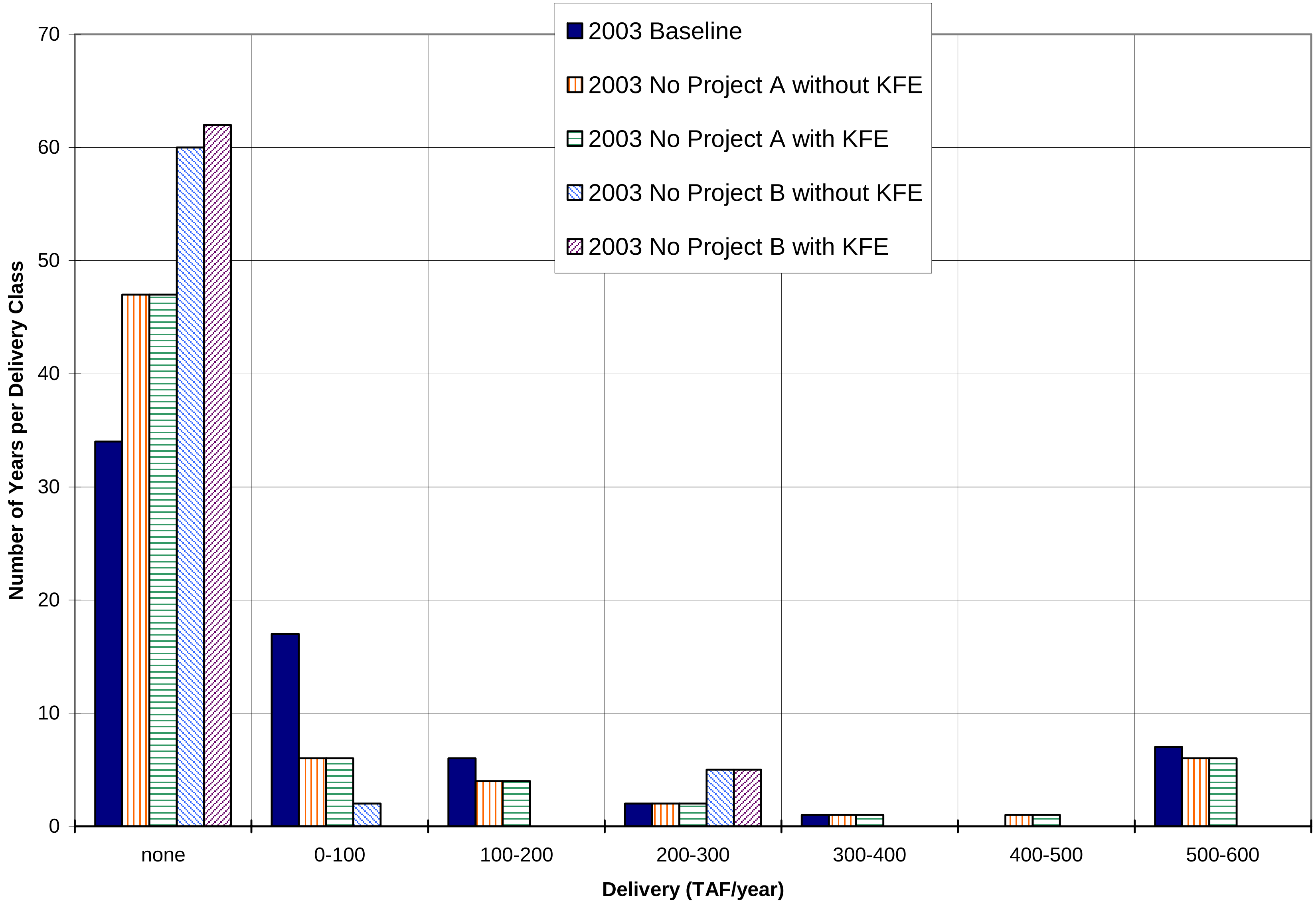


Figure 18c - Frequency of Article 18(a) Agricultural Deficiency at the 2020 Level of Development

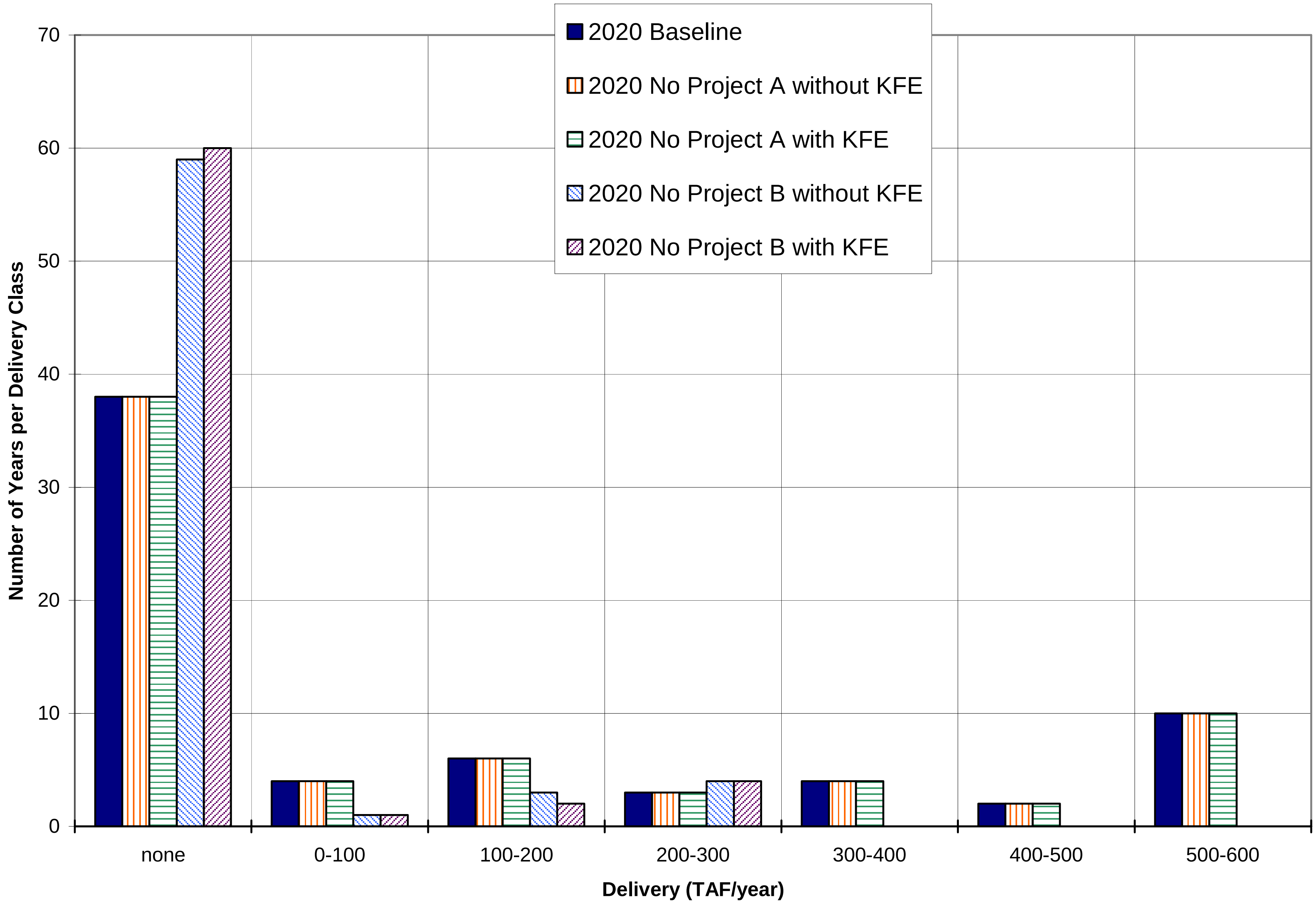


Figure 19a - Cumulative Article 18(a) Agricultural Deficiency at the 1994 Level of Development

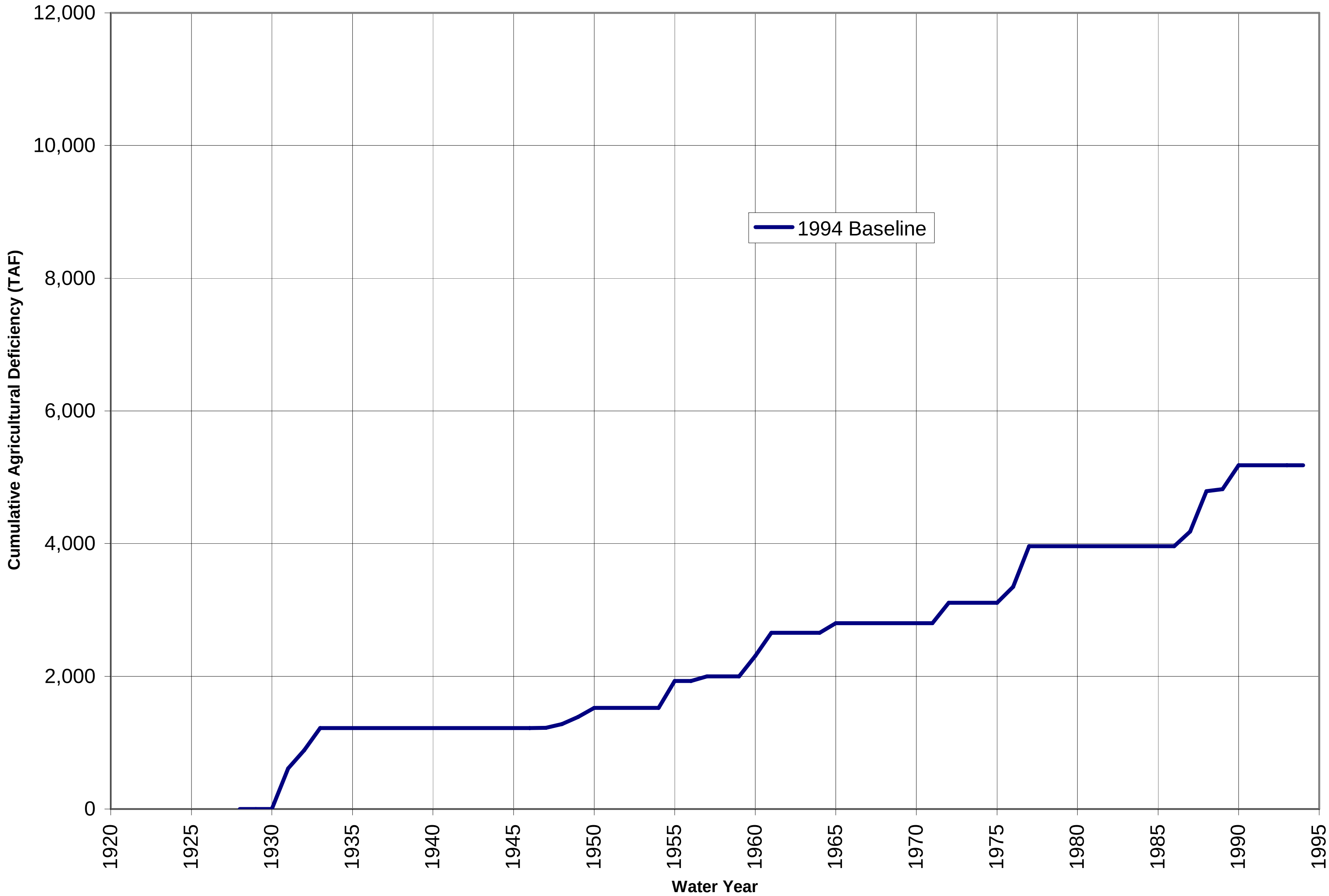


Figure 19b - Cumulative Article 18(a) Agricultural Deficiency at the 2003 Level of Development

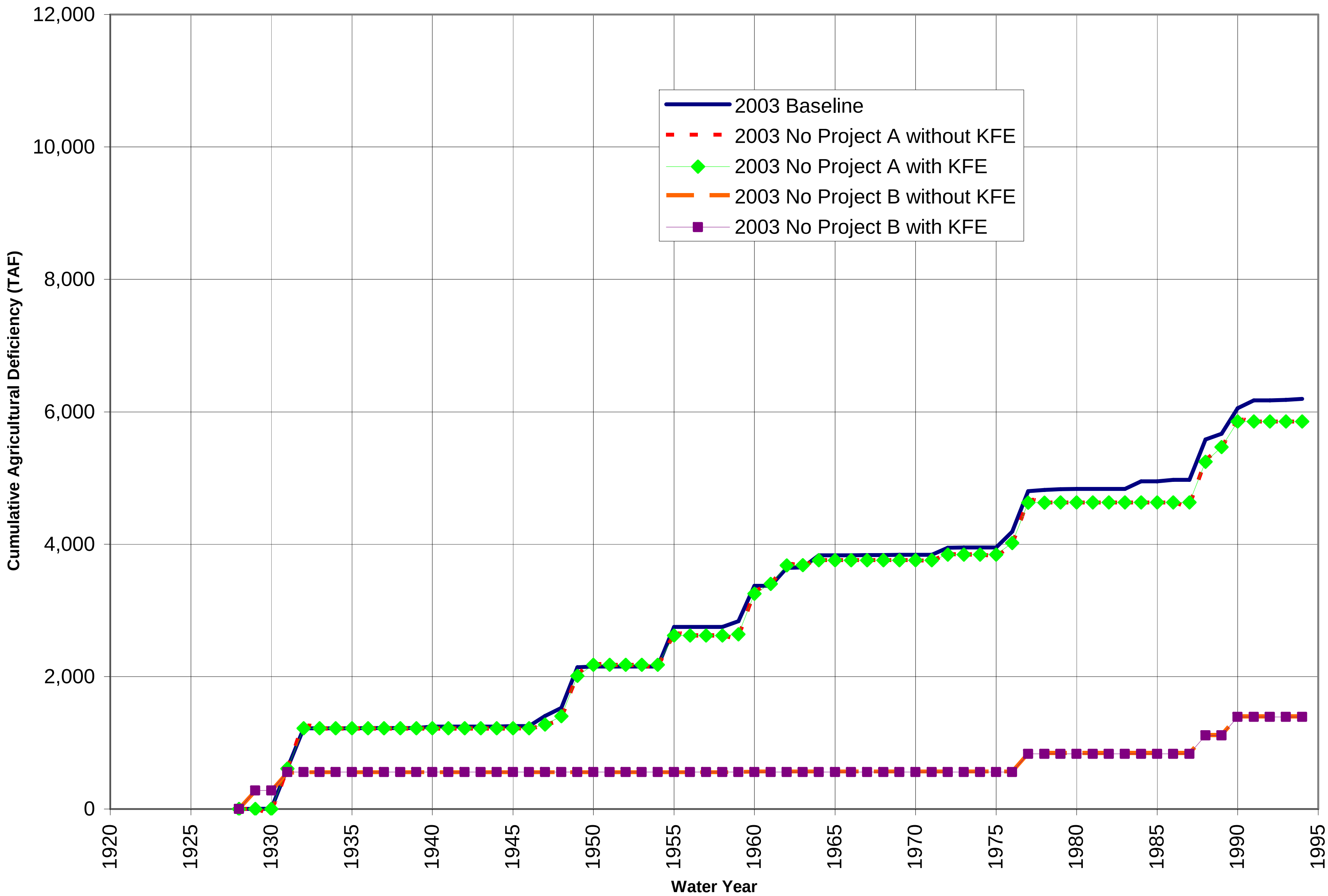
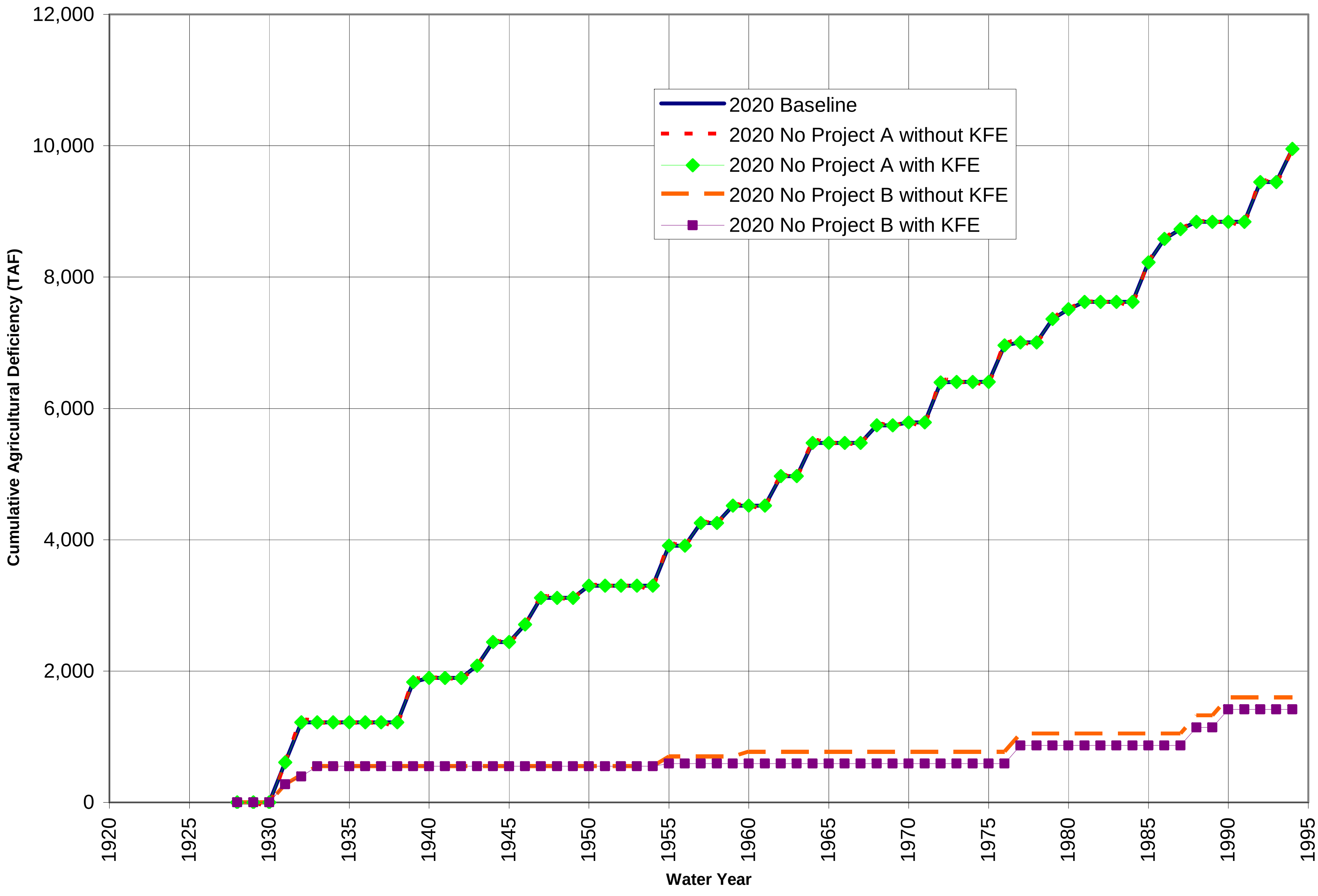


Figure 19c - Cumulative Article 18(a) Agricultural Deficiency at the 2020 Level of Development



3.1.4. Differences Between the Baseline and the Proposed Project and No Project Alternatives

Tables 18a through 18d show the difference in average annual scheduled deliveries to each contractor at the 2003 level of development in each scenario relative to the Baseline for all years and for dry and critical years. Tables 19a through 19d show the same information for the 2020 scenarios.

In both 2003 and 2020, M&I contractors receive more scheduled deliveries in the No Project A scenario and the Proposed Project scenario than in the Baseline, while agricultural contractors receive less deliveries in the No Project A scenario and the Proposed Project scenario than in the Baseline. In the No Project B scenarios, agricultural contractors receive more scheduled deliveries and M&I contractors receive less relative to the Baseline. In No Project Alternative A, this occurs because of Table A transfers from agricultural contractors to M&I contractors. In the Proposed Project, there are more Table A transfers than in No Project Alternative A, but the increase in M&I deliveries is less because the Table A allocation rules shift from those in which M&I contractors receive priority in deliveries to those in which agricultural and M&I contractors share cuts equally. In the No Project B scenarios, the XA Amount allocation rules result in greater deliveries to agricultural contractors than occur under the Baseline, with the increase in agricultural deliveries and reduction in M&I deliveries being greatest in No Project Alternative B-S.

Table 18a - Change in Average Annual Scheduled Deliveries from the Baseline at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project A	2003 No Project A without KFE		2003 No Project A with KFE		2003 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	6.8	6.4	6.8	6.5	0.0	6.5	0.0	6.8	6.4	0.0
Solano	37.7	34.2	37.7	34.2	0.0	34.4	0.2	37.7	34.3	0.0
Zone 7	46.0	40.8	66.5	57.3	16.2	57.5	16.3	66.5	59.3	18.5
Alameda	35.2	31.9	35.2	31.9	0.0	32.0	0.1	35.2	35.2	3.3
Santa Clara	84.7	76.6	84.7	76.7	0.1	76.9	0.4	84.7	75.3	-1.3
Oak Flat	5.7	4.3	5.7	4.5	0.1	4.5	0.1	5.7	4.7	0.3
Kings	4.0	3.0	9.0	7.1	0.2	7.2	0.2	9.0	7.3	4.3
Dudley Ridge	57.7	43.9	61.7	48.2	1.0	48.3	1.1	57.3	46.8	3.0
Empire W.S.	3.0	2.3	3.0	2.3	0.1	2.3	0.1	3.0	2.4	0.2
KCWA (M&I)	134.6	119.4	134.6	119.5	0.0	119.8	0.4	134.6	117.8	-1.6
KCWA (Agric.)	1,018.8	774.7	945.8	736.8	-41.5	738.0	-40.3	864.1	705.7	-69.0
Tulare	118.5	90.1	96.3	74.6	1.6	74.7	1.8	96.3	78.6	-11.5
SLO	4.4	4.3	4.4	4.3	0.0	4.3	0.0	4.4	4.2	0.0
Santa Barbara	26.3	25.2	26.3	25.2	0.0	25.3	0.1	26.3	24.9	-0.2
AVEK	64.9	61.8	64.9	61.8	0.0	62.1	0.3	64.9	61.3	-0.5
Castaic (Agric.)	12.7	9.7	12.7	9.9	0.2	9.9	0.2	12.7	10.4	0.7
Castaic (M&I)	41.5	36.8	41.5	36.8	0.0	36.9	0.1	68.6	61.1	24.3
Coachella	19.3	17.5	19.3	17.5	0.0	17.6	0.1	19.3	17.8	0.3
Crestline	1.9	1.9	1.9	1.9	0.0	1.9	0.0	1.9	1.8	0.0
Desert	31.2	28.3	31.2	28.3	0.0	28.4	0.1	31.2	27.8	-0.5
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.0	13.2	13.0	0.0	13.1	0.0	13.2	13.0	0.0
MWDSC	2,011.5	1,310.0	2,011.5	1,311.4	1.2	1,315.5	5.4	2,011.5	1,284.6	-25.4
Palmdale	14.9	13.5	14.9	13.5	0.0	13.5	0.1	14.9	13.5	0.1
San Bernardino	69.8	64.4	69.8	64.5	0.1	64.7	0.3	69.8	63.5	-0.9
San Gabriel	18.1	16.8	18.1	16.8	0.0	16.9	0.1	18.1	16.6	-0.2
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0
Ventura	5.0	4.9	5.0	4.9	0.0	4.9	0.0	5.0	4.9	0.0
Total Agriculture	1,220.4	928.0	1,134.2	883.5	-38.3	884.9	-36.8	1,048.1	855.9	-72.1
Total M&I	2,667.1	1,907.7	2,687.6	1,926.1	17.8	1,932.2	23.9	2,714.7	1,923.6	15.9
Total	3,887.5	2,835.7	3,821.8	2,809.7	-20.4	2,817.2	-12.9	3,762.8	2,779.5	-56.2

Table 18b - Change in Average Annual Scheduled Deliveries from the Baseline at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project B	2003 No Project B-A without KFE		2003 No Project B-A with KFE		2003 No Project B-S without KFE		2003 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	6.8	6.4	6.8	6.4	0.0	6.4	0.0	7.2	0.8	7.2	0.8
Solano	37.7	34.2	37.7	33.3	-0.9	33.4	-0.8	30.4	-3.8	30.5	-3.7
Zone 7	46.0	40.8	46.0	38.3	-2.6	38.3	-2.5	36.8	-4.0	36.8	-4.0
Alameda	35.2	31.9	35.2	30.8	-1.0	30.9	-1.0	29.9	-2.0	29.9	-1.9
Santa Clara	84.7	76.6	84.7	74.0	-2.6	74.2	-2.4	71.7	-4.9	71.8	-4.8
Oak Flat	5.7	4.3	5.7	4.6	0.3	4.6	0.3	5.2	0.9	5.3	0.9
Kings	4.0	3.0	4.0	3.2	0.2	3.3	0.2	3.7	0.7	3.7	0.7
Dudley Ridge	57.7	43.9	57.7	46.8	2.9	46.9	3.0	53.8	9.9	53.9	10.0
Empire W.S.	3.0	2.3	3.0	2.4	0.2	2.4	0.2	2.8	0.5	2.8	0.5
KCWA (M&I)	134.6	119.4	134.6	111.9	-7.5	112.2	-7.2	108.1	-11.3	108.4	-11.1
KCWA (Agric.)	1,018.8	774.7	1,018.8	826.8	52.1	828.5	53.8	834.2	59.5	836.1	61.4
Tulare	118.5	90.1	118.5	96.2	6.1	96.4	6.3	110.4	20.3	110.6	20.5
SLO	4.4	4.3	4.4	4.2	0.0	4.3	0.0	4.2	0.0	4.3	0.0
Santa Barbara	26.3	25.2	26.3	25.1	-0.1	25.2	0.0	24.5	-0.7	24.6	-0.6
AVEK	64.9	61.8	64.9	61.5	-0.3	61.8	0.0	61.4	-0.4	61.6	-0.2
Castaic (Agric.)	12.7	9.7	12.7	10.3	0.6	10.3	0.7	11.8	2.2	11.9	2.2
Castaic (M&I)	41.5	36.8	41.5	34.5	-2.3	34.6	-2.2	33.1	-3.7	33.2	-3.6
Coachella	19.3	17.5	19.3	16.9	-0.6	17.0	-0.5	16.6	-0.8	16.7	-0.8
Crestline	1.9	1.9	1.9	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0
Desert	31.2	28.3	31.2	27.5	-0.8	27.5	-0.8	27.0	-1.3	27.1	-1.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.0	13.2	13.0	0.0	13.1	0.0	13.0	0.0	13.1	0.0
MWDSC	2,011.5	1,310.0	2,011.5	1,268.2	-41.8	1,271.9	-38.0	1,250.8	-59.2	1,254.4	-55.6
Palmdale	14.9	13.5	14.9	13.0	-0.5	13.0	-0.5	12.5	-0.9	12.5	-0.9
San Bernardino	69.8	64.4	69.8	63.3	-1.1	63.5	-0.9	63.1	-1.3	63.3	-1.1
San Gabriel	18.1	16.8	18.1	16.6	-0.2	16.6	-0.2	16.5	-0.3	16.6	-0.2
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Ventura	5.0	4.9	5.0	4.9	0.0	4.9	0.0	4.9	0.0	4.9	0.0
Total Agriculture	1,220.4	928.0	1,220.4	990.4	62.4	992.4	64.4	1,021.9	93.9	1,024.3	96.3
Total M&I	2,667.1	1,907.7	2,667.1	1,845.3	-62.4	1,850.7	-57.0	1,813.8	-93.9	1,818.9	-88.8
Total	3,887.5	2,835.7	3,887.5	2,835.7	0.0	2,843.2	7.4	2,835.7	0.0	2,843.2	7.5

Table 18c - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project A	2003 No Project A without KFE		2003 No Project A with KFE		2003 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	6.8	5.8	6.8	5.9	0.0	6.0	0.1	6.8	5.7	-0.1
Solano	37.7	28.4	37.7	28.4	0.1	28.7	0.4	37.7	28.5	0.1
Zone 7	46.0	32.1	66.5	42.7	10.4	43.0	10.7	66.5	47.2	15.0
Alameda	35.2	26.2	35.2	26.4	0.1	26.7	0.4	35.2	35.2	9.0
Santa Clara	84.7	62.9	84.7	63.3	0.3	63.9	0.9	84.7	59.5	-3.4
Oak Flat	5.7	2.8	5.7	2.9	0.1	2.9	0.1	5.7	3.5	0.6
Kings	4.0	2.0	9.0	4.6	0.1	4.6	0.2	9.0	5.5	3.5
Dudley Ridge	57.7	28.7	61.7	31.7	0.9	31.9	1.1	57.3	34.8	6.1
Empire W.S.	3.0	1.5	3.0	1.5	0.0	1.6	0.1	3.0	1.8	0.3
KCWA (M&I)	134.6	93.9	134.6	94.0	0.1	94.9	0.9	134.6	89.6	-4.4
KCWA (Agric.)	1,018.8	506.2	945.8	486.0	-23.0	489.2	-19.8	864.1	524.4	18.2
Tulare	118.5	58.9	96.3	49.5	1.4	49.8	1.7	96.3	58.4	-0.5
SLO	4.4	4.0	4.4	4.0	0.0	4.1	0.1	4.4	3.9	-0.1
Santa Barbara	26.3	23.3	26.3	23.4	0.1	23.7	0.3	26.3	22.7	-0.6
AVEK	64.9	56.6	64.9	56.7	0.1	57.4	0.8	64.9	55.3	-1.3
Castaic (Agric.)	12.7	6.3	12.7	6.5	0.2	6.6	0.2	12.7	7.7	1.4
Castaic (M&I)	41.5	29.0	41.5	29.0	0.0	29.3	0.3	68.6	48.5	19.6
Coachella	19.3	14.4	19.3	14.5	0.1	14.6	0.2	19.3	15.3	0.9
Crestline	1.9	1.8	1.9	1.8	0.0	1.8	0.0	1.9	1.8	0.0
Desert	31.2	23.4	31.2	23.5	0.1	23.8	0.4	31.2	22.2	-1.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	12.8	13.2	12.8	0.0	12.8	0.1	13.2	12.8	0.0
MWDSC	2,011.5	1,103.8	2,011.5	1,107.5	3.3	1,118.6	14.4	2,011.5	1,043.3	-60.4
Palmdale	14.9	11.0	14.9	11.1	0.0	11.2	0.2	14.9	11.2	0.2
San Bernardino	69.8	55.3	69.8	55.5	0.2	56.1	0.7	69.8	52.9	-2.4
San Gabriel	18.1	14.7	18.1	14.7	0.0	14.8	0.2	18.1	14.1	-0.6
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0
Ventura	5.0	4.8	5.0	4.8	0.0	4.9	0.0	5.0	4.8	0.0
Total Agriculture	1,220.4	606.4	1,134.2	582.8	-20.3	586.6	-16.5	1,048.1	636.1	29.7
Total M&I	2,667.1	1,604.4	2,687.6	1,620.0	14.8	1,636.4	31.1	2,714.7	1,574.4	-29.9
Total	3,887.5	2,210.8	3,821.8	2,202.8	-5.5	2,222.9	14.6	3,762.8	2,210.5	-0.2

Table 18d - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project B	2003 No Project B-A without KFE		2003 No Project B-A with KFE		2003 No Project B-S without KFE		2003 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	6.8	5.8	6.8	5.7	-0.1	5.7	-0.1	6.6	0.8	6.7	0.9
Solano	37.7	28.4	37.7	26.1	-2.3	26.3	-2.1	22.0	-6.4	22.2	-6.2
Zone 7	46.0	32.1	46.0	27.8	-4.3	28.1	-4.0	25.9	-6.2	26.1	-6.0
Alameda	35.2	26.2	35.2	23.9	-2.3	24.2	-2.1	22.4	-3.9	22.6	-3.6
Santa Clara	84.7	62.9	84.7	57.2	-5.7	57.8	-5.2	53.5	-9.4	54.0	-9.0
Oak Flat	5.7	2.8	5.7	3.4	0.5	3.4	0.6	3.8	0.9	3.8	1.0
Kings	4.0	2.0	4.0	2.4	0.4	2.4	0.4	2.7	0.8	2.8	0.8
Dudley Ridge	57.7	28.7	57.7	34.0	5.4	34.3	5.6	39.5	10.9	39.8	11.2
Empire W.S.	3.0	1.5	3.0	1.8	0.3	1.8	0.3	2.1	0.6	2.1	0.6
KCWA (M&I)	134.6	93.9	134.6	81.5	-12.5	82.2	-11.8	75.9	-18.0	76.6	-17.4
KCWA (Agric.)	1,018.8	506.2	1,018.8	601.1	94.9	605.7	99.5	630.2	123.9	635.4	129.2
Tulare	118.5	58.9	118.5	69.9	11.0	70.4	11.6	81.2	22.3	81.8	22.9
SLO	4.4	4.0	4.4	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0
Santa Barbara	26.3	23.3	26.3	23.1	-0.2	23.4	0.1	21.7	-1.6	21.9	-1.4
AVEK	64.9	56.6	64.9	55.8	-0.8	56.5	-0.1	55.8	-0.8	56.5	-0.1
Castaic (Agric.)	12.7	6.3	12.7	7.5	1.2	7.6	1.2	8.7	2.4	8.8	2.5
Castaic (M&I)	41.5	29.0	41.5	25.1	-3.8	25.3	-3.6	23.3	-5.7	23.5	-5.5
Coachella	19.3	14.4	19.3	13.1	-1.3	13.3	-1.1	12.7	-1.7	12.8	-1.6
Crestline	1.9	1.8	1.9	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0
Desert	31.2	23.4	31.2	21.5	-1.9	21.7	-1.7	20.8	-2.6	21.0	-2.5
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	12.8	13.2	12.7	0.0	12.8	0.0	12.7	0.0	12.8	0.0
MWDSC	2,011.5	1,103.8	2,011.5	1,030.1	-73.6	1,040.2	-63.6	1,003.1	-100.6	1,012.6	-91.2
Palmdale	14.9	11.0	14.9	10.0	-1.0	10.1	-1.0	9.3	-1.8	9.3	-1.7
San Bernardino	69.8	55.3	69.8	52.3	-3.0	52.8	-2.5	52.2	-3.1	52.7	-2.6
San Gabriel	18.1	14.7	18.1	14.0	-0.6	14.2	-0.5	14.0	-0.6	14.2	-0.5
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Ventura	5.0	4.8	5.0	4.8	0.0	4.9	0.0	4.8	0.0	4.9	0.0
Total Agriculture	1,220.4	606.4	1,220.4	720.1	113.7	725.5	119.2	768.1	161.7	774.4	168.0
Total M&I	2,667.1	1,604.4	2,667.1	1,490.7	-113.7	1,505.2	-99.2	1,442.6	-161.7	1,456.3	-148.0
Total	3,887.5	2,210.8	3,887.5	2,210.8	0.0	2,230.8	20.0	2,210.8	0.0	2,230.8	20.0

Table 19a - Change in Average Annual Scheduled Deliveries from the Baseline at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project A	2020 No Project A without KFE		2020 No Project A with KFE		2020 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	24.9	20.3	28.9	23.1	2.8	23.2	2.9	28.9	22.8	2.4
Solano	42.0	34.3	47.8	38.2	3.9	38.4	4.0	47.8	37.6	3.3
Zone 7	46.0	37.6	80.6	61.2	23.6	61.5	23.9	80.6	63.5	25.9
Alameda	42.0	34.3	42.0	34.3	0.0	34.5	0.1	42.0	33.1	-1.3
Santa Clara	100.0	81.7	100.0	81.7	0.0	82.1	0.4	100.0	78.7	-3.0
Oak Flat	5.7	3.9	5.7	3.9	0.0	3.9	0.0	5.7	4.4	0.5
Kings	4.0	2.7	4.0	6.1	3.4	6.2	3.4	4.0	6.9	4.2
Dudley Ridge	57.7	39.3	61.7	42.0	2.7	42.2	2.9	57.3	44.1	4.8
Empire W.S.	3.0	2.0	3.0	2.0	0.0	2.1	0.0	3.0	2.3	0.3
KCWA (M&I)	134.6	110.0	134.6	110.0	0.0	110.5	0.5	134.6	106.0	-4.0
KCWA (Agric.)	1,018.8	694.1	929.8	633.5	-60.6	636.6	-57.5	848.1	652.0	-42.1
Tulare	118.5	80.7	96.3	65.6	-15.2	65.9	-14.9	96.3	74.0	-6.8
SLO	25.0	20.4	25.0	20.4	0.0	20.5	0.1	25.0	19.7	-0.7
Santa Barbara	45.5	37.2	45.5	37.2	0.0	37.3	0.2	45.5	35.8	-1.4
AVEK	138.4	113.1	141.4	115.1	2.0	115.6	2.5	141.4	111.3	-1.8
Castaic (Agric.)	12.7	8.7	12.7	8.7	0.0	8.7	0.0	12.7	9.8	1.1
Castaic (M&I)	41.5	33.9	41.5	33.9	0.0	34.1	0.1	82.5	65.0	31.0
Coachella	111.2	90.9	133.1	105.8	14.9	106.3	15.4	133.1	104.8	13.9
Crestline	5.8	4.7	5.8	4.7	0.0	4.8	0.0	5.8	4.6	-0.2
Desert	50.0	40.9	54.0	43.6	2.7	43.8	2.9	54.0	42.5	1.7
Littlerock	2.3	1.9	2.3	1.9	0.0	1.9	0.0	2.3	1.8	-0.1
Mojave	50.8	41.5	75.8	58.5	17.0	58.8	17.3	75.8	59.7	18.2
MWDSC	1,911.5	1,562.0	1,911.5	1,562.0	0.0	1,568.8	6.8	1,911.5	1,505.1	-56.9
Palmdale	17.3	14.1	21.3	16.9	2.7	16.9	2.8	21.3	16.8	2.6
San Bernardino	102.6	83.8	102.6	83.8	0.0	84.2	0.4	102.6	80.8	-3.1
San Gabriel	28.8	23.5	28.8	23.5	0.0	23.6	0.1	28.8	22.7	-0.9
San Gorgonio	17.3	14.1	17.3	14.1	0.0	14.2	0.1	17.3	13.6	-0.5
Ventura	20.0	16.3	20.0	16.3	0.0	16.4	0.1	20.0	15.7	-0.6
Total Agriculture	1,220.4	831.4	1,118.1	761.7	-69.7	765.5	-66.0	1,032.1	793.5	-38.0
Total M&I	2,957.5	2,416.8	3,059.8	2,486.5	69.7	2,497.3	80.5	3,100.8	2,441.6	24.7
Total	4,177.9	3,248.2	4,177.9	3,248.2	0.0	3,262.8	14.6	4,132.9	3,235.0	-13.2

Table 19b - Change in Average Annual Scheduled Deliveries from the Baseline at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project B	2020 No Project B-A without KFE		2020 No Project B-A with KFE		2020 No Project B-S without KFE		2020 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	24.9	20.3	24.9	19.6	-0.7	19.7	-0.7	18.0	-2.4	18.0	-2.3
Solano	42.0	34.3	42.0	33.1	-1.2	33.2	-1.1	30.0	-4.3	30.1	-4.2
Zone 7	46.0	37.6	46.0	36.2	-1.4	36.4	-1.2	32.9	-4.7	33.1	-4.5
Alameda	42.0	34.3	42.0	33.1	-1.2	33.2	-1.1	30.3	-4.0	30.4	-3.9
Santa Clara	100.0	81.7	100.0	78.8	-3.0	79.0	-2.7	72.2	-9.5	72.4	-9.3
Oak Flat	5.7	3.9	5.7	4.3	0.4	4.3	0.4	4.7	0.8	4.7	0.8
Kings	4.0	2.7	4.0	3.0	0.3	3.0	0.3	3.3	0.6	3.3	0.6
Dudley Ridge	57.7	39.3	57.7	43.4	4.1	43.7	4.4	47.8	8.5	48.0	8.7
Empire W.S.	3.0	2.0	3.0	2.3	0.2	2.3	0.2	2.5	0.4	2.5	0.5
KCWA (M&I)	134.6	110.0	134.6	106.0	-4.0	106.4	-3.6	96.2	-13.8	96.5	-13.5
KCWA (Agric.)	1,018.8	694.1	1,018.8	767.0	72.9	771.4	77.3	843.7	149.6	848.2	154.1
Tulare	118.5	80.7	118.5	89.2	8.5	89.7	9.0	98.1	17.4	98.7	17.9
SLO	25.0	20.4	25.0	19.7	-0.7	19.8	-0.7	17.9	-2.6	17.9	-2.5
Santa Barbara	45.5	37.2	45.5	35.8	-1.3	35.9	-1.2	32.5	-4.7	32.6	-4.6
AVEK	138.4	113.1	138.4	109.0	-4.1	109.4	-3.7	108.3	-4.8	108.7	-4.4
Castaic (Agric.)	12.7	8.7	12.7	9.6	0.9	9.6	1.0	10.5	1.9	10.6	1.9
Castaic (M&I)	41.5	33.9	41.5	32.7	-1.2	32.8	-1.1	29.7	-4.3	29.8	-4.2
Coachella	111.2	90.9	111.2	87.6	-3.3	87.9	-3.0	87.0	-3.9	87.3	-3.6
Crestline	5.8	4.7	5.8	4.6	-0.2	4.6	-0.2	4.1	-0.6	4.2	-0.6
Desert	50.0	40.9	50.0	39.4	-1.5	39.5	-1.3	39.1	-1.7	39.3	-1.6
Littlerock	2.3	1.9	2.3	1.8	-0.1	1.8	-0.1	1.7	-0.2	1.7	-0.2
Mojave	50.8	41.5	50.8	40.0	-1.5	40.1	-1.4	43.2	1.7	43.3	1.8
MWDSC	1,911.5	1,562.0	1,911.5	1,505.6	-56.4	1,510.6	-51.4	1,443.8	-118.2	1,448.7	-113.3
Palmdale	17.3	14.1	17.3	13.6	-0.5	13.7	-0.5	12.4	-1.8	12.4	-1.7
San Bernardino	102.6	83.8	102.6	80.8	-3.0	81.1	-2.8	87.3	3.4	87.5	3.7
San Gabriel	28.8	23.5	28.8	22.7	-0.9	22.8	-0.8	24.5	1.0	24.6	1.0
San Gorgonio	17.3	14.1	17.3	13.6	-0.5	13.7	-0.5	12.4	-1.8	12.4	-1.7
Ventura	20.0	16.3	20.0	15.8	-0.6	15.8	-0.5	14.3	-2.1	14.3	-2.0
Total Agriculture	1,220.4	831.4	1,220.4	918.8	87.3	924.0	92.6	1,010.6	179.2	1,016.0	184.6
Total M&I	2,957.5	2,416.8	2,957.5	2,329.5	-87.3	2,337.2	-79.6	2,237.6	-179.2	2,245.2	-171.6
Total	4,177.9	3,248.2	4,177.9	3,248.2	0.0	3,261.2	13.0	3,248.2	0.0	3,261.2	13.0

Table 19c - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project A	2020 No Project A without KFE		2020 No Project A with KFE		2020 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	24.9	14.5	28.9	16.1	1.6	16.3	1.9	28.9	15.3	0.8
Solano	42.0	24.4	47.8	26.5	2.1	27.0	2.5	47.8	25.2	0.8
Zone 7	46.0	26.7	80.6	39.8	13.0	40.5	13.8	80.6	42.6	15.8
Alameda	42.0	24.4	42.0	24.4	0.0	24.8	0.4	42.0	22.2	-2.2
Santa Clara	100.0	58.1	100.0	58.1	0.0	59.1	1.0	100.0	52.8	-5.3
Oak Flat	5.7	2.1	5.7	2.1	0.0	2.2	0.1	5.7	3.0	0.9
Kings	4.0	1.5	4.0	3.4	1.9	3.5	2.0	4.0	4.8	3.2
Dudley Ridge	57.7	21.7	61.7	23.2	1.5	23.7	2.0	57.3	30.3	8.6
Empire W.S.	3.0	1.1	3.0	1.1	0.0	1.2	0.0	3.0	1.6	0.5
KCWA (M&I)	134.6	78.3	134.6	78.3	0.0	79.5	1.3	134.6	71.1	-7.2
KCWA (Agric.)	1,018.8	382.9	929.8	349.4	-33.5	357.7	-25.1	848.1	447.8	65.0
Tulare	118.5	44.5	96.3	36.2	-8.4	37.0	-7.5	96.3	50.8	6.3
SLO	25.0	14.5	25.0	14.5	0.0	14.8	0.2	25.0	13.2	-1.3
Santa Barbara	45.5	26.4	45.5	26.4	0.0	26.9	0.4	45.5	24.0	-2.4
AVEK	138.4	80.5	141.4	81.6	1.1	83.0	2.5	141.4	74.7	-5.8
Castaic (Agric.)	12.7	4.8	12.7	4.8	0.0	4.9	0.1	12.7	6.7	1.9
Castaic (M&I)	41.5	24.1	41.5	24.1	0.0	24.5	0.4	82.5	43.6	19.4
Coachella	111.2	64.7	133.1	72.9	8.2	74.1	9.5	133.1	70.3	5.6
Crestline	5.8	3.4	5.8	3.4	0.0	3.4	0.1	5.8	3.1	-0.3
Desert	50.0	29.1	54.0	30.6	1.5	31.1	2.0	54.0	28.5	-0.6
Littlerock	2.3	1.3	2.3	1.3	0.0	1.4	0.0	2.3	1.2	-0.1
Mojave	50.8	29.5	75.8	38.9	9.4	39.6	10.1	75.8	40.0	10.5
MWDSC	1,911.5	1,111.5	1,911.5	1,111.5	0.0	1,129.7	18.2	1,911.5	1,009.3	-102.2
Palmdale	17.3	10.1	21.3	11.6	1.5	11.8	1.7	21.3	11.2	1.2
San Bernardino	102.6	59.7	102.6	59.7	0.0	60.6	1.0	102.6	54.2	-5.5
San Gabriel	28.8	16.7	28.8	16.7	0.0	17.0	0.3	28.8	15.2	-1.5
San Gorgonio	17.3	10.1	17.3	10.1	0.0	10.2	0.2	17.3	9.1	-0.9
Ventura	20.0	11.6	20.0	11.6	0.0	11.8	0.2	20.0	10.6	-1.1
Total Agriculture	1,220.4	458.6	1,118.1	420.2	-38.5	430.2	-28.5	1,032.1	545.0	86.3
Total M&I	2,957.5	1,719.8	3,059.8	1,758.2	38.4	1,787.3	67.5	3,100.8	1,637.3	-82.5
Total	4,177.9	2,178.4	4,177.9	2,178.4	0.0	2,217.4	39.0	4,132.9	2,182.3	3.9

Table 19d - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project B	2020 No Project B-A without KFE		2020 No Project B-A with KFE		2020 No Project B-S without KFE		2020 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	24.9	14.5	24.9	13.3	-1.2	13.5	-1.0	11.2	-3.3	11.4	-3.1
Solano	42.0	24.4	42.0	22.5	-2.0	22.8	-1.7	18.5	-5.9	18.8	-5.7
Zone 7	46.0	26.7	46.0	24.6	-2.1	24.9	-1.8	20.3	-6.4	20.6	-6.1
Alameda	42.0	24.4	42.0	22.5	-2.0	22.8	-1.7	18.9	-5.6	19.2	-5.3
Santa Clara	100.0	58.1	100.0	53.5	-4.7	54.2	-4.0	44.9	-13.2	45.6	-12.6
Oak Flat	5.7	2.1	5.7	2.8	0.6	2.9	0.7	3.3	1.2	3.4	1.2
Kings	4.0	1.5	4.0	2.0	0.5	2.0	0.5	2.4	0.9	2.4	0.9
Dudley Ridge	57.7	21.7	57.7	28.2	6.5	28.9	7.2	34.2	12.6	34.9	13.2
Empire W.S.	3.0	1.1	3.0	1.5	0.3	1.5	0.4	1.8	0.7	1.8	0.7
KCWA (M&I)	134.6	78.3	134.6	72.0	-6.3	72.9	-5.3	59.2	-19.1	60.1	-18.1
KCWA (Agric.)	1,018.8	382.9	1,018.8	498.1	115.3	509.9	127.0	604.5	221.7	616.7	233.8
Tulare	118.5	44.5	118.5	57.9	13.4	59.3	14.8	70.3	25.8	71.7	27.2
SLO	25.0	14.5	25.0	13.4	-1.2	13.5	-1.0	11.0	-3.5	11.2	-3.4
Santa Barbara	45.5	26.4	45.5	24.3	-2.1	24.6	-1.8	20.0	-6.4	20.3	-6.1
AVEK	138.4	80.5	138.4	74.0	-6.5	75.0	-5.5	72.5	-8.0	73.4	-7.1
Castaic (Agric.)	12.7	4.8	12.7	6.2	1.4	6.4	1.6	7.5	2.8	7.7	2.9
Castaic (M&I)	41.5	24.1	41.5	22.2	-1.9	22.5	-1.6	18.3	-5.9	18.5	-5.6
Coachella	111.2	64.7	111.2	59.5	-5.2	60.3	-4.4	58.2	-6.4	59.0	-5.7
Crestline	5.8	3.4	5.8	3.1	-0.3	3.1	-0.2	2.6	-0.8	2.6	-0.8
Desert	50.0	29.1	50.0	26.7	-2.3	27.1	-2.0	26.2	-2.9	26.5	-2.5
Littlerock	2.3	1.3	2.3	1.2	-0.1	1.2	-0.1	1.0	-0.3	1.0	-0.3
Mojave	50.8	29.5	50.8	27.2	-2.4	27.5	-2.0	30.9	1.3	31.2	1.7
MWDSC	1,911.5	1,111.5	1,911.5	1,022.3	-89.2	1,035.7	-75.8	936.9	-174.6	950.0	-161.5
Palmdale	17.3	10.1	17.3	9.3	-0.8	9.4	-0.7	7.6	-2.4	7.7	-2.3
San Bernardino	102.6	59.7	102.6	54.9	-4.8	55.6	-4.1	62.3	2.6	63.0	3.4
San Gabriel	28.8	16.7	28.8	15.4	-1.3	15.6	-1.1	17.5	0.7	17.7	0.9
San Gorgonio	17.3	10.1	17.3	9.3	-0.8	9.4	-0.7	7.6	-2.4	7.7	-2.3
Ventura	20.0	11.6	20.0	10.7	-0.9	10.8	-0.8	8.8	-2.8	8.9	-2.7
Total Agriculture	1,220.4	458.6	1,220.4	596.7	138.1	610.7	152.1	724.1	265.5	738.6	280.0
Total M&I	2,957.5	1,719.8	2,957.5	1,581.7	-138.1	1,602.5	-117.3	1,454.3	-265.4	1,474.6	-245.2
Total	4,177.9	2,178.4	4,177.9	2,178.4	0.0	2,213.2	34.8	2,178.4	0.0	2,213.2	34.8

3.2. Central Valley Project Deliveries

Table 20 shows the average annual deliveries to Central Valley Project (CVP) contractors in all years and in each year type in each scenario. Because the CVP has the same demand in each scenario, the deliveries are similar between the scenarios in all year types.

Table 20 - Average Annual Deliveries to CVP Contractors (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	3,460.0	1,762.5	2,224.7	2,078.4	1,859.7	1,605.8	725.9
2003 Baseline	3,460.0	1,741.9	2,238.0	2,049.5	1,858.3	1,562.3	657.0
2003 Proposed Project	3,460.0	1,740.0	2,246.0	2,053.2	1,844.0	1,552.8	656.9
2003 No Project A	3,460.0	1,741.7	2,244.6	2,052.6	1,848.4	1,551.8	666.8
2003 No Project B	3,460.0	1,741.9	2,238.0	2,049.5	1,858.3	1,562.3	657.0
2020 Baseline	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3
2020 Proposed Project	3,460.0	1,775.2	2,336.0	2,160.2	1,839.1	1,503.8	688.3
2020 No Project A	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3
2020 No Project B	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3

3.3. Deliveries to Feather River Area Contractors

Table 21 shows the average annual deliveries to Feather River Service Area (FRSA) agricultural contractors in all years and in each year type in each scenario. Tables 22 and 23 show the same information for the County of Butte and City of Yuba City. In all cases, the deliveries are similar at each level of development between the scenarios in all year types.

Table 21 - Average Annual Deliveries to FRSA Agricultural Contractors (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	796.0	762.1	787.3	792.4	788.5	794.0	619.7
2003 Baseline	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 Proposed Project	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 No Project A	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 No Project B	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2020 Baseline	796.0	760.0	783.9	789.5	786.7	793.0	618.7
2020 Proposed Project	796.0	760.0	783.9	789.5	786.7	793.0	618.6
2020 No Project A	796.0	760.0	783.9	789.5	786.7	793.0	618.7
2020 No Project B	796.0	760.0	783.9	789.5	786.7	793.0	618.7

Table 22 - Average Annual Deliveries to County of Butte (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	0.2	0.1	0.1	0.1	0.1	0.1	0.1
2003 Baseline	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2003 Proposed Project	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2003 No Project A	0.5	0.3	0.3	0.3	0.3	0.3	0.3
2003 No Project B	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2020 Baseline	27.5	13.1	13.1	15.2	14.5	12.5	11.0
2020 Proposed Project	27.5	13.3	13.3	15.4	14.6	12.7	11.3
2020 No Project A	27.5	13.2	13.1	15.3	14.5	12.7	11.3
2020 No Project B	27.5	13.2	13.1	15.3	14.5	12.7	11.3

Table 23 - Average Annual Deliveries to City of Yuba City (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	0.9	0.5	0.5	0.5	0.5	0.3	0.6
2003 Baseline	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2003 Proposed Project	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2003 No Project A	1.2	0.6	0.6	0.6	0.6	0.5	0.9
2003 No Project B	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2020 Baseline	9.6	4.0	3.8	4.5	3.2	3.2	5.8
2020 Proposed Project	9.6	4.0	3.8	4.5	3.2	3.2	6.0
2020 No Project A	9.6	4.0	3.8	4.5	3.2	3.2	5.9
2020 No Project B	9.6	4.0	3.8	4.5	3.2	3.2	5.9

3.4. Flows in the Delta and in North of Delta Rivers

To evaluate the impacts on flows in the Delta and in North of Delta rivers, the EIR will evaluate the following flows and parameters in each of the scenarios (with the applicable CALSIM arc in parenthesis):

- American River flow (C303)
- Feather River flow (C203)
- Sacramento River flow into the Delta (C169)
- San Joaquin River flow at Vernalis (C644)
- Delta Outflow (C407 + D407)
- Minimum Required Delta Outflow (D407)
- SWP Banks Pumping (D419_SWP)
- CVP Banks Pumping (D419_CVP)
- X2 Position (X2_PRV)
- Export/Import Ratio (D418+D419/DELTA-INFLOW)

In the sections below, the EIR compares both annual and monthly values for each of these parameters.

3.4.1. Annual Comparison

Tables 24a and 24b show average annual values in all years and in wet, above normal, below normal, dry and critical years for each parameter in each scenario. The annual values of each of these parameters in the No Project and Proposed Project scenarios are comparable to the Baseline at both the 2003 and 2020 levels of development. Most of the parameters in most year types differ by less than 1%. The only parameter that differs by more than 1% is CVP use of Banks pumping plant. In 2003, CVP use of Banks is greater in the Baseline than in the No Project A and Proposed Project scenarios. In 2020, CVP use of Banks is higher in the Proposed Project than in the Baseline on average but lower in dry and critical years.

A comparison of the parameters between the different year types indicates that as the level of development advances from 1994 to 2003 and then to 2020, the most significant differences are that SWP Banks pumping increases in many years to try to meet the increased SWP demand, with a corresponding decrease in Delta outflow.

3.4.2. Monthly Comparison

Tables 25a through 34b show monthly statistics for each parameter in each scenario. While there is more variation in the monthly values than in the annual values, the values for each parameter are similar between the Baseline and the No Project and Proposed Project scenarios at the same level of development. For every parameter at both levels of development, the difference in all of the statistical measures is less than 1% in a majority of months. And at both the 2003 and 2020 levels of development, no monthly average or median value differs by more than 10% as compared to the Baseline.

Table 24a - Average Annual Flows and Other Delta Parameters for the 1994 and 2003 Scenarios

	American River Flow (TAF/yr)	Feather River Flow (TAF/yr)	Sacramento River Flow into the Delta (TAF/yr)	San Joaquin River at Vernalis (Taf/yr)	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I ratio
1994 Baseline										
All Years	2,401.5	3,011.5	16,106.1	2,805.8	14,435.0	5,551.4	2,945.0	87.3	75.8	0.36
Wet Years	3,856.1	4,802.8	24,593.1	4,902.1	27,790.3	6,801.7	3,628.8	96.7	68.9	0.31
Above Normal Years	2,868.9	3,284.4	19,058.6	3,052.1	16,903.8	6,609.0	3,364.8	144.1	73.6	0.37
Below Normal Years	2,101.0	2,489.1	13,829.9	2,391.5	9,858.7	5,466.6	3,104.2	85.9	76.9	0.40
Dry Years	1,520.0	2,057.4	11,198.5	1,540.1	6,653.3	4,593.3	2,673.2	81.0	79.9	0.42
Critical Years	992.5	1,530.6	7,992.3	1,103.2	4,720.6	3,858.4	1,575.3	33.2	82.6	0.34
2003 Baseline										
All Years	2,416.9	3,081.1	16,307.3	2,864.8	14,656.6	5,609.0	3,000.2	147.7	75.6	0.35
Wet Years	3,883.9	4,826.5	24,655.8	5,039.7	28,007.7	6,821.2	3,592.9	186.0	68.9	0.30
Above Normal Years	2,887.5	3,276.5	19,398.0	2,993.7	17,153.2	6,778.5	3,436.5	181.6	73.5	0.36
Below Normal Years	2,034.8	2,584.1	13,908.0	2,346.9	9,687.8	5,441.9	3,240.0	179.7	77.0	0.40
Dry Years	1,479.3	2,097.6	11,009.5	1,542.3	6,375.0	4,577.5	2,712.8	123.6	79.9	0.40
Critical Years	1,009.4	1,587.3	8,177.8	1,100.0	4,751.7	3,958.3	1,647.7	43.3	82.5	0.32
2003 No Project Alternative A										
All Years	2,416.8	3,080.4	16,298.3	2,864.7	14,673.4	5,607.0	2,983.9	143.3	75.6	0.35
Wet Years	3,883.7	4,837.3	24,642.9	5,040.0	28,028.3	6,826.1	3,586.4	179.8	68.9	0.30
Above Normal Years	2,885.6	3,270.5	19,388.9	2,993.5	17,162.6	6,767.2	3,432.9	175.5	73.5	0.36
Below Normal Years	2,035.9	2,550.6	13,868.7	2,346.1	9,700.6	5,434.5	3,199.9	177.2	77.0	0.40
Dry Years	1,468.4	2,118.4	11,021.2	1,542.2	6,405.8	4,574.0	2,690.5	118.9	79.9	0.40
Critical Years	1,023.2	1,581.1	8,185.2	1,100.3	4,754.5	3,960.0	1,638.9	41.2	82.5	0.32
2003 No Project Alternative B										
All Years	2,416.9	3,081.1	16,307.3	2,864.8	14,656.6	5,609.0	3,000.2	147.7	75.6	0.35
Wet Years	3,883.9	4,826.5	24,655.8	5,039.7	28,007.7	6,821.2	3,592.9	186.0	68.9	0.30
Above Normal Years	2,887.5	3,276.5	19,398.0	2,993.7	17,153.2	6,778.5	3,436.5	181.6	73.5	0.36
Below Normal Years	2,034.8	2,584.1	13,908.0	2,346.9	9,687.8	5,441.9	3,240.0	179.7	77.0	0.40
Dry Years	1,479.3	2,097.6	11,009.5	1,542.3	6,375.0	4,577.5	2,712.8	123.6	79.9	0.40
Critical Years	1,009.4	1,587.3	8,177.8	1,100.0	4,751.7	3,958.3	1,647.7	43.3	82.5	0.32
2003 Proposed Project										
All Years	2,416.9	3,080.6	16,299.0	2,864.7	14,699.0	5,603.6	2,959.5	142.3	75.6	0.35
Wet Years	3,883.2	4,835.2	24,633.8	5,039.5	28,068.5	6,819.1	3,542.9	178.4	68.8	0.30
Above Normal Years	2,889.3	3,249.8	19,369.1	2,993.5	17,186.4	6,769.4	3,389.3	177.0	73.5	0.35
Below Normal Years	2,038.8	2,564.2	13,882.0	2,346.6	9,742.0	5,425.2	3,188.2	172.7	77.0	0.40
Dry Years	1,471.1	2,119.7	11,039.8	1,542.2	6,413.0	4,578.0	2,675.4	120.3	79.9	0.40
Critical Years	1,015.1	1,585.5	8,182.8	1,100.4	4,759.9	3,956.1	1,638.5	40.1	82.5	0.32

Table 24b - Average Annual Flows and Other Delta Parameters for the 2020 Scenarios

	American River Flow (TAF/yr)	Feather River Flow (TAF/yr)	Sacramento River Flow into the Delta (TAF/yr)	San Joaquin River at Vernalis (Taf/yr)	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I ratio
2020 Baseline										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 No Project Alternative A										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 No Project Alternative B										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 Proposed Project										
All Years	2,190.3	3,071.2	16,179.0	2,869.1	14,193.7	5,680.6	3,279.4	144.3	76.0	0.36
Wet Years	3,596.9	4,850.8	24,387.3	5,064.3	26,934.7	6,933.3	4,184.1	219.1	69.5	0.33
Above Normal Years	2,614.5	3,353.2	19,370.9	3,006.3	16,735.4	6,864.4	3,751.3	133.6	74.0	0.37
Below Normal Years	1,830.1	2,525.5	13,799.2	2,348.0	9,444.0	5,477.3	3,420.4	130.9	77.3	0.41
Dry Years	1,268.7	2,071.9	10,887.7	1,526.0	6,177.5	4,658.7	2,813.0	129.8	80.1	0.40
Critical Years	884.3	1,521.6	8,189.8	1,091.0	4,764.4	3,975.2	1,675.3	51.4	82.5	0.32

Table 25a - Monthly Statistics for American River Flow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	104.2	165.1	207.7	254.5	281.8	225.9	207.2	223.9	233.5	238.5	135.5	123.6
Minimum	33.5	22.3	30.7	24.9	22.2	25.3	18.5	21.9	14.4	21.8	11.6	16.7
Median	100.0	116.5	116.8	117.2	189.5	148.2	172.7	176.9	196.8	277.4	131.0	94.7
Maximum	240.6	1036.8	1216.5	1296.2	1833.9	1019.1	861.8	697.9	859.9	362.2	303.5	302.5
St. Dev.	27.1	161.1	245.0	275.3	282.9	204.3	148.2	158.5	147.2	74.3	77.3	87.4
2003 Baseline												
Average	110.9	159.4	203.7	249.9	284.1	227.5	203.1	222.5	232.9	235.5	150.2	121.7
Minimum	33.8	22.3	30.7	25.1	22.2	24.6	11.2	11.6	12.9	50.3	11.6	16.7
Median	101.0	113.9	116.6	115.9	180.1	150.0	159.2	176.8	198.0	272.6	154.6	96.6
Maximum	281.3	985.5	1138.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	29.6	158.3	242.7	276.6	281.2	204.3	146.7	159.9	147.4	72.8	85.6	80.4
2003 No Project Alternative A												
Average	107.9	162.8	204.6	247.7	284.2	227.1	203.3	222.3	233.3	238.1	150.6	119.3
Minimum	23.1	22.3	30.7	15.4	13.9	20.1	18.5	21.9	12.6	47.1	16.2	16.8
Median	101.1	114.9	116.6	115.7	184.4	150.8	158.8	176.8	197.9	272.6	142.0	95.1
Maximum	267.5	987.7	1158.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	33.0	157.4	242.9	278.4	281.3	204.6	146.8	160.1	146.3	70.5	84.4	84.1
2003 No Project Alternative B												
Average	110.9	159.4	203.7	249.9	284.1	227.5	203.1	222.5	232.9	235.5	150.2	121.7
Minimum	33.8	22.3	30.7	25.1	22.2	24.6	11.2	11.6	12.9	50.3	11.6	16.7
Median	101.0	113.9	116.6	115.9	180.1	150.0	159.2	176.8	198.0	272.6	154.6	96.6
Maximum	281.3	985.5	1138.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	29.6	158.3	242.7	276.6	281.2	204.3	146.7	159.9	147.4	72.8	85.6	80.4
2003 Proposed Project Alternative												
Average	108.7	161.6	204.7	250.1	283.2	227.7	203.3	222.4	233.9	237.2	149.4	119.1
Minimum	33.9	22.3	30.7	25.0	22.2	24.6	18.5	21.9	12.8	57.3	16.2	16.7
Median	100.8	114.4	116.8	115.5	171.9	158.1	160.8	176.8	197.6	274.1	142.0	94.1
Maximum	298.5	993.2	1159.2	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	31.8	158.2	242.8	276.9	281.6	204.3	146.4	159.9	146.6	72.9	83.4	83.6

Table 25b - Monthly Statistics for American River Flow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 No Project Alternative A												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 No Project Alternative B												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 Proposed Project Alternative												
Average	100.6	145.3	191.9	234.3	263.3	215.0	187.0	199.7	207.6	215.0	122.0	94.1
Minimum	23.1	22.3	30.7	15.4	20.1	26.5	18.9	22.8	16.9	15.2	11.6	16.7
Median	98.2	110.7	103.9	106.7	159.4	138.8	143.5	165.1	178.5	248.3	113.5	84.7
Maximum	155.0	986.9	1187.3	1283.6	1822.8	1000.5	842.9	663.1	816.6	318.2	287.9	277.6
St. Dev.	27.9	156.5	241.3	272.9	283.7	203.0	142.0	148.8	142.2	85.4	76.9	65.3

Table 26a – Monthly Statistics for Feather River Flow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	129.9	140.0	264.3	331.2	358.1	409.8	202.6	229.1	268.8	337.0	239.1	101.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	48.3	87.7	61.0	45.0
Median	105.0	101.0	143.5	118.6	234.0	294.9	124.5	110.9	281.8	357.9	259.5	65.8
Maximum	332.6	866.9	1496.9	2206.1	1315.2	1981.4	1127.1	1237.0	689.9	563.4	467.7	302.4
St. Dev.	66.5	117.0	296.8	415.1	343.6	434.1	221.9	259.1	114.3	124.0	140.8	55.0
2003 Baseline												
Average	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.5	87.7	61.0	45.0
Median	127.6	101.0	116.9	105.0	186.2	265.8	78.0	100.2	258.9	383.1	331.9	74.2
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	516.7	341.9
St. Dev.	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9
2003 No Project Alternative A												
Average	152.5	133.4	240.0	317.3	342.1	401.1	191.9	221.5	261.0	370.8	280.6	109.2
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.9	87.7	61.0	45.0
Median	120.3	101.0	128.8	105.0	186.2	278.7	80.7	100.2	265.0	372.9	341.4	62.9
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	514.6	326.8
St. Dev.	69.2	111.8	282.9	408.8	345.9	429.1	225.7	260.0	116.2	142.5	153.9	67.7
2003 No Project Alternative B												
Average	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.5	87.7	61.0	45.0
Median	127.6	101.0	116.9	105.0	186.2	265.8	78.0	100.2	258.9	383.1	331.9	74.2
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	516.7	341.9
St. Dev.	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9
2003 Proposed Project Alternative												
Average	151.4	136.7	239.8	319.7	344.8	403.0	191.7	220.5	257.8	367.8	279.1	109.0
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.8	87.7	61.0	45.0
Median	128.8	101.0	129.3	105.0	186.2	280.6	80.2	97.1	256.0	394.3	310.6	62.9
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1972.6	1127.2	1237.0	690.0	614.9	515.8	345.7
St. Dev.	68.2	111.2	280.9	410.9	345.3	432.5	225.6	260.1	115.6	144.0	152.6	67.0

Table 26b - Monthly Statistics for Feather River Flow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 No Project Alternative A												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 No Project Alternative B												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 Proposed Project Alternative												
Average	155.7	127.0	229.7	287.2	322.3	369.9	189.5	221.6	276.3	425.8	288.2	120.6
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.4	45.0
Median	129.7	101.0	105.0	105.0	100.1	266.1	81.7	115.0	279.6	446.6	327.6	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	547.3	317.6
St. Dev.	71.3	105.3	260.9	403.0	340.1	398.6	226.0	261.8	116.6	160.4	156.7	74.1

Table 27a - Monthly Statistics for Sacramento River Flow into the Delta in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	727.5	944.5	1573.5	2050.7	2236.8	2126.4	1468.1	1220.6	1069.2	1074.4	830.3	784.0
Minimum	467.8	421.8	412.7	385.9	417.1	454.9	447.1	359.4	519.0	557.5	405.5	370.3
Median	637.6	726.9	971.7	1442.1	1909.0	1847.3	972.6	911.3	914.2	1112.0	883.9	722.3
Maximum	2280.2	3833.8	4612.3	4698.7	4356.6	4752.1	4428.9	3853.7	3295.7	1484.4	1313.2	1594.8
St. Dev.	277.5	668.6	1300.2	1432.5	1304.9	1266.7	1096.3	812.7	485.2	205.8	180.5	251.1
2003 Baseline												
Average	751.8	931.4	1542.5	2022.3	2212.9	2100.0	1448.6	1195.5	1042.8	1129.0	910.1	787.4
Minimum	468.6	422.3	409.5	356.2	428.6	440.4	438.1	348.1	500.1	566.1	486.6	354.3
Median	715.4	733.8	965.1	1378.8	1900.7	1813.6	974.1	899.9	886.0	1195.1	960.3	744.4
Maximum	2197.4	3833.8	4612.3	4698.7	4355.4	4752.1	4428.9	3771.0	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.1	645.9	1253.4	1442.9	1298.4	1269.5	1095.7	803.2	489.1	201.8	158.0	242.1
2003 No Project Alternative A												
Average	750.4	934.0	1545.2	2017.9	2210.8	2099.7	1449.0	1194.7	1045.9	1124.0	909.6	784.2
Minimum	469.1	422.6	409.8	354.7	424.1	425.4	438.0	348.1	500.5	577.6	486.9	354.9
Median	709.4	740.5	963.7	1378.3	1886.4	1817.1	1008.8	899.9	885.9	1185.0	959.8	742.9
Maximum	2183.0	3833.8	4612.3	4698.7	4356.6	4752.1	4428.9	3771.1	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.6	644.8	1258.6	1438.9	1298.3	1267.4	1096.3	803.3	488.5	198.6	161.7	243.9
2003 No Project Alternative B												
Average	751.8	931.4	1542.5	2022.3	2212.9	2100.0	1448.6	1195.5	1042.8	1129.0	910.1	787.4
Minimum	468.6	422.3	409.5	356.2	428.6	440.4	438.1	348.1	500.1	566.1	486.6	354.3
Median	715.4	733.8	965.1	1378.8	1900.7	1813.6	974.1	899.9	886.0	1195.1	960.3	744.4
Maximum	2197.4	3833.8	4612.3	4698.7	4355.4	4752.1	4428.9	3771.0	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.1	645.9	1253.4	1442.9	1298.4	1269.5	1095.7	803.2	489.1	201.8	158.0	242.1
2003 Proposed Project Alternative												
Average	748.1	935.8	1546.8	2020.4	2212.3	2100.5	1448.5	1193.3	1045.3	1122.1	908.0	785.7
Minimum	469.3	422.6	409.8	362.4	435.1	437.3	438.1	346.6	502.0	575.4	486.9	355.1
Median	702.3	755.3	960.8	1389.2	1892.5	1825.8	972.5	900.0	885.8	1179.6	957.3	733.3
Maximum	2273.6	3833.8	4612.3	4698.7	4356.8	4752.1	4428.9	3771.1	3295.5	1484.3	1313.1	1594.7
St. Dev.	267.3	644.4	1261.9	1439.0	1297.0	1267.1	1095.8	803.4	487.6	196.3	162.8	243.9

Table 27b - Monthly Statistics for Sacramento River Flow into the Delta in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 No Project Alternative A												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 No Project Alternative B												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 Proposed Project Alternative												
Average	748.9	922.3	1522.0	2009.0	2195.0	2097.6	1463.2	1175.4	1029.2	1155.4	887.0	756.2
Minimum	469.8	420.6	409.4	382.5	429.1	440.7	426.9	357.5	490.2	585.8	482.5	356.7
Median	742.4	753.1	1003.2	1311.9	1849.7	1748.5	1013.3	860.9	904.7	1232.5	933.1	764.1
Maximum	1979.8	3871.5	4620.2	4708.2	4356.4	4760.4	4427.8	3633.8	3249.7	1582.2	1269.4	1573.7
St. Dev.	224.6	604.9	1206.7	1426.6	1301.1	1273.3	1096.9	783.0	461.1	238.7	193.9	215.6

Table 28a - Monthly Statistics for San Joaquin River Flow at Vernalis in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	186.1	118.7	185.4	272.7	353.3	387.0	361.5	336.3	248.6	140.7	103.1	112.5
Minimum	67.3	73.6	73.2	67.1	67.5	80.3	87.2	75.8	67.4	53.1	41.1	61.2
Median	130.7	102.0	116.5	129.3	192.5	229.3	287.7	275.0	137.3	118.8	111.6	107.1
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.2	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.7	97.0	223.0	300.1	354.4	425.4	277.6	276.3	338.8	131.3	33.2	48.3
2003 Baseline												
Average	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6
Minimum	70.3	75.1	73.1	67.1	67.5	80.4	87.3	76.0	66.5	52.9	41.1	60.9
Median	131.0	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.7	118.9	111.5	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3
2003 No Project Alternative A												
Average	186.1	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.6	140.7	103.2	112.6
Minimum	67.3	75.4	73.1	67.1	67.5	80.4	87.3	76.0	66.5	53.0	41.1	60.9
Median	130.8	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.6	118.9	111.6	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.5	96.9	223.1	300.1	354.3	425.3	277.6	276.3	338.8	131.4	33.2	48.3
2003 No Project Alternative B												
Average	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6
Minimum	70.3	75.1	73.1	67.1	67.5	80.4	87.3	76.0	66.5	52.9	41.1	60.9
Median	131.0	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.7	118.9	111.5	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3
2003 Proposed Project Alternative												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2

Table 28b - Monthly Statistics for San Joaquin River Flow at Vernalis in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 No Project Alternative A												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 No Project Alternative B												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 Proposed Project Alternative												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.8	52.8	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.7	119.2	111.4	108.1
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.3	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2

Table 29a - Monthly Statistics for Delta Outflow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	404.6	606.9	1359.8	2285.5	2734.6	2482.9	1607.0	1219.2	740.8	437.3	264.4	292.0
Minimum	202.3	267.8	215.2	276.7	388.1	377.9	351.8	246.0	238.0	246.0	184.5	178.5
Median	270.9	345.5	504.6	1063.0	1564.3	1618.9	953.7	857.8	471.0	399.7	246.0	184.0
Maximum	1801.5	4646.4	9526.2	12847.6	11652.1	15576.5	8409.9	4637.9	4981.6	1818.2	769.5	1508.5
St. Dev.	316.7	741.6	1818.8	2649.1	2616.8	2615.2	1555.1	1048.8	755.8	194.7	67.4	230.1
2003 Baseline												
Average	376.0	592.3	1341.9	2264.2	2684.0	2404.9	1637.0	1289.0	732.8	442.0	276.9	278.5
Minimum	195.0	241.5	276.7	317.4	383.3	376.4	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.7	348.5	463.0	959.4	1600.5	1566.2	962.2	1008.4	478.6	409.0	249.3	195.9
Maximum	1708.4	4791.8	9617.2	13000.7	11646.5	15549.7	8428.4	4623.6	4974.6	1706.0	644.1	1482.4
St. Dev.	289.3	729.7	1785.7	2642.8	2604.0	2564.8	1560.7	1051.2	751.6	185.5	61.4	207.1
2003 No Project Alternative A												
Average	376.2	593.9	1346.1	2264.1	2680.5	2410.4	1639.7	1293.2	734.5	440.9	276.7	278.6
Minimum	195.5	266.8	276.7	318.1	382.6	379.0	357.3	246.0	238.0	246.0	184.5	178.5
Median	263.6	356.1	450.5	983.4	1600.6	1566.3	1010.0	1008.4	486.9	400.1	246.0	192.5
Maximum	1693.6	4793.4	9619.1	13001.1	11692.5	15551.5	8489.6	4631.0	4988.2	1705.6	643.7	1528.9
St. Dev.	290.1	729.7	1790.0	2641.7	2603.6	2580.3	1566.4	1049.4	753.2	184.7	61.0	211.0
2003 No Project Alternative B												
Average	376.0	592.3	1341.9	2264.2	2684.0	2404.9	1637.0	1289.0	732.8	442.0	276.9	278.5
Minimum	195.0	241.5	276.7	317.4	383.3	376.4	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.7	348.5	463.0	959.4	1600.5	1566.2	962.2	1008.4	478.6	409.0	249.3	195.9
Maximum	1708.4	4791.8	9617.2	13000.7	11646.5	15549.7	8428.4	4623.6	4974.6	1706.0	644.1	1482.4
St. Dev.	289.3	729.7	1785.7	2642.8	2604.0	2564.8	1560.7	1051.2	751.6	185.5	61.4	207.1
2003 Proposed Project Alternative												
Average	378.9	594.2	1349.0	2269.1	2684.6	2419.2	1639.0	1293.0	734.7	441.0	276.1	279.4
Minimum	196.1	257.1	276.7	317.2	382.7	378.7	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.4	350.8	465.8	986.8	1600.4	1565.9	1009.6	935.0	486.8	409.5	246.0	196.9
Maximum	1784.2	4793.9	9620.2	13001.2	11700.4	15553.6	8493.1	4674.3	5002.5	1705.6	643.7	1559.3
St. Dev.	297.1	730.0	1790.2	2642.3	2604.3	2586.2	1563.4	1053.9	754.9	184.0	62.3	213.7

Table 29b - Monthly Statistics for Delta Outflow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 No Project Alternative A												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 No Project Alternative B												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 Proposed Project Alternative												
Average	326.8	549.7	1248.7	2188.1	2642.4	2372.6	1631.7	1268.1	694.6	444.9	281.0	240.5
Minimum	191.8	267.8	276.7	325.9	383.1	376.4	350.8	246.0	238.0	246.0	203.9	178.5
Median	262.6	358.6	458.6	865.9	1500.7	1509.8	1008.4	988.0	493.2	424.1	247.6	206.2
Maximum	1390.9	4701.8	9518.0	12947.3	11353.6	15448.9	7999.8	4542.2	4827.7	1561.5	511.6	1312.8
St. Dev.	208.8	667.4	1725.7	2588.3	2575.8	2538.4	1523.8	1021.3	692.3	179.6	55.1	144.6

Table 30a - Monthly Statistics for Minimum Required Delta Outflow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	256.3	287.2	269.2	335.6	748.3	867.9	754.3	689.3	530.7	403.7	254.7	178.5
Minimum	184.5	250.3	215.2	276.7	383.6	365.7	350.5	245.4	238.0	246.0	184.5	178.5
Median	246.0	267.8	276.7	368.9	633.1	701.0	666.0	590.8	455.5	399.7	246.0	178.5
Maximum	404.5	397.0	336.3	368.9	1580.6	1672.3	1438.7	1652.6	1357.4	693.2	336.4	178.5
St. Dev.	37.4	30.1	24.3	44.6	342.4	354.7	237.0	339.6	245.0	103.1	28.6	0.0
2003 Baseline												
Average	253.3	299.7	289.1	349.4	739.6	857.6	759.7	686.6	520.3	404.2	270.6	178.5
Minimum	184.5	221.8	215.2	276.7	381.9	364.5	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	290.4	276.7	368.9	633.1	701.0	668.8	582.6	447.6	399.7	246.0	178.5
Maximum	388.8	413.9	406.9	552.0	1580.6	1672.0	1452.3	1647.5	1317.9	730.2	384.9	178.5
St. Dev.	36.5	40.2	40.9	48.4	341.5	345.3	244.5	341.2	246.5	100.5	43.2	0.0
2003 No Project Alternative A												
Average	252.9	299.6	289.5	348.6	739.4	857.7	759.8	686.2	520.0	404.4	270.2	178.5
Minimum	184.5	215.2	215.2	276.7	381.6	364.4	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	289.8	276.7	368.9	633.1	701.0	668.6	581.3	445.9	399.7	246.0	178.5
Maximum	372.9	414.3	421.6	467.8	1580.6	1672.0	1464.7	1648.1	1318.0	725.3	385.7	178.5
St. Dev.	36.1	37.7	40.8	44.9	340.4	344.9	245.4	341.2	246.6	101.0	42.8	0.0
2003 No Project Alternative B												
Average	253.3	299.7	289.1	349.4	739.6	857.6	759.7	686.6	520.3	404.2	270.6	178.5
Minimum	184.5	221.8	215.2	276.7	381.9	364.5	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	290.4	276.7	368.9	633.1	701.0	668.8	582.6	447.6	399.7	246.0	178.5
Maximum	388.8	413.9	406.9	552.0	1580.6	1672.0	1452.3	1647.5	1317.9	730.2	384.9	178.5
St. Dev.	36.5	40.2	40.9	48.4	341.5	345.3	244.5	341.2	246.5	100.5	43.2	0.0
2003 Proposed Project Alternative												
Average	253.6	298.1	289.8	348.5	738.5	857.5	758.7	686.1	519.5	404.6	269.9	178.5
Minimum	184.5	223.9	215.2	276.7	381.7	364.1	349.8	239.3	238.0	246.0	184.5	178.5
Median	246.0	292.4	276.7	368.9	633.1	701.0	668.5	580.6	447.6	399.7	246.0	178.5
Maximum	398.2	409.6	421.7	521.9	1580.6	1672.0	1463.3	1646.5	1318.0	721.7	388.8	178.5
St. Dev.	35.9	35.6	40.2	46.6	340.0	345.3	245.0	341.0	246.7	100.9	44.0	0.0

Table 30b - Monthly Statistics for Minimum Required Delta Outflow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 No Project Alternative A												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 No Project Alternative B												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 Proposed Project Alternative												
Average	248.7	312.4	302.3	358.8	749.9	864.8	764.6	686.3	524.1	408.6	277.5	178.5
Minimum	184.5	239.2	215.2	276.7	380.1	361.9	350.8	239.1	238.0	246.0	203.9	178.5
Median	246.0	304.4	276.7	368.9	633.1	701.0	670.2	583.9	443.5	399.7	246.0	178.5
Maximum	357.6	474.3	455.5	511.5	1580.6	1671.9	1435.7	1616.7	1336.7	738.8	393.3	178.5
St. Dev.	33.0	52.0	52.2	43.9	355.3	350.0	246.8	341.4	249.8	107.1	48.1	0.0

Table 31a - Monthly Statistics for SWP Banks Pumping in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	203.1	220.3	312.2	352.1	289.1	275.6	178.5	168.1	205.3	227.7	245.2	267.8
Minimum	55.7	17.9	64.9	69.4	16.7	18.4	17.9	18.4	17.9	18.4	18.4	56.1
Median	178.0	201.6	319.5	318.3	311.1	325.6	185.6	151.7	198.2	255.3	277.5	267.4
Maximum	410.7	397.5	472.1	522.6	485.3	464.9	312.6	379.8	397.5	410.7	410.7	397.5
St. Dev.	99.1	121.9	112.6	112.5	124.1	115.7	85.5	94.3	110.7	128.7	134.2	96.3
2003 Baseline												
Average	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8
Minimum	52.2	17.9	59.3	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	240.8	187.2	336.1	411.6	340.1	355.2	142.4	69.2	184.4	292.8	343.5	271.8
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	302.7	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4
2003 No Project Alternative A												
Average	231.3	215.1	313.7	358.4	319.1	312.2	141.7	87.7	192.2	253.5	275.8	268.2
Minimum	66.7	17.9	61.7	49.2	17.3	10.5	17.9	18.4	17.9	0.0	0.0	50.7
Median	224.1	185.9	329.8	384.8	339.0	357.3	142.4	69.2	184.8	280.5	330.0	274.0
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	296.6	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.6	127.0	106.0	114.0	133.2	136.7	62.3	63.2	110.1	142.8	138.2	99.9
2003 No Project Alternative B												
Average	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8
Minimum	52.2	17.9	59.3	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	240.8	187.2	336.1	411.6	340.1	355.2	142.4	69.2	184.4	292.8	343.5	271.8
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	302.7	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4
2003 Proposed Project Alternative												
Average	230.7	217.7	311.2	356.4	316.0	310.4	140.3	85.7	189.8	249.6	272.9	265.5
Minimum	63.4	17.9	79.0	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	220.7	193.3	329.0	383.6	340.0	349.0	142.3	69.2	171.8	307.2	319.7	270.2
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	295.0	326.0	397.5	410.7	410.7	397.5
St. Dev.	101.3	124.7	106.4	113.5	131.0	135.2	61.8	60.5	110.4	144.5	137.4	101.4

Table 31b - Monthly Statistics for SWP Banks Pumping in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 No Project Alternative A												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 No Project Alternative B												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 Proposed Project Alternative												
Average	273.5	238.4	373.0	396.0	323.2	338.4	155.6	96.1	216.9	283.1	259.3	289.0
Minimum	69.0	17.9	43.4	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.3
Median	276.7	197.4	387.7	458.2	357.1	390.5	144.4	69.2	193.7	312.8	329.5	297.7
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	447.1	476.0
St. Dev.	128.6	151.4	127.6	123.9	138.5	155.0	75.9	77.9	133.8	154.5	155.6	118.3

Table 32a - Monthly Statistics for CVP Banks Pumping in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	8.0	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	48.8	20.0	8.6
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.2	3.2	0.0
Maximum	128.0	56.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	128.0	128.0	95.3
St. Dev.	23.6	9.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	36.3	28.6	20.4
2003 Baseline												
Average	22.6	12.7	3.5	3.3	4.8	7.4	0.0	0.0	0.0	35.9	29.7	22.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	16.1	0.0
Maximum	141.8	115.5	84.8	77.9	104.4	79.9	0.0	0.0	0.0	159.3	174.6	127.3
St. Dev.	39.5	29.3	13.4	13.7	16.2	18.1	0.0	0.0	0.0	38.9	40.9	32.2
2003 No Project Alternative A												
Average	22.1	12.2	2.4	3.9	4.5	7.1	0.0	0.0	0.0	38.5	29.0	18.8
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.8	18.9	0.0
Maximum	128.0	119.4	93.7	78.3	104.4	83.1	0.0	0.0	0.0	166.8	164.3	139.2
St. Dev.	38.7	29.8	12.6	14.4	15.4	18.7	0.0	0.0	0.0	40.0	37.0	29.3
2003 No Project Alternative B												
Average	22.6	12.7	3.5	3.3	4.8	7.4	0.0	0.0	0.0	35.9	29.7	22.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	16.1	0.0
Maximum	141.8	115.5	84.8	77.9	104.4	79.9	0.0	0.0	0.0	159.3	174.6	127.3
St. Dev.	39.5	29.3	13.4	13.7	16.2	18.1	0.0	0.0	0.0	38.9	40.9	32.2
2003 Proposed Project Alternative												
Average	21.1	11.7	2.4	4.3	4.8	5.4	0.0	0.0	0.0	39.7	29.1	19.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	16.2	0.0
Maximum	127.8	119.6	98.4	78.4	104.4	87.2	0.0	0.0	0.0	173.7	166.3	136.2
St. Dev.	37.7	29.3	12.8	15.4	16.0	16.0	0.0	0.0	0.0	41.7	38.1	28.7

Table 32b - Monthly Statistics for CVP Banks Pumping in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 No Project Alternative A												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 No Project Alternative B												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 Proposed Project Alternative												
Average	24.5	18.6	3.6	0.7	1.8	4.5	0.0	0.0	0.0	35.0	38.8	15.6
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	25.5	0.0
Maximum	124.5	115.9	73.8	25.5	46.7	80.1	0.0	0.0	0.0	146.1	241.8	85.0
St. Dev.	32.9	33.5	12.5	3.9	8.1	15.8	0.0	0.0	0.0	35.5	52.0	21.8

Table 33a - Monthly Statistics for Average X2 Position in the 1994 and 2003 Scenarios (km)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	84.2	85.8	84.2	81.4	77.0	71.3	66.1	65.6	68.0	70.9	75.2	79.3
Minimum	69.7	67.3	66.8	57.7	49.5	49.2	46.7	42.1	48.5	52.1	52.4	60.5
Median	84.1	87.9	86.2	84.0	80.3	73.8	66.6	66.7	69.4	72.0	76.7	79.3
Maximum	88.0	89.5	89.2	86.2	87.7	86.2	82.5	82.4	81.3	85.0	85.2	85.5
St. Dev.	2.4	4.7	5.1	5.7	9.2	10.8	9.9	9.3	8.5	8.3	7.3	4.4
2003 Baseline												
Average	83.8	85.8	84.7	81.6	77.0	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	68.0	66.4	57.4	49.3	49.0	46.5	42.1	48.5	52.1	52.4	61.0
Median	83.6	87.6	86.6	83.6	80.9	74.5	66.7	66.9	69.4	70.5	76.1	79.3
Maximum	87.5	89.5	89.4	87.0	85.8	84.6	82.2	82.3	81.3	84.9	85.3	85.5
St. Dev.	2.1	4.2	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 No Project Alternative A												
Average	83.8	85.9	84.7	81.6	76.9	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	67.7	66.4	57.4	49.3	48.9	46.5	42.1	48.5	52.1	52.4	60.9
Median	83.5	87.7	86.6	83.8	80.9	74.1	66.7	66.9	69.3	70.5	76.1	79.3
Maximum	87.5	89.5	89.5	86.2	85.8	84.4	82.1	82.1	81.3	84.9	85.4	85.5
St. Dev.	2.1	4.3	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 No Project Alternative B												
Average	83.8	85.8	84.7	81.6	77.0	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	68.0	66.4	57.4	49.3	49.0	46.5	42.1	48.5	52.1	52.4	61.0
Median	83.6	87.6	86.6	83.6	80.9	74.5	66.7	66.9	69.4	70.5	76.1	79.3
Maximum	87.5	89.5	89.4	87.0	85.8	84.6	82.2	82.3	81.3	84.9	85.3	85.5
St. Dev.	2.1	4.2	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 Proposed Project Alternative												
Average	83.8	85.9	84.6	81.6	76.9	71.2	66.2	65.8	67.9	70.3	75.1	79.2
Minimum	71.2	67.6	66.3	57.3	49.3	48.9	46.5	42.1	48.5	52.0	52.3	60.9
Median	83.6	87.7	86.6	83.5	80.9	74.4	66.7	66.9	69.3	70.5	76.2	79.3
Maximum	87.5	89.5	89.4	86.6	85.8	84.5	82.1	82.2	81.3	84.5	85.3	85.5
St. Dev.	2.1	4.3	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.3

Table 33b - Monthly Statistics for Average X2 Position in the 2020 Scenarios (km)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 No Project Alternative A												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 No Project Alternative B												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 Proposed Project Alternative												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.5	68.1	58.1	49.6	49.9	46.7	42.2	48.9	52.3	52.7	61.7
Median	83.6	87.3	86.5	83.8	81.5	75.5	67.2	67.3	69.2	70.7	76.0	79.4
Maximum	87.5	89.5	89.7	85.8	85.8	84.6	82.2	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.2	8.4	8.2	7.0	4.3

Table 34a - Monthly Statistics for Export/Import Ratio in the 1994 and 2003 Scenarios

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	0.50	0.45	0.42	0.36	0.24	0.22	0.19	0.19	0.28	0.39	0.50	0.58
Minimum	0.20	0.07	0.03	0.04	0.04	0.02	0.05	0.07	0.07	0.08	0.10	0.23
Median	0.50	0.47	0.50	0.35	0.22	0.22	0.21	0.18	0.31	0.45	0.56	0.63
Maximum	0.65	0.65	0.63	0.65	0.45	0.35	0.32	0.34	0.35	0.52	0.62	0.65
St. Dev.	0.10	0.13	0.18	0.20	0.13	0.10	0.07	0.06	0.08	0.12	0.14	0.09
2003 Baseline												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.03	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.24
Median	0.54	0.48	0.48	0.40	0.25	0.23	0.19	0.11	0.29	0.44	0.56	0.63
Maximum	0.65	0.65	0.64	0.63	0.45	0.35	0.26	0.27	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09
2003 No Project Alternative A												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.02	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.22
Median	0.53	0.48	0.48	0.39	0.24	0.24	0.19	0.11	0.30	0.44	0.56	0.63
Maximum	0.65	0.65	0.62	0.60	0.45	0.35	0.26	0.28	0.35	0.52	0.63	0.65
St. Dev.	0.10	0.14	0.17	0.18	0.13	0.10	0.06	0.05	0.07	0.13	0.15	0.09
2003 No Project Alternative B												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.03	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.24
Median	0.54	0.48	0.48	0.40	0.25	0.23	0.19	0.11	0.29	0.44	0.56	0.63
Maximum	0.65	0.65	0.64	0.63	0.45	0.35	0.26	0.27	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09
2003 Proposed Project Alternative												
Average	0.53	0.45	0.41	0.35	0.24	0.23	0.17	0.12	0.27	0.38	0.49	0.57
Minimum	0.14	0.04	0.02	0.03	0.02	0.02	0.05	0.03	0.06	0.07	0.09	0.20
Median	0.54	0.48	0.48	0.39	0.24	0.24	0.19	0.11	0.30	0.44	0.56	0.62
Maximum	0.65	0.65	0.62	0.60	0.45	0.35	0.26	0.28	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09

Table 34b - Monthly Statistics for Export/Import Ratio in the 2020 Scenarios

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 No Project Alternative A												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 No Project Alternative B												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 Proposed Project Alternative												
Average	0.56	0.47	0.45	0.37	0.25	0.24	0.17	0.12	0.28	0.38	0.47	0.60
Minimum	0.25	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.08	0.08	0.31
Median	0.58	0.50	0.52	0.45	0.26	0.26	0.19	0.11	0.31	0.42	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.25	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.18	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08

3.5. Reservoir Storage Levels

Figures 20a through 20c show the annual carryover storage levels at the end of December in Lake Oroville. Figures 21a through 21c show the same information in the SWP portion of San Luis Reservoir in each scenario. In Lake Oroville, each of the scenarios have similar storage patterns, with the Baseline, Proposed Project and No Project scenarios being very similar in both 2003 and 2020. In San Luis Reservoir, there is more variation between the scenarios in 2003 but the values in 2020 are similar. In both reservoirs there are many years in which the 1994 Baseline has greater carryover storage levels than at the later levels of development, and in many years there are higher carryover storage levels at the 2003 level of development scenarios than in the 2020 level of development scenarios.

Figure 22a shows the average monthly storage in the SWP portion of San Luis Reservoir in each of the 2003 scenarios. Figure 22b shows the same information for the 2020 scenarios. The monthly patterns at each level of development are similar in each of the different scenarios, except that San Luis storage is a little bit higher in most months in the Proposed Project than in the Baseline and No Project scenarios.

In addition, as discussed above the SWP San Luis monthly storage values from the CALSIM II model were adjusted to account for the change in monthly delivery patterns between the different No Project scenarios. As the data in the figures show, these differences had only a minor effect on San Luis storage results.

Figure 20a - End-of-December Carryover Storage Values in Lake Oroville at the 1994 Level of Development

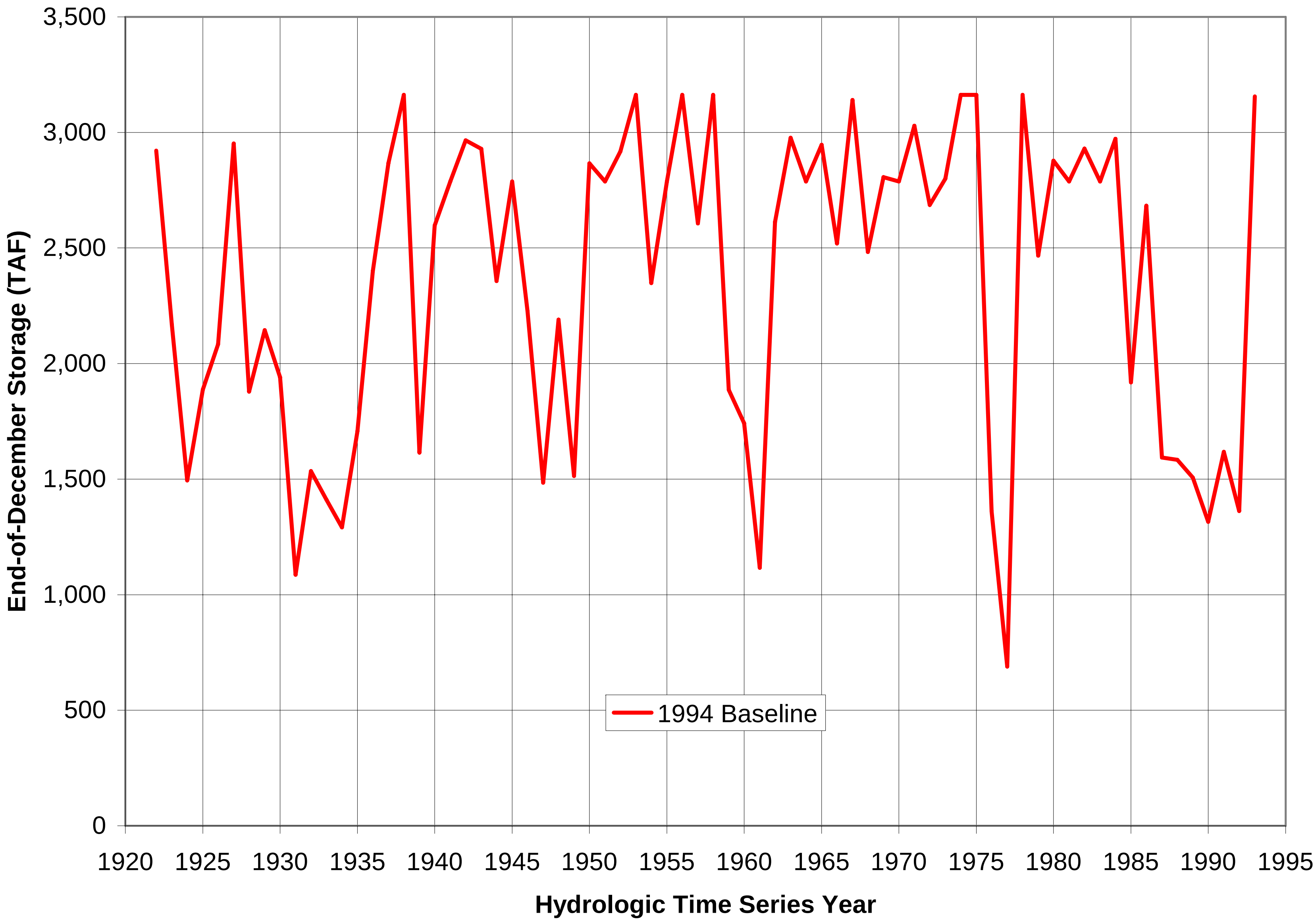


Figure 20b - End-of-December Carryover Storage Values in Lake Oroville at the 2003 Level of Development

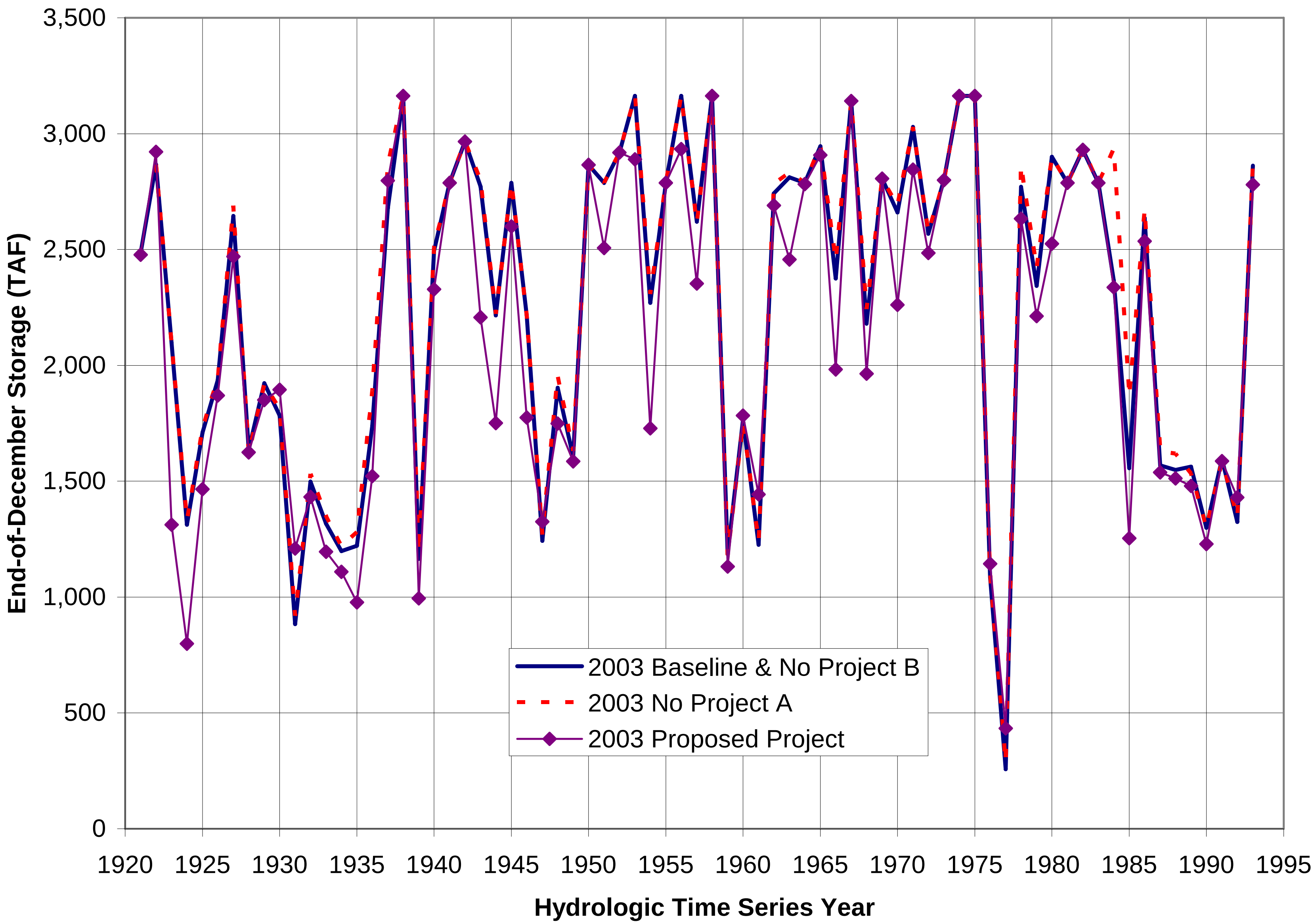


Figure 20c - End-of-December Carryover Storage Values in Lake Oroville at the 2020 Level of Development

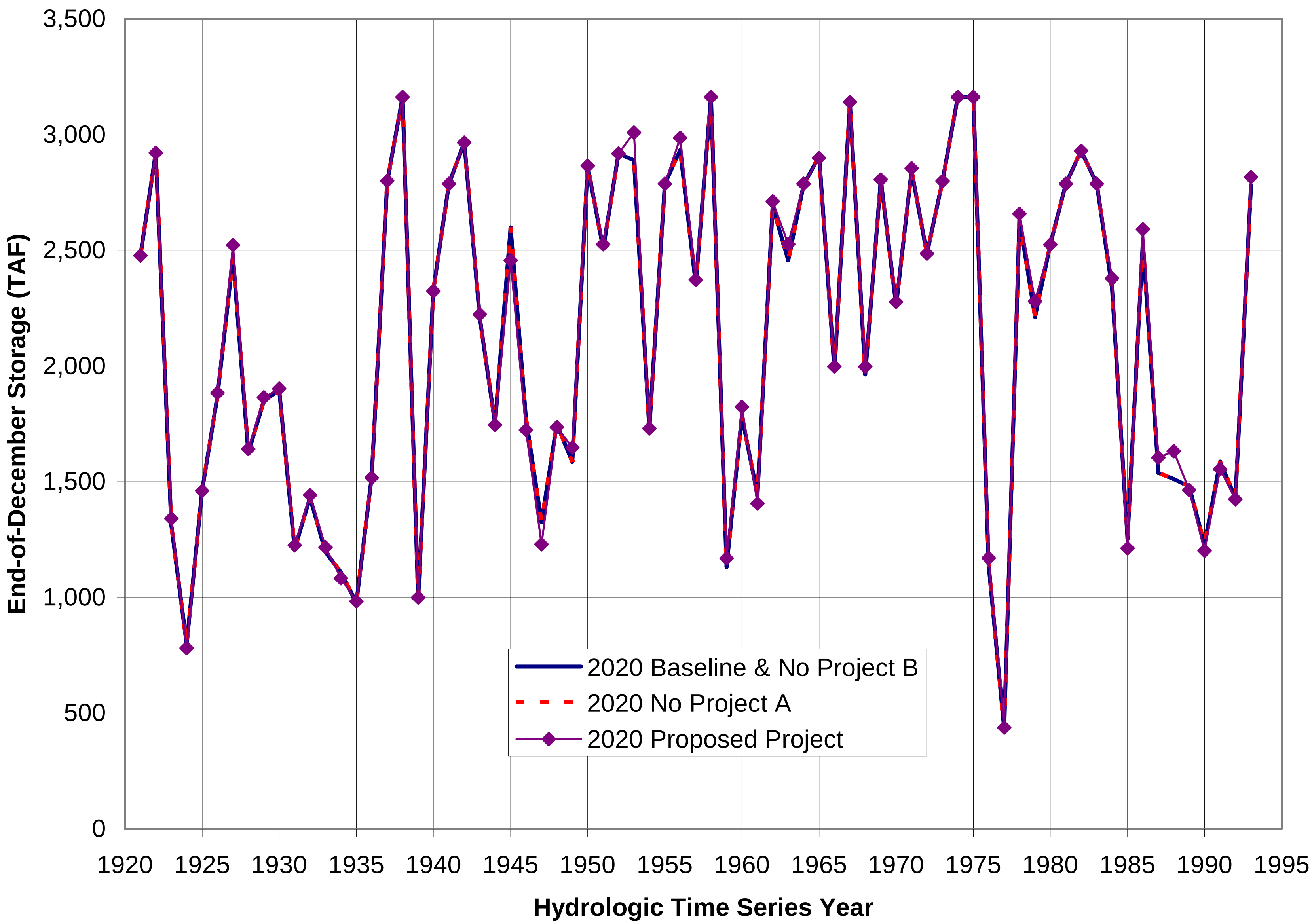


Figure 21a - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 1994 Level of Development

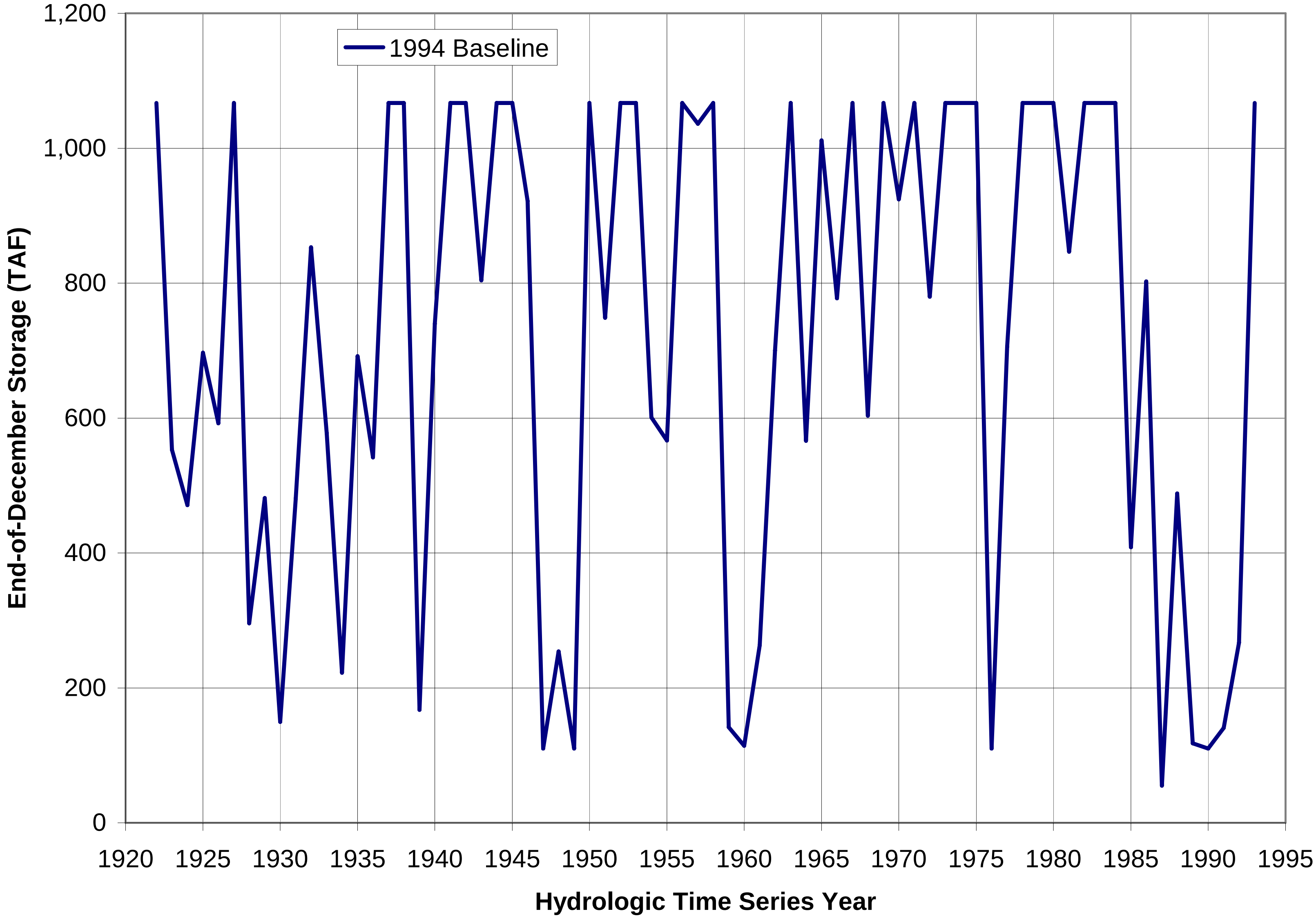


Figure 21b - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 2003 Level of Development

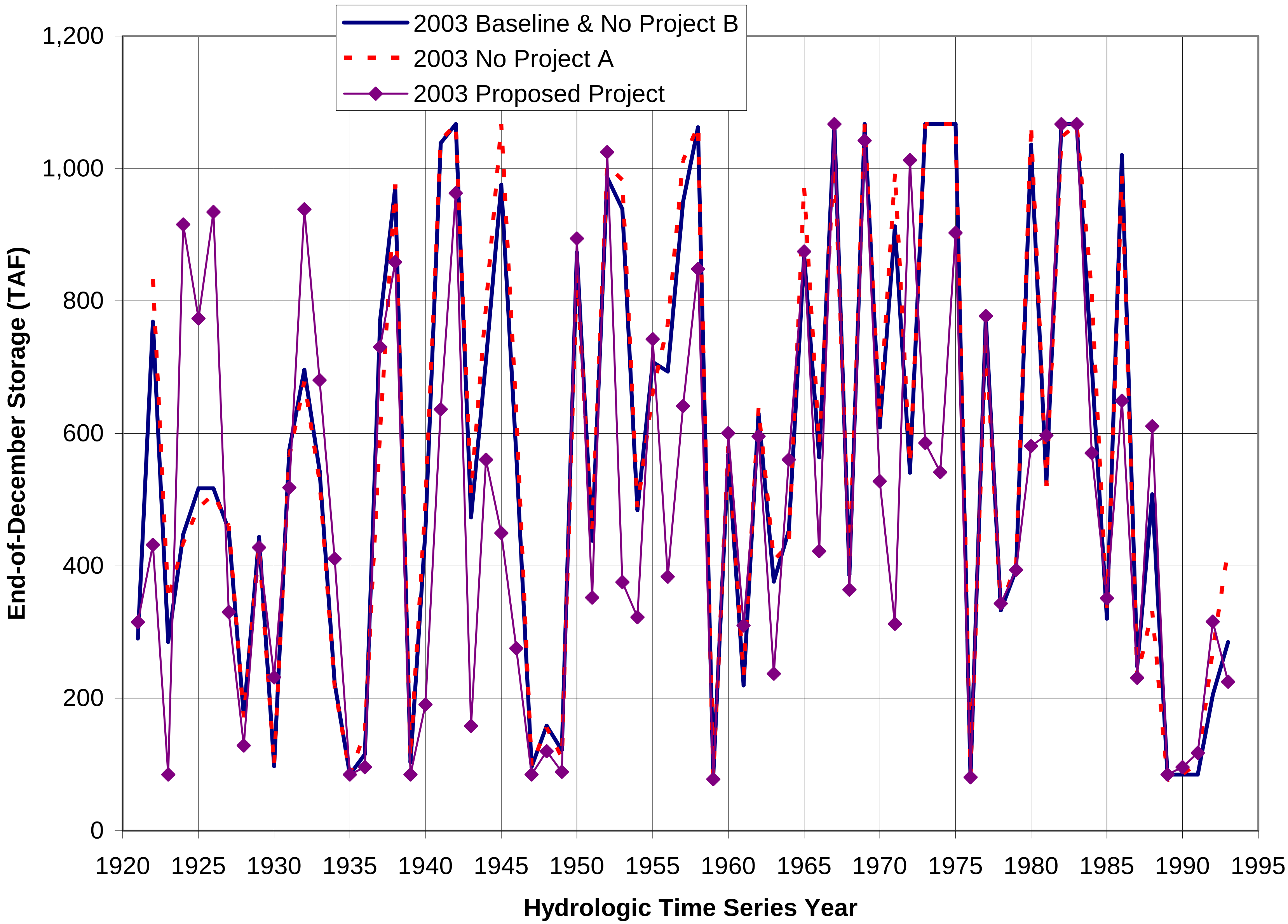


Figure 21c - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 2020 Level of Development

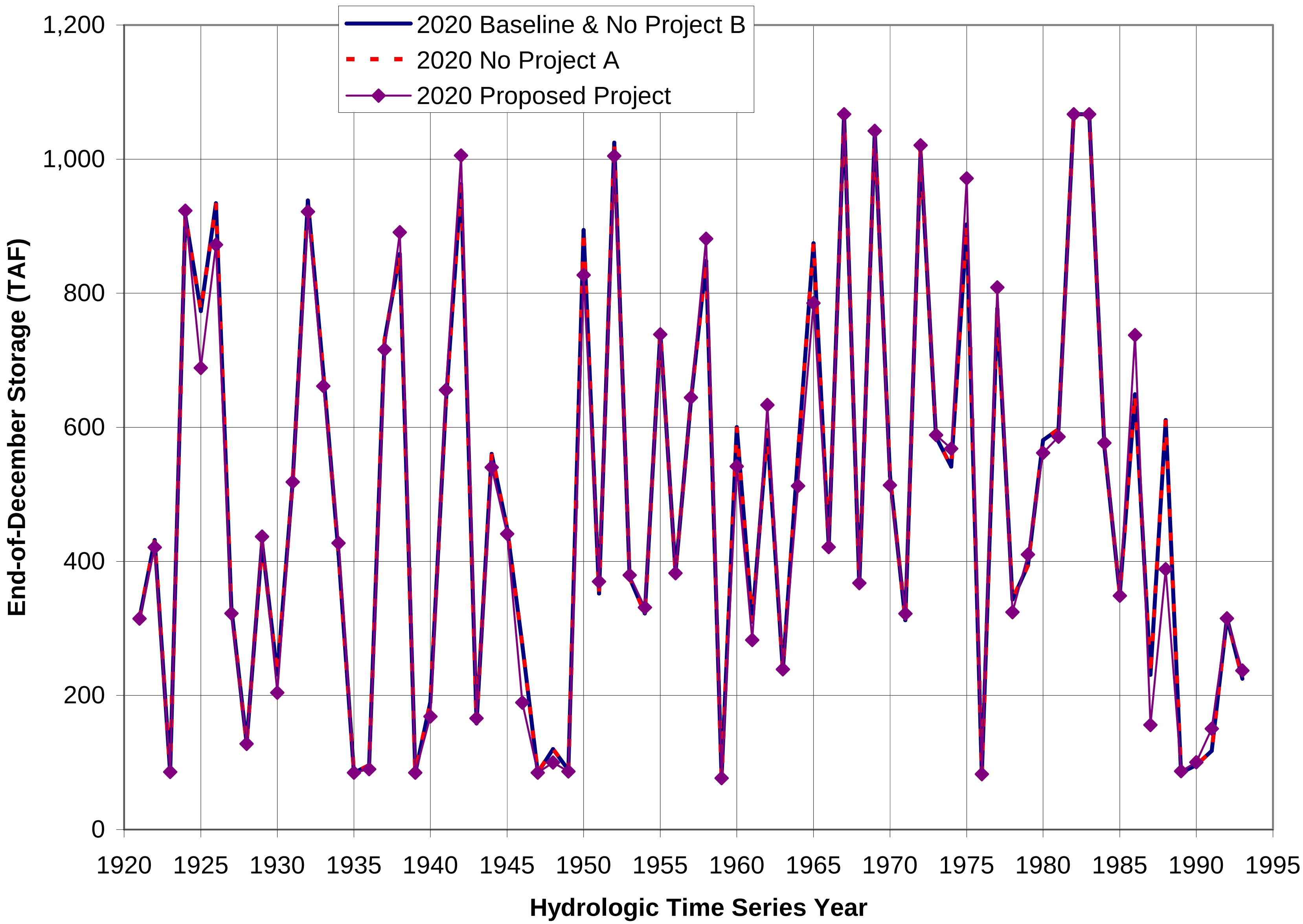


Figure 22a - Average Monthly Storage Values in SWP Portion of San Luis Reservoir at the 2003 Level of Development

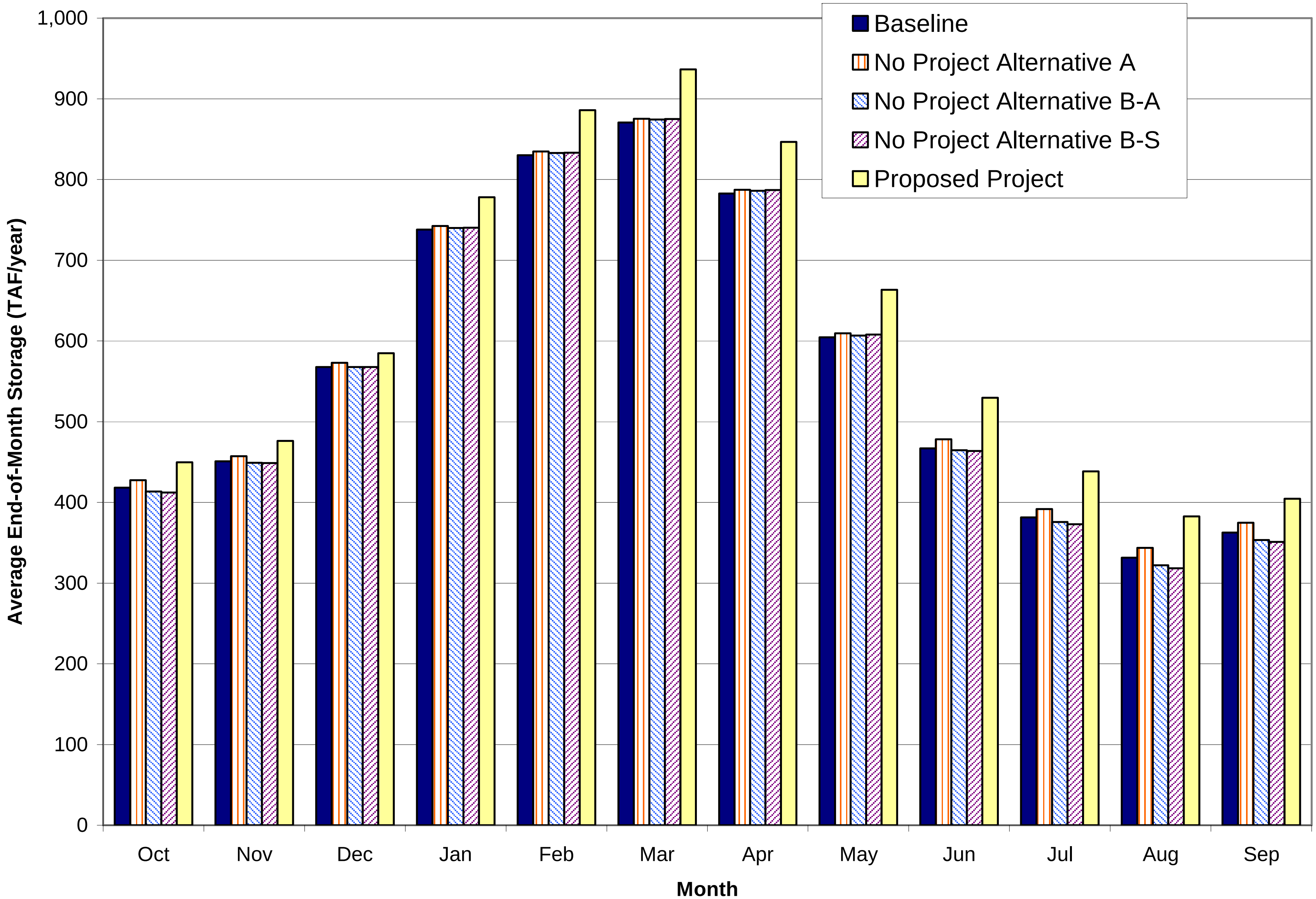
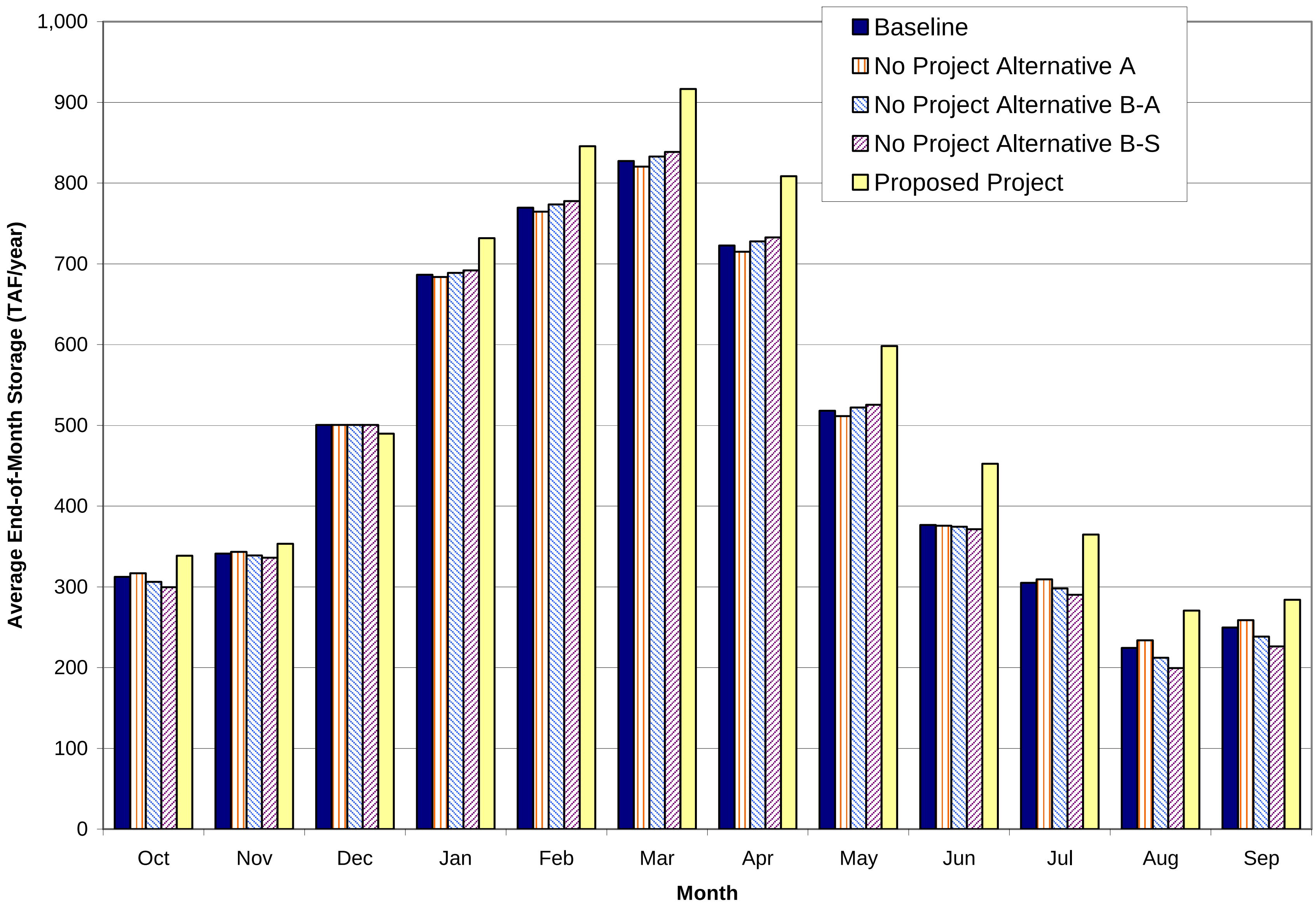


Figure 22b - Average Monthly Storage Values in SWP Portion of San Luis Reservoir at the 2020 Level of Development



3.6. Kern Fan Element Storage Operations

Scenarios were developed for the 2003 and 2020 No Project Alternatives A, B-A, and B-S that incorporate a SWP-owned groundwater banking facility in the Kern Fan Element (KFE). Section 3.1 on SWP deliveries report the scheduled and unscheduled deliveries that occurred under each Alternative with and without the KFE facility in place. This section describes the operations of the banking facility itself.

Table 35 shows the average annual recharge and extraction quantities in each scenario in each water year type. In the 2003 scenarios about 8.6 TAF per year is recharged into KFE, with extractions of about 7.5 TAF per year. In the 2020 scenarios 14.6 to 16.4 TAF is recharged into KFE and 13.0 – 14.6 TAF per year is extracted. In all scenarios, most recharge occurs during wet and above normal years and all of the extraction occurs during dry and critical years.

Table 35 – Kern Fan Element Storage Facility Recharge and Extraction (TAF/year)

	2003 No Project A	**2003 No Project B**	**2020 No Project A**	**2020 No Project B**
Recharge				
All Years	8.6	8.6	16.4	14.6
Wet Years	12.7	13.1	26.8	22.4
Above Normal Years	15.2	15.2	23.8	23.8
Below Normal Years	8.7	8.1	17.9	15.5
Dry Years	5.1	5.1	8.4	8.4
Critical Years	0.0	0.0	0.0	0.0
Extraction				
All Years	7.5	7.5	14.6	13.0
Wet Years	0.0	0.0	0.0	0.0
Above Normal Years	0.0	0.0	0.0	0.0
Below Normal Years	0.0	0.0	0.0	0.0
Dry Years	6.6	6.6	24.5	16.9
Critical Years	37.3	37.1	57.6	57.6

Figures 23a through 23b show the annual extraction and recharge amounts that occur in each water year in each scenario. Figures 24a through 24b show the KFE storage in each month of the simulation. In all scenarios, the KFE storage facility is filled to capacity for much of the period of simulation and then reduced as extractions occur during dry periods.

Figure 23a – Annual Extraction and Recharge in KFE Storage in 2003 No Project Alternative A

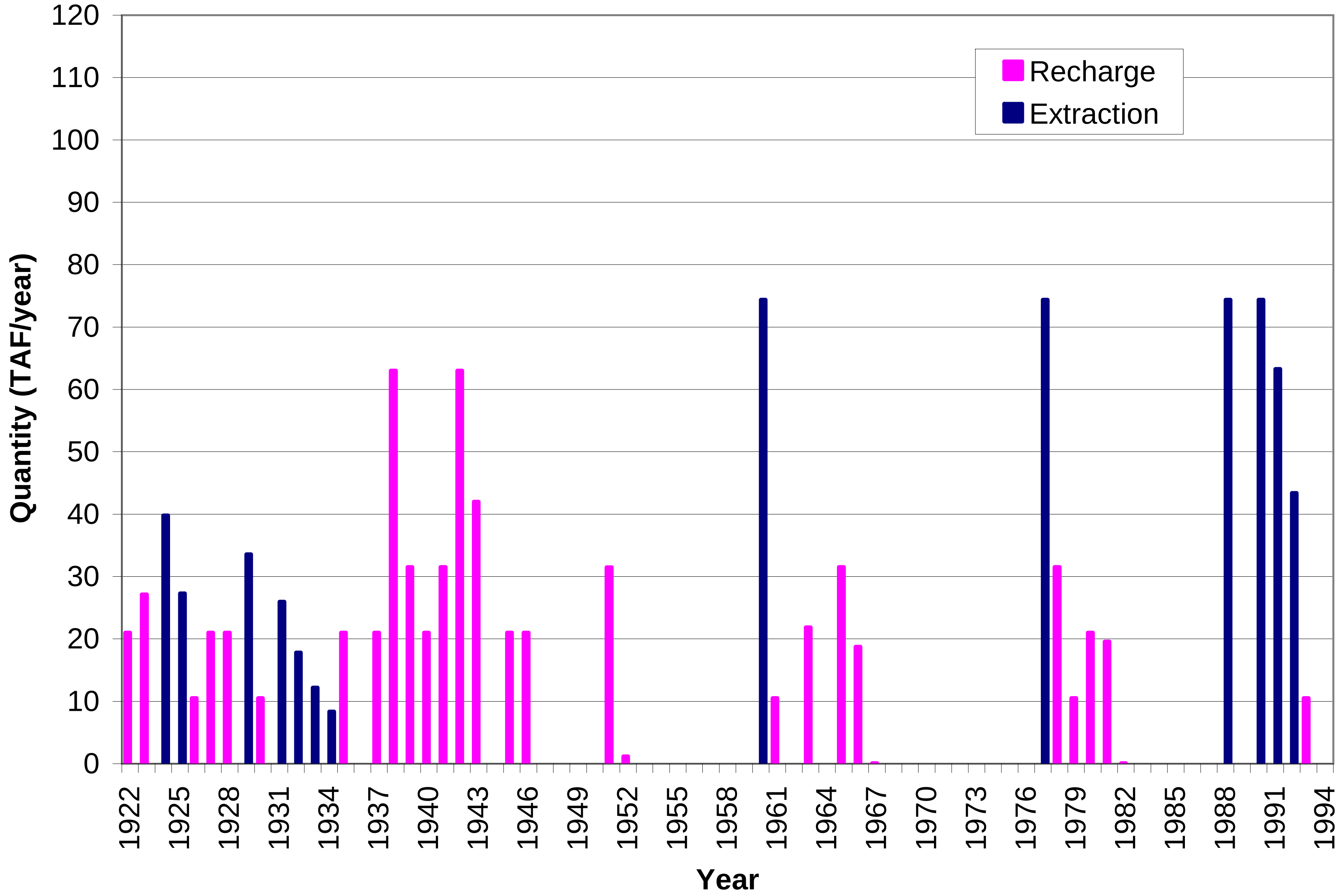


Figure 23b – Annual Extraction and Recharge in KFE Storage in 2003 No Project Alternative B

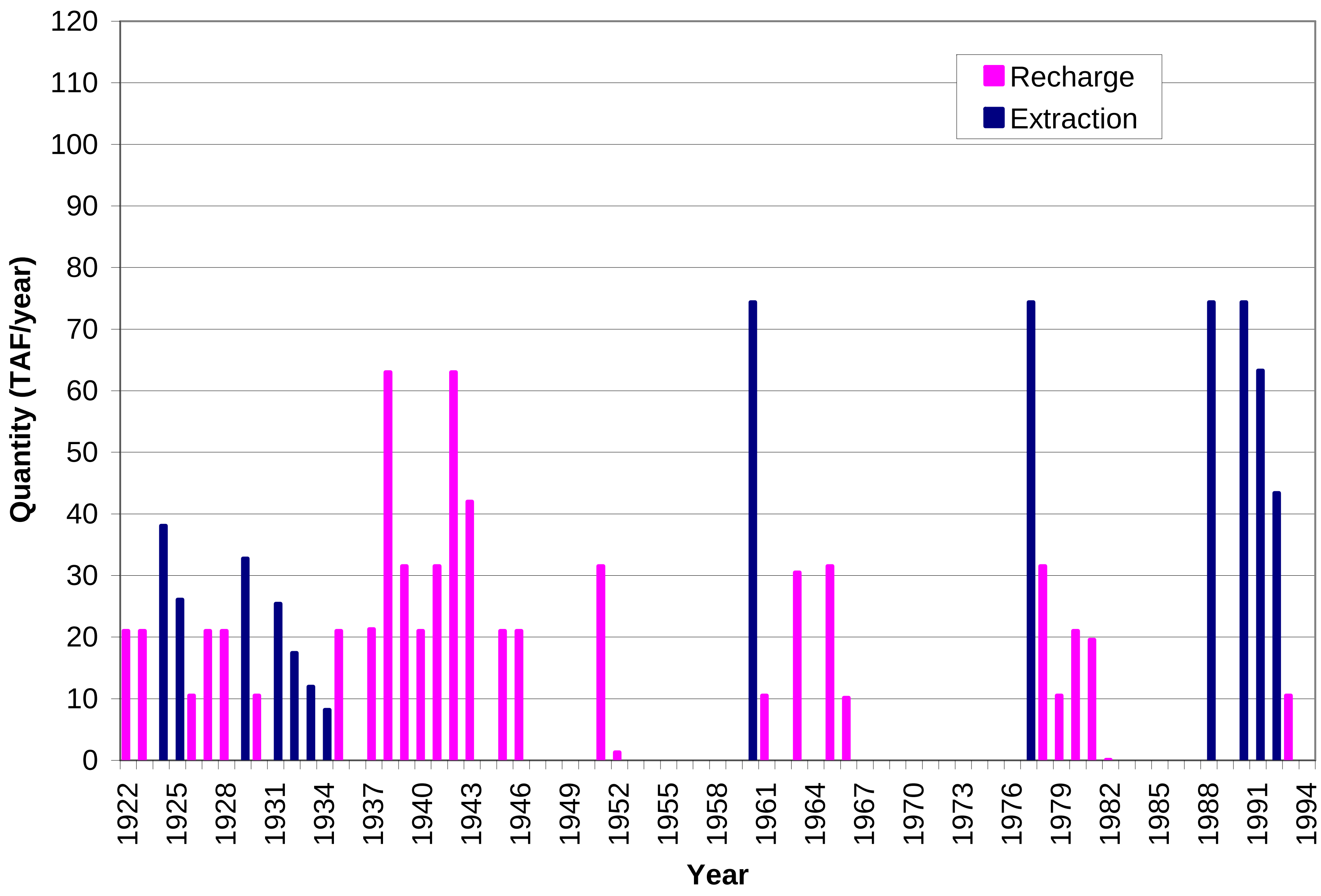


Figure 23c – Annual Extraction and Recharge in KFE Storage in 2020 No Project Alternative A

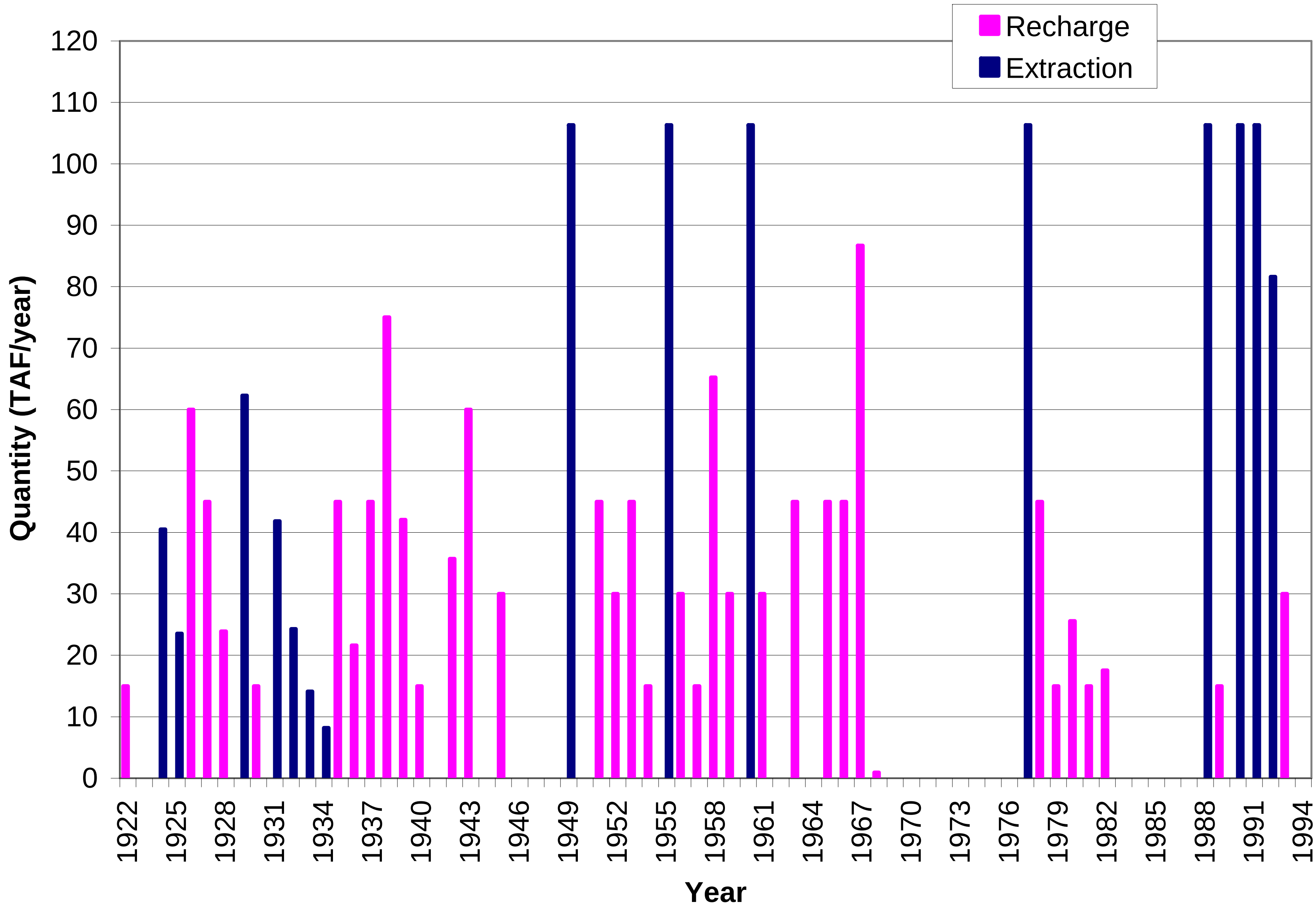


Figure 23d – Annual Extraction and Recharge in KFE Storage in 2020 No Project Alternative B

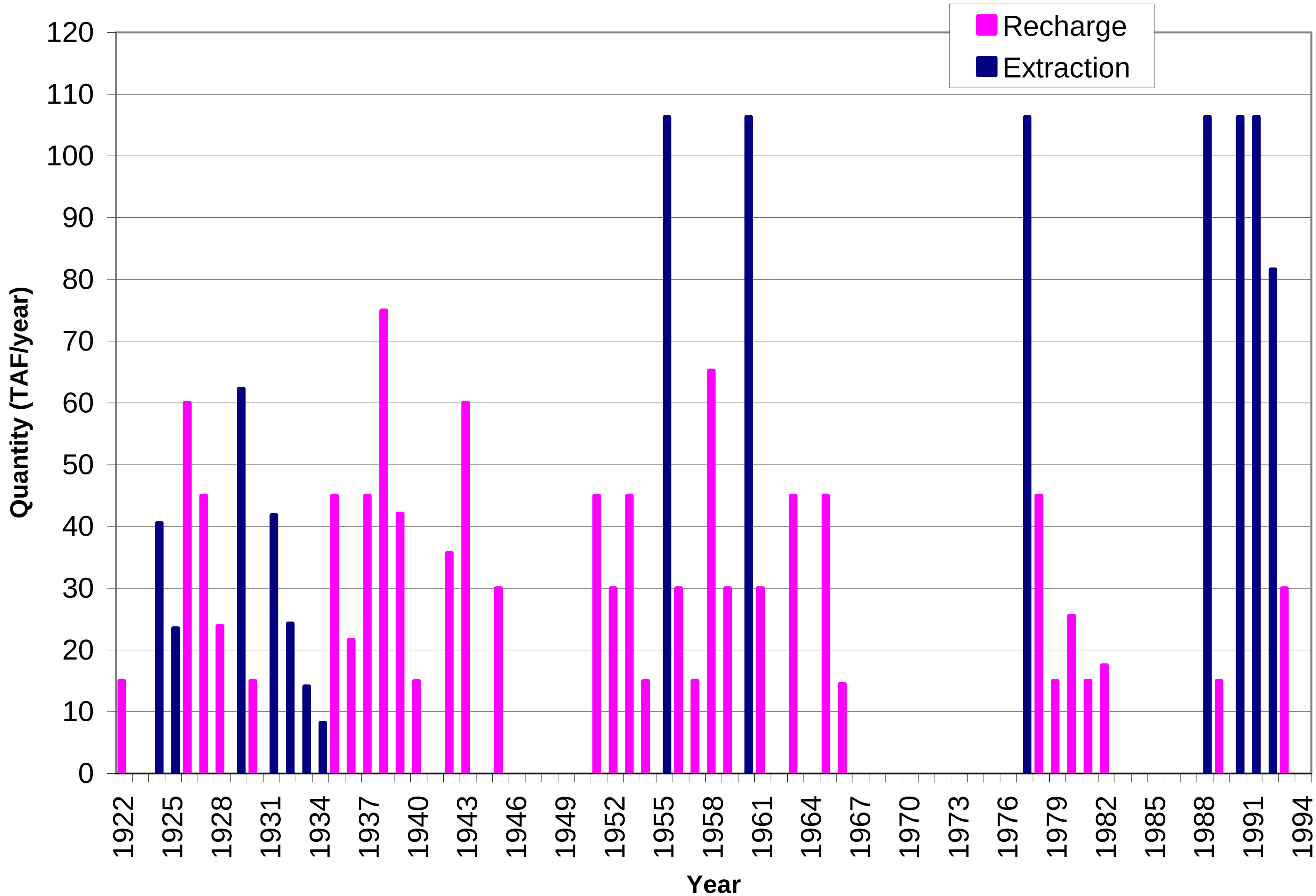


Figure 24a – Monthly Storage in the Kern Fan Element in 2003 No Project Alternative A

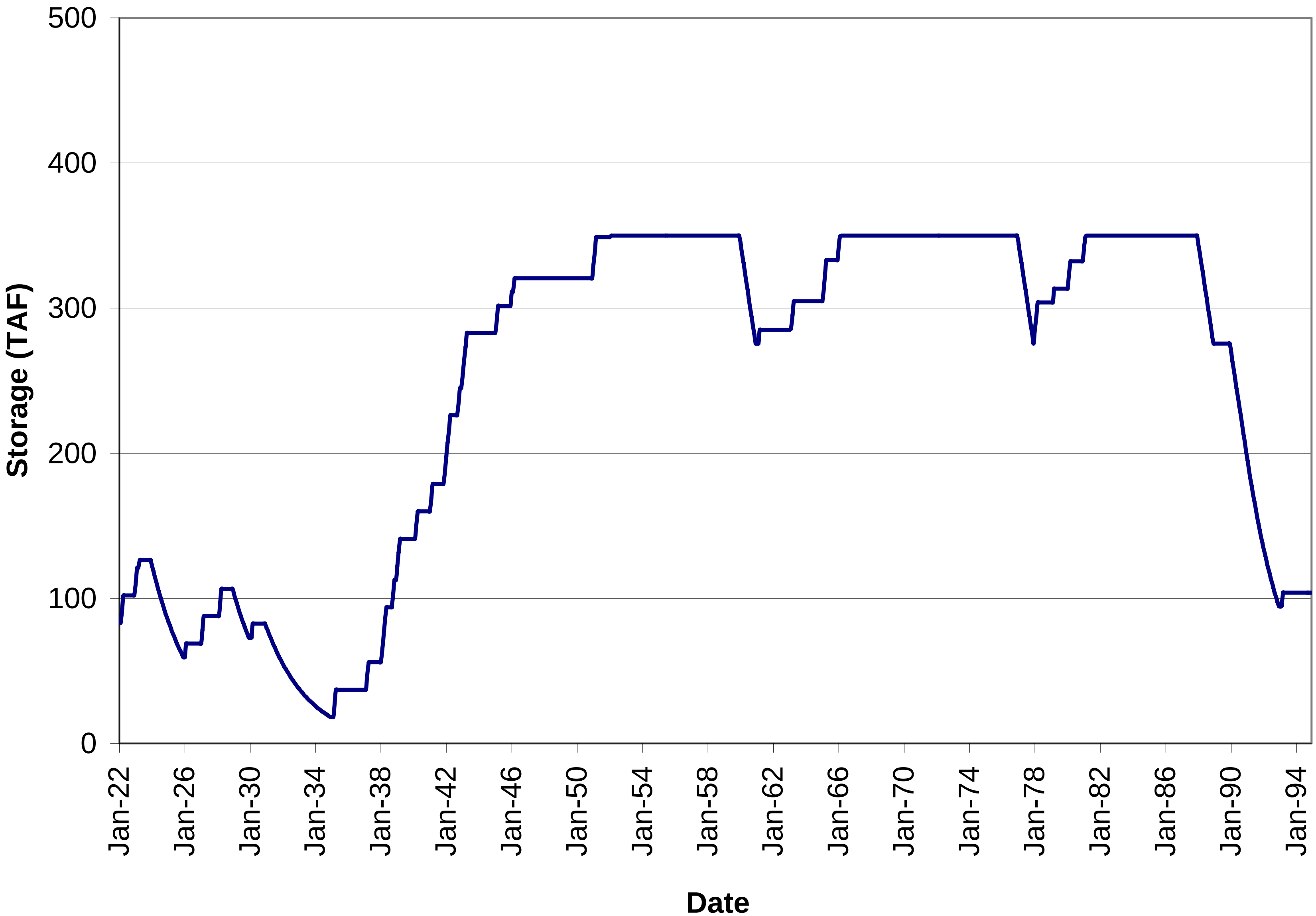


Figure 24b – Monthly Storage in the Kern Fan Element in 2003 No Project Alternative B

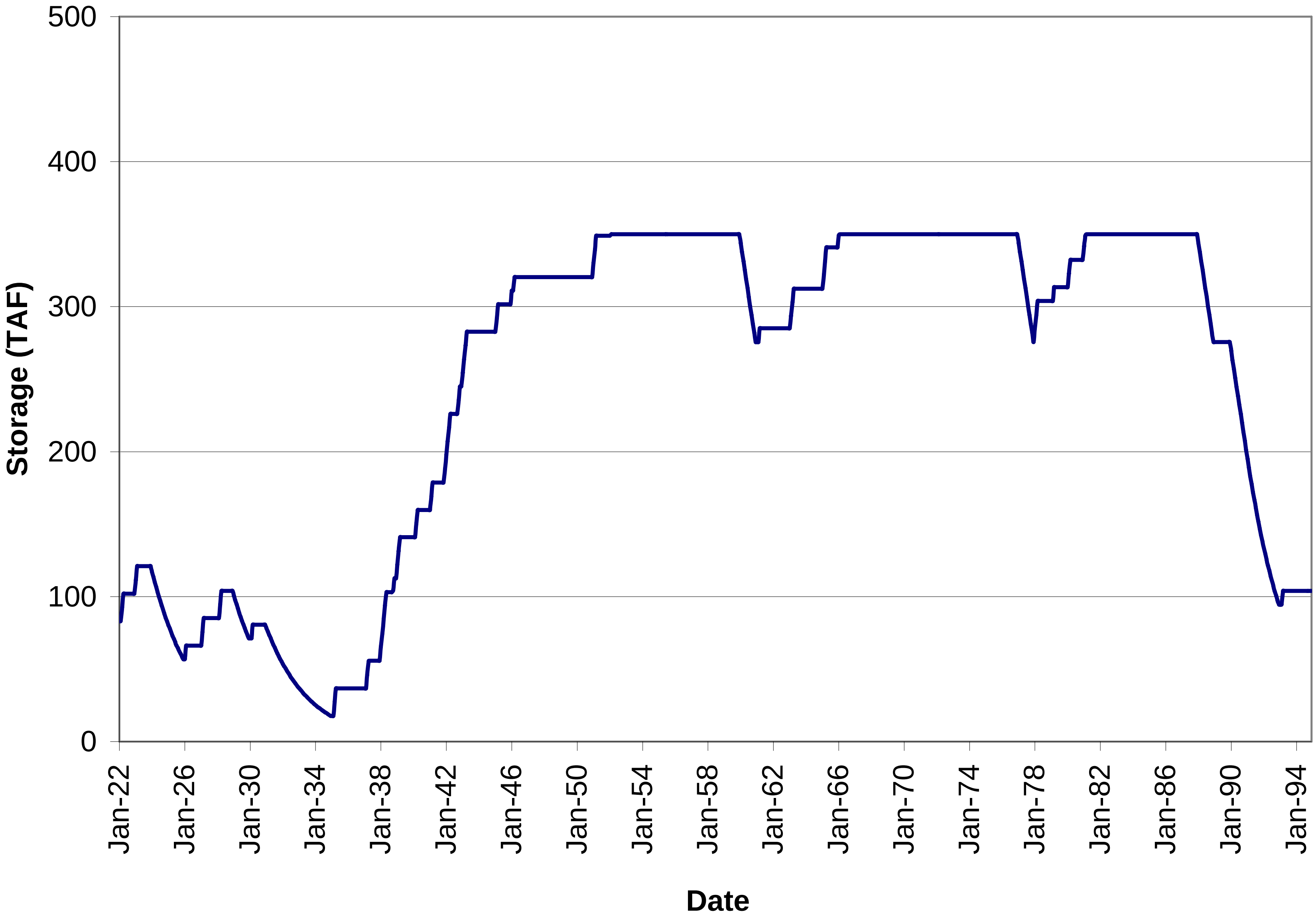


Figure 24c – Monthly Storage in the Kern Fan Element in 2020 No Project Alternative A

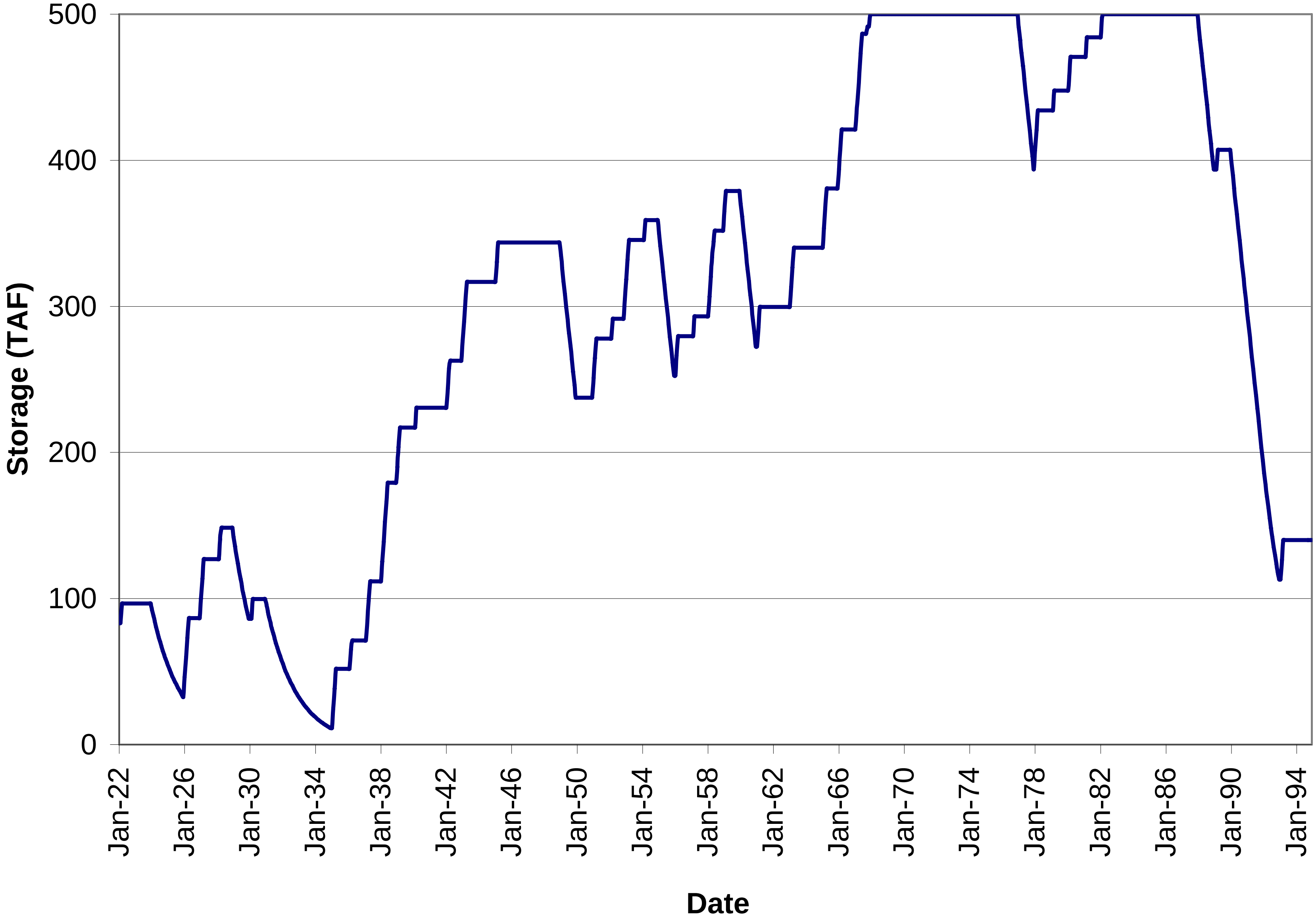
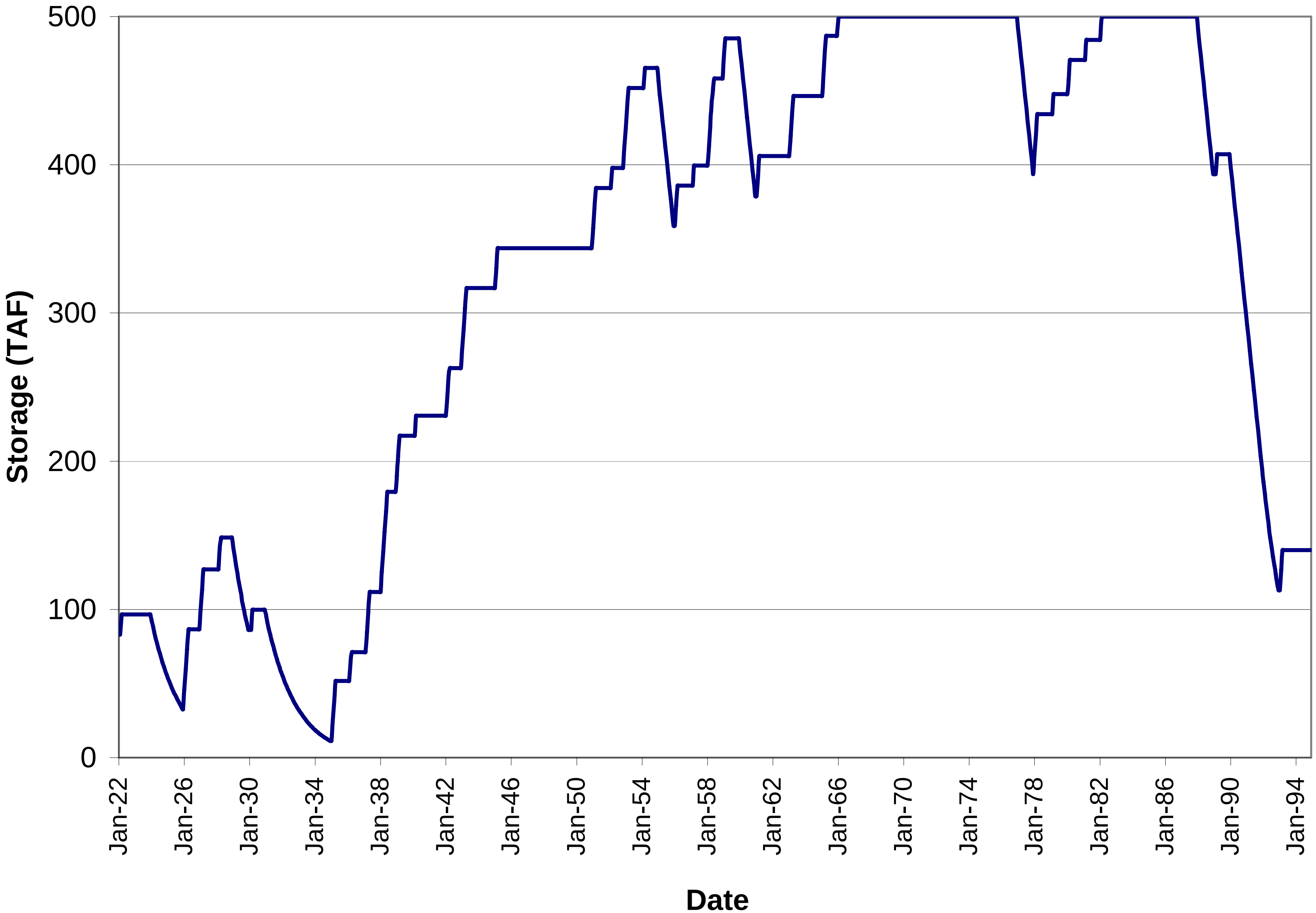


Figure 24d – Monthly Storage in the Kern Fan Element in 2020 No Project Alternative B



4.0. Limitations

For the Monterey Plus EIR, the CALSIM II model was used to simulate overall SWP and CVP operations and the resulting flows in the Delta and in upstream rivers in each alternative. However, because the most significant differences in assumptions between the different alternatives is in the allocation rules for SWP deliveries, the system-wide SWP Table A and Article 21 delivery results from CALSIM II have been post-processed using Excel spreadsheets to determine the deliveries to each contractor in each alternative. With this approach the deliveries to individual contractors are determined according to each alternative's allocation rules but total SWP deliveries for each year are unchanged from the CALSIM II model results.

The CALSIM II model is the best available tool for long-term planning of the SWP, CVP, and the Delta in an integrated manner. However, in its current state of development it has several limitations, some of which were identified in *A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California* (Close et al. 2003). The following are some of the more significant limitations of the CALSIM II model:

- The CALSIM II model simulates at a monthly time step that does not reflect daily variations in flows and climatic conditions. However, monthly results still yield useful insights into the differences between alternatives (USBR 2004).

- Because the operations of the CVPIA (b)(2) and EWA respond to real-time hydrology and fish movements the program operations do not follow a pattern that can be predicted in a monthly model; thus CALSIM II cannot completely represent the operations of these programs. Because the model is set up to run each step of the 3406(b)(2) on an annual basis and because the WQCP and Endangered Species Act actions are set on a priority basis that can trigger actions using 3406(b)(2) water or EWA assets, the model will exceed the dedicated amount of 3406(b)(2) that is available. In addition, the 3406(b)(2) and EWA operations in CALSIM II do not fully account for the potential weighting of assets versus cost or the dynamic influence of biological factors on the timing of actions. The monthly time step of CALSIM II also requires day-weighted monthly averaging to simulate VAMP actions, export reductions, and X2-based operations, which can cause the amount of water needed for these actions to be either an under- or over-estimated (USBR 2004).

- Because CALSIM II uses fixed rules and guidelines, operations might not reflect how the SWP and CVP would operate during extended drought periods. The allocation process utilizes storage-delivery curves to determine annual allocation amounts based on storage conditions and inflow to project reservoirs but does not include project inflow from contributing streams. This curve-based approach may cause some variation in results between studies that would be closer with a more robust approach to the allocation process (USBR 2004).

There are the following additional limitations specific to the modeling approach employed in this analysis:

- Under the pre-Monterey Amendment allocation rules, agricultural Table A amounts receive an initial cut in SWP deliveries in years when 100% Table A allocation cannot be achieved by an amount up to 50% of their Table A amounts in any one year or a total of 100% of their Table A amounts over any seven year period. While these allocation rules were implemented in the analysis, there was no way to fully implement the seven year rule in the first six years of the analysis, which could cause an underestimate of agricultural deliveries in these years in the No Project Alternatives. For this reason, the first six years of data have been removed in the reporting of SWP deliveries in this appendix.

- For the 1994 and 2003 scenarios a constant annual Table A demand was used for every M&I contractor other than MWDSC. In reality, these contractors have demands for Table A water that may differ by year type and other local conditions. However, because of the limited amount of data available to quantify their demands at each level of development and because their demands are relatively much smaller than that of KCWA and MWDSC, the Monterey Plus EIR Modeling Subcommittee determined that assuming a constant Table A demand for each of these contractors was an acceptable simplification.

- In the real-world operation of the State Water Project, contractors may request their full Table A amounts and then only take a portion of their allocated amount. This means that their "request" may differ from their actual "demand". However, while the SWP operators may not know what the demand actually is, in the CALSIM II model and in the post-processing spreadsheets it is assumed that the actual demands are known at the beginning of the contract year. This approach may result in a minor over-estimation of SWP project deliveries in the 1994 and 2003 scenarios.

- The Monterey Amendment includes a provision for a Turnback Pool, by which contractors who do not utilize their entire Table A allocation can sell unused allocation to other contractors. However, the Turnback Pool is not represented in the CALSIM II model, nor is data available to adequately quantify this operation, and thus there was no way to fully represent it in the post-processing spreadsheets. This means that the delivery patterns shown for the Proposed Project scenarios may be somewhat different than they would be if the Turnback Pool were fully represented.

- In this analysis, the monthly storage pattern in San Luis Reservoir and the monthly delivery pattern to SWP contractors are operated dynamically in the CALSIM II model and then are post-processed to match the allocation assumptions of each alternative. This approach results in only a minor change in San Luis Reservoir operation in most years, but it does not allow for a dynamic operation of the reservoir, which likely results in some minor inefficiencies in the operation of the Project.

- For the 1994 scenario, there is no available data set for the 1994 level of development for many parts of the system, including Sacramento and San Joaquin River hydrology and CVP demands. In order to analyze this scenario it has been assumed that these components of the state water system are the same as in the 2003 alternatives.

For the Monterey Plus EIR, the effects of these limitations have been minimized because the model and post-processing results have been presented in "comparative" mode as opposed to “absolute” or “predictive” mode. In “absolute” applications the model is run once to predict a future outcome and errors or assumptions in formulation, system representation, data, operational criteria and other model inputs all contribute to total error or uncertainty in model results. In “comparative” applications the model is run two or more times, once to represent a baseline condition and additional times with specific changes in inputs to assess the changes in the outcome due to the input changes. In comparative mode, only the difference between two simulations is of importance – the errors and uncertainties that exist in both simulations are largely removed (or significantly reduced) when measuring the change between simulations.

5.0. References

California Department of Water Resources (1990) *Kern Water Bank First Stage Kern Fan Element Feasibility Report*. Sacramento, CA, December 1990.

California Department of Water Resources (2002) *Benchmark Study Assumptions.* Sacramento, CA, September 2002.

Close, A., Haneman, W.M., Labadie, J.W., Loucks, D.P., Lund, J.R., McKinney, D.C., and Stedinger, J.R. (2003) *A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California.* Submitted to the California Bay Delta Authority Science Program and Association of Bay Governments, Oakland, CA, December 2003.

U.S. Department of the Interior, Bureau of Reclamation (2004) *Long-Term Central Valley Project Operations Criteria and Plan CVP-OCAP*. Sacramento, CA, June 2004.

Monterey Plus EIR

Attachment to
Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines

5/03/2007

This document is an attachment to the appendix *Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines* (May 30, 2006). The appendix describes the approach, assumptions and results of CALSIM II modeling and associated post-processing that was performed in support of the Monterey Plus EIR. The modeling assisted analysis of some of the Monterey Amendment's impacts on the State Water Project (SWP) and other areas. The analysis included evaluation of a 1994 Baseline and 2003 and 2020 evaluations of a Baseline, the Proposed Project and multiple No Project Alternatives that reflect different interpretations of the pre-Monterey contracts.

This attachment describes the assumptions and results of additional scenarios at the 2003 and 2020 levels of development have been developed since the release of the May 30, 3006 appendix. For each of these additional scenarios the SWP deliveries to each contractor have been post-processed using the same process used previously. The attachment reports the resulting SWP scheduled and unscheduled deliveries to each contractor.

Additional Scenarios

The following additional scenarios have been analyzed at both the 2003 and 2020 levels of development for the following alternatives.

- No Project Alternative 1
- No Project Alternative 2
- No Project Alternative 3
- No Project Alternative 4

A revised version of the Proposed Project has also been analyzed at the 2020 level of development.

No Project Alternatives 1, 3, and 4 have been analyzed both with and without a hypothetical SWP groundwater banking facility in the Kern Fan Element (KFE). No Project Alternative 2 does not include a state-owned groundwater banking facility in the KFE.

In addition, for No Project Alternative 1 and revised Proposed Project at the 2020 level of development additional scenarios were developed to analyze SWP deliveries under climate change conditions.

Changes in Assumptions for Additional Scenarios

With the exception of the changes described below, the revised Proposed Project scenarios utilize all of the same assumptions as the original Proposed Project scenarios; the No Project Alternative 1 and No Project Alternative 2 scenarios utilize all of the same assumptions as the original Baseline and No Project A scenarios; the No Project Alternative 3 scenarios utilize all of the same assumptions as the original Alternative B-A scenarios; and the No Project Alternative 4 scenarios utilize all of the same assumptions as the original Alternative B-S scenarios.

The additional scenarios incorporate the following changes in assumptions relative to the original scenarios.

- For all of the 2020 scenarios, Banks Pumping Plant has been operated at the 1994 operating capacity of 6,680 cfs.
- The assumed Table A transfers have been revised from the original scenarios. The assumed Table A transfers included in the additional scenarios are shown in Table A-1. Table A-2 shows the resulting Table A amounts for each contractor in each scenario.

CALSIM II Simulations Used for Post-Processing Analysis

2003 Scenarios

SWP deliveries for the additional 2003 scenarios were post-processed from the same CALSIM II simulations that were used for the original scenarios. The No Project Alternative 1, 3 and 4 scenarios were post-processed using data from the Baseline CALSIM II simulation. The No Project Alternative 2 scenario was post-processed using data from the No Project A CALSIM II simulation.

At the 2003 level of development, the Proposed Project scenario is unchanged from the original scenario contained in the May 30, 2006 appendix. However, Table A amounts and SWP delivery results from the original scenario are shown in this attachment for comparison purposes.

2020 Scenarios

Updated versions of the 2020 Baseline and 2020 Proposed Project CALSIM II simulations were performed. The assumptions and input data for these scenarios were the same as the original CALSIM II simulations except that the operation of Banks Pumping Plant was changed to a capacity of 6,680 cfs. The No Project Alternative 1, 2, 3 and 4 scenarios were post-processed using data from the updated Baseline CALSIM II simulation. The revised Proposed Project scenario was post-processed using data from the updated Proposed Project CALSIM II simulation.

Analysis of Climate Change Scenarios

For the climate change scenarios, the annual scheduled deliveries used as an input into the post-processing spreadsheets were modified using SWP delivery data from the GFDL B1 and Base scenarios contained in *Progress on Incorporating Climate Change into Management of California's Water Resources* (DWR, July 2006). The Table A deliveries from the Monterey

Plus EIR CALSIM II simulations were adjusted by multiplying each year's value by a factor equal to the ratio of the Table A delivery in the GFDL B1 scenario divided by the Base scenario. Post-processing of the SWP deliveries was then performed using this revised time series.

Unscheduled deliveries were not modified to account for climate change because the average annual unscheduled deliveries in the GFDL B1 scenario were very close to that in the Base scenario.

SWP Delivery Results for the Additional Scenarios

Average annual scheduled and unscheduled deliveries to each contractor in each of the additional scenarios in all years, wet years, above normal years, below normal years, dry years, and critical years are shown in revised versions of Tables A-3a-f, A-4a-f, A-5a-f, and A-6a-f.

Table A-1 - Table A Transfers (acre-feet)

Transferor	Transferee	No Project Alternative 1	No Project Alternative 2	No Project Alternative 3	No Project Alternative 4	Proposed Project	Applicable Levels of Development
Kern County WA	Mojave WA	0	25,000	0	0	25,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	7,000	0	0	7,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	15,000	0	0	15,000[1]	2003, 2020
Kern County WA	Castaic Lake WA	0	41,000	0	0	41,000[1]	2003, 2020
Kern County WA	Palmdale WD	0	4,000	0	0	4,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	10,000	0	0	10,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	2,219	0	0	2,219[1]	2003, 2020
Kern County WA	Napa Co.	0	4,025	0	0	4,025[1]	2003, 2020
Kern County WA	Solano County WA	0	5,756	0	0	5,756[1]	2003, 2020
Kern County WA	Coachella VWD	0	0	0	0	12,000[1]	2020
Kern County WA	Desert WA	0	0	0	0	4,000[1]	2020
Tulare Lake Basin WSD	AVEK WA	3,000	3,000	3,000	3,000	3,000	2003, 2020
Tulare Lake Basin WSD	Dudley Ridge WD	3,973	3,973	3,973	3,973	3,973	2003, 2020
Tulare Lake Basin WSD	Alameda Co., Zone 7	400	400	400	400	400	2003, 2020
Tulare Lake Basin WSD	County of Kings	5,000	5,000	5,000	5,000	5,000	2003, 2020
Tulare Lake Basin WSD	Coachella VWD	9,900	9,900	9,900	9,900	9,900	2003, 2020
MWDSC	Coachella VWD	88,100	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	11,900	11,900	11,900	11,900	11,900	2020

Notes:
(1) This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers

Table A-2 - Table A Amounts in the Additional Scenarios (acre-feet)

SWP CONTRACTOR	2003 No Project 1	2020 No Project 1	2003 No Project 2	2020 No Project 2	2003 No Project 3 & 4	2020 No Project 3 & 4	2003 Proposed Project	2020 Proposed Project
County of Butte	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	46,400	46,400	80,619	80,619	21,132	20,902	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	9,000	9,000	9,000	9,000	4,099	4,054	9,000	9,000
Dudley Ridge WD	61,673	61,673	61,673	61,673	28,087	27,783	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
Kern County Water Agency (M&I)	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
Kern County Water Agency (Agric.)	1,018,800	1,018,800	904,800	904,800	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	96,227	96,227	96,227	96,227	43,824	43,349	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	141,400	141,400	141,400	141,400	64,397	63,698	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	82,500	82,500	18,900	18,695	82,500	82,500
Coachella Valley WD	33,000	121,100	33,000	121,100	15,029	54,554	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	50,000	38,100	50,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,100	2,011,500	1,911,500
Palmdale WD	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,207,100	1,207,100	1,093,100	1,093,100	549,744	543,779	1,048,100	1,032,100
Total M&I	2,964,826	3,010,586	3,078,826	3,124,586	1,350,256	1,356,221	3,078,826	3,140,586
Total	4,171,926	4,217,686	4,171,926	4,217,686	1,900,000	1,900,000	4,126,926	4,172,686

Table A-3a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.5	6.5	6.5	6.4	6.4	7.2	7.2	6.4
Solano	34.2	34.3	34.2	33.3	33.4	30.5	30.6	34.3
Zone 7	41.1	41.2	57.4	38.7	38.8	37.1	37.2	59.3
Alameda	31.9	32.0	31.9	30.8	30.9	29.9	30.0	31.3
Santa Clara	76.6	76.8	76.7	74.0	74.2	71.8	72.0	75.3
Oak Flat	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.7
Kings	7.0	7.0	7.2	7.4	7.4	3.3	3.4	7.3
Dudley Ridge	47.2	47.3	48.4	50.3	50.4	48.3	48.4	46.8
Empire W.S.	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.4
KCWA (M&I)	119.4	119.8	119.5	112.3	112.6	108.6	108.8	117.8
KCWA (Agric.)	778.3	779.5	706.1	829.0	830.7	852.9	854.9	705.7
Tulare	73.0	73.1	74.9	77.8	78.0	89.6	89.8	78.6
SLO	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2
Santa Barbara	25.2	25.3	25.2	25.1	25.2	24.5	24.6	24.9
AVEK	61.8	62.1	61.8	61.5	61.8	61.4	61.6	61.3
Castaic (Agric.)	9.7	9.7	9.9	10.3	10.4	10.6	10.7	10.4
Castaic (M&I)	36.8	36.9	58.7	34.6	34.7	33.5	33.5	61.1
Coachella	17.5	17.5	17.5	16.9	17.0	16.7	16.7	17.8
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
Desert	28.3	28.4	28.3	27.5	27.5	27.0	27.1	27.8
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.0	13.1	13.0	13.0	13.1	13.0	13.1	13.0
MWDSC	1,310.1	1,314.3	1,311.5	1,269.9	1,273.7	1,253.5	1,257.1	1,284.6
Palmdale	13.5	13.5	13.5	13.0	13.0	12.5	12.6	13.5
San Bernardino	64.4	64.6	64.5	63.3	63.5	63.1	63.3	63.5
San Gabriel	16.8	16.9	16.8	16.6	16.6	16.5	16.6	16.6
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total Agriculture	921.8	923.2	853.3	981.9	983.9	1,012.1	1,014.4	855.9
Total M&I	1,908.3	1,914.3	1,948.2	1,848.2	1,853.6	1,818.0	1,823.1	1,919.7
Total	2,830.1	2,837.5	2,801.5	2,830.1	2,837.5	2,830.1	2,837.5	2,775.7

Table A-3b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.6	37.6	35.9	35.9	37.7
Zone 7	46.4	46.4	66.5	45.7	45.7	44.5	44.5	66.5
Alameda	35.2	35.2	35.2	35.0	35.0	34.3	34.3	35.2
Santa Clara	84.7	84.7	84.7	84.1	84.1	82.5	82.5	84.7
Oak Flat	5.3	5.3	5.4	5.3	5.3	5.3	5.3	5.3
Kings	8.6	8.6	8.8	8.7	8.7	3.8	3.8	8.4
Dudley Ridge	57.0	57.0	58.3	57.7	57.7	54.2	54.2	53.4
Empire W.S.	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
KCWA (M&I)	134.6	134.6	134.6	132.6	132.6	130.2	130.2	134.6
KCWA (Agric.)	938.5	938.5	845.2	949.3	949.3	956.7	956.7	805.0
Tulare	87.3	87.3	89.3	88.4	88.4	99.9	99.9	89.6
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.0	26.0	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.4	64.4	64.9
Castaic (Agric.)	11.7	11.7	12.0	11.8	11.8	11.9	11.9	11.8
Castaic (M&I)	41.5	41.5	68.6	40.9	40.9	40.1	40.1	68.6
Coachella	19.3	19.3	19.3	19.2	19.2	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.0	31.0	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,272.5	1,272.5	1,272.5	1,264.4	1,264.4	1,263.6	1,263.6	1,272.5
Palmdale	14.9	14.9	14.9	14.8	14.8	14.5	14.5	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.3	69.3	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.0	18.0	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,111.2	1,111.2	1,021.7	1,124.0	1,124.0	1,134.7	1,134.7	976.3
Total M&I	1,928.4	1,928.4	1,975.7	1,915.6	1,915.6	1,905.0	1,905.0	1,975.7
Total	3,039.7	3,039.7	2,997.3	3,039.6	3,039.6	3,039.7	3,039.6	2,952.0

Table A-3c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	36.7	36.7	37.7
Zone 7	46.4	46.4	66.5	46.0	46.0	45.2	45.2	66.5
Alameda	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Santa Clara	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Oak Flat	5.4	5.4	5.5	5.4	5.4	5.5	5.5	5.4
Kings	8.7	8.7	8.8	8.8	8.8	3.8	3.8	8.6
Dudley Ridge	58.7	58.7	59.2	59.0	59.0	55.2	55.2	54.5
Empire W.S.	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.9
KCWA (M&I)	134.6	134.6	134.6	133.5	133.5	132.2	132.2	134.6
KCWA (Agric.)	966.1	966.1	860.9	971.5	971.5	974.3	974.3	821.0
Tulare	90.3	90.3	91.1	90.8	90.8	101.5	101.5	91.4
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.0	12.0	12.2	12.1	12.1	12.1	12.1	12.1
Castaic (M&I)	41.5	41.5	68.6	41.2	41.2	40.8	40.8	68.6
Coachella	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,537.7	1,537.7	1,537.7	1,533.0	1,533.0	1,531.1	1,531.1	1,537.6
Palmdale	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,144.0	1,144.0	1,040.5	1,150.5	1,150.5	1,155.2	1,155.2	995.7
Total M&I	2,193.7	2,193.7	2,240.9	2,187.2	2,187.2	2,182.6	2,182.6	2,240.8
Total	3,337.8	3,337.8	3,281.4	3,337.8	3,337.8	3,337.8	3,337.8	3,236.5

Table A-3d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	34.3	34.3	37.7
Zone 7	46.4	46.4	65.2	43.2	43.2	41.6	41.6	66.5
Alameda	35.2	35.2	35.2	34.7	34.7	33.8	33.8	35.2
Santa Clara	84.7	84.7	84.7	83.3	83.3	81.1	81.1	84.7
Oak Flat	5.1	5.1	5.3	5.5	5.5	5.7	5.7	5.4
Kings	8.1	8.1	8.4	8.7	8.7	4.0	4.0	8.6
Dudley Ridge	55.7	55.7	57.5	59.2	59.2	57.5	57.5	54.5
Empire W.S.	2.7	2.7	2.8	2.9	2.9	3.0	3.0	2.9
KCWA (M&I)	134.6	134.6	134.6	125.4	125.4	121.5	121.5	134.6
KCWA (Agric.)	919.5	919.5	842.5	978.1	978.1	1,015.5	1,015.5	821.8
Tulare	86.8	86.8	89.6	92.3	92.3	105.3	105.3	91.5
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.2	26.2	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	11.5	11.5	11.8	12.2	12.2	12.7	12.7	12.1
Castaic (M&I)	41.5	41.5	66.8	38.7	38.7	37.4	37.4	68.6
Coachella	19.3	19.3	19.3	19.0	19.0	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	30.9	30.9	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,606.5	1,606.5	1,606.5	1,554.9	1,554.9	1,523.8	1,523.8	1,592.1
Palmdale	14.9	14.9	14.9	14.6	14.6	14.2	14.2	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,089.4	1,089.4	1,017.9	1,158.9	1,158.9	1,203.6	1,203.6	996.7
Total M&I	2,262.5	2,262.5	2,306.6	2,193.0	2,193.0	2,148.2	2,148.2	2,295.3
Total	3,351.9	3,351.9	3,324.5	3,351.8	3,351.8	3,351.9	3,351.9	3,292.1

Table A-3e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.6	6.6	7.5	7.5	6.7
Solano	36.5	36.7	36.7	32.6	32.6	27.5	27.5	35.7
Zone 7	42.1	42.2	55.8	36.1	36.1	33.1	33.1	60.2
Alameda	33.7	33.8	33.9	29.9	30.0	27.9	27.9	31.8
Santa Clara	80.9	81.2	81.3	71.7	71.8	66.7	66.7	76.3
Oak Flat	3.8	3.8	3.9	4.6	4.6	4.7	4.7	4.5
Kings	6.0	6.0	6.1	7.3	7.3	3.5	3.5	7.1
Dudley Ridge	41.2	41.3	41.9	50.0	50.2	49.8	50.1	45.4
Empire W.S.	2.0	2.0	2.0	2.4	2.4	2.6	2.6	2.4
KCWA (M&I)	122.4	122.8	122.4	104.6	104.8	96.6	96.6	116.5
KCWA (Agric.)	681.1	682.8	615.3	826.7	829.4	880.0	883.9	684.3
Tulare	64.3	64.5	65.4	78.1	78.3	94.0	94.4	76.2
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.1	26.1	23.9	23.9	26.0
AVEK	64.9	64.9	64.9	63.9	64.0	63.8	63.9	64.0
Castaic (Agric.)	8.5	8.5	8.6	10.3	10.3	11.0	11.0	10.1
Castaic (M&I)	37.7	37.9	56.2	32.3	32.3	29.8	29.8	62.0
Coachella	18.5	18.5	18.6	16.4	16.5	15.8	15.8	18.6
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	30.0	30.1	30.2	26.8	26.8	25.7	25.8	28.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,365.6	1,368.8	1,368.1	1,254.1	1,256.6	1,217.9	1,219.4	1,286.5
Palmdale	14.2	14.2	14.3	12.5	12.5	11.6	11.6	14.0
San Bernardino	68.9	69.1	69.1	63.8	63.9	63.6	63.7	66.0
San Gabriel	18.0	18.0	18.0	16.9	17.0	16.9	16.9	17.3
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	807.0	809.0	743.3	979.5	982.6	1,045.5	1,050.2	830.0
Total M&I	1,991.3	1,996.0	2,027.0	1,818.9	1,822.3	1,752.8	1,754.7	1,934.5
Total	2,798.4	2,804.9	2,770.3	2,798.3	2,804.9	2,798.4	2,804.9	2,764.5

Table A-3f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	4.7	4.9	4.7	4.5	4.5	5.5	5.6	4.4
Solano	17.8	18.3	17.9	17.8	18.5	15.2	15.7	19.3
Zone 7	19.9	20.4	26.2	18.1	18.5	17.1	17.6	30.5
Alameda	16.8	17.3	16.9	16.4	16.8	15.6	16.1	16.0
Santa Clara	40.1	41.3	40.3	39.0	40.0	37.2	38.2	38.3
Oak Flat	1.6	1.7	1.8	1.8	1.8	1.9	1.9	2.1
Kings	2.5	2.6	2.8	2.7	2.8	1.3	1.4	3.3
Dudley Ridge	17.5	17.9	19.1	19.3	19.7	19.2	19.6	21.3
Empire W.S.	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1
KCWA (M&I)	57.8	59.3	58.0	52.5	53.9	49.9	51.3	55.3
KCWA (Agric.)	289.9	295.2	281.0	320.4	327.5	338.4	345.5	321.0
Tulare	27.4	27.9	29.9	30.4	31.2	37.0	37.8	35.7
SLO	3.5	3.6	3.5	3.5	3.5	3.5	3.5	3.3
Santa Barbara	19.5	20.2	19.6	19.3	20.0	18.8	19.5	18.4
AVEK	46.0	47.6	46.3	45.5	46.9	45.6	47.0	44.2
Castaic (Agric.)	3.6	3.7	3.9	4.0	4.1	4.2	4.3	4.7
Castaic (M&I)	17.8	18.3	26.3	16.2	16.6	15.4	15.8	31.4
Coachella	9.2	9.5	9.3	9.0	9.2	8.9	9.1	11.1
Crestline	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
Desert	15.1	15.5	15.2	14.8	15.2	14.5	14.9	14.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	12.2	12.4	12.2	12.1	12.3	12.1	12.3	12.3
MWDSC	771.5	792.7	776.4	748.1	767.8	734.2	753.9	733.9
Palmdale	7.0	7.2	7.0	6.7	6.9	6.4	6.6	7.6
San Bernardino	38.1	39.2	38.3	37.7	38.7	37.7	38.8	36.2
San Gabriel	10.4	10.7	10.5	10.3	10.6	10.3	10.6	9.9
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.6	4.7	4.6	4.6	4.7	4.6	4.7	4.6
Total Agriculture	343.5	349.7	339.4	379.6	388.0	403.1	411.5	389.3
Total M&I	1,113.9	1,144.8	1,135.0	1,077.7	1,106.5	1,054.3	1,083.0	1,092.6
Total	1,457.3	1,494.5	1,474.4	1,457.3	1,494.5	1,457.4	1,494.5	1,481.9

Table A-4a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	20.1	20.2	22.9	19.4	19.4	17.5	17.6	22.5	18.2	18.3	20.1
Solano	33.9	34.1	37.8	32.7	32.8	29.3	29.4	37.1	30.7	30.8	33.2
Zone 7	37.5	37.6	60.9	36.1	36.2	32.5	32.6	62.6	33.8	34.0	56.0
Alameda	33.9	34.1	33.9	32.7	32.8	29.6	29.7	32.6	30.7	30.8	29.2
Santa Clara	80.8	81.1	80.8	77.8	78.1	70.5	70.8	77.7	73.0	73.3	69.5
Oak Flat	3.8	3.8	3.8	4.2	4.2	4.7	4.7	4.3	3.3	3.3	3.9
Kings	6.1	6.1	6.1	6.8	6.8	7.5	7.5	6.8	5.3	5.3	6.1
Dudley Ridge	41.2	41.3	41.2	45.7	45.9	50.9	51.1	43.4	35.8	36.0	38.8
Empire W.S.	2.0	2.0	2.0	2.2	2.2	2.5	2.5	2.3	1.7	1.7	2.0
KCWA (M&I)	108.8	109.2	108.8	104.7	105.1	93.8	94.2	104.5	98.3	98.7	93.5
KCWA (Agric.)	679.0	681.9	601.0	754.5	757.6	839.2	842.4	642.2	590.0	593.0	574.5
Tulare	63.7	64.0	63.7	70.8	71.1	78.8	79.1	72.9	55.3	55.6	65.2
SLO	20.2	20.3	20.2	19.4	19.5	17.4	17.5	19.4	18.3	18.3	17.4
Santa Barbara	36.8	36.9	36.8	35.4	35.5	31.7	31.8	35.3	33.2	33.4	31.6
AVEK	113.9	114.4	113.9	109.9	110.3	109.4	109.8	109.8	102.8	103.3	98.2
Castaic (Agric.)	8.5	8.5	8.5	9.4	9.4	10.5	10.5	9.6	7.4	7.4	8.6
Castaic (M&I)	33.5	33.7	61.6	32.3	32.4	28.9	29.0	64.1	30.3	30.4	57.3
Coachella	96.7	97.0	96.7	94.0	94.4	94.2	94.6	103.4	87.1	87.5	92.5
Crestline	4.7	4.7	4.7	4.5	4.5	4.0	4.1	4.5	4.2	4.3	4.0
Desert	40.4	40.6	40.4	38.9	39.0	38.6	38.7	41.9	36.5	36.7	37.5
Littlerock	1.9	1.9	1.9	1.8	1.8	1.6	1.6	1.8	1.7	1.7	1.6
Mojave	41.1	41.2	58.2	39.5	39.7	43.0	43.2	58.9	37.1	37.3	52.7
MWDSC	1,545.0	1,551.1	1,545.0	1,486.6	1,492.0	1,418.3	1,423.8	1,484.3	1,395.7	1,401.9	1,327.8
Palmdale	14.0	14.0	16.7	13.5	13.5	12.1	12.1	16.5	12.6	12.7	14.8
San Bernardino	82.9	83.3	82.9	79.8	80.1	86.9	87.2	79.7	74.9	75.2	71.3
San Gabriel	23.3	23.4	23.3	22.4	22.5	24.4	24.5	22.4	21.0	21.1	20.0
San Gorgonio	14.0	14.0	14.0	13.5	13.5	12.1	12.1	13.4	12.6	12.7	12.0
Ventura	16.2	16.2	16.2	15.6	15.6	13.9	14.0	15.5	14.6	14.7	13.9
Total Agriculture	804.3	807.7	726.3	893.6	897.4	994.0	997.8	781.5	698.9	702.4	699.1
Total M&I	2,399.5	2,408.9	2,477.5	2,310.2	2,318.6	2,209.8	2,218.2	2,407.8	2,167.3	2,177.0	2,154.0
Total	3,203.8	3,216.6	3,203.8	3,203.8	3,216.0	3,203.8	3,216.0	3,189.3	2,866.2	2,879.4	2,853.0

Table A-4b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.4	24.4	28.3	24.2	24.2	23.6	23.6	28.1	23.6	23.6	26.8
Solano	41.2	41.2	46.7	40.8	40.8	39.7	39.7	46.4	39.7	39.7	44.3
Zone 7	45.5	45.5	77.9	45.1	45.1	43.9	43.9	78.2	43.9	43.9	74.8
Alameda	41.2	41.2	41.2	40.8	40.8	39.8	39.8	40.8	39.7	39.7	39.0
Santa Clara	98.2	98.2	98.2	97.1	97.1	94.7	94.7	97.1	94.6	94.6	92.8
Oak Flat	5.1	5.1	5.1	5.3	5.3	5.4	5.4	5.3	4.8	4.8	5.0
Kings	8.3	8.3	8.3	8.6	8.6	8.8	8.8	8.3	7.8	7.8	7.9
Dudley Ridge	55.8	55.8	55.8	57.4	57.4	58.9	58.9	53.0	52.1	52.1	50.6
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8	2.5	2.5	2.6
KCWA (M&I)	132.1	132.1	132.1	130.7	130.7	127.1	127.1	130.6	127.4	127.4	124.9
KCWA (Agric.)	919.7	919.7	811.9	945.6	945.6	969.7	969.7	784.5	857.9	857.9	748.2
Tulare	85.9	85.9	85.9	88.3	88.3	90.5	90.5	89.0	80.0	80.0	84.9
SLO	24.5	24.5	24.5	24.3	24.3	23.6	23.6	24.3	23.7	23.7	23.2
Santa Barbara	44.6	44.6	44.6	44.2	44.2	42.9	42.9	44.1	43.0	43.0	42.2
AVEK	138.7	138.7	138.7	137.3	137.3	137.5	137.5	137.2	133.6	133.6	131.2
Castaic (Agric.)	11.5	11.5	11.5	11.8	11.8	12.1	12.1	11.7	10.7	10.7	11.2
Castaic (M&I)	40.7	40.7	79.5	40.3	40.3	39.2	39.2	80.1	39.3	39.3	76.5
Coachella	118.5	118.5	118.5	117.6	117.6	118.0	118.0	129.2	114.0	114.0	123.5
Crestline	5.7	5.7	5.7	5.6	5.6	5.5	5.5	5.6	5.5	5.5	5.4
Desert	49.1	49.1	49.1	48.6	48.6	48.6	48.6	52.4	47.3	47.3	50.1
Littlerock	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1
Mojave	49.9	49.9	73.5	49.3	49.3	50.8	50.8	73.6	48.1	48.1	70.3
MWDSC	1,876.3	1,876.3	1,876.3	1,856.2	1,856.2	1,836.6	1,836.6	1,855.2	1,808.8	1,808.8	1,773.4
Palmdale	17.0	17.0	20.8	16.8	16.8	16.3	16.3	20.7	16.4	16.4	19.8
San Bernardino	100.7	100.7	100.7	99.6	99.6	102.6	102.6	99.6	97.1	97.1	95.2
San Gabriel	28.3	28.3	28.3	28.0	28.0	28.8	28.8	28.0	27.3	27.3	26.7
San Gorgonio	17.0	17.0	17.0	16.8	16.8	16.3	16.3	16.8	16.4	16.4	16.1
Ventura	19.6	19.6	19.6	19.4	19.4	18.9	18.9	19.4	18.9	18.9	18.6
Total Agriculture	1,089.1	1,089.1	981.3	1,119.7	1,119.7	1,148.3	1,148.3	954.6	1,015.9	1,015.9	910.5
Total M&I	2,915.5	2,915.5	3,023.3	2,884.9	2,884.9	2,856.4	2,856.4	3,009.5	2,810.3	2,810.3	2,876.8
Total	4,004.6	4,004.6	4,004.6	4,004.6	4,004.6	4,004.6	4,004.6	3,964.1	3,826.2	3,826.2	3,787.3

Table A-4c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.3	24.3	27.8	23.5	23.5	22.2	22.2	27.4	22.3	22.3	24.7
Solano	41.0	41.0	45.9	39.6	39.6	37.2	37.2	45.2	37.6	37.6	40.8
Zone 7	45.2	45.2	74.8	43.8	43.8	41.2	41.2	76.3	41.5	41.5	68.9
Alameda	41.0	41.0	41.0	39.6	39.6	37.5	37.5	39.7	37.6	37.6	35.9
Santa Clara	97.5	97.5	97.5	94.4	94.4	89.2	89.2	94.6	89.5	89.5	85.4
Oak Flat	4.7	4.7	4.7	5.2	5.2	5.5	5.5	5.1	4.1	4.1	4.7
Kings	7.6	7.6	7.6	8.3	8.3	8.8	8.8	8.1	6.7	6.7	7.4
Dudley Ridge	51.2	51.2	51.2	55.9	55.9	59.2	59.2	51.8	44.6	44.6	47.4
Empire W.S.	2.5	2.5	2.5	2.7	2.7	2.9	2.9	2.7	2.2	2.2	2.5
KCWA (M&I)	131.3	131.3	131.3	127.0	127.0	119.3	119.3	127.3	120.5	120.5	115.0
KCWA (Agric.)	842.6	842.6	744.0	920.6	920.6	975.1	975.1	766.1	734.8	734.8	701.2
Tulare	78.7	78.7	78.7	86.0	86.0	91.1	91.1	86.9	68.6	68.6	79.6
SLO	24.4	24.4	24.4	23.6	23.6	22.2	22.2	23.6	22.4	22.4	21.4
Santa Barbara	44.4	44.4	44.4	42.9	42.9	40.3	40.3	43.0	40.7	40.7	38.9
AVEK	137.6	137.6	137.6	133.4	133.4	133.5	133.5	133.7	126.2	126.2	120.8
Castaic (Agric.)	10.5	10.5	10.5	11.5	11.5	12.2	12.2	11.5	9.2	9.2	10.5
Castaic (M&I)	40.5	40.5	75.9	39.2	39.2	36.8	36.8	78.0	37.2	37.2	70.5
Coachella	117.0	117.0	117.0	114.3	114.3	114.8	114.8	125.9	107.1	107.1	113.7
Crestline	5.7	5.7	5.7	5.5	5.5	5.1	5.1	5.5	5.2	5.2	5.0
Desert	48.8	48.8	48.8	47.2	47.2	47.2	47.2	51.1	44.8	44.8	46.1
Littlerock	2.2	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.1	2.1	2.0
Mojave	49.5	49.5	71.2	47.9	47.9	50.8	50.8	71.7	45.5	45.5	64.8
MWDSC	1,864.0	1,864.0	1,864.0	1,803.6	1,803.6	1,759.4	1,759.4	1,808.0	1,711.6	1,711.6	1,632.9
Palmdale	16.9	16.9	20.3	16.3	16.3	15.3	15.3	20.1	15.5	15.5	18.2
San Bernardino	100.1	100.1	100.1	96.8	96.8	102.6	102.6	97.0	91.9	91.9	87.6
San Gabriel	28.1	28.1	28.1	27.2	27.2	28.8	28.8	27.2	25.8	25.8	24.6
San Gorgonio	16.9	16.9	16.9	16.3	16.3	15.3	15.3	16.4	15.5	15.5	14.8
Ventura	19.5	19.5	19.5	18.9	18.9	17.7	17.7	18.9	17.9	17.9	17.1
Total Agriculture	997.8	997.8	899.2	1,090.2	1,090.2	1,154.8	1,154.8	932.2	870.2	870.2	853.3
Total M&I	2,895.5	2,895.5	2,994.2	2,803.1	2,803.1	2,738.6	2,738.6	2,932.9	2,658.3	2,658.3	2,648.9
Total	3,893.4	3,893.4	3,893.4	3,893.4	3,893.4	3,893.4	3,893.4	3,865.1	3,528.4	3,528.4	3,502.2

Table A-4d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	22.4	22.4	25.4	21.2	21.2	18.0	18.0	24.9	19.7	19.8	21.7
Solano	37.8	37.8	42.0	35.7	35.7	29.9	29.9	41.1	33.3	33.3	35.8
Zone 7	41.7	41.7	66.7	39.5	39.5	33.2	33.2	69.4	36.7	36.8	60.4
Alameda	37.8	37.8	37.8	35.7	35.7	30.4	30.4	36.2	33.3	33.3	31.5
Santa Clara	90.1	90.1	90.1	85.1	85.1	72.5	72.5	86.1	79.2	79.4	75.0
Oak Flat	4.2	4.2	4.2	4.8	4.8	5.6	5.6	4.9	3.5	3.5	4.3
Kings	6.6	6.6	6.6	7.7	7.7	8.9	8.9	7.8	5.5	5.6	6.7
Dudley Ridge	45.0	45.0	45.0	52.5	52.5	61.1	61.1	49.4	37.9	38.0	43.0
Empire W.S.	2.2	2.2	2.2	2.6	2.6	3.0	3.0	2.6	1.8	1.9	2.2
KCWA (M&I)	121.3	121.3	121.3	114.5	114.5	95.7	95.7	115.9	106.6	106.9	100.9
KCWA (Agric.)	742.7	742.7	659.6	866.6	866.6	1,008.7	1,008.7	730.6	626.5	628.3	635.7
Tulare	70.1	70.1	70.1	81.9	81.9	95.3	95.3	82.9	59.2	59.3	72.1
SLO	22.5	22.5	22.5	21.3	21.3	17.8	17.8	21.5	19.8	19.8	18.7
Santa Barbara	41.0	41.0	41.0	38.7	38.7	32.3	32.3	39.2	36.0	36.1	34.1
AVEK	126.9	126.9	126.9	120.3	120.3	119.7	119.7	121.8	111.5	111.7	106.0
Castaic (Agric.)	9.3	9.3	9.3	10.8	10.8	12.6	12.6	10.9	7.8	7.8	9.5
Castaic (M&I)	37.4	37.4	67.3	35.3	35.3	29.5	29.5	71.1	32.9	32.9	61.8
Coachella	107.4	107.4	107.4	103.0	103.0	103.6	103.6	114.6	94.2	94.4	99.8
Crestline	5.2	5.2	5.2	4.9	4.9	4.1	4.1	5.0	4.6	4.6	4.3
Desert	45.0	45.0	45.0	42.5	42.5	42.2	42.2	46.5	39.6	39.7	40.5
Littlerock	2.1	2.1	2.1	2.0	2.0	1.6	1.6	2.0	1.8	1.8	1.7
Mojave	45.8	45.8	64.0	43.2	43.2	49.6	49.6	65.3	40.2	40.3	56.8
MWDSC	1,722.0	1,722.0	1,722.0	1,626.0	1,626.0	1,511.4	1,511.4	1,646.5	1,514.1	1,517.5	1,432.7
Palmdale	15.6	15.6	18.5	14.7	14.7	12.3	12.3	18.3	13.7	13.7	16.0
San Bernardino	92.4	92.4	92.4	87.3	87.3	100.2	100.2	88.4	81.3	81.4	76.9
San Gabriel	25.9	25.9	25.9	24.5	24.5	28.1	28.1	24.8	22.8	22.9	21.6
San Gorgonio	15.6	15.6	15.6	14.7	14.7	12.3	12.3	14.9	13.7	13.7	13.0
Ventura	18.0	18.0	18.0	17.0	17.0	14.2	14.2	17.2	15.8	15.9	15.0
Total Agriculture	879.9	879.9	796.8	1,026.8	1,026.8	1,195.1	1,195.1	889.0	742.3	744.5	773.6
Total M&I	2,674.0	2,674.0	2,757.1	2,527.1	2,527.1	2,358.8	2,358.8	2,670.9	2,350.8	2,356.0	2,324.1
Total	3,553.9	3,553.9	3,553.9	3,553.9	3,553.9	3,553.9	3,553.9	3,560.0	3,093.1	3,100.5	3,097.7

Table A-4e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	18.0	18.1	20.1	16.7	16.8	13.5	13.5	19.3	15.3	15.5	16.3
Solano	30.3	30.5	33.2	28.2	28.3	22.2	22.3	31.8	25.8	26.1	26.9
Zone 7	33.4	33.6	51.0	31.2	31.3	24.7	24.8	53.8	28.4	28.8	45.3
Alameda	30.3	30.5	30.3	28.2	28.3	22.8	22.8	28.0	25.8	26.1	23.6
Santa Clara	72.2	72.7	72.2	67.2	67.4	54.2	54.4	66.7	61.5	62.2	56.2
Oak Flat	2.9	3.0	2.9	3.6	3.7	4.4	4.5	3.8	2.4	2.4	3.2
Kings	4.6	4.7	4.6	5.7	5.8	7.2	7.2	6.0	3.7	3.8	5.1
Dudley Ridge	31.8	32.0	31.8	39.2	39.7	49.0	49.5	38.2	25.7	26.1	32.2
Empire W.S.	1.5	1.6	1.5	1.9	1.9	2.4	2.4	2.0	1.2	1.3	1.7
KCWA (M&I)	97.1	97.8	97.1	90.5	90.7	71.1	71.3	89.8	82.8	83.8	75.7
KCWA (Agric.)	525.0	529.2	466.3	646.9	655.9	809.5	818.5	565.6	424.1	431.8	476.9
Tulare	49.6	50.0	49.6	61.1	62.0	76.5	77.3	64.2	40.1	40.8	54.1
SLO	18.0	18.2	18.0	16.8	16.9	13.2	13.2	16.7	15.4	15.6	14.1
Santa Barbara	32.8	33.1	32.8	30.6	30.7	24.0	24.1	30.3	28.0	28.3	25.6
AVEK	101.4	102.1	101.4	95.0	95.2	93.0	93.3	94.3	86.3	87.4	79.5
Castaic (Agric.)	6.5	6.6	6.5	8.1	8.2	10.1	10.2	8.5	5.3	5.4	7.1
Castaic (M&I)	30.0	30.2	51.1	27.9	28.0	21.9	22.0	55.0	25.5	25.8	46.4
Coachella	85.4	86.0	85.4	81.1	81.3	80.7	81.0	88.8	72.5	73.4	74.8
Crestline	4.2	4.2	4.2	3.9	3.9	3.1	3.1	3.9	3.6	3.6	3.3
Desert	36.1	36.3	36.1	33.6	33.7	32.7	32.8	36.0	30.7	31.1	30.4
Littlerock	1.7	1.7	1.7	1.5	1.6	1.2	1.2	1.5	1.4	1.4	1.3
Mojave	36.7	36.9	49.5	34.2	34.2	39.7	39.8	50.6	31.2	31.6	42.6
MWDSC	1,379.6	1,389.1	1,379.6	1,285.3	1,288.7	1,154.9	1,158.3	1,274.8	1,175.2	1,189.7	1,074.8
Palmdale	12.5	12.6	14.5	11.6	11.7	9.1	9.2	14.2	10.6	10.8	12.0
San Bernardino	74.1	74.6	74.1	69.0	69.2	80.2	80.4	68.4	63.1	63.9	57.7
San Gabriel	20.8	20.9	20.8	19.4	19.4	22.5	22.6	19.2	17.7	17.9	16.2
San Gorgonio	12.5	12.6	12.5	11.6	11.7	9.1	9.2	11.5	10.6	10.8	9.7
Ventura	14.4	14.5	14.4	13.4	13.5	10.6	10.6	13.3	12.3	12.4	11.2
Total Agriculture	622.0	627.0	563.3	766.4	777.1	959.0	969.7	688.3	502.4	511.6	580.3
Total M&I	2,141.4	2,156.1	2,200.1	1,997.0	2,002.5	1,804.5	1,809.9	2,067.9	1,823.8	1,846.3	1,743.5
Total	2,763.4	2,783.1	2,763.4	2,763.4	2,779.6	2,763.4	2,779.6	2,756.2	2,326.2	2,357.9	2,323.8

Table A-4f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	8.9	9.2	9.8	8.4	8.8	7.3	7.7	9.4	6.9	7.1	7.1
Solano	15.0	15.6	16.2	14.2	14.8	12.2	12.8	15.5	11.6	11.9	11.6
Zone 7	16.5	17.1	24.2	15.7	16.4	13.5	14.2	26.2	12.7	13.1	19.7
Alameda	15.0	15.6	15.0	14.2	14.8	12.4	13.0	13.6	11.6	11.9	10.2
Santa Clara	35.7	37.0	35.7	33.8	35.3	29.5	31.0	32.4	27.6	28.4	24.4
Oak Flat	1.3	1.3	1.3	1.5	1.6	1.8	1.8	1.8	0.9	0.9	1.4
Kings	2.0	2.1	2.0	2.4	2.5	2.9	3.0	2.9	1.3	1.4	2.2
Dudley Ridge	13.8	14.6	13.8	16.7	17.1	19.9	20.4	18.6	9.2	9.6	14.0
Empire W.S.	0.7	0.7	0.7	0.8	0.8	1.0	1.0	1.0	0.4	0.5	0.7
KCWA (M&I)	48.1	49.8	48.1	45.5	47.6	39.1	41.1	43.7	37.1	38.2	32.8
KCWA (Agric.)	228.6	240.6	203.0	275.3	283.1	328.5	336.2	275.2	152.7	159.0	206.8
Tulare	21.6	22.7	21.6	26.0	26.7	31.0	31.8	31.2	14.4	15.0	23.5
SLO	8.9	9.3	8.9	8.5	8.8	7.3	7.6	8.1	6.9	7.1	6.1
Santa Barbara	16.2	16.8	16.2	15.4	16.1	13.2	13.9	14.8	12.5	12.9	11.1
AVEK	50.1	52.0	50.1	47.6	49.7	47.0	49.1	45.9	38.6	39.7	34.5
Castaic (Agric.)	2.8	3.0	2.8	3.4	3.5	4.1	4.2	4.1	1.9	2.0	3.1
Castaic (M&I)	14.8	15.4	24.0	14.0	14.7	12.1	12.7	26.8	11.4	11.8	20.1
Coachella	41.9	43.5	41.9	40.3	42.0	40.2	42.0	43.2	32.1	33.1	32.5
Crestline	2.1	2.1	2.1	2.0	2.0	1.7	1.8	1.9	1.6	1.6	1.4
Desert	17.9	18.5	17.9	16.9	17.7	16.6	17.4	17.5	13.8	14.2	13.2
Littlerock	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.6
Mojave	18.1	18.8	23.8	17.2	17.9	19.1	19.8	24.6	14.0	14.4	18.5
MWDSC	682.8	707.8	682.8	646.6	675.4	603.9	632.7	620.2	526.8	542.1	466.0
Palmdale	6.2	6.4	7.1	5.9	6.1	5.0	5.3	6.9	4.8	4.9	5.2
San Bernardino	36.6	38.0	36.6	34.7	36.3	38.5	40.1	33.3	28.3	29.1	25.0
San Gabriel	10.3	10.7	10.3	9.7	10.2	10.8	11.2	9.3	7.9	8.2	7.0
San Gorgonio	6.2	6.4	6.2	5.9	6.1	5.0	5.3	5.6	4.8	4.9	4.2
Ventura	7.1	7.4	7.1	6.8	7.1	5.8	6.1	6.5	5.5	5.7	4.9
Total Agriculture	270.8	285.0	245.2	326.2	335.4	389.2	398.3	334.9	180.9	188.4	251.6
Total M&I	1,059.4	1,098.3	1,085.0	1,004.0	1,048.7	941.0	985.7	1,006.1	817.1	840.8	756.0
Total	1,330.2	1,383.4	1,330.2	1,330.2	1,384.1	1,330.2	1,384.0	1,341.0	998.0	1,029.2	1,007.6

Table A-5a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	1.0	0.8	1.0	1.0	0.8	1.0	0.8	1.7
Solano	1.0	0.9	1.1	1.0	0.9	1.0	0.9	2.1
Zone 7	1.1	1.1	1.2	1.1	1.1	1.1	1.1	2.2
Alameda	1.4	1.3	1.5	1.4	1.3	1.4	1.3	2.1
Santa Clara	5.1	4.7	5.5	5.1	4.7	5.1	4.7	7.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.2	2.1	2.2	2.2	2.1	2.2	2.1	2.2
Empire W.S.	1.6	1.5	1.8	1.6	1.5	1.6	1.5	1.0
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	101.2	99.1	105.2	101.2	99.1	101.2	99.1	81.8
Tulare	26.7	25.6	29.3	26.7	25.6	26.7	25.6	16.7
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.7	1.7	1.8	1.7	1.7	1.7	1.7	2.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.0	0.9	1.2	1.0	0.9	1.0	0.9	2.2
Coachella	3.0	2.8	3.2	3.0	2.8	3.0	2.8	2.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	6.9	6.2	7.1	6.9	6.2	6.9	6.2	5.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	119.8	116.4	124.2	119.8	116.4	119.8	116.4	164.0
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	131.7	128.4	138.5	131.7	128.4	131.7	128.4	101.6
Total M&I	142.0	136.8	147.7	142.0	136.8	142.0	136.8	192.3
Total	273.8	265.2	286.2	273.8	265.2	273.8	265.2	294.0

Table A-5b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	2.1	1.7	2.2	2.1	1.7	2.1	1.7	3.1
Solano	2.3	1.9	2.4	2.3	1.9	2.3	1.9	4.2
Zone 7	2.4	2.3	2.5	2.4	2.3	2.4	2.3	4.3
Alameda	2.9	2.8	3.1	2.9	2.8	2.9	2.8	4.1
Santa Clara	10.6	9.9	11.4	10.6	9.9	10.6	9.9	13.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	4.3	4.2	4.3	4.3	4.2	4.3	4.2	4.3
Empire W.S.	3.3	3.1	3.4	3.3	3.1	3.3	3.1	1.9
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	200.3	196.5	207.6	200.3	196.5	200.3	196.5	152.0
Tulare	53.9	52.3	58.8	53.9	52.3	53.9	52.3	31.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	3.5	3.4	3.6	3.5	3.4	3.5	3.4	4.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	2.3	1.9	2.6	2.3	1.9	2.3	1.9	4.4
Coachella	6.3	5.8	6.4	6.3	5.8	6.3	5.8	4.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	14.3	13.1	14.5	14.3	13.1	14.3	13.1	11.1
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	215.1	211.5	213.5	215.1	211.5	215.1	211.5	304.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	261.8	256.3	274.1	261.8	256.3	261.8	256.3	190.0
Total M&I	261.7	254.2	262.3	261.7	254.2	261.7	254.2	358.5
Total	523.5	510.5	536.4	523.5	510.5	523.5	510.5	548.5

Table A-5c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.5	0.7	0.7	0.5	0.7	0.5	1.8
Solano	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.2
Zone 7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	2.3
Alameda	1.1	1.0	1.2	1.1	1.0	1.1	1.0	2.2
Santa Clara	3.6	3.2	4.1	3.6	3.2	3.6	3.2	7.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.4	2.3	2.4	2.4	2.3	2.4	2.3	2.3
Empire W.S.	1.5	1.2	1.8	1.5	1.2	1.5	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	104.4	101.2	107.7	104.4	101.2	104.4	101.2	86.5
Tulare	24.9	22.5	28.8	24.9	22.5	24.9	22.5	15.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.4
Coachella	2.9	2.5	3.0	2.9	2.5	2.9	2.5	3.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.8	4.9	6.6	5.8	4.9	5.8	4.9	5.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	110.9	104.0	128.7	110.9	104.0	110.9	104.0	173.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	133.3	127.2	140.8	133.3	127.2	133.3	127.2	104.7
Total M&I	128.6	119.5	148.0	128.6	119.5	128.6	119.5	203.4
Total	261.9	246.7	288.8	261.9	246.7	261.9	246.7	308.1

Table A-5d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.6	0.8	0.7	0.6	0.7	0.6	1.3
Solano	0.8	0.7	0.9	0.8	0.7	0.8	0.7	1.4
Zone 7	0.9	0.8	1.1	0.9	0.8	0.9	0.8	1.5
Alameda	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.4
Santa Clara	3.9	3.6	4.3	3.9	3.6	3.9	3.6	5.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Empire W.S.	1.2	1.2	1.3	1.2	1.2	1.2	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	71.1	68.8	73.1	71.1	68.8	71.1	68.8	65.1
Tulare	18.7	18.4	19.7	18.7	18.4	18.7	18.4	14.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.2	1.1	1.3	1.2	1.1	1.2	1.1	1.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.8	0.7	1.0	0.8	0.7	0.8	0.7	1.5
Coachella	2.1	2.0	2.3	2.1	2.0	2.1	2.0	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.1	4.7	5.5	5.1	4.7	5.1	4.7	4.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	108.8	104.6	118.9	108.8	104.6	108.8	104.6	130.6
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	92.5	89.8	95.5	92.5	89.8	92.5	89.8	81.4
Total M&I	125.2	119.8	137.2	125.2	119.8	125.2	119.8	151.9
Total	217.8	209.5	232.7	217.7	209.5	217.7	209.5	233.3

Table A-5e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8
Solano	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.0
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1
Alameda	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1.0
Santa Clara	2.2	2.0	2.3	2.2	2.0	2.2	2.0	3.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1
Empire W.S.	0.8	0.7	1.0	0.8	0.7	0.8	0.7	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	47.8	47.3	53.5	47.8	47.3	47.8	47.3	40.7
Tulare	12.8	11.8	15.2	12.8	11.8	12.8	11.8	7.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.8	0.7	0.8	0.8	0.7	0.8	0.7	1.1
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.1
Coachella	1.3	1.1	1.4	1.3	1.1	1.3	1.1	1.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.8	2.3	2.9	2.8	2.3	2.8	2.3	2.7
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	66.1	63.7	69.1	66.1	63.7	66.1	63.7	81.7
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	62.4	60.9	70.7	62.4	60.9	62.4	60.9	49.7
Total M&I	75.4	71.8	78.8	75.4	71.8	75.4	71.8	95.7
Total	137.8	132.7	149.6	137.8	132.7	137.8	132.7	145.4

Table A-5f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4
Solano	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Zone 7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Alameda	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Santa Clara	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	21.8	21.8	20.6	21.8	21.8	21.8	21.8	22.2
Tulare	5.8	5.8	5.7	5.8	5.8	5.8	5.8	5.3
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Coachella	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	34.9	34.9	34.3	34.9	34.9	34.9	34.9	44.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	28.5	28.5	27.1	28.5	28.5	28.5	28.5	28.2
Total M&I	40.1	40.1	39.4	40.1	40.1	40.1	40.1	51.9
Total	68.6	68.6	66.5	68.6	68.6	68.6	68.6	80.1

Table A-6a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9	0.1	0.1	0.9
Solano	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	1.0	0.3	0.2	1.0
Alameda	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.9	0.5	0.4	0.9
Santa Clara	1.5	1.1	1.5	1.5	1.2	1.5	1.2	3.3	1.5	1.2	3.3
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.1	1.0	1.1	1.1	1.0	1.1	1.0	1.0	1.1	1.0	1.0
Empire W.S.	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.3	0.7	0.6	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	48.1	44.3	48.0	48.1	44.3	48.1	44.3	36.1	48.1	44.3	36.1
Tulare	11.8	10.3	11.9	11.8	10.4	11.8	10.4	4.9	11.8	10.3	4.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.0	0.7	0.6	1.0
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Coachella	1.3	1.1	1.3	1.3	1.1	1.3	1.1	2.0	1.3	1.1	2.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	2.1	2.4	2.4	2.1	2.4	2.1	2.4	2.4	2.2	2.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	52.1	44.0	52.0	52.1	44.3	52.1	44.3	62.9	52.1	44.3	62.9
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	61.6	56.2	61.6	61.6	56.3	61.6	56.3	42.3	61.6	56.2	42.3
Total M&I	59.2	49.8	59.2	59.2	50.2	59.2	50.2	76.5	59.2	50.2	76.5
Total	120.8	106.0	120.8	120.8	106.5	120.8	106.5	118.7	120.8	106.4	118.7

Table A-6b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.5	0.1	0.0	1.5
Solano	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.6	0.1	0.0	1.6
Zone 7	0.3	0.1	0.4	0.3	0.1	0.3	0.1	1.7	0.3	0.1	1.7
Alameda	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.6	0.7	0.6	1.6
Santa Clara	2.1	1.5	2.1	2.1	1.5	2.1	1.5	5.6	2.1	1.5	5.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.7	1.8	1.7	1.7
Empire W.S.	1.2	1.0	1.2	1.2	1.0	1.2	1.0	0.3	1.2	1.0	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	79.4	72.6	79.2	79.4	72.6	79.4	72.6	59.9	79.4	72.6	59.9
Tulare	19.6	16.6	19.8	19.6	17.0	19.6	17.0	6.4	19.6	16.6	6.4
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	0.9	1.0	1.0	0.9	1.0	0.9	1.8	1.0	0.9	1.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.2	0.1	0.0	0.1	0.0	1.7	0.1	0.0	1.7
Coachella	1.9	1.7	1.9	1.9	1.7	1.9	1.7	3.4	1.9	1.7	3.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.6	3.4	3.6	3.6	3.4	3.6	3.4	3.6	3.6	3.4	3.6
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	80.4	65.1	80.2	80.4	65.7	80.4	65.7	100.3	80.4	65.1	100.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	102.0	91.9	101.9	102.0	92.4	102.0	92.4	68.3	102.0	91.9	68.3
Total M&I	90.4	73.4	90.4	90.4	74.0	90.4	74.0	122.7	90.4	73.4	122.7
Total	192.3	165.3	192.3	192.3	166.3	192.3	166.3	191.1	192.3	165.3	191.1

Table A-6c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1
Solano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
Zone 7	0.1	0.0	0.2	0.1	0.0	0.1	0.0	1.3	0.1	0.0	1.3
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.2	0.4	0.4	1.2
Santa Clara	1.3	0.9	1.3	1.3	0.9	1.3	0.9	4.0	1.3	0.9	4.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.3	1.2	1.3	1.3	1.2	1.3	1.2	1.3	1.3	1.2	1.3
Empire W.S.	1.0	0.7	1.0	1.0	0.7	1.0	0.7	0.2	1.0	0.7	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	61.8	58.7	61.8	61.8	58.7	61.8	58.7	40.5	61.8	58.7	40.5
Tulare	15.5	12.1	15.5	15.5	12.1	15.5	12.1	3.8	15.5	12.1	3.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.3	0.7	0.6	1.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3
Coachella	1.4	1.2	1.4	1.4	1.2	1.4	1.2	2.5	1.4	1.2	2.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.9	2.4	2.4	1.9	2.4	1.9	2.2	2.4	1.9	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	56.6	45.2	56.5	56.6	45.2	56.6	45.2	77.8	56.6	45.2	77.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	79.5	72.6	79.5	79.5	72.6	79.5	72.6	45.8	79.5	72.6	45.8
Total M&I	63.0	50.3	63.0	63.0	50.3	63.0	50.3	93.9	63.0	50.3	93.9
Total	142.5	123.0	142.5	142.5	123.0	142.5	123.0	139.7	142.5	123.0	139.7

Table A-6d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

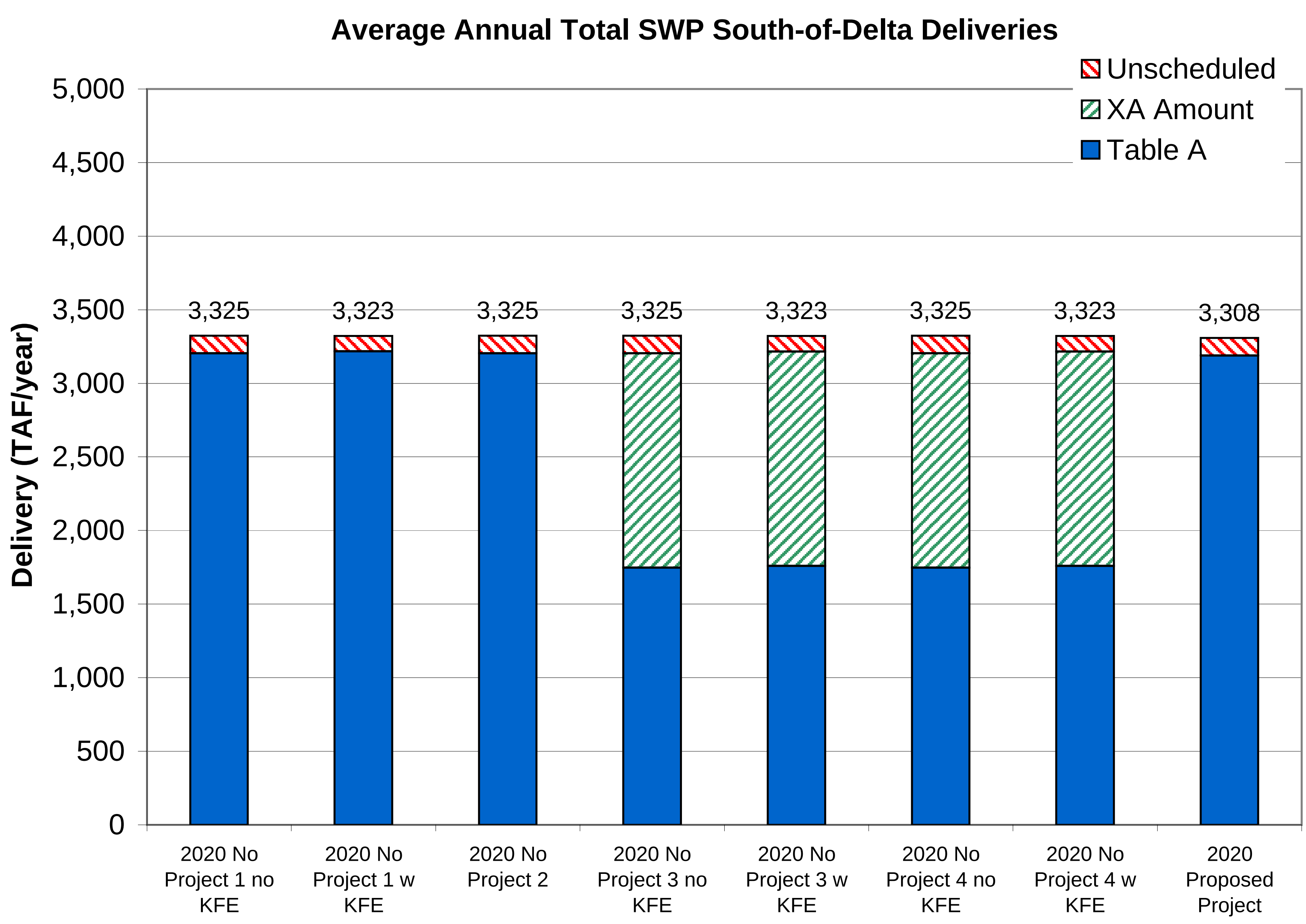
SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.8	0.1	0.0	0.8
Solano	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.9	0.3	0.2	0.9
Alameda	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8	0.4	0.3	0.8
Santa Clara	1.4	0.9	1.4	1.4	0.9	1.4	0.9	3.1	1.4	0.9	3.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	0.9	1.0	1.0	0.9	1.0	0.9	0.9	1.0	0.9	0.9
Empire W.S.	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.3	0.6	0.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	41.4	36.0	41.3	41.4	36.0	41.4	36.0	34.0	41.4	36.0	34.0
Tulare	9.6	8.9	9.6	9.6	8.9	9.6	8.9	4.6	9.6	8.9	4.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.9	0.7	0.6	0.9
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Coachella	1.2	1.0	1.2	1.2	1.0	1.2	1.0	1.8	1.2	1.0	1.8
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.8	2.4	2.4	1.8	2.4	1.8	2.2	2.4	1.8	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	44.2	36.9	44.2	44.2	36.9	44.2	36.9	52.8	44.2	36.9	52.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	52.5	46.3	52.5	52.5	46.3	52.5	46.3	39.7	52.5	46.3	39.7
Total M&I	51.1	41.7	51.1	51.1	41.7	51.1	41.7	65.2	51.1	41.7	65.2
Total	103.6	88.0	103.6	103.6	88.0	103.6	88.0	104.8	103.6	88.0	104.8

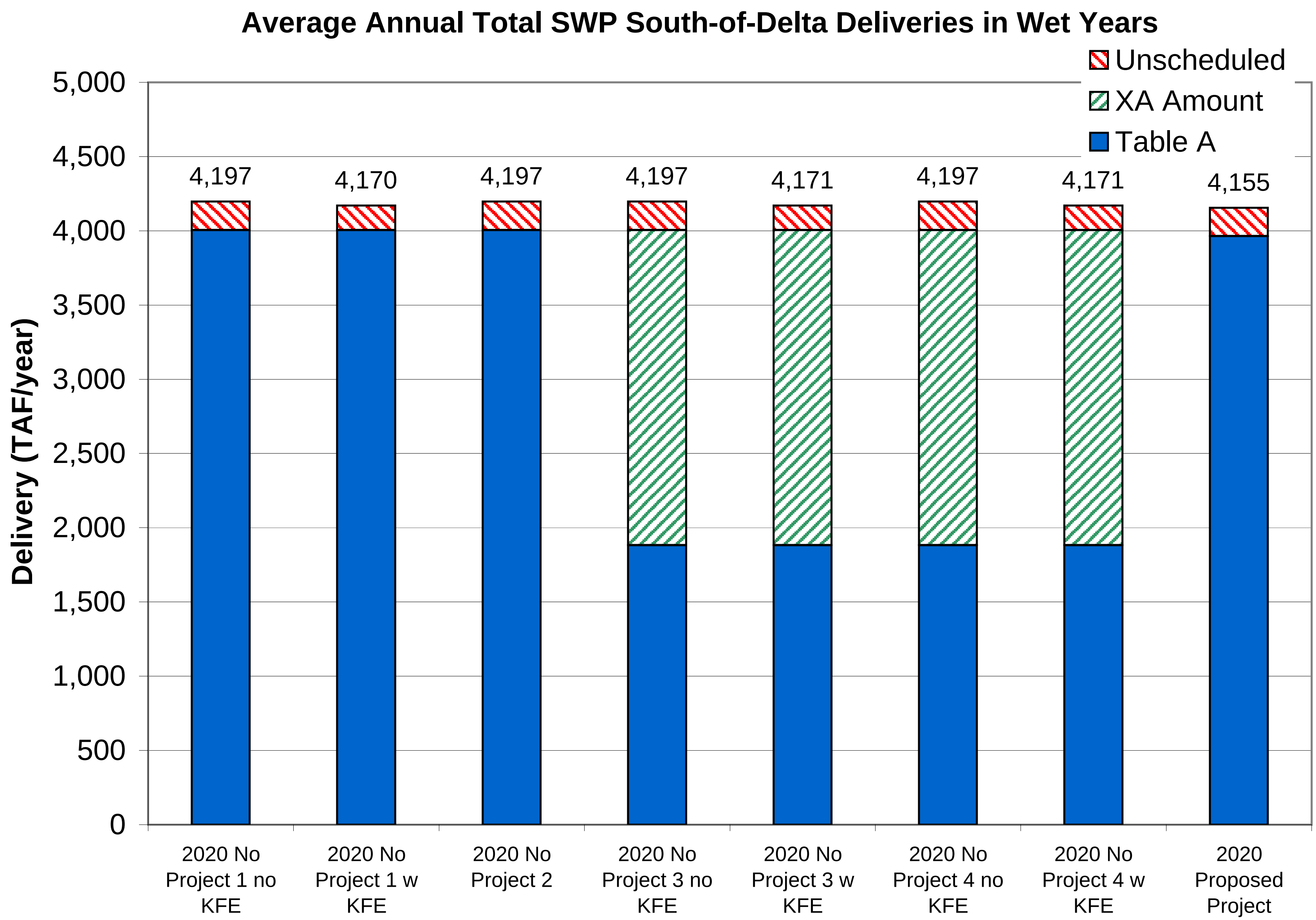
Table A-6e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Solano	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Zone 7	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Alameda	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3
Santa Clara	0.7	0.5	0.7	0.7	0.6	0.7	0.6	1.0	0.7	0.7	1.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.5	0.4	0.4
Empire W.S.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	20.6	19.3	20.5	20.6	19.3	20.6	19.3	11.8	20.6	19.3	11.8
Tulare	4.1	4.0	4.2	4.1	4.0	4.1	4.0	2.5	4.1	4.0	2.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Coachella	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.0	0.7	1.0	1.0	0.8	1.0	0.8	1.0	1.0	0.9	1.0
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	21.3	18.5	21.3	21.3	19.1	21.3	19.1	23.3	21.3	19.8	23.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	25.5	23.9	25.4	25.5	23.9	25.5	23.9	14.8	25.5	23.9	14.8
Total M&I	24.7	20.9	24.7	24.7	22.0	24.7	22.0	28.0	24.7	23.0	28.0
Total	50.2	44.8	50.2	50.2	45.9	50.2	45.9	42.8	50.2	47.0	42.8

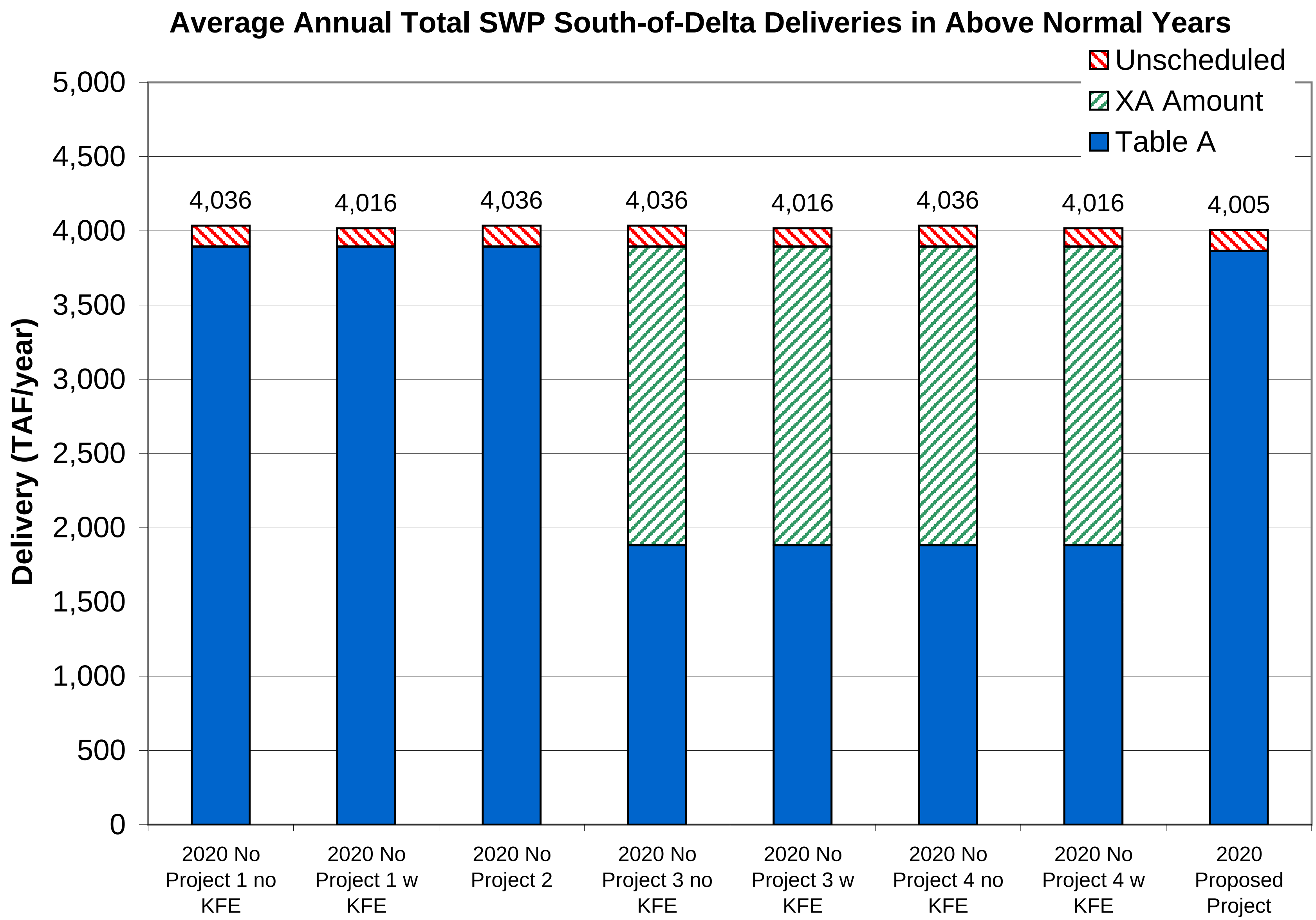
Table A-6f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

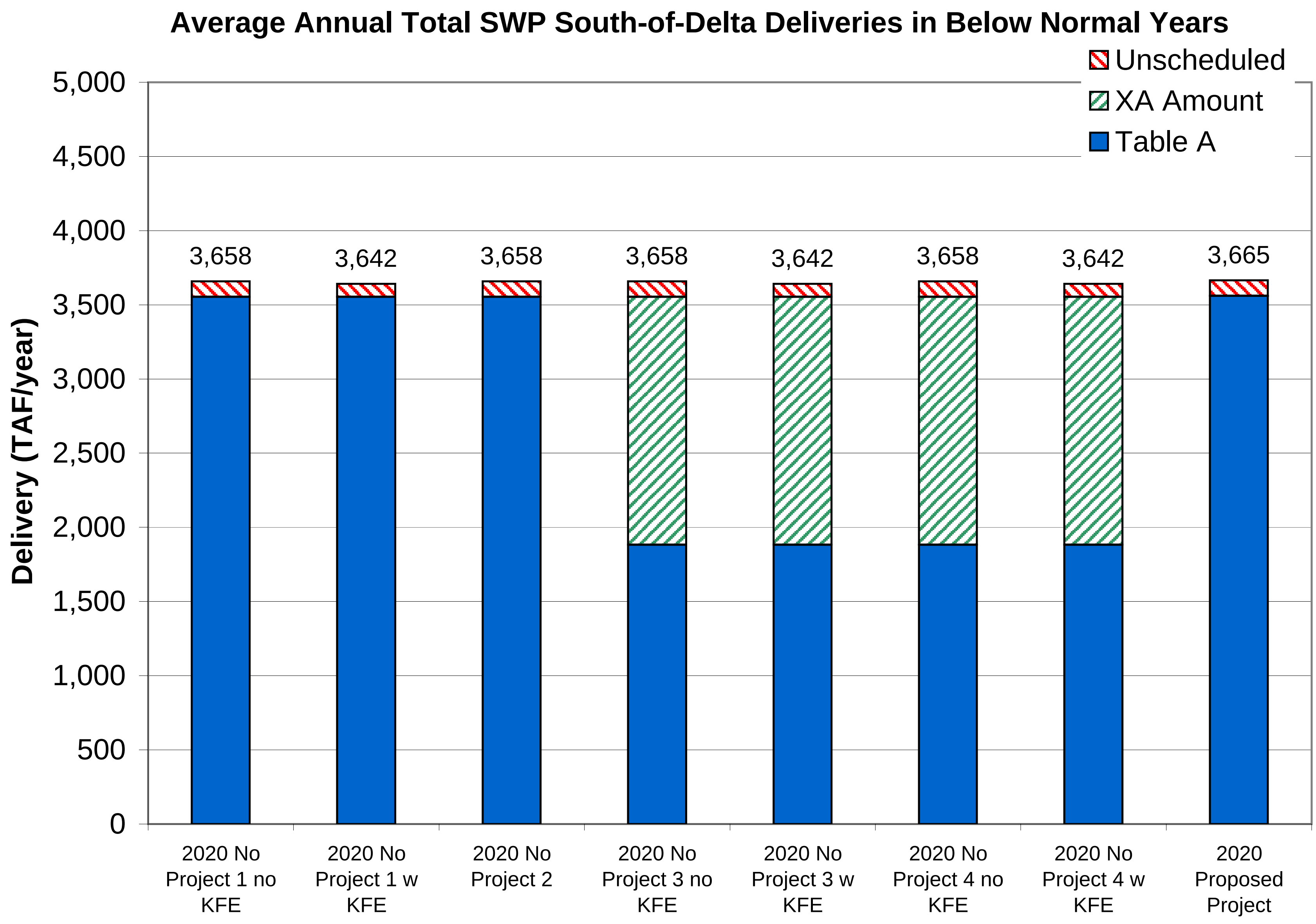
SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Solano	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alameda	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Santa Clara	1.8	1.8	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.5	0.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
Tulare	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5	6.8	6.8	6.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Coachella	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.3	2.1	2.1	2.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.5	45.4	45.4	45.5
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.0	30.5	30.5	30.0
Total M&I	52.8	52.8	52.8	52.8	52.8	52.8	52.8	53.2	52.8	52.8	53.2
Total	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.1	83.2	83.2	83.1


Average Annual Total SWP South-of-Delta Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,325
3,323
3,325
3,325
3,323
3,325
3,323
3,308
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

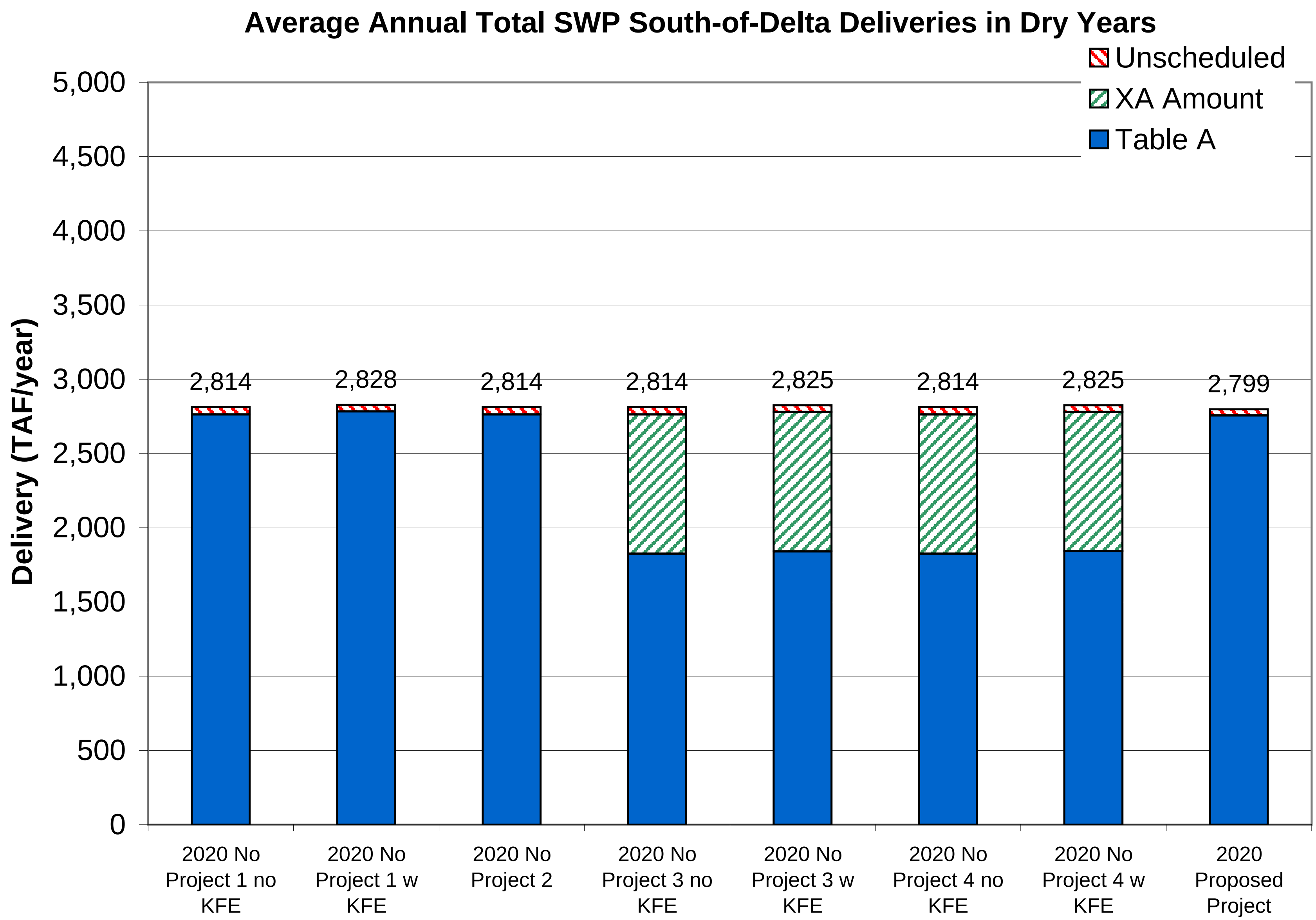


Average Annual Total SWP South-of-Delta Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
4,197
4,170
4,197
4,197
4,171
4,197
4,171
4,155
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

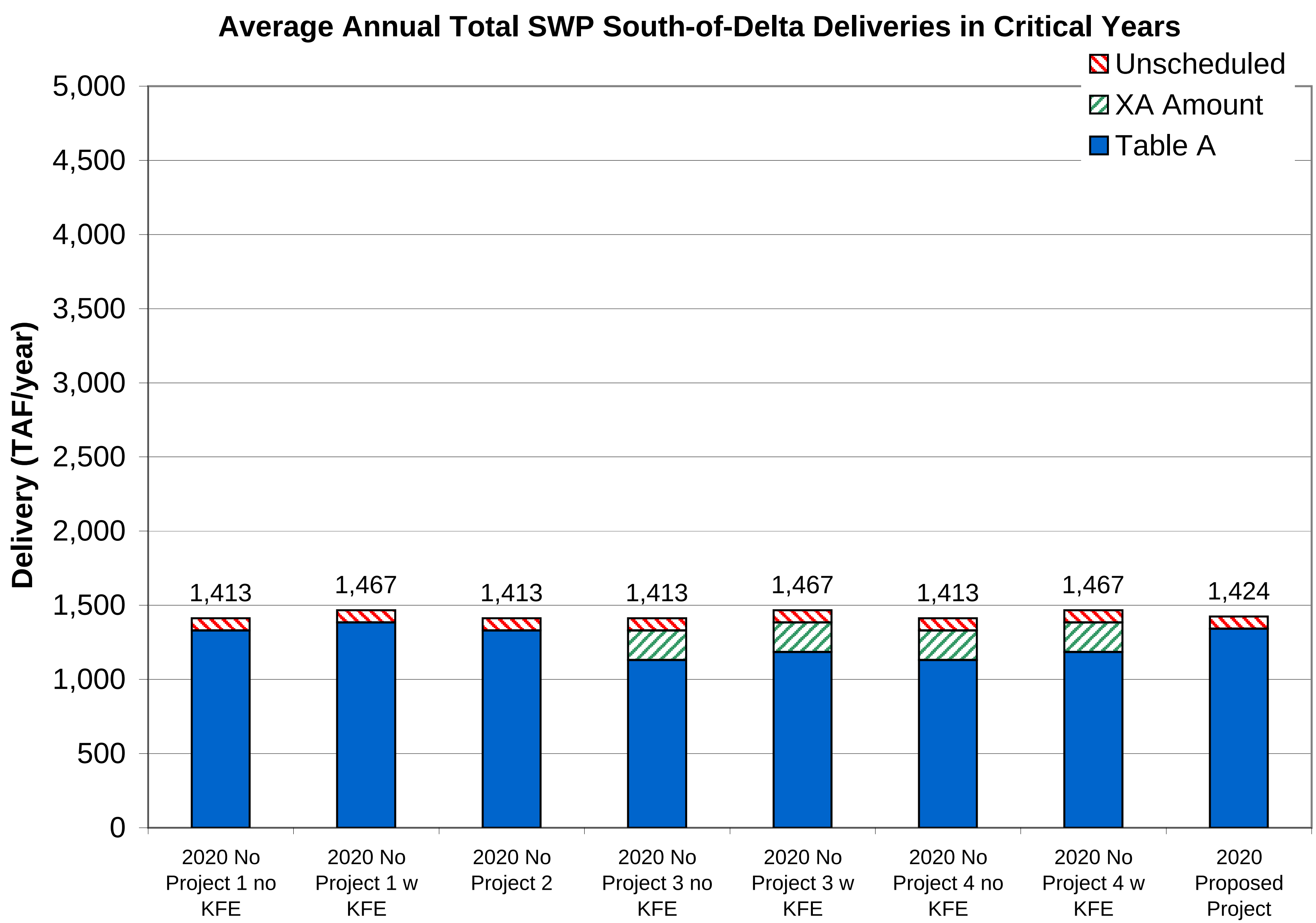

Average Annual Total SWP South-of-Delta Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
4,036
4,016
4,036
4,036
4,016
4,036
4,016
4,005
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

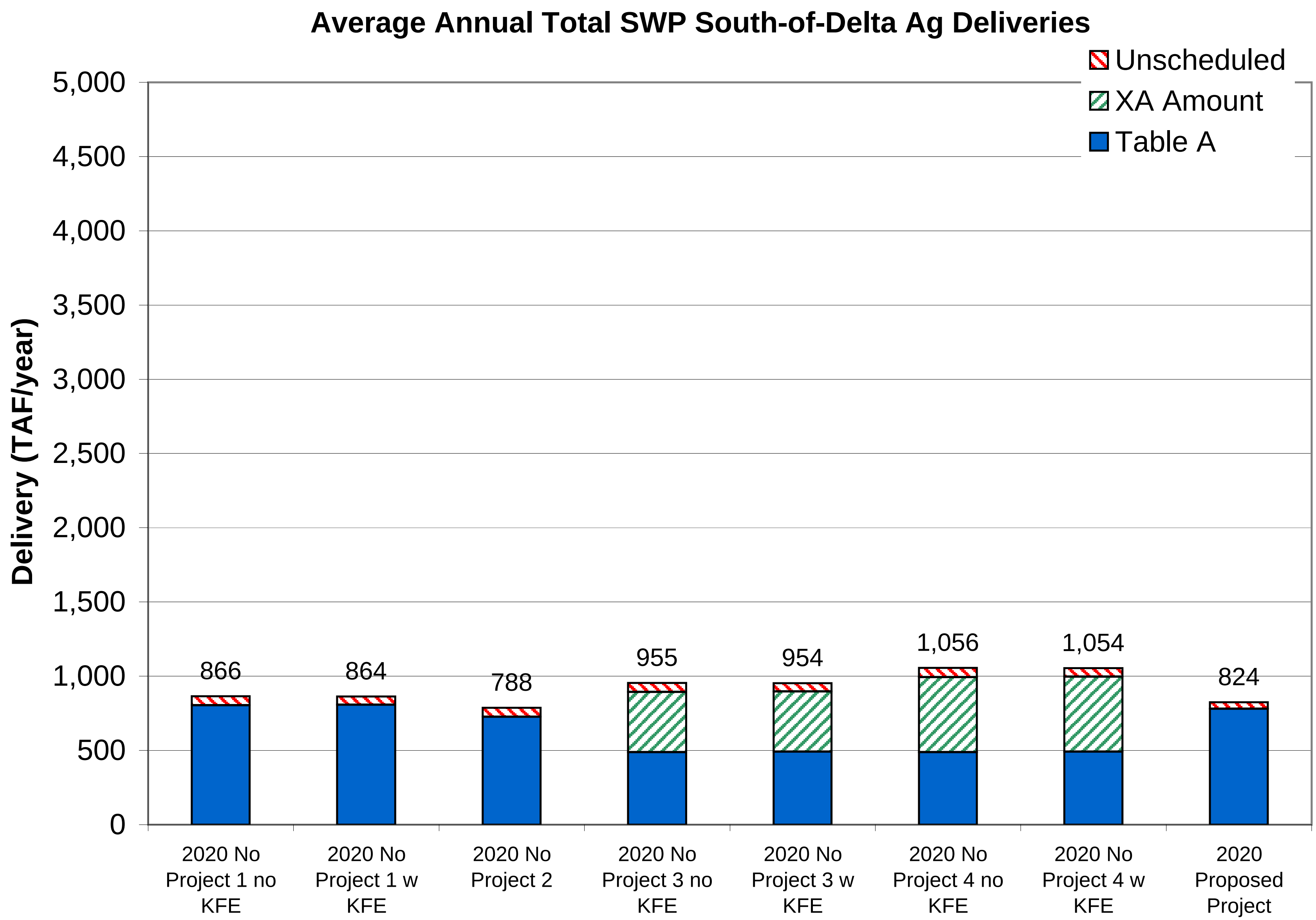


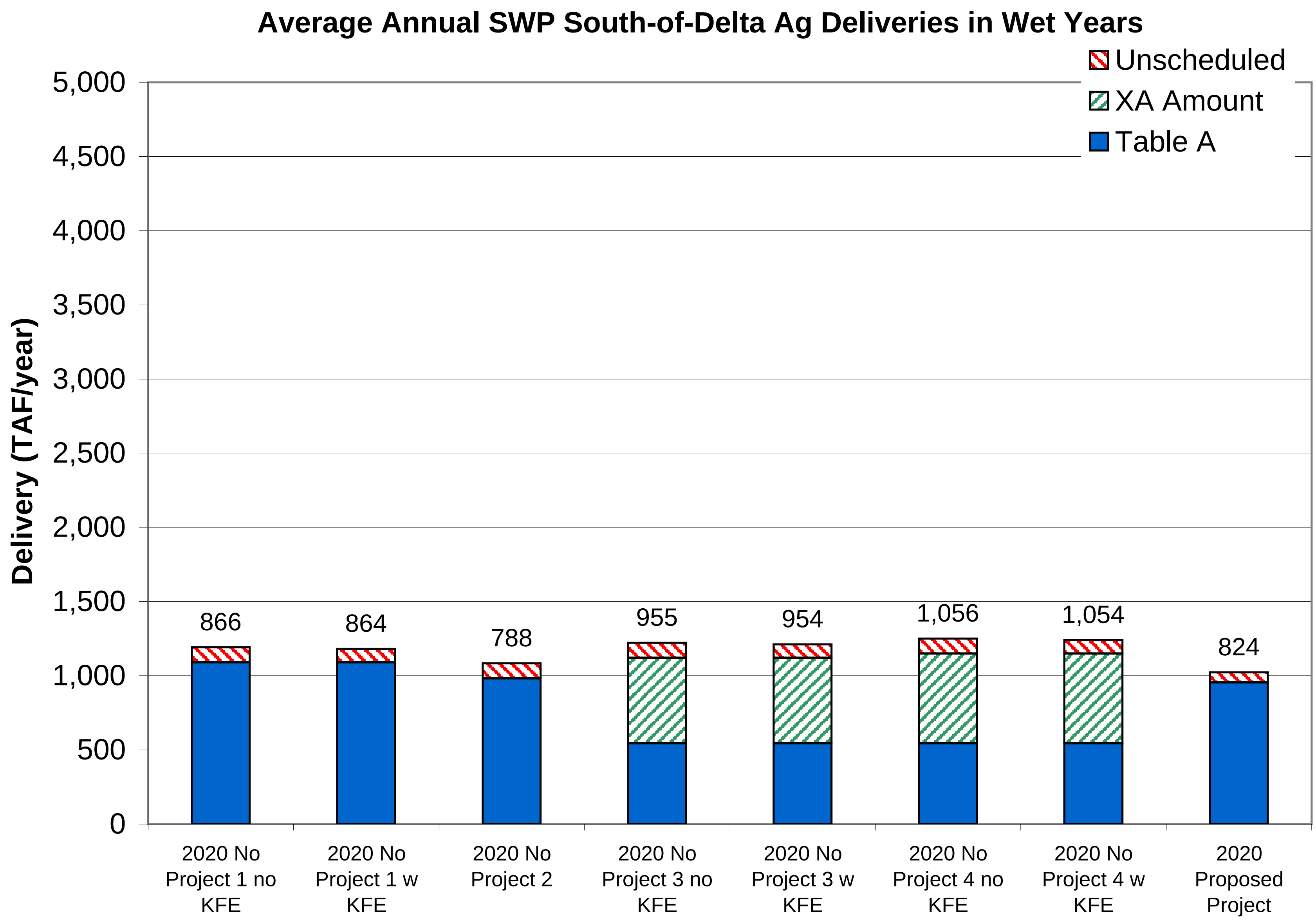
Average Annual Total SWP South-of-Delta Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,658
3,642
3,658
3,658
3,642
3,658
3,642
3,665
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

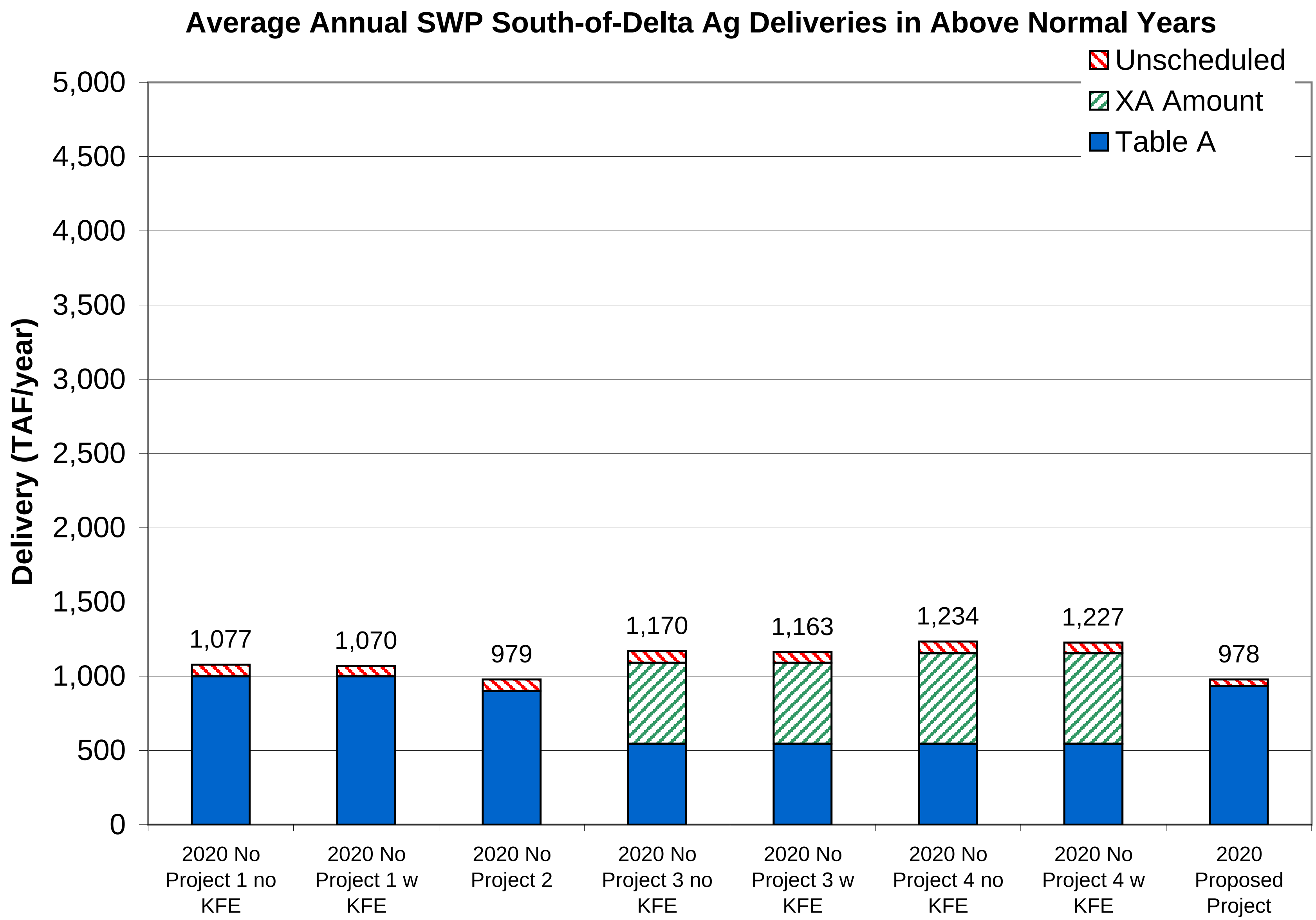


Average Annual Total SWP South-of-Delta Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,814
2,828
2,814
2,814
2,825
2,814
2,825
2,799
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

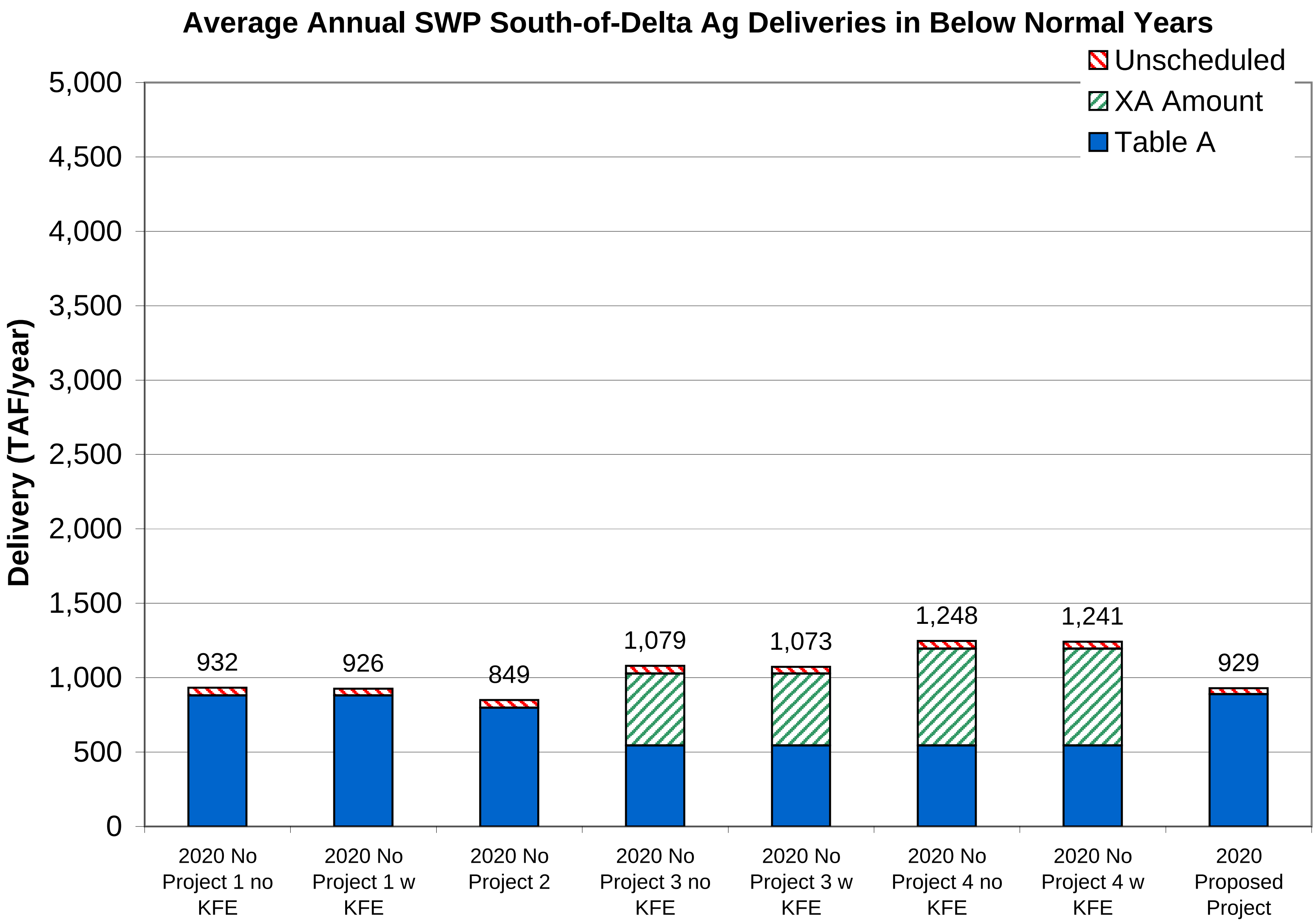

Average Annual Total SWP South-of-Delta Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,413
1,467
1,413
1,413
1,467
1,413
1,467
1,424
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project


Average Annual Total SWP South-of-Delta Ag Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
866
864
788
955
954
1,056
1,054
824
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

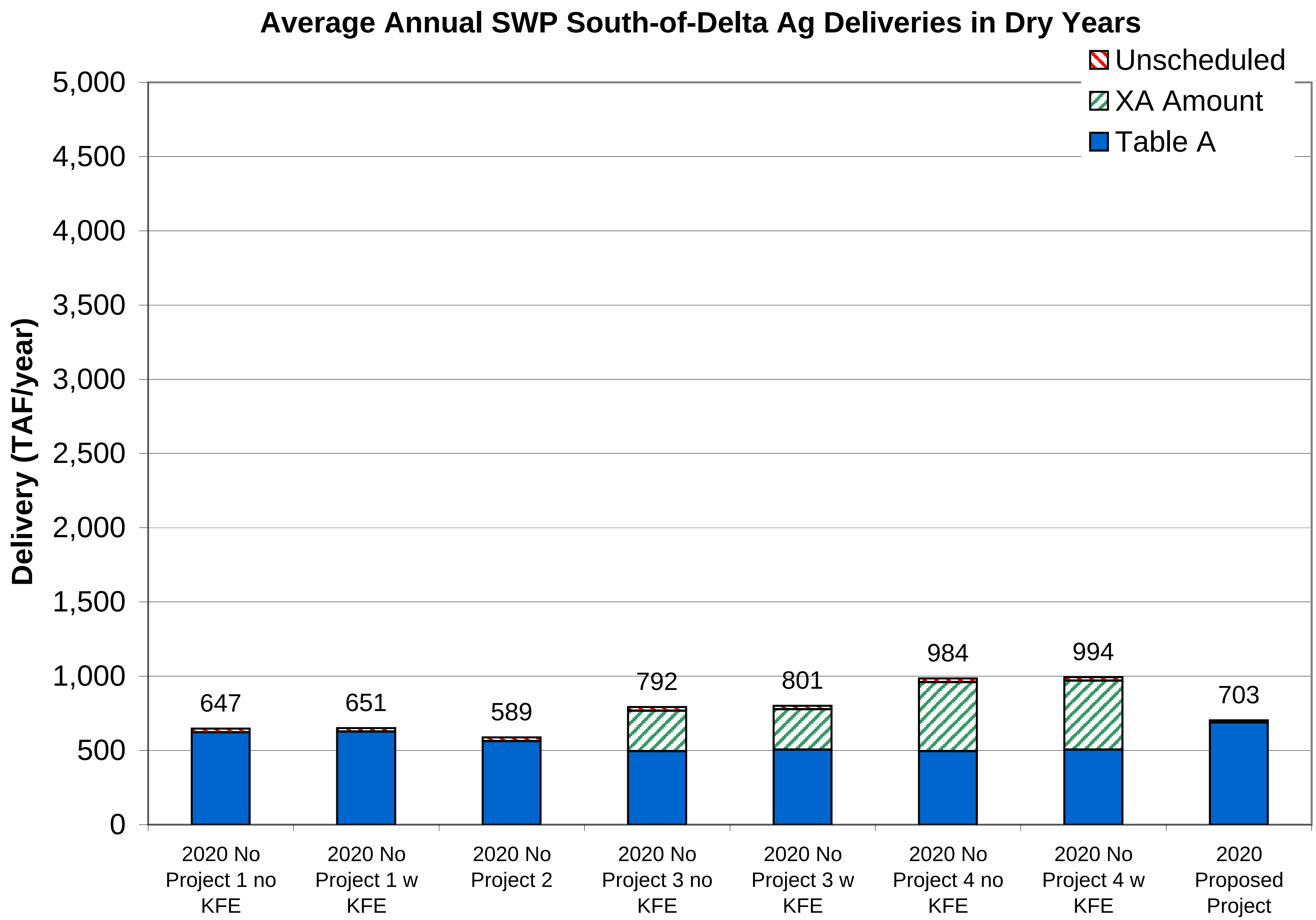

Average Annual SWP South-of-Delta Ag Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
866
864
788
955
954
1,056
1,054
824
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project



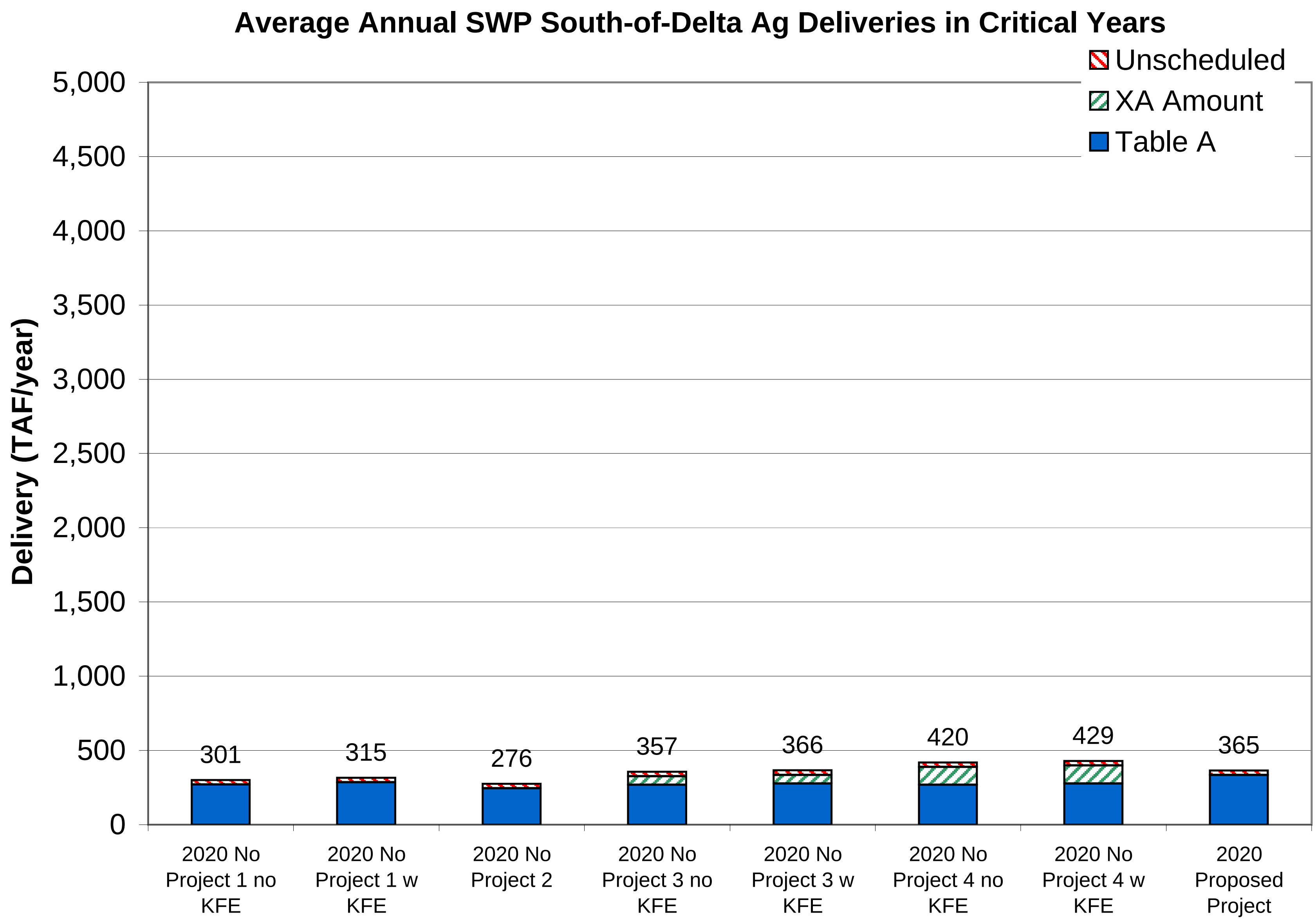
Average Annual SWP South-of-Delta Ag Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,077
1,070
979
1,170
1,163
1,234
1,227
978
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

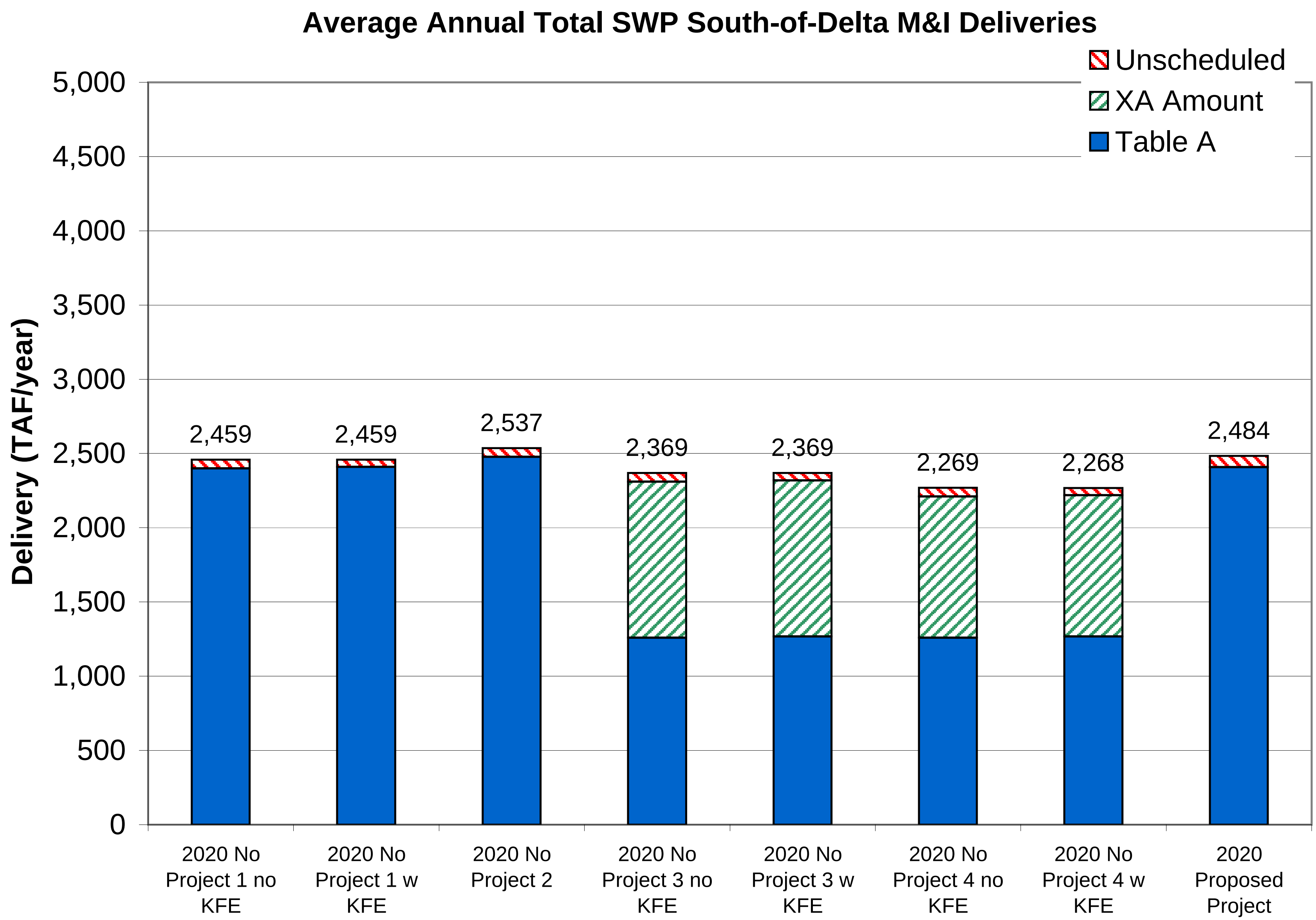


Average Annual SWP South-of-Delta Ag Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
932
926
849
1,079
1,073
1,248
1,241
929
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

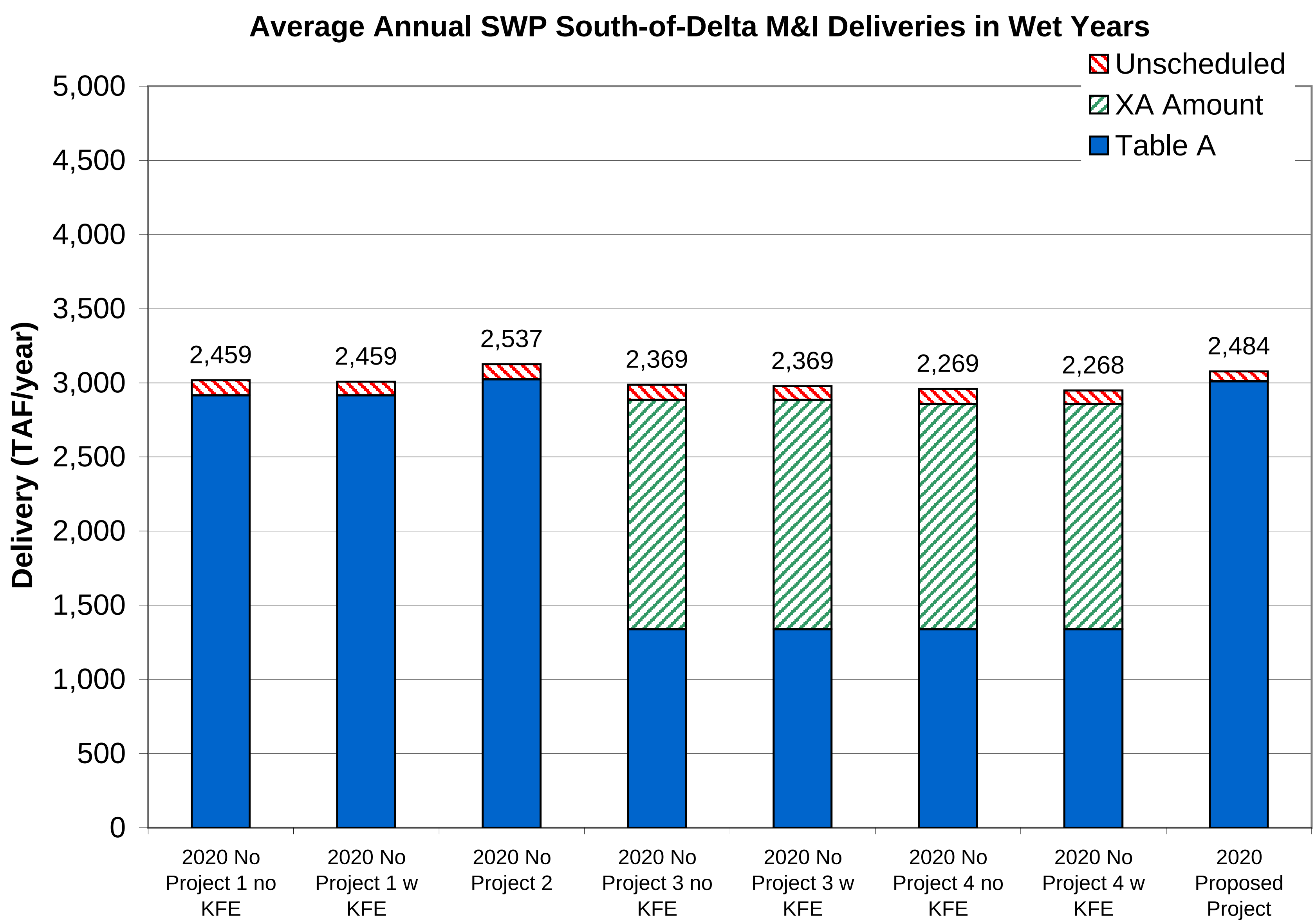


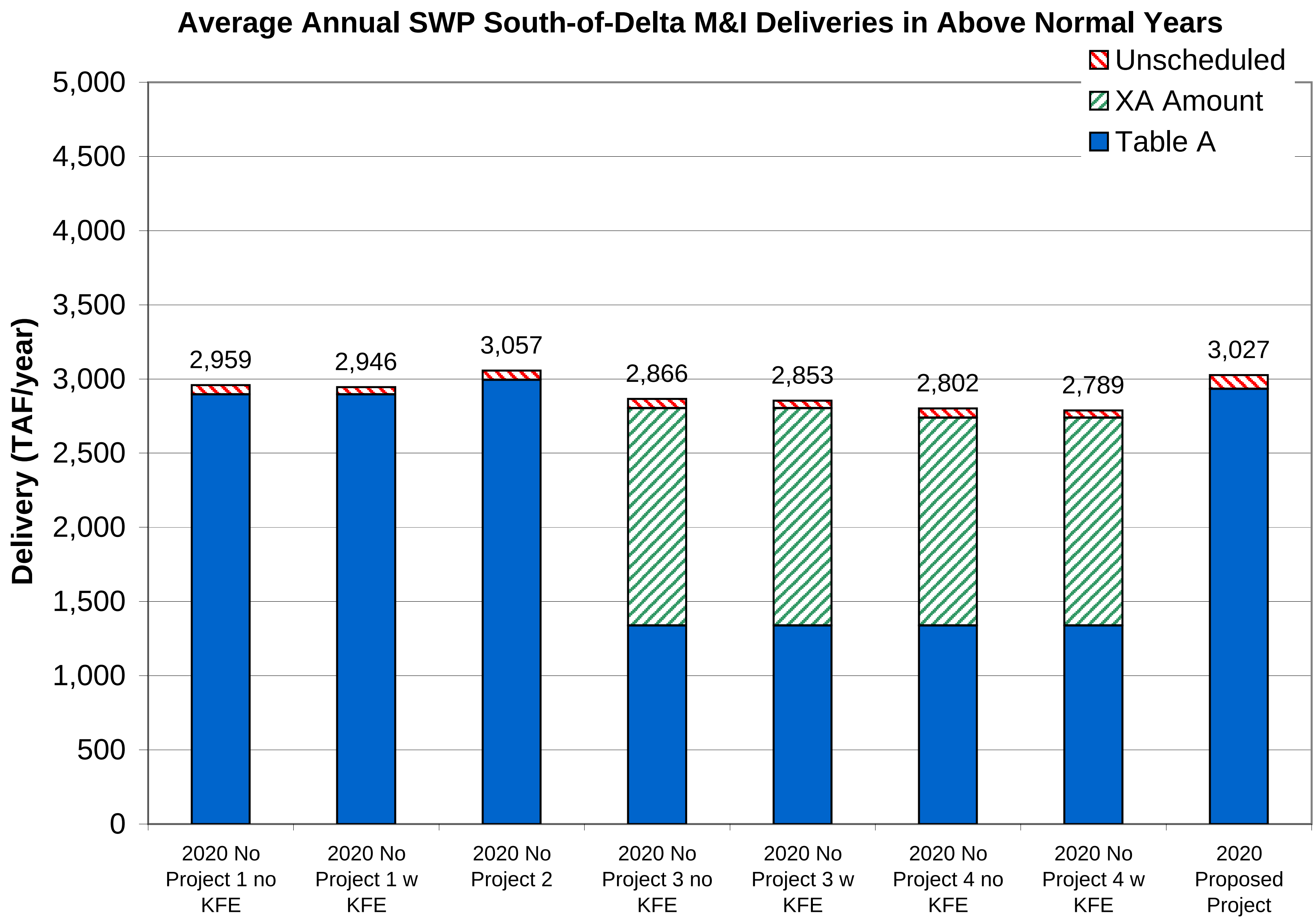
Average Annual SWP South-of-Delta Ag Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
647
651
589
792
801
984
994
703
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project


Average Annual SWP South-of-Delta Ag Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
301
315
276
357
366
420
429
365
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

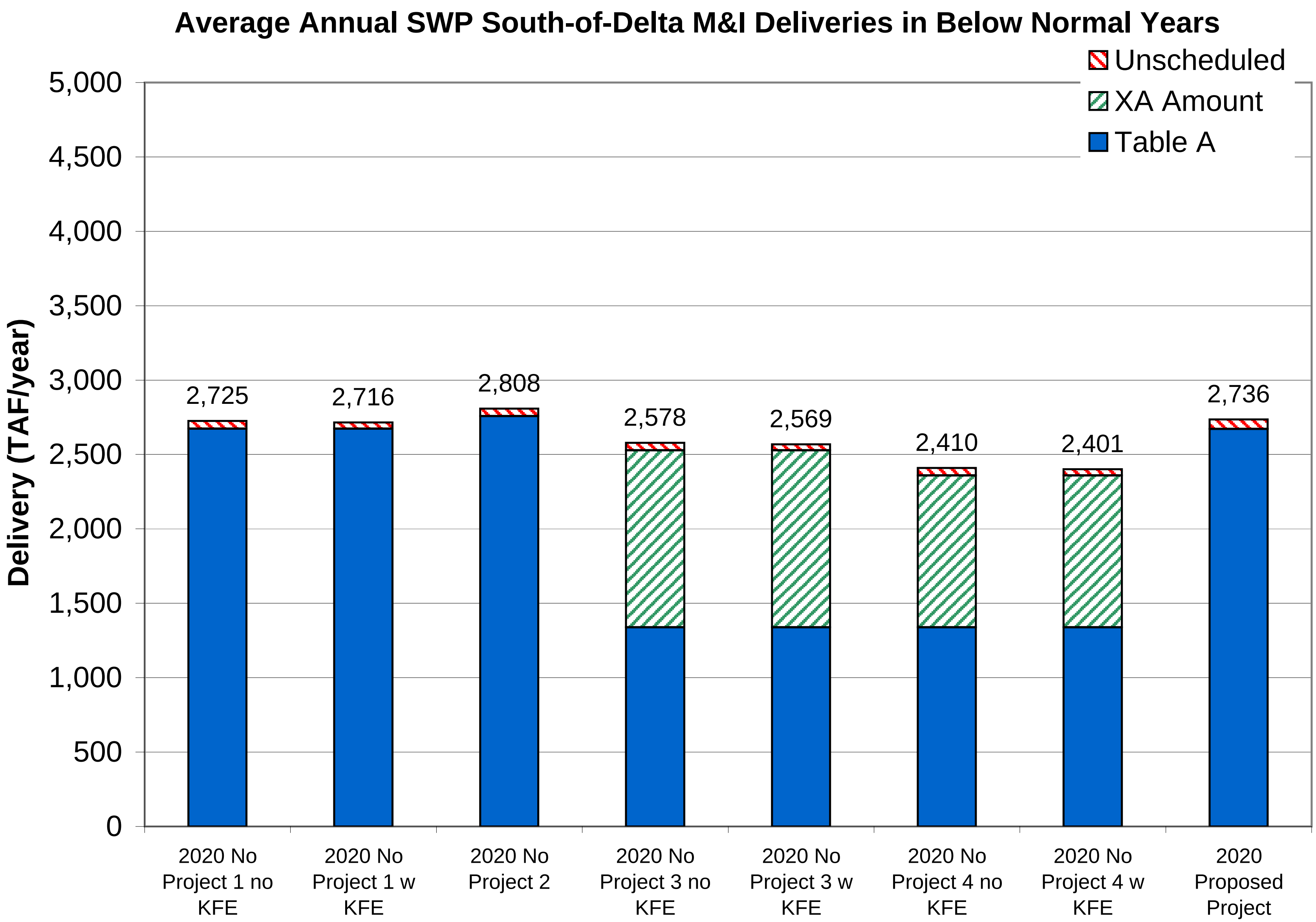


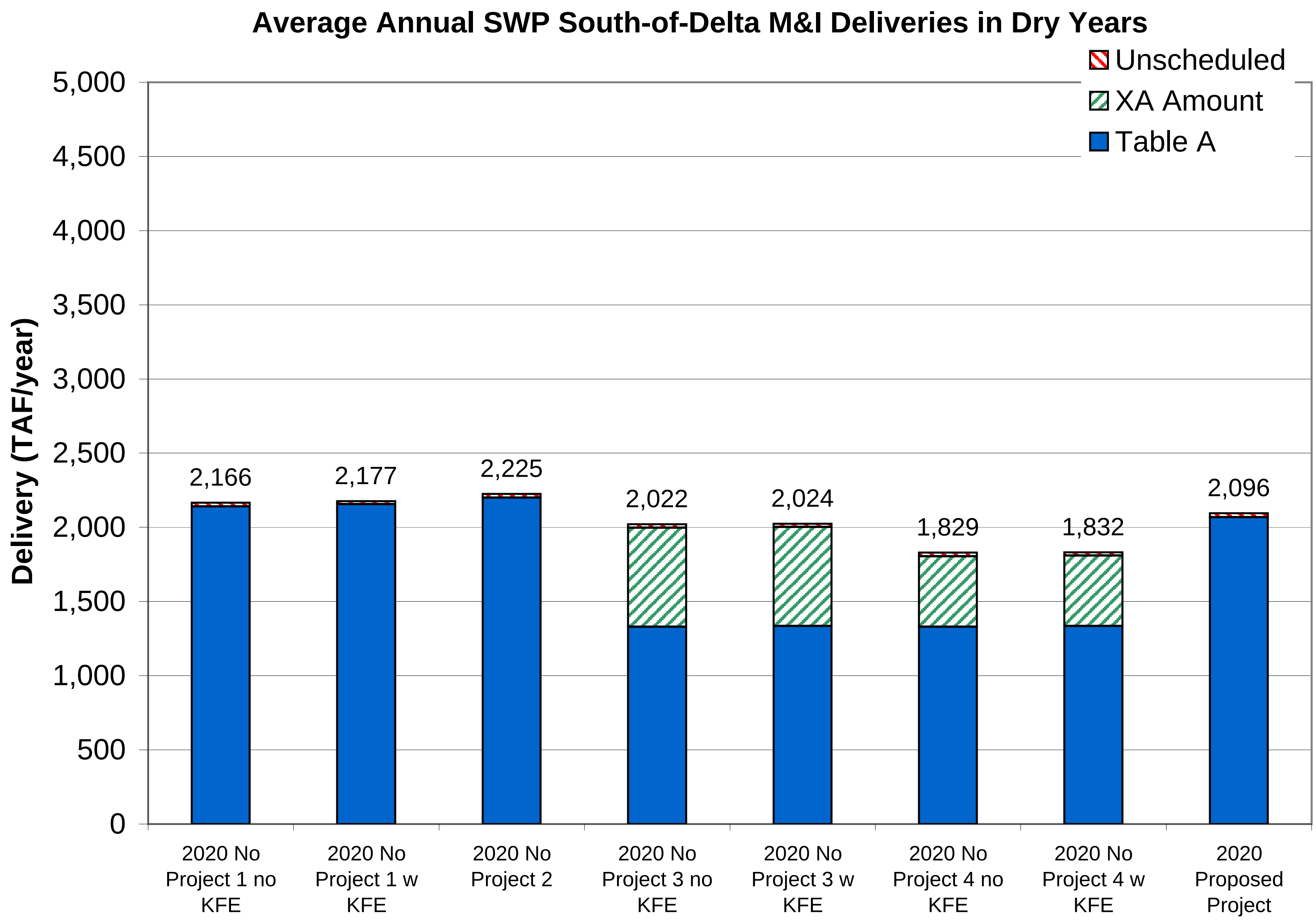
Average Annual Total SWP South-of-Delta M&I Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,459
2,459
2,537
2,369
2,369
2,269
2,268
2,484
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project


Average Annual SWP South-of-Delta M&I Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,459
2,459
2,537
2,369
2,369
2,269
2,268
2,484
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

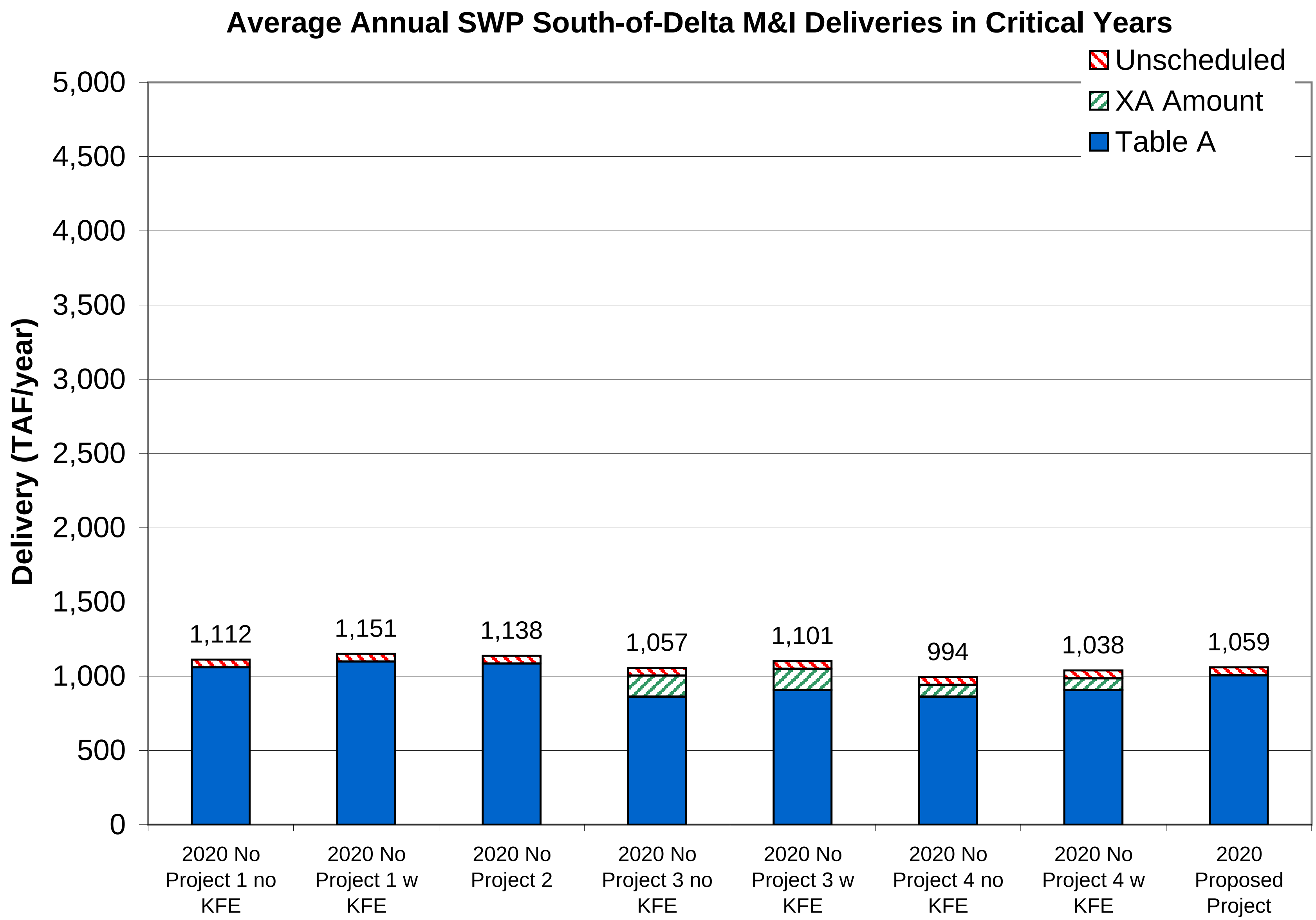


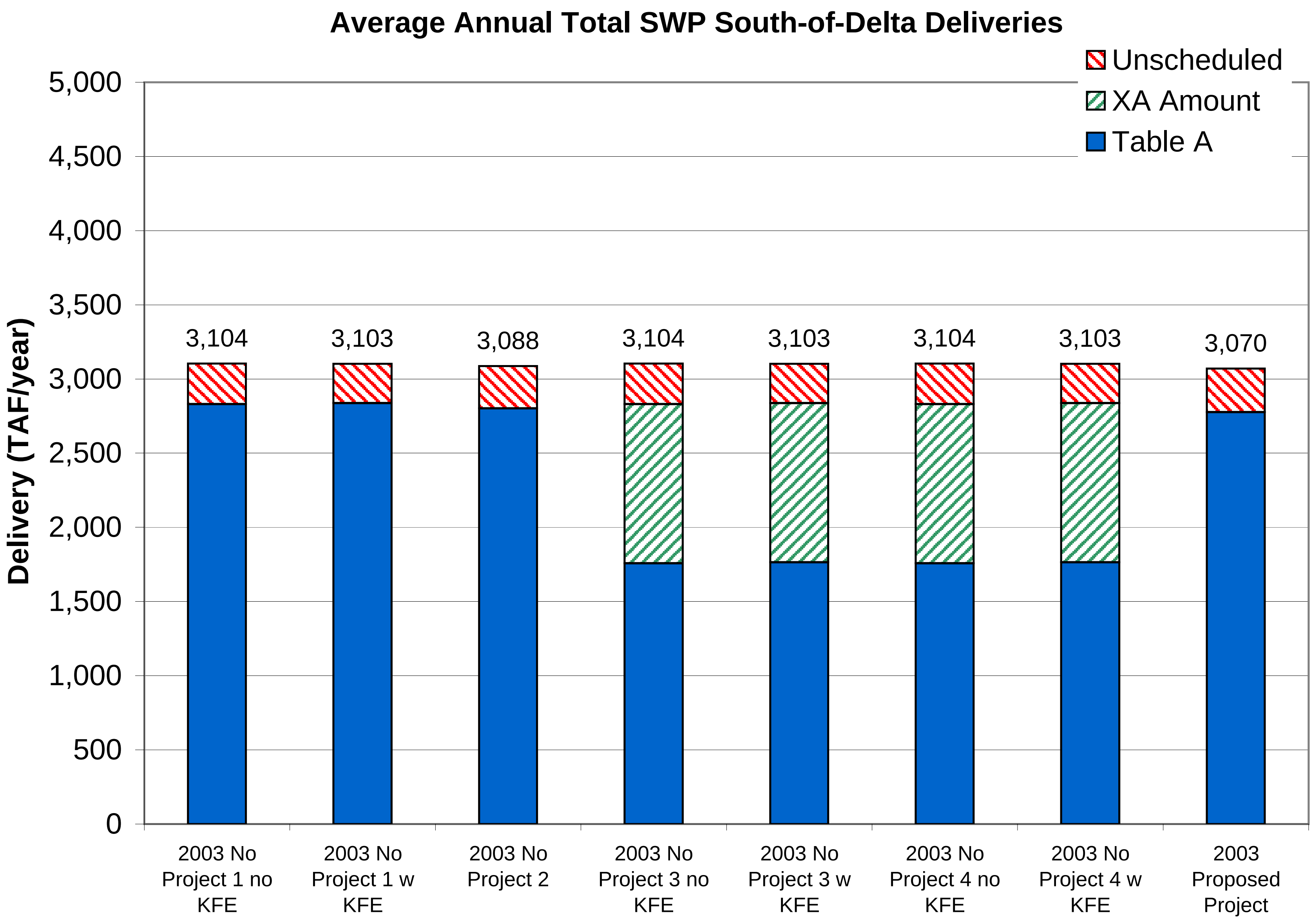
Average Annual SWP South-of-Delta M&I Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,959
2,946
3,057
2,866
2,853
2,802
2,789
3,027
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

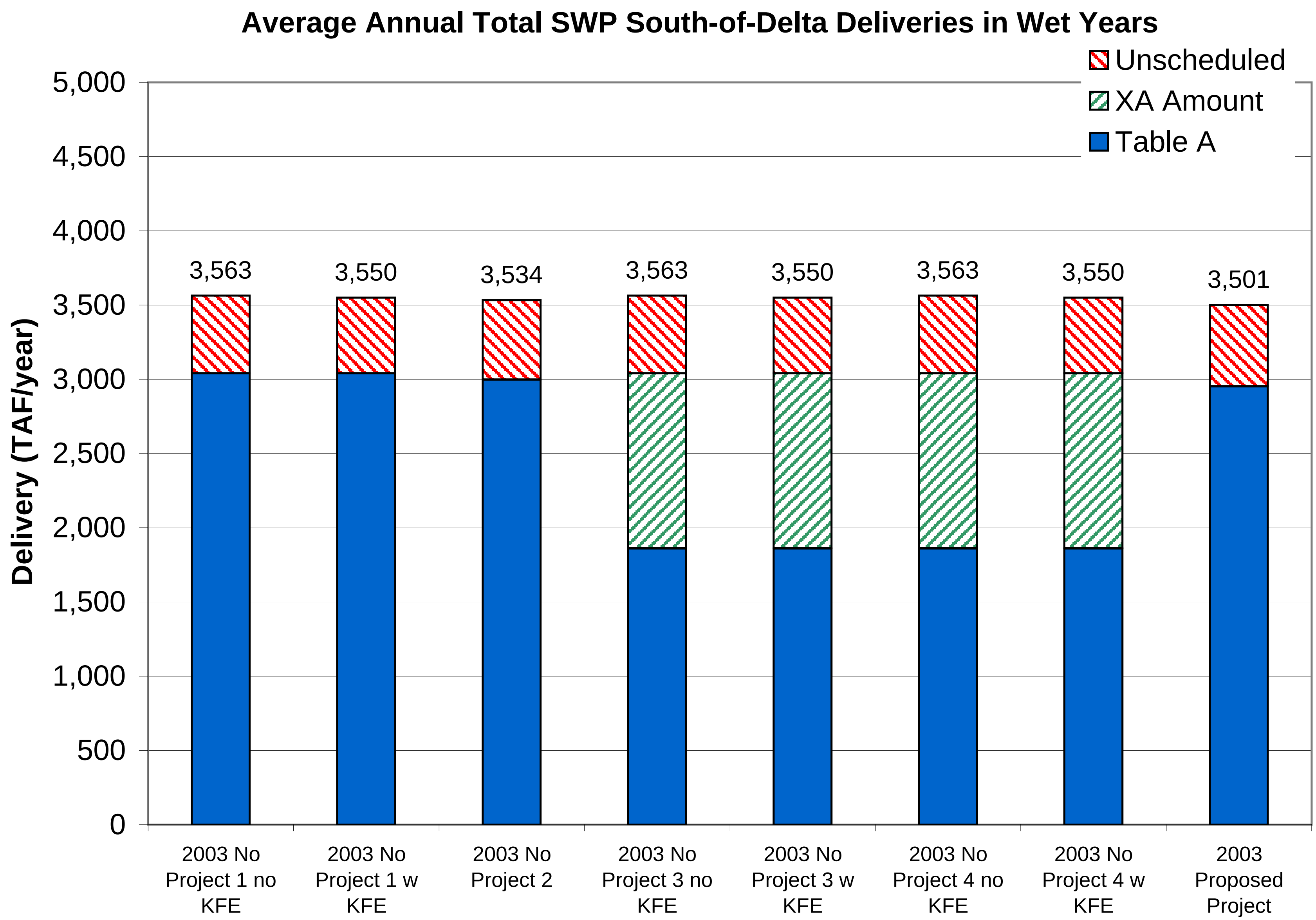

Average Annual SWP South-of-Delta M&I Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,725
2,716
2,808
2,578
2,569
2,410
2,401
2,736
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

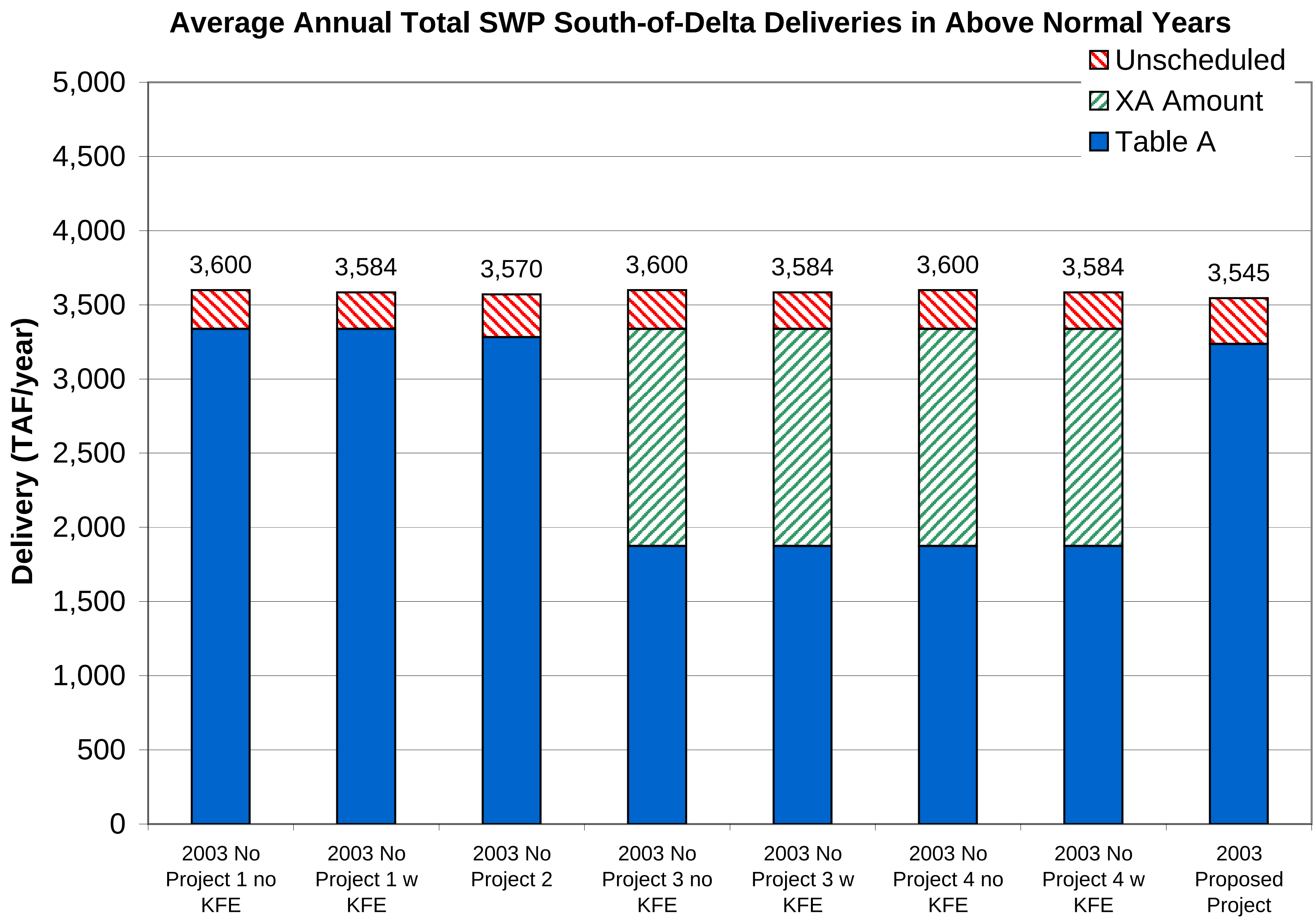


Average Annual SWP South-of-Delta M&I Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,166
2,177
2,225
2,022
2,024
1,829
1,832
2,096
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project

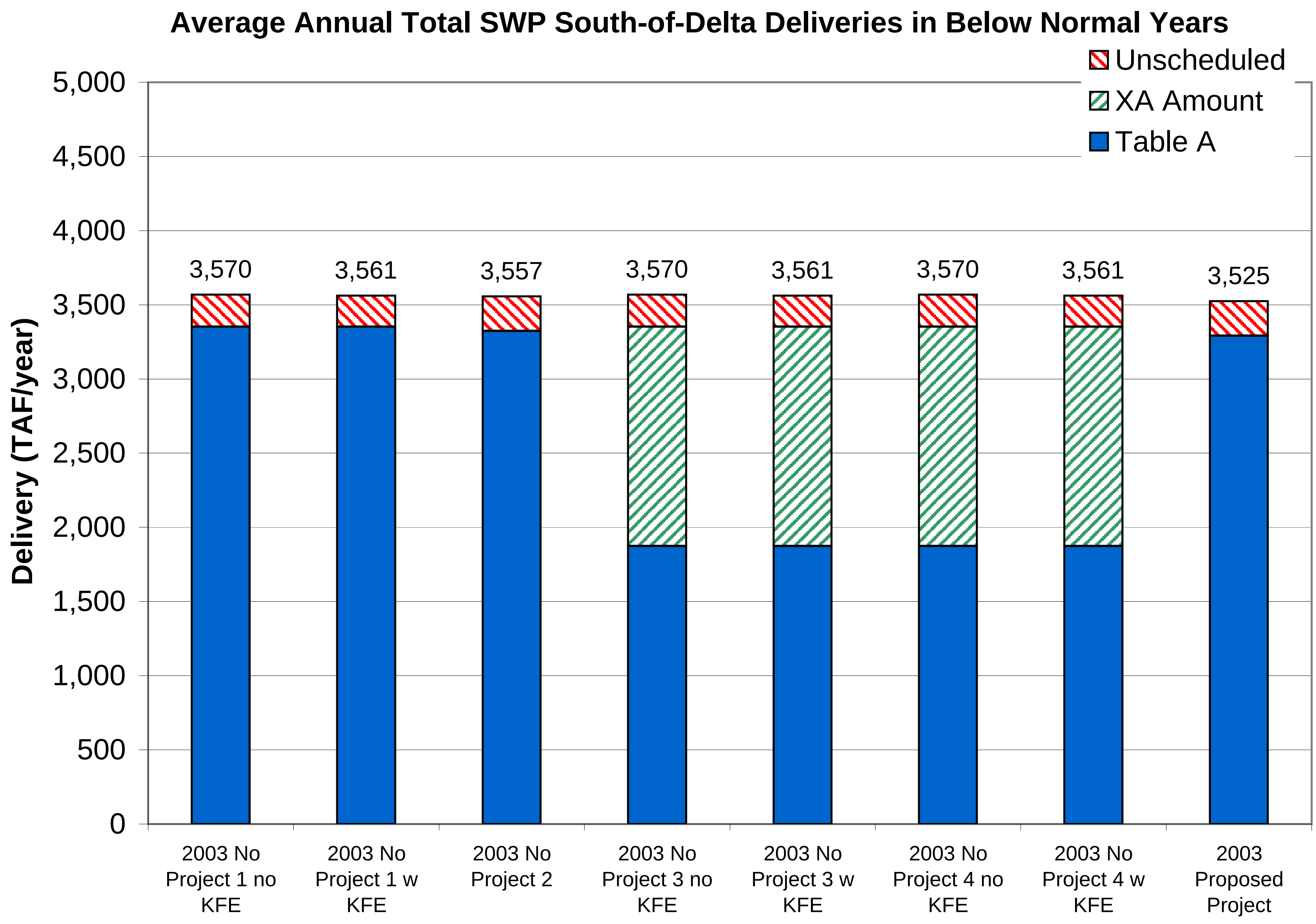

Average Annual SWP South-of-Delta M&I Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,112
1,151
1,138
1,057
1,101
994
1,038
1,059
2020 No Project 1 no KFE
2020 No Project 1 w KFE
2020 No Project 2
2020 No Project 3 no KFE
2020 No Project 3 w KFE
2020 No Project 4 no KFE
2020 No Project 4 w KFE
2020 Proposed Project


Average Annual Total SWP South-of-Delta Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,104
3,103
3,088
3,104
3,103
3,104
3,103
3,070
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

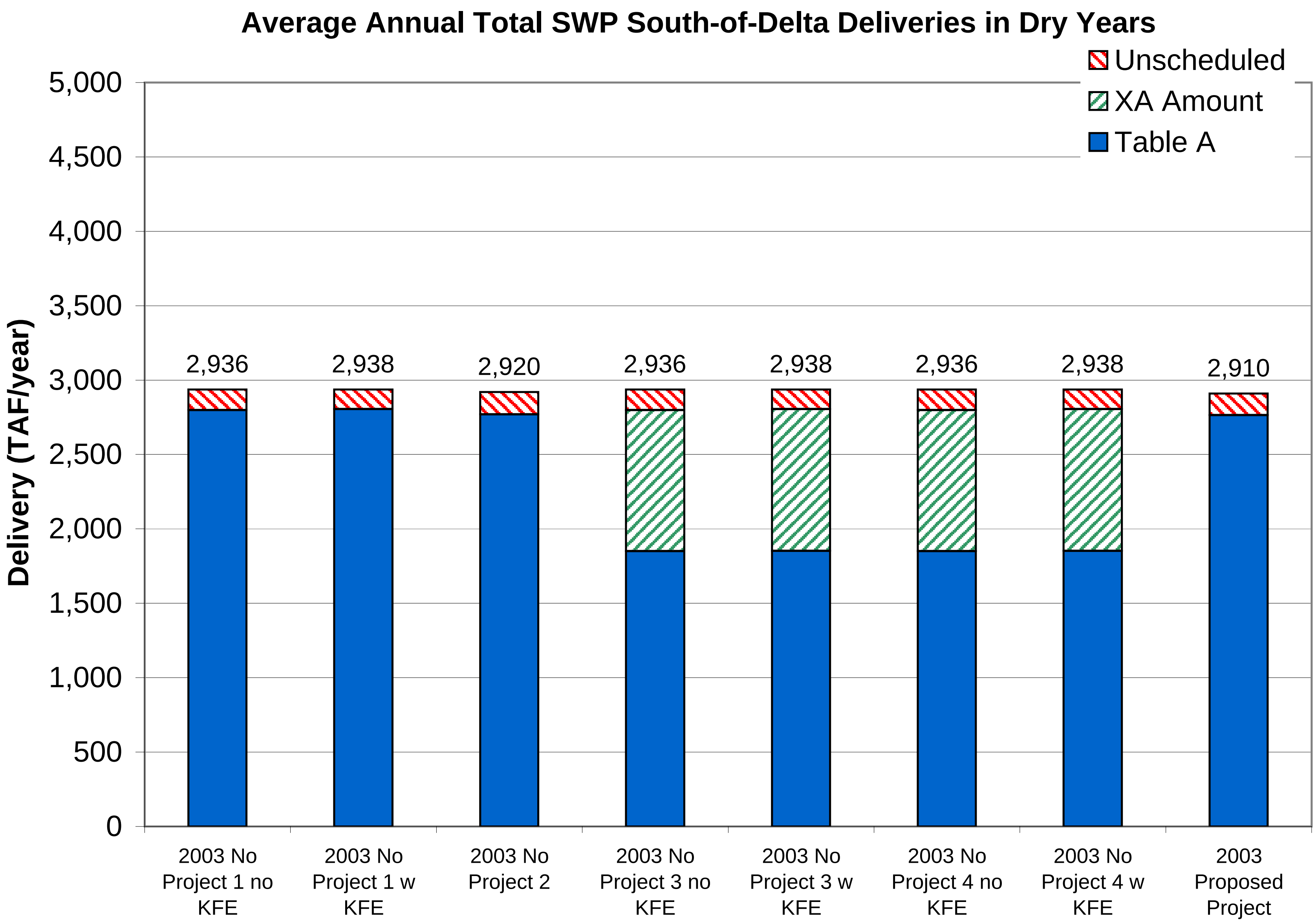

Average Annual Total SWP South-of-Delta Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,563
3,550
3,534
3,563
3,550
3,563
3,550
3,501
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project



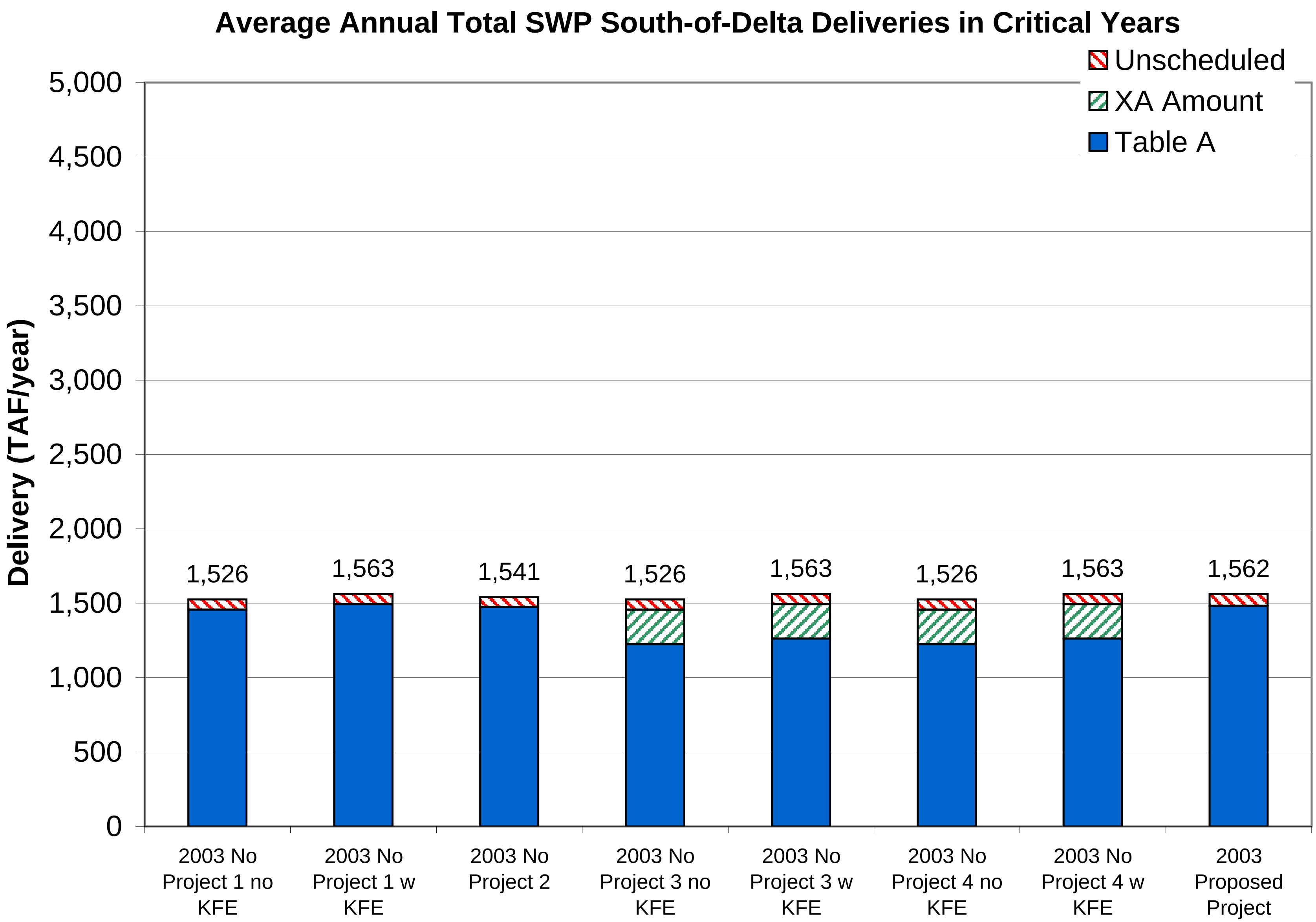
Average Annual Total SWP South-of-Delta Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,600
3,584
3,570
3,600
3,584
3,600
3,584
3,545
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

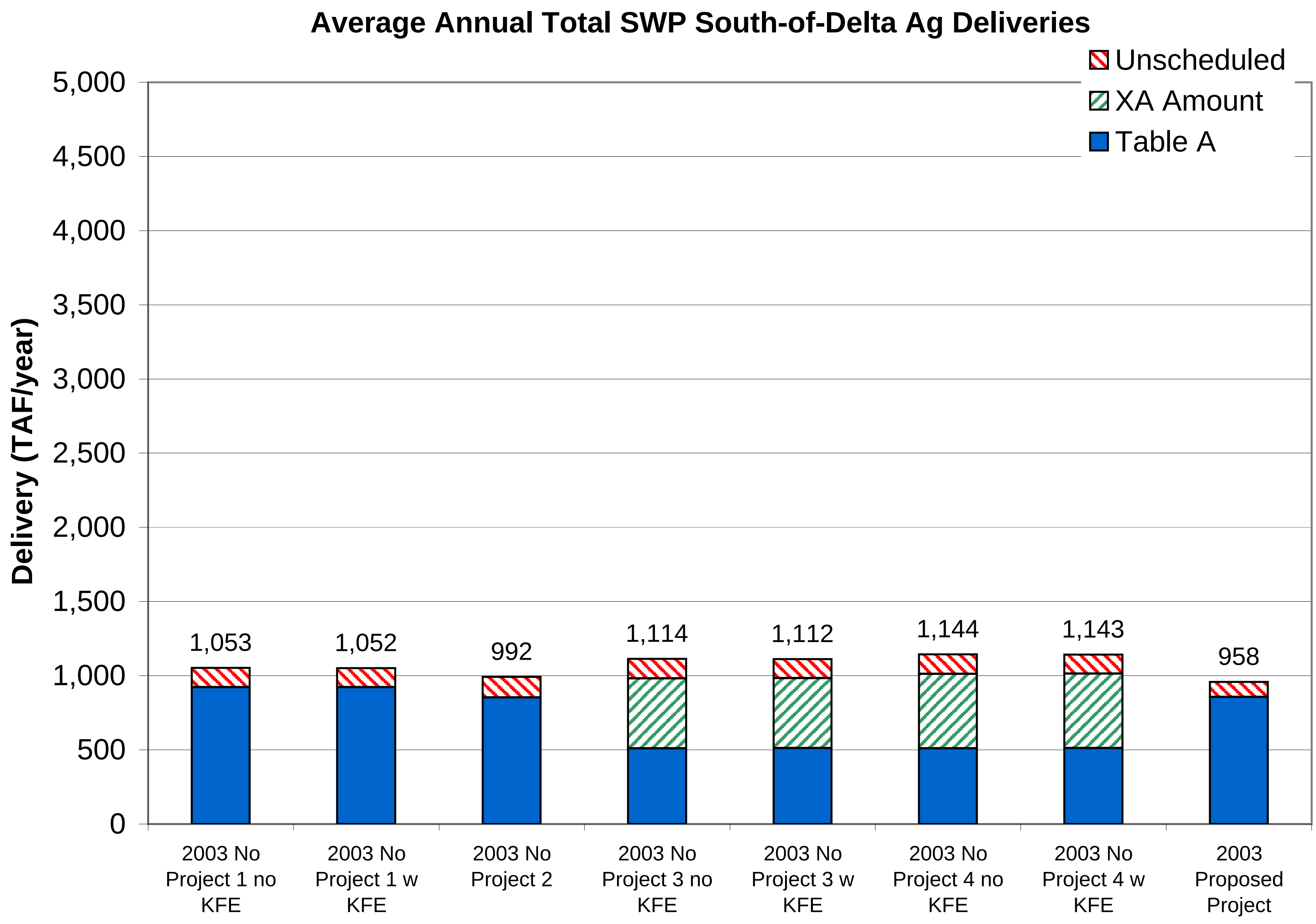


Average Annual Total SWP South-of-Delta Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,570
3,561
3,557
3,570
3,561
3,570
3,561
3,525
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

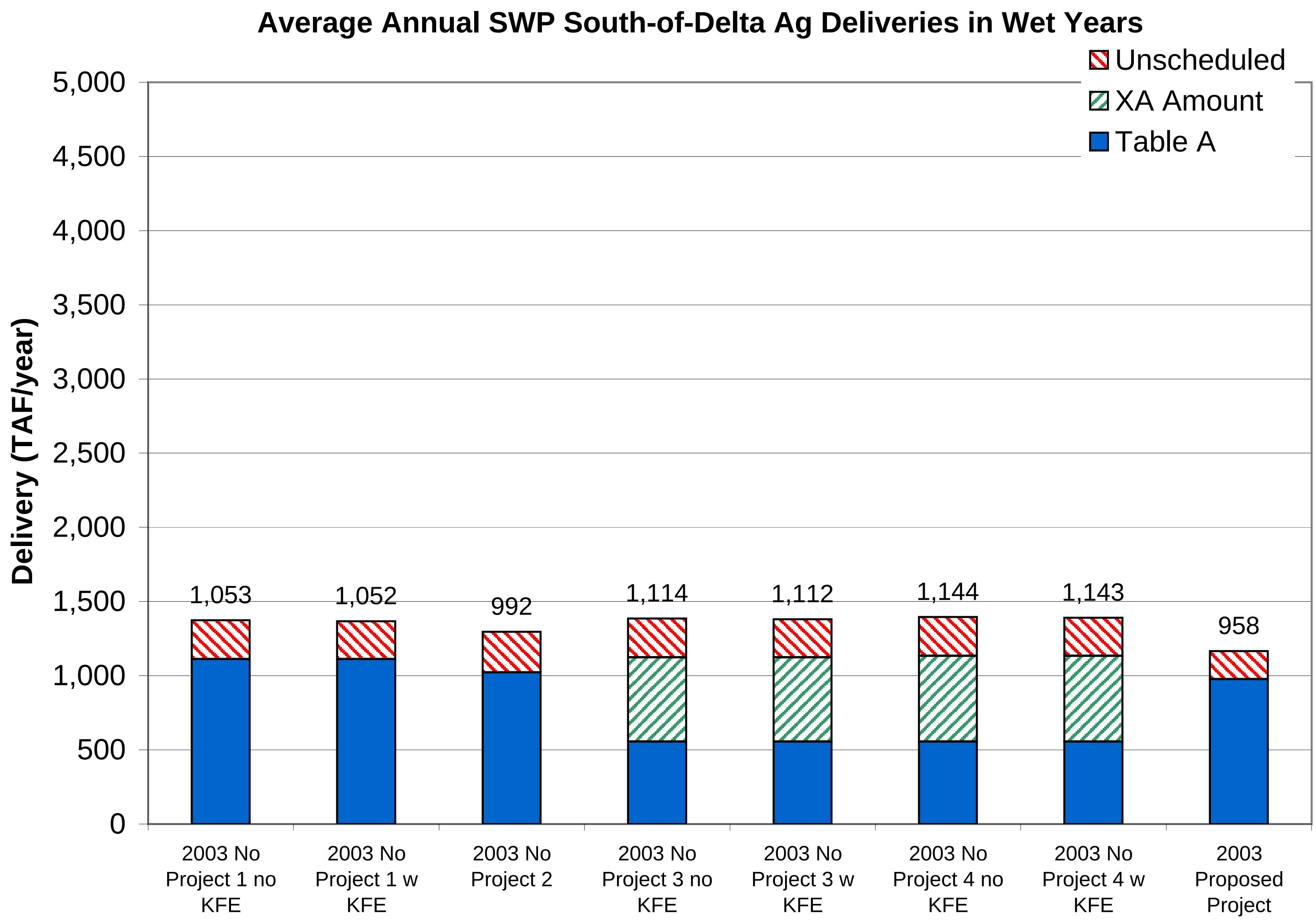


Average Annual Total SWP South-of-Delta Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,936
2,938
2,920
2,936
2,938
2,936
2,938
2,910
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

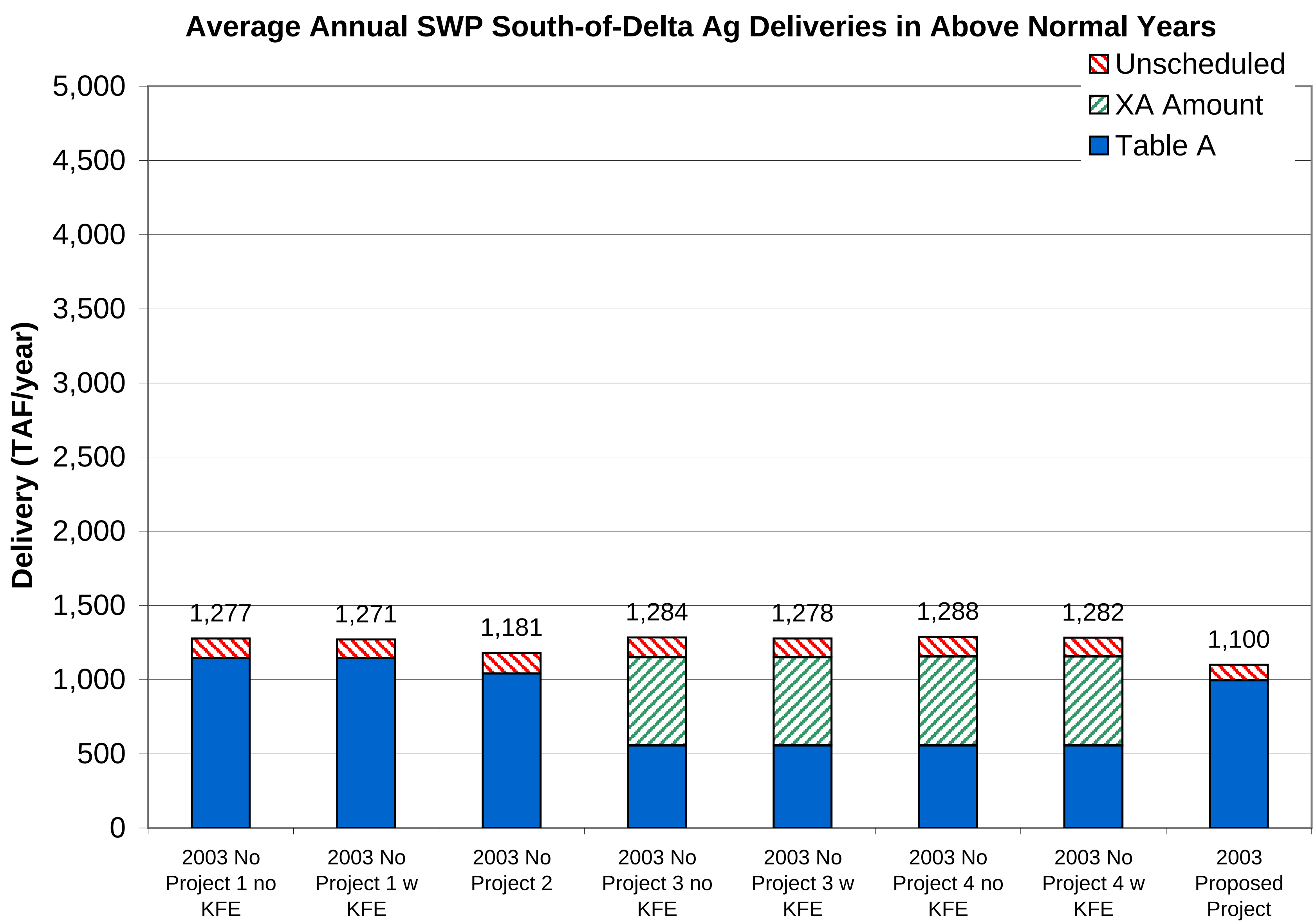

Average Annual Total SWP South-of-Delta Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,526
1,563
1,541
1,526
1,563
1,526
1,563
1,562
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project



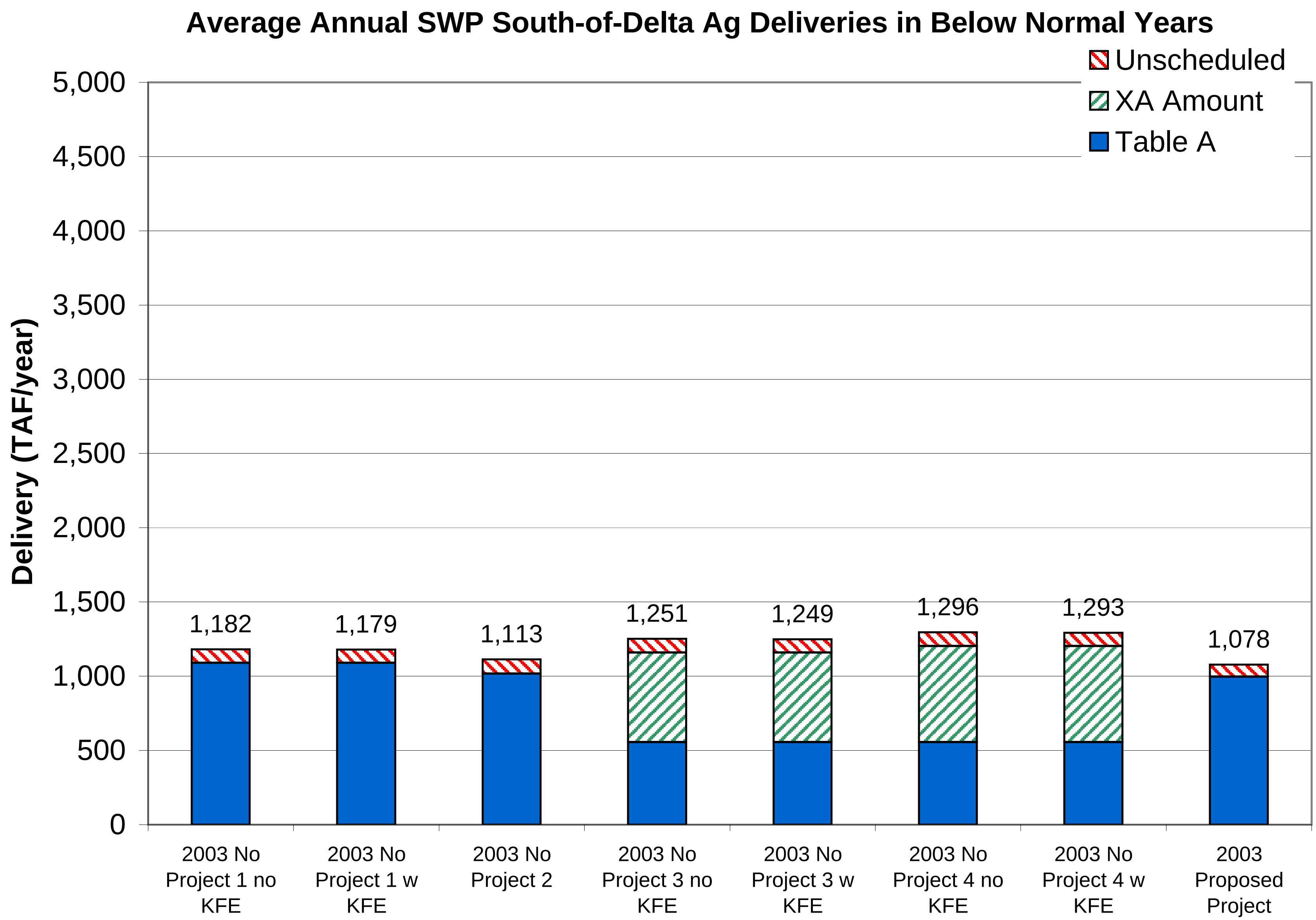
Average Annual Total SWP South-of-Delta Ag Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,053
1,052
992
1,114
1,112
1,144
1,143
958
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project



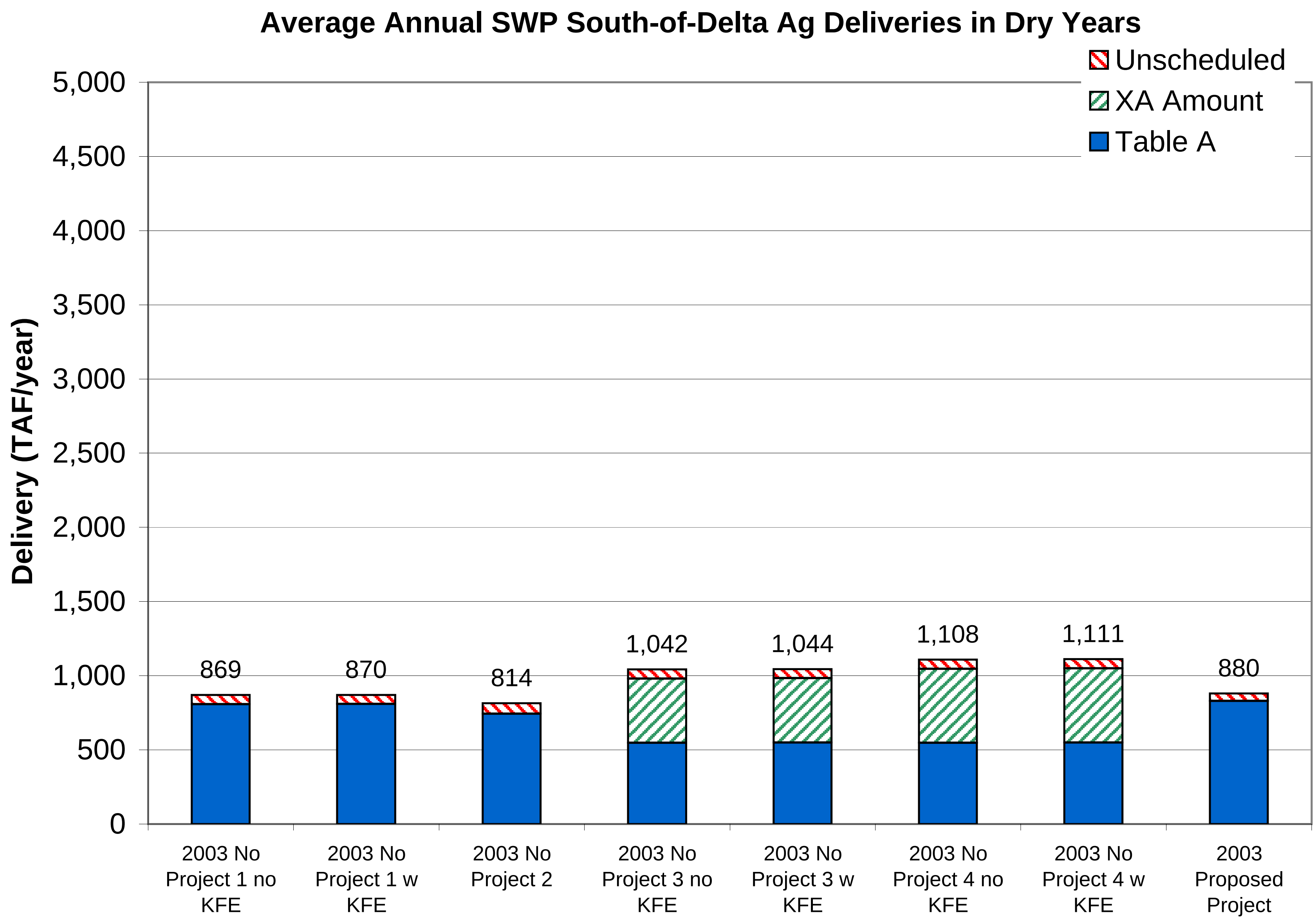
Average Annual SWP South-of-Delta Ag Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,053
1,052
992
1,114
1,112
1,144
1,143
958
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project



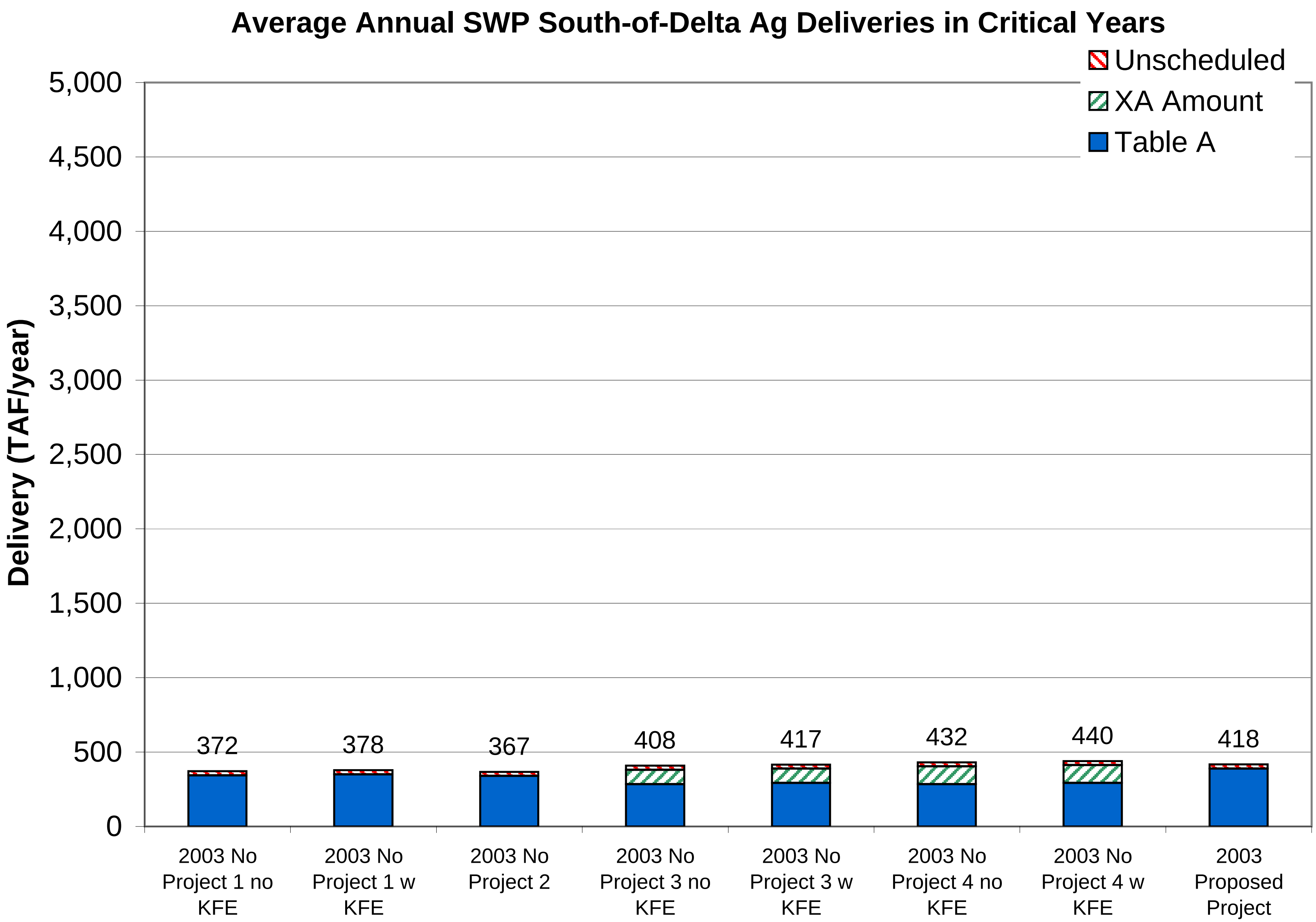
Average Annual SWP South-of-Delta Ag Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,277
1,271
1,181
1,284
1,278
1,288
1,282
1,100
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

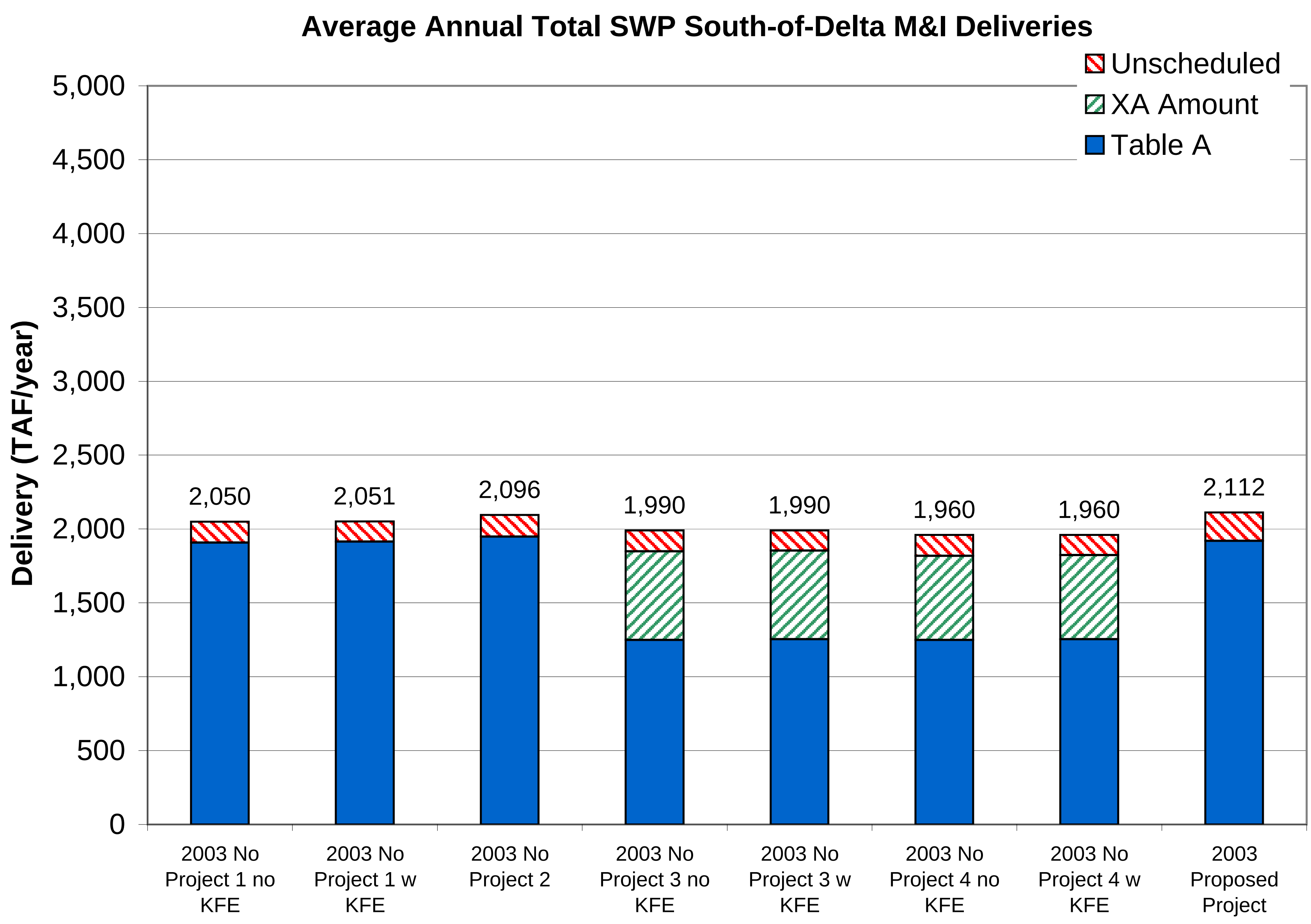


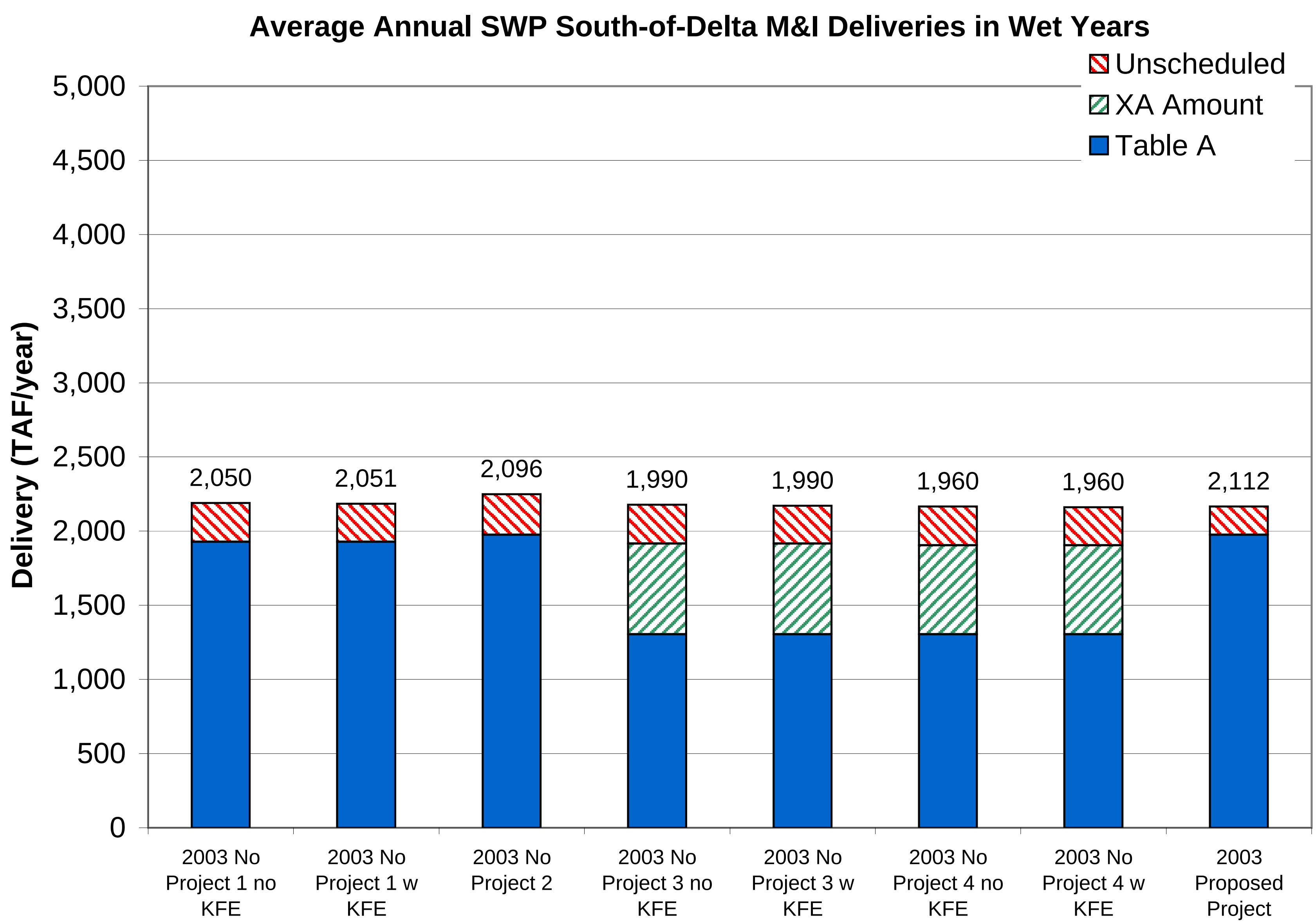
Average Annual SWP South-of-Delta Ag Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,182
1,179
1,113
1,251
1,249
1,296
1,293
1,078
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

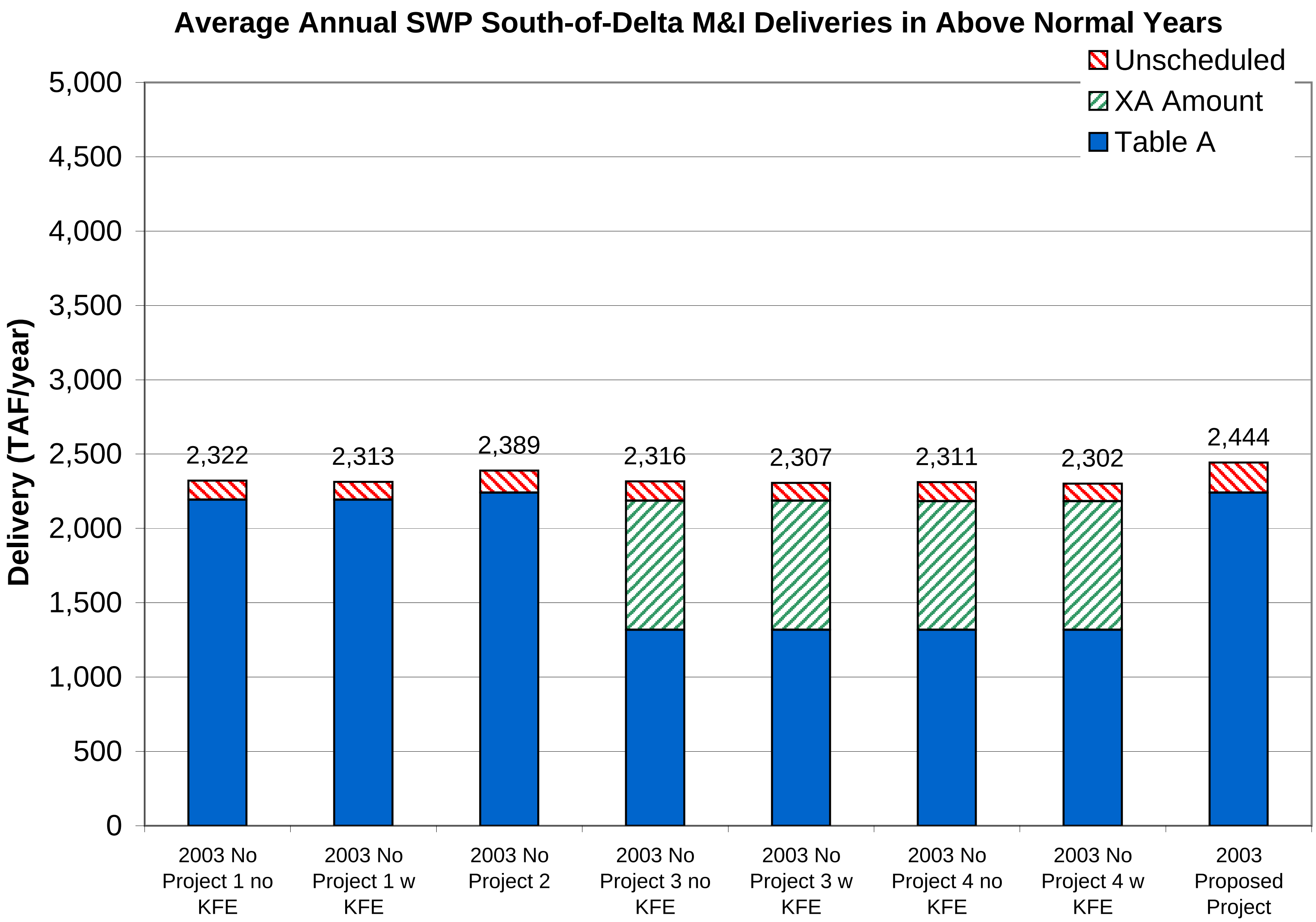


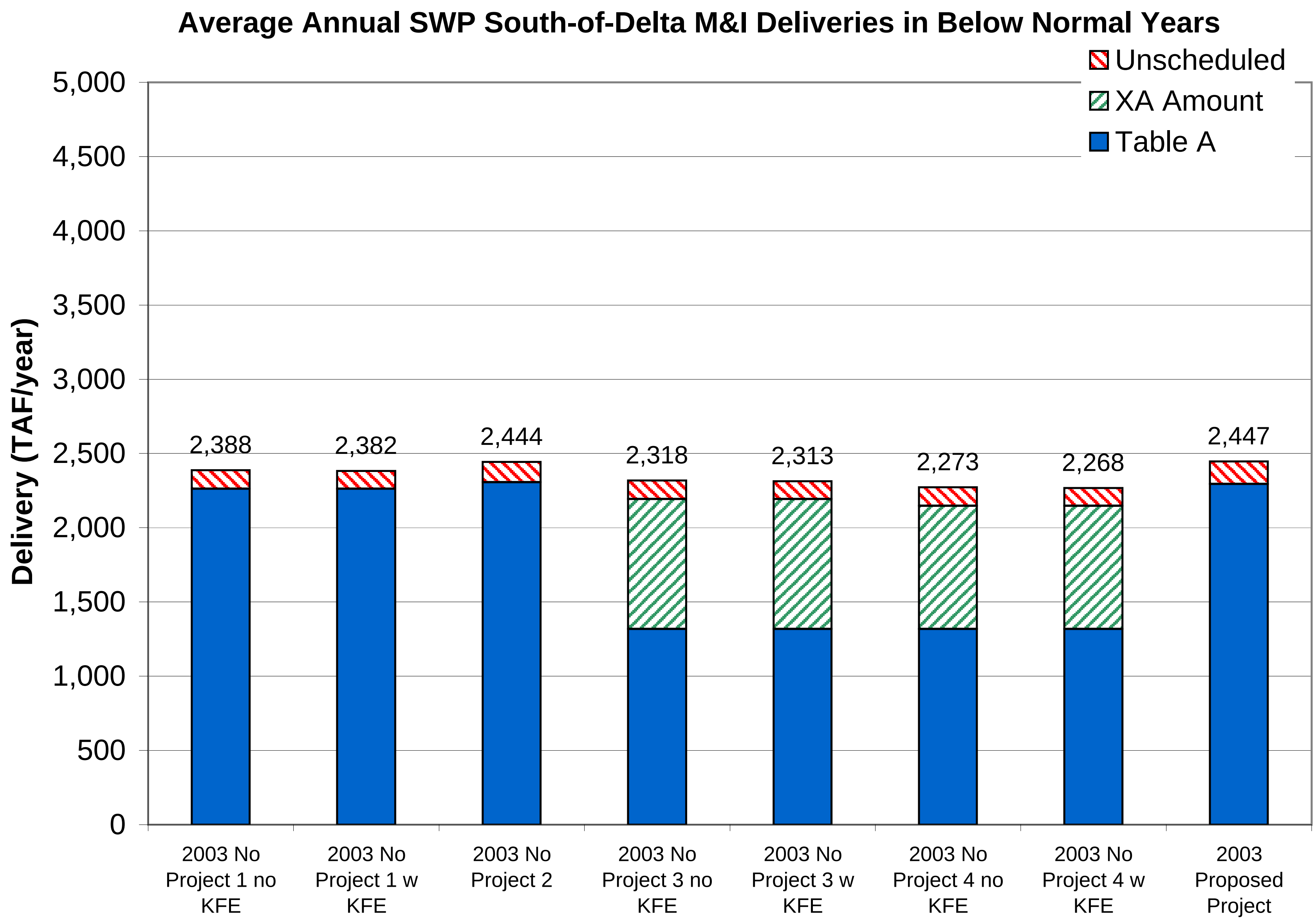
Average Annual SWP South-of-Delta Ag Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
869
870
814
1,042
1,044
1,108
1,111
880
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

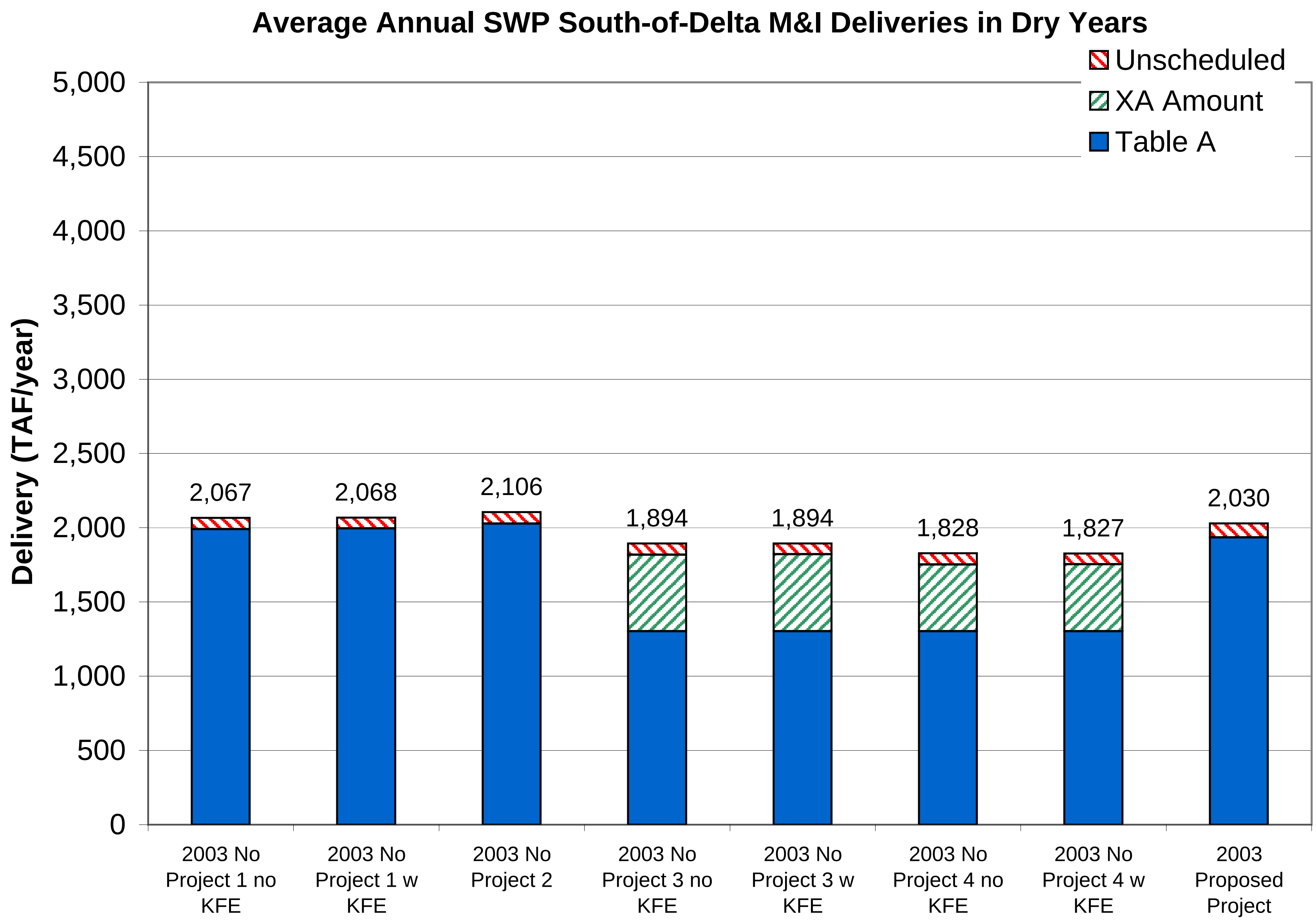

Average Annual SWP South-of-Delta Ag Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
372
378
367
408
417
432
440
418
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

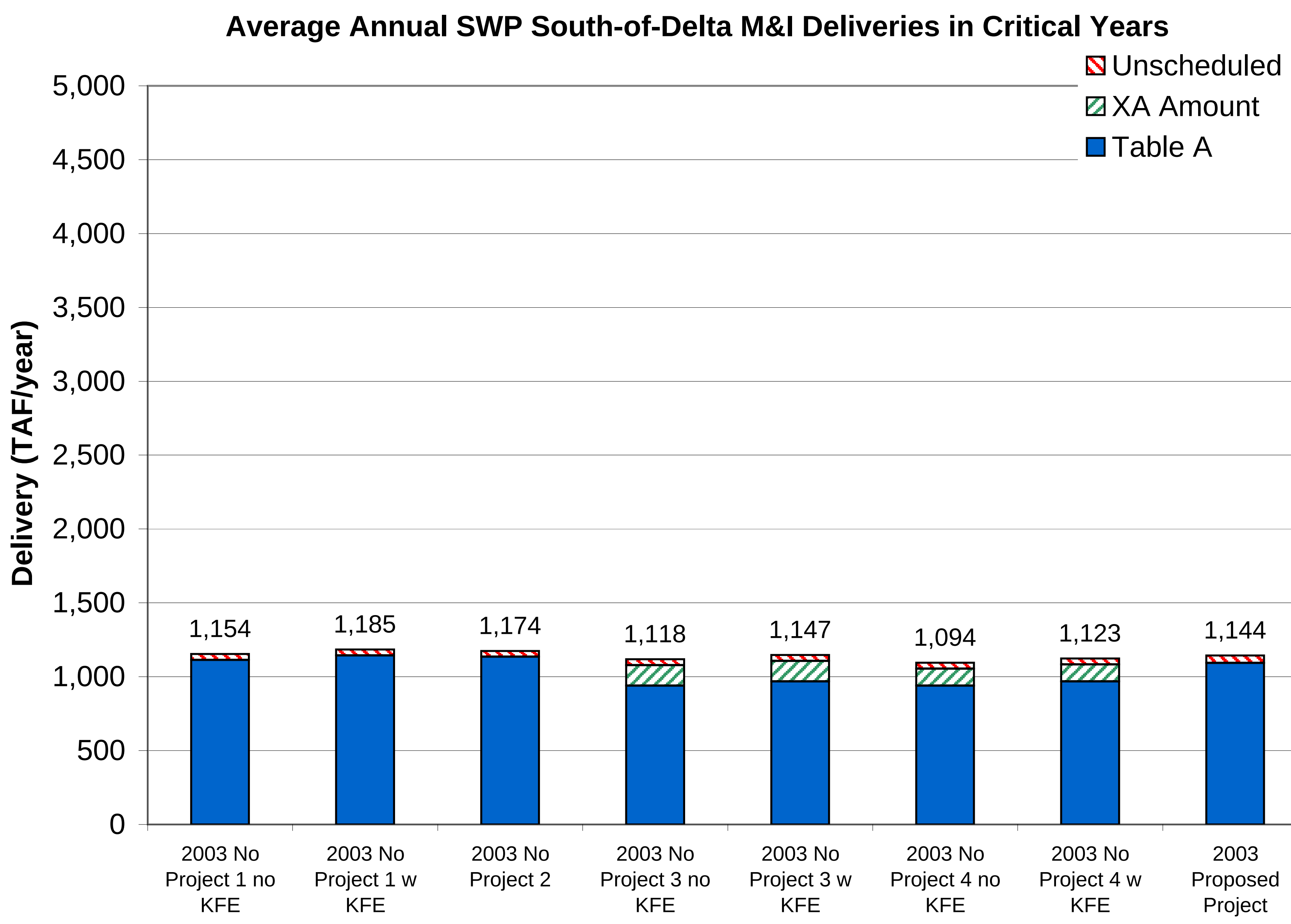

Average Annual Total SWP South-of-Delta M&I Deliveries
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,050
2,051
2,096
1,990
1,990
1,960
1,960
2,112
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project


Average Annual SWP South-of-Delta M&I Deliveries in Wet Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,050
2,051
2,096
1,990
1,990
1,960
1,960
2,112
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project


Average Annual SWP South-of-Delta M&I Deliveries in Above Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,322
2,313
2,389
2,316
2,307
2,311
2,302
2,444
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project


Average Annual SWP South-of-Delta M&I Deliveries in Below Normal Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,388
2,382
2,444
2,318
2,313
2,273
2,268
2,447
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project


Average Annual SWP South-of-Delta M&I Deliveries in Dry Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,067
2,068
2,106
1,894
1,894
1,828
1,827
2,030
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project



Average Annual SWP South-of-Delta M&I Deliveries in Critical Years
Unscheduled
XA Amount
Table A
Delivery (TAF/year)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,154
1,185
1,174
1,118
1,147
1,094
1,123
1,144
2003 No Project 1 no KFE
2003 No Project 1 w KFE
2003 No Project 2
2003 No Project 3 no KFE
2003 No Project 3 w KFE
2003 No Project 4 no KFE
2003 No Project 4 w KFE
2003 Proposed Project

Monterey Plus EIR

Attachment to
Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines

8/22/2007

This document is an attachment to the appendix *Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines* (May 30, 2006). The appendix describes the approach, assumptions and results of CALSIM II modeling and associated post-processing that was performed in support of the Monterey Plus EIR. The modeling assisted analysis of some of the Monterey Amendment's impacts on the State Water Project (SWP) and other areas. The analysis included evaluation of a 1994 Baseline and 2003 and 2020 evaluations of a Baseline, the Proposed Project and multiple No Project Alternatives that reflect different interpretations of the pre-Monterey contracts.

This attachment describes the assumptions and results of additional scenarios at the 2003 and 2020 levels of development have been developed since the release of the May 30, 3006 appendix. For each of these additional scenarios the SWP deliveries to each contractor have been post-processed using the same process used previously. The attachment reports the resulting SWP scheduled and unscheduled deliveries to each contractor.

Additional Scenarios

The following additional scenarios have been analyzed at both the 2003 and 2020 levels of development for the following alternatives.

- No Project Alternative 1
- No Project Alternative 2
- No Project Alternative 3
- No Project Alternative 4

A revised version of the Proposed Project has also been analyzed at the 2020 level of development.

No Project Alternatives 1, 3, and 4 have been analyzed both with and without a hypothetical SWP groundwater banking facility in the Kern Fan Element (KFE). No Project Alternative 2 does not include a state-owned groundwater banking facility in the KFE.

In addition, for No Project Alternative 1 and revised Proposed Project at the 2020 level of development additional scenarios were developed to analyze SWP deliveries under climate change conditions.

Changes in Assumptions for Additional Scenarios

With the exception of the changes described below, the revised Proposed Project scenarios utilize all of the same assumptions as the original Proposed Project scenarios; the No Project Alternative 1 and No Project Alternative 2 scenarios utilize all of the same assumptions as the original Baseline and No Project A scenarios; the No Project Alternative 3 scenarios utilize all of the same assumptions as the original Alternative B-A scenarios; and the No Project Alternative 4 scenarios utilize all of the same assumptions as the original Alternative B-S scenarios.

The additional scenarios incorporate the following changes in assumptions relative to the original scenarios.

- For all of the 2020 scenarios, Banks Pumping Plant has been operated at the 1994 operating capacity of 6,680 cfs.
- The assumed Table A transfers have been revised from the original scenarios. The assumed Table A transfers included in the additional scenarios are shown in Table A-1. Table A-2 shows the resulting Table A amounts for each contractor in each scenario.
- The No Project Alternative 2 scenarios include the Table A relinquishments that are shown in Table 4 of the May 30, 2006 appendix.

CALSIM II Simulations Used for Post-Processing Analysis

2003 Scenarios

SWP deliveries for the additional 2003 scenarios were post-processed from the same CALSIM II simulations that were used for the original scenarios. The No Project Alternative 1, 3 and 4 scenarios were post-processed using data from the Baseline CALSIM II simulation. The No Project Alternative 2 scenario was post-processed using data from the Proposed Project CALSIM II simulation.

At the 2003 level of development, the Proposed Project scenario is unchanged from the original scenario contained in the May 30, 2006 appendix. However, Table A amounts and SWP delivery results from the original scenario are shown in this attachment for comparison purposes.

2020 Scenarios

Updated versions of the 2020 Baseline and 2020 Proposed Project CALSIM II simulations were performed. The assumptions and input data for these scenarios were the same as the original CALSIM II simulations except that the operation of Banks Pumping Plant was changed to a capacity of 6,680 cfs. The No Project Alternative 1, 3 and 4 scenarios were post-processed using data from the updated Baseline CALSIM II simulation. No Project Alternative 2 and the revised Proposed Project scenario was post-processed using data from the updated Proposed Project CALSIM II simulation.

Analysis of Climate Change Scenarios

For the climate change scenarios, the annual scheduled deliveries used as an input into the post-processing spreadsheets were modified using SWP delivery data from the GFDL B1 and Base scenarios contained in *Progress on Incorporating Climate Change into Management of California's Water Resources* (DWR, July 2006). The Table A deliveries from the Monterey Plus EIR CALSIM II simulations were adjusted by multiplying each year's value by a factor equal to the ratio of the Table A delivery in the GFDL B1 scenario divided by the Base scenario. Post-processing of the SWP deliveries was then performed using this revised time series.

Unscheduled deliveries were not modified to account for climate change because the average annual unscheduled deliveries in the GFDL B1 scenario were very close to that in the Base scenario.

SWP Delivery Results for the Additional Scenarios

Average annual scheduled and unscheduled deliveries to each contractor in each of the additional scenarios in all years, wet years, above normal years, below normal years, dry years, and critical years are shown in revised versions of Tables A-3a-f, A-4a-f, A-5a-f, and A-6a-f.

Table A-1 - Table A Transfers (acre-feet)

Transferor	Transferee	No Project Alternative 1	No Project Alternative 2	No Project Alternative 3	No Project Alternative 4	Proposed Project	Applicable Levels of Development
Kern County WA	Mojave WA	0	25,000	0	0	25,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	7,000	0	0	7,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	15,000	0	0	15,000[1]	2003, 2020
Kern County WA	Castaic Lake WA	0	41,000	0	0	41,000[1]	2003, 2020
Kern County WA	Palmdale WD	0	4,000	0	0	4,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	10,000	0	0	10,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	2,219	0	0	2,219[1]	2003, 2020
Kern County WA	Napa Co.	0	4,025	0	0	4,025[1]	2003, 2020
Kern County WA	Solano County WA	0	5,756	0	0	5,756[1]	2003, 2020
Kern County WA	Coachella VWD	0	0	0	0	12,000[1]	2020
Kern County WA	Desert WA	0	0	0	0	4,000[1]	2020
Tulare Lake Basin WSD	AVEK WA	3,000	3,000	3,000	3,000	3,000	2003, 2020
Tulare Lake Basin WSD	Dudley Ridge WD	3,973	3,973	3,973	3,973	3,973	2003, 2020
Tulare Lake Basin WSD	Alameda Co., Zone 7	400	400	400	400	400	2003, 2020
Tulare Lake Basin WSD	County of Kings	5,000	5,000	5,000	5,000	5,000	2003, 2020
Tulare Lake Basin WSD	Coachella VWD	9,900	9,900	9,900	9,900	9,900	2003, 2020
MWDSC	Coachella VWD	88,100	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	11,900	11,900	11,900	11,900	11,900	2020

Notes:

(1) This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers

Table A-2 - Table A Amounts in the Additional Scenarios (acre-feet)

SWP CONTRACTOR	2003 No Project 1	2020 No Project 1	2003 No Project 2	2020 No Project 2	2003 No Project 3 & 4	2020 No Project 3 & 4	2003 Proposed Project	2020 Proposed Project
County of Butte	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	46,400	46,400	80,619	80,619	21,132	20,902	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	9,000	9,000	9,000	9,000	4,099	4,054	9,000	9,000
Dudley Ridge WD	61,673	61,673	57,343	57,343	28,087	27,783	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
Kern County Water Agency (M&I)	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
Kern County Water Agency (Agric.)	1,018,800	1,018,800	864,130	864,130	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	96,227	96,227	96,227	96,227	43,824	43,349	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	141,400	141,400	141,400	141,400	64,397	63,698	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	82,500	82,500	18,900	18,695	82,500	82,500
Coachella Valley WD	33,000	121,100	33,000	121,100	15,029	54,554	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	50,000	38,100	50,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,100	2,011,500	1,911,500
Palmdale WD	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,207,100	1,207,100	1,048,100	1,048,100	549,744	543,779	1,048,100	1,032,100
Total M&I	2,964,826	3,010,586	3,078,826	3,124,586	1,350,256	1,356,221	3,078,826	3,140,586
Total	4,171,926	4,217,686	4,126,926	4,172,686	1,900,000	1,900,000	4,126,926	4,172,686

Table A-3a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.5	6.5	6.5	6.4	6.4	7.2	7.2	6.4
Solano	34.2	34.3	34.3	33.3	33.4	30.5	30.6	34.3
Zone 7	41.1	41.2	57.7	38.7	38.8	37.5	37.6	59.3
Alameda	31.9	32.0	31.9	30.8	30.9	29.9	30.0	31.3
Santa Clara	76.6	76.8	76.8	74.0	74.2	71.8	72.0	75.3
Oak Flat	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.7
Kings	7.0	7.0	7.2	7.4	7.4	7.6	7.6	7.3
Dudley Ridge	47.2	47.3	45.2	50.3	50.4	51.7	51.8	46.8
Empire W.S.	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.4
KCWA (M&I)	119.4	119.8	120.1	112.3	112.6	108.6	108.8	117.8
KCWA (Agric.)	778.3	779.5	677.5	829.0	830.7	852.9	854.9	705.7
Tulare	73.0	73.1	75.3	77.8	78.0	81.6	81.9	78.6
SLO	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2
Santa Barbara	25.2	25.3	25.2	25.1	25.2	24.5	24.6	24.9
AVEK	61.8	62.1	61.9	61.5	61.8	61.4	61.6	61.3
Castaic (Agric.)	9.7	9.7	10.0	10.3	10.4	10.6	10.7	10.4
Castaic (M&I)	36.8	36.9	59.0	34.6	34.7	33.5	33.5	61.1
Coachella	17.5	17.5	17.5	16.9	17.0	16.7	16.7	17.8
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
Desert	28.3	28.4	28.4	27.5	27.5	27.0	27.1	27.8
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.0	13.1	13.0	13.0	13.1	13.0	13.1	13.0
MWDSC	1,310.1	1,314.3	1,315.3	1,269.9	1,273.7	1,253.5	1,257.1	1,284.6
Palmdale	13.5	13.5	13.5	13.0	13.0	12.5	12.6	13.5
San Bernardino	64.4	64.6	64.5	63.3	63.5	63.1	63.3	63.5
San Gabriel	16.8	16.9	16.8	16.6	16.6	16.5	16.6	16.6
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total Agriculture	921.8	923.2	822.1	981.9	983.9	1,011.7	1,014.1	855.9
Total M&I	1,908.3	1,914.3	1,953.6	1,848.2	1,853.6	1,818.4	1,823.5	1,919.7
Total	2,830.1	2,837.5	2,775.7	2,830.1	2,837.5	2,830.1	2,837.5	2,775.7

Table A-3b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.6	37.6	35.9	35.9	37.7
Zone 7	46.4	46.4	66.5	45.7	45.7	44.9	44.9	66.5
Alameda	35.2	35.2	35.2	35.0	35.0	34.3	34.3	35.2
Santa Clara	84.7	84.7	84.7	84.1	84.1	82.5	82.5	84.7
Oak Flat	5.3	5.3	5.4	5.3	5.3	5.3	5.3	5.3
Kings	8.6	8.6	8.8	8.7	8.7	8.7	8.7	8.4
Dudley Ridge	57.0	57.0	53.9	57.7	57.7	58.1	58.1	53.4
Empire W.S.	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
KCWA (M&I)	134.6	134.6	134.6	132.6	132.6	130.2	130.2	134.6
KCWA (Agric.)	938.5	938.5	804.2	949.3	949.3	956.7	956.7	805.0
Tulare	87.3	87.3	89.3	88.4	88.4	90.7	90.7	89.6
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.0	26.0	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.4	64.4	64.9
Castaic (Agric.)	11.7	11.7	12.0	11.8	11.8	11.9	11.9	11.8
Castaic (M&I)	41.5	41.5	68.6	40.9	40.9	40.1	40.1	68.6
Coachella	19.3	19.3	19.3	19.2	19.2	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.0	31.0	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,272.5	1,272.5	1,272.5	1,264.4	1,264.4	1,263.6	1,263.6	1,272.5
Palmdale	14.9	14.9	14.9	14.8	14.8	14.5	14.5	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.3	69.3	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.0	18.0	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,111.2	1,111.2	976.4	1,124.0	1,124.0	1,134.3	1,134.3	976.3
Total M&I	1,928.4	1,928.4	1,975.6	1,915.6	1,915.6	1,905.4	1,905.4	1,975.7
Total	3,039.7	3,039.7	2,952.0	3,039.6	3,039.6	3,039.7	3,039.6	2,952.0

Table A-3c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	36.7	36.7	37.7
Zone 7	46.4	46.4	66.5	46.0	46.0	45.6	45.6	66.5
Alameda	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Santa Clara	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Oak Flat	5.4	5.4	5.5	5.4	5.4	5.5	5.5	5.4
Kings	8.7	8.7	8.8	8.8	8.8	8.8	8.8	8.6
Dudley Ridge	58.7	58.7	54.9	59.0	59.0	59.1	59.1	54.5
Empire W.S.	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.9
KCWA (M&I)	134.6	134.6	134.6	133.5	133.5	132.2	132.2	134.6
KCWA (Agric.)	966.1	966.1	820.3	971.5	971.5	974.3	974.3	821.0
Tulare	90.3	90.3	91.1	90.8	90.8	92.2	92.2	91.4
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.0	12.0	12.2	12.1	12.1	12.1	12.1	12.1
Castaic (M&I)	41.5	41.5	68.6	41.2	41.2	40.8	40.8	68.6
Coachella	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,537.7	1,537.7	1,537.7	1,533.0	1,533.0	1,531.1	1,531.1	1,537.6
Palmdale	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,144.0	1,144.0	995.6	1,150.5	1,150.5	1,154.8	1,154.8	995.7
Total M&I	2,193.7	2,193.7	2,240.9	2,187.2	2,187.2	2,183.0	2,183.0	2,240.8
Total	3,337.8	3,337.8	3,236.5	3,337.8	3,337.8	3,337.8	3,337.8	3,236.5

Table A-3d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	34.3	34.3	37.7
Zone 7	46.4	46.4	65.3	43.2	43.2	42.0	42.0	66.5
Alameda	35.2	35.2	35.2	34.7	34.7	33.8	33.8	35.2
Santa Clara	84.7	84.7	84.7	83.3	83.3	81.1	81.1	84.7
Oak Flat	5.1	5.1	5.4	5.5	5.5	5.7	5.7	5.4
Kings	8.1	8.1	8.5	8.7	8.7	8.9	8.9	8.6
Dudley Ridge	55.7	55.7	53.9	59.2	59.2	61.4	61.4	54.5
Empire W.S.	2.7	2.7	2.8	2.9	2.9	3.0	3.0	2.9
KCWA (M&I)	134.6	134.6	134.6	125.4	125.4	121.5	121.5	134.6
KCWA (Agric.)	919.5	919.5	812.1	978.1	978.1	1,015.5	1,015.5	821.8
Tulare	86.8	86.8	90.4	92.3	92.3	96.0	96.0	91.5
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.2	26.2	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	11.5	11.5	11.9	12.2	12.2	12.7	12.7	12.1
Castaic (M&I)	41.5	41.5	67.1	38.7	38.7	37.4	37.4	68.6
Coachella	19.3	19.3	19.3	19.0	19.0	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	30.9	30.9	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,606.5	1,606.5	1,606.5	1,554.9	1,554.9	1,523.8	1,523.8	1,592.1
Palmdale	14.9	14.9	14.9	14.6	14.6	14.2	14.2	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,089.4	1,089.4	985.0	1,158.9	1,158.9	1,203.2	1,203.2	996.7
Total M&I	2,262.5	2,262.5	2,307.1	2,193.0	2,193.0	2,148.6	2,148.6	2,295.3
Total	3,351.9	3,351.9	3,292.1	3,351.8	3,351.8	3,351.9	3,351.9	3,292.1

Table A-3e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.6	6.6	7.5	7.5	6.7
Solano	36.5	36.7	36.6	32.6	32.6	27.5	27.5	35.7
Zone 7	42.1	42.2	56.8	36.1	36.1	33.4	33.4	60.2
Alameda	33.7	33.8	33.8	29.9	30.0	27.9	27.9	31.8
Santa Clara	80.9	81.2	81.3	71.7	71.8	66.7	66.7	76.3
Oak Flat	3.8	3.8	3.9	4.6	4.6	4.7	4.7	4.5
Kings	6.0	6.0	6.2	7.3	7.3	7.7	7.8	7.1
Dudley Ridge	41.2	41.3	39.6	50.0	50.2	53.2	53.5	45.4
Empire W.S.	2.0	2.0	2.1	2.4	2.4	2.6	2.6	2.4
KCWA (M&I)	122.4	122.8	124.8	104.6	104.8	96.6	96.6	116.5
KCWA (Agric.)	681.1	682.8	596.7	826.7	829.4	880.0	883.9	684.3
Tulare	64.3	64.5	66.4	78.1	78.3	85.9	86.4	76.2
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.1	26.1	23.9	23.9	26.0
AVEK	64.9	64.9	64.9	63.9	64.0	63.8	63.9	64.0
Castaic (Agric.)	8.5	8.5	8.8	10.3	10.3	11.0	11.0	10.1
Castaic (M&I)	37.7	37.9	57.2	32.3	32.3	29.8	29.8	62.0
Coachella	18.5	18.5	18.6	16.4	16.5	15.8	15.8	18.6
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	30.0	30.1	30.1	26.8	26.8	25.7	25.8	28.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,365.6	1,368.8	1,378.0	1,254.1	1,256.6	1,217.9	1,219.4	1,286.5
Palmdale	14.2	14.2	14.3	12.5	12.5	11.6	11.6	14.0
San Bernardino	68.9	69.1	68.8	63.8	63.9	63.6	63.7	66.0
San Gabriel	18.0	18.0	17.9	16.9	17.0	16.9	16.9	17.3
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	807.0	809.0	723.7	979.5	982.6	1,045.2	1,049.8	830.0
Total M&I	1,991.3	1,996.0	2,040.8	1,818.9	1,822.3	1,753.2	1,755.1	1,934.5
Total	2,798.4	2,804.9	2,764.5	2,798.3	2,804.9	2,798.4	2,804.9	2,764.5

Table A-3f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	4.7	4.9	4.8	4.5	4.5	5.5	5.6	4.4
Solano	17.8	18.3	18.1	17.8	18.5	15.2	15.7	19.3
Zone 7	19.9	20.4	26.5	18.1	18.5	17.2	17.7	30.5
Alameda	16.8	17.3	17.0	16.4	16.8	15.6	16.1	16.0
Santa Clara	40.1	41.3	40.7	39.0	40.0	37.2	38.2	38.3
Oak Flat	1.6	1.7	1.8	1.8	1.8	1.9	1.9	2.1
Kings	2.5	2.6	2.9	2.7	2.8	2.9	2.9	3.3
Dudley Ridge	17.5	17.9	18.2	19.3	19.7	20.4	20.8	21.3
Empire W.S.	0.9	0.9	1.0	0.9	1.0	1.0	1.0	1.1
KCWA (M&I)	57.8	59.3	58.6	52.5	53.9	49.9	51.3	55.3
KCWA (Agric.)	289.9	295.2	274.1	320.4	327.5	338.4	345.5	321.0
Tulare	27.4	27.9	30.5	30.4	31.2	34.1	34.9	35.7
SLO	3.5	3.6	3.6	3.5	3.5	3.5	3.5	3.3
Santa Barbara	19.5	20.2	19.9	19.3	20.0	18.8	19.5	18.4
AVEK	46.0	47.6	46.8	45.5	46.9	45.6	47.0	44.2
Castaic (Agric.)	3.6	3.7	4.0	4.0	4.1	4.2	4.3	4.7
Castaic (M&I)	17.8	18.3	26.6	16.2	16.6	15.4	15.8	31.4
Coachella	9.2	9.5	9.4	9.0	9.2	8.9	9.1	11.1
Crestline	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
Desert	15.1	15.5	15.3	14.8	15.2	14.5	14.9	14.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	12.2	12.4	12.2	12.1	12.3	12.1	12.3	12.3
MWDSC	771.5	792.7	787.2	748.1	767.8	734.2	753.9	733.9
Palmdale	7.0	7.2	7.1	6.7	6.9	6.4	6.6	7.6
San Bernardino	38.1	39.2	38.7	37.7	38.7	37.7	38.8	36.2
San Gabriel	10.4	10.7	10.6	10.3	10.6	10.3	10.6	9.9
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.6	4.7	4.6	4.6	4.7	4.6	4.7	4.6
Total Agriculture	343.5	349.7	332.4	379.6	388.0	402.9	411.3	389.3
Total M&I	1,113.9	1,144.8	1,149.5	1,077.7	1,106.5	1,054.4	1,083.2	1,092.6
Total	1,457.3	1,494.5	1,481.9	1,457.3	1,494.5	1,457.4	1,494.5	1,481.9

Table A-4a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	20.1	20.2	23.0	19.4	19.4	17.5	17.6	22.5	18.2	18.3	20.1
Solano	33.9	34.1	38.0	32.7	32.8	29.3	29.4	37.1	30.7	30.8	33.2
Zone 7	37.5	37.6	61.2	36.1	36.2	32.5	32.6	62.6	33.8	34.0	56.0
Alameda	33.9	34.1	34.1	32.7	32.8	29.6	29.7	32.6	30.7	30.8	29.2
Santa Clara	80.8	81.1	81.2	77.8	78.1	70.5	70.8	77.7	73.0	73.3	69.5
Oak Flat	3.8	3.8	3.8	4.2	4.2	4.7	4.7	4.3	3.3	3.3	3.9
Kings	6.1	6.1	6.1	6.8	6.8	7.5	7.5	6.8	5.3	5.3	6.1
Dudley Ridge	41.2	41.3	38.5	45.7	45.9	50.9	51.1	43.4	35.8	36.0	38.8
Empire W.S.	2.0	2.0	2.0	2.2	2.2	2.5	2.5	2.3	1.7	1.7	2.0
KCWA (M&I)	108.8	109.2	109.3	104.7	105.1	93.8	94.2	104.5	98.3	98.7	93.5
KCWA (Agric.)	679.0	681.9	577.0	754.5	757.6	839.2	842.4	642.2	590.0	593.0	574.5
Tulare	63.7	64.0	64.2	70.8	71.1	78.8	79.1	72.9	55.3	55.6	65.2
SLO	20.2	20.3	20.3	19.4	19.5	17.4	17.5	19.4	18.3	18.3	17.4
Santa Barbara	36.8	36.9	36.9	35.4	35.5	31.7	31.8	35.3	33.2	33.4	31.6
AVEK	113.9	114.4	114.5	109.9	110.3	109.4	109.8	109.8	102.8	103.3	98.2
Castaic (Agric.)	8.5	8.5	8.5	9.4	9.4	10.5	10.5	9.6	7.4	7.4	8.6
Castaic (M&I)	33.5	33.7	62.0	32.3	32.4	28.9	29.0	64.1	30.3	30.4	57.3
Coachella	96.7	97.0	97.1	94.0	94.4	94.2	94.6	103.4	87.1	87.5	92.5
Crestline	4.7	4.7	4.7	4.5	4.5	4.0	4.1	4.5	4.2	4.3	4.0
Desert	40.4	40.6	40.6	38.9	39.0	38.6	38.7	41.9	36.5	36.7	37.5
Littlerock	1.9	1.9	1.9	1.8	1.8	1.6	1.6	1.8	1.7	1.7	1.6
Mojave	41.1	41.2	58.5	39.5	39.7	43.0	43.2	58.9	37.1	37.3	52.7
MWDSC	1,545.0	1,551.1	1,552.2	1,486.6	1,492.0	1,418.3	1,423.8	1,484.3	1,395.7	1,401.9	1,327.8
Palmdale	14.0	14.0	16.8	13.5	13.5	12.1	12.1	16.5	12.6	12.7	14.8
San Bernardino	82.9	83.3	83.3	79.8	80.1	86.9	87.2	79.7	74.9	75.2	71.3
San Gabriel	23.3	23.4	23.4	22.4	22.5	24.4	24.5	22.4	21.0	21.1	20.0
San Gorgonio	14.0	14.0	14.0	13.5	13.5	12.1	12.1	13.4	12.6	12.7	12.0
Ventura	16.2	16.2	16.2	15.6	15.6	13.9	14.0	15.5	14.6	14.7	13.9
Total Agriculture	804.3	807.7	700.1	893.6	897.4	994.0	997.8	781.5	698.9	702.4	699.1
Total M&I	2,399.5	2,408.9	2,489.3	2,310.2	2,318.6	2,209.8	2,218.2	2,407.8	2,167.3	2,177.0	2,154.0
Total	3,203.8	3,216.6	3,189.3	3,203.8	3,216.0	3,203.8	3,216.0	3,189.3	2,866.2	2,879.4	2,853.0

Table A-4b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.4	24.4	28.3	24.2	24.2	23.6	23.6	28.1	23.6	23.6	26.8
Solano	41.2	41.2	46.7	40.8	40.8	39.7	39.7	46.4	39.7	39.7	44.3
Zone 7	45.5	45.5	78.0	45.1	45.1	43.9	43.9	78.2	43.9	43.9	74.8
Alameda	41.2	41.2	41.2	40.8	40.8	39.8	39.8	40.8	39.7	39.7	39.0
Santa Clara	98.2	98.2	98.2	97.1	97.1	94.7	94.7	97.1	94.6	94.6	92.8
Oak Flat	5.1	5.1	5.2	5.3	5.3	5.4	5.4	5.3	4.8	4.8	5.0
Kings	8.3	8.3	8.4	8.6	8.6	8.8	8.8	8.3	7.8	7.8	7.9
Dudley Ridge	55.8	55.8	51.8	57.4	57.4	58.9	58.9	53.0	52.1	52.1	50.6
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8	2.5	2.5	2.6
KCWA (M&I)	132.1	132.1	132.1	130.7	130.7	127.1	127.1	130.6	127.4	127.4	124.9
KCWA (Agric.)	919.7	919.7	774.9	945.6	945.6	969.7	969.7	784.5	857.9	857.9	748.2
Tulare	85.9	85.9	86.1	88.3	88.3	90.5	90.5	89.0	80.0	80.0	84.9
SLO	24.5	24.5	24.5	24.3	24.3	23.6	23.6	24.3	23.7	23.7	23.2
Santa Barbara	44.6	44.6	44.6	44.2	44.2	42.9	42.9	44.1	43.0	43.0	42.2
AVEK	138.7	138.7	138.7	137.3	137.3	137.5	137.5	137.2	133.6	133.6	131.2
Castaic (Agric.)	11.5	11.5	11.5	11.8	11.8	12.1	12.1	11.7	10.7	10.7	11.2
Castaic (M&I)	40.7	40.7	79.6	40.3	40.3	39.2	39.2	80.1	39.3	39.3	76.5
Coachella	118.5	118.5	118.5	117.6	117.6	118.0	118.0	129.2	114.0	114.0	123.5
Crestline	5.7	5.7	5.7	5.6	5.6	5.5	5.5	5.6	5.5	5.5	5.4
Desert	49.1	49.1	49.1	48.6	48.6	48.6	48.6	52.4	47.3	47.3	50.1
Littlerock	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1
Mojave	49.9	49.9	73.6	49.3	49.3	50.8	50.8	73.6	48.1	48.1	70.3
MWDSC	1,876.3	1,876.3	1,876.3	1,856.2	1,856.2	1,836.6	1,836.6	1,855.2	1,808.8	1,808.8	1,773.4
Palmdale	17.0	17.0	20.8	16.8	16.8	16.3	16.3	20.7	16.4	16.4	19.8
San Bernardino	100.7	100.7	100.7	99.6	99.6	102.6	102.6	99.6	97.1	97.1	95.2
San Gabriel	28.3	28.3	28.3	28.0	28.0	28.8	28.8	28.0	27.3	27.3	26.7
San Gorgonio	17.0	17.0	17.0	16.8	16.8	16.3	16.3	16.8	16.4	16.4	16.1
Ventura	19.6	19.6	19.6	19.4	19.4	18.9	18.9	19.4	18.9	18.9	18.6
Total Agriculture	1,089.1	1,089.1	940.5	1,119.7	1,119.7	1,148.3	1,148.3	954.6	1,015.9	1,015.9	910.5
Total M&I	2,915.5	2,915.5	3,023.6	2,884.9	2,884.9	2,856.4	2,856.4	3,009.5	2,810.3	2,810.3	2,876.8
Total	4,004.6	4,004.6	3,964.1	4,004.6	4,004.6	4,004.6	4,004.6	3,964.1	3,826.2	3,826.2	3,787.3

Table A-4c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.3	24.3	27.9	23.5	23.5	22.2	22.2	27.4	22.3	22.3	24.7
Solano	41.0	41.0	46.0	39.6	39.6	37.2	37.2	45.2	37.6	37.6	40.8
Zone 7	45.2	45.2	75.1	43.8	43.8	41.2	41.2	76.3	41.5	41.5	68.9
Alameda	41.0	41.0	41.0	39.6	39.6	37.5	37.5	39.7	37.6	37.6	35.9
Santa Clara	97.5	97.5	97.6	94.4	94.4	89.2	89.2	94.6	89.5	89.5	85.4
Oak Flat	4.7	4.7	4.8	5.2	5.2	5.5	5.5	5.1	4.1	4.1	4.7
Kings	7.6	7.6	7.7	8.3	8.3	8.8	8.8	8.1	6.7	6.7	7.4
Dudley Ridge	51.2	51.2	47.8	55.9	55.9	59.2	59.2	51.8	44.6	44.6	47.4
Empire W.S.	2.5	2.5	2.5	2.7	2.7	2.9	2.9	2.7	2.2	2.2	2.5
KCWA (M&I)	131.3	131.3	131.4	127.0	127.0	119.3	119.3	127.3	120.5	120.5	115.0
KCWA (Agric.)	842.6	842.6	714.8	920.6	920.6	975.1	975.1	766.1	734.8	734.8	701.2
Tulare	78.7	78.7	79.4	86.0	86.0	91.1	91.1	86.9	68.6	68.6	79.6
SLO	24.4	24.4	24.4	23.6	23.6	22.2	22.2	23.6	22.4	22.4	21.4
Santa Barbara	44.4	44.4	44.4	42.9	42.9	40.3	40.3	43.0	40.7	40.7	38.9
AVEK	137.6	137.6	137.7	133.4	133.4	133.5	133.5	133.7	126.2	126.2	120.8
Castaic (Agric.)	10.5	10.5	10.6	11.5	11.5	12.2	12.2	11.5	9.2	9.2	10.5
Castaic (M&I)	40.5	40.5	76.3	39.2	39.2	36.8	36.8	78.0	37.2	37.2	70.5
Coachella	117.0	117.0	117.2	114.3	114.3	114.8	114.8	125.9	107.1	107.1	113.7
Crestline	5.7	5.7	5.7	5.5	5.5	5.1	5.1	5.5	5.2	5.2	5.0
Desert	48.8	48.8	48.8	47.2	47.2	47.2	47.2	51.1	44.8	44.8	46.1
Littlerock	2.2	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.1	2.1	2.0
Mojave	49.5	49.5	71.4	47.9	47.9	50.8	50.8	71.7	45.5	45.5	64.8
MWDSC	1,864.0	1,864.0	1,865.5	1,803.6	1,803.6	1,759.4	1,759.4	1,808.0	1,711.6	1,711.6	1,632.9
Palmdale	16.9	16.9	20.4	16.3	16.3	15.3	15.3	20.1	15.5	15.5	18.2
San Bernardino	100.1	100.1	100.1	96.8	96.8	102.6	102.6	97.0	91.9	91.9	87.6
San Gabriel	28.1	28.1	28.1	27.2	27.2	28.8	28.8	27.2	25.8	25.8	24.6
San Gorgonio	16.9	16.9	16.9	16.3	16.3	15.3	15.3	16.4	15.5	15.5	14.8
Ventura	19.5	19.5	19.5	18.9	18.9	17.7	17.7	18.9	17.9	17.9	17.1
Total Agriculture	997.8	997.8	867.6	1,090.2	1,090.2	1,154.8	1,154.8	932.2	870.2	870.2	853.3
Total M&I	2,895.5	2,895.5	2,997.5	2,803.1	2,803.1	2,738.6	2,738.6	2,932.9	2,658.3	2,658.3	2,648.9
Total	3,893.4	3,893.4	3,865.1	3,893.4	3,893.4	3,893.4	3,893.4	3,865.1	3,528.4	3,528.4	3,502.2

Table A-4d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	22.4	22.4	25.7	21.2	21.2	18.0	18.0	24.9	19.7	19.8	21.7
Solano	37.8	37.8	42.4	35.7	35.7	29.9	29.9	41.1	33.3	33.3	35.8
Zone 7	41.7	41.7	67.5	39.5	39.5	33.2	33.2	69.4	36.7	36.8	60.4
Alameda	37.8	37.8	38.1	35.7	35.7	30.4	30.4	36.2	33.3	33.3	31.5
Santa Clara	90.1	90.1	90.8	85.1	85.1	72.5	72.5	86.1	79.2	79.4	75.0
Oak Flat	4.2	4.2	4.2	4.8	4.8	5.6	5.6	4.9	3.5	3.5	4.3
Kings	6.6	6.6	6.7	7.7	7.7	8.9	8.9	7.8	5.5	5.6	6.7
Dudley Ridge	45.0	45.0	42.7	52.5	52.5	61.1	61.1	49.4	37.9	38.0	43.0
Empire W.S.	2.2	2.2	2.2	2.6	2.6	3.0	3.0	2.6	1.8	1.9	2.2
KCWA (M&I)	121.3	121.3	122.2	114.5	114.5	95.7	95.7	115.9	106.6	106.9	100.9
KCWA (Agric.)	742.7	742.7	643.4	866.6	866.6	1,008.7	1,008.7	730.6	626.5	628.3	635.7
Tulare	70.1	70.1	71.6	81.9	81.9	95.3	95.3	82.9	59.2	59.3	72.1
SLO	22.5	22.5	22.7	21.3	21.3	17.8	17.8	21.5	19.8	19.8	18.7
Santa Barbara	41.0	41.0	41.3	38.7	38.7	32.3	32.3	39.2	36.0	36.1	34.1
AVEK	126.9	126.9	127.9	120.3	120.3	119.7	119.7	121.8	111.5	111.7	106.0
Castaic (Agric.)	9.3	9.3	9.5	10.8	10.8	12.6	12.6	10.9	7.8	7.8	9.5
Castaic (M&I)	37.4	37.4	68.2	35.3	35.3	29.5	29.5	71.1	32.9	32.9	61.8
Coachella	107.4	107.4	108.3	103.0	103.0	103.6	103.6	114.6	94.2	94.4	99.8
Crestline	5.2	5.2	5.3	4.9	4.9	4.1	4.1	5.0	4.6	4.6	4.3
Desert	45.0	45.0	45.4	42.5	42.5	42.2	42.2	46.5	39.6	39.7	40.5
Littlerock	2.1	2.1	2.1	2.0	2.0	1.6	1.6	2.0	1.8	1.8	1.7
Mojave	45.8	45.8	64.7	43.2	43.2	49.6	49.6	65.3	40.2	40.3	56.8
MWDSC	1,722.0	1,722.0	1,735.2	1,626.0	1,626.0	1,511.4	1,511.4	1,646.5	1,514.1	1,517.5	1,432.7
Palmdale	15.6	15.6	18.7	14.7	14.7	12.3	12.3	18.3	13.7	13.7	16.0
San Bernardino	92.4	92.4	93.1	87.3	87.3	100.2	100.2	88.4	81.3	81.4	76.9
San Gabriel	25.9	25.9	26.1	24.5	24.5	28.1	28.1	24.8	22.8	22.9	21.6
San Gorgonio	15.6	15.6	15.7	14.7	14.7	12.3	12.3	14.9	13.7	13.7	13.0
Ventura	18.0	18.0	18.2	17.0	17.0	14.2	14.2	17.2	15.8	15.9	15.0
Total Agriculture	879.9	879.9	780.4	1,026.8	1,026.8	1,195.1	1,195.1	889.0	742.3	744.5	773.6
Total M&I	2,674.0	2,674.0	2,779.6	2,527.1	2,527.1	2,358.8	2,358.8	2,670.9	2,350.8	2,356.0	2,324.1
Total	3,553.9	3,553.9	3,560.0	3,553.9	3,553.9	3,553.9	3,553.9	3,560.0	3,093.1	3,100.5	3,097.7

Table A-4e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	18.0	18.1	20.2	16.7	16.8	13.5	13.5	19.3	15.3	15.5	16.3
Solano	30.3	30.5	33.4	28.2	28.3	22.2	22.3	31.8	25.8	26.1	26.9
Zone 7	33.4	33.6	51.3	31.2	31.3	24.7	24.8	53.8	28.4	28.8	45.3
Alameda	30.3	30.5	30.5	28.2	28.3	22.8	22.8	28.0	25.8	26.1	23.6
Santa Clara	72.2	72.7	72.7	67.2	67.4	54.2	54.4	66.7	61.5	62.2	56.2
Oak Flat	2.9	3.0	2.9	3.6	3.7	4.4	4.5	3.8	2.4	2.4	3.2
Kings	4.6	4.7	4.7	5.7	5.8	7.2	7.2	6.0	3.7	3.8	5.1
Dudley Ridge	31.8	32.0	29.6	39.2	39.7	49.0	49.5	38.2	25.7	26.1	32.2
Empire W.S.	1.5	1.6	1.6	1.9	1.9	2.4	2.4	2.0	1.2	1.3	1.7
KCWA (M&I)	97.1	97.8	97.8	90.5	90.7	71.1	71.3	89.8	82.8	83.8	75.7
KCWA (Agric.)	525.0	529.2	446.6	646.9	655.9	809.5	818.5	565.6	424.1	431.8	476.9
Tulare	49.6	50.0	49.7	61.1	62.0	76.5	77.3	64.2	40.1	40.8	54.1
SLO	18.0	18.2	18.2	16.8	16.9	13.2	13.2	16.7	15.4	15.6	14.1
Santa Barbara	32.8	33.1	33.0	30.6	30.7	24.0	24.1	30.3	28.0	28.3	25.6
AVEK	101.4	102.1	102.1	95.0	95.2	93.0	93.3	94.3	86.3	87.4	79.5
Castaic (Agric.)	6.5	6.6	6.6	8.1	8.2	10.1	10.2	8.5	5.3	5.4	7.1
Castaic (M&I)	30.0	30.2	51.3	27.9	28.0	21.9	22.0	55.0	25.5	25.8	46.4
Coachella	85.4	86.0	85.9	81.1	81.3	80.7	81.0	88.8	72.5	73.4	74.8
Crestline	4.2	4.2	4.2	3.9	3.9	3.1	3.1	3.9	3.6	3.6	3.3
Desert	36.1	36.3	36.3	33.6	33.7	32.7	32.8	36.0	30.7	31.1	30.4
Littlerock	1.7	1.7	1.7	1.5	1.6	1.2	1.2	1.5	1.4	1.4	1.3
Mojave	36.7	36.9	49.8	34.2	34.2	39.7	39.8	50.6	31.2	31.6	42.6
MWDSC	1,379.6	1,389.1	1,388.7	1,285.3	1,288.7	1,154.9	1,158.3	1,274.8	1,175.2	1,189.7	1,074.8
Palmdale	12.5	12.6	14.6	11.6	11.7	9.1	9.2	14.2	10.6	10.8	12.0
San Bernardino	74.1	74.6	74.5	69.0	69.2	80.2	80.4	68.4	63.1	63.9	57.7
San Gabriel	20.8	20.9	20.9	19.4	19.4	22.5	22.6	19.2	17.7	17.9	16.2
San Gorgonio	12.5	12.6	12.6	11.6	11.7	9.1	9.2	11.5	10.6	10.8	9.7
Ventura	14.4	14.5	14.5	13.4	13.5	10.6	10.6	13.3	12.3	12.4	11.2
Total Agriculture	622.0	627.0	541.7	766.4	777.1	959.0	969.7	688.3	502.4	511.6	580.3
Total M&I	2,141.4	2,156.1	2,214.4	1,997.0	2,002.5	1,804.5	1,809.9	2,067.9	1,823.8	1,846.3	1,743.5
Total	2,763.4	2,783.1	2,756.2	2,763.4	2,779.6	2,763.4	2,779.6	2,756.2	2,326.2	2,357.9	2,323.8

Table A-4f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	8.9	9.2	10.0	8.4	8.8	7.3	7.7	9.4	6.9	7.1	7.1
Solano	15.0	15.6	16.6	14.2	14.8	12.2	12.8	15.5	11.6	11.9	11.6
Zone 7	16.5	17.1	24.5	15.7	16.4	13.5	14.2	26.2	12.7	13.1	19.7
Alameda	15.0	15.6	15.3	14.2	14.8	12.4	13.0	13.6	11.6	11.9	10.2
Santa Clara	35.7	37.0	36.5	33.8	35.3	29.5	31.0	32.4	27.6	28.4	24.4
Oak Flat	1.3	1.3	1.3	1.5	1.6	1.8	1.8	1.8	0.9	0.9	1.4
Kings	2.0	2.1	2.0	2.4	2.5	2.9	3.0	2.9	1.3	1.4	2.2
Dudley Ridge	13.8	14.6	12.7	16.7	17.1	19.9	20.4	18.6	9.2	9.6	14.0
Empire W.S.	0.7	0.7	0.7	0.8	0.8	1.0	1.0	1.0	0.4	0.5	0.7
KCWA (M&I)	48.1	49.8	49.2	45.5	47.6	39.1	41.1	43.7	37.1	38.2	32.8
KCWA (Agric.)	228.6	240.6	191.6	275.3	283.1	328.5	336.2	275.2	152.7	159.0	206.8
Tulare	21.6	22.7	21.3	26.0	26.7	31.0	31.8	31.2	14.4	15.0	23.5
SLO	8.9	9.3	9.1	8.5	8.8	7.3	7.6	8.1	6.9	7.1	6.1
Santa Barbara	16.2	16.8	16.6	15.4	16.1	13.2	13.9	14.8	12.5	12.9	11.1
AVEK	50.1	52.0	51.2	47.6	49.7	47.0	49.1	45.9	38.6	39.7	34.5
Castaic (Agric.)	2.8	3.0	2.8	3.4	3.5	4.1	4.2	4.1	1.9	2.0	3.1
Castaic (M&I)	14.8	15.4	24.3	14.0	14.7	12.1	12.7	26.8	11.4	11.8	20.1
Coachella	41.9	43.5	42.8	40.3	42.0	40.2	42.0	43.2	32.1	33.1	32.5
Crestline	2.1	2.1	2.1	2.0	2.0	1.7	1.8	1.9	1.6	1.6	1.4
Desert	17.9	18.5	18.3	16.9	17.7	16.6	17.4	17.5	13.8	14.2	13.2
Littlerock	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.6
Mojave	18.1	18.8	24.1	17.2	17.9	19.1	19.8	24.6	14.0	14.4	18.5
MWDSC	682.8	707.8	698.3	646.6	675.4	603.9	632.7	620.2	526.8	542.1	466.0
Palmdale	6.2	6.4	7.2	5.9	6.1	5.0	5.3	6.9	4.8	4.9	5.2
San Bernardino	36.6	38.0	37.5	34.7	36.3	38.5	40.1	33.3	28.3	29.1	25.0
San Gabriel	10.3	10.7	10.5	9.7	10.2	10.8	11.2	9.3	7.9	8.2	7.0
San Gorgonio	6.2	6.4	6.3	5.9	6.1	5.0	5.3	5.6	4.8	4.9	4.2
Ventura	7.1	7.4	7.3	6.8	7.1	5.8	6.1	6.5	5.5	5.7	4.9
Total Agriculture	270.8	285.0	232.4	326.2	335.4	389.2	398.3	334.9	180.9	188.4	251.6
Total M&I	1,059.4	1,098.3	1,108.6	1,004.0	1,048.7	941.0	985.7	1,006.1	817.1	840.8	756.0
Total	1,330.2	1,383.4	1,341.0	1,330.2	1,384.1	1,330.2	1,384.0	1,341.0	998.0	1,029.2	1,007.6

Table A-5a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	1.0	0.8	1.0	1.0	0.8	1.0	0.8	1.7
Solano	1.0	0.9	1.2	1.0	0.9	1.0	0.9	2.1
Zone 7	1.1	1.1	1.3	1.1	1.1	1.1	1.1	2.2
Alameda	1.4	1.3	1.6	1.4	1.3	1.4	1.3	2.1
Santa Clara	5.1	4.7	5.7	5.1	4.7	5.1	4.7	7.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.2	2.1	2.3	2.2	2.1	2.2	2.1	2.2
Empire W.S.	1.6	1.5	1.8	1.6	1.5	1.6	1.5	1.0
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	101.2	99.1	107.3	101.2	99.1	101.2	99.1	81.8
Tulare	26.7	25.6	30.1	26.7	25.6	26.7	25.6	16.7
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.7	1.7	1.8	1.7	1.7	1.7	1.7	2.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.0	0.9	1.3	1.0	0.9	1.0	0.9	2.2
Coachella	3.0	2.8	3.2	3.0	2.8	3.0	2.8	2.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	6.9	6.2	7.2	6.9	6.2	6.9	6.2	5.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	119.8	116.4	128.1	119.8	116.4	119.8	116.4	164.0
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	131.7	128.4	141.6	131.7	128.4	131.7	128.4	101.6
Total M&I	142.0	136.8	152.4	142.0	136.8	142.0	136.8	192.3
Total	273.8	265.2	294.0	273.8	265.2	273.8	265.2	294.0

Table A-5b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	2.1	1.7	2.2	2.1	1.7	2.1	1.7	3.1
Solano	2.3	1.9	2.6	2.3	1.9	2.3	1.9	4.2
Zone 7	2.4	2.3	2.7	2.4	2.3	2.4	2.3	4.3
Alameda	2.9	2.8	3.3	2.9	2.8	2.9	2.8	4.1
Santa Clara	10.6	9.9	12.0	10.6	9.9	10.6	9.9	13.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	4.3	4.2	4.5	4.3	4.2	4.3	4.2	4.3
Empire W.S.	3.3	3.1	3.5	3.3	3.1	3.3	3.1	1.9
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	200.3	196.5	212.4	200.3	196.5	200.3	196.5	152.0
Tulare	53.9	52.3	61.0	53.9	52.3	53.9	52.3	31.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	3.5	3.4	3.7	3.5	3.4	3.5	3.4	4.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	2.3	1.9	2.9	2.3	1.9	2.3	1.9	4.4
Coachella	6.3	5.8	6.5	6.3	5.8	6.3	5.8	4.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	14.3	13.1	14.7	14.3	13.1	14.3	13.1	11.1
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	215.1	211.5	216.6	215.1	211.5	215.1	211.5	304.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	261.8	256.3	281.4	261.8	256.3	261.8	256.3	190.0
Total M&I	261.7	254.2	267.2	261.7	254.2	261.7	254.2	358.5
Total	523.5	510.5	548.5	523.5	510.5	523.5	510.5	548.5

Table A-5c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.5	0.7	0.7	0.5	0.7	0.5	1.8
Solano	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.2
Zone 7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	2.3
Alameda	1.1	1.0	1.3	1.1	1.0	1.1	1.0	2.2
Santa Clara	3.6	3.2	4.4	3.6	3.2	3.6	3.2	7.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.4	2.3	2.5	2.4	2.3	2.4	2.3	2.3
Empire W.S.	1.5	1.2	2.0	1.5	1.2	1.5	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	104.4	101.2	112.2	104.4	101.2	104.4	101.2	86.5
Tulare	24.9	22.5	30.6	24.9	22.5	24.9	22.5	15.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.4
Coachella	2.9	2.5	3.1	2.9	2.5	2.9	2.5	3.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.8	4.9	6.9	5.8	4.9	5.8	4.9	5.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	110.9	104.0	140.7	110.9	104.0	110.9	104.0	173.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	133.3	127.2	147.3	133.3	127.2	133.3	127.2	104.7
Total M&I	128.6	119.5	160.9	128.6	119.5	128.6	119.5	203.4
Total	261.9	246.7	308.1	261.9	246.7	261.9	246.7	308.1

Table A-5d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.6	0.8	0.7	0.6	0.7	0.6	1.3
Solano	0.8	0.7	0.9	0.8	0.7	0.8	0.7	1.4
Zone 7	0.9	0.8	1.2	0.9	0.8	0.9	0.8	1.5
Alameda	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.4
Santa Clara	3.9	3.6	4.3	3.9	3.6	3.9	3.6	5.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Empire W.S.	1.2	1.2	1.3	1.2	1.2	1.2	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	71.1	68.8	72.8	71.1	68.8	71.1	68.8	65.1
Tulare	18.7	18.4	19.9	18.7	18.4	18.7	18.4	14.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.2	1.1	1.4	1.2	1.1	1.2	1.1	1.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.8	0.7	1.0	0.8	0.7	0.8	0.7	1.5
Coachella	2.1	2.0	2.2	2.1	2.0	2.1	2.0	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.1	4.7	5.4	5.1	4.7	5.1	4.7	4.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	108.8	104.6	119.6	108.8	104.6	108.8	104.6	130.6
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	92.5	89.8	95.5	92.5	89.8	92.5	89.8	81.4
Total M&I	125.2	119.8	137.8	125.2	119.8	125.2	119.8	151.9
Total	217.8	209.5	233.3	217.7	209.5	217.7	209.5	233.3

Table A-5e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8
Solano	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.0
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1
Alameda	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1.0
Santa Clara	2.2	2.0	2.2	2.2	2.0	2.2	2.0	3.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1
Empire W.S.	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	47.8	47.3	52.3	47.8	47.3	47.8	47.3	40.7
Tulare	12.8	11.8	13.6	12.8	11.8	12.8	11.8	7.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.8	0.7	0.8	0.8	0.7	0.8	0.7	1.1
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.1
Coachella	1.3	1.1	1.3	1.3	1.1	1.3	1.1	1.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.8	2.3	2.9	2.8	2.3	2.8	2.3	2.7
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	66.1	63.7	68.2	66.1	63.7	66.1	63.7	81.7
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	62.4	60.9	67.8	62.4	60.9	62.4	60.9	49.7
Total M&I	75.4	71.8	77.6	75.4	71.8	75.4	71.8	95.7
Total	137.8	132.7	145.4	137.8	132.7	137.8	132.7	145.4

Table A-5f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.4
Solano	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Zone 7	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Alameda	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Santa Clara	1.2	1.2	1.5	1.2	1.2	1.2	1.2	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	21.8	21.8	23.3	21.8	21.8	21.8	21.8	22.2
Tulare	5.8	5.8	6.9	5.8	5.8	5.8	5.8	5.3
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Coachella	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.5	1.5	1.7	1.5	1.5	1.5	1.5	1.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	34.9	34.9	43.0	34.9	34.9	34.9	34.9	44.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	28.5	28.5	31.1	28.5	28.5	28.5	28.5	28.2
Total M&I	40.1	40.1	49.1	40.1	40.1	40.1	40.1	51.9
Total	68.6	68.6	80.1	68.6	68.6	68.6	68.6	80.1

Table A-6a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9	0.1	0.1	0.9
Solano	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	1.0	0.3	0.2	1.0
Alameda	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.9	0.5	0.4	0.9
Santa Clara	1.5	1.1	1.5	1.5	1.2	1.5	1.2	3.3	1.5	1.2	3.3
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.1	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.1	1.0	1.0
Empire W.S.	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.2	0.7	0.6	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	48.1	44.3	46.8	48.1	44.3	48.1	44.3	36.1	48.1	44.3	36.1
Tulare	11.8	10.3	12.0	11.8	10.4	11.8	10.4	4.9	11.8	10.3	4.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.6	0.7	0.6	0.7	0.6	1.0	0.7	0.6	1.0
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Coachella	1.3	1.1	1.2	1.3	1.1	1.3	1.1	2.0	1.3	1.1	2.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	2.1	2.3	2.4	2.1	2.4	2.1	2.4	2.4	2.2	2.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	52.1	44.0	51.2	52.1	44.3	52.1	44.3	62.9	52.1	44.3	62.9
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	61.6	56.2	60.5	61.6	56.3	61.6	56.3	42.2	61.6	56.2	42.2
Total M&I	59.2	49.8	58.2	59.2	50.2	59.2	50.2	76.5	59.2	50.2	76.5
Total	120.8	106.0	118.7	120.8	106.5	120.8	106.5	118.7	120.8	106.4	118.7

Table A-6b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.5	0.1	0.0	1.5
Solano	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.6	0.1	0.0	1.6
Zone 7	0.3	0.1	0.4	0.3	0.1	0.3	0.1	1.7	0.3	0.1	1.7
Alameda	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.6	0.7	0.6	1.6
Santa Clara	2.1	1.5	2.2	2.1	1.5	2.1	1.5	5.6	2.1	1.5	5.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.7	1.8	1.7	1.7
Empire W.S.	1.2	1.0	1.2	1.2	1.0	1.2	1.0	0.2	1.2	1.0	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	79.4	72.6	78.0	79.4	72.6	79.4	72.6	59.9	79.4	72.6	59.9
Tulare	19.6	16.6	19.6	19.6	17.0	19.6	17.0	6.4	19.6	16.6	6.4
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	0.9	1.0	1.0	0.9	1.0	0.9	1.8	1.0	0.9	1.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.2	0.1	0.0	0.1	0.0	1.7	0.1	0.0	1.7
Coachella	1.9	1.7	1.9	1.9	1.7	1.9	1.7	3.4	1.9	1.7	3.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.6	3.4	3.5	3.6	3.4	3.6	3.4	3.6	3.6	3.4	3.6
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	80.4	65.1	80.3	80.4	65.7	80.4	65.7	100.3	80.4	65.1	100.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	102.0	91.9	100.5	102.0	92.4	102.0	92.4	68.2	102.0	91.9	68.2
Total M&I	90.4	73.4	90.4	90.4	74.0	90.4	74.0	122.7	90.4	73.4	122.7
Total	192.3	165.3	190.9	192.3	166.3	192.3	166.3	190.9	192.3	165.3	190.9

Table A-6c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1
Solano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
Zone 7	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.3	0.1	0.0	1.3
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.2	0.4	0.4	1.2
Santa Clara	1.3	0.9	1.2	1.3	0.9	1.3	0.9	4.0	1.3	0.9	4.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.3	1.2	1.3	1.3	1.2	1.3	1.2	1.3	1.3	1.2	1.3
Empire W.S.	1.0	0.7	1.1	1.0	0.7	1.0	0.7	0.1	1.0	0.7	0.1
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	61.8	58.7	61.4	61.8	58.7	61.8	58.7	40.5	61.8	58.7	40.5
Tulare	15.5	12.1	16.7	15.5	12.1	15.5	12.1	3.8	15.5	12.1	3.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.3	0.7	0.6	1.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3
Coachella	1.4	1.2	1.3	1.4	1.2	1.4	1.2	2.5	1.4	1.2	2.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.9	2.3	2.4	1.9	2.4	1.9	2.2	2.4	1.9	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	56.6	45.2	53.2	56.6	45.2	56.6	45.2	77.8	56.6	45.2	77.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	79.5	72.6	80.4	79.5	72.6	79.5	72.6	45.7	79.5	72.6	45.7
Total M&I	63.0	50.3	59.1	63.0	50.3	63.0	50.3	93.9	63.0	50.3	93.9
Total	142.5	123.0	139.6	142.5	123.0	142.5	123.0	139.6	142.5	123.0	139.6

Table A-6d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.8	0.1	0.0	0.8
Solano	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.9	0.3	0.2	0.9
Alameda	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8	0.4	0.3	0.8
Santa Clara	1.4	0.9	1.3	1.4	0.9	1.4	0.9	3.1	1.4	0.9	3.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	0.9	0.9	1.0	0.9	1.0	0.9	0.9	1.0	0.9	0.9
Empire W.S.	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.2	0.6	0.5	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	41.4	36.0	41.4	41.4	36.0	41.4	36.0	34.0	41.4	36.0	34.0
Tulare	9.6	8.9	10.1	9.6	8.9	9.6	8.9	4.6	9.6	8.9	4.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.6	0.7	0.6	0.7	0.6	0.9	0.7	0.6	0.9
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Coachella	1.2	1.0	1.1	1.2	1.0	1.2	1.0	1.8	1.2	1.0	1.8
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.8	2.2	2.4	1.8	2.4	1.8	2.2	2.4	1.8	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	44.2	36.9	45.2	44.2	36.9	44.2	36.9	52.8	44.2	36.9	52.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	52.5	46.3	53.1	52.5	46.3	52.5	46.3	39.6	52.5	46.3	39.6
Total M&I	51.1	41.7	51.7	51.1	41.7	51.1	41.7	65.2	51.1	41.7	65.2
Total	103.6	88.0	104.8	103.6	88.0	103.6	88.0	104.8	103.6	88.0	104.8

Table A-6e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

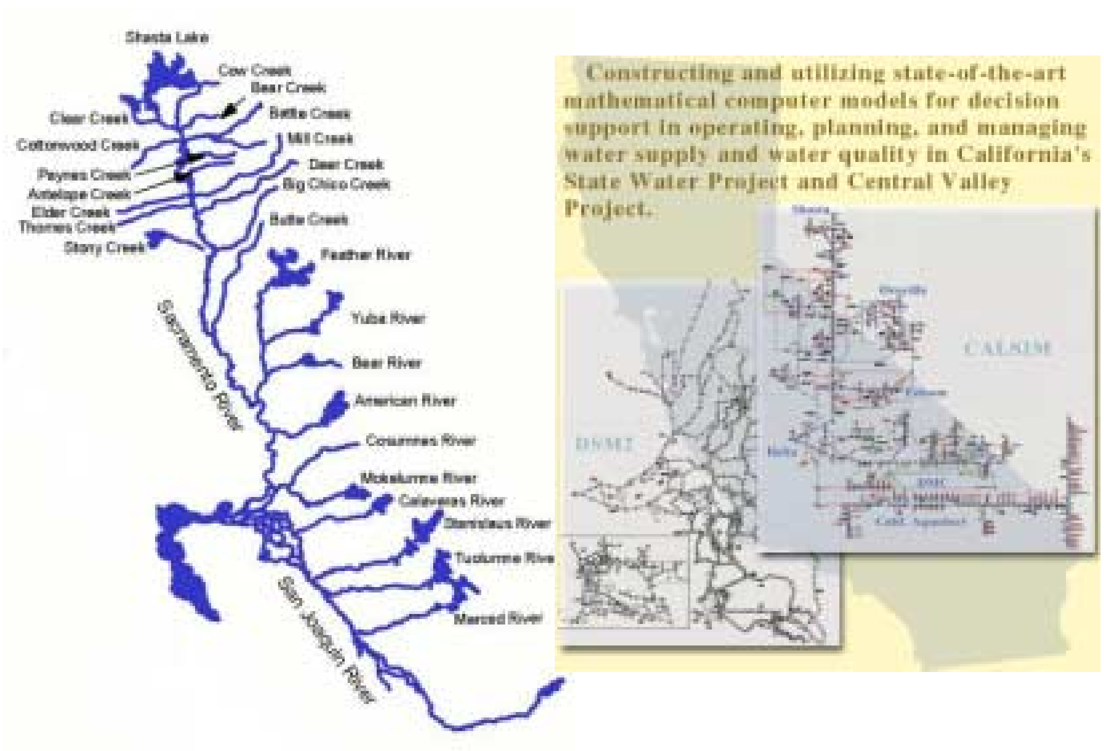
SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Solano	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Zone 7	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Alameda	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3
Santa Clara	0.7	0.5	0.7	0.7	0.6	0.7	0.6	1.0	0.7	0.7	1.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.5	0.4	0.4
Empire W.S.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	20.6	19.3	16.7	20.6	19.3	20.6	19.3	11.8	20.6	19.3	11.8
Tulare	4.1	4.0	3.8	4.1	4.0	4.1	4.0	2.5	4.1	4.0	2.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Coachella	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.0	0.7	0.8	1.0	0.8	1.0	0.8	1.0	1.0	0.9	1.0
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	21.3	18.5	18.7	21.3	19.1	21.3	19.1	23.3	21.3	19.8	23.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	25.5	23.9	21.1	25.5	23.9	25.5	23.9	14.7	25.5	23.9	14.7
Total M&I	24.7	20.9	21.6	24.7	22.0	24.7	22.0	28.0	24.7	23.0	28.0
Total	50.2	44.8	42.7	50.2	45.9	50.2	45.9	42.7	50.2	47.0	42.7

Table A-6f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Solano	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alameda	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Santa Clara	1.8	1.8	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
Tulare	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5	6.8	6.8	6.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Coachella	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.3	2.1	2.1	2.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.5	45.4	45.4	45.5
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.0	30.5	30.5	30.0
Total M&I	52.8	52.8	52.8	52.8	52.8	52.8	52.8	53.2	52.8	52.8	53.2
Total	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2

G. CALSIM II PEER REVIEW REPORT AND THE DEPARTMENT'S RESPONSE

A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California



Submitted to the

California Bay Delta Authority Science Program
Association of Bay Governments
Oakland, California

by

A. Close, W.M. Haneman, J.W. Labadie, D.P. Loucks (Chair), J.R. Lund, D.C. McKinney, and J.R. Stedinger

December 4, 2003

Executive Summary

1. Summary

The central all-encompassing question put to the panel is whether the CALFED program has adopted an appropriate approach to modeling the CVP-SWP-Central Valley system. Is the general CALSIM modeling approach appropriate for predicting the performance of the general facilities and for use in allocation planning, assessing water supply reliabilities and for carrying out operational studies? We believe the use of an optimization engine for simulating the hydrology and for making allocation decisions is an appropriate approach and is in fact the approach many serious efforts of this kind are using. It is a substantial improvement of the previous modeling approaches and provides a basis for consensus among federal and state interests. The modeling approach addresses many of the complexities of the CVP-SWP system and its water management decisions.

There exists a common tension between those who wish for greater detail and those who want less detail from the model. This argues for a more comprehensive, modular and flexible approach than is now available. In this report we suggest some ways this might be accomplished in the future. We also propose some management procedures that could be considered to improve model and model application quality control and documentation. The openness and availability of the model is admirable and very important given the numerous stakeholders who have interests in the management and allocation of water in the state. To increase the public's confidence in the many components and features of CALSIM II, we suggest that these components of CALSIM be subjected to careful technical peer review by appropriate experts and stakeholders.

2. Background

The California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) have developed a computer model called CALSIM II that simulates much of the water resources infrastructure in the Central Valley of California and the Delta region. This infrastructure is referred to as the CVP-SWP system. In particular CALSIM II provides quantitative hydrologic-based information to those responsible for planning, managing and operating the State Water Project (SWP) and the federal Central Valley Project (CVP). As the official model of those projects, CALSIM II is the default system model for any inter-regional or statewide analysis of water in the Central Valley of California.

CALSIM II has a central role in the analysis of many CVP-SWP and related issues, some of which require capabilities beyond those included in the model. California needs a large-scale relatively versatile inter-regional operations planning model and CALSIM II currently serves that purpose reasonably well. As the primary State and Federal-sponsored model available for water operations and planning, CALSIM II is critical to the study of many technical and policy issues related to water supply reliability, environmental management and performance, water demands, economics, hydrology and climate, and regulatory compliance.

CALSIM II is a particular application of the California Water Resources Simulation Model called CALSIM. It uses a mixed integer linear programming model solver to route water through a network over time. Currently it uses monthly time steps. Policies and priorities are implemented through the use of user-defined weights applied to the flows in the system (represented by arcs of the network). Simulation cycles at different temporal scales allow for successive implementation of constraints. The model can simulate the operation of relatively complex environmental water accounts and state and federal environmental regulations. In our judgment CALSIM II represents a very impressive modeling effort on the part of all those involved with its development and application.

The CALFED Science Program commissioned this external review panel (Appendix D) to 1) provide an independent analysis and evaluation of the strengths and weaknesses of CALSIM and CALSIM II, and 2) to offer suggestions on the appropriate uses of these modeling tools, on ways their use might complement or be complemented by other models, and on further development, quality assurance, and use in major water systems operations and planning in California.

The panel received background documents (Appendix B), including a survey by the University of California at Davis of stakeholder responses to questions about CALSIM II. We subsequently met for one and a half days in Sacramento for discussions and presentations (Appendix A) by CALFED, DWR and USBR staff. The discussions concluded with a summary presentation by the panel outlining our tentative conclusions.

The information we received and the shortness of our meetings with modeling staff precluded a thorough technical analysis of CALSIM II. We believe such a technical review should be carried out. Only then will users of CALSIM II have some assurance as to the appropriateness of its assumptions and to the quality (accuracy) of its results. By necessity our review is more strategic. It offers some suggestions for establishing a more complete technical peer review, for managing the CALSIM II applications and for ensuring greater quality control over the model and its input data, and for increasing the quality of the model, the precision of its results, and their documentation.

In this review we were asked to address the following questions:

1. Is CALSIM a reasonable modeling approach for current and proposed applications and problems?
2. Do other modeling approaches show similar or greater promise and flexibility for such problems? If so, how?
3. What are the major comparative strengths and weaknesses of the current CALSIM approach and alternative approaches?
4. What are major scientific, technical, and institutional limitations, uncertainties, and impediments for current and proposed applications of CALSIM?
5. What model, software, and data developments, special studies or tests would be beneficial to improve CALSIM for current and proposed uses?
6. How might CALSIM development and applications be managed and overseen to improve the quality assurance of model results for current and proposed applications?

7. What are your suggestions for long-term use, development, or replacement of the current suite of models and data available for the current and proposed uses of CALSIM?

The following sections of this summary present our responses to these questions. The main parts of this report and its appendices provide additional detail.

3. CALSIM Modeling Approach

CALSIM II is a simulation model developed as a joint venture between the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to (i) provide a significant modernization and upgrading of the DWRSIM and PROSIM models developed and used by these organizations, (ii) develop a comprehensive modeling system that simultaneously addresses the current and future needs of both the SWP and CVP systems; and (iii) develop a generalized modeling system that could be applied in any river basin system, in contrast with the previous models that were less generalized and more specifically designed for the existing SWP and CVP systems. In this respect, CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling systems such as ARSP, MODSIM, OASIS, REALM, RiverWare and WEAP.

CALSIM uses linear programming to solve sets of equations that simulate water movement through the CVP-SWP system in accordance with various objectives and constraints. This is a modeling approach which has been used successful in California (Johnson et al., 1991). In a complex system such as that being modeled, it is essential to have some mathematical representation of system flows that reflects all of the interconnections and constraints. Use of an optimization algorithm allows good decisions to be identified from among all possible and feasible decisions. To the extent this simulates what actually occurs, it is a good modeling approach. To the extent it optimizes when in reality no such optimization is implemented, it has the potential to produce inaccurate and overly optimistic outputs.

Most successful applications of optimization that attempt to simulate the behavior of a system have calibrated their objective functions (i.e., set the weights that prioritize flows over time and space) so that the model results correspond to what actually happens or would happen under a particular hydrologic and demand scenario. In these cases the model's decisions correspond to those the operators would make, as often prescribed by rules that have been worked out in a legal/political process. It does not appear that such a calibration of the objective function weights in CALSIM has yet been completed.

4. Other Modeling Approaches

There are two aspects of modeling, the model structure and algorithms used, and the model software. The use of linear optimization algorithms to solve simultaneous equations for simulating hydrology is a common way of avoiding a typically long list of procedural rules for simulating regional water systems. Such sets of procedures can be difficult to generate for complex systems, and very different and new rule sets may be needed if structural or significant policy changes are to be investigated. In addition the performance of the system when simulated will be less than that which can be achieved in practice if a good set of rules is not provided. Optimization models are generally easier to reformulate when system changes are to be investigated. However unless the optimization is calibrated in such a way as to actually resemble what takes place in practice it can produce an optimistic description of system performance. This is particularly true if the optimization model is allowed to have perfect foresight of future events that in practice would not be available to system operators.

Large simulation models using optimization and procedural rules both need to have internal checks to ensure to the extent possible that errors in mass balances, for example, do not occur due to errors made when the model is being defined or created. Such internal checking is not apparent to us in our admittedly brief review of CALSIM II. Nor were calibration procedures well defined.

One obvious limitation of using linear optimization procedures is its inability to model accurately and efficiently some of the non-linear hydrologic and decision processes that occur in systems as complex as the CVP-SWP. One approach to addressing this issue of model accuracy, and possibly for decreasing the computational time as well, is to link linear optimization models to non-linear simulation models in a way that permits the simulation to represent the hydrology in any spatial and temporal detail desired. The optimization is used to determine what the decisions should be at every site where a water allocation, reservoir release, or other management decisions must be made. The time steps for simulation could be daily, or weekly or longer, depending on the needs of the user, but would likely be of shorter durations than the optimization time steps. After a predetermined number of simulation time steps, the optimization model would be run. The initial state of the optimization should be set at the beginning of each optimization time step. The optimization component should include multiple future time periods, with imperfect hydrologic and demand forecasts, but once solved only the current period's solutions are implemented – i.e., these decision variable values are sent to the simulation component. The decisions indicated for future periods are ignored. When appropriate, the initial state of the multi-period optimization model is updated and the model is again solved. And so on. Such a modeling approach may prove to be both more realistic, more accurate, and require less time, once developed. We believe such an approach might be worth considering for future development.

CALSIM II currently consists of a combination of software modules developed in several languages, including FORTRAN, Java and C. Several of the modules require proprietary software packages in order to run CALSIM II (Lahey FORTRAN and XA Solver). DWR and USBR staff have said that these components are being replaced by public domain software that can be obtained free of charge. We agree with this decision. Very good public domain software packages of optimization, visualization, file management, and data base support are currently available, and new ones will continually be produced. Periodic updates should be anticipated as part of the business of maintaining the modeling system.

Significant thought should be given to the sustainability of the CALSIM II software. How will future programmers be able to maintain this software? How will future software developments be incorporated into the system? Will the solver currently being developed by LBNL be adequate in terms of accuracy and computation speed? Will other solvers need to be tested? Can the system accommodate these future developments without major modifications? What reasonable modifications could be made now in anticipate of future developments?

5. Comparative Strengths and Weaknesses

Many of the stakeholder perceived strengths and weaknesses of CALSIM and CALSIM II are very well identified in the survey report from the University of California at Davis (Ferreira, et al. 2003). Our background materials and briefings covered various strengths and weaknesses, but without first hand experience, all we can do here is to summarize those that we have heard expressed by others.

Here we provide a brief summary list.

5.1 Some Prominent Strengths

The strengths of CALSIM II are many. Most are expressed in comparison to previous DWRSIM and PROSIM models DWR and USBR were using. Some of these strengths include:

- Consensus model. CALSIM II is the official joint modeling environment of the State DWR and USBR. This includes a common schematic, hydrologic representation of the system, common set of facility capacities, and common representation of system operating policies. This helps all parties improve representations, rather than compete over representations.

- Common effort. The joint development of CALSIM II by USBR and DWR has provided more focused and effective use of resources and expertise than previous development of agency-specific models. CALSIM II development has also involved other agencies and consulting expertise more than pervious models of this system.

- Data-driven model. CALSIM II is a rather data-driven simulation model with an optimization engine. This modeling approach provides:
    a. greater flexibility than its predecessors and traditional water resources simulation approaches.
    b. a promising framework for improving transparency, data, and model documentation, compared to other approaches.

- Public domain. The model and data are substantially in the public domain, facilitating transparency and adaptability for California's decentralized water system.

- Steady improvements. Data improvements have been steadily pursued following the adoption of CALSIM II, although deficiencies remain.

- Improved Delta water quality representation. Although problems appear to remain, the model developers have made substantial gains in representing Delta water quality operating criteria and performance.

- Better groundwater representation. Efforts to better include groundwater and non-CVP-SWP project operations merit continuation and expansion.

- Benchmark Studies. The development of documented benchmark studies have resulted in significant model improvements and aided in the development of comparative model applications. Such exercises should be continued and improved.

- Long-term vision. The vision of a more transparent and publicly available model that can be employed by those outside the major agencies is excellent. This is a major change in direction, and achieving this vision will require adjustments over time. Often, these adjustments will be externally driven. Externally-driven improvements are a price of success and evidence of success for an open, public, modeling policy.

- Important CALSIM II features:
    a. CALSIM II is able to simulate the operation of the complete CVP-SWP system in all areas that contribute flow to the Delta in monthly time-steps.
    b. CALSIM II is being applied to examine a diverse range of options including flood control, water conservation and supply, power generation, recreation, water transfers, groundwater banking, recycling, desalination, conjunctive use, the purchase of options and streamflow and water quality protection.
    c. CALSIM II has successfully been applied by both DWR and USBR to examine both structural and non-structural changes to the CVP-SWP system as well as to ascertain the risks involved with different potential operating scenarios and to quantify the impacts of proposed actions.
    d. CALSIM II can dynamically model operation of environmental water accounts.
    e. Demands may vary according to various levels of development (e.g. 2001, 2020) and to hydrologic conditions.
    f. The regulatory environment under which the projects must operate can be simulated.
    g. CALSIM II can link to external modules as needed, e.g., to estimate the salinity at water quality stations within the Delta.

5.2 Some prominent weaknesses

As its strengths are many, so are its weaknesses. It seems worth saying, however, that no model can perfectly (meaning efficiently and effectively) serve all interests in a system as complex as the CVP-SWP. Tradeoffs need to be made. This can result in what some would call weaknesses. Such weaknesses are often accepted to gain strengths in another ways.

We heard that the CALSIM II model was too complex. We also heard that it did not handle particular components of the system with sufficient detail. And such is the dilemma of any complex model, such as CALSIM II. The model is clearly too complex, and not complex enough. The root of this difficulty is that when such a model is constructed, it is not clear what level of detail is needed, so the model must be made sufficiently complex to ensure it is complex enough. And the complexity needed to address some issues will remain in the model when it is used to address other less complex issues, or the same issues at less complex locations. One approach to addressing this issue is to develop different linkable modules of CALSIM II having different complexities. In this way the level of detail can be varied to be consistent the application or study at hand, and level of sophistication and resources available to the user.

Other weaknesses model users would like addressed include:

- The model provides limited and inadequate coverage of non CVP or SWP water and of the California water system south of the Delta.
- The model assumes that facilities, land-use, water supply contracts and regulatory requirements are constant over this period, representing a fixed level of development rather than one that varies in response to hydrologic conditions or changes over time.
- Groundwater has only limited representation in CALSIM II.
- Groundwater resources are assumed infinite, i.e., there is no upper limit to groundwater pumping.
- The linear programming model considers only the current month, and hence CALSIM II operating rules are required to determine annual water allocations, to establish reservoir carryover storage targets, and to trigger transfers from north of Delta to south of Delta storage.
- Better quality control is needed both for the model and its current version and the input data. Procedures for model calibration and verification are also needed. Currently many users are not sure of the accuracy of the results. A sensitivity and uncertainty prediction capability and analysis is needed.
- Need improved ways of altering the model's geographic scope and resolution and its temporal resolution to better meet the needs of various analyses and studies.
- Need to improve the model's comparative as well as absolute (or predictive) capabilities.
- CALSIM II needs better capabilities for analyzing economic, water quality, and groundwater issues.
- Need improved documentation explaining how the model works, its assumptions, its limitations, and its applicability to various planning and management issues.
- DWR and USBR have not provided a centralized source of support for CALSIM II. More training for CALSIM II is needed. There is a need for more people who can run CALSIM II. There is a need for a well-publicized user group. A more extensive users' guide is needed.
- Improved capabilities are needed for real-time operations especially during droughts, gaming involving stakeholders during a simulation run, handling of evapotranspiration and agriculture demand changes over time, water transfers, Delta storage, carryover contract rights, refuge water demands and more up to date representation of Feather River, Stanislaus River, Upper American River, San Joaquin River and Yuba River operations.

- Need an improved graphical user interface to facilitate input of model data, setting of model constraints and weights, operating the model, and displaying and post analysis of model results.
- Need to be able to change the model time period durations for improved accuracy of model results.

6. Limitations, Uncertainties, and Impediments

6.1 Absolute Values or Comparative Results

Modelers sometimes make a distinction between the use of a model for *absolute* versus *comparative* analyses. In an absolute analysis one runs the model once to predict an outcome. In a comparative analysis, one runs the model twice, once as a baseline and the other with some specific change, in order to assess change in outcome due to the given change in model input configuration. The suggestion is that, while the model might not generate a highly reliable absolute prediction because of errors in model specification and/or estimation, nevertheless it might produce a reasonably reliable estimate of the relative change in outcome. The panel is somewhat skeptical of this notion because it relies on the assumption that the model errors which render an absolute forecast unreliable are sufficiently independent of, or orthogonal to, the change being modeled that they do not similarly affect the forecast of change in outcome; they mostly cancel out. This feature of the model is something that would need to be documented rather than merely assumed.

In our opinion CALSIM II has not yet been calibrated or validated for making absolute predictions values. Yet it is apparent that there has been a distinct need by model users for absolute predictions. In the absence of alternatives, users are adopting CALSIM II results as the best absolute prediction available and they are likely to continue to do so. We recommend that model developers recognize the requirement for CALSIM II to provide absolute predictions. To satisfy this new purpose, additional calibration of the model will be required to ensure that the output it produces is fit for this purpose. Regardless of how possible it is to match the model closely with observed behavior, statistics on the accuracy of the calibration run should be supplied to users to enable them to gauge the likely errors involved with using the model output.

6.2 Sensitivity and Uncertainty Analyses

Sensitivity analyses would be useful to identify which parameters and input data have major impacts on decisions and system performance criteria of concern. Uncertainty analyses would help users of the model understand better the risks of various decisions and the confidence they can have in various predictions.

6.3 Graphical User Interface

Having a graphical user interface would substantially aid those who use the model in managing both input and output data, and in controlling or managing model operations. This model will not likely become as available to and as well understood by the public, to the extent desired by the model developers, until an effective menu-driven GUI has been created that can help create and draw from a database of system parameters and characteristics, and simulation results.
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6.4 Documentation and Training

When if ever is adequate documentation and training available? Rarely, but we believe there is a serious need to improve the documentation as well as the training available for all those interested in using CALSIM II.

7. Options for Improving CALSIM

7.1 CALSIM Model Software

We encourage the developers of CALSIM to convert their present software to that which is publicly available and to develop a useful graphic based user interface that can facilitate the input, editing, and display of all the data that are input to and output from CALSIM II. There are many options, some of which we have discussed with the model developers.

The CALSIM package should be made more modular and capable of linking to other more complex models of components of the CVP-SWP system. If the changes in code and modeling approach result in a quicker running model, it might be possible to link, when desired, modules that facilitate position analyses and other types of uncertainty analyses. A modular system would allow alternative representations of different components of the system. Thus different levels of spatial detail, or representations of the fundamental processes, would be allowed within the overall system representation and record of California hydrology. This will allow the use of more general and streamlined models for use of preliminary investigation and general planning, as well as a more detailed representation of the system for final analyses and more detailed studies. This would be very useful.

7.2 Sensitivity and uncertainty analyses

Both sensitivity analyses need to be performed, and procedures need to be developed to enable the estimation of measures of uncertainty associated with model output. Perhaps workshops focused on just these needs should be scheduled to better determine how best to meet these needs. There are numerous procedures available that could be applied. Appendix H contains some approaches for performing sensitivity and uncertainty analyses.

7.3 Model calibration

There is a need to develop the model so that it is able to provide absolute estimates of key model outputs rather than limiting the use of the model to comparative studies. One way to do this is to subject the model to a comprehensive calibration process where it is fine-tuned until it is able to reproduce the historical behavior of the system with sufficient accuracy to provide absolute results. The calibration of the model should aim to test all the key outputs of model including water quality in the San Joaquin River and in the Delta. It is necessary to test the monthly values of outputs for those outputs for which the monthly pattern is important.

7.4 Other extensions and improvements

- The opportunity of improving the collection of data on the use of water (preferably broken down by irrigation district and water source) should be investigated. The use of groundwater should be included in this investigation.
- It would be useful to expand the geographic extent of the model so that it includes all the components of the linked water supply system, including both the San Joaquin and Tulare Lake Basins of the Central Valley. The model should also account in some manner for imported supplies of water to users in southern California from the Colorado River.
- The linkage between surface water and groundwater would appear to be of critical importance and output that would enable the impact of surface water use on groundwater extractions would appear to be useful.
- Examination of the report *'CALSIM II Simulation of Historical SWP/CVP Operations',* DWR (2003) indicates that the current formulation of CALSIM II:
  - Overestimates water deliveries to SWP and CVP contractors,
  - Determines carryover storage target values that differ from those the operators have determined in the past, and
  - Operates the San Luis Reservoir at lower levels and fills it later in the season than operators have in the past.

8. Managing CALSIM Development and Applications

The predicted impacts and other information derived from CALSIM II applied to the CVP and SWP can influence major investment decisions. It is thus self evident that those who use the model results need to have some confidence as to their precision. Is the science behind the information derived from CALSIM II been reviewed and judged correct? Is the model software free from errors? Are the assumptions made when performing the modeling the correct ones? Are the model results accurately and fully reported? In other words, just how much credence should decision makers place in the model output? Users of the model results should be assured that they are credible and unbiased. One way to help ensure this is to have the models, their associated software, and their applications under the control of some interagency organization that can oversee and provide quality control over model development, application and documentation. They can also plan and implement needed peer reviews.

One possible means of facilitating the peer review processes and for maintaining control on the particular versions of CALSIM II and accompanying models used for CVP-SWP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and other stakeholder organization (including university) personnel if they are interested and want to participate. This center would be responsible for maintaining a toolbox of 'acceptable' models for use by the agencies and contractors. The models placed in the toolbox should be peer reviewed with respect to their applicability and suitability for use in particular applications. Those that are not peer reviewed should be considered for peer review. New models proposed for use in California should be peer reviewed with respect to their suitability, and for their strengths and limitations, before being placed in the toolbox. The review should be of the theory underlying the model, the model's software, the documentation of the model as well as of its software, the model's functions and capabilities including those pertaining to model data input and output, the input data themselves, model calibration and verification, capabilities for sensitivity and uncertainty analyses, user control of all model operations including pre and post analyses (GUIs), spatial and temporal resolutions, and its limiting assumptions.

9. Future Use, Development, or Replacement of CALSIM

9.1 A coupled optimization simulation approach

Given a system as complex as the SWP/CVP system, it seems to us it might make sense to consider the development of a more detailed simulation 'engine' and couple it to an optimization or management 'engine'. The simulation component can more accurately model hydrologic processes. For example it can include the deterministic non-linear routing of flows and their quality constituents through the system on a smaller time step (e.g., daily) and hence much more realistically or accurately, than can linear optimization using longer time steps, even with all the known tricks for linearizing separable (single variable) non-linear functions and 'if-then-else' statements. The simulation engine itself may require a simultaneous equation solver, especially for the Delta. But the simulation engine needs to know what to do, i.e., what decisions to make. Periodic use of the optimization, say once a week or even less frequently if conditions are relatively constant, for determining the decisions to be simulated, e.g., the water allocation and reservoir release decisions, eliminates much of the maze of rules that otherwise would be required and which developers of CALSIM II are avoiding through the use of optimization. Each time the optimization or management 'engine' is run it is first updated with the current state of the system as determined from the more precise simulation 'engine'. The optimization component would include multiple time periods only to the extent that the current period's solution is not affected by the time horizon in the optimization. The other time period solutions are ignored. This coupled optimization-simulation approach has the potential to be both more accurate as well as quicker to execute. In our opinion it is worth considering for future development.

9.2 Models as hypotheses

CALSIM II is really about the future, not the past. Benchmarking studies can help establish the credibility of the model and provide estimates of its accuracy by comparing its performance to actual historical operations. A concern is how well the model reproduces historical operations, not whether it is valid or invalid on some absolute scale of perfection. But the real issue is how well CALSIM can predict what might happen in the future with sets of hydrological and meteorological conditions that have not yet been experienced, and may be significantly different from the past if climate variability and climate change are considered. In these cases the ability of the model to forecast what will happen depends both upon its ability to describe what would happen should a particular system operating policy, priorities and water demands be adopted. In this sense CALSIM II modeling studies should be thought of as the exploration of a hypothesis that particular policies and priorities have been adopted. Our ability to predict the future has generally been poor, but it is the obligation of agencies such as DWR and USBR to attempt to ensure that should water demands, water supplies, and water policies evolve as one would expect, society is prepared for the consequences. And that would seem to be what CALSIM II is about.

9.3 Future Model Development and Use

From the list of perceived weaknesses above, there are clearly many opportunities for further refinement of CALSIM II. Rather than attempt to meet all needs using only one model, namely CALSIM II, it seems preferable to improve its adaptability to various levels of detail through its ability to link to other models when additional detail in a particular region or for a particular feature is desired. For example, the monthly time step used by CALSIM II is sufficient for many studies. Yet some seasonal (multi-month) decision making is needed in CALSIM II to reflect decisions made by the SWP and CVP as to what Table A and other allocations to honor in full. On the other hand, it is clear that many water quality and ecosystem management decisions would profit from more detailed weekly or daily time steps. However, such shorted time-step models will need the guidance of a longer time-step model. As discussed earlier, models with shorter time scales can require increased spatial resolution, both of which lead to increased model complexity and a strong argument for model modularity.

Additional potential applications of CALSIM II include operational planning using gaming, or the involvement of potential decision makers during the simulation runs via a well developed graphical user interface, and to improve the capability of modeling water quality, energy production, conjunctive groundwater and surface water interactions and use, to mention a few.

There will always be a need to perform alternative 'what if' policy analyses where a relatively fast model that also provides some capability for uncertainty analyses is required. Perhaps CALSIM II will never be able to serve this need, and if so another more simplified modeling approach could be developed to fill that need. This simpler screening tool would be calibrated to produce results comparable to those of CALSIM II or observed data. Is this possible? We can not be certain but feel the idea should be seriously considered.

Acknowledgments

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Caveat

Just as all models are approximations of reality, so may all advice be an approximation of what it should be. We hope what we have written in this report is correct and useful, but encourage CALSIM model managers and California's water community to take our assessments and suggestions for what they are, arrived at based on our own experiences and some limited exposure to those who know much more about CALSIM and CALSIM II than we do.

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1. CALSIM Compared to Other Modeling Approaches

Management of complex systems such as coordination of the California State Water Project (SWP) and the Federal Central Valley Project (CVP) requires effective decision support tools for simulating and analyzing system components in a fully integrated manner. The classic definition of a decision support system (DSS) provided by Sprague and Carlson (1982) is *"an interactive computer-based support system that helps decision makers utilize data and models to solve unstructured problems."*

A DSS integrates the following interactive subsystems: (i) dialog generation and management subsystem (DGMS) for managing the interface between the user and the system; (ii) data base management subsystem (DBMS); and (iii) model base management subsystem (MBMS).

CALSIM II is a DSS developed as a joint venture between the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Bureau) to (i) provide a significant modernization and upgrading of the previous models DWRSIM and PROSIM employed by these organizations, (ii) develop a comprehensive modeling system that simultaneously addresses the current and future needs of both the SWP and CVP; and (iii) develop a generalized modeling system that could be applied in any river basin system, in contrast with the previous models that were less generalized and more specifically designed for the SWP and CVP. In this respect, CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other river basin modeling systems such as AQUATOOL (Valencia Polytechnic University, Spain), ARSP (Acres Reservoir Simulation Program) (Boss International, 2003), IRAS (Interactive River-Aquifer Simulation) (Loucks, et al. 1996), MIKE BASIN (Danish Hydrologic Institute, 2002), MODSIM (Labadie and Larson, 2000), OASIS (Randall, et al., 1997), RAISON (Young, et al. 2000), ResSim (U.S. Army Corps of Engineers, Hydrologic Engineering Center), Ribasim (River BAsin SIMulation Model) (Delft Hydraulics, Netherlands), REALM (REsource ALlocation Model) (James, 2003), RiverWare (Zagona, et al. 1998), WaterWare (Jamieson and Fedra, 1996), and WEAP (Water Evaluation and Planning System, 2003) (Hansen, 1994). All of these can be categorized as decision support systems since all three subsystems of a DSS are embodied within them.

A distinguishing feature of several of these modeling systems is the use of optimization on a period by period basis (not fully dynamic) to "simulate" the allocation of water under various prioritization schemes, such as water rights, without the presumption of perfect foreknowledge of future hydrology and other uncertain information. This is a valid approach since use of optimization overcomes the disadvantage of employing numerous, unwieldy prescriptive rules governing water allocation. Systems employing optimization in this manner include: ARSP, MODSIM, OASIS, REALM, RiverWare, and WEAP and are therefore more akin to CALSIM II. ARSP, MODSIM, REALM and Ribasim are further distinguished by use of specialized minimum cost network flow optimization algorithms, although of these only MODSIM includes iterative structures using an imbedded scripting language for including non-network "side constraints" in the optimization. The other modeling systems are essentially limited to a pure network structure that does not allow inclusion of all the complex, non-network type constraints necessary to model the complex CVP-SWP system.

It may be useful to compare this use of optimization with some other uses that have appeared in the modeling literature. One use of optimization is purely for computational convenience; in this case optimization is employed as a numerical method for obtaining the solution of a series of simultaneous (often linear) equations. This approach, which was used in the first generation of computational economic models about forty years ago, exploited the fact that some existing computational algorithms for solving optimization problems were faster than those for solving large systems of simultaneous equations. A second use of optimization applies when the solution of the system of equations characterizing a water balance has multiple possible solutions; this is essentially the case described above, where optimization is being used primarily to identify a unique solution for a system of equations. Both of these uses of optimization are primarily descriptive rather than prescriptive (also referred to as positive vs. normative) in intent: the goal is to model how a system, characterized by a set of equations, operates. To the extent that the real–world managers of the system do optimize some objective function, the aim is to mimic their behavior by setting up and solving a similar optimization. But, the goal is to model what they actually do, not to advise them what they ought to do. The third use of optimization adopts an explicitly prescriptive goal and sets out to ascertain what managers ought to do if they wished to optimize some objective function (e.g. maximize economic efficiency). While this is certainly a legitimate analytical exercise, it should be kept conceptually distinct from the use of optimization in a purely descriptive context.

1.1 Advantages of Optimization-Driven Simulation

For large, complex, integrated systems, simulation models that optimize operation and allocation of water within each time-step by operational priorities have become the major simulation approach. Models of similar approach include ACRES (Acres Engineering), AQUATOOL (Spain), MODSIM (Colorado State U.), OASIS (Hydrologics, Inc.), WASP (Australia), and WEAP (Tellus Institute). Priority-based simulation models with optimization engines have become widespread in part because:

- The models are simpler to develop, comprehend, and modify.
- Their software is easier to upgrade, since the data set describing the system and its operating policies is substantially separate from the software code.
- Data are easier to update and modify, since changes require little or no software changes.
- Priority-based operations are a common basis for water rights and operating policies.
- Priority-based operations are relatively easy to explain.

The major exception to this technological trend in simulation modeling is to use more traditional procedural operating rules in simulation models with a graphical user interface for primarily flood control operations (HEC-RESSIM) or for exploratory study of large systems or detailed management of relatively small systems (Stella-type models).

Similar to several of these systems, CALSIM II allows specification of objectives and constraints in strategic planning and operations without the need for reprogramming of complex models. The CALSIM II authors developed the English-like WRESL (Water Resources Engineering Simulation Language) as an intuitive means of defining the objective function and constraints for a mixed-integer linear programming model, similar to the OCL (Operational Control Language) used in OASIS and the Policy Editor employed in RiverWare. In MODSIM, the optimization model is formulated directly through the graphical user interface with no need for a modeling language, but with supplemental features of the optimization defined through the PERL scripting language. WRESL allows planners and operators to specify targets, objectives, guidelines, constraints, and their associated priorities, in ways familiar to them. WRESL provides simple text file output that is converted to FORTRAN 90 code by a parser-interpreter program, whereas PERL is fully embedded in the network optimization code. Both modeling systems are data centered, meaning that model operation is controlled solely by user specification of input data rather than hidden rules or hard-wired data structures.

CALSIM II, OASIS, RiverWare and MODSIM are similar in that all use a high level language with syntax and logical operators; are written to simple text files which are subsequently parsed and interpreted; use rule-based or IF-THEN-ELSE conditional structures; are designed to be easy for planners and operators to use without the need for reprogramming; allow adaptive and conditional rules which are dependent on current system state variable information; include constructs for assigning targets, guidelines and constraints, along with their associated priorities; and include a goal seeking capability. CALSIM employs a mixed integer linear programming solver for repeated period by period solution that is less efficient computationally than the network solver employed in MODSIM, ARSP, REALM and Ribasim.

Unfortunately, unlike these aforementioned modeling systems, CALSIM lacks a comprehensive graphical user interface for constructing and editing the river basin system topology. CALSIM II would be greatly enhanced if, similar to RiverWare, IRAS, and MODSIM, objects representing features of the basin such as reservoirs, canals, and river reaches, could be created on the palette of a graphical user interface by simply clicking and dragging various icons for the objects to the display. The objects are instances of various classes that share certain common characteristics, and each object contains its own physical process methods and associated data. We believe that complaints concerning the complexity of using CALSIM II would be greatly reduced with development of such an object-oriented graphical user interface.

2. Comparative Strengths and Weaknesses

2.1 Some Prominent Strengths

CALSIM II has important strengths as a general inter-regional operations planning model, particularly compared with available alternatives and its predecessors. The primary strengths include:

- Coordination of Federal and State Interests A unique aspect of CALSIM II is the high degree of cooperation between Federal (i.e., U.S. Bureau of Reclamation) and State (i.e., California Department of Water Resources) interests in its development. This kind of cooperation is rare, and in fact this may be the only such example of such coordination for a system of this scale and complexity. Although it is clear that DWR staff have taken the greatest degree of responsibility in the planning, development, coding, testing and application of CALSIM II, it is also clear that USBR staff have also played an important role. CALSIM II can provide a showcase for other states as to what can be accomplished with Federal and State cooperation for river basin management.

- Consensus model. CALSIM II is the official joint modeling environment of the State and USBR. This includes a common schematic, hydrologic representation of the system, common set of facility capacities, and common representation of system operating policies. This saves a lot of unproductive bickering and helps all parties improve representations, rather than compete over representations.

- Common effort. The joint development of CALSIM II by USBR and DWR has provided more focused and effective use of resources and expertise than previous development of agency-specific models. CALSIM II development has also involved other agencies and consulting expertise more than pervious models of this system.

- Data-driven model. CALSIM II is a rather data-driven simulation model with an optimization engine. This modeling approach provides:

    a. much greater flexibility than its predecessors and traditional water resources simulation approaches.
    b. a promising framework for improving transparency, data, and model documentation, compared to other approaches.

- Public domain. The model and data are substantially in the public domain, facilitating transparency and adaptability for California's decentralized water system. Ongoing software development efforts will improve CALSIM in this regard.

- Steady improvements. Data improvements have been steadily pursued following the adoption of CALSIM II, although deficiencies remain widespread.

- Improved Delta water quality representation. Although problems appear to remain, the model developers have made substantial gains in representing Delta water quality operating criteria and performance.

- Better groundwater representation. Efforts to better include groundwater and non-CVP-SWP project operations are good efforts in the right direction, and merit continuation and expansion.

- Benchmark Studies. The development of documented benchmark studies seems to have resulted in significant model improvements and aided in the development of comparative model applications. Such exercises should be continued and improved.

- Long-term vision. The vision of a more transparent and publicly available model that can be employed by those outside the major agencies is excellent. This is a major change in direction, and achieving this vision will require adjustments over time. Often, these adjustments will be externally driven. Externally-driven improvements are a price of success and evidence of success for modeling policy that is open and public.

Few, if any, modeling organizations in the country have consistently done as good a job on model development and application for such a large, complex, and controversial system as the modeling group which developed CALSIM II. They are to be commended for their work to take California water modeling beyond past "closed shop" practices in favor of the development and dissemination of modeling capabilities that are more relevant to California's current water management problems. Most areas and suggestions for improvement noted below are meant to aid the model developers in moving further and faster in the direction they are already heading.

2.2 Some Prominent Weaknesses

The strengths and weaknesses of CALSIM II are not only technical (software, data, and methods), but also are institutional regarding how this model has been developed and employed. The administrative setting and objectives of model development and application are important, and difficult to manage. Alas, the management/policy problems of a system change frequently, while data and modeling capability change more slowly, and effective administrative structures change very slowly, if at all.

- Inadequate data development and management are principal shortcomings of CALSIM II. There has not been a sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity, and operational data for CALSIM II. This problem extends beyond inadequate documentation and has led to controversy, confusion, and inefficiency in application of CALSIM II.
    a. Inadequate data management steepens the unavoidably difficult learning curve inherent for a complex system. Data have mostly been considered a "back room" activity of a few experienced experts. Retirement, promotion, or departure of these experts has left many gaps in knowledge and created difficulties for re-developing data for newer policy and planning problems.
    b. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework. Data required by CALSIM II are developed by several administrative units, without systematic technical vision or quality control for modeling purposes. Within DWR, different groups develop hydrologic and water demand data under different Deputy Directors, without effective coordination. This division must be overcome for a coherent data and analytical framework to be developed and implemented.
    c. In many cases it appears that water use and other hydrologic data inputs to CALSIM II are based on data collection and analyses that took place during the 1960s when DWRSIM and PROSIM were being constructed. It is important to ensure that data used for CALSIM II are up-to-date and consistent with the best current information

- The expertise and insights of many in local agencies, system operators, and consulting firms have not been prominent in the development of CALSIM II. For such a system with many hundreds of local experts, this is somewhat unavoidable, especially early in model development. Periodic re-examinations of how each area in CALSIM II is represented, in consultation with local agency and consulting experts, might overcome these technical shortcomings, and create and maintain a broader technical, user, and credibility base for CALSIM II. Active involvement of local agencies in CALSIM II development and applications would be much easier with better data management, and would be rewarded with a broader base of CALSIM II expertise and enhanced model credibility.

- Compared to the current CALSIM II, any central operations planning model for California water management should be:
    a. Expanded in geographic scope to include major non-CVP-SWP areas, especially the Tulare Basin, the Colorado River, and southern California. Operations and demands in these regions seem increasingly important for CVP and SWP operations, and are important for the integrated operations of California's major local and regional water management agencies.
    b. Expanded in management scope to include local management options such as water conservation, reuse, water transfers, groundwater and conjunctive use management, etc. These additional water management options are important for local, regional, and statewide water policy, planning, and management efforts and can have significant effects on CVP and SWP water demands.
    c. Made regionally modular, so smaller regional models can be run independently and tested locally, with boundary conditions consistent with the larger model.
    d. Made modular in terms of hydrologic, water management, and water demand processes, allowing better development, comparison, and updating of hydrologic and water demand process models. Agricultural, urban, environmental, and other water demands should be represented more directly, and explicitly. Groundwater should be represented and operated more explicitly. Land use based local hydrology and water demand approaches might be implemented in such standardized modules.
    e. Subject to a systematic model and data testing regime and continuous quality improvement program. As the problems of California water change, different and greater demands will be placed on analytical capability, requiring an essentially continuous testing, re-testing, and improvement of data and models. This might parallel a continuous review of local representations and data involving local agency and consulting experts.
    f. Financed on a broader base, by more than the CVP and SWP projects. Increasing use of CALSIM II is being made by local, regional, State, and Federal agencies interested in developing bilateral or multi-lateral water transfers or projects, which incidentally involve the CVP and SWP. To develop inter-regional modeling capability needed to integrate these activities at local, regional, and inter-regional scales, more sustained funding and involvement from local and regional agencies is needed. In effect, local and regional agencies have been "free riders" on CALSIM

II's analytical capabilities, and it is not necessarily a good bargain for them. Everyone should benefit from broader technical and financial participation.

g. Capable of analyzing a wide range of scenarios. More capability is needed to examine various long-term scenarios with respect to hydrologic, water demand, and operational uncertainties in the future. There also needs to be a better capacity to accommodate other approaches to representing hydrologic uncertainty and variability besides simply simulating 70-plus years of record.

- Input data and its development. Important aspects of CALSIM II rest upon the representations of other models of Delta hydrodynamics and water quality, water demands, and groundwater. The credibility of CALSIM II also rests on testing these models that send important data/representations to CALSIM II, and documenting them adequately. These models include:
  a. CU Model and SIMETAW: The consumptive use model and the newer SIMETAW model, used to develop hydrologic inputs and estimate return flows, also require testing and more explicit documentation. The underlying data for these models also need more systematic, standardized, and transparent treatment.
  b. DSM2: Representation of the Sacramento-San Joaquin Delta will always be important and prone to controversy, given the prominent importance of Delta flows and water quality for the operation and planning of California's water system. The difficulties of representing the Delta in operations and planning models are compounded by the tidal nature of the Delta, which usually implies a need for shorter time-steps. Representation of Delta water quality constraints currently falls heavily on an ANN method within CALSIM II. This ANN is calibrated (trained) based on a hydrodynamics model, DSM2. Thus, controversies regarding Delta representation in CALSIM II are likely to lead to questions of the adequacy of DSM2. The transparency and testing procedures valuable for establishing the credibility and limitations of a Central Valley operations model would also seem to apply to DSM2, or any other Delta hydrodynamics-water quality model. Tests of methods used to represent small-time step phenomena with larger time-steps (e.g., "partial month standards") should be tested in a forum that would give the approach credibility and where its limits could be developed, discussed, and documented.
  c. CVPM/CALAG/LCPSIM/IWR-MAIN: Representations of water demands in CALSIM II rely heavily on other models, particularly CVPM and eventually CALAG for agricultural water demands and LCPSIM and eventually IWR-MAIN for urban water demands. Thus, these models also will attract attention, and will probably require the same types of testing, transparency, and documentation suggested for DSM2 and CALSIM II. Many water contractors of the CVP and SWP also have internal water sources (groundwater, water conservation, and water reuse) and side contracts with other agencies to supply water that can increase or decrease (at different times) their water demands from the CVP and SWP contracts and from the demands estimated from CALAG and IWR-MAIN types of models.
  d. IGSM /CVGSM: Water users in California rely on groundwater as a water source and as the major source of over-year drought storage. Groundwater is also being increasingly used and looked-towards as a source of storage as part of conjunctive use schemes, and water transfer and market schemes. Thus, representation of

groundwater in the system is important, and probably should be expanded considerably. The representation of groundwater quantities, storage, and recharge and pumping capability will also attract attention from interested and critical parties. Thus, the IGSM/CVGSM modeling efforts of DWR and USBR should include the same types of transparency, documentation, and testing suggested for CALSIM II.

e. Agricultural demands: _Agricultural demands in the model are estimated by an external modeling system (CU model). Staff noted that the estimation methods being used are include out of date information on agricultural cropping patterns and irrigation technology, both of which result in inaccurate estimates of agricultural water demands. This estimation process needs to be revised and updated to include current information on an ongoing basis. The methodology needs to be improved to include economic factors in the estimation of cropping decisions and water demands. In many case, the preferred spatial scale for the economic modeling of agricultural water demand is going to be the individual irrigation district rather than very broad areas containing multiple quite heterogeneous districts.

- CALSIM II is currently awkward to apply for broader State and CVP-SWP policy questions. Practically, the time needed to complete analyses is too long and CALSIM II does not explicitly represent many of the management options which policy makers are interested in investigating, evaluating, and orchestrating.

- More CALSIM II modelers are needed. Many water managers and policy makers across California look to CALSIM II for many purposes, and there is near-universal consensus that the application of CALSIM II is currently limited by a dearth of knowledgeable modelers. Current training by DWR and USBR on CALSIM software is useful, but clearly insufficient. To be a functioning and credible CALSIM II modeler one must understand both CALSIM software and the operational complexities of the system (which probably no one can know in its entirety). Improved model and data documentation is also essential here.

- Stakeholders and policy makers are poorly guided in how to interpret CALSIM II results. Not only must CALSIM II become more responsive to current planning and policy concerns and management options, but current policy makers must receive some education in the benefits and limits of such modeling for their purposes. This is a very difficult problem that will often involve the role assigned to modeling and model results within larger politically-driven policy making processes.

- Non-interpretation of model results is not helpful. Several recent DWR reports based on CALSIM II results have been considerable improvements over past practices in terms of presenting model results, discussion of the model, and examination of model performance in a historical context. However, often the studies have not contained the kind of written discussion and interpretation of results that would demonstrate that the authors have thought about the results and drawn conclusions in a realistic and self-critical manner. This detracts from the perceived credibility of the work and makes the study less informative for readers (most of who surely do not have the modeling background of the authors).

- <u>Some needs exist to improve CALSIM software</u>. These are well-known to the model developers and include:
    a. Elimination of the need for the FORTRAN compiler,
    b. A public-domain mixed integer-linear programming (MIP) solver,
    c. A graphical user interface, including ties to databases and GIS display if possible,
    d. Post-processing tools for users to help new users and broader application and scrutiny of CALSIM II results,
    d. Version control software and system (also a problem for model administration),
    e. Better data and database management software and protocols (this has great data management and administration implications),
    f. An ability to more systematically set objective function weights,
    g. More automated input and output data checking is needed to improve productivity in model application and quality control of modeling output. This would also facilitate use of CALSIM II by a broader range of modelers,
    h. Ability to access and employ sensitivity analysis information coming from the MIP solver to identify possible multiple optima and identify binding constraints and slacks,
    i. A debug version of the code where water can be added or subtracted at any location and time (at a great penalty) to quickly identify locations and times of model infeasibilities. (Prof. J. Lund has had great success with this approach to correcting infeasibilities in the CALVIN model of California for a network flow algorithm.),
    j. Time-step issues should be explored and evaluated comparatively. There are major drawbacks to shortening time-steps system-wide (run-time, data development, interpretability of results, etc.), but short time-step components within the model or other approaches might adequately represent short-period aspects of the system for many purposes.

There will be some who argue that CALSIM II is and should remain a model of only the CVP and SWP system. While this would be simpler administratively and financially, it seems technically and politically untenable. California's water system is being asked to operate in an increasingly integrated manner across local and regional scales, with multiple local water demands, supplies, and aquifers being coordinated with the operations of major aqueduct and storage infrastructure. Any model of the CVP and SWP systems must be responsive to this operational integration, either implicitly through better parameterization of local supplies and demands, or explicitly by widening the geographic and functional scope of the model.

3. Limitations, Uncertainties, and Impediments

3.1 Removal of Unnecessary Ties to DWRSIM and PROSIM

Much of the spatial detail employed in CALSIM II is a carryover from the previous DWRSIM model. This is particularly evident in the coarse delineation of watersheds and sub-areas, which may no longer be relevant for future applications of CALSIM II. It is recommended that all unnecessary ties to the previous DWRSIM and PROSIM models be removed in further development of CALSIM II.

3.2 Relative vs. Absolute Predictions

As noted in the Executive Summary, we are skeptical of the usefulness of the distinction between comparative and absolute predictions. To declare that CALSIM II is intended for comparative predictions and should not be used for absolute predictions is not a helpful or desirable strategy. Rather than embracing this limited view of what CALSIM II can be expected to accomplish, we recommend that model developers recognize the requirement for CALSIM II to provide absolute values. To satisfy this purpose, additional calibration of the model will be required to ensure that it provides a reasonably reliable depiction of how the California water system operates. In addition, data on model accuracy and the outcome of the calibration runs should be made available so that users can gauge the likely errors involved in using the model for their own particular purposes. Some methods for doing this and performing sensitivity and uncertainty analyses are contained in Appendix H.

Model uses should realize that model calibration and validation exercises can illustrate only how well the model can reproduce historical decisions and system behavior. Our ability to predict future policy decisions and the emergency responses to water shortages is clearly limited, thus decreasing the absolute precision of any model's predicted values of various system performance measures. Thus it is useful to distinguish between the ability of the model to reproduce correctly the physical operations of the water systems in California (which should be good), its ability to reproduce and anticipate decisions by the agricultural sector that determine the quantities of water the consume, and its ability to mimic historical and current water operation decisions by the CVP, SWP and other water management agencies.

In general, it appears that the developers of CALSIM II do not have a clear idea of how to define the scope of CALSIM II use and many of the applications are evolving in a reactionary manner. Model developers should identify clearly the desired uses for CALSIM II and then determine acceptable approaches for satisfying those desires. Developers should seek to improve data accuracy and overcome unrealistic assumptions to improve confidence in model results.

3.3 Hydropower

CALSIM II is currently greatly lacking in hydropower computations, which is an important of the federal CVP system. This should include risk-based power capacity evaluation, and possible incorporate the ISM (indexed sequential hydrologic modeling) method that the Bureau has used for many years in hydropower capacity analysis. Also, hydropower should not simply be an after-the-fact calculation, but explicitly included in the system objectives.

3.4 Daily operations

A great challenge awaits the developers as they attempt to adapt CALSIM II to daily operations. These challenges are primarily related to the impacts of routing on distribution of flows and scheduling of reservoir releases. Under the current period-by-period optimization structure over daily time increments, without appropriate consideration of routing there is the danger that the model will allow diversion of upstream flows to lower priority users, resulting in injury to higher priority downstream users in the following days where travel times exceed 1 day. The proper inclusion of routing in the daily operations requires some kind of look-ahead capability in CALSIM II, which is currently lacking. In addition, scheduling of reservoir releases on a daily basis creates difficult timing issues in order to minimize unnecessary downstream spills or shortages caused by routing and attenuation of upstream reservoir releases. Another complexity in moving into daily operations is that reservoir discharges now become head-dependent, whereas this can usually be ignored on a monthly time scale. This means that the maximum reservoir release in any day will be dependent on the head, and should be based on the average head over the day, which introduces the potential for time consuming iterative processes to deal with nonlinear relationships in discharge-head curves for any reservoir.

3.5 Groundwater model

Groundwater has only limited representation in CALSIM II. This resource is modeled as a series of inter-connected lumped-parameter basins. Groundwater pumping, recharge from irrigation, stream-aquifer interaction and inter-basin flow are calculated dynamically by the model.

The purpose of the multi-cell groundwater model is to better represent groundwater levels in the vicinity of the streams to better estimate stream gains and losses to aquifers.

In the Sacramento Valley floor, groundwater is explicitly modeled in CALSIM II using a multiple-cell approach based on DSA boundaries. For the Sacramento Valley, there are a total of 14 groundwater cells.

Currently no multi-cell model has been developed for the San Joaquin Valley. Instead stream-aquifer interaction is estimated from historical stream gage data. These flows are fixed and are not dynamically varied according to stream flows or groundwater elevation.

The approach to modeling groundwater in CALSIM II, a lumped-parameter "tank" model seems to be a reasonable approach. However, few details of this implementation were provided to the review panel, that it is not possible to assess its accuracy or reliability. Details of the calibration and verification activities performed to date should be carried out and reported for the groundwater tank model. The effect of using large size tanks should be assessed and the level of uncertainty in computed results reported. In addition, the effect of these uncertainties on CALSIM II calculations should also be assessed. The San Joaquin valley aquifers are not well represented in the tank model, but it is in the CVGSWM. The San Joaquin valley groundwater should also be modeled in CALSIM II.

Groundwater availability from aquifers is poorly represented in the model. This results from the fact that aquifers in the northern part of the state (Sacramento Valley) have not been investigated regarding storage and recharge characteristics. Thus, in the model, upper bounds on potential pumping from aquifers are undefined. This does not represent reality, since, if CALSIM II is used for statewide planning, it would allow pumping of vast quantities of water for export to southern parts of the state, something which agency staff claim is unrealistic.

Realistic upper bounds to pumping from any of the aquifers represented in the model need to be developed and implemented.

In addition, historical groundwater pumping is used to estimate local groundwater sources in the model. However, the information on the historical pumping is very limited, causing these pumping rates to be very uncertain. Better pumping information is needed and an analysis of the effect of this uncertainty on model results needs to be conducted.

In general, the level of representation of groundwater in CALSIM II is not reasonable from the point of view of the reviewers. This is due to several factors, perhaps the most important being the lack of information presented to the reviewers for their assessment. Another factor is the lack of data collected and analyzed by the State of California to properly account for groundwater resources in the Central Valley. These data are critical to an understanding of the availability of water in the state and the operation of the major water systems that supply water to agriculture and small municipalities in the Central Valley. Assumptions of unlimited groundwater resources in the Sacramento Valley are unfounded and unbelievable. Efforts should be taken to make reasonable estimates of these resources.

There are other approaches that provide reasonably accurate estimates of river-aquifer interactions and groundwater basin response, while not sacrificing computer time. The response function approach is a good example, whereby the CVGSM model is used to develop kernel functions describing this response. A similar approach is described in Fredericks, et al. (1998). These kernels may require readjustment as head conditions change in the basin, but they provide a more accurate prediction tool and are easily incorporated in the MIP model since they apply a linear superposition assumption and retain the linearity of the constraints in the model. A dynamically linked CALSIM-CVGSM configuration is not necessary for reasonably accurate solutions. If computer run time for CALSIM II is considered excessive now, it could only considerably worsen if this type of linkage is incorporated.

Soil moisture is not dealt with in a realistic manner and needs to be improved in applications where the model output might be sensitive to these assumptions.

3.6 Dynamic Variation of Priority Weights

A severe restriction in CALSIM II is the inability to dynamically vary the weights used to prioritize flow allocation in the system. It should not only be possible to dynamically vary these weights, but this variation should be conditional on the current system state, however that state (or states) is defined. In addition to dynamic variation of weights, more explanation is needed of the reservoir operating rules and how these rules are incorporated into CALSIM II. The description of operating rules used in the system is not very clear. For example, what kinds of hedging or shortage rules are used to mitigate the effects of drought?

3.7 Expanding Scope of CALSIM II

CALSIM II is a considerable advance on earlier models in that it fully incorporates both the State Water Project run by the Department of Water Resources and the Central Valley Project operated by the Bureau of Reclamation. However to be able to examine the full range of Californian water issues, it would be desirable that all components of the linked system should be incorporated in the model including the Friant system, the larger Tulare Basin, and southern California and its links to the Colorado River. Also because of the very important linkage between surface water and groundwater use, improvements should be made in this area particularly with regard to how that linkage affects demand for surface water and how access to groundwater reduces the economic impact of surface water restrictions.

When expanding the geographical scope of the model to include non CVP-SWP areas, as well as Southern California, a hierarchical, decomposition approach would allow development of separate models for these areas that can then be linked together through iterative processes. Otherwise, the CALSIM II model can become extremely unwieldy. Again, integration can still be achieved through appropriate iterative interaction between the regional models. In the same vein, it is also unnecessary to explicitly integrate water quality and detailed water demand/consumptive use models into the model structure. Iterative schemes involving successive estimation of water quality and other parameters can produce comparable accuracy at reduced computer run times, while reducing the complexity of the model.

The replacement of DSM2 with a neural network is consistent with reinforcement or machine learning methods which are increasingly being used to replace complex, computationally time consuming models employed in decision support systems. The complex models are only used to provide the data sets used for training the neural network. Current research at Colorado State University and elsewhere is using neural networks for groundwater surface water interaction and return flow computation to replace computationally expensive groundwater models.

3.8 Key Model Outputs

In the past, the primary purpose behind the development of CALSIM II and its predecessors has been the examination of the reliability of water supplied to the State Water and the Central Valley Projects. However it is clear that there is now a demand for a model that will provide a wider range of outputs including:

- Water supply reliability for all water users
- Demand for water by existing users
- Outflows to Delta
- Use of groundwater and the rate of depletion of aquifers
- Water quality in the Delta and in the San Joaquin River
- Indicators of ecological health in particular with regard to key fish species
- The value of hydroelectric generation.

Although the modules in the CALSIM II package currently address many of these areas, the recognition that all these outputs are important may necessitate some further model development and a greater degree of testing and calibration of these parameters.

3.9 Modeling Allocation, Accounting and Operating Rules

CALSIM II uses a system of weights and constraints to define the water allocation process and the operating rules for storage reservoirs. Unfortunately these do not accurately reflect how operators of the state and federal water projects behave in managing their complex systems. Ideally, CALSIM should both reflect how the operators behave and be accepted by them as a useful tool when considering their management alternatives. The failure to achieve this limits the usefulness of CALSIM to investigate the specific operating or accounting rules that are of interest to those operators. For example, CALSIM II was not used to test changes to the accounting and allocation rules that have recently been proposed by the Department of Water Resources and the US Bureau of Reclamation because the rules that were changed do not exist in CALSIM II.

4. Options for Improving CALSIM

4.1 Optimization Model and Run Times

Many of the complaints regarding using of CALSIM II relate to long run times, which is not conducive to sensitivity or uncertainty analyses. Since CALSIM II employs a mixed integer linear programming (MIP) solver, the usual sensitivity information available in linear programming solvers, such as dual variables and right-hand-side ranging, are not available. The problem is that small changes in right-hand-side constants or objective coefficients (i.e., weights on water allocation priorities) can produce large abrupt changes in model solutions. In this case, dual variables do not provide useful information for MIP problems. Sensitivity analysis can only be conducted through trial and error processes involving incremental adjustment of important weights, coefficients, and uncertain data inputs with subsequent repetitive execution of the model. In light of this, it is crucial that the MIP solver employed in CALSIM II is upgraded. Significant advances have been made in MIP solvers, as described by Bixby, et al. (2000), which are not reflected in the current XA solver utilized in CALSIM II. There have been many recent improvements to the branch and bound method which should be incorporated, and the LP solver itself can be improved with better sparse matrix analysis. As planned by the CALSIM II developers, removal of the need for use of the FORTRAN 90 compiler will also improve run times when changes in optimization model structure are required.

4.2 Confidence in the model

The usefulness of a computer model in water resource management is only as good as the confidence that the stakeholders have in the accuracy and reliability of the model and the trust that they have in the modelers. There are several factors that affect that confidence and a number of ways that confidence can be improved.

- **Documentation**

Producing documentation of models requires considerable resources to do properly and ongoing resources to maintain especially when model development is continuing. Typically documentation of any water resource model is poorly done. However, where there are external model users, as is the case with CALSIM II, it is important. The survey conducted by Ferreira et al (2003) indicated that many users of the model thought that documentation of CALSIM II was poor.

- **Seminars**

In the Murray-Darling Basin, seminars with key users and interest groups in which the operation of the model is described and discussed have proved to be useful in increasing confidence in models. The practicality of this approach will depend on the number and location of the prospective participants and the resources available to support the process.

- **Data**

A model can only be as good as the data that is used to develop and calibrate it. The agreement over an acceptable set of hydrologic data that occurred during the development of CALSIM II is a considerable advance. However, there appears to be a need to improve the collection and use of data on water diversions and return flows. Because of the close links between the surface water use and groundwater use there also is a need to have better information on the use of groundwater.

The models used to calculate the Local Water Supplies in the Depletion Study Areas depend on estimates of surface water use, crop evapotranspiration rates and water use efficiencies developed using data from the 1970's. Confidence would be improved if more recent data were available to check these estimates.

- **Calibration**

A very good way to improve confidence in a model is to calibrate it against historical data to ensure that the model output is able to reproduce the observed data. Calibration is the process of using the model to reproduce the historical behavior of the system and then fine-tuning the model so that the match between modeled and observed values improves. The calibration of the model assists in detecting errors in the model and the input data. It also enables a comparison to be made between the way that the operators actually manage the system and the way that the model assumes that the system is managed.

A further consequence of the calibration process is that the statistics of the match between modeled and observed values can be used as a reasonable estimate of the absolute accuracy of the model output.

It is legitimate in a calibration/validation run to incorporate changes to infrastructure, institutional or operational rules as they occurred especially if these changes are specified as input parameters to the model. This was done to a limited extent in the CALSIM II validation run with three regulatory periods modeled related to decisions made by the State Water Resources Control Board. It is also legitimate to incorporate growth in demand especially if that growth is described in a manner that is consistent with the way that demand is specified in the production run. Demand north of the Delta was specified in the validation run by inputting the historical crop areas.

A Calibration/Validation report should be very useful in demonstrating the accuracy of the model. However there are a number of elements in the CALSIM II validation run and the validation report which reduce that confidence including:

- State Water Project (SWP) demands south of the Delta were set at historical deliveries in years with no restriction and at the contractor's request level in restricted years. Neither of these pieces of information is available to a production run which calculates demand based on crop areas. Therefore the validation run does not provide reliable information on how well the model can represent these demands.
- The validation run omitted Article 21 deliveries. Although this omission will not affect the delivery of 'Table A' volumes south of the Delta, it will affect flow in the Delta and Delta water quality. Also, in the example model run presented in the paper by Draper A.J. et al (2003) which was supplied as part of the review, changes to Article 21 deliveries constituted the largest impact resulting from a change to the allowable pumping capacity at Banks between March and December. This suggests that the modeling of these demands is important.
- The DWR (2003) report produces estimates of SWP and Central Valley Project (CVP) deliveries south of the Delta but then adjusts them for changes in storage before presenting comparisons of those results with observed deliveries. This process merely checks that the model is preserving a water balance and does not present a legitimate validation of model deliveries.
- The report provides statistics on long term average deliveries and flows but no statistics on the fit for individual years. Additional analysis of the output would assist stakeholders to assess whether the estimate of water supply reliability and in particular the modeled volumes of water available in the most restricted years are accurate.
- In some instances, such as the examination of water quality in the Delta, the ability to accurately model monthly flows and deliveries will be important. The validation report contains no information that would enable the ability to model monthly flows to be assessed.
- A key model output is the water quality in the Delta. It would assist the validation of the model if a comparison of parameters such as the location of the X2 boundary was provided.

The users of CALSIM should recognize that models are a summary of what one believes to be true and important about a system. Validation is then an exercise to test how good that summary and understanding really is.

Appendix I contains brief descriptions of calibration modeling in the Murray-Darling Basin in Australia and in the State of Texas.

4.3 Assessment of the reliability of "delivered" water

An important recent application of CALSIM II which has drawn widespread attention is the "State Water Project Delivery Reliability Report. While this is an important step forward in the use of CALSIM for policy purposes, it highlights a number of issues, both conceptual and empirical, that need to be resolved in order to provide a more adequate assessment of the reliability of water supply in California.

First, it illustrates the need for sound calibration of CALSIM. The question being asked is not a comparative one – What are the consequences of changing some aspect of the system from X to Y? – but rather an absolute one – How does the system function at present? How often can users expect a shortage in deliveries of Z%?

Second, it highlights the fact any water system model such as CALSIM requires a blend of hydrology and behavioral analysis. To conduct a water balance, the model needs to know what deliveries are required by the customers of the given project, and what are the diversions by other user groups who extract water from the same surface or groundwater sources. These are fundamentally questions of economic and institutional behavior, not matters of hydrology. Therefore they cannot be dealt with by hydrologists alone. Like its predecessors, CALSIM tends to treat these as black boxes. The diversions by water users outside the CVP-SWP are taken as exogenously given, based on an assumed "level of development" and simplistic assumptions about the patterns of water use associated with that level of development. The deliveries required by the water users who are served by CVP-SWP are generally taken as given. For reasons explained below, both of these treatments are simplistic and unsatisfactory.

In CALSIM modeling exercises the level of development plays two different roles depending upon the context. In a simulation context, the level of development is used to represent hydrologic variability and uncertainty; in a calibration/validation context, it is used to reflect the actual historical demand for water withdrawals. These are very different purposes and it is important to keep them distinct. In most applications of CALSIM prior to the recent reliability study, the main focus was simulation and the representation of hydrologic variability. The chief purpose served by using 73 years of adjusted streamflow records was to represent the variability and uncertainty in the streamflow that one can expect to observe in any single year. Therefore, the calendar date of the record has no substantive significance, the (adjusted) streamflows for 1952 or 1982 are not being used to represented what happened historically in 1952 or 1982, but rather as an indication of the variation in streamflow that could be expected to occur next year, or any other year. In this context of simulating hydrologic variability, it makes good sense to apply the *same* level of development (i.e. the same pattern of water use) to every year in the sequence, rather than a series of different levels of development that vary with calendar time, because the streamflows represent alternative hydrologies that can occur in any given year.[1] The situation is different when one is conducting a calibration or validation

[1] This could be modified to allow for the fact that local weather conditions have a significant impact on irrigation (and urban) demands – e.g., farmers plant fewer acres of crops in a drought year. In that case, one could have different levels of water demand and extraction in different year *types;* but, these would all be keyed to the same overall level of economic development (e.g. the California economy in the 1990s). CALSIM II does not presently

exercise. In that case, one wants to represent the historical demands in 1952 or 1982 in order to compare what the model predicts with what actually happened. Therefore, in a calibration or validation exercise one wants the level of development to change each year in order to reflect the demand that occurred historically.

Both simulation and calibration/validation raise some other important technical issues. In the context of simulation, there are several different ways to generate a hydrologic sequence that is calibrated to a fixed level of development. One can use all 73 years for which data are available. One could use a subset of those years chosen either according to some deterministic rule or randomly. The subset could be oriented, for example, towards the extremes of the 73 sequence of annual records. However, the drawback of any approach based on sampling from the observed historical record is that it *understates* the full variability in streamflow that could be experienced in the future. The 73 years of record are drawings from a probability distribution the extremes of which extend beyond the minimum and maximum flows observed in the historical record. Relying on this record, therefore, understates the true minimum and maximum flows that might be encountered. In a reliability assessment exercise, one might want to take some steps to minimize the potential understatement of streamflow uncertainty. This could be accomplished by fitting a (parametric) probability model to the historical streamflow record and then sampling from the tails of the fitted distribution (Stedinger, 1981). The use of statistical models of streamflow variability could be considered in future applications of CALSIM to assess delivery reliability.

The assessment of delivery reliability requires that particular attention be given to the definition and measurement of the water users' demands. In this context, the user's demands play two roles: they affect the definition of "deliveries" and they influence the assessment of "reliability". With respect to deliveries, CALSIM II considers water to be delivered whenever it has the water irrespective of the ability of a contractor to use the water or to store it; The reality is that, if the contractor does not have a demand for the full quantity of water and is not able to store the excess, that amount will not be delivered. Therefore, the calculation of deliveries would be flawed. Furthermore, reliability cannot be assessed without reference to demand. Stating that a water supply system can deliver 100 acre feet in a wet year but only 70 acre feet in a dry year is useful only if one knows what the demands will be in wet and dry years. The implications are quite different if the user needs 105 acre feet per year than if he or she needs 65 acre feet per year. Thus, the users' demands should serve as the norm against which reliability is assessed. Instead, the recent reliability report uses the so-called 'Table A' water amounts as the norm for assessing deliveries to SWP contractors. This does not seem to be a satisfactory approach because there is no presumption that the Table A amounts, negotiated in 1960, measure the actual demands of SWP contractors in any particular year. The actual demands of the individual contractors will be influenced by how much storage they have, what access they have to other surface water or groundwater, and the demands of the farmers they serve to plant crops and apply water. Without accounting for these factors, it is difficult to generate a meaningful assessment of supply reliability.

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consider the impact of annual weather conditions on demands. In order to model water demands accurately in a year, the climate conditions would be linked to the flow conditions to provide an input set for a particular year.

The assessment of reliability should ideally go beyond a comparison with quantities demanded to incorporate the notion of a loss function. If a user has a demand for 100 acre feet and can only receive 90 acre feet in one scenario and 80 acre feet in another, while the shortfall is twice as large in the second scenario the actual *consequences* of the shortfall to the user, in terms of lost profit or higher cost, might be more than twice as large. To assess the economic value of reliability, or the economic cost of a lack of reliability, one needs to be able translate shortages into monetary losses. To accomplish this, the warning time provided and the delivery shortfalls from CALSIM would need to be processed through an economic model of the value of water to different SWP contractors.

Because water users face difference demands and have access to different sources of supply, when assessing reliability it is unhelpful to aggregate all contractors and simply present the results in terms of total annual project deliveries, as was done in the report. Precisely because of the potential non-linearity of the loss function, a given aggregate shortfall can have different consequences when distributed differently among the individual contractors. A similar observation applies to the temporal distribution of delivery shortfalls across the year. It is unhelpful to aggregate supply system deliveries into an annual total, as done in the report. For a user to be able to obtain 100% of his or her demands in the period from March to May but only 60% in the next three-month period from June to August has different consequences than being able to obtain 80% in each of the six months. Furthermore, for both agricultural users and many urban users, major decisions affecting water use have to be made in the spring. They are based on the expectation around March about the amount of water that will subsequently be available for delivery during the summer months. What matters to these users when assessing supply reliability is the amount of water they can expect around March to be delivered over the summer, rather than the ultimate total delivery.

For both reliability assessment and also model calibration/validation, it is important to avoid excessive aggregation when describing shortfalls between demand and supply, or deviations between model predictions and actual outcomes. In regression analysis, it is the convention to measure the goodness of fit of a regression equation not by the average deviation but rather by the sum of the squared deviations. In ordinary least squares regression, by definition the average deviation is always zero (that is to say, the average of the predicted values of the dependent variable always equals the average of the actual values) regardless of how well or badly the regression equation fits the data. The average deviation thus provides *no* information regarding the goodness of fit; by contrast, the sum of squared deviations or the sum of the absolute values of the deviations are sensitive measures of goodness of fit. Although the calibration of CALSIM is not an exercise in least squares regression, the same general principle applies. To judge whether the model is doing a good job, the goodness of fit should be measured by reference to the disaggregate results and not simply by the overall average deviation.

Additional comments on the 2003 CALSIM II Validation Report are contained in Appendix F.

5. Managing CALSIM Development and Applications

The costs of not continuously and substantially improving our analytical capabilities are political (in terms of continued controversy and diminished agency credibility), economic (as inferior system performance for agricultural and urban water users), environmental (in terms of inferior environmental system performance), and financial (lawyers and policy consultants are more expensive than engineers and scientists).

CALSIM II is a substantial improvement over its predecessor models, DWRSIM and PROSIM, with a great deal more flexibility, transparency, and potential than these earlier models. The modeling team for CALSIM has identified an exciting and relevant vision of how modeling should be done for this complex and difficult system in the coming years. However, implementation of this vision in a coherent technical manner that leads to both technical and stakeholder credibility will be a difficult process, requiring financial and institutional support if this kind of capability is to be developed and sustained.

To accomplish these objectives CALSIM II developers need to be in an institutional position where they can see the model more as "outsiders" view it. This would allow them to be more responsive in supporting the credibility of their work and the relevancy of their tools and results to the broad range of current water management problems. As such CALSIM II should no longer be solely responsible to CVP-SWP managers, but should be responsible to a broader range of technical managers from additional interests, reflecting its current and prospective uses.

It would be imprudent to manage a state's finances, a business, or a retirement plan without quantification – quantification in such matters is necessarily imperfect, but necessary nonetheless. While shortcomings have been identified in CALSIM II, it would be similarly irresponsible to manage California's water budget without carefully-interpreted quantification. Progressive and continuous improvement in our quantitative understanding of California's water system provides a common basis for improving its performance for all interests.

One possible means of maintaining control of the quality of particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and persons from other stakeholder organizations if they are interested and want to participate. This consortium would be responsible for maintaining a toolbox of 'acceptable' models for 'official' use by the agencies and contractors.

IMC responsibilities and authority could include:

- Prioritize, coordinate, and provide consistency, technical guidance and oversight for all modeling applications,
- Approve model selection and insure that each requested application is carried out using the most appropriate model(s) and input data,
- Provide or otherwise insure documentation of the modeling process itself as well as the modeling results,

- Insure that the results are expressed and made available in a way such that others can understand and benefit from that modeling application, as applicable.
- Implement peer reviews of models and their applications as deemed appropriate.

To help meet their responsibilities the IMC will need to establish, publish and implement some procedures for insuring the quality of the entire model development and application process. They will need to identify among all the models that might be used, which are the most appropriate to address each of these separate groups of model applications. They must identify various models, i.e., establish a model toolbox, from which clients can choose the one that best meets their needs (or perhaps argue that another model should be added to the toolbox). The IMC will also need to maintain model documentation and provide for peer reviews of any model, its documentation, and/or its use in a project.

Further suggestions and discussion on the creation and operation of a possible IMC for model development and application, as well as for managing peer reviews of both the models and their applications, are contained in Appendix E.

6. Recommendations for Future Use, Development, and Application of CALSIM II

The most concise recommendation we might make would be to fix the shortcomings beginning with what are considered the most serious, and proceeding to those that are less serious, taking into account the time and other resources needed to address each weakness. However, we believe it is more useful to suggest ideas on how to systematically address both present shortcomings and those likely to emerge as stakeholders' quantitative understanding of California's water system and its problems continue to evolve.

6.1 Model development and support consortium

As discussed in the previous section and in Appendix E, it might be useful to explore creation of a broader interagency modeling consortium for developing operations planning models for California. The joint DWR-USBR development strategy used for CALSIM II has shown some notable successes, and should be expanded to include additional parties and sources of expertise. Such a consortium might include staffs from several agencies (DWR and USBR, as well as potential members from MWD, KCWA, CCWD, and other agencies), NGOs, some consultants, and universities. Such a model development forum would:

a. Bring a wider range of expertise to bear on model development problems.
b. Facilitate having more agencies involved in supporting model development with expertise and financial resources.
c. Better enable model developers to see the model as "outsiders" see it.
d. Potentially improve contracting for model development and testing.

e. Take model development and testing outside of the explicit agency framework; a broader consortium should be more conducive to self-critical and transparent technical practices.
f. Provide a common training ground for agency, NGO, and consulting staffs to become effective modelers, broadening the talent base for technical work in California.
g. Reduce impediments to model development and testing arising from current State budgetary and personnel hiring problems.

Many of the questions, concerns, and problems mentioned in the user community interviews could be addressed well in such a distributed model development, testing, and support framework. It would still be necessary for each stakeholder group and agency to maintain its own modeling staff, but these would be partially shared in an interagency modeling consortium.

The governance and finance of such a consortium would be difficult and would probably require a steering committee or governing board, but any resulting model(s) would have broader credibility and a broader and deeper technical base.

In the immediate term, a users' group should be formed and the formal listing of model development activities should be posted on the web, including short descriptions of each development activity and contact information.

6.2 Quality Control Program

The DWR and USBR modeling team (or a broader model development consortium) need an explicit quality control program. Such a program should include a variety of activities:

a. periodic external reviews on the broad modeling program
b. specialized external reviews of model products and applications
c. a standing (or sitting) external technical advisory body
d. software engineering and maintenance
e. a regime of model testing
f. model and data documentation
g. data development and management
h. user group activities
i. local agency and interest involvement
j. model, data, and documentation accessibility (including web site use).
k.

Such a quality control program would benefit from deep consultation with stakeholders and the broad community of water technical people, perhaps via the California Water and Environment Modeling Forum (www.cwemf.org).

6.3 A Training Program

DWR, USBR, and assorted agencies and consultants should establish a more formal common regimen to train new CALSIM II users in both CALSIM software and the complexities of actual system operation. All these groups currently rely on a relatively small pool of perhaps a dozen knowledgeable CALSIM II users and all proclaim a need for many more capable users. A training regimen consisting of current CALSIM II training classes, supplemented by additional training in software application and system operation and apprenticeships or rotations through operations and model development shops would be useful to all concerned. The entire water community would benefit from having such expertise being widespread. Having widespread CALSIM II modeling expertise also makes explaining CALSIM II and its results easier. This might be an appropriate activity for a model development consortium.

6.4 Extend Improvements in Modeling Practice to Supporting Models

CALSIM II is at the center of a web of additional models used by DWR, USBR, and other agencies to prepare inputs for CALSIM II and post-process outputs from CALSIM II.

Delta controversies and difficulties of representation seem endemic to problems of modeling Central Valley operations. The technical basis for representations of Delta operations and water quality performance requires a similar level of transparency and testing to avoid this becoming a "weak link" in the Valley-wide operations planning model. Since so much is based on the DSM2 Delta model, documentation of fairly strenuous tests of the DSM2 model are highly desirable. This would provide a firm foundation for the use of ANN or other approaches for summarizing DSM2 behavior in an operations model. Similar documentation, testing, and development are desirable for the other models mentioned above which provide data for CALSIM II (CVGSM/IGSM, CVPM/CALAG, IWR-MAIN, LCPSIM, CU model, and SIMETAW).

6.5 Hydrologic Data and Data Development

An effort should be made to step back and perhaps re-define a more systematic and solid basis for developing hydrology for water management models of California's inter-tied water system. Currently, several efforts exist to develop surface or groundwater hydrologies for parts of the Central Valley (sponsored by DWR-USBR, USACE-Sacramento District, USEPA, USGS, CALFED, local agencies, etc.). An effort should be made to broaden the range of hydrologic expertise involved in hydrology data development for management modeling of California's inter-tied water system, and establish a consistent and high, but reasonable, standard of documentation and testing for developed data and any underlying hydrologic models. Establishing such a standard of documentation and testing would make existing hydrologic studies more accessible and useful for future studies and encourage the comparison and further development of existing representations of the system's hydrology.

6.7 Performance-Based Optimization

Performance-based optimization should be added to CALSIM's capabilities; it would not be difficult in terms of software or data, and would add much greater ability to explore and seek improvements in management within a complex system. The multi-period optimization approach being developed (CAM) is an operations-oriented first step in this direction, but could be expanded without great difficulty.

For large-scale water resource systems of great complexity and many options for system management, it is often difficult to find "optimal" operations with simulation modeling. There are simply many myriads of decision options and combinations of options, which theoretically each require a simulation model run – which would be prohibitive in terms of analysis cost and time. In such situations, performance-based optimization models, such as those seeking maximum economic performance, can offer useful insights as to where to look for improving system operations and management. Metropolitan Water District of Southern California (MWD) and San Diego County Water Authority (SDCWA) employ performance-based optimization modeling of parts of California's water system to gain strategic insights for planning and management. An economic-engineering optimization model has been developed for California and, despite significant limitations, shows several insights for California (CALVIN), suitable for identifying promising operational and management strategies worthy of more detailed analysis (Jenkins et al. 2001; Draper et al. 2003; Jenkins et al. 2004). The CALSIM II modeling approach could easily be adapted to provide greater functionality to this type of performance optimization. Having performance-based optimization capability together with a compatible simulation model for more detailed analysis and trade-off evaluation could greatly improve the capability of California's water community to explore and develop promising and creative options for improving operations, facilities, and overall system management.

6.8 Modular and Layered Versions of CALSIM II

Speedier versions of CALSIM II are needed for operations planning and integrated water planning studies. Such versions would be regional modules of CALSIM II (for regional studies) or explicitly aggregated system-wide models from the most detailed CALSIM II schematic for system-wide or statewide studies. Both approaches would simplify the model for particular purposes, yet be tied to a common detailed schematic and detailed hydrologic, operations, and water demand data sets.

Geographically modular or aggregated system-wide versions would allow additional local and regional water management options to be represented for particular operations and policy planning purposes and allow users to more quickly explore and develop operating policies. The final runs from such integrated or exploratory studies could then be evaluated using a more detailed and complete version of CALSIM II.

Modular regional models might represent regions with relatively few inter-ties, such as: Sacramento Valley, Delta and eastside streams, San Joaquin Valley, San Francisco Bay Area, Tulare Basin, and Southern California (DWR's South Coast and Colorado River hydrologic regions). (We have had good success with the CALVIN model of California with 5 modular regional models, which combine to form a system-wide model. These geographic sub-models greatly improved quality control in model development, work flow and data checking, and identification of problems in the model.)

6.9 Model Calibration and Testing

Many approaches exist for model calibration and testing (Modeling Forum 2000). Calibrating a planning model oriented to operations in an uncertain and distant future is always challenging. For a model that serves many uses (including policy-urgent uses unforeseen by developers), use-specific testing will often be impossible within a responsive time frame and budget. Such unavoidable situations call for more thorough, general, and well-documented model calibration and testing than would otherwise be needed.

For the model to have technical credibility, stakeholder credibility, and to serve the kind of training and reference function needed for the water management community, a systematic and coherent means of setting parameter values in the model and documenting these values is needed. Similarly, a systematic self-critical means of testing is needed for a model to establish and retain credibility, and have defined limitations, for a range of applications.

A potentially excellent resource for model testing is comparisons of seasonal operations planning CALSIM II model runs with recent years' seasonal operations, as done by actual operators. Similarly, system operators could scrutinize historical simulations, such as those in the recent November report, for systematic differences from operating practice. Such comparison with operator policies and philosophy could also be performed with SWP or CVP delivery reliability estimates. Such comparative analyses would both help define the likely (and unavoidable) differences between actual and modeled operations and water deliveries and identify potential opportunities to narrow such differences.

Credibility arises, in part, from demonstration that problems and limitations are systematically identified and addressed or considered in model development and in making and interpreting model runs. This can be accomplished by use of documentation, metadata, written guidance, and protocols and logs for identifying model problems and recording model improvements.

Given present and anticipated uses of CALSIM II, the model should be calibrated, tested, and documented for "absolute" or non-comparative uses. This is what many applications require today and will be increasingly desired and required in the future. Maintaining the traditional "comparative-only" use of CALSIM II is undesirable if the model is to be useful for the CVP and SWP systems, the operations of water contractors, or for statewide planning purposes.

6.10 Documentation of Model Improvements

Along with better documentation of model versions, logs of data and model improvements and "bug fixes" should be maintained. Explicit protocols and records for identifying and correcting modeling errors and problems would enhance the credibility of the modeling effort with technical people and policy makers. Such protocols also provide an internal aid to staff and staff development in modeling. I understand that this kind of record-keeping is done, but the precise form of, nature, and extent of this record-keeping is unclear. It would be useful and reassuring to stakeholders and policy makers to know that this kind of record-keeping of the software and data was being done.

6.11 Better Model Integration in Decision-Processes and Stakeholder Education

Greater aid should be given to interested parties and decision-makers who must work with the unavoidable limitations of any model. If possible, a document should be prepared for stakeholders and interested parties outlining the model, summarizing the model's primary limitations, and providing guidelines for interpreting model results. Those developing policy-making forums and processes should thoughtfully incorporate computer models in these processes in ways that do not assume model omniscience, or otherwise place too great or exclusive a reliance on model results.

Models and model results will never be perfect. If models are to be important for planning and policy-making, they be must be presented and used in ways that enlighten policy-makers more than they add confusion and controversy to already difficult situations, if possible.

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A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California

Appendices

Appendix A: CALSIM II Science Review

Dates: Nov 13-14th
Location: Bay-Delta Room, CBDA Offices
650 Capitol Mall, 5th Floor
Sacramento, CA

Day 1: The Management Context, Model and Application Details

9:00 Welcome – Kim Taylor
- Overview of the CALFED Bay Delta Program -
- Introduction of the Panel

9:15 Water issues in California – Francis Chung
- General Hydrology
- SWP/CVP
- Operational challenges
- Sacramento-San Joaquin Delta – Ron Ott (5 min.)

9:35 Panel Q&A

9:45 Planning Models – Andy Draper
- CALSIM software
- CALSIM II application overview
- Interaction with other models

10:10 Panel Q&A

10:20 Break

10:30 Summary of CALSIM Applications
- DPLA/CalFed/US Bureau of Reclamation: Integrated Storage Investigations – Steve Roberts
- Bay Delta Office (DWR): SWP Delivery Reliability Report - Kathy Kelly
- USBR: Multi-layered modeling to simulate CVPIA (b)(2) water and Environmental Water Account Operations – Nancy Parker
- Operations Control Office (DWR): Oroville Relicensing, SWP Allocation decision procedure – Curtis Creel
- Department of Planning and Local Assistance (DWR): California Water Plan Update – Kamyar Guivetchi/Ken Kirby

12:15 Panel Q&A

12:30 Lunch

1:15 Summary of User and Stakeholder Interviews
- 1:15 Interview Summary and Findings – UC Davis
- 1:35 Panel Q&A
- 1:50 Public Comment

2:15 CalSim II Details
- Development philosophy – Francis Chung
- Operation priorities, constraints, common assumptions – Erik Reyes
- Hydrology development – Andy Draper
- Delta water quality constraints – Ryan Wilbur

3:15 CalSim Evaluation
- Historical Operations Study / Sensitivity Analysis – Sushil Arora

3:30 Panel Q&A

3:45 Break

4:00 Future Directions
- Data Structure / Version Control / Multi-Period Prescriptive Optimization – Ryan Wilbur
- Daily Time Step - Dan Easton
- CalSim II – CVGSM Integration – Tariq Kadir
- Water Quality / Upstream Models – Nancy Parker

5:00 Panel organizational meeting (additional information needs, questions of specific staff, discussion plan)

Day 2—Panel Deliberations and Preliminary Report

8:30 Panel Q&A with specific DWR and USBR staff on request

9:30 Panel *in camera* discussions

11:00 Panel presentation of draft main findings—Pete Loucks

12:00 Wrap up and next steps - Kim Taylor i

Appendix B: Briefing Material for CALSIM II Peer Review

California Water
Averting a California Water Crisis (3 pages)
California Water Today, Bulletin 160-0, Chapter 2 (20 pages)
Water Supplies, California Water Plan Update, Bulletin 160-98, Chapter 3 (11pages)
Urban, Agricultural and Environmental Water Use, California Water Plan Update, Bulletin 160-98, Chapter 4 (17 pages)
California's Major Water Projects (map) (1 page)

CVP and SWP
State Water Project Operations (6 pages)
Central Valley Project Operations (16 pages)

CalSim and CalSim II Overview
CalSim: A Generalized Model for Reservoir System Analysis (19 pages)

CalSim Software Details
CalSim water resources simulation model: Users guide (18 pages)
CalSim water resources simulation model: Wresl language reference (11 pages)

CalSim II Details
Network Representation (1 page)
Sacramento-San Joaquin Delta Operations (9 pages)
Coordinated Operating Agreement (3 pages)
Reservoir Rule Curves (2 pages)
CalSim ANN Implementation (8 pages)
*CVPIA (b)(2) Management and Operations (6 pages).*ii
EWA Management and Operations (8 pages)
Multi-Cell Groundwater Model (2 pages)
SWP and CVP Delivery Allocation Logic (3 pages)

Hydrology Development
Surface Water Hydrology Development for CalSim II (8 pages)

Supporting Computer Models
Model Interaction (1 page)
CALAG (2 pages)
CU Model (2 pages)
DSM2 (2 pages)
IGSM2 – CVGSM (4 pages)
LCPSIM (5 pages)

CalSim II Evaluation
Planned Sensitivity Analysis (7 pages)
CalSim II Simulation of Historical SWP-CVP Operations - Extracts (61 pages)

CalSim II Applications
CalSim II Project Applications Summary (not completed)
SWP Delivery Reliability Report – Extracts (25 pages)
North of Delta Offstream Storage Investigations (3 pages)
In-Delta Storage Investigations (3 pages)
California Water Plan Update 2003 (3 pages)
*CalSim II and SWP Operations Control Office (1 page).*iii

Future Model Development

(a) CalSim Software
CalSimMulti-period Prescriptive Optimization (not completed)
CalSim Daily Time Step Model (not completed)
CalSim Water Quality Module (not completed)
Data Structure / Version Control (not completed)
CalSim Graphical User Interface (not completed)

(b) CalSim II Applications
CalSim II – CVGSM Integration (not completed)
CalSim II Geographical Expansion (not completed)
Global Climate Change (not completed)
Refined Spatial Resolution (not completed)
Expansion of Land Use Based Demands (not completed)
CalSim II – CALVIN Integration (not completed)
Revision of Urban Water Demands (not completed)

(c) Supporting Models
Replacement of Consumptive Use Model (not completed)

Appendix C: CALSIM II Review Process and Timeline

Establishing the Peer Review Panel

Dr. Pete Loucks (Cornell University and South Florida Water Management District) has accepted the CALFED Science Program's invitation to chair the panel. Other members are being currently being contacted by the Science Program staff

Organization of Briefing Material

Science Program and key agency staff, in consultation with the review panel chair, are identifying and organizing briefing material for panel members. Target date for completion is Sept 1, 2003. (This was extended to December 8, 2003)

Public Meeting of Review Panel

Target: 2-day session in November, 2003 in Sacramento area

Review workshop structure will include:

- Presentation overviews of California hydrology, water management, current issues, and the development of CALSIM II
- Presentations on the range of different current and potential applications of CALSIM for planning, operations, and supply reliability projects
- A summary of an independent interview project by Dr. Jay Lund of users and stakeholders explaining the major questions people are trying to answer with CALSIM II and other models
- Public comment to the panel
- Detail discussion of the model, including assumptions used in different applications, verification studies, and sensitivity analyses
- Opportunity for panel members to ask follow up questions of CALSIM developers and users
- An in camera session for panelists to discuss and begin compiling review comments
- A public presentation of the panel's draft findings

Panel Chair Provides Final Report to CALFED Lead Scientist

The panelists will be asked to finalize their review comments within 3 weeks of the public meeting and to transmit those directly to the Lead Scientist. The Science Program will transmit the completed review to CBDA and the CALFED community.

Appendix D: Panelists CALSIM II Review, Nov. 13-14, 2003

Name	Affiliation	Position	Address/Phone/E-mail
Andy Close	Murray Darling Basin Commission	Lead Modeler and System Manager	GPO Box 409 Canberra ACT 2601, AUSTRALIA (02)62790102 andy.close@mdbc.gov.au
Michael Haneman	UC Berkeley	"Senior Economist, Professor"	327 Giannini Hall, Berkeley, CA 94720-3310 (510)642-2670 hanemann@are.berkeley.edu
John Labadie	Colorado State University	Professor	B211 Engineering, Fort Collins, CO 80523 (970)491-6898 John.Labadie@colostate.edu
Pete Loucks	Cornell University	Professor	"Civil and Environmental Engineering, 311 Hollister Hall, Ithaca, NY 14853 " (607) 255-4896 DPL3@cornell.edu
Jay Lund	UC Davis	Professor	Civil and Environmental Engineering 3109 Engineering III, Davis, CA 95616" (530)752-5671 jrlund@ucdavis.edu
Daene McKinney	University of Texas at Austin	Professor	Civil and Environmental Engineering Campus Mail Code: C1786, Austin, TX 78712 (512)471-8772 daene_mckinney@mail.utexas.edu
Jery Stedinger	Cornell University	Professor	Civil and Environmental Engineering, Hollister Hall, Ithaca, NY 14853 (607) 255 2351 JRS5@Cornell.edu

Appendix E: Managing Model Development, Application, Documentation and Communication.

One possible means of maintaining control of the quality of particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and persons from other stakeholder organizations, including NGOs and universities, if they are interested and want to participate. This consortium would be responsible for maintaining a toolbox of 'acceptable' models for 'official' use by the agencies and contractors.

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- Approve model selection and insure that each requested application is carried out using the most appropriate model(s) and input data,
- Provide or otherwise insure documentation of the modeling process itself as well as the modeling results,
- Insure that the results are expressed and made available in a way such that others can understand and benefit from that modeling application, as applicable.
- Implement peer reviews of models and their applications as deemed appropriate.

To help meet their responsibilities the IMC will need to establish, publish and implement some procedures for insuring the quality of the entire model development and application process. They will need to identify among all the models that might be used, which are the most appropriate to address each of these separate groups of model applications. They must identify various models, i.e., establish a model toolbox, from which clients can choose the one that best meets their needs (or perhaps argue that another model should be added to the toolbox). The IMC will also need to maintain model documentation and provide for peer reviews of any model, its documentation, and/or its use in a project.

CMM Level 3 Performance Expectations

Firms that develop professional software are typically required to meet certain software standards. One such standard is defined in a book from Carnegie Mellon University. These so called Capability Maturity Model (CMM 1994) standards have various levels. For example, the South Florida Water Management District, that develops hydrologic models used as inputs to major investment decisions, strives to meet Level 3 standards. To meet such standards in software development and peer review, one needs to show that

- Modeling related problems are anticipated and prevented

- Model development and application groups work together as an integrated product team.
- Model use training is planned and provided as is needed.
- New modeling methodologies are identified and evaluated for possible implementation on a qualitative basis.
- Data are collected and used in all defined processes.
- Data are systematically shared across various projects.
- Both the models and their applications are evaluated and judged satisfactory by independent reviewers.

It seems to this panel that CALFED could without too much difficulty meet such standards if it chose to. Clearly planning for, conducting, and documenting these activities will require additional time and money. The expectation is that in the long run, such documentation and review will save time and money by redirecting misguided initiatives, identifying alternative approaches, or providing valuable technical support for a potentially controversial decision.

Model Toolbox

The IMC in collaboration with all agencies involved in water resources planning could be responsible for creating and maintaining a collection of models that agencies can use to meet their needs. As shown in Figure 1, this collection of models might be called the model toolbox. The criteria to be used as a basis for deciding whether a proposed model should or should not be included in the toolbox will depend in part on an assessment of the attributes of that model compared to alternative models and the suitability of the model to meet the needs of the project. Associated with the model toolbox is a library of completed model application documents and data bases for use by anyone who could benefit from them.

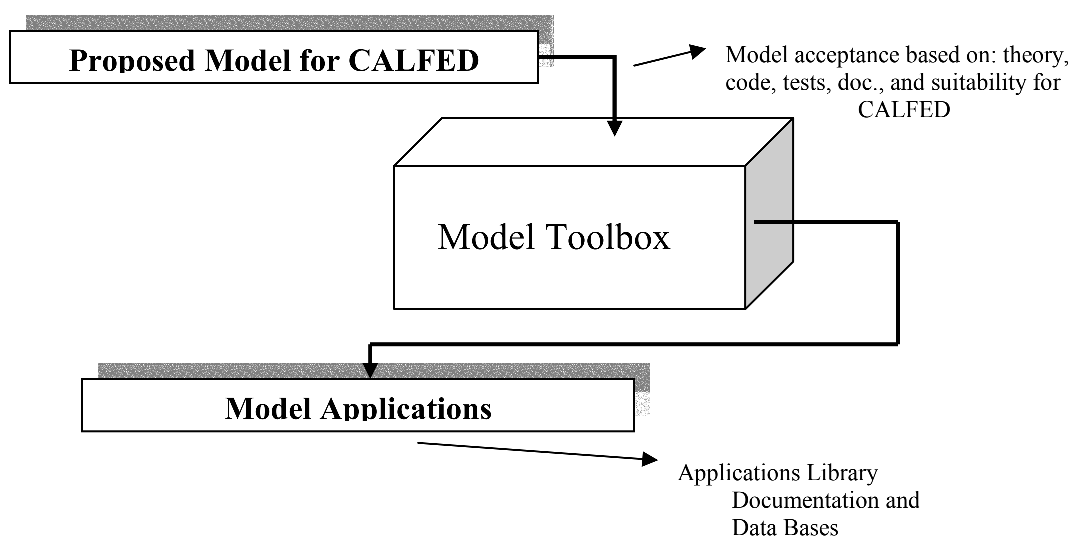

Figure 1. Model Toolbox consisting of approved models for use and Applications Library consisting of documentation and model data bases.

Everyone would agree that all modeling applications should be performed with the 'best' models available. But 'best' does not mean that all models used should be the most detailed, complex, realistic and thus usually the most expensive models available. The decision regarding the 'best' or most appropriate model should be based on the particular issues or questions being addressed, on the quantity and quality of the available input data, and on the time, personnel, and money available to perform the modeling application. The central question to be answered before initiating any modeling application is just what model output information (and precision) is needed to meet the needs of the decision making process. Expressed in other words, just how sensitive will the decision be to the type, amount and precision of the model output?

IMC in consultation with the other agencies could provide guidance on the adequacy of a particular version of CALSIM II or other associated model requested by each client with respect to the theory upon which it is based, its data requirements, its spatial and temporal resolutions, its documentation and status with respect to peer reviews, its capabilities, and its limitations. Similar considerations must be given to the proposed input data. To provide these services to each client requesting services from the IMC would require IMC to be staffed with personnel acquainted with the models in the toolbox, as well as be able to perform or review the simulations requested by various agencies.

There will likely be requests to use models not yet included in the model toolbox. IMC together with others from the DWR and/or USBR will need to judge the merits of such requests and if deemed beneficial, consider including such models in the toolbox. Undoubtedly the extent and quality of the documentation, testing, and peer review of various models in the toolbox will vary. However, a model's inclusion in the toolbox should signify that the model has been judged to be the best available for meeting the goals for which it was designed and is applicable to conditions in California.

Information Flows and Documentation

The IMC will probably be devoting a substantial amount of time giving guidance to clients and, when applicable, to the public. They will need to be working with the clients who are requesting model applications, and in situations where they are not doing this work, they will need to be reviewing and approving the work of the agencies or contractors who are performing the modeling services. IMC would provide technical assistance as well as oversight and coordination among all CALSIM II modeling activities.

Requests for modeling are easy to make, and time and money are required to carry them out. Requests sent to this proposed IMC should reflect some thought by those requesting such model runs as to just why the model application is desired, and just how the results are to be used. We would propose that requests include such items as:

- Reason for modeling,

- Type of modeling (e.g., event based or continuous),
- Particular model preference if any, and why, and possible alternatives,
- Model output information (data) needed and why and when it is needed,
    - What questions are the model results going to answer?
    - What issues are being studied?
    - What decisions are to be made, or at least to be informed, based on these model results?
    - When are the model results needed?
    - What formats are desired for presenting the model results?
- Location or site being modeled and the spatial and temporal scales desired,
- Particular input data assumptions, boundary conditions and other regional assumptions required,
- Source of input data, and format required or desired for the output data,
- Model calibration and verification needs and preferred procedures if any,
- Money and time available for modeling,
- Extent (duration) of the simulations to be performed,
- Desired performance measures, other than variables being simulated, if any,
- Alternative scenarios to be modeled (i.e., number of simulation runs needed),
- Other analyses or model applications that may or will need the output from this model application,
- Sensitivity and uncertainty analyses needed, and for which decision variables and why,
- Client contact person,
- Requirements for intermediate reviews of results or needs for periodic review of modeling application process logs and documents, and
- Other particular requirements or needs.

The use of a model nearly always takes place within a broader context. The model itself can also be part of a larger whole, such as a network of models in which some are using the outputs of other models. These conditions may impose constraints on the simulation modeling project. All these considerations need to be specified in the modeling application request.

Along with the proposal, there should also be a simple order-of-magnitude estimate of the expected values of all relevant decision variables based on simple mass-balance analytical solution methods that can be used without requiring a computer. These estimated values should be used to validate (check the reasonableness of) selected portions of the model runs. If there are any serious discrepancies, it may signify a major problem in the model output.

Is all this paperwork useful? It is to the extent it leads to a more effective and efficient use of personnel, money and time. Preparing a formal modeling application request requires some serious thought as to just why this is necessary and just what information is needed to further the project or analysis. It involves defining the objectives that are to be accomplished. Writing this down in some detail helps reduce the differences in perception that can exist between those who need information and those who are going to provide that information (IMC or a contractor). The problem as stated is often not the problem as understood, by either the client or the model user. In addition, problem perceptions and modeling objectives can change over the duration of a project. One should ask and answer the question of whether or not modeling in general is the right way to obtain the needed information. What are the alternatives to modeling?

The objective of any modeling project should be clearly understood with respect to the domain and the problem area, the reason for using a particular model, the questions to be answered by the model, the model assumptions and limitations, and the scenarios to be modeled. Throughout the project these objective components should be checked to see if any have changed and if they are being met.

If IMC is to serve as a central point to coordinate CALSIM II-related modeling activities, and to provide modeling services, it needs to have the authority to do so. This authority extends to giving advice on issues related to model and input data selection, and for reviewing, approving and prioritizing requests for services. Should contractors be involved in particular model applications, IMC must be authorized to specify the technical terms to be met and oversee the work done by the contractor. Finally IMC will need the financial and human resources needed to do this in a timely manner.

Modeling Application Documentation

One common problem of model studies once they are underway occurs when one wishes to go back over a series of simulation results to see what was changed or why a particular simulation was made or what was learned. It is also commonly difficult if not impossible for third parties to continue from the point at which any previous modeling project was terminated, especially if some time has passed. These problems are caused by a lack of information on how the study was carried out. What was the pattern of thought that took place? Which actions and activities were carried out? Who carried out what work and why? What choices were made? How reliable are the end results? These questions should be answerable if a model journal is kept. Just like computer programming documentation, modeling project documentation is often neglected under the pressure of time and perhaps because writing it is not as interesting as running the models themselves.

The paper trail of what has happened, what assumptions have been made, how calibration and verification were carried out, what results were obtained, why changes, if any, were made, what sensitivity analysis procedures were used and their results, and so on, could be contained in a modeling application documentation (MAD). Once the model application is completed, a copy of the MAD should be given to the requesting agency, as applicable and a copy should remain in IMC. These reports, or at least a summary of them, should be available for downloading from the web. Should further model applications be requested and approved, the requester as well as the IMC can refer to this previously prepared documentation to better understand what was done previously that pertains to the current request.

Model Calibration

Once a model is tested satisfactorily, it can be calibrated. Calibration of models such as CALSIM II are difficult because there are no historical observations of future scenarios to compare with model results. Historical runs, such as have been made, can provide some basis for calibration. In general the smaller the deviation between the calculated model results and the field observations, the better the model. This is true to a certain extent, as the deviations in a perfect model are only due to measurement errors. In practice, however, a good fit is by no means a guarantee of a good model.

The deviations between the model results and the field observations can be due to a number of factors. These factors include possible software errors, inappropriate modeling assumptions such as the (conscious) simplification of complex structures, neglecting certain processes, errors in the mathematical description or in the numerical method applied, inappropriate parameter values, errors in input data and boundary conditions, and measurement errors in the field observations.

To determine whether or not a calibrated model is a 'good' predictor, it should be validated or verified. Calibrated models should be able to reproduce field observations not used in calibration. Validation can be carried out for calibrated models if an independent data set has been kept aside for this purpose. If all available data are used in the calibration process in order to arrive at the best possible results, validation will not be possible. A decision to leave out validation may be a justifiable one especially when data are limited.

Philosophically it is impossible to know if a simulation model of a complex system is 'correct'. There is no way to prove it. Experimenting with a model, such as by carrying out multiple validation tests, can increase confidence in that model. After a sufficient number of successful tests, one might be willing to state that the model is 'good enough', based on the modeling project requirements. The model can then be regarded as having been validated, at least for the ranges of input data and field observations used in the validation.

If model predictions are to be made for situations or conditions for which the model has been validated, there may be some confidence in the reliability of those predictions. Yet one cannot be certain. Much less confidence can be placed on model predictions for conditions outside the range for which the model was validated.

While a model should not be used for extrapolations as commonly applied in predictions and in scenario analyses, this is often exactly the reason for the modeling project. What is likely to happen given events we have not yet experienced? A model's answer to this question should also include the uncertainties attached to these predictions. Depending on the type of model selected and used, one might end up predicting an incorrect future with great accuracy, or predicting the correct future with great uncertainty'. We don't yet know how to predict the correct future with great accuracy – so we do 'what ifs'. One can then argue about what scenarios – the ifs – are the most reasonable or probable, or about the impacts from improbable scenarios that you want to avoid should such scenarios occur.

Use the model

Once the model has been judged 'good enough,' the model may be used to obtain the information desired. Close communication between the client and the modeler during the modeling application process is essential to avoid any unnecessary misunderstandings about what information is wanted and the assumptions on which that information is to be based.

Before the end of this model-use step one should determine whether all the necessary simulations have been performed and whether they have been performed well. Questions to ask include

- did the model fulfill its purpose?
- are the results valid?
- are the quality requirements met?
- was the discretization of space and time chosen well?
- was the choice of the model restrictions correct?
- was the correct model and/or model program chosen?
- was the numerical approach appropriate?
- was the implementation performed correctly?
- what are the sensitive parameters (and other factors)?
- was an uncertainty analysis performed?

If any of the answers to these questions is no, then the situation should be corrected. If it cannot, the reason(s) for why it cannot be corrected should be documented in the model application document (MAD).

Interpret model results

Interpreting the information resulting from models is a crucial step in the modeling application process, especially in situations in which the client may only be interested in those results and not the way they were obtained. The model results can be compared to those of other similar studies. Are the results consistent? IMC must make that judgment. Any unanticipated results should be discussed and explained. The results should be judged with respect to the modeling project objectives.

The results of any modeling project typically include large files of time-series data. Only the most dedicated of clients will want to read those files. Thus these data must be presented in a more concise form. Statistical summaries should explicitly include any restrictions and uncertainties in the results. They should identify any gaps in the domain knowledge, thus generating new research questions or identifying the need for more field observations and measurements.

Report model results

Once the modeling application is completed, the organization doing the modeling will be responsible for preparing a report. The contents of this report should conform to the agreement made between modeling organization and the client prior to the initiation of the modeling application (see above). Although the results of a model are very rarely used as the sole basis for policy decisions, those requesting model applications may have a responsibility to translate their model results into policy recommendations. Policymakers, managers, and indeed the participating stakeholders typically want simple and clear unambiguous answers to complex questions. Much of the scientifically justified discussion, say regarding the uncertainties associated with some of the data, included in the main body of a report are not included in the executive summary of that report. This executive summary is often the only part read by those responsible for making decisions. Therefore, the conclusions of the model study must not only be scientifically correct, but also concisely formulated, without jargon, and fully understandable by managers and policymakers. When preparing or reviewing contractor model results reports, the IMC should consider this need.

These model application and model results reports should include sufficient detail to allow others to reproduce the model study (including its results) and/or to proceed from the point where this study ended. The report therefore requires a clear indication of the validity, usability and any restrictions of the model results.

Data Management

CALSIM II and its associated or linked models will require data. They will also produce data. Many of these data will have spatial and temporal dimensions. This information must be documented (meta data), preserved, and made accessible to IMC customers, coordination agencies and others. IMC should participate in data management strategic development, storage, documentation and dissemination. It should work with data base managers of various agencies to help them satisfy the IMC's data management requirements.

The availability of quality assured data is a critical dependency that must be met to facilitate timely completion of model development, implementation and application. To mitigate the impact of the availability of data on the timeline for the major model completion deadlines, the following issues should be addressed. :

- Updating land use / land cover data at regular and timely intervals.
- Developing and maintaining a common modeling database. This data base should include infrastructure design and operating policy data as well as water quality, ecological, land use, economic and of course hydrological data. Many of these data sets will have spatial as well as temporal dimensions. Each data set should have an associated metadata file.
- Pre-processed and post-processed datasets from previous model runs should be archived along with its metadata file in a central location for ease of access and availability.
- Measures to insure the consistency and quality of the input data.
- Measures to insure adequate communication among model developers, users and stakeholders. This includes measures to assist in developing documentation appropriate for each type of stakeholder.

Support of IMC activities

Common failures of IMC type organizations are typically due to:

- Insufficient staff to enable cross-training. This may lead to the dependency on one person or a very small group of employees for each sub module or the overall effort.
- Inadequate funding to institute good project management discipline.
- Inadequate funding to contract for technical writers and software engineers.
- Inadequate funding to contract for peer reviews.

Risk assessments

A risk assessment of CALSIM II and its associated models and data should be completed. The timely availability of quality assured data for example, is a risk. Project risk management includes the processes concerned with identifying, analyzing, and responding to uncertainties. Risk management attempts to minimize the results of adverse events. As a guide, the template, such as shown at the end of this Appendix, may be used to facilitate the assessment of risks.

Problem Management

Given the high visibility and criticality of the CALSIM II modeling effort an issue or problem management process should be developed within IMC. Issue/problem management includes the process for identifying, communicating, and resolving issues and problems.

The purpose of this procedure is to ensure that:

- Issues are identified, reported, managed, and resolved in a timely and effective manner. Responsibility is assigned to an owner for reporting, managing and resolving each issue
- All affected stakeholders are aware of the status of the issues
- Escalation of unresolved issues take place according to a defined procedure

In order to ensure that project issues and problems are appropriately managed various issue/problem management steps should be identified and followed to track the actions taken to resolve the issue or problem throughout the life of a modeling project.

B. Managing Peer Reviews

One means of quality control involves peer reviews of the models, their associated software, and their applications. One possible means of facilitating the peer review processes and for maintaining control on the particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is another reason to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and other stakeholder organization personnel if they are interested and want to participate. As suggested above, this consortium could be responsible for maintaining a toolbox of 'acceptable' peer-reviewed models for use by the agencies and contractors. The peer reviews should be of the theory underlying each model, the model's software, the documentation of that software, the model's functions and capabilities including those pertaining to model data input and output, model calibration and verification, sensitivity analyses, uncertainty analyses, user control (GUIs), spatial and temporal resolutions, limiting assumptions, and on the model (as opposed to code) documentation.

Just having evidence of published articles about a particular model in peer reviewed journals is not a substitute for a peer review of the model software and its applicability or suitability for certain types of analyses for SWP-CVP. Peer reviews of all models, their software, and their use should be accomplished by experts both within and outside of the originating agencies. 'Inside' agency (or internal) reviews may uncover some needed changes and identify other issues or problems that external reviewers could be asked to specifically examine and address. Internal reviews can make the external review process more effective, less costly and less time consuming.

Peer reviews are considered a key process area for Level 3 and higher of the Capability Maturity Model guidelines for improving the software process (Carnegie Mellon University, 1994). The purpose of peer review evaluations is to find defects in the model formulation and software and in its use, i.e., model application. Peer reviewers can also identify possible ways of correcting those defects, if any. If there are no defects, or after all known defects have been corrected, both the developers and users of any model and its software can have a stronger basis for believing that their product and its output are reliable.

Peer reviews serve the same function as accountants. Once a firm's financial records have been peer reviewed by accountants (assuming they are qualified, objective and honest) the board of directors as well as the stockholders will have more assurance of the liabilities and net worth of their firm, and just how well it is being managed. In this case it is the assurance of the quality of the models, their software, and on their use in project evaluations, that actual and potential users of the model results depend upon.

The types of problems and issues for which a model, its software, and its documentation are designed to address are called the model's 'application niche'. Peer review of model development should include the evaluation of the intended application niche along with consideration of other aspects of model performance. Users of any model should be aware of the types of analyses for which the model is best suited and those for which the model is not well suited. This, along with the results of a peer review of any model application, should help the potential model user, or the user of the model results, better understand the limitations of the scientific basis of the model and just how much confidence can be placed on the model output.

Peer review triggers

Clearly judgment will have to be exercised as to just when and in what detail a peer review needs to be implemented. However the triggers on when a decision about a peer review needs to be made can be defined.

As shown in Figure 2, decisions regarding peer review are needed when models are proposed for the tool box and when model applications are completed. Should IMC decide a peer review is warranted when either of those events takes place, they will have to decide on the type of review and its level of detail. They will also need to identify the individuals to be asked to carry out that peer review.

Peer reviews are going to take time and cost money. They will also require IMC time to prepare the documentation needed for the peer reviewers and to read and act on reports prepared by the peer reviewers. This will apply if the peer review is internal or external.

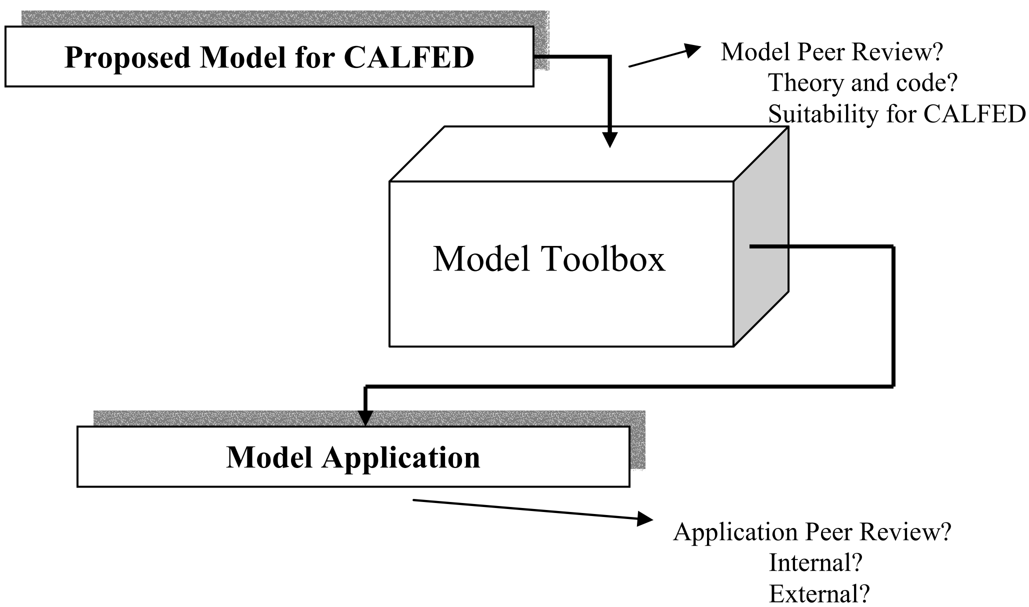

Figure 2. Schematic showing events where a peer review decision can be made.

The particular models and their associated software and documentation to be peer reviewed should be identified by the individuals or departments or agencies. This can include model process descriptions, software source code, documents, test results, and other supporting materials, as needed, for an adequate peer review of the entire model and its software. These products to be reviewed should be identified in writing and a written history of the review of different versions of each item should be maintained.

Events that take place in the progression of model development and use and subsequent modifications that warrant a peer review should be identified and specified in a written document. (This fits in to the model development and use documentation that should be maintained for Level 3 or higher CMM) When these events take place a peer review process should be considered, and if warranted, implemented. Depending on the event, the review can be solely internal, or it can involve an independent external review team as well.

Model application reviews should include an evaluation of the intended model application niche, and its applicability to current needs. Peer review may be appropriate for existing models when new information becomes available that could negate some or all of the conclusions of previous reviews or suggest a change in the currently specified application niche. Peer review of a model's applicability to a particular study should be planned well in advance of when model results are needed. The results of application reviews can influence the decisions made based on the model outputs. Once a peer review has been conducted for a particular model and its input data, peer reviews of subsequent applications of a model with similar inputs might be unnecessary. However, any time the model results may be controversial, or end up in litigation, another peer review may be justified.

Peer Review Process

The extent and process of performing and responding to peer reviews can vary in any organization. The ones discussed in this section attempt to follow the processes recommended by the Capability Maturity Model Level 3 guidelines.

Project peer review process should be specified in writing. A first step in this process should be to identify the particular modeling products and processes that will undergo peer review. This includes the models (i.e. the processes being modeled and the assumptions built into the models for describing these processes), their supporting software, the documentation of the model and its software, as well as all the written guidelines on how the models are to be used.

A second step is to perform an internal peer review prior to a model's use for project evaluation. It should be peer reviewed for accuracy, its suitability for use, and for identifying any possible errors in its logic, its coding, or in its documentation. Following an internal review, an external peer review can be performed.

Following the successful conclusion of internal and external peer reviews of a model and its documentation, the model can be applied to evaluate alternative projects. After the model has been applied to a particular project, the modeling process and its results should be peer reviewed to insure that the model has been applied properly, that the input data were appropriate, and that the conclusions drawn were valid.

Peer review teams should be selected, along with a peer review team leader. The particular personnel on the team will depend on the particular model and its software and documentation being reviewed. CALFED should have a list of qualified peer reviewers representing all applicable disciplines, both internal and external, that it can call upon to perform these reviews. The peer reviews are to be of the models and their use, not of the people who developed or used them. The reviews are to be used to evaluate the quality of modeling products and processes, not of the personnel involved.

Establishing and carrying out ongoing peer review processes costs money. Adequate funding must be made available to

1. identify and recruit a peer review team and team leader
2. prepare and distribute the peer review materials to the peer review team
3. support the time required for the team to review the materials prior to a team meeting
4. support the team meeting and to participate in it as appropriate (e.g., answering questions, conducting model experiments and sensitivity analyses, etc.)
5. reproduce and distribute the team report and to take actions as needed
6. monitor the modifications or changes being made to the model, its software, and its documentation, or redoing the model application, as needed.
7. prepare and distribute to model developers and potential users a report on the results of the peer review and the actions taken.

The particular peer review process may depend on just what is being peer reviewed and the resources and time available to perform the review. In general, however, the steps of a peer review could include the following:

1. DWR or CALFED should identify and establish a pool of possible reviewers representing various disciplines, with sufficient redundancy to allow for scheduling conflicts when ever some subset of those reviewers are needed. This includes both internal as well as external reviewers. What ever administrative work is need to establish this pool should be completed prior to when these reviewers will be needed.

2. At particular milestones in any new model development or in model application an internal peer review process could be initiated, to examine the modeling assumptions, the software that implements those assumptions in the case of model development or the data being used for model inputs in the case of model applications, and the documentation being prepared to describe the processes, to document the software code, and to document the tests that were run to test the code, or to document the results of the model application. If deemed appropriate, an external peer review could also be performed. If an external review is to take place, the particular reviewers need to be selected, notified, sent supporting documents, and be scheduled for one or more meetings, as needed. They should be issued contracts specifying the requirements (the checklist of items to be reviewed) and products expected.

3. Recommendations made by the peer review team need to be addressed and the actions taken along with the rationale for those actions should be documented.

4. The peer review team should review the actions taken and the results obtained from these actions. If not judged acceptable new recommendations should be made and submitted. A final report should be prepared by the peer review team when all recommendations have been successfully implemented or addressed, or if no further actions based on review team's recommendations will be taken by the model developers or users.

The time and effort required for various levels of review should also be assessed and provided to the review team so that they can carry out the level of review requested of them. Otherwise the reviews may be superficial and while appearing to be peer reviewed, a model and its associated products may in fact be inadequately reviewed. Peer review teams have the responsibility to specify in writing the scope and limitations of their reviews.

As was the case for this peer review panel, the materials to be sent to the review team to allow them to prepare for their meeting should include the statement of review objectives and the level of detail desired, the applicable requirements and standards upon which to judge the adequacy of the products being reviewed, and of course the material that is to be reviewed. There should be a list of questions for the reviewers to address. Each review team member should be assigned and given responsibility for answering specific questions and for completing specific aspects of the overall review. All team members should be given specific review standards or requirements, including the expected completion dates. Checklists should be provided the review team that are applicable to the specific type of product being reviewed and the level of detail to be examined. These checklists will contain the criteria for judging the product, such as compliance with any standards and procedures, completeness, correctness, rules of construction, and maintainability.

Peer Review Issues and Questions

Each model development or application review will dictate its own special set of questions to be addressed. Some of these questions could relate to:

- Model Purpose and Objective
  - Use of model related to decisions being considered.
  - Model application niche, and why.
  - Model strengths and weaknesses –is it the best model?
- Model Processes and Limitations
  - Model processes, spatial and temporal scales, grid resolution.
  - Model variables and level of aggregation.
- Model Theoretical Basis
  - Model algorithms, numerical or analytical methods,
  - Model process formulation
  - Modeling approach in comparison with other models
  - Any shortcomings in relation to application niche
- Model Parameter Estimation
  - Methods used
  - Data available for parameter estimation
  - Parameter estimate reliabilities
  - Boundary conditions and appropriateness.
- Model Input Data Quantity/Quality
  - Data used in design of model
  - Data adequacy (quantity, quality, resolution) for model purpose and application
  - Data necessary for application of model
  - Key data gaps in model application
  - Additional data needs and why
- Model Key Assumptions
  - Basis for major assumptions

    - Sensitivity of model outputs to key assumptions
    - Sensitivity of potential decisions to key assumptions
    - Ease in modifying key assumptions
- Model Performance Measures
    - Criteria for assessing model performance
    - Correspondence of model output with measured observed data
    - Any model bias throughout range of model predictions
    - Variability and uncertainty analyses and representations in model results
    - What determines model's variability and uncertainty.
    - Model performance relative to others in application niche
- Model Documentation and User's Guide
    - Clarity of documentation, comprehensiveness of user's guide
    - Model applicability and limitations
    - Input data requirements for calibration, verification, model runs
    - Post modeling analyses, display and interpretation of results
    - Model code documentation
    - Model application documentation examples for prospective users.
- Review Retrospective
    - How well model and its application meet objectives and needs of project
    - Possible changes in the model to improve model performance
    - Robustness of model solutions to small changes in uncertain parameters, etc.
    - Ease of including uncertainty analyses associated with uncertain input data.
    - Key research needs for model improvement.

Peer Review Completion Reports

Procedures need to be established to track and confirm actions based on suggested changes or modifications in the material being reviewed. Once these actions are taken and completed, and documented, the peer review process for that particular product is completed. Peer review completion reports should contain data on what was reviewed and the results of the review. These data should include a description of the products that were reviewed, the level of detail of the review, any review limitations or qualifications, the number and backgrounds of the reviewers, the time spent preparing for and during review team meetings, the defects found and recommendations made, and the actions taken to address these recommendations.

Overall Peer Review Evaluations

The IMC or initiating agency should document the planning for and scheduling of peer reviews. The products to be reviewed and the level of detail to be examined also need to be specified. The procedures to be followed for selecting peer review team members, and the team leader, should also be determined and documented. Procedures for training potential reviewers, if such training is needed, should be identified and implemented, as required.

Periodically the IMC or applicable agency should assess just how well the plan described in the preceding paragraph is being carried out, and just how beneficial these peer reviews are to the overall modeling effort. Measures should be identified and used to determine the status of the peer review activities.   These measures could include the number of completed peer reviews performed compared to the number expected to be performed, the overall effort expended on peer reviews compared to that expected, and the number and extent of peer review recommendations requiring actions.

At a minimum these periodic reviews should verify that

1. The planned peer reviews and/or audits are conducted.
2. The peer review leaders are adequately trained for their roles.
3. The reviewers are properly trained or experienced in their roles.
4. The processes for preparing for and conducting peer reviews, and for following up on reviewer's recommendations are adequate and are being followed.
5. The reporting of peer review results is complete, accurate, timely and is being made available to model users.

Risk Management Template

Risk Definition Name	Enter a short name that uniquely defines the risk
Risk #	Enter a unique number assigned to the risk. Range starts with 1 and continues.
Date Risk Identified	Enter the date the risk was identified
Risk Identification Source	Enter the source of the risk identification. In example, meeting name, group, or person.
Risk Owner	Enter the name of the person who will be responsible for ensuring the risk is approved, managed, periodically assessed, communicated, and tracked through closed or transfer.
Risk Detailed Description	Enter a detailed description of the risk so that a reader clearly understands the risk.
Probable Impact of Risk on Project (H, M, L)	Enter the impact on the project. o High = the risk will most likely occur and the impact could prevent the project from achieving its purpose. o Medium = there is a 50/50 change the risk would occur and the impact is serious but the project could still achieve its purpose if appropriately managed. o Low = there is a low probability that the risk would occur and minimal impact to the project's purpose.
Probable Impact of Risk on Project Costs	Enter the impact on the project in dollars. Determine what the potential cost to the project would be if the risk occurs.
Probable Impact of Risk on Project Schedule	Enter the schedule impact on the project. Determine how the schedule would be potentially impacted if the risk occurs.
Probable Impact of Risk on Project Results	Enter the impact on the project. Determine how the overall project purpose and results will be potentially impacted if the risk occurs.
Detailed Plan to Mitigate or Transfer Risk	Enter the detailed plan to mitigate the risk or a statement that the risk will be accepted. Mitigation could include ways to minimize, avoid, or transfer the risk to another party or group. Risk transfer would include evidence of agreement by the accepting party.
Detailed Project Action Items Required to Mitigate or Transfer Risk	Enter the detailed action items required to mitigate the risk. These items will be summarized and assigned within the project Action Log, along with an action item owner, and target completion date.
Detailed Project Plan Tasks Required to Mitigate Risk	Enter the detailed project plan task required to mitigate the risk. These items will be summarized and contained within the MS Project Schedule along with the effort, duration, schedule, and assigned resources.
Comments	Enter any permanent comments that cannot be included in the above items.
Referenced Documents	Enter any documents that a reader should consider in understanding, analyzing, mitigating, or accepting this risk.
Date Risk Closed	Enter the date this risk was closed. This would include when all action items or project tasks were completed, or the risk was transferred to another party or group.

Appendix F: Analysis of the November 2003 CALSIM II Validation Report

The following comments come from an analysis of the model results presented in the validation report *'CALSIM II Simulation of Historical SWP/CVP Operations'*, DWR (2003). The observations relate to the formulation of the model at November 2003. Changes might be made to that formulation which could resolve these issues.

Overestimation of Project Deliveries

The validation run suggests that the modeled demands included in CALSIM II overestimate the actual demands. CVP demands south of the Delta are assumed to be always equal to the contract entitlement whereas the observed deliveries in unrestricted years are consistently less than this amount. The modeled North of Delta deliveries are also consistently higher than observed. The modeled and observed CVP deliveries from the validation report are listed in Table 1.

Table 1. Comparison of modelled and observed CVP deliveries (1975-1998)

Project	Simulated Delivery (Taf/yr)	Historical Delivery (taf/yr)	Difference (taf/yr)	% Difference
CVP North of Delta	1960	1750	210	12
CVP South of Delta	2650	2490	160	6.4

Because the SWP south of delta demands were set to historical deliveries in many years, comparison with the historical deliveries in the validation report is of limited validity. However the fact that the historical SWP deliveries over the last ten years have averaged only 2385 taf/year while the modeled 'year 2001 development' SWP Delta deliveries reported in the 2002 State Water Project Delivery Reliability Report average 3090 taf/year, suggests that modeled SWP deliveries may also be too high.

Allocations to Project Contractors

Seasonal allocations to SWP and CVP contractors are made on the basis of water in storage, forecast inflows, projected carryover storage requirements and in-Basin and Delta regulatory requirements. The allocation processes used by the operators and those used by CALSIM II, are not identical. An examination of the way that CALSIM II has restricted project deliveries during the dry period of 1987-1992 (Figures 10, 16, 17 and 24 of the validation report) suggests that CALSIM II has allocated less water in the early years of the dry sequence than occurred in practice and consequently had more water available in 1991 and 1992 when the most severe restrictions were experienced. The carryover storage rules adopted can have a significant impact on the expected frequency and severity of water supply restrictions. The model rules need to be examined to ensure that the accurately reflect the way the system will be managed in the future.

San Luis Reservoir Operation

The rules used by the system operators for transferring water from headwater storages to the San Luis Reservoir can have a significant impact on:

- the pattern of flow in the Delta,
- the operation of accounting rules between the SWP and the CVP and
- opportunities for SWP wheeling of CVP water and possibly the availability of Article 21 water to SWP contractors.

A comparison of the modeled and observed storage behavior of the SWP component of San Luis (Figure 15) reveals that the model consistently underestimates the volume in storage. A comparison of the CVP component of the storage (Figure 23) indicates that the actual storage is filled earlier in the season and that the actual storage is also slightly higher than the modeled.

Users of CALSIM II output need to be confident that the rules adopted by the model for determining these transfers reflect the way this component of the system will be operated in the future.

Appendix G: Some Principles for Strategic Water Analysis for the California Water Plan Bulletin 160-03 (from the stakeholder review Draft, Sept. 30, 2003)

Strategy:

1) A frequently amended strategic document will lay out DWR's strategic analysis framework and identify the technical objectives, roles, and responsibilities of major DWR data collection efforts and analytical tools and their interactions and their responsible managers.

Transparency:

2) All data and models should be in the public domain and available on the web.
3) All data and models should have significant documentation.
4) Known limitations should be documented.

Longer-term viability:

5) Modularity: Major analytical tools will be designed and implemented to fit modularly and explicitly within the larger strategic analysis framework.
6) Adaptive data management framework: Major data efforts will fall within a larger data management framework, including protocols for data documentation and updating, and documentation of limitations.
7) A frequently-updated document will outline short-term and long-term efforts, budgets, and responsibilities for continuous improvement of analytical tools and data, with policy for continued user, local agency, and stakeholder involvement.

Coverage:

8) Spatial coverage for the basic data and analytical framework will be statewide.
9) Local and regional water management and resources will be explicitly represented.

Accountability and Quality Control:

10) In developing analytical tools, systematic efforts should be made to involve local agencies and stakeholders.
11) Major analytical products will undergo external review by a) external unaffiliated experts and b) local agencies whose systems are included in the model. User groups will exist for all major analytical products.
12) DWR's strategic analysis framework will undergo periodic internal and external review.

Appendix H: Model Sensitivity and Uncertainty Analysis

(This is a draft of a book chapter by DPL/JRS that may be useful for CALSIM II developers)

The usefulness of any model is in part dependent on the accuracy and reliability of its output data. Yet, because all models are imperfect abstractions of reality, and because precise input data are rarely if ever available, all output values are subject to imprecision. The input data and modeling uncertainties are not independent of each other. They can interact in various ways. The end result is imprecision and uncertainty associated with model output. This chapter focuses on ways of identifying, quantifying, and communicating the uncertainties in model outputs.

1. Introduction

Models are the primary way we have to estimate the multiple affects of alternative water resource system design and operating policies. Models predict the values of various system performance indicators. Model outputs are based on model structure, hydrologic and other time-series inputs and a host of parameters whose values describe the system being simulated. Even if these assumptions and input data reflect, or are at least representative of, conditions believed to be true, we know they will be wrong. Our models are always simplifications of the real systems we are studying. Furthermore, we simply cannot forecast the future with precision. So we know the model outputs of future conditions are uncertain estimates, at best.

Some prediction uncertainties can be reduced by additional research and data collection and analysis. Before undertaking expensive studies to gather and analyze additional data it is reasonable to ask what improvement in estimates of system performance or what reduction in the uncertainty associated with those estimates would result if all data and model uncertainties could be reduced. Such information helps determine how much one would be willing to 'pay' to reduce prediction uncertainty. If prediction uncertainty on average is costing a lot, it may pay to invest in additional data collection, more studies, or in better models all aimed at reducing that prediction uncertainty. If that uncertainty has no, or only a very modest, impact on the likely decision that is to be made, one should find other issues to worry about.

If it appears that reducing prediction uncertainty is worthwhile, then one should consider how best to do it. If doing this involves obtaining additional information, then it is clear that the value of this additional information, however measured, should exceed the cost of obtaining it. The value of such information will be the increase in system performance, or the reduction in its variance, that one can expect from obtaining such information. If additional information is to be obtained, it should be that information which reduces the uncertainties considered important, not the unimportant ones.

This chapter reviews some methods for identifying and communicating model prediction uncertainty. The discussion begins with a review of the causes of risk and uncertainty in model output. It then examines ways of measuring or quantifying uncertainty and model output sensitivity to model input imprecision, concentrating on methods that seem most relevant or practical for large-scale regional simulation modeling. It builds on some of the statistical methods reviewed in Chapter III and the modeling of risk and uncertainty in Chapter VI.

2. Issues, concerns, and terminology

Outcomes or events that cannot be predicted with certainty are often called risky or uncertain. Some individuals draw a special and interesting distinction between risk and uncertainty. In particular, the term risk is often reserved to describe situations for which probabilities are available to describe the likelihood of various events or outcomes. If probabilities of various events or outcomes cannot be quantified, or if the events themselves are unpredictable, some would say the problem is then one of uncertainty, and not of risk. In this chapter what is not certain is considered uncertain, and uncertainty is often described by a probability distribution. When the ranges of possible events are known and their probabilities are measurable, risk is called objective risk. If the probabilities are based solely on human judgment, the risk is called subjective risk.

Such distinctions between objective and subjective risk, and between risk and uncertainty, rarely serve any useful purpose to those developing and using models. Likewise the distinctions are often unimportant to those who should be aware of the risks or uncertainties associated with system performance indicator values.

Uncertainty in information is inherent in future-oriented planning efforts. Uncertainty stems from inadequate information and incorrect assumptions, as well as from the variability of natural processes. Water managers often need to identify both the uncertainty as well as the sensitivity of, or changes in, system performance indicator values due to the any changes in possible input data and parameter values from what were predicted. They need to reduce this level of uncertainty to the extent practicable. Finally, they need to communicate the residual uncertainties clearly so that decisions can be made with this knowledge and understanding.

Sensitivity analysis can be distinguished from uncertainty analysis. Sensitivity analysis procedures explore and quantify the impact of possible errors in input data on predicted model outputs and system performance indices. Simple sensitivity analysis procedures can be used to illustrate either graphically or numerically the consequences of alternative assumptions about the future. Uncertainty analyses employing probabilistic descriptions of model inputs can be used to derive probability distributions of model outputs and system performance indices. Figure 1 illustrates the impact of both input data sensitivity and input data uncertainty on model output uncertainty.

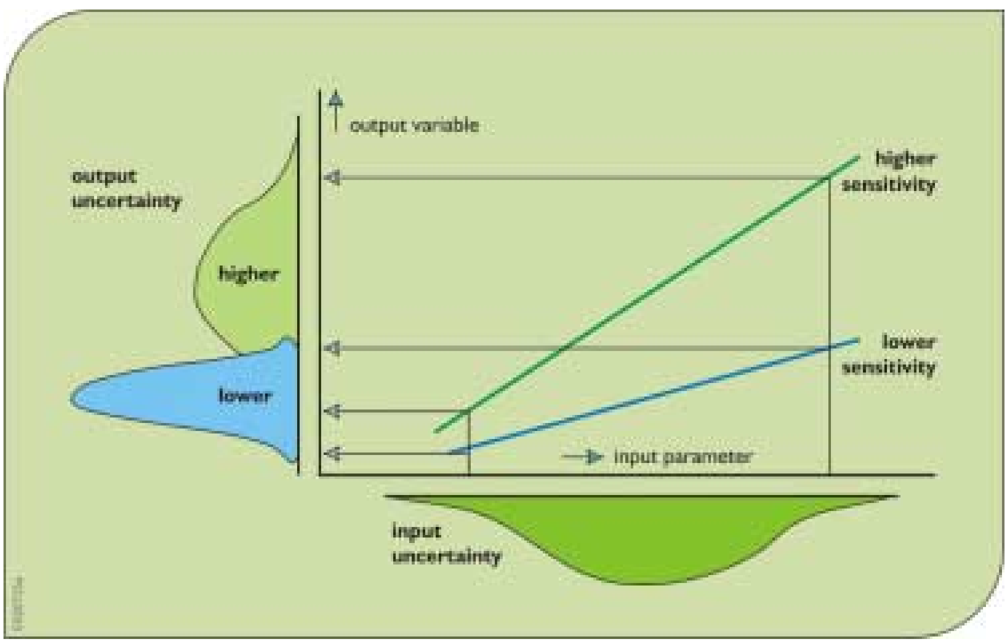

Figure 1. Schematic diagram showing relationship among model input parameter uncertainty and sensitivity to model output variable uncertainty (Lal, 1995).

It is worthwhile to explore the transformation of uncertainties in model inputs and parameters into uncertainty in model outputs when conditions differ from those reflected by the model inputs. Historical records of system characteristics are typically used as a basis for model inputs. Yet conditions in the future may change. There may be changes in the frequency and amounts of precipitation, changes in land cover and topography, and changes in the design and operation of control structures, all resulting in changes of water stages and flows, and their qualities, and consequently changes in the impacted ecosystems.

If asked how the system would operate with inputs similar to those in the historical database, the model should be able to interpolate within the available knowledge base to provide a fairly precise estimate. Still that estimate will not be perfect. This is because our ability to reproduce current and recent operations is not perfect, though it should be fairly good. If asked to predict system performance for situations very different from those in the historical knowledge base, or when the historical data are not considered representative of what might happen in the future, say due to climate change, such predictions become much less precise. There are two reasons why. First, our description of the characteristics of those different situations or conditions may be imprecise. Second, our knowledge base may not be sufficient for calibrating model parameters in ways that would enable us to reliably predict how the system will operate under conditions unlike those that have been experienced historically. The more conditions of interest are unlike those in the historical knowledge base, the less confidence we have that the model is providing a reliable description of systems operation. Figure 2 illustrates this issue.

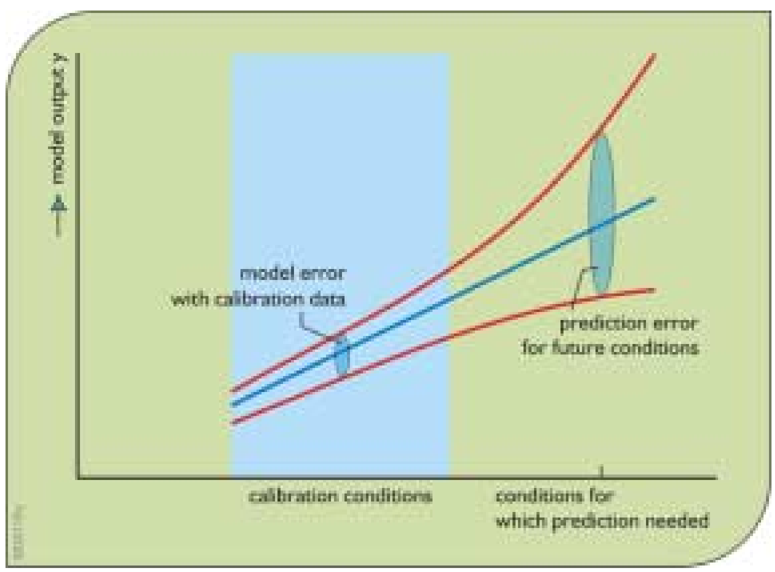

Figure 2. The precision of model predictions is affected by the difference between the conditions or scenarios of interest and the conditions or scenarios for which the model was calibrated.

Clearly a sensitivity analysis needs to consider how well a model can replicate current operations, and how similar the target conditions or scenarios are to those described in the historical record. The greater the required extrapolation from what has been observed, the greater will be the importance of parameter and model uncertainties.

The relative and absolute importance of different parameters will depend on the system performance indicators of interest. Seepage rates may have a very large local effect, but a small global effect. Changes in system-wide evapotranspiration rates will likely impact system-wide flows. The precision of model projections and the relative importance of errors in different parameters will depend upon the:

(1) precision with which the model can reproduce observed conditions,
(2) difference between the conditions predicted and the historical experience included in the knowledge base, and the
(3) system performance characteristics of interest.

Errors and approximations in input data measurement, parameter values, model structure and model solution algorithms, are all sources of uncertainty. While there are reasonable ways of quantifying and reducing these errors and the resulting range of uncertainty of various system performance indicator values they are impossible to eliminate. Decisions will still have to be made in the face of a risky and uncertain future. Decisions can be modified as new data and knowledge are obtained in a process of adaptive management.

There is also uncertainty with respect to human behavior and reaction related to particular outcomes and their likelihoods, i.e., to their risks and uncertainties. As important as risks and uncertainties associated with human reactions are to particular outcomes, they are not usually part of the models themselves. Social uncertainty may often be the most significant component of the total uncertainty associated with just how a water resource system will perform. For this reason we should seek designs and operating policies that are flexible and adaptable.

When uncertainties associated with system operation under a new operating regime are large, one should anticipate the need to make changes and improvements as experience is gained and new information accumulates. When predictions are highly unreliable, responsible managers should favor actions that are robust (e.g., good under a wide range of situations), gain information through research and experimentation, monitor results to provide feedback for the next decision, update assessments and modify policies in the light of new information, and avoid irreversible actions and commitments.

3. Variability and uncertainty in model output

Differences between model output and observed values can result from either natural variability, say caused by unpredictable rainfall, evapotranspiration, water consumption, and the like, and/or by both known and unknown errors in the input data, the model parameters, or the model itself. The later is sometimes called knowledge uncertainty but it isn’t always due to a lack of knowledge. Models are always simplifications of reality and hence ‘imprecision’ can result. Sometimes imprecision occurs because of a lack of knowledge, such as just how a particular species will react to various environmental and other habitat conditions. Other times known errors are introduced simply for practical reasons.

Imperfect representation of processes in a model constitutes model structural uncertainty. Imperfect knowledge of the values of parameters associated with these processes constitutes model parameter uncertainty. Natural variability includes both temporal variability and spatial variability, to which model input values may be subject.

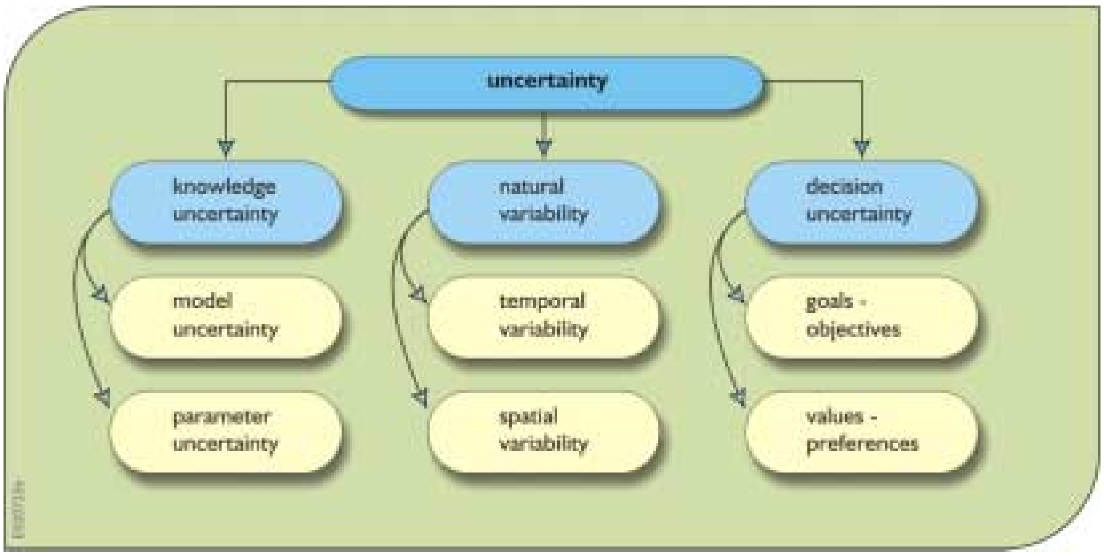

Figure 3. One way of classifying types of uncertainty.

Figure 3 illustrates these different types of uncertainty. For example, the rainfall measured at a weather station within a particular model grid cell may be used as an input value for that cell, but the rainfall may actually vary at different points within that cell and its mean value will vary across the landscape. Knowledge uncertainty can be reduced through further measurement and/or research. Natural variability is a property of the natural system, and is usually not reducible at the scale being used. Decision uncertainty is simply an acknowledgement that we cannot predict ahead of time just what decisions individuals and organizations will make, or even just what particular set of goals or objectives will be considered and the relative importance of each.

Rather than contrasting 'knowledge' uncertainty vs. natural variability vs. decision uncertainty, one can classify uncertainty in another way based on specific sources of uncertainty, such as those listed below, and address ways of identifying and dealing with each source of uncertainty.

Informational Uncertainties:

- imprecision in specifying the boundary and initial conditions that impact the output variable values
- imprecision in measuring observed output variable values

Model Uncertainties:

- uncertain model structure and parameter values
- variability of observed input and output values over a region smaller than the spatial scale of the model
- variability of observed model input and output values within a time smaller than the temporal scale of the model. (e.g., rainfall and depths and flows within a day)
- errors in linking models of different spatial and temporal scales

Numerical Errors:

- errors in the model solution algorithm

3.1 Natural variability

The main source of hydrologic model output value variability is the natural variability in hydrological and meteorological input series. Periods of normal precipitation and temperature can be interrupted by periods of extended drought and intense meteorological events such as hurricanes and tornadoes. There is no reason to think such events will not continue to occur and become even more frequent and extreme. Research has demonstrated that climate has been variable in the past and concerns about anthropogenic activities that may increase that variability increase each year. Sensitivity analysis can help assess the affect of errors in predictions if those predictions are based only on past records of historical time-series data describing precipitation, temperature and other exogenous forces across and on the border of the regions being studied.

Time series input data are often actual, or at least based on, historical data. The time-series values typically describe historical conditions including droughts and wet periods. What is distinctive about natural uncertainty, as opposed to errors and uncertainty due to modeling limitations, is that natural variability in meteorological forces cannot be reduced by improving the model's structure, increasing the resolution of the simulation, or by better calibration of model parameters.

Errors result if meteorological values are not measured or recorded accurately, or if mistakes are made in the generation of computer data files. Furthermore, there is no assurance the statistical properties of historical data will accurately represent the statistical properties of future data. Actual future precipitation and temperature scenarios will be different from those in the past, and this difference in many cases may have a larger affect than the uncertainty due to incorrect parameter values. However, the affects of uncertainties in the parameter values used in stochastic generation models are often much more significant than the affects of using different stochastic generation models (Stedinger and Taylor, 1982).

While variability of model output is a direct result of variability of model input (e.g., hydrologic and meteorological data), the extent of the variability, and the lower and upper limits of that variability, may also be affected by errors in the inputs, the values of parameters, initial boundary conditions, model structure, processes and solution algorithms.

Figure 4 illustrates the distinction between the variability of a system performance indicator due to input data variability, and the extended range of variability due to the total uncertainty associated with any combination of the causes listed in the previous section. This extended range is what is of interest to water resource planners and managers.

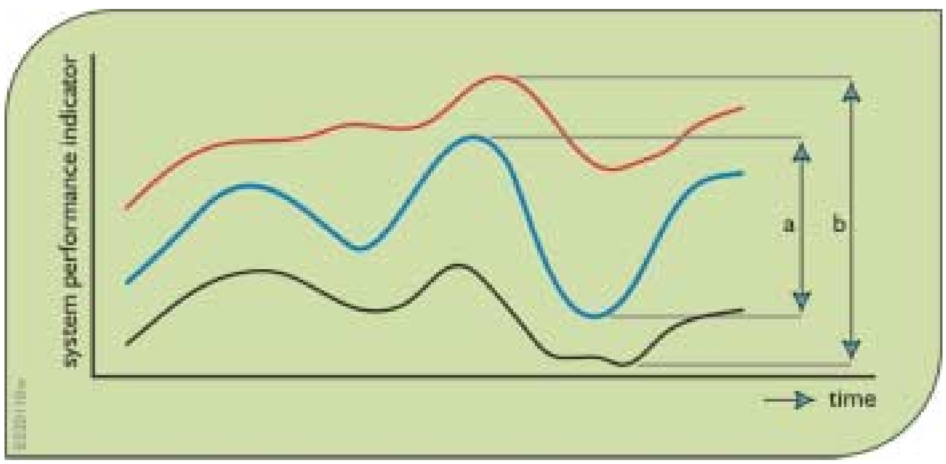

Figure 4. Time-series of model output or system performance showing variability over time. Range "a" results from the natural variability of input data over time. The extended range "b" results from the variability of natural input data as well as from imprecision in input data measurement, parameter value estimation, model structure and errors in model solution algorithms. The extent of this range will depend on the confidence level associated with that range.

What can occur in practice is a time-series of system performance indicator values that can range anywhere within or even outside the extended range, assuming the confidence level of that extended range is less than 100%. The confidence one can have that some future value of a time series will be within a given range is dependent on two factors. The first is the number of measurements used to compute the confidence limits. The second is on the assumption that those measurements are representative of - come from the same statistical or stochastic process yielding - future measurements. Figure 5 illustrates this point. Note that the time series may even contain values outside the range "b" defined in Figure 4 if the confidence level of that range is less than 100%. Confidence intervals associated with less than 100% certainty will not include every possible value that might occur.

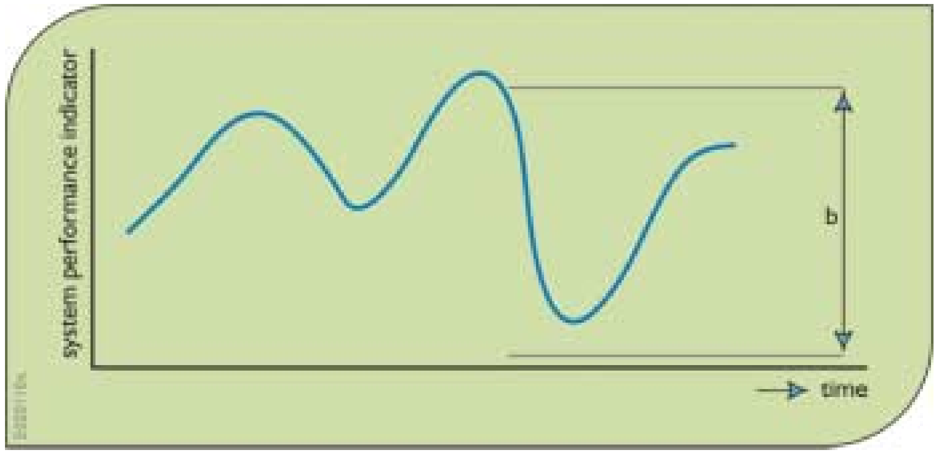

Figure 5. Typical time series of model output or system performance indicator values that are the result of input data variability and possible imprecision in input data measurement, parameter value estimation, model structure and errors in model solution algorithms.

3.2 Knowledge uncertainty

Referring to Figure 3, knowledge uncertainty includes model structure and parameter value uncertainties. First we consider parameter value uncertainty including boundary condition uncertainty, and then model and solution algorithm uncertainty.

3.2.1 Parameter value uncertainty

A possible source of uncertainty in model output results from uncertain estimates of various model parameter values. If the model calibration procedure were repeated using different data sets, different parameter values would result. Those values would yield different simulated system behavior, and thus different predictions. We can call this parameter uncertainty in the predictions because it is caused by imprecise parameter values. If such parameter value imprecision were eliminated, then the prediction would always be the same and so the parameter value uncertainty in the predictions would be zero. But this does not mean that predictions would be perfectly accurate.

In addition to parameter value imprecision, uncertainty in model output can result from imprecise specification of boundary conditions. These boundary conditions can be either fixed or variable. However, because they are not being computed based on the state of the system, their values can be uncertain. These uncertainties can affect the model output, especially in the vicinity of the boundary, in each time step of the simulation.

3.2.2 Model structural and computational errors

Uncertainty in model output can also result from errors in the model structure compared to the real system, and approximations made by numerical methods employed in the simulation. No matter how good our parameter value estimates, our models are not perfect and there is a residual model error. Increasing model complexity to more closely represent the complexity of the real system may not only add to the cost of data collection, but also introduce even more parameters, and thus even more potential sources of error in model output. It is not an easy task to judge the appropriate level of model complexity, and to estimate the resulting levels of uncertainty associated with various assumptions regarding model structure and solution methods. Kuczera (1988) provides an example of a conceptual hydrologic modeling exercise with daily time steps where model uncertainty dominated parameter value uncertainty.

3.3 Decision uncertainty

Uncertainty in model predictions can result from unanticipated changes in what is being modeled. These can include changes in nature, human goals, interests, activities, demands, and impacts. An example of this is the deviation from standard or published operating policies by operators of infrastructure such as canal gates, pumps, and reservoirs in the field, as compared to what is specified in documents and incorporated into the water systems models. Comparing field data with model data for model calibration may yield incorrect calibrations if operating policies actually implemented in the field differ significantly from those built into the models. What do operators do in times of stress? And can anyone identify a place where deviations from published policies do not occur?

What humans will want to achieve in the future may not be the same as what they want today. Predictions of what people will want in the future are clearly sources of uncertainty. A perfect example of this is in the very flat Greater Everglades region of south Florida in the US. Fifty years ago folks wanted the swampy region protected from floods and drained for agricultural and urban development. Today many want just the opposite at least where there are no human settlements. They want to return to a more natural hydrologic system with more wetlands and unobstructed flows, but now for ecological restoration objectives that were not a major concern or much appreciated some half a century ago. Once the mosquitoes return and if the sea level continues to rise, future populations who live there may want more flood control and drainage again. Who knows? Complex changing social and economic processes influence human activities and their demands for water resources and environmental amenities over time. Some of these processes reflect changes in local concerns, interests and activities, but population migration and many economic activities and social attitudes can also reflect changing national and international trends.

Sensitivity scenarios that include human activities can help define the affects of those activities within an area. It is important that careful attention go into the development of these alternative scenarios so that they realistically capture the forces or stresses that the system may face. The history of systems studies are full of examples where the issues studied were rapidly overwhelmed by much larger social forces resulting from, for example, the relocation of major economic activities, an oil embargo, changes in national demand for natural resources, economic recession, sea-level rise, an act of terrorism, or even war. One thing is sure; the future will be different than the past, and no one is certain just how.

3.3.1 Surprises

Water resource managers may also want to consider how vulnerable a system is to undesirable environmental surprises. What havoc might an introduced species like the zebra mussel invading the Great Lakes of North America have in a particular watershed? Might some introduced disease suddenly threaten key plant or animal species? Might management plans have to be restructured to address the survival of some species such as salmon in the Rhine River in Europe or in the Columbia River in North America? Such uncertainties are hard to anticipate when by their nature they are truly surprises. But surprises should be expected. Hence system flexibility and adaptability should be sought to deal with changing management demands, objectives, and constraints.

4. Sensitivity and uncertainty analyses

An uncertainty analysis is not the same as a sensitivity analysis. An uncertainty analysis attempts to describe the entire set of possible outcomes, together with their associated probabilities of occurrence. A sensitivity analysis attempts to determine the relative change in model output values given modest changes in model input values. A sensitivity analysis thus measures the change in the model output in a localized region of the space of inputs. However, one can often use the same set of model runs for both uncertainty analyses and sensitivity analyses. It is possible to carry out a sensitivity analysis of the model around a current solution and then use it as part of a first order uncertainty analysis.

This discussion begins by focusing on some methods of uncertainty analysis. Then various ways of performing and displaying sensitivity analyses are reviewed.

4.1 Uncertainty Analyses

Recall that uncertainty involves the notion of randomness. If a value of a performance indicator or performance measure, or in fact any variable, like the phosphorus concentration or the depth of water at a particular location varies and this variation over space and time cannot be predicted with certainty, it is called a random variable. One cannot say with certainty what the value of a random variable will be but only the likelihood or probability that it will be within some specified range of values. The probabilities of observing particular ranges of values of a random variable are described or defined by a probability distribution. There are many types of distributions and each can be expressed in several ways as presented in Chapter III.

Suppose the random variable is *X*. If the observed values of this random variable can be only discrete values, the probability distribution of *X* can be expressed as a histogram, as shown in Figure 6a. The sum of the probabilities for all possible outcomes must equal 1. If the random variable is a continuous variable that can assume any real value over a range of values, the probability distribution of *X* can be expressed as a continuous distribution as shown in Figure 6b. The shaded area under the density function for the continuous distribution is 1. The area between two values of the continuous random variable, such as between u and v in Figure 6c, represents the probability that the observed value *x* of the random variable value *X* will be within that range of values.

The probability distribution, $P_X(x)$ shown in Figure 6 (a) is called a probability mass function. The probability distributions shown in Figure 6 (b and c) are called a probability density functions (pdf) and are denoted by $f_X(x)$. The subscript *X* of P_X and f_X represents the random variable, and the variable *x* is some value of that random variable *X*.

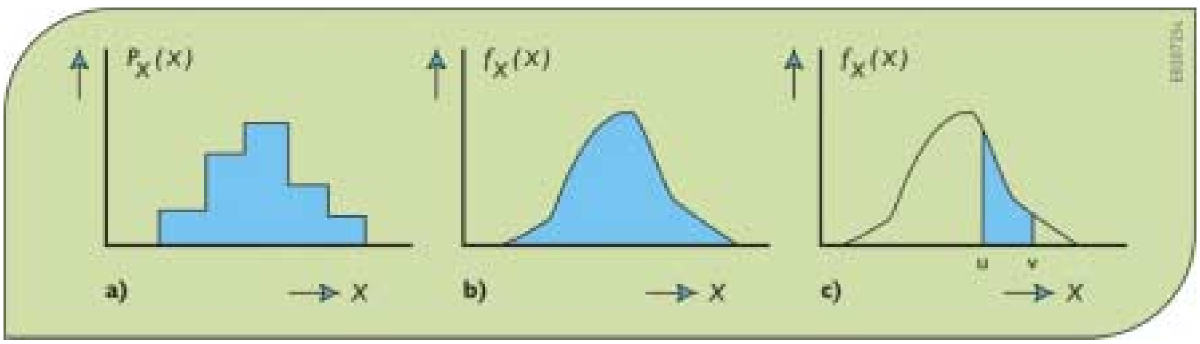

Figure 6. Probability distributions for a discrete or continuous random variable *X*. The area under the distributions (shaded areas in a and b) is 1, and the shaded area in c is the probability that the observed value x of the random variable *X* will be between u and v.

Uncertainty analyses involve identifying characteristics of various probability distributions of model input and output variables, and subsequently functions of those random output variables that are performance indicators or measures. Often targets associated with these indicators or measures are themselves uncertain.

A complete uncertainty analysis would involve a comprehensive identification of all sources of uncertainty that contribute to the joint probability distributions of each input or output variable. Assume such analyses were performed for two alternative project plans, *A* and *B*, and that the resulting probability density distributions for a specified performance measure were as shown in Figure 7. Figure 7 also identifies the costs of these two projects. The introduction of two performance criteria, cost and probability of exceeding a performance measure target (e.g., a pollutant concentration standard) introduces a conflict where a tradeoff must be made.

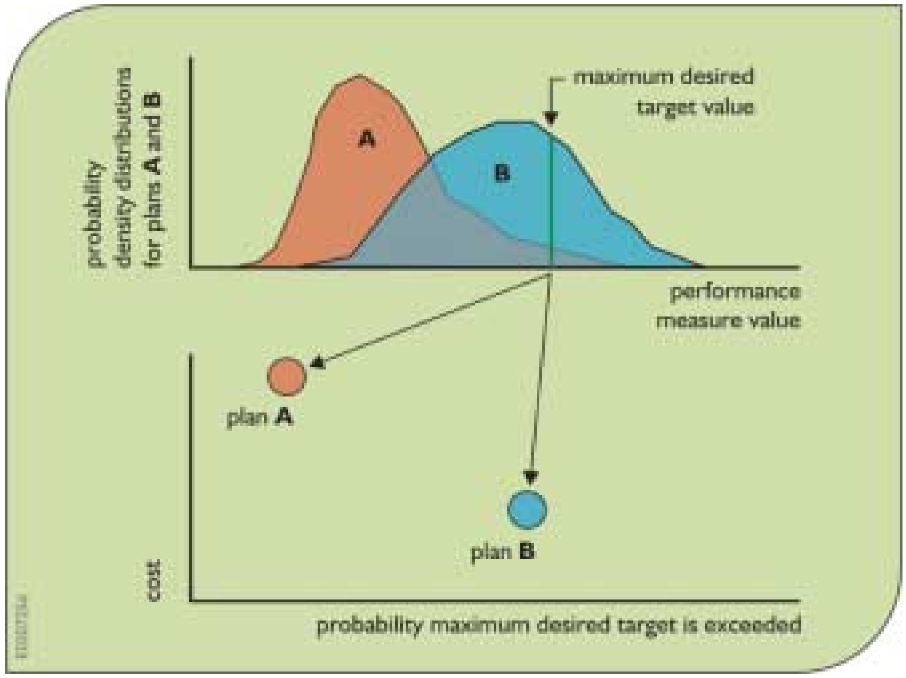

Figure 7. Tradeoffs involving cost and the probability that a maximum desired target value will be exceeded. In this illustration we want the lowest cost (*B* is best) and the lowest probability of exceedance (*A* is best).

4.1.1 Model and model parameter uncertainties

Consider a situation as shown in Figure 8, in which for a specific set of model inputs, the model outputs differ from the observed values, and for those model inputs, the observed values are always the same. Here nothing randomly occurs. The model parameter values or model structure needs to be changed. This is typically done in a model calibration process.

Given specific inputs, the outputs of deterministic models are always going to be the same each time those inputs are simulated. If for specified inputs to any simulation model the predicted output does not agree with the observed value, as shown in Figure 8, this could result from imprecision in the measurement of observed data. It could also result from imprecision in the model parameter values, the model structure, or the algorithm used to solve the model.

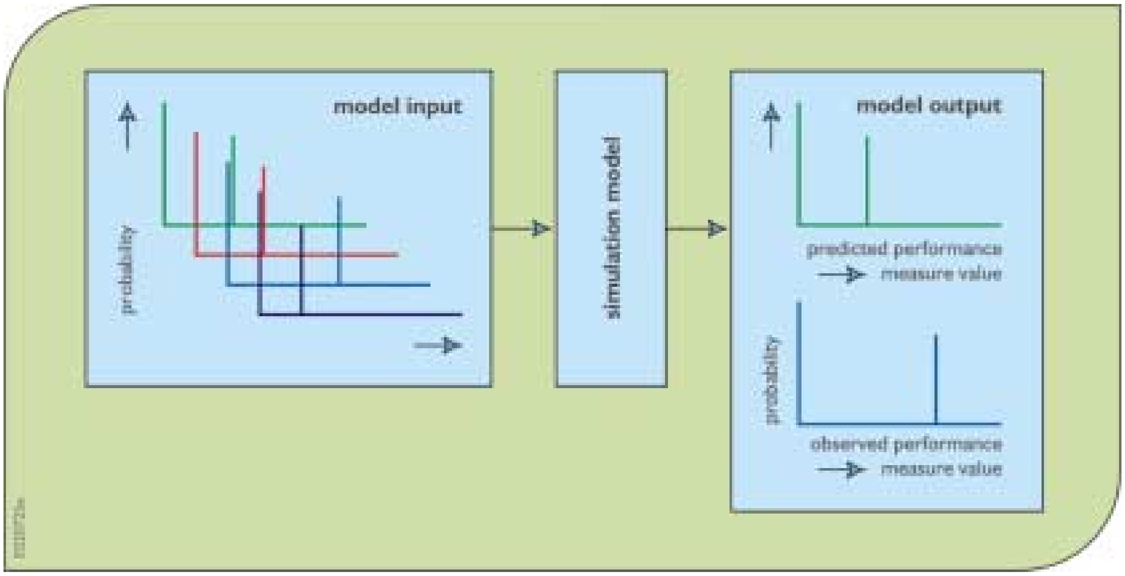

Figure 8. A deterministic system and a simulation model of that system needing calibration or modification in its structure. There is no randomness, only parameter value or model structure errors to be identified and corrected.

Next consider the same deterministic simulation model but now assume at least some of the inputs are random, i.e., not predictable, as may be case when random outputs of one model are used as inputs into another model. Random inputs will yield random outputs. The model input and output values can be described by probability distributions. If the uncertainty in the output is due only to the uncertainty in the input, the situation is similar to that shown in Figure 8. If the distribution of performance measure output values does not fit or is not identical to the distribution of observed performance measure values, then calibration of model parameter values or modification of model structure may be needed.

If a model calibration or 'identification' exercise finds the 'best' values of the parameters to be outside reasonable ranges of values based on scientific knowledge, then the model structure or algorithm might be in error. Assuming the algorithms used to solve the models are correct and observed measurements of system performance vary for the same model inputs, as shown in Figure 9, it can be assumed that the model structure does not capture all the processes that are taking place that impact the value of the performance measures. This is often the case when relatively simple and low-resolution models are used to estimate the hydrological and ecological impacts of water and land management policies. However, even large and complex models can fail to include or adequately describe important phenomena.

In the presence of informational uncertainties there may be considerable uncertainty about the values of the "best" parameters during calibration. This problem becomes even more pronounced with increases in model complexity.

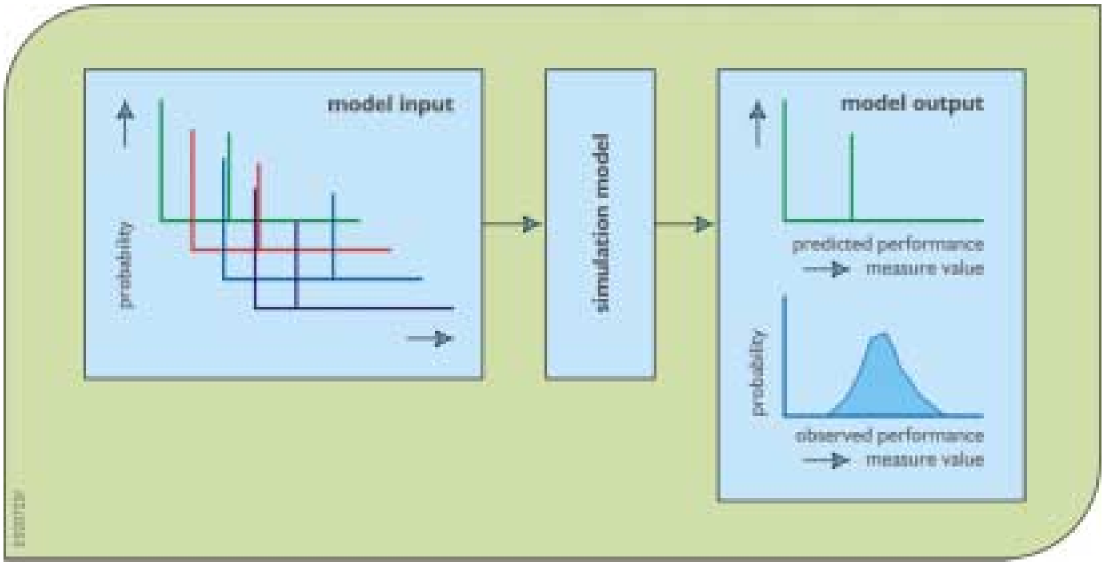

Figure A deterministic simulation model of a ‘random or stochastic’ system. To produce the variability in the model output that is observed in the real system, even given the same input values, the model’s parameter values may need to vary over distributions of values and/or the model structure may need modification along with additional model inputs.

An example: Consider the prediction of a pollutant concentration at some site downstream of a pollutant discharge site. Given a streamflow Q (in units of 1000 m^3/day), the distance between the discharge site and the monitoring site, X (m), the pollutant decay rate constant k (day^{-1}), and the pollutant discharge W (Kg/day), we can use the following simplified model to predict the concentration of the pollutant C (g/m^3 = mg/l) at the downstream monitoring site:

$$C = (W/Q)\ \exp\{-k(X/U)\}$$

In the above equation assume the velocity U (m/day) is a known function of the streamflow Q.

In this case the observed value of the pollutant concentration C may differ from the computed value of C even for the same inputs of W, Q, k, X, and U. Furthermore, this difference varies in different time periods. This apparent variability, as illustrated in Figure 9, can be simulated using the same model but by assuming a distribution of values for the decay rate constant k. Alternatively the model structure can be modified to include the impact of streamflow temperature T on the prediction of C.

$$C = (W/Q)\ \exp\{-k\theta^{T-2}(X/U)\}$$

Now there are two model parameters, the decay rate constant k and the dimensionless temperature correction factor θ and an additional model input, the streamflow temperature, T. It could be that the variation in streamflow temperature was the sole cause of the first equation's 'uncertainty' and that the assumed parameter distribution of k was simply the result of the distribution of streamflow temperatures on the term $k\theta^{T-20}$.

If the output were still random given constant values of all the inputs, then another source of uncertainty exists. This uncertainty might be due to additional random loadings of the pollutant, possibly from non-point sources. Once again the model could be modified to include these additional loadings if they are knowable. Assuming these additional loadings are not known, a new random parameter could be added to the input variable W or to the right hand side of the equations above that would attempt to capture the impact on C of these additional loadings. A potential problem, however, might be the likely correlation between those additional loadings and the streamflow Q.

While adding model detail removed some 'uncertainty' in the above example, increasing model complexity will not always eliminate or reduce uncertainty in model output. Adding complexity is generally not a good idea when the increased complexity is based on processes whose parameters are difficult to measure, the right equations are not known at the scale of application, or the amount of data for calibration is small compared to the number of parameters.

Even if more detailed models requiring more input data and more parameter values were to be developed, the likelihood of capturing all the processes occurring in a complex system is small. Hence those involved will have to make decisions taking this uncertainty into account. Imprecision will always exist due to less than a complete understanding of the system and the hydrologic processes being modeled. A number of studies have addressed model simplification, but only in some simple cases have statisticians been able to identify just how one might minimize modeling related errors in model output values.

The problem of determining the "optimal" level of modeling detail is particularly important when simulating the hydrologic events at many sites over large areas. Perhaps the best approach for these simulations is to establish confidence levels for alternative sets of models and then statistically compare simulation results. But even this is not a trivial or costless task. Increases in the temporal or spatial resolution typically require considerable data collection and/or processing, model recalibrations, and possibly the solution of stability problems resulting from the numerical methods used in the models. Obtaining and implementing alternative hydrologic simulation models will typically involve considerable investments of money and time for data preparation and model calibration.

What is needed is a way to predict the variability evident in the system shown in Figure 9. Instead of a fixed output vector for each fixed input vector, a distribution of outputs are needed for each performance measure based on fixed inputs (Figure 9) or a distribution of inputs (Figure 10.). Furthermore the model output distribution for each performance measure should 'match' as well as possible the observed distribution of that performance measure.

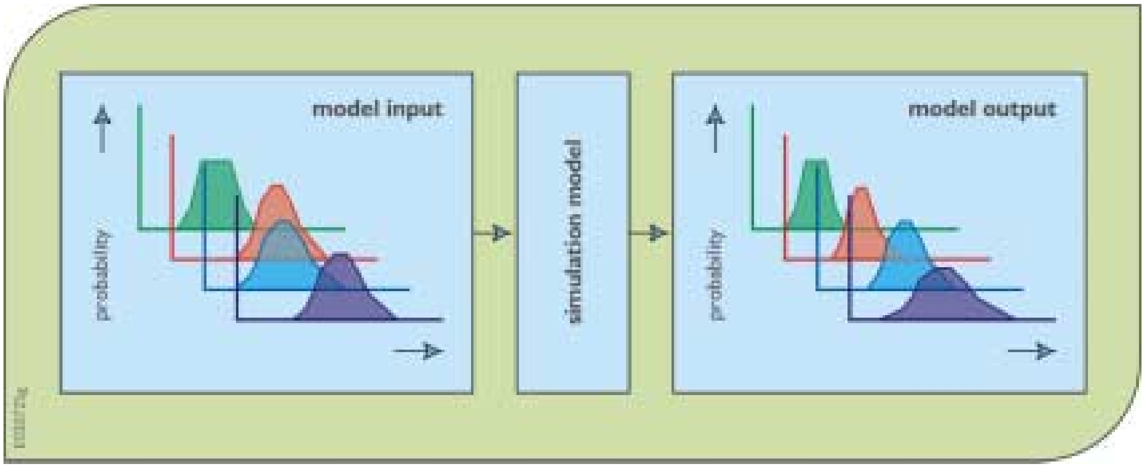

Figure 10. Simulating variable inputs to obtain probability distributions of predicted performance indices that match the probability distributions of observed performance values.

4.1.2 What uncertainty analysis can provide

An uncertainty analysis takes a set of randomly chosen input values (that can include parameter values), passes them through a model (or transfer function) to obtain the distributions (or statistical measures of the distributions) of the resulting outputs. As illustrated in Figure 11, the output distributions can be used to

- Describe the range of potential outputs of the system at some probability level.
- Estimate the probability that the output will exceed a specific threshold or performance measure target value.

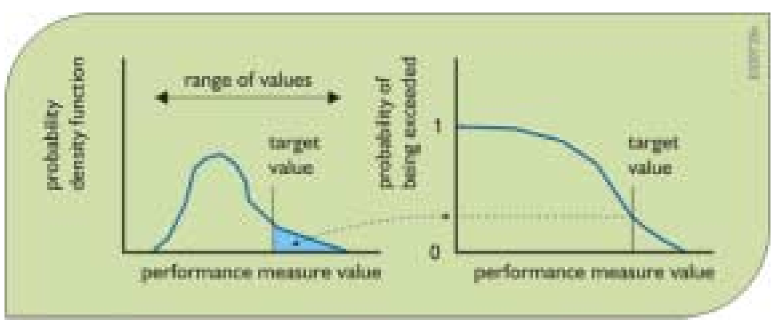

Figure 11. The distribution of performance measures defines range of potential values and the likelihood that a specified target value will be exceeded. The shaded area under the density function on the left represents the probability that the target value will be exceeded. This probability is shown in the probability of exceedance plot on the right.

Common uses for uncertainty analyses are to make general inferences, such as the following:

- Estimating the mean and standard deviation of the outputs.
- Estimating the probability the performance measure will exceed a specific threshold.
- Putting a reliability level on a function of the outputs, e.g., the range of function values that is likely to occur with some probability.
- Describing the likelihood of different potential outputs of the system.

Implicit in any uncertainty analysis are the assumptions that statistical distributions for the input values are correct and that the model is a sufficiently realistic description of the processes taking place in the system. Neither of these assumptions is likely to be entirely correct.

4.2 Sensitivity analyses

"Sensitivity analysis" is aimed at describing how much model output values are affected by changes in model input values. It is the investigation of the importance of imprecision or uncertainty in model inputs in a decision making or modeling process. The exact character of sensitivity analysis depends upon the particular context and the questions of concern. Sensitivity studies can provide a general assessment of model precision when used to assess system performance for alternative scenarios, as well as detailed information addressing the relative significance of errors in various parameters. As a result, sensitivity results should be of interest to the general public, federal and state management agencies, local watershed planners and managers, model users, and model developers.

Clearly, upper level management and the public may be interested in more general statements of model precision, and should be provided such information along with model predictions. On the other hand, detailed studies addressing the significance and interactions among individual parameters would likely be meaningful to model developers and some model users. They can use such data to interpret model results and to identify where efforts to improve models and their input values should be directed.

Initial sensitivity analysis studies could focus on two products:

(1) detailed results to guide research and assist model development efforts, and
(2) calculation of general descriptions of uncertainty associated with model predictions so that policy decisions can reflect both the modeling efforts best prediction of system performance and the precision of such predictions.

In the first case, knowing the relative uncertainty in model projections due to possible errors in different sets of parameters and input data should assist in efforts to improve the precision of model projections. This knowledge should also contribute to a better understanding of the relationships between model assumptions, parameters, data and model predictions.

For the second case, knowing the relative precision associated with model predictions should have a significant effect on policy development. For example, the analysis may show that, given data inadequacies, there are very large error bands associated with some model variables. When such large uncertainties exist, predictions should be used with appropriate skepticism.

Incremental strategies should be explored along with monitoring so that greater experience can accumulate to resolve some of those uncertainties.

Sensitivity analysis features are available in many linear and nonlinear programming (optimization) packages. They identify the changes in the values of the objective function and unknown decision variables given a change in the model input values, and a change in levels set for various constraints (Chapter V). Thus sensitivity analysis addresses the change in "optimal" system performance associated with changes in various parameter values, and also how "optimal" decisions would change with changes in resource constraint levels, or target output requirements. This kind of sensitivity analysis provides estimates of how much another unit of resource would be worth, or what "cost" a proposed change in a constraint places on the optimal solution. This information is of value to those making design decisions.

Various techniques have been developed to determine how sensitive model outputs are to changes in model inputs. Most approaches examine the affects of changes in a single parameter value or input variable assuming no changes in all the other inputs. Sensitivity analyses can be extended to examine the combined effects of multiple sources of error, as well.

Changes in particular model input values can affect model output values in different ways. It is generally true that only a relatively few input variables dominate or substantially influence the values of a particular output variable or performance indicator at a particular location and time. If the range of uncertainty of only some of the output data is of interest, then undoubtedly only those input data that significantly impact on the values of those output data need be included in the sensitivity analysis.

If input data estimates are based on repeated measurements, a frequency distribution can be estimated that characterizes natural variability. The shorter the record of measurements, the greater will be the uncertainty regarding the long-term statistical characteristics of that variability. If obtaining a sufficient number of replicate measurements is not possible, subjective estimates of input data ranges and probability distributions are often made. Using a mixture of subjective estimates and actual measurements does not affect the application of various sensitivity analysis methods that can use these sets or distributions of input values, but it may affect the conclusions that can be drawn from the results of these analyses.

It would be nice to have available accurate and easy-to-use analytical methods for relating errors in input data to errors in model outputs, and to errors in system performance indicator values that are derived from model output. Such analytical methods do not exist for complex simulation models. However methods based on simplifying assumptions and approximations can be used to yield useful sensitivity information. Some of these are reviewed in the remainder of this chapter.

4.2.1 Sensitivity coefficients

One measure of sensitivity is the sensitivity coefficient. This is the derivative of a model output variable with respect to an input variable or parameter. A number of sensitivity analysis methods use these coefficients. First-order and approximate first-order sensitivity analyses are two such methods that will be discussed later. The difficulty of

1. obtaining the derivatives for many models,
2. needing to assume mathematical (usually linear) relationships when obtaining estimates of derivatives by making small changes of input data values near their nominal or most likely values, and
3. having large variances associated with most hydrologic process models have motivated the replacement of analytical methods by numerical and statistical approaches to sensitivity analysis.

Implicit in any sensitivity analysis are the assumptions that statistical distributions for the input values are correct and that the model is a sufficiently realistic description of the processes taking place in the system. Neither of these assumptions is likely to be entirely correct.

The importance of the assumption that the statistical distributions for the input values are correct is easy to check by using different distributions for the input parameters. If the outputs vary significantly, then the output is sensitive to the specification of the input distributions and hence they should be defined with care. A relatively simple deterministic sensitivity analysis can be of value here (Benaman, 2002). A sensitivity coefficient can be used to measure the magnitude of change in an output variable Q per unit change in the magnitude of an input parameter value P from its base value P_o. Let SI_{PQ} be the sensitivity index for an output variable Q with respect to a change ΔP in the value of the input variable P from its base value P_o. Noting that the value of the output $Q(P)$ is a function of P, the sensitivity index could be defined as

$$SI_{PQ} = [\, Q(P_o + \Delta P) - Q(P_o - \Delta P)\,] / 2\,\Delta P \tag{1}$$

Other sensitivity indices could be defined (McCuen 1973). Letting the index i represent a decrease and j represent an increase in the parameter value from its base value P_o, the sensitivity index SI_{PQ} for parameter P and output variable Q is could be defined as

$$SI_{PQ} = \{\, |(Q_o - Q_i) / (P_o - P_i)| + |(Q_o - Q_j) / (P_o - P_j)| \,\} / 2 \tag{2}$$

or

$$SI_{PQ} = \max \{\, |(Q_o - Q_i) / (P_o - P_i)|\,,\ |(Q_o - Q_j) / (P_o - P_j)| \,\} \tag{3}$$

A dimensionless expression of sensitivity is the elasticity index, EI_{PQ}, that measures the relative change in output Q for a relative change in input P could be defined as

$$EI_{PQ} = [P_o / Q(P_o)]\, SI_{PQ} \tag{4}$$

4.2.2 A simple deterministic sensitivity analysis procedure

This deterministic sensitivity analysis approach is very similar those most often employed in the engineering economics literature. It is based on the idea of varying one uncertain parameter value, or set of parameter values, at a time. The ideas are applied to a water quality example to illustrate their use.

The output variable of interest can be any performance measure or indicator. Thus one does not know if more or less of a given variable is better or worse. Perhaps too much and/or too little is undesirable. The key idea is that, whether employing physical measures or economic metrics of performance, various parameters (or sets of associated parameters) are assigned high and low values. Such ranges may reflect either the differences between the minimum and maximum values for each parameter, the 5 and 95 percentiles of a parameters distribution, or points corresponding to some other criteria. The system model is then run with the various alternatives, one at a time, to evaluate the impact of those errors in various sets of parameter values on the output variable.

Table 1 illustrates the character of the results that one would obtain. Here Y_0 is the nominal value of the model output when all parameters assume the estimated best values, and $Y_{i,L}$ and $Y_{i,H}$ are the values obtained by increasing or decreasing the values of the ith set of parameters.

Table 1. Sensitivity of model output Y to possible errors in four parameter sets containing a single parameter or a group of parameters that vary together.

parameter set	low value	nominal	high value
1	$Y_{1,L}$	Y_0	$Y_{1,H}$
2	$Y_{2,L}$	Y_0	$Y_{2,H}$
3	$Y_{3,L}$	Y_0	$Y_{3,H}$
4	$Y_{4,L}$	Y_0	$Y_{4,H}$

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A simple water quality example is employed to illustrate this deterministic approach to sensitivity analysis. The analysis techniques illustrated here are just as applicable to complex models. The primary difference is that more work would be required to evaluate the various alternatives with a more complex model, and the model responses might be more complicated.

The simple water quality model is provided by Vollenweider's empirical relationship for the average phosphorus concentration in lakes (Vollenweider, 1976). He found that the phosphorus concentration, P (mg/m^3), is a function of the annual phosphorus loading rate, L (mg/m^2•a), the annual hydraulic loading, q (m/a or more exactly m^3/m^2•a), and the mean water depth, z (m).

$$P = (L/q) / [\ 1 + (z/q)^{0.5}\ ] \tag{5}$$

L/q and P have the same units; the denominator is an empirical factor that compensates for nutrient recycling and elimination within the aquatic lake environment.

Data for Lake Ontario in North America would suggest that reasonable values of the parameters are L = 680 mg/m^3; q = 10.6 m/a; and z = 84 m, yielding P = 16.8 mg/m^3. Values of phosphorus concentrations less than 10 mg/m^3 are considered oligotrophic, whereas values greater than 20 mg/m^3 generally correspond to eutrophic conditions. Reasonable ranges reflecting possible errors in the three parameters yield the values in Table 2.

Table 2. Sensitivity of estimates of phosphorus concentration (mg/m^3) to model parameter values. The two right most values in each row correspond to the Low and High values of the parameter, respectively

	parameter value		phosphorus concentration	
	low	high	P_{low}	P_{high}
L – P loading (mg/m^3. a)	500	900	12.4	22.3
q – hydraulic loading (m/a)	8	13.5	20.0	14.4
z – mean depth (m)	81	87	17.0	16.6

One may want to display these results so they can be readily visualized and understood. A tornado diagram (Eschenbach, 1992) would show the lower and upper values of P obtained from variation of each parameter, with the parameter with the widest limits displayed on top, and the parameter having smallest limits on the bottom. Tornado diagrams (Figure 12) are easy to construct and can include a large number of parameters without becoming crowded.

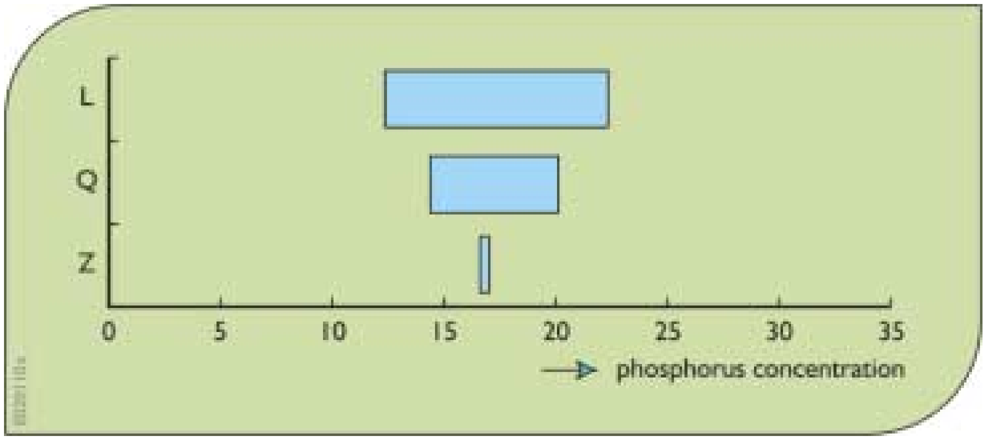

Figure 12. A Tornado diagram showing the range of the output variable representing phosphorus concentrations for high and low values of each of the parameter sets. Parameters are sorted so that the largest range is on top, and the smallest on the bottom.

An alternative to tornado diagrams is a Pareto chart showing the width of the uncertainty range associated with each variable, ordered from largest to smallest. A Pareto chart is illustrated in Figure 13.

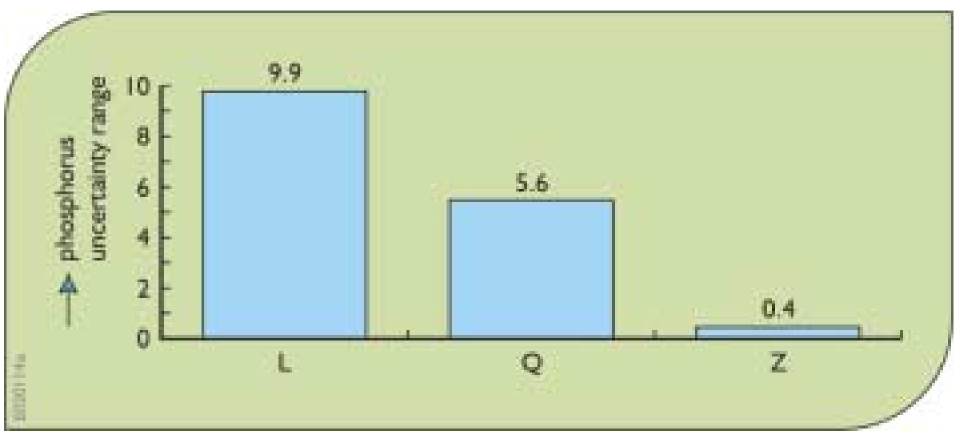

Figure 13. A Pareto Chart showing the range of the output variable representing phosphorus concentrations resulting from high and low values of each parameter set considered.

Another visual presentation is a spider plot showing the impact of uncertainty in each parameter on the variable in question, all on the same graph (Eschenback, 1992; DeGarmo, 1993, p. 401). A spider plot, Figure 14, shows the particular functional response of the output to each parameter on a common scale, so one needs a common metric to represent changes in all of the parameters. Here we use percentage change from the nominal or best values.

Spider plots are a little harder to construct than tornado diagrams, and can generally include only 4 - 5 variables without becoming crowded. However, they provide a more complete view of the relationships between each parameter and the performance measure. In particular, a spider plot reveals nonlinear relationships and the relative sensitivity of the performance measure to (percentage) changes in each variable.

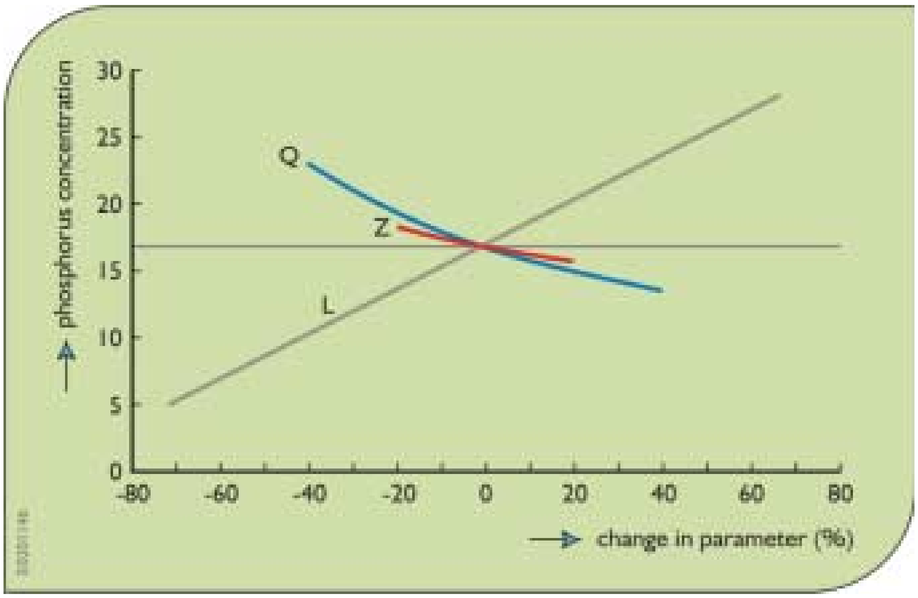

Figure 14. Spider Plot illustrates the relationships between model output describing phosphorus concentrations and variations in each of the parameter sets, expressed as a percentage deviation from their nominal values.

In the spider plot, the linear relationship between *P* and *L* and the gentle nonlinear relationship between *P* and *q* is illustrated. The range for *z* has been kept small given the limited uncertainty associated with that parameter.

4.2.3 Multiple errors and interactions

An important issue that should not be ignored is the impact of simultaneous errors in more than one parameter. Probabilistic methods directly address the occurrence of simultaneous errors, but the correct joint distribution needs to be employed. With simple sensitivity analysis procedures, errors in parameters are generally investigated one at a time, or in groups. The idea of considering pairs or sets of parameters is discussed here.

Groups of factors. It is often the case that reasonable error scenarios would have several parameters changing together. For this reason, the alternatives have been called parameter sets. For example, possible errors in water depth would be accompanied with corresponding variations in aquatic vegetation and chemical parameters. Likewise, alternatives related to changes in model structure might be accompanied with variations in several parameters. In other cases, there may be no causal relationship among possible errors (such as model structure versus inflows at the boundary of the modeled region), but they might still interact to effect the precision of model predictions.

Combinations. If one or more non-grouped parameters interact in significant ways, then combinations of one or more errors should be investigated. However, one immediately runs into a combinatorial problem. If each of m parameters can have 3 values (high, nominal, and low) there are 3^m combinations, as opposed to 2m + 1 if each parameter is varied separately. [For m = 5, the differences are $3^5 = 243$ versus 2(5)+1 = 11.] These numbers can be reduced by considering instead only combinations of extremes so that only $2^m + 1$ cases need be considered [$2^5 + 1 = 33$], which is a more manageable number. However, all of the parameters would be at one extreme or the other, and such situations would be very unusual.

Two factors at a time. A compromise is to consider all pairs of two parameters at a time. There are m(m-1)/2 possible pairs of m parameters. Each parameter has a high and low value. Since there are 4 combinations of high and low values for each pair, there are a total of 2m(m-1) combinations. [For m = 5 there are 40 combinations of two parameters each having two values.]

The presentation of these results could be simplified by displaying for each case only the maximum error, which would result in m(m-1)/2 cases that might be displayed in a Pareto diagram. This would allow identification of those combinations of two parameters that might yield the largest errors and thus are of most concern.

For the water quality example, if one plots the absolute value of the error for all four combinations of high (+) and low (-) values for each pair of parameters, they obtain Figure 15.

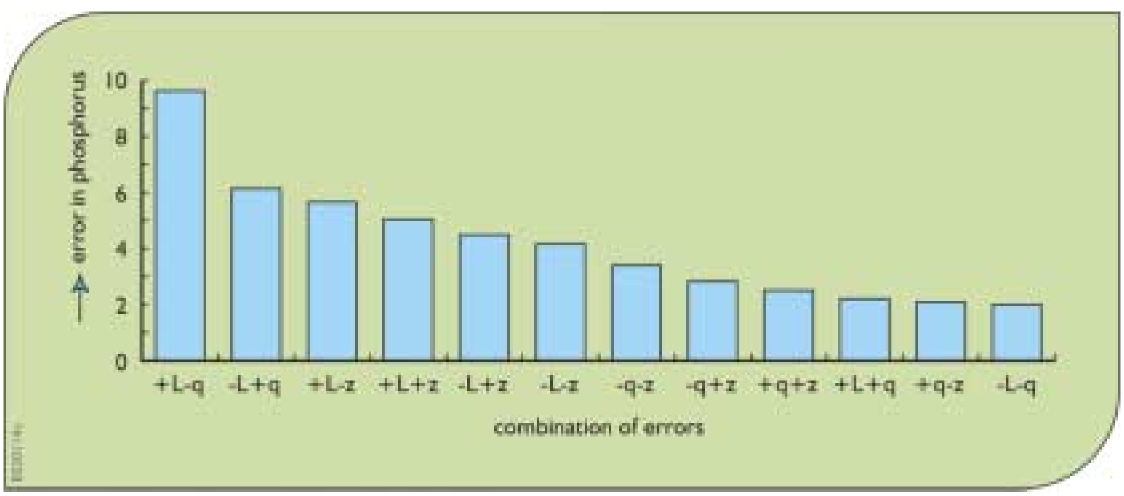

Figure 15. Pareto diagram showing errors in phosphorus concentrations for all combinations of pairs of input parameters errors. A + indicates a high value, and a - indicates a low value for indicated parameter. *L* is the phosphorus loading rate, *q* is the hydraulic loading, and *z* is the mean lake depth.

Considering only the worst error for each pair of variables yields Figure 16.

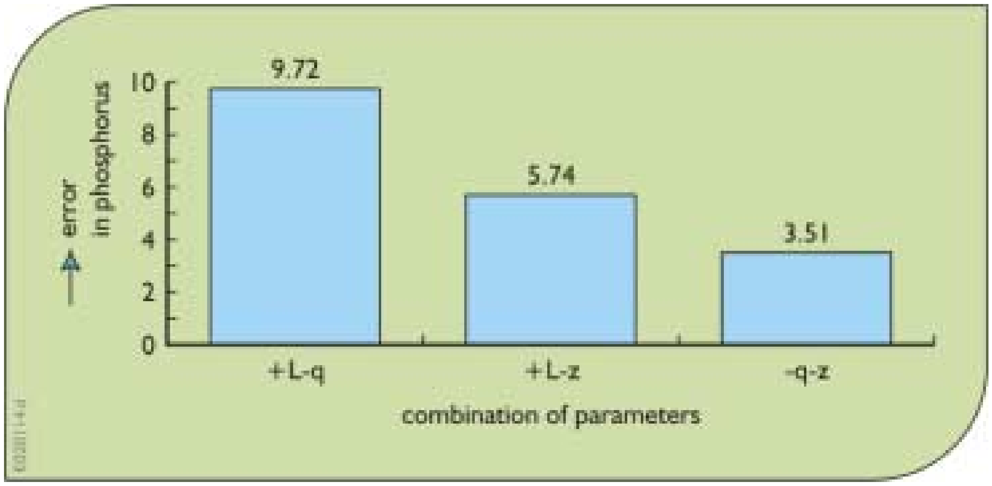

Figure 16. Pareto diagram showing worst error combinations for each pair of input parameters. A '+' indicates a high value, and a '–' indicates a low value for indicated parameter.

Here we see, as is no surprise, that the worst error results from the most unfavorable combination of *L* and *q* values. If both parameters have their most unfavorable values, the predicted phosphorus concentration would be 27 mg/m^3.

Looking for non-linearities. One might also display in a Pareto diagram the maximum error for each pair as a percentage of the sum of the absolute values of the maximum error from each parameter separately. The ratio of the joint error to the individual errors would illustrate potentially important nonlinear interactions. If the model of the system and the physical measure or economic metric were strictly linear, then the individual ratios should add to one.

4.2.4 First-order sensitivity analysis

The above deterministic analysis has trouble representing reasonable combinations of errors in several parameter sets. If the errors are independent, it is highly unlikely that any two sets would actually be at their extreme ranges at the same time. By defining probability distributions of the values of the various parameter sets, and specifying their joint distributions, a probabilistic error analysis can be conducted. In particular, for a given performance indicator, one can use multivariate linear analyses to evaluate the approximate impact on the performance indices of uncertainty in various parameters. As shown below, the impact depends upon the square of the sensitivity coefficients (partial derivatives) and the variances and covariances of the parameter sets.

For a performance indicator $I = F(Y)$, which is a function $F(\bullet)$ of model outputs Y, that are in turn a function $g(P)$ of input parameters P, one can use a multivariate Taylor series approximation of F to obtain the expected value and variance of the indicator:

$$\mathrm{E}[I] = F(\text{ based on mean values of input parameters}) + (1/2)\ \{\Sigma_i \Sigma_j\ [\partial F^2/\partial P_i \partial P_j]\ \mathrm{Cov}\ [P_i, P_j]\ \} \quad (6)$$

and

$$\mathrm{Var}[I] = \Sigma_i \Sigma_j\ (\partial F/\partial P_i)(\partial F/\partial P_j)\ \mathrm{Cov}\ [P_i, P_j] \quad (7)$$

where $(\partial F/\partial P_i)$ are the partial derivative of the function F with respect to P_i evaluated at the mean value of the input parameters P_i, and $\partial F^2/\partial P_i \partial P_j$ are the second partial derivatives. The covariance of two random input parameters P_i and P_j is the expected value of the product of differences between the values and their means.

$$\mathrm{Cov}[P_i, P_j] = \mathrm{E}[(P_i - \mathrm{E}[P_i])(P_j - \mathrm{E}[P_j])] \quad (8)$$

If all the parameters are independent of each other, and the second-order terms in the expression for the mean E[I] are neglected, one obtains

$$\mathrm{E}[I] = F(\text{ based on mean values of input parameters}) \quad (9)$$

and

$$\mathrm{Var}\ [I] = \Sigma_i\ [\partial F/\partial P_i]^2\ \mathrm{Var}\ [P_i] \quad (10)$$

(Benjamin and Cornell, 1970). Equation 6 for E[I] shows that in the presence of substantial uncertainty, the mean of the output from nonlinear systems is not simply the system output corresponding to the mean of the parameters (Gaven and Burges, 1981, p. 1523). This is true for any nonlinear function.

Of interest in the analysis of uncertainty is the approximation for the variance Var[I] of indicator I. In Equation 10 the contribution of P_i to the variance of I equals Var[P_i] times $[\partial F/\partial P_i]^2$, which are the squares of the sensitivity coefficients for indicator I with respect to each input parameter value P_i.

4.2.4.1 An example of first-order sensitivity analysis

It may appear that first-order analysis is difficult because the partial derivatives of the performance indicator I are needed with respect to the various parameters. However, reasonable approximations of these sensitivity coefficients can be obtained from the simple sensitivity analysis described in Table 3, as shown below. In that table, three different parameter sets, P_i, are defined in which one parameter of the set is at its high value, P_{iH}, and one is at its low value, P_{iL}, to produce corresponding values (called high, I_{iH}, and low, I_{iL}) of a system performance indicator I.

Table 3. Approximate parameter sensitivity coefficients.

parameter set	value low	value high	sensitivity coefficient
1	I_{1L}	I_{1H}	$[I_{1H}-I_{1L}]/[P_{1H}-P_{1L}]$
2	I_{2L}	I_{2H}	$[I_{2H}-I_{2L}]/[P_{2H}-P_{2L}]$
3	I_{3L}	I_{3H}	$[I_{3H}-I_{3L}]/[P_{3H}-P_{3L}]$

It is then necessary to estimate some representation of the variances of the various parameters with some consistent procedure. For a normal distribution, the distance between the 5 and 95 percentiles is 1.645 standard deviations on each side of the mean, or 2(1.645) = 3.3 standard deviations. Thus, if the high/low range is thought of as approximately a 5-95 percentile range for a normally distributed variate, a reasonable approximation of the variance might be

$$\mathrm{Var}[P_i] = \{\, [P_{iH}-P_{iL}]/3.3 \,\}^2. \qquad (11)$$

This is all that is needed. Use of these average sensitivity coefficients is very reasonable for modeling the behavior of the system performance indicator *I* over the indicated ranges.

As an illustration of the method of first-order uncertainty analysis, consider the lake quality problem described above. The "system performance indicator" in this case is the model output, the phosphorus concentration *P*, and the input parameters, now denoted as $X = L$, q, and z. The standard deviation of each parameter is assumed to be the specified range divided by 3.3. Average sensitivity coefficients $\partial P/\partial X$ were calculated. The results are reported in the table below.

Table 4. Calculation of approximate parameter sensitivity coefficients.

variable X	units	$\delta P/\delta X$	St Dev[X]	$(\delta P/\delta X)^2$ Var[X]	%
L	mg/m^2 . a	0.025	121.21	9.18	75.7
q	m/a	-1.024	1.67	2.92	24.1
z	m	-0.074	1.82	0.02	0.2

Assuming the parameter errors are independent:

$$\mathrm{Var}[P] = 9.18 + 2.92 + 0.02 = 12.12 \tag{12}$$

The square root of 12.12 is the standard deviation and equals 3.48. This agrees well with a Monte Carlo analysis reported below.

Note that 100*(9.18/12.12), or about 76% of the total parameter error variance in the phosphorus concentration P is associated in the phosphorus loading rate L and the remaining 24% is associated with the hydrologic loading q. Eliminating the uncertainty in z would have a negligible impact on the overall model error. Likewise, reducing the error in q would at best have a modest impact on the total error.

Due to these uncertainties, the estimated phosphorus concentration has a standard deviation of 3.48. Assuming the errors are normally distributed, and recalling that ± 1.645 standard deviations around the mean define a 5-95 percentile interval, the 5-95 percentile interval would be about

$$16.8 \pm 1.645\ (3.48)\ \mathrm{mg/m^3} = 16.8 \pm 5.7\ \mathrm{mg/m^3} = 11.1 \text{ to } 22.5\ \mathrm{mg/m^3}. \tag{13}$$

These error bars indicate there is substantial uncertainty associated with the phosphorus concentration P, primarily due to uncertainty in the loading rate L.

The upper bound of 22.6 mg/m^3 is considerably less than the 27 mg/m^3 that would be obtained if both L and q had their most unfavorable values. In a probabilistic analysis with independent errors, such a combination is highly unlikely.

4.2.4.2 Warning on accuracy.

First-order uncertainty analysis is indeed an approximate method based upon a linearization of the response function represented by the full simulation model. It may provide inaccurate estimates of the variance of the response variable for nonlinear systems with large uncertainty in the parameters. In such cases Monte Carlo simulation (discussed below and in Chapter VII) or the use of higher-order approximation may be required. Beck (1987, p. 1426) cites studies that found that Monte Carlo and first-order variances were not appreciably different, and a few studies that found specific differences. Differences are likely to arise when the distributions used for the parameters are bimodal (or otherwise unusual), or some rejection algorithm is used in the Monte Carlo analysis to exclude some parameter combinations. Such errors can result in a distortion in the ranking of predominant sources of uncertainty. However, in most cases very similar results were obtained.

4.2.5 Fractional factorial design method

An extension of first-order sensitivity analysis would be a more complete exploration of the response surface using a careful statistical design. First consider a complete factorial design. Input data are divided into discrete "levels'. The simplest case is two levels. These two levels can be defined as a nominal value, and a high (low) value. Simulation runs are made for all combinations of parameter levels. For *n* different inputs, this would require 2^n simulation runs. Hence for a three-input variable or parameter problem, 8 runs would be required. If 4 discrete levels of each input variable or parameter were allowed to provide a more reasonable description of a continuous variable, the three-input data problem would require 4^3 or 64 simulation runs. Clearly this is not a useful tool for large regional water resources simulation models.

A fractional factorial design involves simulating only a fraction of what is required from a full factorial design method. The loss of information prevents a complete analysis of the impacts of each input variable or parameter on the output.

To illustrate the fractional factorial design method, consider the two-level with three-input variable or parameter problem. Table 5 below shows the 8 simulations required for a full factorial design method. The '+' and the '–' show the upper and lower levels of each input variable or parameter P_i where $i = 1, 2, 3$. If all 8 simulations were performed, seven possible effects could be estimated. These are the individual effects of the three inputs P_1, P_2, and P_3, the three two-input variable or parameter interactions, $(P_1)(P_2)$, $(P_1)(P_3)$, and $(P_2)(P_3)$, and the one three-input variable or parameter interaction $(P_1)(P_2)(P_3)$.

Table 5. A three-input factorial design.

simulation run	value of input P_1	value of input P_2	value of input P_3	value of output - variable Y
1	-	-	-	Y_1
2	+	-	-	Y_2
3	-	+	-	Y_3
4	+	+	-	Y_4
5	-	-	+	Y_5
6	+	-	+	Y_6
7	-	+	+	Y_7
8	+	+	+	Y_8

Consider an output variable Y, where Y_j is the value of Y in the jth simulation run. Then an estimate of the effect, denoted $\delta(Y|P_i)$, that input variable or parameter P_i has on the output variable Y, is the average of the four separate effects of varying P_i:

For i = 1:

$$\delta(Y \mid P_1) = 0.25 \; [\; (Y_2-Y_1)+(Y_4-Y_3)+(Y_6-Y_5)+(Y_8-Y_7) \;] \tag{14}$$

Each difference in parentheses is the difference between a run in which P_1 is at its upper level and a run in which P_1 is at its lower level, but the other two parameter values, P_2 and P_3, are unchanged. If the effect is equal to 0, then, in this case, P_1 has no impact on the output variable Y.

Similarly the effects of P_2 and P_3, on variable Y can be estimated as:

$$\delta(Y \mid P_2) = 0.25 \; \{\; (Y_3-Y_1)+(Y_4-Y_2)+(Y_7-Y_5)+(Y_8-Y_6) \;\} \tag{15}$$

and

$$\delta(Y \mid P_3) = 0.25 \; \{\; (Y_5-Y_1)+(Y_6-Y_2)+(Y_7-Y_3)+(Y_8-Y_4) \;\} \tag{16}$$

Consider next the interaction effects between P_1 and P_2. This is estimated as the average of the difference between the average P_1 effect at the upper level of P_2, and the average P_1 effect at the lower level of P_2. This is the same as the difference between the average P_2 effect at the upper level of P_1 and the average P_2 effect at the lower level of P_1:

$$\delta(Y \mid P_1, P_2) = (1/2) \; \{\; [\; (Y_8-Y_7) + (Y_4-Y_3)]/2 - [\; (Y_2-Y_1) + (Y_6-Y_5)]/2 \;\}$$

$$= (1/4) \; \{\; [\; (Y_8-Y_6)+(Y_4-Y_2)] - [\; (Y_3-Y_1) + (Y_7-Y_5)] \;\} \tag{17}$$

Similar equations can be derived for looking at the interaction effects between P_1 and P_3, and between P_2 and P_3 and the interaction effects among all three inputs P_1, P_2, and P_3.

Now assume only half of the simulation runs were performed, perhaps runs 2, 3, 5 and 8 in this example. If only outputs Y_2, Y_3, Y_5, and Y_8 are available, for our example:

$$\delta(Y \mid P_3) = \square(Y \mid P_1, P_2) = 0.5 \; \{\; (Y_8 - Y_3) - (Y_2 - Y_5) \;\} \tag{18}$$

The separate effects of P_3 and of P_1P_2 are not available from the output. This is the loss in information resulting from fractional instead of complete factorial design.

4.2.6 Monte Carlo sampling methods

The Monte Carlo method of performing sensitivity analyses, illustrated in Figure 16, first selects a random set of input data values drawn from their individual probability distributions. These values are then used in the simulation model to obtain some model output variable values. This process is repeated many times, each time making sure the model calibration is valid for the input data values chosen. The end result is a probability distribution of model output variables and system performance indices that results from variations and possible errors in all of the input values.

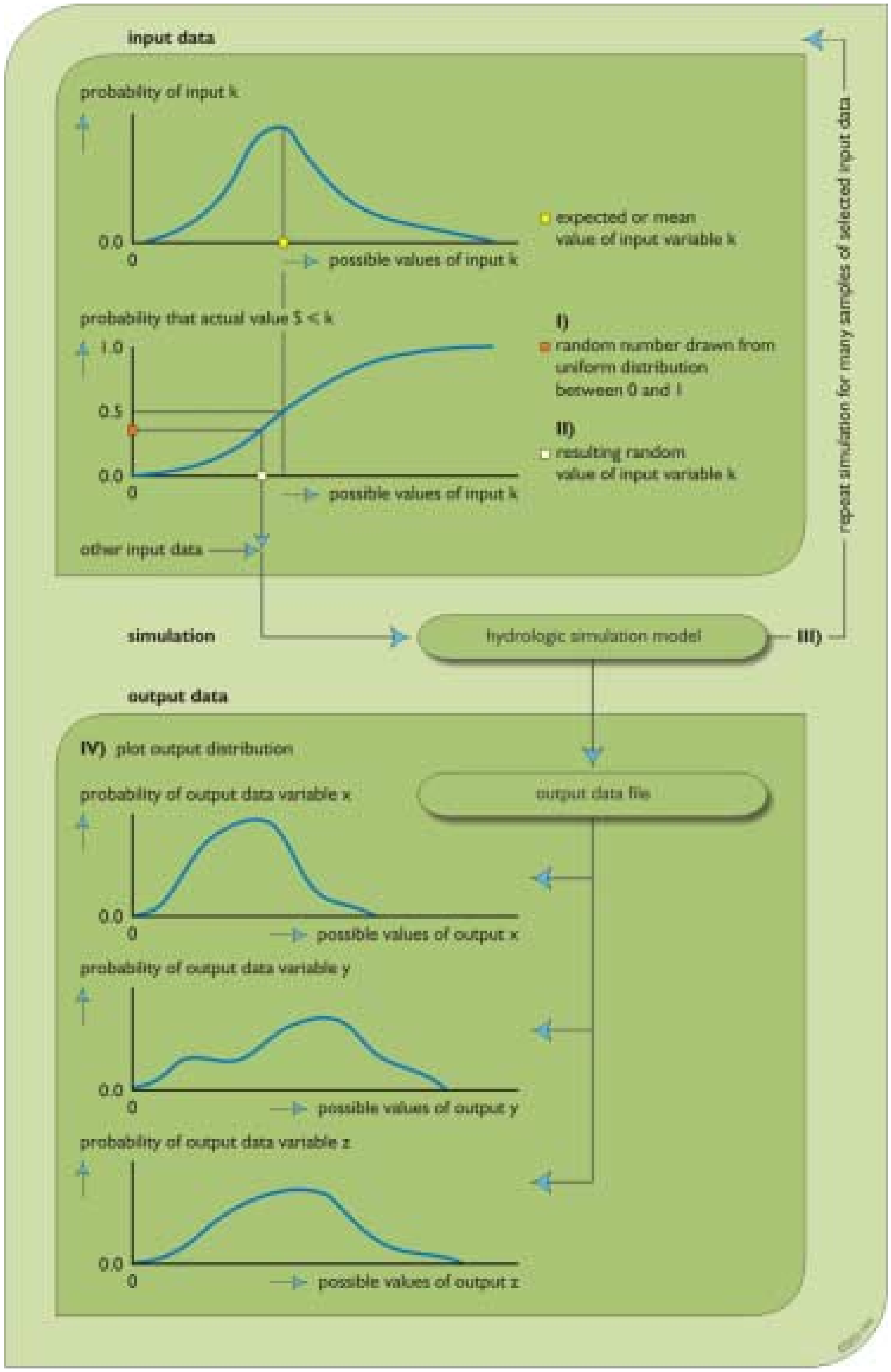

Figure 16. Monte Carlo sampling and simulation procedure for finding distributions of output variable values based on distributions, for specified reliability levels, of input data values. This technique can be applied to one or more uncertain input variables at a time. The output distributions will reflect the combined effects of this input uncertainty over the specified ranges.

Using a simple Monte Carlo analysis, values of all of the parameter sets are selected randomly from distributions describing the individual and joint uncertainty in each, and then the modeled system is simulated to obtain estimates of the selected performance indices. This must be done many times (often well over 100) to obtain a statistical description of system performance variability. The number of replications needed is generally not dependent on the number of parameters whose errors are to be analyzed. One can include in the simulation the uncertainty in parameters as well as natural variability. This method can evaluate the impact of single or multiple uncertain parameters.

A significant problem that arises in such simulations is that some combinations of parameter values result in unreasonable models. For example, model performance with calibration data sets might be inconsistent with available data sets. The calibration process places interesting constraints on different sets of parameter values. Thus, such Monte Carlo experiments often contain checks that exclude combinations of parameter values that are unreasonable. In these cases the generated results are conditioned on this validity check.

Whenever sampling methods are used, one must consider possible correlations among input data values. Sampling methods can handle spatial and temporal correlations that may exist among input data values, but the existence of correlation requires defining appropriate conditional distributions.

One major limitation of applying Monte Carlo methods to estimate ranges of risk and uncertainty for model output variable values, and system performance indicator values based on these output variable values, is the computing time required. To reduce the computing times needed to perform sensitivity analyses using sampling methods, some tricks and as well as stratified sampling methods are available. The discussion below illustrates the idea of a simple modification (or trick) using a "standardized" Monte Carlo analysis. The more general Latin Hypercube Sampling procedure is also discussed.

4.2.6.1 Simple Monte Carlo sampling

To illustrate the use of Monte Carlo sampling methods consider again Vollenweider's empirical relationship, Equation 5, for the average phosphorus concentration in lakes (Vollenweider, 1976). Two hundred values of each parameter were generated independently from normal distributions with the means and variances as shown in Table 6.

The table contains the specified means and variances for the generated values of L, q and z, and also the actual values of the means and variances of the 200 generated values of L, q, z and also of the 200 corresponding generated output phosphorus concentrations, P. Figure 17 displays the distribution of the generated values of P.

Table 6. Monte Carlo analysis of lake phosphorus levels.

parameter	L	q	z	P
specified means and standard deviations				
mean standard deviations	680.00 121.21	10.60 1.67	84.00 1.82	— ---
generated means and standard deviations				
mean standard deviations	674.18 130.25	10.41 1.73	84.06 1.82	17.07 3.61

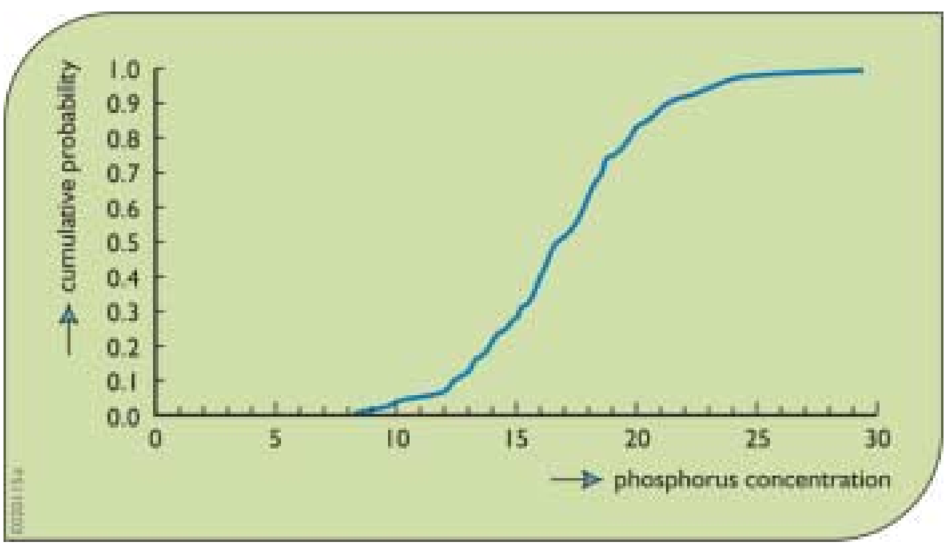

Figure 17. Distribution of lake phosphorus concentrations from Monte Carlo analysis

One can see that given the estimated levels of uncertainty, phosphorus levels could reasonably range from below 10 to above 25. The probability of generating a value greater than 20 mg/m^3 was 12.5%. The 5% to 95 percentile range was 11.1 to 23.4 mg/m^3. In the figure, the cumulative probability curve is rough because only 200 values of the phosphorus concentration were generated, but these are clearly enough to give a good impression of the overall impact of the errors.

4.2.6.2 Sampling uncertainty.

In this example, the mean of the 200 generated values of the phosphorus concentration, *P*, was 17.07. However a different set of random values would have generated a different set of *P* values as well. Thus it is appropriate to estimate the standard error, SE, of this average. The standard error equals the standard deviation σ of the *P* values divided by the square root of the sample size *n*:

$$SE = \sigma/(n)^{0.5} = 3.61/(200)^{0.5} = 0.25. \qquad (19)$$

From the central limit theorem of mathematical statistics, the average of a large number of independent values should have very nearly a normal distribution. Thus, 95% of the time, the true mean of *P* should be in the interval 17.1 ± 1.96 (0.25), or 16.6 to 17.6 mg/m^3 . This level of uncertainty reflects the observed variability of *P* and the fact that only 200 values were generated.

4.2.6.3 Making sense of the results.

A significant challenge with complex models is to determine from the Monte Carlo simulation which parameter errors are important. Calculating the correlation between each generated input parameter value and the output variable value is one way of doing this. As Table 7 below shows, based upon the magnitudes of the correlation coefficients, errors in *L* were most important, and those in *q* second in importance.

Table 7. Correlation analysis of Monte Carlo results.

variable	*L*	*q*	*z*	*P*
L	1			
q	0.079	1		
z	0.1297	-0.139	1	
P	0.851	-0.434	0.144	1

One can also use regression to develop a linear model defining variations in the output based on errors in the various parameters. The results are shown in the Table 8. The fit is very good, and R^2 = 98%. If the model for *P* had been linear, a R^2 value of 100% should have resulted. All of the coefficients are significantly different from zero.

Note that the correlation between *P* and *z* was positive in Table 7, but the regression coefficient for *z* is negative. This occurred because there is a modest negative correlation between the generated *z* and *q* values. Use of partial correlation coefficients can also correct for such spurious correlations among input parameters.

Table 8. Results of Regression Analysis on Monte Carlo Results

	coefficient	standardized error	ratio t
intercept	18.605	1.790	10.39
L	0.025	0.000	85.36
q	-1.068	0.022	-48.54
z	-0.085	0.021	- 4.08

Finally we display a plot, Figure 18, based on this regression model illustrating the reduction in the variance of *P* that is due to dropping each variable individually. Clearly *L* has the biggest impact on the uncertainty in *P,* and *z* the least.

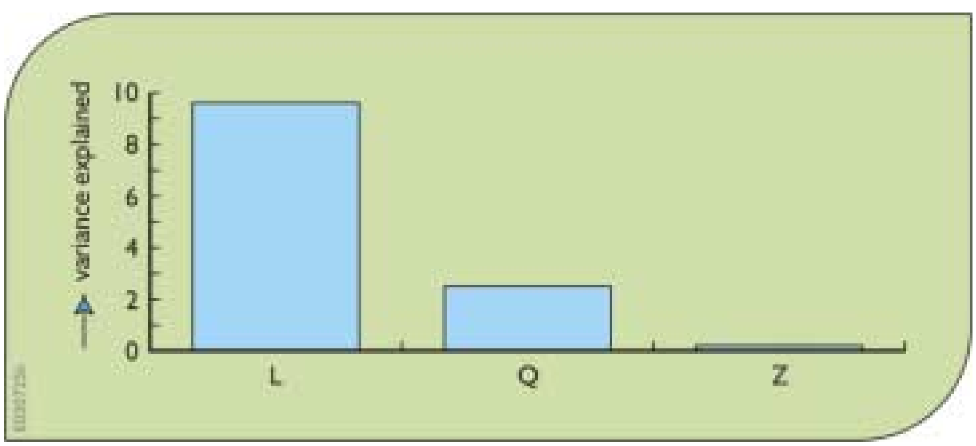

Figure 18. Reduction in the variance of P that is due to dropping from the regression model each variable individually. Clearly L has the biggest impact on the uncertainty in P, and z the least.

4.2.6.4 Standardized Monte Carlo analysis

Using a "standardized" Monte Carlo analysis, one could adjust the generated values of L, q and z above so that the generated samples actually have the desired mean and variance. While making that correction, one can also shuffle their values so that the correlations among the generated values for the different parameters are near zero, as is desired. This was done for the 200 generated values to obtain the statistics shown in Table 9.

Table 9. Standardized Monte Carlo analysis of lake phosphorus levels

parameter	L	q	z	P
	specified means and standard deviations			
Mean	680.00	10.60	84.00	—
Standard deviations	121.21	1.67	1.82	---
	generated means and standard deviations			
Mean	680.00	10.60	84.00	17.03
Standard deviations	121.21	1.67	1.82	3.44

Repeating the correlation analysis from before (shown in Table 10) now yields much clearer results that are in agreement with the regression analysis. The correlation between P and both q and z are now negative as they should be. Because the generated values of the three parameters have been adjusted to be uncorrelated, the signal from one is not confused with the signal from another.

Table 10. Correlation analysis of standardized Monte Carlo results

variable	*L*	*q*	*z*	*P*
L	1.00			
q	0.01	1.00		
z	0.02	0.00	1.00	
P	0.85	-0.50	-0.02	1.00

The mean phosphorus concentration changed very little. It is now 17.0 instead of 17.1 mg/m^3.

Using control variates with a linear predictive model in conjunction with the standardized Monte Carlo variates, the standard deviation of the errors associated with the 200 observations is only 0.45. Thus the standard error for this estimate of the mean of P is $0.45/(200)^{0.5}$ or just 0.03. Thus this is a highly accurate result. The regressions were also repeated and yielded very similar results. The only real difference was that the parameter estimates had small standard errors and were more significant because of the elimination of correlation between the generated parameters.

4.2.6.5 Generalized likelihood estimation

Beven (1993) and Binley and Beven (1991) suggest a Generalized Likelihood Uncertainty Estimation (GLUE) technique for assessment of parameter error uncertainty using Monte Carlo simulation. It is described as a "formal methodology for some of the subjective elements of model calibration" (Beven, 1989, p. 47). The basic idea is to begin by assigning reasonable ranges for the various parameters and then to draw parameter sets from those ranges using a uniform or some similar (and flat) distribution. These generated parameter sets are then used on a calibration data set so that unreasonable combinations can be rejected, while reasonable values are assigned a posterior probability based upon a likelihood measure which may reflect several dimensions and characteristics of model performance.

Let $L(P_i) > 0$ be the value of the likelihood measure assigned to the i^{th} parameter set's calibration sequence. Then the model predictions generated with parameter set/combination P_i are assigned posterior probability, $p(P_i)$.

$$p(P_i) = L(P_i) / \Sigma_j L(P_j) \qquad (20)$$

These probabilities reflect the form of Bayes theorem, which is well supported by probability theory (Devore, 1991). This procedure should capture reasonably well the dependence or correlation among parameters, because *reasonable* sequences will all be assigned larger probabilities, whereas sequences that are unable to reproduce the system response over the calibration period will be rejected or assigned small probabilities.

However, in a rigorous probabilistic framework, the L would be the likelihood function for the calibration series for particular error distributions. (This could be checked with available goodness-of-fit procedures; for example, Kuczera, 1988.) When relatively ad hoc measures are adopted for the likelihood measure with little statistical validity, the $p(P_i)$ probabilities are best described as pseudo probabilities or "likelihood" weights.

Another concern with this method is the potential efficiency. If the parameter ranges are too wide, a large number of unreasonable or very unlikely parameter combinations will be generated. These will either be rejected or else will have small probabilities and thus little effect on the analysis. In this case the associated processing would be a waste of effort. A compromise is to use some data to calibrate the model and to generate a prior or initial distribution for the parameters that is at least centered in the best range (Beven 1993, p. 48). Then use of a different calibration period to generate the $p(P_i)$ allows an updating of those initial probabilities to reflect the information provided by the additional calibration period with the adopted likelihood measures.

After the accepted sequences are used to generate sets of predictions, the likelihood weights would be used in the calculation of means, variances and quantiles, rather than the customary procedure of giving all the generated realizations equal weight. The resulting conditional distribution of system output reflects the initial probability distributions assigned to parameters, the rejection criteria, and the likelihood measure adopted to assign "likelihood" weights.

4.2.7 Latin hypercube sampling

For the simple Monte Carlo simulations described above, with independent errors, a probability distribution is assumed for each input parameter or variable. In each simulation run, values of all input data are obtained from sampling those individual and independent distributions. The value generated for an input parameter or variable is usually independent of what that value was in any previous run, or what other input parameter or variable values are in the same run. This simple sampling approach can result in a clustering of parameter values and hence both redundancy of information from repeated sampling in the same regions of a distribution and lack of information from no sampling in other regions of the distributions.

A stratified sampling approach ensures more even coverage of the range of input parameter or variable values with the same number of simulation runs. This can be accomplished by dividing the input parameter or variable space into sections and sampling from each section with the appropriate probability.

One such approach, Latin hypercube sampling (LHS), divides each input distribution into sections of equal probability for the specified the probability distribution, and draws one observation randomly from each range. Hence the ranges of input values within each section actually occur with equal frequency in the experiment. These values from each interval for each distribution are randomly assigned to those from other intervals to construct sets of input values for the simulation analysis. Figure 19 shows the steps in constructing a LHS for six simulations involving three inputs P_j (P_1, P_2, and P_3) and six intervals of their respective normal, uniform and triangular probability distributions.

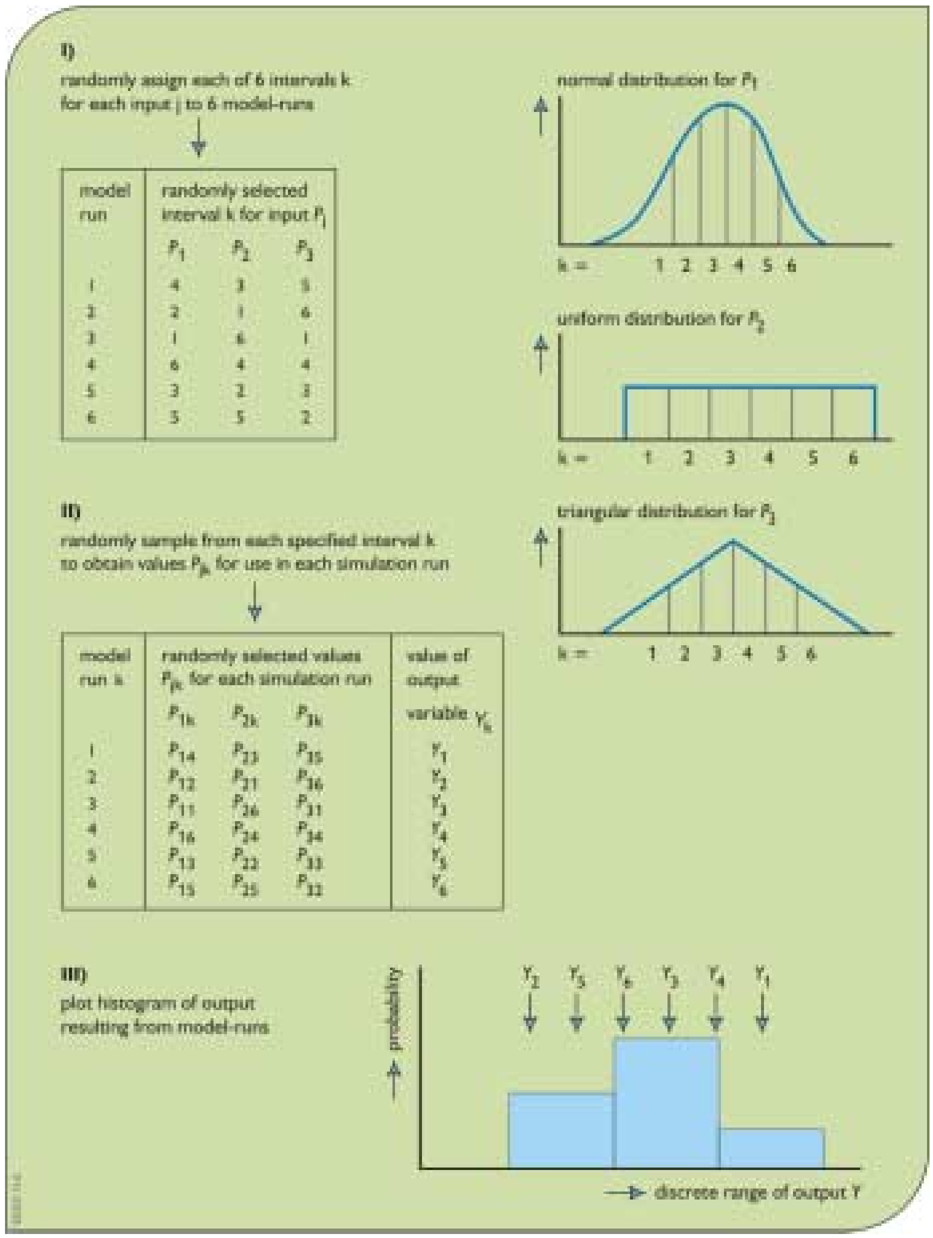

Figure 19. Schematic representation of a Latin hypercube sampling procedure for six simulation runs.

5. Performance indicator uncertainties

5.1 Performance measure target uncertainty

Another possible source of uncertainty is the selection of performance measure target values. For example, consider a target value for a pollutant concentration based on the effect of exceeding it in an ecosystem. Which target value is best or correct? When this is not clear, there are various ways of expressing the uncertainty associated with any target value. One such method is the use of fuzzy sets (Chapter VI). Use of 'grey' numbers or intervals instead of 'white' or fixed target values is another. When some uncertainty or disagreement exists over the selection of the best target value for a particular performance measure it seems to us the most direct and transparent way to do this is to subjectively assume a distribution over a range of possible target values. Then this subjective probability distribution can be factored into the tradeoff analysis, as outlined in Figure 20.

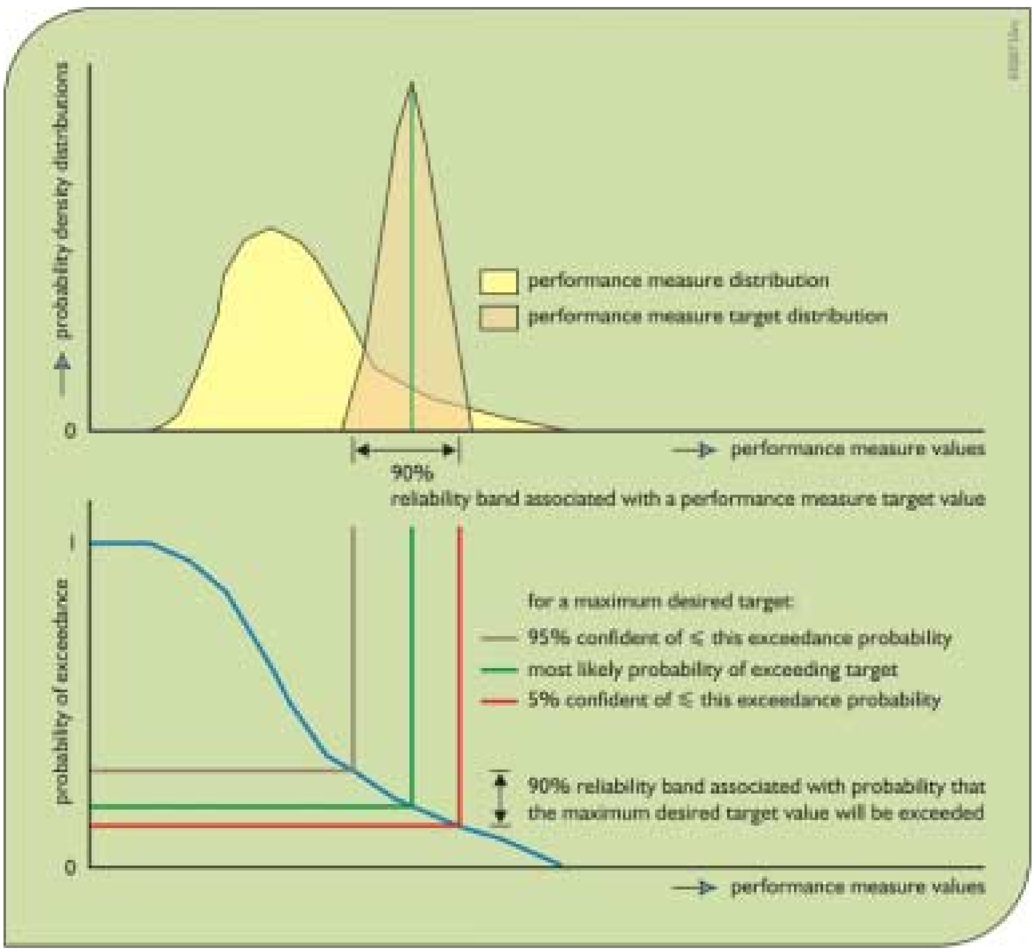

Figure 20. Combining the probability distribution of performance measure values with the probability distribution of performance measure target values to estimate the confidence one has in the probability of exceeding a maximum desired target value.

One of the challenges associated with defining and including in an analysis the uncertainty associated with a target or threshold value for a performance measure is that of communicating just what the result of such an analysis means. Referring to Figure 20, suppose the target value represents some maximum limit of a pollutant, say phosphorus, concentration in the flow during a given period of time at a given site or region, and it is not certain just what that maximum limit should be. Subjectively defining the distribution of that maximum limit, and considering that uncertainty along with the uncertainty (probability of exceedance function) of pollutant concentrations – the performance measure – one can attach a confidence to any probability of exceeding the maximum desired concentration value.

The 95% probability of exceedance shown on Figure 20, say $P_{0.95}$, should be interpreted as "we can be 95% confident that the probability of the maximum desired pollutant concentration being exceeded will be no greater than $P_{0.95}$." We can be only 5% confident that the probability of exceeding the desired maximum concentration will be no greater than the lower $P_{0.05}$ value. Depending on whether the middle line through the subjective distribution of target values in Figure 20 represents the most likely or median target value, the associated probability of exceedance is either the most likely, as indicated in Figure 20, or that for which we are only 50% confident.

Figure 21 attempts to show how to interpret the reliabilities when the uncertain performance targets are

- minimum acceptable levels that are to be maximized,
- maximum acceptable levels that are to be minimized or
- optimum levels.

An example of a minimum acceptable target level might be the population of wading birds in an area. An example of a maximum acceptable target level might be, again, the phosphorus concentration of the flow in a specific wetland or lake. An example of an optimum target level might be the depth of water most suitable for selected species of aquatic vegetation during a particular period of the year.

For performance measure targets that are not expressed as minimum or maximum limits but that are the 'best' values, referring to Figure 21, one can state that one is 90% confident that the probability of achieving the desired target is no more than B. The 90% confidence level probability of not achieving the desired target is at least A+C. The probability of the performance measure being too low is at least A and the probability of the performance measure being too high is at least C, again at the 90% confidence levels. As the confidence level decreases the bandwidth decreases, and the probability of not meeting the target increases.

Now, clearly there is uncertainty associated with each of these uncertainty estimations, and this raises the question of how valuable is the quantification of the uncertainty of each additional component of the plan in an evaluation process. Will plan evaluators and decision makers benefit from this additional information, and just how much additional uncertainty information is useful?

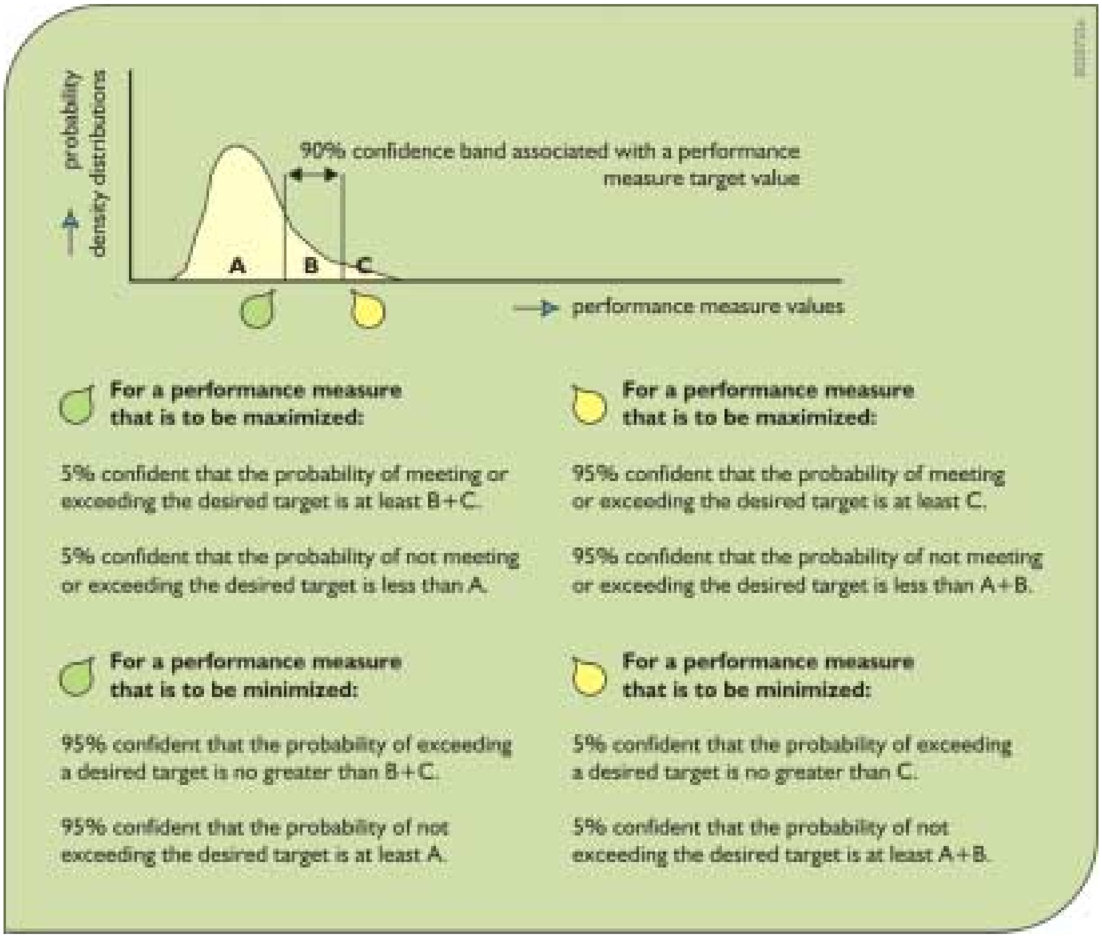

Figure 21. Interpreting the results of combining performance measure probabilities with performance measure target probabilities depends on the type of performance measure. The letters A, B, and C represent proportions of the probability density function of performance measure values. (Hence probabilities A + B + C = 1.)

Now consider again the tradeoffs that need to be made as illustrated in Figure 7. Instead of considering a single target value as shown on Figure 7, assume there is a 90% confidence range associated with that single performance measure target value. Also assume that the target is a maximum desired upper limit (e.g., of some pollutant concentration).

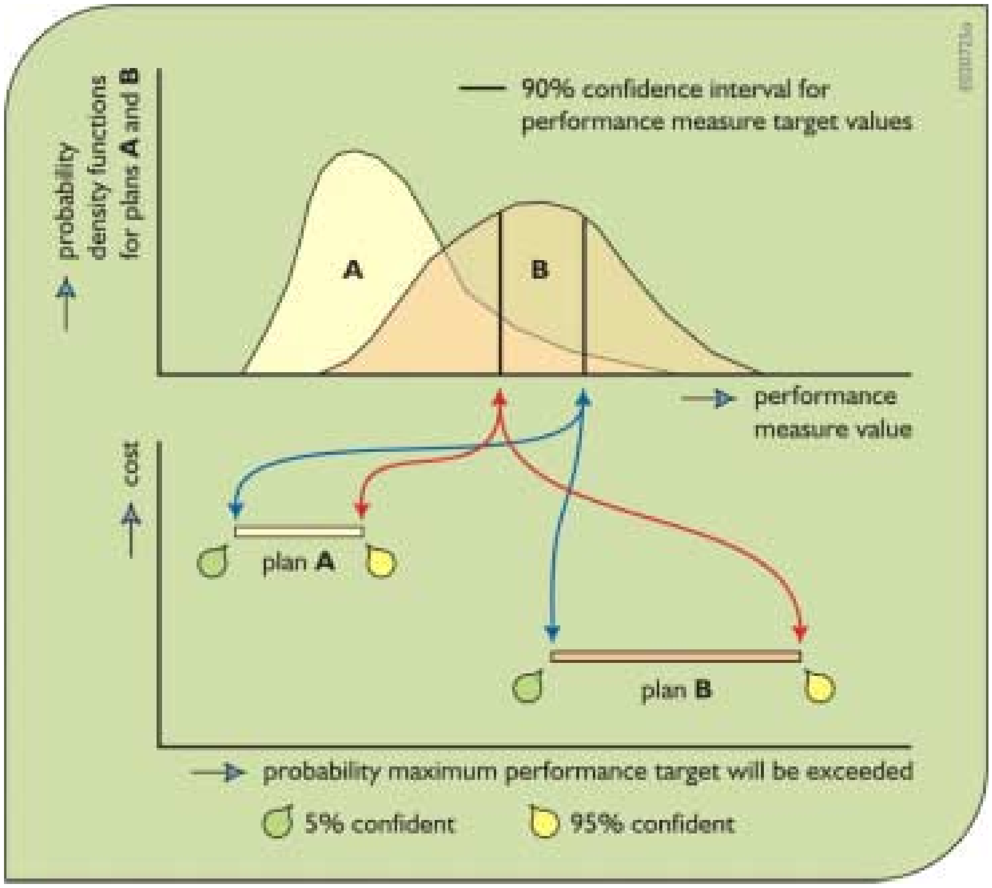

Figure 22. Two plans showing ranges of probabilities, depending on one's confidence, that an uncertain desired maximum (upper limit) performance target value will be exceeded. The 95% confidence levels are associated with the higher probabilities of exceeding the desired maximum target. The 5% confident levels are associated with the more desirable lower probabilities of exceeding the desired maximum target. Plan A with reduced probabilities of exceeding the upper limit costs more than Plan B.

In the case shown in Figure 22, the tradeoff is clearly between cost and reliability. In this example, no matter what confidence one chooses, Plan A is preferred to Plan B with respect to reliability, but Plan B is preferred to Plan A with respect to cost. The tradeoff is only between these two performance indicators or measures.

Consider however a third plan, as shown in Figure 23. This situation adds to the complexity of making appropriate tradeoffs. Now there are three criteria: cost, probability of exceedance (reliability) and the confidence in those reliabilities or probabilities. Add to this the fact that there will be multiple performance measure targets, each expressed in terms of their maximum probabilities of exceedance and the confidence in those probabilities.

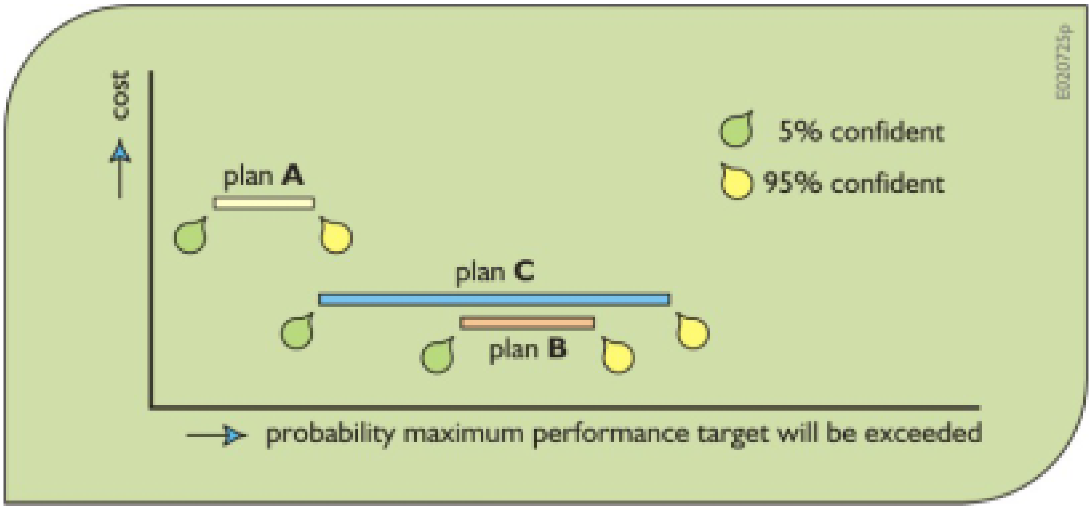

Figure 23. Tradeoffs among cost, reliabilities, and the confidence level of those reliabilities. The relative ranking of plans with respect to the probability of exceeding the desired (maximum limit) target may depend on the confidence given to that probability.

In Figure 23, in terms of cost the plans are ranked, from best to worst, B, C, and A. In terms of reliability at the 90 percent confidence level, they are ranked A, B, and C but at the 50 percent confidence level the ranking is A, C and B.

If the plan evaluation process has difficulty handling all this it may indicate the need to focus the uncertainty analysis effort on just what is deemed important, achievable, and beneficial. Then when the number of alternatives has been narrowed down to only a few that appear to be the better ones, a more complete uncertainty analysis can be performed. There is no need nor benefit in performing sensitivity and uncertainty analyses on all possible management alternatives. Rather one can focus on those alternatives that look the most promising, and then carry out additional uncertainty and sensitivity analyses only when important uncertain performance indicator values demands more scrutiny. Otherwise the work is not likely to affect the decision anyway.

5.2 Distinguishing differences between performance indicator distributions

Simulations of alternative water management infrastructure designs and operating policies require a comparison of the simulation outputs – the performance measures or indicators – associated with each alternative. A reasonable question to ask is are the observed differences statistically significant. Can one really tell if one alternative is better than another or are the observed differences explainable by random variations attributable to variations in the inputs and how the system responds?

This is a common statistical issue that is addressed by standard hypothesis tests (Devore, 1991; Benjamin and Cornell, 1970). Selection of an appropriate test requires that one first resolve what type of change one expects in the variables. To illustrate, consider the comparison of two different operating policies. Let Y_1 denote the set of output performance variable values with the first policy, and Y_2 the set of output performance variable values of the second policy. In many cases, one would expect one policy to be better than the other. One measure might be the difference in the mean of the variables; for example is $E[Y_1] < E[Y_2]$?. Alternatively one could check the difference in the median (50 percentile) of the two distributions.

In addition, one could look for a change in the variability or variance, or a shift in both the mean and the variance. Changes described by a difference in the mean or median often make the most sense and many statistical tests are available that are sensitive to such changes. For such investigations parametric and non-parametric tests for paired and unpaired data can be employed.

Consider the differences between “paired” and “unpaired” data. Suppose that the meteorological data for 1941-1990 is used to drive a simulation model generating data as described in Table 11:

Table 11. Possible flow data from a 50-year simulation

1941	Y_1 (1)	Y_2 (1)
1942	Y_1 (2)	Y_2 (2)
1943	Y_1 (3)	Y_2 (3)
1944	Y_1 (4)	Y_2 (4)
1989	Y_1 (49)	Y_2 (49)
1990	Y_1 (50)	Y_2 (50)

Here there is one sample, $Y_1(1)$ through $Y_1(50)$, for policy 1, and another sample, $Y_2(1)$ through $Y_2(50)$, for policy 2. However, the two sets of observations are not independent. For example, if 1943 was a very dry year, then we would expect both $Y_1(3)$ for policy 1 in that year and $Y_2(3)$ for policy 2 to be unusually small. With such paired data, one can use a paired hypothesis test to check for differences. Paired tests are usually easier than the corresponding unpaired tests that are appropriate in other cases. (For example, if one were checking for a difference in average rainfall depth between 1941-1960, and 1961-1990, they would have two sets of independent measurements for the two periods. With such data, one should use a two-sample unpaired test.)

Paired tests are generally based on the differences between the two sets of output, $Y_1(i) - Y_2(i)$. These are viewed as a single independent sample. The question is then are the differences positive (say Y_1 tends to be larger then Y_2), or negative (Y_1 tends to be smaller), or are positive and negative differences are equally likely (there is no difference between Y_1 and Y_2).

Both parametric and non-parametric families of statistical tests are available for paired data. The common parametric test for paired data (a one-sample t test) assumes that the mean of the differences

$$X(i) = Y_1(i) - Y_2(i) \tag{21}$$

are normally distributed. Then the hypothesis of no difference is rejected if the t statistic is sufficiently large, given the sample size n.

Alternatively, one can employ a nonparametric test and avoid the assumption that the differences X(i) are normally distributed. In such a case, one can use the Wilcoxon Signed Rank test. This nonparametric test ranks the absolute values $|X(i)|$ of the differences. If the sum S of the ranks of the positive differences deviates sufficiently from its expected value, $n(n+1)/4$ (were there no difference between the two distributions), one can conclude that there is a statistically significant difference between the $Y_1(i)$ and $Y_2(i)$ series. Standard statistical texts have tables of the distribution of the sum S as a function of the sample size n, and provide a good analytical approximation for $n > 20$ (for example, Devore, 1991). Both the parametric t test and the nonparametric Wilcoxon Signed Rank test require that the differences between the simulated values for each year be computed.

6. Communicating model output uncertainty

Spending money on reducing uncertainty would seem preferable to spending it on ways of calculating and describing it better. Yet attention to uncertainty communication is critically important if uncertainty analyses and characterizations are to be of value in a decision making process. In spite considerable efforts by those involved in risk assessment and management, we know very little about how to ensure effective risk communication to gain the confidence of stakeholders, incorporate their views and knowledge, and influence favorably the acceptability of risk assessments and risk-management decisions.

The best way to communicate concepts of uncertainty may well depend on what the audiences already know about risk and the various types of probability distributions (e.g., density, cumulative, exceedance) based on objective and subjective data, and the distinction between mean or average values and the most likely values. Undoubtedly graphical representations of these ways of describing uncertainty considerably facilitate communication.

The National Research Council (NRC 1994) addressed the extensive uncertainty and variability associated with estimating risk and concluded that risk characterizations should not be reduced to a single number or even to a range of numbers intended to portray uncertainty. Instead, the report recommended managers and the interested public should be given risk characterizations that are both qualitative and quantitative and both verbal and mathematical.

In some cases communicating qualitative information about uncertainty to stakeholders and the public in general may be more effective than quantitative information. There are, of course, situations in which quantitative uncertainty analyses are likely to provide information that is useful in a decision-making process. How else can tradeoffs such as illustrated in Figures 10 and 27 be identified? Quantitative uncertainty analysis often can be used as the basis of qualitative information about uncertainty, even if the quantitative information is not what is communicated to the public.

One should acknowledge to the public the widespread confusion regarding the differences between variability and uncertainty. Variability does not change through further measurement or study, although better sampling can improve our knowledge about variability. Uncertainty reflects gaps in information about scientifically observable phenomena.

While it is important to communicate uncertainties and confidence in predictions, it is equally important to clarify who or what is at risk, possible consequences, and the severity and irreversibility of an adverse effect should a target value, for example, not be met. This qualitative information is often critical to informed decision-making. Risk and uncertainty communication is always complicated by the reliability and amounts of available relevant information as well as how that information is presented. Effective communication between people receiving information about who or what is at risk, or what might happen and just how severe and irreversible an adverse effect might be should a target value not be met, is just as important as the level of uncertainty and the confidence associated with such predictions. A two-way dialog between those receiving such information and those giving it can help identify just what seems best for a particular audience.

Risk and uncertainty communication is a two-way street, It involves learning and teaching. Communicators dealing with uncertainty should learn about the concerns and values of their audience, their relevant knowledge, and their experience with uncertainty issues. Stakeholders' knowledge of the sources and reasons for uncertainty needs to be incorporated into assessment and management and communication decisions. By listening, communicators can craft risk messages that better reflect the perspectives, technical knowledge, and concerns of the audience.

Effective communication should begin before important decisions have been made. It can be facilitated in communities by citizen advisory panels. Citizen advisory panels can give planners and decision makers a better understanding of the questions and concerns of the community and an opportunity to test its effectiveness in communicating concepts and specific issues regarding uncertainty.

One approach to make uncertainty more meaningful is to make risk comparisons. For example, a ten parts per billion target for a particular pollutant concentration is equivalent to 10 seconds in over 31 years. If this is an average daily concentration target that is to be satisfied "99 percent," of the time, this is equivalent to an expected violation of less than one day every three months.

Many perceive the reduction of risk by an order of magnitude as though it were a linear reduction. A better way to illustrate orders of magnitude of risk reduction is shown in Figure 24, in which a bar graph depicts better than words that a reduction in risk from one in a 1,000 (10^{-3}) to one in 10,000 (10^{-4}) is a reduction of 90% and that a further reduction to one in 100,000 (10^{-5}) is a reduction 10-fold less than the first reduction of 90%. The percent of the risk that is reduced by whatever measures is a much easier concept to communicate than reductions expressed in terms of estimated absolute risk levels, such as 10^{-5}.

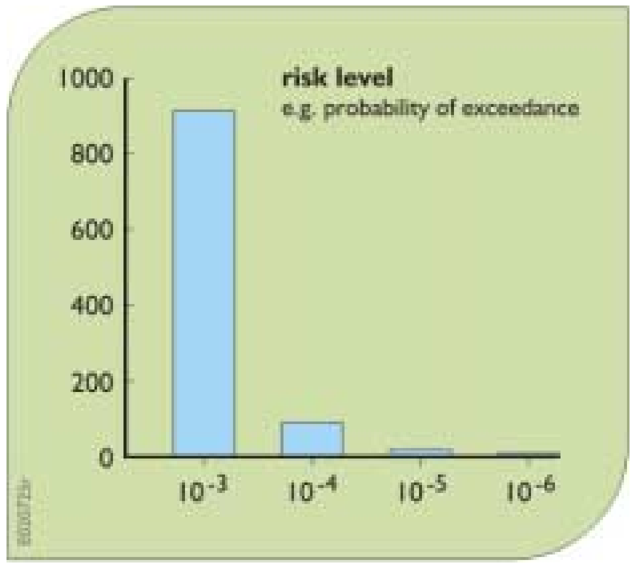

Figure 24. Reducing risk by orders of magnitude is not equivalent to linear reductions.

Risk comparisons can be helpful, but they should be used cautiously and tested if possible. There are dangers in comparing risks of diverse character, especially when the intent of the comparison is seen as minimizing a risk (NRC 1989). One difficulty in using risk comparisons is that it is not always easy to find risks that are sufficiently similar to make a comparison meaningful. How is someone able to compare two alternatives having two different costs and two different risk levels, for example, as is shown in Figure 7? One way is to perform an indifference analysis (Chapter X), but that can lead to different results depending who performs it. Another way is to develop utility functions using weights, where, for example reduced phosphorus load by half is equivalent to a 25 percent shorter hydroperiod in that area, but again each person's utility or tradeoff may differ.

At a minimum, graphical displays of uncertainty can be helpful. Consider the common system performance indicators that include:

- Time-series plots for continuous time-dependent indicators (Figure 25 upper left)
- Probability exceedance distributions for continuous indicators (Figure 25 upper right),
- Histograms for discrete event indicators (Figure 25 lower left), and
- Overlays on maps for space-dependent discrete events (Figure 25 lower right).

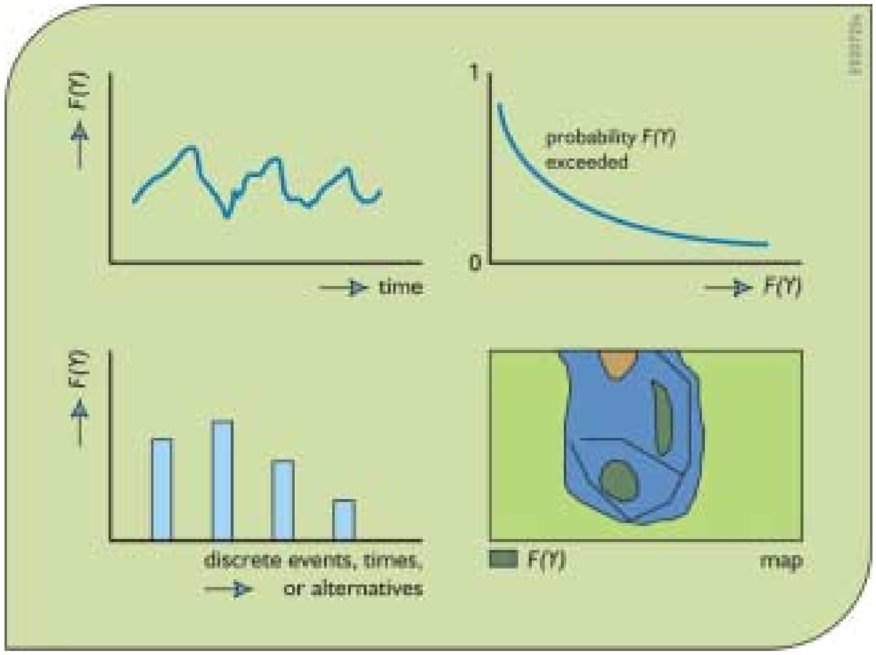

Figure 25. Different types of displays used to show model output Y or system performance indicator values $F(Y)$.

The first three graphs in Figure 25 could show, in addition to the single curve or bar that represents the most likely output, a range of outcomes associated with a given confidence interval. For overlays of information on maps, different colors could represent the spatial extents of events associated with different ranges of risk or uncertainty. Figure 26, corresponding to Figure 25, illustrates these approaches for displaying these ranges.

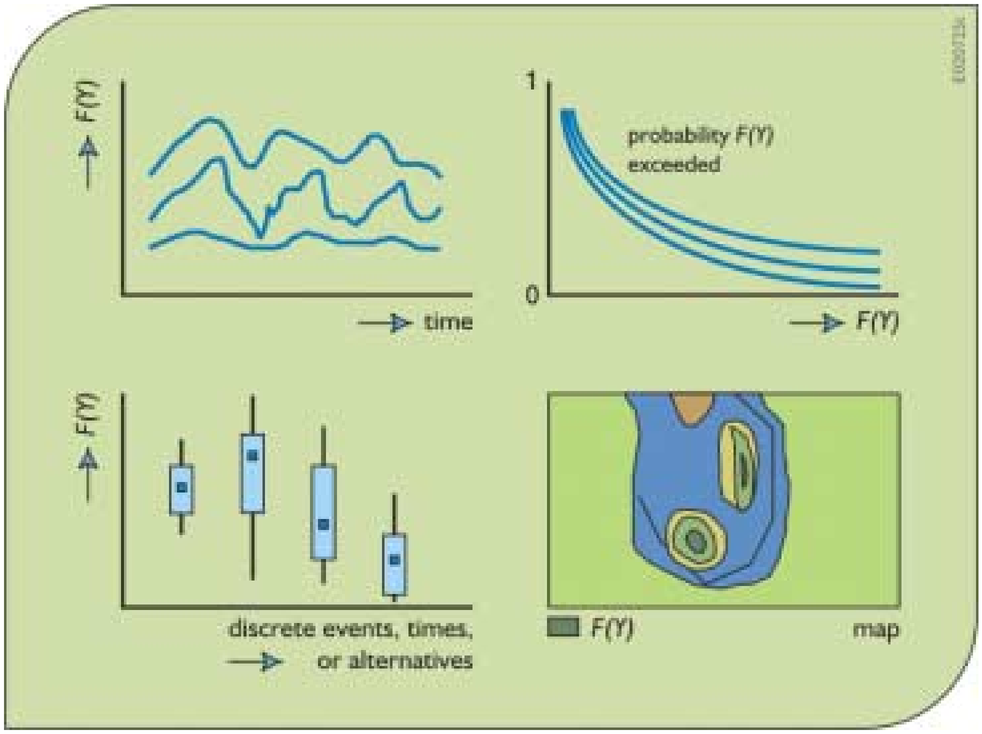

Figure 26. Plots of ranges of possible model output Y or system indicator values $F(Y)$ for different types of displays.

7. Conclusions

This chapter provides an overview of uncertainty and sensitivity analyses in the context of hydrologic or water resources systems simulation modeling. A broad range of tools are available to explore, display, and quantify the sensitivity and uncertainty in predictions of key output variables and system performance indices with respect to imprecise and random model inputs and to assumptions concerning model structure. They range from relatively simple deterministic sensitivity analysis methods to more involved first-order analyses and Monte Carlo sampling methods.

Because of the complexity of many watersheds or river basins, Monte Carlo methods for uncertainty analyses may be a very major and unattractive undertaking. Therefore it is often prudent begin with the relatively simple deterministic procedures. This coupled with a probabilistically based first-order uncertainty analysis method can help quantify the uncertainty in key output variables and system performance indices, and the relative contributions of uncertainty in different input variables to the uncertainty in different output variables and system performance indices. These relative contributions may differ depending upon which output variables and indices are of interest.

A sensitivity analysis can provide a systematic assessment of the impact of parameter value imprecision on output variable values and performance indices, and of the relative contribution of errors in different parameter values to that output uncertainty. Once the key variables are identified, it should be possible to determine the extent to which parameter value uncertainty can be reduced through field investigations, development of better models, and other efforts.

Model calibration procedures can be applied to individual catchments and subsystems, as well as to composite systems. Automated calibration procedures have several advantages including the explicit use of an appropriate statistical objective function, identification of those parameters that best reproduce the calibration data set with the given objective function, and the estimations of the statistical precision of the estimated parameters.

All of these tasks together can represent a formidable effort. However, knowledge of the uncertainty associated with model predictions can be as important to management decision and policy formulation as are the predictions themselves.

No matter how much attention is given to quantifying and reducing uncertainties in model outputs, uncertainties will remain. Professionals who analyze risk, managers and decision makers who must manage risk, and the public who must live with risk and uncertainty, have different information needs and attitudes regarding risk and uncertainty. It is clear that information needs differ among those who model or use models, those who make substantial investment or social decisions, and those who are likely to be impacted by those decisions. Meeting those needs should result in more informed decision making. But it comes at a cost that should be considered along with the benefits of having this sensitivity and uncertainty information.

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Appendix I: Model Calibration Examples

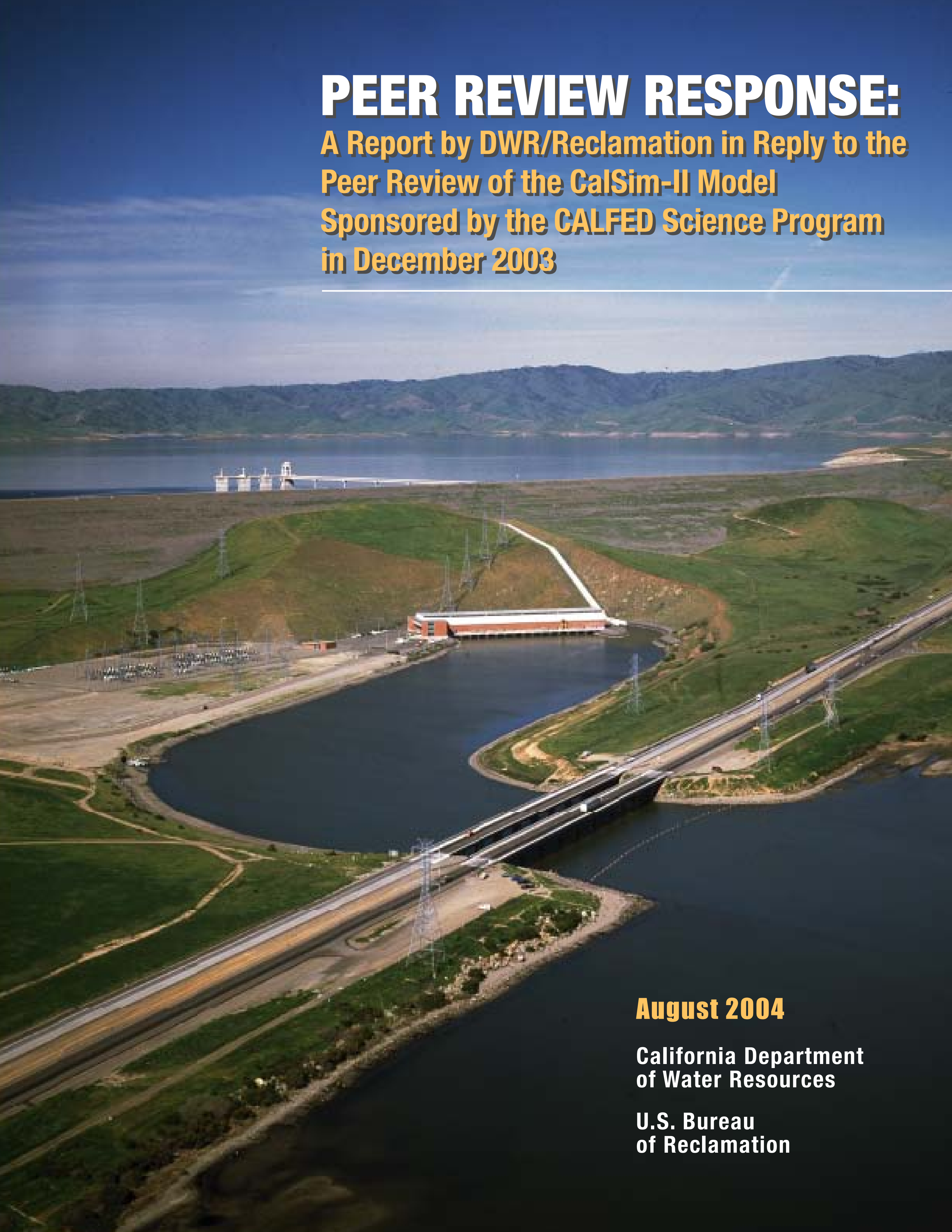
- *Calibration of models in the Murray-Darling Basin*

In the Murray-Darling Basin, in order to preserve water quality, water reliability and the environment, a decision was made in 1995 to restrict water use to the 1993/94 level of development. Computer models of the major tributary streams are now used at the end of each year to determine the annual use target for the previous season based on that level of development. Rules are in place to ensure that long term usage is maintained at the agreed level. Because the models now define the overall water rights of each valley, there are legal requirements to calibrate models and each model is independently audited and certified as being unbiased before being approved as fit for purpose. The key model output of interest is water use but emphasis is also placed on the modeling of downstream flow which impacts the rights of downstream regions. Each model must be calibrated over at least ten years and this often means that changes in infrastructure, operating rules and growth in demand have to be incorporated into the calibration run. Calibration reports contain plots of modeled and observed water use, storage behavior and flow and statistics such as mean error, correlation coefficients and standard errors. The aim of calibration is to ensure that the model is unbiased and to give confidence to stakeholders.

An issue that is sometimes raised with model development is the role of calibration, where the model is fine-tuned to match the observed data, and validation where the model is tested against data that was not used in the calibration process to get an independent assessment of the model's accuracy. For the Murray River, because of the variability of our climate, we like to calibrate our model against a long period of data including the most recent years when the current operating rules were being used and the historical data is generally the most reliable. Validation is considered to be less important and is typically carried out using the two or three years of data available following the completion of model calibration.

- *Use of models for Allocating Water in Texas*

Recent legislation in Texas revised the State Water Planning process and mandated the development of water allocation models for every river basin in the state (http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/permits.html). Similar to the Murray – Darling situation, these models are used to provide estimates of reliability for all permitted water diversions in the state as well as analysis of the effects of all permit applications. Naturalized, or predevelopment, time series of flows were constructed for the basins, and then the effects of developments were added in to achieve models of the current situation. The process of developing the basin models was an iterative, peer reviewed calibration process subject to stakeholder comment at several critical junctures. The naturalized flows and subsequent development of the basins now form an accepted and legal basis for future water allocations. Currently, similar activities are ongoing to provide calibrated and verified models of the state's groundwater aquifers and usage.



PEER REVIEW RESPONSE:

A Report by DWR/Reclamation in Reply to the Peer Review of the CalSim-II Model Sponsored by the CALFED Science Program in December 2003

August 2004

California Department of Water Resources

U.S. Bureau of Reclamation

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This report was prepared jointly

By the

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And

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August, 2004

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Table of Contents

1. Introduction

The California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) have jointly developed a computer model called CalSim-II that simulates much of the water resources infrastructure in the Central Valley of California and Delta region. CalSim-II provides quantitative hydrologic-based information to those responsible for the planning, managing and operating the State Water Project (SWP) and federal Central Valley Project (CVP).

CalSim-II is a particular application of software developed primarily by DWR called CalSim. CalSim is a generalized water resources tool that can be applied to most reservoir-river basin systems. CalSim was recently renamed by DWR and Reclamation to WRIMS (Water Resources Integrated Modeling System). For consistency, however, the name CalSim rather than WRIMS will be used throughout this report.

In 2003, the CALFED Science Program commissioned an external review panel to provide an independent analysis and evaluation of the strengths and weaknesses of CalSim and CalSim-II. Specifically the review panel was asked (Strategic Review, p3) to answer the following questions below: (note: The Strategic Review report used the upper case “CALSIM” for the engine and the upper case “CALSIM II” for the application. In the seven questions below, as extracted from that report, the word “CALSIM” appears to imply both the engine CALSIM and, more importantly, the application CALSIM II. For consistency in this report, the words CalSim will be used for the engine and CalSim-II for the application)

1. Is CALSIM a reasonable modeling approach for current and proposed applications and problems?
2. Do other modeling approaches show similar or greater promise and flexibility for such problems?
3. What are the major comparative strengths and weaknesses of the current CALSIM approach and alternate approaches?
4. What are the major scientific, technical, and institutional limitations, uncertainties, and impediments for current and proposed applications of CALSIM?
5. What model, software, and data developments, special studies or tests would be beneficial to improve CALSIM for current and proposed uses?
6. How might CALSIM development and applications be managed and overseen to improve the quality assurance of the model results for current and proposed applications?
7. What are the panel suggestions for long-term use, development, or replacement of the current suite of models and data available for the current and proposed uses of CALSIM?

The Peer Review was held November 13-14, 2003. The panel’s responses to the above questions were published in “*A strategic review of CALSIM II and its uses for water planning, management, and operations in central California*” (Strategic Review, December 4, 2003), herein referred to as the Strategic Review. This report is a response from DWR and Reclamation to the Strategic Review. The following information clarifies issues raised by the Peer Review, outlines the priority of development, and addresses current and future development work.

2. Goals of CalSim-II Development

The Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation) strive to develop, maintain, and apply CalSim-II as the simulation model of the State Water Project and Central Valley Project best representing the two projects for planning and management studies. It is intended to serve organizations with an interest in the CVP/SWP management with the goals of developing and maintaining the best available technical tools for planning and management studies.

3. Summary of Response Goals and Priorities

DWR and Reclamation share the view that our response priorities need to be steered by a philosophy for carrying out the goals of CalSim-II development. This philosophy begins with the overarching goal of maintaining trust and credibility of CalSim-II among the user community. A complimentary goal of equal priority is assuring quality of CalSim-II data, assumptions and results. With credibility maintained and quality assured, we adopt secondary goals of implementing obvious and feasible enhancements of CalSim-II and providing service to the evolving needs of the user community with advancements that go beyond the present application of CalSim-II.

Given this philosophy of meeting the goals of CalSim-II development, DWR and Reclamation suggest the following prioritization of response projects. Many of these projects have already been initiated (independent of this prioritization, see Table 2). Each response item is discussed in more detail in section 4 and the Appendices. Items are listed in order of priority:

1. Establish Credibility and Trust
    a. Uncertainty and Sensitivity Analysis (*section 4.4.2, 4.4.3)*
    b. Documentation (*section 4.2.13, 4.3.4.1, Appendix D*)
    c. Establish formal schedule of Training Classes and User Group meetings (*section 4.3.5.6)*

2. Hydrology Enhancement (priority order beginning after 1., implemented over a longer term)
    a. Sacramento Valley (*section 4.2.1, 4.2.2, 4.2.11, Appendix E, F*)
    b. West Side San Joaquin (*Appendix F)*

3. Software Development Needs – Part 1 (priority order after 2., although many of these projects have been initiated (Table 2)).
    a. Version Control (*section 4.3.4.14)*
    b. (Meta) Data Control (*section 4.3.2, 4.3.3)*
    c. Error Checking (*section 4.3.4.2)*
    d. Solver Reliability/Infeasibility Handling (*section 4.3.1, 4.3.4.5*)
    e. Graphical Network Builder (*section 4.3.4.4)*

4. CalSim-II Module Enhancements (priority order after 3., although many of these projects have been initiated (Table 2))
    a. CalSim Allocation Module (CAM) (*section 4.2.8, 4.3.1, 4.3.4.8, Appendix B)*
    b. Water Quality Modules for the MWD-related facilities and the San Joaquin Valley (*section 4.2.7, 4.3.4.15, Appendix B)*

5. Software Development Needs – Part 2 (priority order after 4, although many of these projects have been initiated (Table 2)).
    a. Modularity (*section 4.3.4.7)*
    b. Runtime (*section 4.3.4.11)*
    c. Ability to Link Linear Optimization and Non-Linear Extensions (*section 4.3.4.12)*

6. Application/Software Extensions (priority listed in order after 5, although many of these projects have been initiated (Table 2)).
    a. Modular Application of CalSim (*section 4.2.6)*
    b. Demand Management and Supply Augmentation Schemes (Conjunctive Use) (*section 4.2.9).*

DWR and Reclamation plan to explore partnerships with stakeholder groups and outside resources to support implementation of some of these priority items in a comprehensive manner.

4. DWR/Reclamation Response to Specific Issues

4.1. Summary of Comments and Responses

Table 1 is a matrix of the various comments raised in the Strategic Review. The comments have been grouped into categories. The column on the far right-hand side of Table 1 refers to DWR and Reclamation's response to each individual comment as summarized below:

1 DWR and Reclamation do not agree with the comment stated.

2 DWR and Reclamation agree with the comment stated.

2a DWR and Reclamation agree with the comment stated and staff is currently working on it as part of our immediate needs for CalSim-II. A work plan is being developed by both DWR and Reclamation and will be shared with the public in the very near future.

2b DWR and Reclamation agree with the comment stated and consider it important to address in the short term with a target date of January 2007.

2c DWR and Reclamation agree with the comment stated but considers it should be addressed on a longer term with a target date of January 2011.

Where there is agreement (i.e., 2) then DWR and Reclamation attempt to fit the response within their projected timelines. Sometimes there is agreement and disagreement on an issue (e.g., 1, 2) indicating disagreement with portions of the comment but agreements on other parts.

4.2. Conceptual Level

The scope of a model should be defined in relation to its intended purpose. CalSim-II was originally conceived as a model of the CVP-SWP system to be used for planning purposes and comparative analysis of *project* alternatives. CalSim-II is now being advocated for analysis of more general water management issues. The Strategic Review (p2) states that:

"*As the official model of those projects, CalSim-II is the default system model for any inter-regional or statewide analysis of water in the Central Valley of California.*"

"California needs a large-scale relatively versatile inter-regional operations planning model and CalSim-II currently serves that purpose reasonably well."

Clearly, CalSim-II has evolved from being a CVP-SWP specific model. Yet, its wider role and purpose has not been clearly stated. The Strategic Review contains many recommendations relating to the wider (non CVP-SWP) role of the model. DWR/Reclamation agrees in principal to most of these recommendations. Any planner would wish for additional capabilities. However, implementation of these recommendations is constrained by the limited resources available to DWR and Reclamation.

It is necessary to examine the applicability of CalSim-II to a wider range of water related questions and to plan how further model development can support future planning activities associated with California water. The following is a set of modeling policy statements that DWR/Reclamation support and advocate to help direct future model development.

- Model users and decision-makers need to have confidence in CalSim-II for both absolute and comparative analysis (Strategic Review, p9)

- CalSim-II should evolve toward a more consistent representation of the rules that govern annual and real-time operations planning (Strategic Review, p8)
- CalSim-II needs to evolve from a model of the CVP-SWP system to a model of California's inter-connected water system (Strategic Review, p24)
- CalSim-II needs to explicitly represent a wide range of water management options, that include water conservation, reuse, water transfers, and groundwater conjunctive use management (Strategic Review, p21)
- Groundwater needs to be more fully represented in CalSim-II (Strategic Review, p19)

The Strategic Review (p2) agrees that CalSim is an appropriate approach for the modeling of the CVP-SWP-Central Valley system. The following sub-sections discuss particular issues raised in the Strategic Review that would broaden the model's applicability.

4.2.1. Geographical Scope

Development of CalSim-II beyond the needs of the SWP/CVP systems and the Sacramento-San Joaquin drainage area may go further than the current purpose of the model. Widening the geographic scope encompassing the Tulare Basin and Southern California would require considerable additional resources and greater support and involvement of local agencies. DWR, however, is currently working on the calibration of CVGSM2 (an application of IGSM2 to the Central Valley which includes Tulare Basin). DWR and Reclamation expect to use CVGSM2 or an alternative tool as the principal tool for developing the hydrology, modeling surface water – ground water interaction, and modeling ground water flow.

DWR and Reclamation support the development of CalSim models of the upstream watersheds, and the integration of these models with CalSim-II. An example of this cooperation is the development of the CalSim Yuba model that is supported by Yuba County Water Agency, and development of a daily time-step model of Upper American River operations (above Folsom Lake), commissioned by Reclamation. DWR and Reclamation support the vision of CalSim providing a common platform for water resources analysis in California.

4.2.2. Groundwater

Modeling groundwater in CalSim has evolved from the simpler Depletion Analysis approach to the current multiple-cell approach used in the Sacramento Valley. As part of its short-term goals, DWR is working on enhancing the modeling of groundwater flow and the surface water – groundwater interaction through the use of CVGSM2 (Central Valley Groundwater – Surface water Model) or its variants. CVGSM2 is the application to the Central Valley of the IGSM2 (Integrated Groundwater – Surface water Model) model. IGSM2 is currently developed and supported by DWR. A brief description of IGSM2 is given in Appendix F. One clarification: Page 8 of the Strategic Review lists a series of weaknesses model users would like addressed. These concerns were identified in a survey of stakeholders conducted by the University of California at Davis, prior to the Peer Review during the summer 2003. One of the concerns is stated as:

> *"Groundwater resources are assumed infinite, i.e., there is no upper limit to groundwater pumping"*

This is a mischaracterization of the model. Groundwater pumping *is* constrained in CalSim-II, and is also only available to meet local agricultural or urban demands. A full description of how groundwater pumping is modeled is given in Appendix A.

4.2.3. Hydropower

Reclamation has incorporated project hydropower generation and use directly into a version of CalSim-II, but hydropower is not included as an objective. Reclamation and DWR are currently using post-processing spreadsheets to analyze hydropower operations in CalSim-II. The Reclamation post-processing spreadsheet was originally designed for and approved by the Western Area Power Authority (WAPA). The WAPA spreadsheet currently represents all the CVP facilities. DWR uses a spreadsheet that was originally designed for DWRSIM (predecessor to CalSim-II) and applies to all SWP facilities. In the near future, the SWP plans to adopt a methodology for approximating hydropower that is similar to the WAPA spreadsheet.

DWR may consider integrating hydropower as a decision variable or objective in SWP operations as part of its long-term planning for CalSim-II. This will also be dependent on the availability and/or development of trade-off curves between hydropower generation and surface water deliveries.

4.2.4. Local Projects

Similar to the geographical extension of CalSim-II, DWR and Reclamation welcome and support, as far as possible, the use of CalSim by local agencies to develop planning models of their local facilities. These detailed models should be 'collapsible' so that they can be included in CalSim-II in an aggregate form, and so that CalSim-II can provide the local boundary conditions for more detailed local planning. This approach is consistent with the modular approach advocated by the Strategic Review.

4.2.5. Analyzing Future Scenarios

The Strategic Review (p22) recommends that capability to analyze a greater range of future scenarios be enhanced. Long-term planning for California may be best served by considering the notion other than that of a certain future, and implementing plans that best position the State to respond to a range of possible futures. This approach has been adopted by the California Water Plan Update, and DWR is evaluating the use of CalSim-II for future quantitative analysis. DWR and Reclamation agree that this is a desirable approach. However, the current hydrology development process is too unwieldy to efficiently produce a suite of possible land use, water supply and demand scenarios. DWR and Reclamation agree that, as part of the near term future model development the agencies examine ways to streamline the development of alternate futures, and restructuring of code to allow users to quickly change key input assumptions.

4.2.6. Modular Approach

The Strategic Review (p2) identifies a '*common tension between those who wish for greater detail and those who want less detail from the model*.' The successful implementation of an expanded role for CalSim-II depends on the adoption of a modular approach to modeling. This should allow the quick construction of different CalSim-II versions, ranging from a very simple system representation for preliminary screening analysis or educational purposes, to a detailed and complex model that includes many local project operations. Modularity can be addressed at three levels: hierarchical, spatial, and temporal. An example of hierarchical level is a screening version of CalSim (as compared to a detailed representation of the system). DWR and Reclamation are also considering that the CalSim-II code be restructured to implement the modular approach before more detail is added to the model to represent local project operations in the Sacramento and San Joaquin Valleys.

4.2.7. Operational Objectives

Operational objectives in CalSim-II are either flow or storage related (minimum instream flows, storage targets, deliveries). Although water quality in the Delta is a constraint on project operations, it is not an objective. The Strategic Review (p8) suggests the capability of CalSim-II to analyze economic, water quality and groundwater issues be improved. Reclamation has developed a San Joaquin River Westside Drainage module for CalSim-II that disaggregates electrical conductivity (EC) source components that contribute to simulated Vernalis EC, which is an integral first step of future San Joaquin water quality investigations involving the main stem of SJR, Westside irrigation activities, and Upper/Eastside San Joaquin tributary operations. DWR is currently working with the Metropolitan Water District of Southern California (MWD) to add water quality functionality to the CalSim software. Using economic drivers for initial screening analysis has been discussed. Reclamation has worked with UC Davis on the development of the CALVIN model, which uses prescriptive optimization techniques and economic drivers to manage California's water system. Both agencies remain interested in adding CALVIN-type capabilities to CalSim-II. This work would probably best be implemented by the University of California, supported by DWR and Reclamation as part of the long-term strategy.

4.2.8. Real-Time Operations

Both DWR and Reclamation share the modeling vision to narrow the gap between their respective operations models and CalSim-II. One key area where operations and planning tools overlap is that the former is used to set allocation targets and the latter must represent the *process* of setting allocation targets. In actual operations, the DWR and Reclamation spreadsheet operations models are applied by operators to establish annual allocation levels; these levels evolve through the snowmelt season. In planning application within CalSim-II (i.e. during a multi-year simulation), the *process* of setting annual allocations is currently emulated in a very simplified manner that considers stored-water inventory and forecast hydrology at the time of allocation setting.

This simplified representation stands to be improved greatly through the application of the CalSim Allocation Module (CAM), which is being developed by DWR in collaboration with Reclamation. CAM was developed to mimic the procedure used by operations staff. This includes using forecasted hydrology for a 12 month time horizon and a simplified representation of the system (as compared to CalSim-II). Operating guidelines are being developed in consultation with SWP/CVP operators to reflect the procedures used in real-time operations. Use of multi-period optimization simplifies the required simulation rules by relying on the MIP solver to optimize the monthly reservoir release/export decisions subject to the system constraints and operating guidelines of the project reservoirs. Linking CAM with CalSim-II takes advantage of both model approaches and improves the ability of the planning tool to mimic real-time operations.

4.2.9. Water Management Options

The Strategic Review (p21 & 23) states that CalSim-II should more explicitly model many demand management and supply augmentation options. The demand management options require that CalSim-II represent demands in greater detail and more explicitly. DWR and Reclamation will consider if modeling of these options may best be achieved through better linkages of CalSim-II to its agricultural (CALAG) and urban (IWR-MAIN, LCPSIM) demand counterparts. This will include how data inputs and outputs can be more easily communicated between these models. Also for consideration is revising urban demands in CalSim-II so as to represent them in their entirety rather than limiting representation to outdoor (consumptive) urban demand.

4.2.10. Objective Function

The Strategic Review (p4) raises an important issue regarding the characterization of reservoir operators' behavior.

"*Most successful applications of optimization that attempt to simulate the behavior of a system have calibrated their objective function so that the model results correspond to what actually happens or would happen under a particular hydrologic and demand scenario*."

A good example of this approach is the positive mathematical programming technique used in DWR's agricultural production models CVPM and CALAG. The lack of calibration is one reason why the *CalSim-II Simulation of Historical SWP/CVP Operations* study was unable to mimic historical project carryover storage during drought conditions.

In the past, DWRSIM and CalSim-II had a prescriptive rather than a descriptive approach in defining reservoir operation rules. For example, carryover storage targets were developed that maintained minimum storage levels during a prolonged drought while trying to minimize shortages in any particular year. While this is a valid approach, it may lead to over-optimistic model results due to discrepancies between model and actual operators' decisions.

DWR and Reclamation are engaged with their respective project operators to reduce these discrepancies. The difficulty in calibrating CalSim-II to past behavior is that the behavior is dynamic. Reservoir operations continually evolve due to changing regulatory conditions, changing systems demands, and requests from project contractors. The agencies modeling staff, reservoir operators and contractors are working together to develop a CalSim-II module (CAM) that can be used to determine present month decision variables (e.g., allocation levels, expectations on future carryover or fill targets) based on foreseen operations determined through multi-period optimization and hydrologic foresight. If successful, this approach will be extended to other model rule curves, such as balancing north and south of Delta storage.

4.2.11. Land Use

Projected-level land-use in CalSim-II is assumed constant. It is an exogenous input derived from the Central Valley Production Model (CVPM). Land use projections result from assumptions regarding farmer's long-run response to long-term average annual surface water and groundwater availability and associated cost. Evidently, farmer's planting decisions will vary in the short-run due to annual variation in supply. This short-term response is not modeled in CalSim-II, although it can be modeled using CVPM (or its successor CALAG). DWR has developed an internal memorandum on how such a response could be represented in CalSim-II. However, modeling land-use variation is considered secondary to a more general revision and update of the CalSim-II hydrology development (Appendix E).

4.2.12. Hydrologic Uncertainty

The Strategic Review states that there needs to be *'a better capacity to accommodate other approaches to representing hydrologic uncertainty and variability besides simply simulating 70-plus years of record.'* DWR and Reclamation believe that the use of explicitly stochastic techniques or the use of synthetic hydrologic data would not be a useful contribution at this time. Assembling a reasonable representation of auto- and cross-correlation of inflows for a large-part of California is a daunting task. Preservation of the persistence of drought phenomena is very difficult. Even harder would be gaining public acceptance of such an approach. Nonetheless, DWR and Reclamation do believe that there are alternatives to the reliance on a single hydrology. Underlying the use of historical flows is the belief that the past is a good indicator of the future. DWR and Reclamation are currently working with the Scripps Research Institute to develop alternate hydrologies that may be more likely to occur due to global climate change. DWR and Reclamation are also considering the use of rainfall-runoff models as part of the hydrology development, which offer a more flexible approach to modeling extreme events beyond the recent historical record.

4.2.13. Documentation

Over the last two years DWR and Reclamation have worked together to document the model system representation and logic. As part of the September 30, 2002 Benchmark release, the agencies issued a 156 page model description and a document summarizing the simulation output. Since the release, DWR and Reclamation have dedicated time and resources to the following documentation activities:

- Creation of the CalSim-II Review and Documentation Team
- Development of WRESL code commenting protocol
- Implementation of commenting protocol for the September 30, 2002 Benchmark (review and revision of existing comments)
- Development of CalSim reference manual outline
- Development of CalSim documentation management system strategy

Despite the coordinated effort, documentation activities have often been given second priority to the production of model studies. Both DWR and Reclamation acknowledge the need to prioritize and supplement the Review and Documentation Team effort with additional resources to complete the documentation task. A brief description of the proposed CalSim-II documentation management system is given in Appendix D.

4.3. Implementation Level

4.3.1. Numerical Approach

CalSim uses mixed integer linear programming (MIP) to route water through a network of nodes and links in accordance to a user-defined set of priorities and constraints. The Strategic Review states (p4) that this approach is similar to other state-of-the art modeling tools such as ARSP, MODSIM, OASIS, REALM, Riverware and WEAP. However, the peer review does warn that optimization "*has the potential to produce inaccurate and overly optimistic results.*"

The Strategic Review recommends (p5) that the current strategy of single-step optimization should be supplemented by:

- Multi-period optimization to guide decisions with impacts that stretch beyond the current time-step,
- Detailed simulation of some system elements, allowing modeling of non-linearities, and potential reduction in run time.

DWR and Reclamation are currently implementing these recommendations in various ways. These fall under categories for enhancing and streamlining the numerical procedure. Enhancements to the numerical procedure of CalSim will allow expanded functionality, including

- Iterative solution of a cycle. A cycle will repeatedly be solved until the user-specified convergence criteria are met (or maximum number of iterations). This will increase the ability to model nonlinear aspects of the system.
- Automation of writing decision variables and constraints for multi-period optimization. The CAM model (briefly described in Appendix B) uses a time-consuming manual process for defining the MIP for multi-period optimization. This may be automated by introducing arrays for decision variables and constraints.
- Dynamic computation of decision variable weights. This will allow increased flexibility of the MIP.

Streamlining of the numerical procedure of CalSim will reduce run-times and simplify software maintenance. Items include the following:

- Streamlining of cycling MIP solutions. Cycles will be streamlined to eliminate the need for separate "Single Study Runner" and "Multi-Study Runner". This will allow a single GUI to be used for all CalSim simulations.
- Expanded use of DSS pathnames. A single DSS output file may be used for all "multi-step" studies. Transfer files may be eliminated, reducing time-consuming reading/writing to hard drive.
- Allowing State Variables to be written to DSS. Currently only Decision Variables are written to the DSS output file. Allowing State Variables to be directly written to the DSS file will eliminate the current practice of sending these parameters through the MIP solver and unnecessarily increasing the overhead on the solver.

4.3.2. Data

Concern of the quality of data in CalSim-II, is one of the most recurrent themes of the Strategic Review. For example (p20): "*There has not been sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity and operational data. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework.*"

The validity of data inputs impacts both model results and model credibility. The greatest concern is the validity of the hydrologic inputs and parameters. Concern is compounded by the current lack of complete documentation. Over the last two years DWR and Reclamation have attempted to document model inputs. Reclamation is currently documenting the current CalSim-II hydrology procedures. This effort needs to be extended and updated.

It is worth noting that the restructuring of the CalSim software as part of release 2.0 allows metadata describing the source of model inputs to be stored with the actual data. A brief description of the proposed CalSim-II data and documentation management system is given in Appendix D.

4.3.3. Data Management

The Strategic Review (p.58) identified data management as a critical aspect for CalSim. A web-based version control software (Perforce) is used by DWR modelers for managing the text-file input files of the current version of CalSim (v1.2). Adoption of a public domain relational database management system is under development for the next version of CalSim (v2.0). This database will provide a central repository that will contain documentation in addition to the model input/output data (time series data may continue to be stored in HEC-DSS). This will provide a full-featured client/server database including version control, integrity of data, documentation (including metadata), and ease of dissemination.

4.3.4. Software

In general, DWR agrees with the recommendations of the Strategic Review regarding the CalSim software. Many of these recommendations have been adopted and are being implemented for the next version of CalSim (v2.0). Given the growing use of CalSim outside of the two agencies, DWR accepts the need for extensive discussion and input from the wider modeling community and extensive beta-testing before the release of the next version of CalSim (v2.0). New software developments must take into account the considerable familiarity represented by the body of existing software users. It is important that major changes to the structure and look of the CalSim software benefit from feedback from this user-pool.

The following sections answer specific points raised in the Strategic Review. A brief general description of the next version of CalSim (v2.0) is given in Appendix B. In general, DWR's goal is to cease development work on the current release of CalSim (v1.2), and to implement improvements discussed below for the next version of CalSim (v2.0).

4.3.4.1. <u>Documentation</u>

Three documents are currently available to the CalSim user: the CalSim User's Guide, the CalSim Manual, and the WRESL Language Reference. These documents offer the minimum required help to the CalSim novice. DWR accepts that these documents need to be updated and expanded. Initially DWR supported a web-based software bug reporting and archiving system. This system needs to be reactivated. DWR and Reclamation intend to publish a list of frequently asked questions (FAQ). This will eliminate many wasted hours of model user's time due to minor software bugs and idiosyncrasies. DWR accepts the need to provide centralized support. Given the agencies current workload and resource constraints it seems that it may be best to contract this to a third party.

4.3.4.2. Error Checking

The Strategic Review identified automated error (p5) and input/output (p24) checking for increased productivity. Staff from DWR, Reclamation, and other agencies or consultants has developed several spreadsheets for such purposes. A short-term goal of DWR is to collect, refine, and develop such spreadsheets into a series of standard pre and post processors that become a standardized set of tools. In addition, development of the next version of CalSim (v2.0) software may include expanding the solvers capability to track potential errors in setting up input data.

4.3.4.3. Gaming

Stakeholder participation will be sought to develop a gaming interface for the next version of CalSim (v2.0).

4.3.4.4. GUI

A CalSim-II geo-referenced network schematic is under development by Reclamation. The primary purpose of this project is to provide a communication tool between CalSim-II users, agency management, project managers, and the public. Geo-referencing the network provides quality control and a spatial connection between the system and the topography. The general CalSim GIS toolbox can be applied in any geographic location and features drag and drop icons with connector linkages for easy modifications. CalSim-II network schematic developments also anticipate future integration options. GIS is capable of generating CalSim code based on the network representation to run an application, storing pertinent meta data and coverage information, and has online integrated mapping system capabilities. In addition, the CalSim GIS toolbox has been applied to the SWP and CVP system and is now under review. Alternative options (public domain) for schematic generation are also in discussion.

4.3.4.5. Infeasibilities

DWR recognizes that the solver report of an infeasible solution is a periodic, but potentially very time-consuming problem. Tools do exist currently in CalSim to identify the causal constraints, but they are not well documented. The current LP solver in CalSim is XA (by Sunsoft, Inc). Users may use the XA reporting options in CalSim to help identify the problem. In many cases XA will report which constraints it has not been able to satisfy, and by how much it would need to relax the constraint to find a solution. However, in some cases XA fails to identify the problematic constraints. The Strategic Review (p24) recommends overcoming the infeasibility problem, which adds slack and surplus auxiliary variables to each constraint. High penalty values assigned to the auxiliary variables would assure that they would be non-basic (i.e. have a value of zero) unless the solution would otherwise be infeasible. The auxiliary variables would only be added to the MIP problem if an infeasible solution were obtained, so as not to increase run-time There is merit to this approach ,which is currently used in CalSim to assure that the continuity constraint for storage nodes can always be met.

DWR is working with Lawrence Berkeley Laboratories on an alternate approach to develop analysis tools for infeasible and non-unique solutions (Section 4.3.4.10).

4.3.4.6. LP Output

CalSim currently provides limited output from the MIP solver. For successful solutions, only final decision variable values are reported. These include Lagrange multipliers (a.k.a. dual variables, shadow prices, trade offs) which indicate the sensitivity of the objective function to each decision variable, slack variables which indicate the sensitivity of decision variable bounds on the solution, and basic and non-basic variables which are used internally by the solver. These output parameters may help users understand the complex nature of the multiple constraints on the system and how they interact with the MIP.

4.3.4.7. Modularity

The Strategic Review (p21) indicated modularity of data components will help to alleviate the conflicts of different users requiring both a less complicated and more details system representation (p21). Included in the next version of CalSim (v2.0) is the ability to store data in modules. This functionality may be used in several ways, which the CalSim user community should establish protocols for their use. Possibilities include various levels of geographic resolution (ranging from simple to complex), modularizing regulations into distinct packages and/or representing hydrologic processes in different levels of complexity. These various components may be linked together in a simulation to form various distinct models suitable to the user and purpose of simulation.

4.3.4.8. Multi-Period Optimization

CalSim-II uses the MIP to route water through the system on a single time step. Simulation rules are used to bind the optimization solver for monthly decisions. The Strategic Review suggested use of multi-period optimization may provide a useful platform to represent the system and interact with the simulation model (p5, 8, 38). The CalSim Allocation Module (CAM, Appendix B) uses this methodology for a remainder-of-Calendar-Year optimization window (e.g., twelve months if initiated in January). During the multi-month optimization window the solver is allowed to determine the optimal pattern of reservoir releases, channel flows, and exports relative to storage and release constraints that represent operator sensibilities during allocation planning, rather than specifying simulation rules. CAM was developed within the existing CalSim software by writing the system constraints manually. DWR will automate implementation of multi-period optimization by allowing the next version of CalSim (v2.0) GUI to essentially write and interpret arrays. This functionality will facilitate the exploration of multi-period optimization within the CalSim environment.

4.3.4.9. Post-Processing

The CalSim software has some limited functionality to analyze and interpret model results. This is primarily the viewing and comparison of base and alternate time series data using charts and tables. While DWR and Reclamation acknowledge the need for better post-processing tools, it is the belief of both agencies that this functionality is best provided by third-party tools such as Excel. There are currently many different post-processing tools used by CalSim users to import HEC-DSS data into Excel and subsequently to manipulate the data for interpretation.

DWR and Reclamation recommend that resources be invested into pooling the availability of these tools with further investment in their development. In addition to automated generation of charts and tables within Excel, it has been shown that for developed gaming models MS-Excel can be a good visualization tool.

4.3.4.10. Public Domain

DWR is following a policy of adopting public domain software for CalSim. This includes:

- Elimination of the FORTRAN compiler,
- Replacement of the XA proprietary MIP solver, and
- Search for a public domain GUI for the construction and editing of the river basin topology.

DWR is currently testing the public domain solver GLPK for use in CalSim. At this time, individual CalSim cycles have been solved by GLPK, and, so far, it reproduces the proprietary XA solver solutions. The next version of CalSim (v2.0) is being modified to use GLPK for further testing. Based on initial tests, GLPK is not as efficient in solving CalSim type problems as the XA solver. Solve time is approximately three times greater with GLPK. Lawrence Berkeley Laboratory (LBL) is working on improving the efficiency of GLPK. LBL has also been asked to add other utilities to GLPK such as analysis tools for infeasible and non-unique solutions.

4.3.4.11. Run Time

Advances in computer processing speeds are steadily reducing model run times. However long run time remains a problem, precluding for example sensitivity analysis on model inputs. Much of the problem relates to inefficient coding of the MIP problem in which large parts of the system are unnecessarily simulated multiple times in each time step. To reduce run times DWR and Reclamation are adopting the following strategy:

- Eliminate unnecessary variables from the LP problem (e.g. use of alias statements),
- Restructure the WRESL code to eliminate repetitive calculations,
- Optimize the reading and writing of data to HEC-DSS.

4.3.4.12. Simulation

The Strategic Review (p5) suggests that linking of linear multi-period optimization procedures to non-linear simulation models might both increase the accuracy of the model, and possibly decrease run time. The optimization module would be run each time some type of 'optimal' decision needs to be made e.g. annual allocations, reservoir releases or other management decisions. More detailed simulation at a shorter time step would subsequently implement these decisions, and define the consequences, routing water through the network according to a set of rules.

The peer review panel was not unanimous in this view. Most of the panel agreed that single time-step optimization is needed to reduce the dependence on operating rules. The use of multi-period optimization is discussed in Section 4.3.4.8. DWR, however, does agree that greater use of simulation might reduce run-time. The CalSim software should be modified to permit simulation both at the end and beginning of each time-step. Subsequently the CalSim-II code should be reviewed so as to eliminate variables from the MIP problem that could be defined through simple arithmetic calculations.

4.3.4.13. Time-Step

CalSim-II is a monthly planning model of a geographically extensive system. Aggregation in time and space, by necessity, simplifies or omits many operational details. Of particular concern has been the error that a monthly time-step may introduce in representing the Delta.

- Project export capability may be over-estimated due to monthly averaging of Delta inflow,
- A monthly time-step may poorly represent regulatory requirements, such as X2, which may be met on the basis of 14-day running average EC, or 3-day running average Net Delta Outflow Index.

DWR has developed a daily time-step version of CalSim-II for the Sacramento Valley and Delta (Appendix B).

DWR and Reclamation heed the warnings of the Strategic Review (p24) that shortened time steps pose problems of run-time, data development and model interpretability, amongst others. DWR proposes to conduct a study to evaluate the errors introduced by using a monthly time-step. The study will compare project exports from CalSim-II to the daily Delta CalSim model. In the first part of the study the daily model will be run with the daily Delta inflow set equal to the average monthly inflow as determined by the monthly CalSim-II model, i.e. with no day-to-day flow variation. In the second part of the study the daily model will be re-run, but imposing a daily fluctuating flow pattern on the Delta inflow. This two-stage approach will distinguish between the impacts of modeling Delta regulations at a daily time scale to the impacts due to the varying daily flow pattern. A technical report of this evaluation will be published.

At this time DWR does not anticipate further extension of the daily-time step model or the introduction of routing into CalSim-II.

4.3.4.14. Version Control

Good quality control is essential given the complexity of CalSim-II, the enormous data requirements and the number of model developers. Good quality control is a key component to model credibility. Without it the accuracy or reliability of CalSim-II could quickly degenerate. The Strategic Review (p37 & 58) makes detailed recommendations relating to quality control. It cannot be achieved solely through software innovations. Protocols for data management and model development need to be written, published and adhered to.

Quality control needs to start with the central storing and sharing of data and the implementation of a version control system. This version control system should at a minimum:

- Keep track of model changes
- Facilitate the storage of metadata regarding those changes
- Allow any previous version of the model to be recovered

- Allow multiple developers to work simultaneously
- Alert model users to model changes

DWR and Reclamation have implemented a version control system for CalSim-II's text-based input files. The system allows model users web-based access to a central database. Model studies can be downloaded from the database, changes made locally to the model, and the revised data input stored back in the central location. The system has not been fully adopted, due in part to the lack of in-place model development/model management protocols. The current text-based version control system will be replaced by an analogous version-control feature with the release of the nexe version of CalSim (v2.0) that is centered on a relational database. DWR and Reclamation agree that it is a high priority to develop enterprise database capabilities for the next version of CalSim (v2.0), so that central data management and version control can be implemented.

4.3.4.15. <u>Water Quality</u>

DWR is currently working with MWD to develop a water quality module for CalSim. The first-phase of the project would permit the user to specify inflow concentrations, and concentrations for agricultural and urban return flows for various conservative constituents. CalSim would calculate the resulting water quality throughout the network using constituent mass balance. Water quality calculations would be post-processed at the end of each time-step. A second phase of development would allow the model user to specify water quality targets as drivers in the optimization procedure.

4.3.4.16. <u>Weights</u>

The objective function weights establish the priority for releasing water from storage and making deliveries to different parts of the network. DWR and Reclamation accept that the process of weight setting is as much an art as a science. Currently the creation of a successful set of weights requires a sophisticated model user or a very patient one that is willing to submit to a time consuming trial and error process. A systematic and standardized approach is needed to generate weights, once the user has defined relative priorities (Strategic Review, p24). The acceptability of CalSim-II results and ease of model use are subject to some debate and concern, partly due to the current difficulties in weight setting.

DWR and Reclamation support the idea of research into a method of automatically assigning values to individual weights to represent the underlying water right-based allocation rules, contractual and institutional requirements, regulatory policy layers and operating rules simulated in CalSim-II.

4.3.5. Administrative Issues

4.3.5.1. <u>Resources</u>

DWR and Reclamation will explore and work with other public agencies; at local, regional, state or federal level, to seek needed resources to continue the development work proposed in this response plan.

4.3.5.2. Model Management

DWR and Reclamation will also seek new opportunities and avenues, both private and public, to broaden the management base for the existing and future model developments. Currently there is an interagency team coordinating this effort.

4.3.5.3. Peer Review

DWR and Reclamation believe that peer review enhances the acceptability of the modeling tool. The agencies may suggest peer reviews of modeling components it deems necessary.

4.3.5.4. Public Involvement

DWR and Reclamation will work with all interested parties, both public and private, to seek technical input in developing and enhancing the current and future modeling components.

4.3.5.5. Sustainability

The proposed Model Management Team (DWR, Reclamation and others) will work to develop a strategy in this important area.

4.3.5.6. Training and Education

The agencies modelers will continue to support, to the extent resources permit, to broaden the model users' base for appropriate use of models. The Proposed Model Management Team may also be charged with this responsibility.

4.4. Model Testing

4.4.1. Calibration and Validation

Model calibration is the process of fine-tuning the value of various model parameters, so that model results match the observed data. Validation is the subsequent testing of the model against data that has not been used in the calibration to obtain an independent assessment of the model's accuracy.

The need for testing, calibration and validation of CalSim-II is one of the most controversial issues raised in the Strategic Review. Some of the peer review panel recommended that further validation of the model is required through the comparison of model results to recent historical data. However some in the modeling community express their doubts on the usefulness of such a comparison (CalSim-II in California's Water Community – Musing on a Model, p158). The Strategic Review (p129) notes that for the Murray-Darling Basin model, validation is considered to be less important. The Murray-Darling Basin model is calibrated using a long period of data. In contrast validation is carried out using only two to three years of data.

In discussing the merits of calibration it is important to distinguish between physical parameters that remain essentially constant (e.g. stream-bed conductance), and behavioral parameters that may change and adapt (e.g. reservoir operating policy). Water use parameters such as irrigation efficiency may fall somewhere in between these two extremes. Where possible the value of parameters should be determined from direct observation. This may not be possible for some parameters such as regional scale reuse of water.

DWR and Reclamation believe that model calibration to determine the value of physical parameters, and parameters such as irrigation efficiency, is a valuable exercise, and benefits model accuracy and model credibility. However, DWR and Reclamation suggest that a more reasonable approach to defining behavioral parameters is through discussions with system operators to define *current* operational policy or rules. California's water system, especially with regard to the Delta, has undergone many changes in the 1990s (Delta Water Quality Control Plan, CalFed, ESA actions, CVPIA (b)(2), Environmental Water Account) so that calibration to historical practice has limited value. It would appear more reasonable to define operating rules in conversations with operators and subsequently use a recent wet, normal and dry year in a validation exercise.

The debate on calibration stems partly from a misunderstanding of the hydrology development. The CalSim-II hydrology is tied to historical stream gage data. The following points explain what calibration has been undertaken for the Sacramento Valley:

- The accretions and depletions between the project reservoirs and the Delta ***are*** calibration terms. They have been determined so that at a historical level CalSim-II will exactly match historical gage data if reservoir releases are fixed at their historical level and groundwater pumping and stream-aquifer interaction are fixed at their assumed historical values.
- Calibration of groundwater use has not been carried-out due to the lack of historical data.
- The stream-aquifer model in CalSim-II is calibrated to the more sophisticated Central Valley Groundwater Surface Water Model (CVGSM).
- The CalSim-II hydrology is calibrated to net consumptive use rather than stream diversions and return flows. CalSim-II may therefore not simulate well diversions to particular irrigation districts.
- The hydrology adjustment to account for the impact of land-use change on rainfall-runoff has not been calibrated or validated.
- Calibration or validation of district-scale diversions in CalSim-II cannot be undertaken without increasing the resolution of the model.

DWR and Reclamation recommend the following approach to CalSim-II calibration and validation:

- DWR and Reclamation modeling staff continue to work with project operators to define operating rules that correctly capture current (rather than historical) operational policies.
- Following re-calibration of CVGSM[1], the CalSim-II groundwater model is refined and re-calibrated.
- DWR and Reclamation develop methods to validate assumptions regarding land use change impacts on rainfall-runoff.

[1] Major revisions to the underlying IGSM software and the input data sets to CVGSM have been made by DWR since the development and calibration of the CalSim-II groundwater module.

- DWR and Reclamation work with local irrigation districts and their consultants to refine the spatial scale of CalSim-II and calibrate/validate local projects operations through comparison of model output with historical data,
- Modeling groundwater pumping is modified to a land-use based approach. DWR has identified through land use surveys areas that are dependent on groundwater, areas that rely on surface water and areas that use groundwater as a contingent supply. The spatial resolution of CalSim-II should be refined to distinguish between these three land types.

After the completion of the above, CalSim-II should undergo a limited validation exercise using different recent year types.

Validation of local project operations has been shown to work well with the recent model enhancements to the San Joaquin Valley. Working with local districts has resulted in successfully calibrated hydrologic parameters so that CalSim-II has matched recent historical storage and flow data.

4.4.2. Sensitivity Analysis

The primary goal of CalSim-II sensitivity analysis is three-fold: (1) to verify if the key model input parameters are working properly within their reasonable range of variations; (2) to determine the impact of each parameter on selected model results; and (3) to set up priorities for potential refinements of model input parameters. Some of the parameters being evaluated are: SWP demands, target carryover storages, reservoir inflows, agricultural and urban water use, water use efficiencies, Delta water quality requirements etc. This sensitivity analysis had been undertaken by DWR and will be coordinated with Reclamation.

4.4.3. Uncertainty Analysis

Uncertainty analysis uses probabilistic descriptions of model inputs to derive probability distributions of model outputs and system performance indices (Strategic Review, p73). CalSim-II users need not only stand alone for absolute model results but also the degree of confidence they can place them. For example, what is the 95% confidence limit on the exceedence curve of project exports from the Delta? Hydrologic uncertainty is expressed through the use of a 73-year time series. There is currently no measure of data input uncertainty. Appendix H of the Strategic Review focuses on ways to identify and quantify uncertainty.

DWR and Reclamation agree that a method of implementing uncertainty analysis for CalSim-II needs to be defined. One approach is to simulate historical operations and use the statistics of goodness of fit to identify the uncertainty. An alternate approach is to identify plausible ranges of input parameters and to repeat model runs using high and low values of complimentary parameters (e.g. low efficiency in conjunction with high demands). This approach is more akin to the multiple future scenarios adopted by the California Water Plan Update.

4.4.4. CalSim-II Historical Operations Study

The primary purpose of the *CalSim-II Simulation of Historical SWP/CVP Operations Study* (DWR, 2003) was to evaluate the ability of CalSim-II to represent CVP and SWP operations, in general, and the delivery capability of the projects, in particular, when compared with a recent historical 24-year period. The following paragraphs discuss issues regarding this study raised in the Strategic Review.

4.4.4.1. <u>Overestimation of Project Deliveries</u> <u>(Strategic Review, p68)</u>

Comments in the Appendix E of the Strategic Report suggest that CalSim-II Historical Operations Study overestimates Project deliveries. The reviewers observe that CVP deliveries in the validation study are higher than historic; and the SWP deliveries taken from a model study conducted at 2001 level of development, are higher than the average of the last ten years. We do not believe this will be the case when compared with appropriate studies.

The Historical Operations Study was designed to simulate historical deliveries to evaluate how well other components of the system (such as reservoir storage, river flows, Delta outflow) compare with historical values. In this study, a simplistic demand assumption was made for the CVP. For each year of the simulation, CVP demands were fixed at the contractual amounts for north and south-of-delta contractors. It appears this assumption is the main reason for the overestimation of CVP deliveries. The historical data show that for most years during the study period of 1975-1998, especially during 1980s and early 1990s, CVP contractors received 100 percent of what was requested. If the CVP demand assumption could be refined for each year of the historical simulation, then, of course, the CVP overestimation is significantly reduced.

The reviewers observe the SWP deliveries also appear overestimated. This observation is not based upon the Historical Operations Study because the SWP demands in that study are artificially set at the values for historical deliveries during non-dry years when contractors received 100 percent of what was requested. The comment is based on comparing actual average annual deliveries for the last 10 years (2385 taf/yr) with the modeled 73-year average annual deliveries (3090 taf/yr) from a study conducted at 2001 Level of Development, based on current entitlement request. Note that this study was conducted for a different purpose for use in the *SWP Delivery Reliability Report, 2003*. DWR does not believe 2001 level study overestimates SWP deliveries. For dry periods, the results are very close to historical because the deliveries are limited by supply. The modeled average annual south-of-delta deliveries for the recent drought of 1987-1992 compare well with the actual values. The average annual values for SWP deliveries during this period are 1,930 taf/yr for the 2001 level study and 2,030 taf/yr historical. Similarly, the average south-of-Delta CVP deliveries are 2,340 taf/yr for 2001 level study and 2,320 taf/yr historical. In the wetter years, the demand (2001 level) is higher than the historical demand, so estimated deliveries are higher than the historical amounts.

When long term deliveries are compared among appropriate studies, the average annual values for SWP during the 23 year period are 1810 taf/yr for the Historical Operations Study and 1790 taf/yr actual historical deliveries for the same period. Similarly, the average south-of-Delta CVP deliveries are 2650 taf/yr for Historical Operations Study and 2490 taf/yr actual historical.

4.4.4.2. Allocation to Project Contractors (Strategic Review, p68)

Real-time allocation rules are moving targets that are year-specific and are based on entitlement requests, hydrology forecasts, initial storage conditions (both north and south of the Delta), and many other operational considerations. As such, allocation rules are very closely tied to each historical year's operation, and are not easily amenable to general mathematical formulations under a wide range of hydrologic conditions for use in the CalSim-II modeling studies. Knowing this, DWR does agree in general with the reviewers' observation that current allocation rules in the model tend to deliver water more uniformly over the dry period. Current allocation rules in CalSim-II have been designed to operate the system at a fixed level of development, present or future, which tend to maximize long-term deliveries while protecting the average annual deliveries during the historical dry periods of 1987-1992 and 1928-1934. This rule reduces the potential variability of deliveries from year to year. During the dry period of 1987-1992, more water was delivered by the SWP and the CVP during the first years of the drought and less during the latter part when compared to the delivery values of the Historical Operations Study. Although CalSim-II does not capture the potential variability of deliveries during dry periods, the simulations are useful for quantifying the total amount of deliveries over dry periods and providing information for more detailed analyses designed to address this variability. At this time, DWR will continue with the method currently used in CalSim-II for allocating water.

4.4.4.3. San Luis Reservoir Operations (Strategic Review, p69)

DWR acknowledges the reviewer's statement that San Luis Reservoir storage in the Historical Operations Study is consistently underestimated during the 1987 1992 drought when compared to the historically observed storage and that this can significantly effect the results for the pattern of flow in the Delta, opportunities for wheeling and pumping under Article 21, and accounting under the Coordinated Operations Agreement. It is also acknowledged that users of CalSim-II output need to be confident that the rules adopted by the model for determining how water is moved from north of the Delta to south of the Delta reflect the way San Luis Reservoir will be operated in the future.

DWR and Reclamation agree this component of the model merits additional review and plan to review CalSim-II's operation criteria for San Luis Reservoir with project operators and stakeholders.

4.4.5. Comparative vs. Absolute Predictions

CalSim-II and its predecessor models can be used in two ways. The first is in the comparative mode and the other is in the absolute mode. The comparative mode consists of comparing two model runs: one that contains a proposed action and one that does not. Differences in certain factors, such as deliveries or reservoir storage levels, are analyzed to determine the effect of the proposed action. In the absolute mode, the results of one model run, such as the amount of delivery or reservoir levels, are analyzed directly.

Traditionally both DWR and Reclamation have assumed that model assumptions are less significant in a comparative study than an absolute study. All of the assumptions are the same for both the "with-action" and "without-action" model runs, except the action itself, and the focus of the analysis is the differences in the results. The Strategic Review (p9), however, suggests that the assumed relative accuracy of a comparative analysis may be incorrect as:

"…*it relies on the assumption that the model errors which render an absolute forecast unreliable are sufficiently independent of, or orthogonal to, the change being modeled that they do not similarly affect the forecast of change in outcome; they mostly cancel out*."

CalSim-II and its predecessors DWRSIM, PROSIM, and SANJASM were originally conceived for comparative analysis. However, for endangered species consultation, biological assessments, facility re-licensing efforts under FERC, or local planning efforts by project contractors and local agencies, absolute values of delivery reliability or other performance measures are required. DWR and Reclamation recognize the requirement of CalSim-II to provide absolute predictions, and consequently the need for further work in refining model inputs and quantifying the likely range of model error. Relying on analysis of long periods (anywhere from a few years to the period of record) through calculation of statistical parameters and development of exceedence data may be useful for absolute predictions. Reliance on individual monthly values or yearly averages is not recommended.

The relative accuracy of a comparative analysis can be demonstrated through sensitivity analysis. Sensitivity to model inputs can be compared between a stand-alone study and a comparative analysis. In the comparative sensitivity analysis, a unit change of input to both the “with” and “without” project model, results in a change in the difference in the model outputs.

CalSim-II is constantly improving. DWR and Reclamation will consider, through discussions with stakeholders, the relative priorities of (1) refining the current model to improve its accuracy, and (2) quantifying the level of accuracy of the current CalSim-II model.

5. Development Priorities

Table 2 summarizes current CalSim/CalSim-II development projects and recommends priorities for future development. These are categorized according to immediate needs, short-term priorities, and long-term priorities. The time frame for the short and long-term priorities is January 2007 and January 2011, respectively. Comments and references in Table 1 can be matched (in general) with those in Table 2.

6. Summary and Conclusions

6.1. Summary

6.1.1. Model Scope

The Strategic Review identified many areas in which the scope of CalSim-II could be extended to support a wider range of planning activities. In its current form it is predominantly a model of the CVP-SWP system. The coarse spatial resolution of the model and the limited integration of groundwater limit its usefulness in other planning forums. Nonetheless DWR and Reclamation believe that CalSim-II is an adequate model for planning studies for new storage and conveyance facilities in the CVP & SWP systems.

DWR and Reclamation support further development of CalSim-II to broaden its applicability to California water planning issues other than those relating to the CVP-SWP. DWR and Reclamation intend to work with stakeholders to produce a model strategy for future model development. In the near-term, DWR and Reclamation believe that the geographical and conceptual extension of CalSim-II to non-project areas and issues should be secondary to a technical audit/peer review of the existing model data input and logic, and completion of application documentation.

Future model extension should be modular. A more complete groundwater model for the Sacramento and San Joaquin valleys is an essential component. Other important modules that should be added include:

1) Water transfers
2) Groundwater banking, and conjunctive use
3) Water conservation options
4) Water quality
5) Economic drivers

Consideration should also be given to extending land use based demands to the west side of the San Joaquin Valley and to areas in the Tulare Basin served by the two projects.

DWR is evaluating the use of CalSim-II to analyze a broad range of future scenarios for the California Water Plan Update. DWR will examine ways to streamline the development of alternate water supply and demand input data. DWR and Reclamation will also examine ways to better integrate CalSim-II with the Department's other planning models (CVGSM, CALAG, LCPSIM) that would benefit both agencies.

6.1.2. Data and Documentation

Model credibility is viewed as the most immediate concern. Unless the credibility of CalSim-II stays above a certain threshold, the continued development and use of the model will be threatened. The issue of credibility stems partly from the complex representation of California's water system, exasperated by incomplete documentation. It also stems from the limited efforts to demonstrate that CalSim-II's water accounting is unbiased and reasonably accurate. Many of the data concerns relate to the input hydrology. Priorities for the two agencies are:

1) Documentation of the CalSim-II's conceptual model and associated data inputs
2) Overhaul of the CalSim-II hydrology, with the development of updated hydrologic inputs supported by calibration and or validation
3) Integration of CalSim-II and CVGSM2 (or alternative) system representation and data set
4) Extension of hydrologic data to 2002 or beyond
5) Validation of CalSim-II using different year types
6) Uncertainty analysis

6.1.3. Software

Improvements to the CalSim software should focus on the release of the next version of CalSim (v2.0). This represents a major restructuring of the model, with the replacement of text input files with a relational database. This will provide the functionality to implement many of the Strategic Review recommendations: modularity, version control, and documentation (metadata). The database will allow users to quickly query constraint sets and decision variables, and more easily follow model coding logic. Elimination of the FORTRAN compiler and the use of a public domain solver will make the software more accessible. Other important software development goals are:

1) Development of a GUI for construction of reservoir river-basin topology and the input and output of data
2) Creation of a common post-processing utility (using third-party tools such as Micosoft Excel) that streamlines the comparison of model results across model runs
3) Update and expand the CalSim user's manual and provide centralized support to CalSim/CalSim-II users
4) Reduce model run times by implementing better data transfer efficiency, increased modularity, and a more efficient solver
5) Develop a stripped-down CalSim-II for training of new users
6) Develop and automated procedure for weight setting
7) Develop multi-period optimization capabilities

6.1.4. Long-term Development

Models take time to develop. Substantial thought should be given to the problems and type of analysis that CalSim will have to address in the next five to ten years, and the likely available resources within DWR and Reclamation. DWR and Reclamation will seek involvement from local agencies in model development. With modeling needs clearly defined, a strategy should then be devised for how to go from the current state of the model to the desired state of the model within the given timeframe.

6.2. Conclusions

The following remarks are extracted from the CalSim-II peer review panel

"A unique aspect of CALSIM II is the high degree of cooperation between federal (i.e. U.S. Bureau of Reclamation) and State (i.e. California Department of Water Resources) interests in its development. This kind of cooperation is rare, and in fact this may be the only such example of such coordination for a system of this scale and complexity…..CALSIM II can provide a showcase for other states as to what can be accomplished with Federal and state cooperation for river basin management." (Strategic Review, p18):

"We believe the use of an optimization engine for simulating the hydrology and for making allocation decisions is an appropriate approach and is in fact the approach many serious efforts of this kind are using." (Strategic Review, p2)

"…CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling systems such as ARSP, MODSIM, OASIS, REALM, RiverWare, and WEAP." (Strategic Review, p4)

DWR and Reclamation believe that CalSim-II is an adequate model for planning studies for new storage and conveyance facilities in the CVP & SWP systems. For certain applications of CalSim-II as described in section 4.4.5, absolute values of CalSim-II results are required as projected estimates of future system performance. For such applications of CalSim-II, full discussion of all pertinent assumptions and careful examination of input data must accompany presentation of CalSim-II results. Many enhancements described in this Response Plan, when properly implemented, will greatly improve the performance of CalSim-II, thereby expanding the applicable scope of the model and enhancing the level of public acceptance. Sustained effort will be required to accomplish the planned enhancements. Periodic review and updates of the planned enhancements will also be part of this sustained effort.

APPENDIXES

Appendix A. Representation of Groundwater Pumping

Modeling of Groundwater Resources

In CalSim-II, groundwater in the Sacramento Valley is used to meet both agricultural and urban demand. The volume of groundwater pumping varies according to the availability of surface water, and spring precipitation. In modeling groundwater, the developers of CalSim-II had a choice: (1) to restrict the volume of groundwater pumping in drier years to, for example, an estimate of the installed pumping capacity for a particular sub-basin; or (2) to assume groundwater pumping continues until demand is fully met. In either case, the impact of groundwater extraction can be measured by the impact on groundwater storage of each sub-basin, which is explicitly modeled in CalSim-II. Average annual groundwater pumping over and above the natural and artificial recharge will result in depletion of the basin. Once a groundwater basin is fully depleted, CalSim-II will no longer run. Model developers selected option (2) above, which gave rise to the concern of unlimited groundwater pumping voiced by the peer review. It is important to note, however, that CalSim-II does not include local ground water inventories. Currently the multiple-cell approach mimics the CVGSM model, which in itself is an “approximation” of built-in inventories (based on the historical calibration).

CalSim-II attempts to mimic farmers pumping decisions over the recent historical period. Groundwater extraction in CalSim-II is limited in several ways:

- The total of stream diversions and groundwater pumping must be less than the land use based demand. This demand is calculated from an assumed cropping pattern and monthly crop evapotranspiration, and takes into account the monthly and annually varying precipitation.
- The assumed cropping pattern used for CalSim-II is based on an agricultural economic production model that is calibrated to recent observed water use and cropped acreage. As such, CalSim-II implicitly accounts for the cost of groundwater pumping, which limits farmer’s willingness to pump water.
- For areas that have access to both surface water and groundwater, groundwater is the secondary or contingent resource. Groundwater pumping occurs only after the model has tried to maximize service water deliveries given the various operational constraints (minimum instream flows, Delta water quality requirements, minimum reservoir levels and reservoir carryover storage targets).
- Groundwater pumping may only be used to satisfy the demands of overlying landowners. No groundwater is exported from the overlying watershed (except in the form of surface water return flow or tailwater that results from irrigation using groundwater).

The above bulleted items are discussed in more detail in the following sections.

Land Use Based Demands

Demands in the Sacramento River Basin (including the Feather and American River basins) and Delta are determined based on land use and vary by month and year according to hydrologic conditions. Land use-based demands are calculated using DWR’s Consumptive Use

(CU) model. The CU model simulates soil moisture conditions for 13 different crop types over the historical period. Irrigation demand is triggered when soil moisture falls below a specified minimum. The CU model calculates the crop consumptive use of applied water. The consumptive use is subsequently multiplied by water use efficiency factors to obtain a regional water requirement to be met from stream diversions or groundwater pumping. Agricultural demands in the Delta are represented more simply as an overall mass balance between precipitation and crop evapotranspiration.

Central Valley Production Model

The Central Valley Production Model (CVPM) predicts cropping patterns, land use, and water use within the Central Valley by considering land availability, water availability and cost, irrigation technology, market conditions, and production costs. CVPM was used in the California Water Plan Update (Bulletin 160-98) to forecast future agricultural acreage. CVPM has recently been updated and extended into a statewide model, known as CALAG.

CVPM is a regional model of irrigated agricultural production and economics that simulates the decisions of agricultural producers (farmers) in the Central Valley. The model assumes that farmers maximize profit subject to resource, technical, and market constraints. Farmers sell and buy in competitive markets, and no one farmer can affect or control the price of any commodity. To obtain a market solution, the model's objective function maximizes the sum of producers' surplus (net income) and consumers' surplus (net value of the agricultural products to consumers).

The model is calibrated using recent historical irrigated acreage, applied surface water and groundwater pumping for 21 sub-regions in the Central Valley. The model includes information on pumping depth and pumping costs.

Matching of Demands and Supply

Within the Sacramento Valley CalSim-II always meets the land use based demand.

Groundwater Pumping Logic

In the Sacramento Valley demand is met by a mix of surface water and ground water. Farmers and urban municipalities may have access to either one or both of these supplies. In CalSim-II a minimum groundwater pumping is specified to represent those demands that only have access to groundwater. The CalSim-II code is written so that demands are first met by groundwater pumping, up to the minimum specified volume. It is subsequently met by surface water diversions up to the contract amount for project demands and up to its availability for riparian demands. Any difference between demand and supply is finally met by additional pumping. No shortages occur. Minimum groundwater pumping volumes are based on water years 1981-1993 of the historical CVGSM run.

Groundwater Export

There are a total of seven basins that represent the Sacramento Valley floor north of the Delta. There is no export of groundwater from the sub-basin. Groundwater is pumped only to meet the demands within each sub-basin. The CalSim-II logic allows a certain percentage of pumped groundwater applied as irrigation to flow to the stream network as return flow.

Results from CalSim-II Historical Operations Study

DWR recently released a report describing the results of a CalSim-II Historical Operations Study. The purpose of the Historical Operations Study was to evaluate the ability of

CalSim-II to represent CVP and SWP operations, in general, and the delivery capability of the projects, in particular, through the simulation of recent historical conditions (water years 1975-1998). The following is an extract from that report.

> *Does CalSim-II overestimate the availability of surface water in the Delta by meeting Sacramento Valley in-basin use through excessive groundwater pumping?*
>
> *The mix of surface water and groundwater used by the model to meet Sacramento Valley consumptive demands depends primarily on project water allocation decisions and levels of minimum groundwater pumping that are specified in the model. Over the 24-year period average annual net groundwater extraction in CalSim-II as compare to estimates based on the Central Valley Groundwater Surface water Model (CVGSM) is lower by 378 taf. The average annual net stream inflow from groundwater in CalSim-II is 190 taf greater than estimated by the CVGSM for the same period. The combined affect of dynamically modeling groundwater operations in CalSim-II (pumping, recharge and stream-aquifer interaction) leads to 188 taf/yr less water being available to the Delta. For the 1987-92 period the combined effect results in 46 taf/yr additional water being available to the Delta.*

Thus the Historical Operations Study concludes that the current representation of groundwater in CalSim-II results, on average, in an underestimate of the water available at the Delta.

Appendix B. Current CalSim / CalSim-II Development Projects

CalSim Software

Version Control

Good quality control is essential given the complexity of CalSim-II, the huge data requirements and the number of model developers. Good quality control is essential to model credibility. Without it, the accuracy or reliability of CalSim-II could quickly degenerate. The Strategic Review (p37 & 58) makes detailed recommendations relating to quality control. It cannot be achieved solely through software innovations. Protocols for data management and model development need to be written, published and adhered to.

Quality control needs to start with the central storing and sharing of data and the implementation of a version control system. This version control system should at a minimum:

- Keep track of model changes
- Facilitate the storage of metadata regarding those changes
- Allow any previous version of the model to be recovered
- Allow multiple developers to work simultaneously
- Alert model users to model changes

DWR and Reclamation have implemented a version control system for CalSim-II's text-based input files. The system allows model users web-based access to a central database. Model studies can be downloaded from the database, changes made locally to the model, and the revised data input stored back in the central location. The system has not been fully adopted, due in part to the lack of in-place model development/model management protocols. The current text-based version control system will no longer work with the release of the next version of CalSim (v2.0) that is centered on a relational database. DWR and Reclamation agree that it is a high priority to develop enterprise database capabilities for the next version of CalSim (v2.0), so that central data management and version control can be implemented.

Geographically Referenced Network Schematic

DWR and Reclamation are working cooperatively to develop a GIS based geo-referenced schematic of CalSim-II which would allow a user to interactively query attributes (e.g., reservoir or channel physical characteristics or all references to a node or link in the WRESL files), and time series data.

Public Domain Solver

DWR is currently working with the LBL to investigate the possibility of replacing the current XA solver in CalSim with a public domain solver.

CalSim-II Applications

Geographical Expansion

Over the last four years DWR and Reclamation have worked to develop CalSim models for the mountain watersheds in the Sacramento Valley. Models for Stony Creek, Yuba River, Bear River, and Upper American River have been successfully developed. These models require a technical peer review before being integrated into CalSim-II. The Yuba River model is currently being reviewed by Yuba County Water Agency's consultants, and is expected to be an integral part of the next CalSim-II benchmark study release.

Global Climate Change

CalSim-II is being used by a joint DWR-Reclamation Climate Change Work Team to investigate impacts of climate change on California's water resources. Currently downscaled projections of future climates are being used to generate reservoir inflow time series for use in CalSim-II to investigate impacts on water allocation and Delta water quality. The work is an extension of previous studies conducted at UC Berkeley. Future work will focus on incorporating probabilistic risk analysis. Initial assessments focus on potential climate change impacts on SWP and CVP yield, carry-over reservoir storage, Delta outflow and compliance with Delta water quality standards.

East-Side San Joaquin Operations/Hydrology

The representation of the east-side of the San Joaquin Valley has been substantially revised. Modifications include:

- Use of land use based demands
- Refine spatial resolution
- Revised reservoir operational logic for local projects
- Revised accretions and depletions

This effort is currently being extended to the Delta east-side streams.

CalSim-II Modules

Daily Time Step Model

DWR has created a daily time-step CalSim Delta Model as part of the evaluation of the proposed In-Delta Storage Project. This model was used in conjunction with the CalSim-II monthly model. The entire system's operation was simulated for a one month period with the CalSim monthly model and then the information on inflows to the Delta and south-of-Delta delivery amounts were passed on to the Daily Delta Model. The Daily Delta Model was used to re-simulate the operations in the Delta and the export facilities.

The monthly CalSim-II model provides monthly flows for various Delta locations. However, the daily model requires daily flow data as its input. Thus, a disaggregating model, which was trained using historical observations, was used to generate the daily flows from the monthly flows. While the daily inflow hydrograph was patterned after the historically recorded inflow, the total volume of the inflow to the Delta provided by the monthly model was preserved. The results of the Daily Delta Model are provided to the monthly model as the initial conditions for the following month's simulation. The operation of the upstream reservoirs is re-simulated, and any gains or losses of water are reflected in Delta outflow and storage at San Luis Reservoir. The next month's simulation is then started with the modified end-of-month storage in San Luis Reservoir and the state of the Delta as simulated by the Daily Delta Model.

Since its use for evaluating the In-Delta storage Project, the daily model has been extended upstream to include the Sacramento Valley downstream of the major project reservoirs.

Water Quality Module

MWD is taking the lead to develop and implement a water quality mass- tracking algorithm in the CalSim-II model. The implementation will track water quality constituent mass through arcs and reservoirs with the assumptions that the constituent is conservative and that perfect and instantaneous mixing occurs over the time step. Linearization of the mass balance relationship, by using source concentrations from beginning of time step, may be necessary for efficient implementation in CalSim-II. Linkage of Delta flow-salinity results to the south-of-Delta water quality mass tracking will be included.

CalSim Allocation Module

The CalSim Allocation Module (CAM) was developed to help integrate the CalSim-II planning model with operational models used by the CVP and SWP. Specifically it was created to help operators:

- Define project reservoir carryover storage targets
- Define what hydrologic probabilities should be used in making projections
- Investigate how late the projects should make adjustments to annual allocations

CAM uses multi-period optimization to make annual allocation decisions based on imperfect hydrologic forecasts. By necessity this requires a much simpler representation of the system compared to CalSim-II. At the beginning of the contract year, CAM is run to define an initial annual allocation decision. The period of optimization is from the current month to the end of the September. The resulting allocation decision, based on maximizing deliveries for a given carryover storage target, is passed to the full CalSim-II model, which simulates in greater detail the response of the system for the current month. Updated forecasts and storage conditions from CalSim-II are subsequently passed back to CAM. CAM model is rerun to obtain an updated allocation. This process is continued until annual allocation decisions become firm, usually in the month of May.

On-going work for CAM includes the refinement of hydrologic forecasts, and developing better Delta required outflow projections.

San Joaquin River West-Side Drainage WQ Module

Reclamation is working with consultants and DWR to complete development of a water quality mass-balance module that maps source loads of electrical conductivity associated with the San Joaquin River irrigation activities to electrical conductivity conditions in the main stem of the San Joaquin River. The purpose of the module is to improve the CalSim-II salinity estimate at Vernalis through: (1) San Joaquin River westside flow disaggregation; (2) salt balance along the San Joaquin River main stem (nodes between Lander Avenue and Vernalis) by assigning EC values to the disaggregated flows.

CalSim Water Transfers Tool (Screening Model)

The Water Transfers Tool (WTT) currently being developed for DWR will be a separate, smaller application from CalSim-II but will incorporate the major hydrologic, SWP/CVP system, and operational features of the larger model. Changes in the land use-based diversion requirements included in the model -by Depletion Study Area (DSA)- will serve as a surrogate for a variety of fallowing, crop change, conservation, and groundwater substitution transfers. Stored water transfers will be simulated through a surrogate reservoir concept at the location of the transfer and limited to upstream storage capacity availability. The WTT will be developed through a layering approach to allow for a large number of transfers at varying priorities for purchase and conveyance.

Appendix C. Software Development Proposed Plan

The original CalSim 1.0 program was initially released to the public in 1999. Since that time, updates have been made to refine the original software and add capabilities as required by users. In that time the manner in which CalSim based modeling has been used has grown in terms of the number of users, the complexity of the regulatory environment needed to be simulated, and an increase in the scope and detail of the system required to be modeled. These and a number of other concerns led to the recognition that in order to achieve a robust and fully acceptable model of the current CalSim (v1.2) program required improvement.

The development of the next version of CalSim (v2.0) is intended to create a more robust modeling environment for the increasing number of users and complexity of system representation. These improvements fall under three categories of data management, a graphical user interface, and the solution controller.

Data Management

Proper data management is an essential component for applications relying on large amounts of data. The text-based structure of the current CalSim application is sufficient for small numbers of users. However, as the complexity of the model and number of users increases, the greater the chances are for mismanagement of data. Integration of a relational database management system for CalSim's data storage formalizes the collection of data into a state-of-the-art management tool. Version control, integrity of data (validity of data is still required on the user side), reduction of duplicated data, and ease of linking with a graphical user interface are all advantages of using a relational database system.

Client/server functionality of the database provides for a central repository of benchmarked and finalized projects. Users may connect as a client to the database server to send and receive updates. The client may keep a local copy of the database on their computer and update with the server as desired.

Incorporation of metadata into the relational database is a significant step forward in automated documentation. As data is entered or manipulated the author and date is automatically recorded. A text area is also available for user comments and documenting the source of the data. Protocols on what users should record in this field have been developed by the CalSim-II Review and Documentation Team.

A tool will be developed that will ease the adoption of the next version of CalSim (v2.0) by automating the transfer of existing text files into the database.

Graphical User Interface

With the incorporation of a relational database management system there needs to be a user interface for entering, manipulating and viewing the information. An integrated graphical user interface (GUI) is being developed for this purpose. All data required for running CalSim simulations is interfaced through this single menu-driven GUI using standard windows features.

A hierarchical visualization of the relation of Projects, Simulations, and Cycles is the main component of the GUI. Properties of these components are viewable/editable through a standard point-and-click window. WRESL and Lookup tables are viewable/editable through similar standard windows. Standard editing features such as searching and copy/paste will also be provided.

The next version of CalSim (v2.0) GUI controls the management of projects which encapsulate any number of simulations. User privileges defined in the database allow for management of projects and simulations by controlling who may modify such data.

Solution Controller

A JAVA based solution controller has replaced the current FORTRAN package. Adoption of object-oriented programming into the controller allows for more robust techniques. This increases not only the longevity of the management of source code but provides a simpler context for probable future modifications to the solution package.

Additional features of the new solution controller include the following:

- Elimination of the FORTRAN compiler. Reduces cost.
- Investigation of alternative MIP solvers. Potential cost reduction.
- Streamlining relationship of ‘projects’, ‘simulations’, and ‘cycles’.
- Embedded ‘cycles’. Replaces the Multi-Study Runner by allowing ‘cycles’ to contain other ‘cycles’.
- Introduction of ‘layers’. Collection of data (WRESL, tabular lookup, etc.) that allows for modularity of data across ‘projects’. Cycles may contain any number of ‘layers’. Layers are overlaid one on top of the other and may overwrite previously defined data. Protocols will be developed for sufficient need of using ‘layers’ (i.e. geographic subsystems, regulatory components, etc.).
- Iteration of a ‘cycle’. A single ‘cycle’ may iterate on its solution until convergence criteria is met.
- Increased use of DSS path names. Using the ‘cycle’ name in one of the DSS path names facilitates the use of embedded cycles and eliminates the need for the costly run-time transfer files.
- Pre/Post-MIP ‘state variables’. Some ‘state variables’ are functions of ‘decision variables’. These are evaluated after the MIP solver but remain on the current time step.
- Direct writing of ‘state variables’ to the results file. Eliminates the need to send unnecessary decision variables and constraints to the solver to get ‘state variables’ in the results file.
- Dynamic calculation of ‘decision variable’ weights. Increases ability to control the MIP for each ‘cycle’ and time step.

- Introduction of ‘watch variables’. Allows results from the simulation to be dynamically viewed while the simulation is running.
- Facilitation for an interactive schematic. Development of GIS or other tools is being investigated.
- Facilitation of multiple-period optimization. GUI-assistance in writing WRESL that will span multiple time periods

Appendix D. Documentation Proposed Plan

The most recent release of CalSim-II application documentation accompanied the September 30, 2002 benchmark. This literature is contained within the Benchmark Assumptions Document and Study Results, a summary of the simulation output. Criticisms to the documentation include a deficiency in: explaining how the model works, the underlying assumptions, limitations, and applicability to planning and management issues (Strategic Review, p 8). In addition, CalSim-II documentation is hampered by three factors: protocol has been mostly absent, maintenance is difficult and the knowledge of the vast SWP and CVP systems resides in many different individuals. Both DWR and Reclamation realize the importance of documenting information. However, more often than not, documentation has been placed at a lower priority or overlooked as an integral task to data and logic development or modification.

Despite the difficulties and challenges both agencies face to complete documentation of the CalSim-II application, a consorted effort has been initiated to remedy the deficiencies identified by both internal and external criticisms. DWR and Reclamation have proposed to develop a CalSim documentation management system. The purpose of the documentation management system is to

- Institute documentation protocol
- Provide a convenient method for documentation updates
- Flexible media products for users

This documentation system will become fully integrated within the next version of CalSim (v2.0) data management system and will be linked to the CalSim logic and data. The data management system will require a standardized set of documentation fields and meta data. Finally, the management system will be capable of generating a variety of media products with graphics, linking, indexing and searching options.

Documentation Management

The current documentation techniques are cumbersome for the CalSim-II modeling community to maintain. A variety of formats such as text documents, comments in the code, spreadsheets, supporting model reports, and PDFs are housed in several different locations. The formats and locations make it almost impossible to update all aspects of a modification with absolute certainty.

Therefore, a documentation management system is proposed that utilizes a database to organize and maintain the information. The system will be used as a “central-file” for all model documentation. The new system will track and maintain a documentation history similar to features in the next version of CalSim (v2.0) data management system. Existing documentation will also be rolled into the new management system.

The key features of the documentation management system include:

- Documentation linked to the code
- Tiered levels of detail
- New topics of documentation not yet covered
- Links to source documents (e.g. PDFs or spreadsheets)
- Documentation of state, initial, and decision variables
- Documentation of lookup tables
- Documentation of logic and system control files
- Data confidence rating
- Distinction between actual practice and implementation
- Flexible report templates
- Advanced query options
- Electronic, hard-copy and Help File applications

It is anticipated that the organized and centralized documentation management system will be the new standard for CalSim documentation procedures. Linkages between the documentation and the code will eliminate undocumented or overlooked topics. New documentation coverage will address deficiencies and multi levels of detail will support both the novice and expert. The document management system is also expected to be an integral and priority component of the CalSim work effort.

Appendix E. Surface Water Hydrology Enhancement Proposed Plan

The term hydrology development is used to describe: (1) the conceptual (node-link) model of the Central Valley, (2) the calculation of water supply and demand inputs and (3), water use parameters (efficiencies, losses, minimum groundwater pumping, etc.). Many of the methods used in the hydrology development were originally formulated in the 1960s and 1970s. This section proposes a major overhaul of the surface water hydrology, particularly for the Sacramento Valley, which provides approximately 80% of the inflow to the Delta.

The redevelopment of the surface water hydrology is to meet the following goals:

- Integrate the hydrology development with other statewide data collection and analysis efforts, in particular the land and water analysis carried-out by DWR's Division of Planning and Local Assistance (DPLA) regional offices
- Allow for spatial and temporal aggregation/disaggregation
- Provide a common approach for other agency planning models (CalSim-II, IGSM, CALAG)
- Easy to understand and implement
- Facilitate the use of CalSim-II to support other CalFed, DWR and Reclamation planning processes: e.g. Water Use Efficiency Program
- Refine estimate of Sacramento Valley 'in-basin use'
- Correct minor conceptual errors in existing methods

Both DWR and Reclamation agree on modifying and enhancing the hydrology development for CalSim-II. At this time, different proposals are being considered; but no agreement has yet been finalized (including the approaches discussed below).

Conceptual Model

Water supplies and demands are currently represented in CalSim-II in a very aggregate form. For example, in the Sacramento Valley floor water supplies (other than inflows from the surrounding foothills) and agricultural and urban demands are lumped into only seven Depletion Study Areas (DSAs). The typical representation for each DSA is shown in Figure 11-1. A single inflow arc typically represents total regional inflow from minor ungaged streams and direct runoff. This flow is an unimpaired inflow. Any irrigation demands associated with these minor streams are met by proxy by diversions from the principal stream running through the DSA (the Sacramento River, the Feather River and the American River). A single land use based demand is calculated for each DSA using DWR's Consumptive Use (CU) model[2]. This demand is subsequently disaggregated into project and non-project demands using a constant fraction or percentage. Project demands may be met from releases of stored water from project reservoirs, but are constrained by the annual project allocation/contract entitlement. Non-project demands

[2] The CU model estimates irrigation demands by simulating monthly soil moisture conditions in the root zone for 13 crop types.

are not constrained by contract, but are constrained by the availability of stream flow, unimpaired by project operations. Both project and non-project diversions are constrained by the land use based demand.

It is assumed that a certain percentage of demand must be met from groundwater pumping to represent areas that have no access to groundwater. Above a specified minimum pumping, demand is met from surface water supplies up to its availability or allocation. Supplemental groundwater pumping meets any unmet demand.

Land use based demands are at the resolution of the DSA. However, contract entitlements represented in CalSim-II are at a more disaggregated scale, typically at the level of the larger irrigation districts. To resolve this discrepancy in resolution, CalSim-II disaggregates demand by assuming it is proportional to the contract entitlement.

The aggregation of demand by DSA leads to assumptions about project and non-project water use that may not be entirely accurate.

- Project and non-project demands have identical efficiencies
- Project and non-project demands have the same monthly pattern of diversion requirements (implicitly the same cropping pattern)
- Project and non-project demands have similar dependency on groundwater (as represented by the assumed minimum groundwater pumping)

Non-project demands are predominantly located on the minor streams tributary to the Sacramento River. These supplies may be more restricted in dry years. The DSAs are currently not consistent with DPLA's proposed new Planning Areas used for land use planning and economic analysis. The boundaries of the DSAs make hydrologic mass balance calculations difficult in some areas (e.g. the Colusa Basin)

Spatial Representation

There is a proposal to replace the existing DSAs with new water management areas so that demand units are associated with their correct water supply sources. Demands would be distinguished according to:

- Source of water,
- Contract type,
- Cropping pattern, and
- Water use efficiency.

The proposed new water demand areas are shown in Figure 11-2. Both project and non-project demands may be present in one planning area. Different project demands in a single planning region may be differentiated according to their water source, type of contract (with the CVP, SWP or local project), type of use (M&I vs. agriculture), cropping pattern, and water use efficiency. However non-project demands within a planning region are represented as a single aggregated unit. This proposed refinement of CalSim-II's spatial resolution could lead to greater engagement of local irrigation districts and water agencies.

Water Use Efficiency

DWR's CU model calculates the irrigation water required to meet crop evapotranspiration while maintaining soil moisture above some minimum threshold. A 'basin efficiency' factor is subsequently used to calculate the water demand at a regional level. The basin efficiency factors are based on field measurements conducted by DWR during 1969-1974. These efficiencies were derived for use in DWRSIM (CalSim-II's predecessor). DWRSIM modeled groundwater as a net extraction from the aquifer, rather than explicitly modeling pumping and subsequent recharge from irrigation activities. The original basin efficiencies therefore had to be modified to account for losses from deep percolation. Use of a lumped efficiency factor, rather than explicitly representing losses at different scales, leads to assumptions and potential inaccuracies:

- Water use efficiencies are independent of the source of water, although most groundwater pumping is at farm/field level, and significant conveyance losses may be associated with stream diversions
- Project contractors and non-project diverters have identical water use efficiencies (conveyance losses, farm efficiencies, reuse, etc.)
- The project non-project demand split does not account for differences in water use efficiency so may be incorrect
- It is difficult to assess the impacts of on-farm and in-district water conservation measures due to the poor representation of efficiencies, losses and return flows
- The representation of demands in CalSim-II, CALAG/CVPM and CVGSM are difficult to reconcile since efficiencies and losses are represented in different ways
- CalSim-II demands are not related to applied water demands at the farm level and demands at the district level, although most of the available data is at these scales rather than at a regional level

It is also proposed to replace the existing representation of agricultural demand with an explicit representation of on-farm applied water demands, reuse (both intra-district and inter-district), conveyance losses, and operational spills. Different conveyance loss factors would be applied to the different contractors and non-project diverters according to their water source. The proposed approach is shown diagrammatically in Figure 11-3.

Rainfall-Runoff Modeling

CalSim-II uses the historical hydrology to represent the possible range of water supply conditions that could occur at a future point in time (level of development). This enables future water supply reliability to be expressed in probabilistic terms. DWR and Reclamation recognize that this approach poses several problems. The historical stream flow record is incomplete. Flow data, where it exists, is impaired by historical diversions and return flows. Lastly historical stream flows are affected by the stream-aquifer interaction, a process that CalSim-II models dynamically. The current hydrology development uses a 'depletion analysis' to estimate the historical and projected level flows. The aggregate stream inflow for each DSA is calculated as the closure term of a hydrologic mass balance. Subsequently, historical flows must be adjusted to account for the impact of land use change on runoff. While this approach has its advantages, there are also disadvantages:

- The need to define historical land use, and historical consumptive use resulting from irrigation
- The need to define historical groundwater pumping and recharge
- The need to define the historical stream-aquifer interaction
- The need to define historical water transfers (imports and exports) across the model boundary
- The absence of a good measure of the associated error (errors are encompassed in the closure term)

With increasing demands for details, the depletion analysis approach (while serving its original intent) is becoming more difficult to use, requiring a detailed knowledge of the basin. It is very time-consuming to develop new hydrologies for different levels of development or to extend the period of simulation. To model historical water use also imposes considerable constraints on modernizing the approach. For example, representing changes in rice irrigation requirements due to changes in planting dates, shorter-growing crop varieties, winter flooding for rice straw decomposition all have to be represented as phased changes over time rather than simply considering today's practices. Lastly, the current depletion analysis does not lend itself to the modular approach advocated by the Strategic Review (p21).

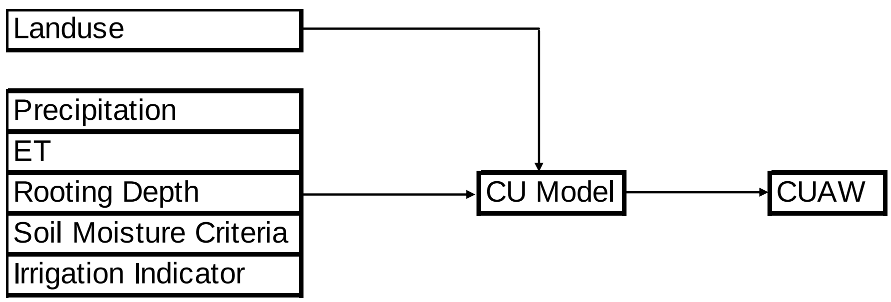
Under consideration is proposed work that a more modern and flexible rainfall-runoff approach to estimating local hydrology and rim inflows for use in CalSim-II would have considerable advantages. The rainfall-runoff approach has been successfully implemented for use in other planning models. The benefits of rainfall-runoff modeling include:

- Easier to field verify
- Easier to update hydrology for changing land use conditions (or climate conditions)
- Easier to document and sustain with personnel changes
- Easier for various model users and hydrologists to understand and use
- Easier for more groups of hydrologists (agencies and consultants) to contribute to model upgrades and refinements
- Easier to apply consistently across basins
- Provides a framework for keeping land use, water demand, surface hydrology, and groundwater hydrology assumptions consistent
- Provides consistency with CVGSM/IGSM (or alternative model) representation of groundwater hydrology
- Easier to change modeling time-step
- Easier to modify spatial coarseness
- Easier for state, regional, and local agencies to employ for a wider range of hydrologic, planning, and management studies (such as local water supply, flooding, and restoration problems)

Consumptive Use Model

The Consumptive Use (CU) model was originally developed by DWR to create input for the water resources planning model DWRSIM. Its role in CalSim-II is essentially unchanged. The CU model simulates monthly soil moisture conditions in the root zone using simple mass balance accounting. For a given land use, the model calculates:

- Monthly agricultural and outdoor urban water use (consumptive use of applied water)
- Monthly precipitation that is used consumptively through evapotranspiration.



The time series of CUAW is aggregated by DSA and multiplied by efficiency factors to obtain the land use based target demands used in CalSim-II. The consumptive use of precipitation on developed areas compared to pre-development is used to calculate the effects of land use change on runoff. These adjustments are required to estimate the local water supplies or accretions in CalSim-II.

A main limitation of the CU model is that it does not integrate soil moisture accounting with rainfall-runoff and deep percolation. The separate estimation of rainfall runoff, evapotranspiration and deep percolation in CalSim-II can lead to errors. One approach under consideration is:

- Replace CU model with a soil moisture accounting model (e.g., Sacramento Watershed Model framework, implemented by CA-NV RFC) that directly estimates runoff and deep percolation
- Structure new model so that it can be directly incorporated into IGSM or alternative model
- Integrate new model's current work on irrigation model development such as DPLA's CUP and SIMETAW

Modularity

The refinement of the CalSim-II spatial resolution should go hand-in-hand with implementation of the modular concept of modeling. For example, agricultural areas in the Sacramento and San Joaquin Valley could be represented as a black box with boundary flows linking the black box to the major stream and groundwater system. The boundary flows are:

- Diversion arc(s) from the stream network with associated monthly demands and monthly weights

- Return flow arc(s) to the stream network, with flow calculated as a piecewise linear function of the flow in the diversion arc
- A groundwater pumping arc, with flow calculated as a piecewise linear function of the flow in the diversion arc
- An inflow arc to the groundwater system representing recharge from deep percolation (given a fixed land use, flow in this arc could be constrained to a fixed time series)

Alternatively, a region may be represented in more detail, broken-down into constituent irrigation districts with arcs showing conveyance losses, reuse, and operational spills. This more detailed representation is required for defining the relationship between surface water deliveries, groundwater pumping and return flows. Once these relationships have been established, the detailed model can be switched to the 'black box' representation to simplify the CalSim-II model and reduce run-times. The more detailed model can be used for analyzing impacts of water conservation measures.

DWR is considering implementing this dual modular approach for a test area, such as the Feather River Basin, that has a very complex internal structure of diversions from different sources and reuse between irrigation districts.

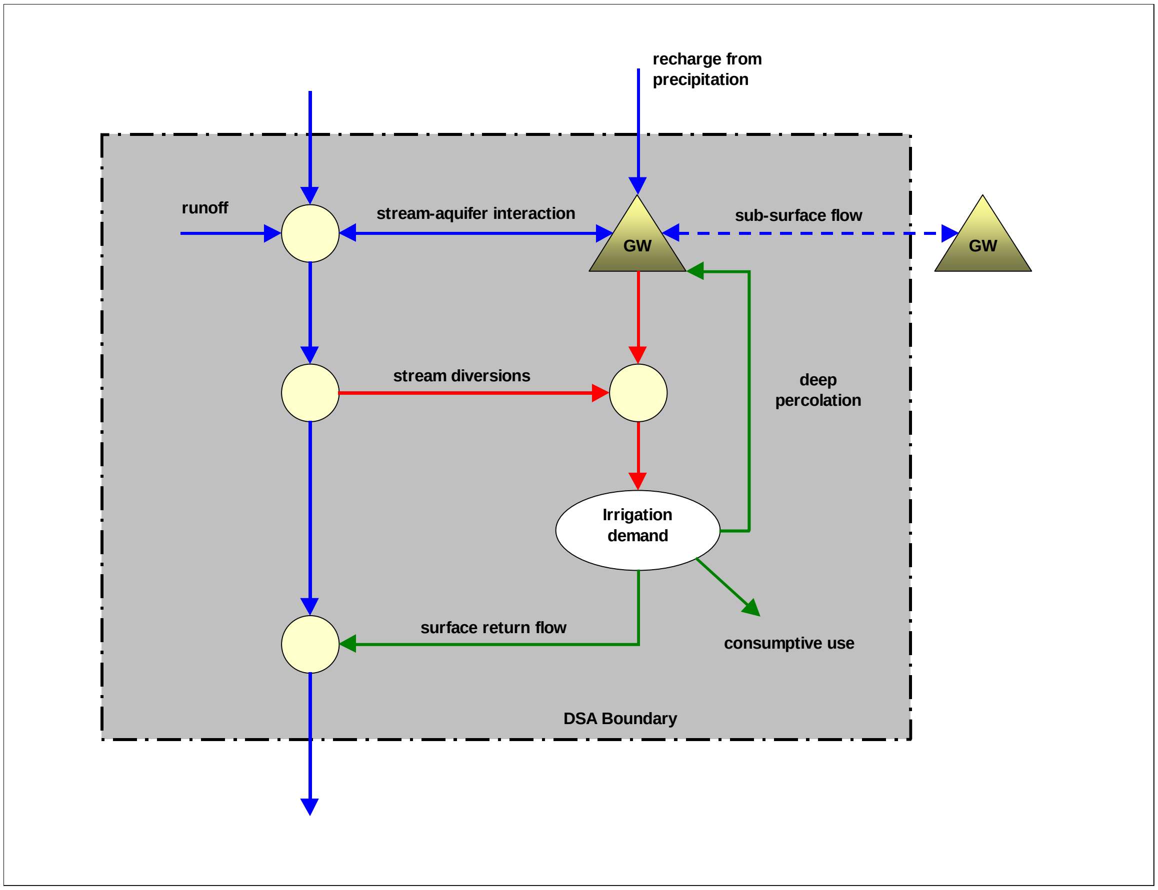


Figure E-1 Existing Conceptual Water Use Diagram

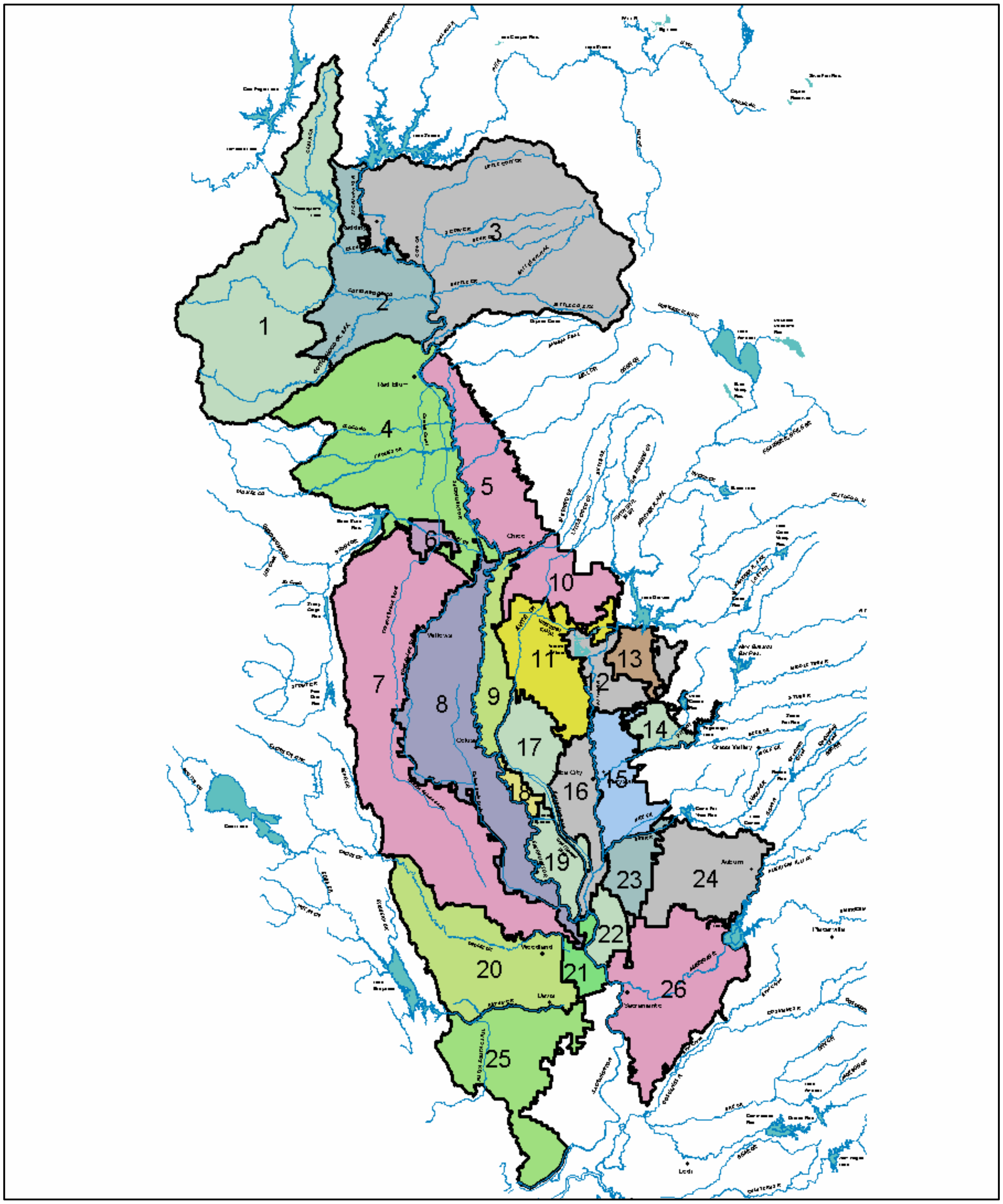


Figure E-2 Proposed New Water Management Areas

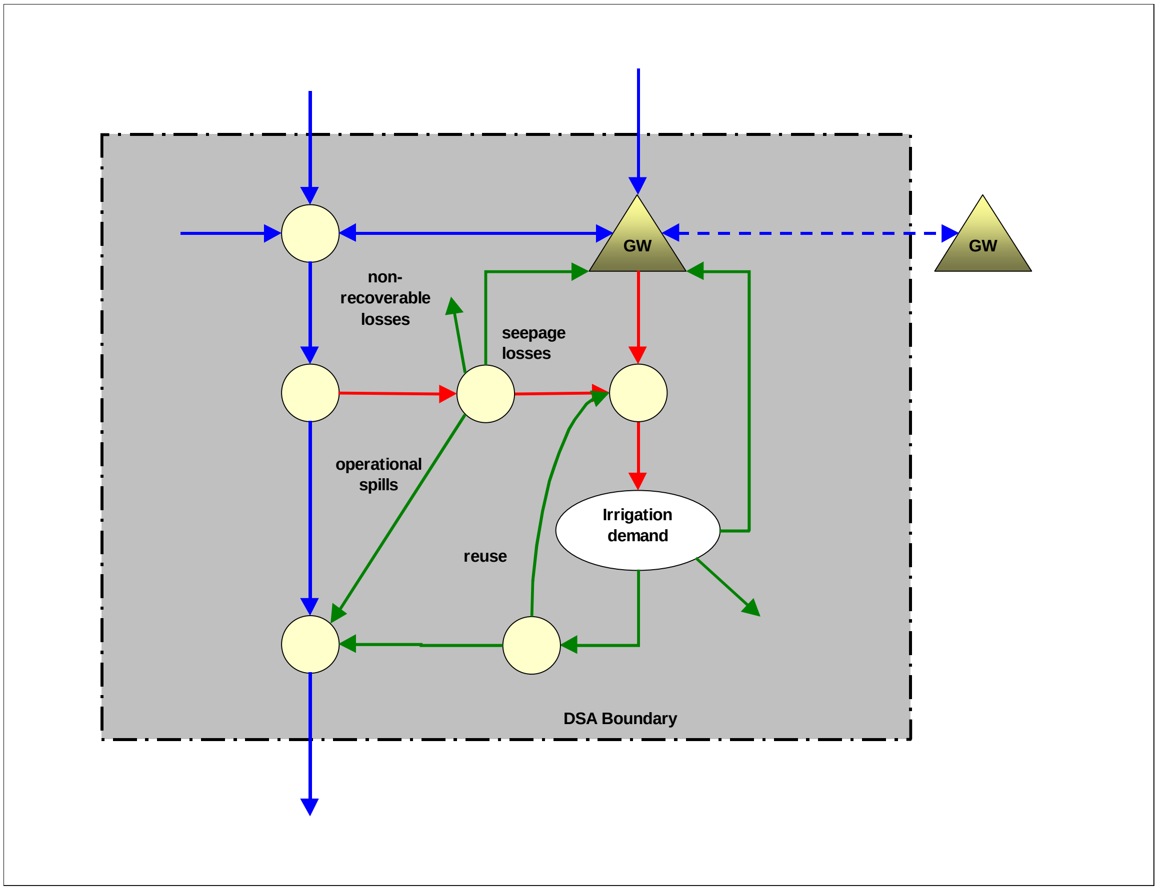


Figure E-3 Proposed Conceptual Water Use Diagram

Appendix F. Groundwater Modeling Proposed Plan

Current representation of groundwater (inventories and impacts) in CalSim-II is approximate and limited. Both DWR and Reclamation recognize the strong need to enhance the modeling of groundwater in CalSim-II and a more realistic impact of recharge and pumping on local ground water resources. One model under consideration is the Integrated Groundwater – Surface water Model IGSM2 (Figure 12-1) the latest version of which was developed and is supported by DWR. The application of IGSM2 to the Central Valley is called the Central Valley Groundwater – Surface water model CVGSM2 (Figure 12-2). However, other models will also be investigated, including how the model is used (e.g, directly, or mimicked through approximate methods such as response functions).

One approach for meeting such an objective is the coupling of CalSim-II and IGSM2/CVGSM2 (or alternative model or mimicked version) for hydrology development, ground water representation and assessment in future versions of CalSim-II. This new approach could be used calculating the hydrology input to CalSim-II, the accounting for surface water – ground water interaction, and the modeling of groundwater flow. The type of "linkage" between CalSim-II and CVGSM2 (or alternative) would depend on what hierarchical level of CalSim-II is being used. For example, at its simplest formulation CalSim-II as a screening model of the SWP/CVP system may use an emulation of CVGSM2 (or alternative) to account for the accretions and surface water – groundwater interaction (e.g, through the use of response functions that would be developed based on CVGSM2 or alternative model runs). At a different level, resolution at a planning area level may be sufficient. At another level, interactions at the finite element level of CVGSM2 may be important. This hierarchical approach of CalSim-II and the associated form of using CVGSM or alternative (direct, indirect, or by emulation) is still being investigated by DWR and Reclamation.

There are many benefits for linking CalSim-II with IGSM2 (or alternative):

- The hydrology at future levels of development would be integrated in the simulation and developed on-the-fly allowing for modifications to land use (especially during dry periods) and/or modifications for meeting demands from surface water and groundwater.
- The spatial resolution would be enhanced, and allow for GIS technologies for use in calculating water demands by element of CVGSM (or alternative), rather than DSA.
- The accretions calculations will be more physically based, and would eliminate the use of the CU model and the Depletion model and their limitations for the valley floor areas. Currently IGSM2 uses the NRCS (SCS) method for calculating rainfall/runoff components.
- There would be a marked theoretical improvement in modeling groundwater flow and the surface water - ground water interaction, and allow for carrying conjunctive use studies.
- The extent of the simulation areas would be extended to include Tulare Basin.

In modeling California's complex water resources, it is important that key elements reflecting hydrologic processes be accounted for either directly or indirectly in the model itself, its assumptions, or input. Key elements to consider in modeling surface hydrologic processes include: rainfall, snowfall, snowmelt, interception, retention, detention, infiltration, evaporation, surface runoff, return flows, artificial recharge, land and water use, water quality, and water rights. Key elements that need to be considered in modeling subsurface hydrologic processes include saturated flow, unsaturated flow in the vadose zone, ground water pumping, evapotranspiration, water quality, and water rights. The interaction between the two processes occurs through streams, rivers, canals, lakes, reservoirs, and land surface. The IGSM2 incorporates most of the processes listed. Other models exist also, but the focus of this section is to use IGSM2 as a surrogate model.

IGSM2 is a regional scale model developed by DWR for the simulation of groundwater elevations, surface flows and surface-subsurface flow interactions. It is a completely revamped version of its predecessor IGSM version 5.0. IGSM was originally developed by consultants for Reclamation, DWR and other agencies. The first major public release of IGSM was in 1991. The first public release of CVGSM was also in 1991. Since its 1991 version, IGSM has undergone various upgrades by different groups based on specific applications to numerous basins in California, Colorado, Wisconsin, and Florida. In January 2001, DWR began the development of IGSM2 that included an extensive review and revamp of the theory, simulation methodologies and the source code used in IGSM. Based on this work, IGSM2 Version 1.0 that utilized enhanced/modified theory and simulation techniques was made available to public in December 2002. IGSM2 Version 2.0 was released in December 2003.

IGSM2 simulates groundwater elevations in a multi-layer aquifer system and the flows among these layers. The depth-integrated conservation equation is solved for horizontal flows in each layer and an approximate method is utilized to compute vertical flows among layers. The Galerkin finite element method is used to solve the non-linear conservation equation for each aquifer layer. A mixture of confined and unconfined aquifer layers that are separated by semi-confining layers can be modeled. The changing aquifer conditions (confined to unconfined and vise versa) as well as subsidence, and effect of tile drains, injection and pumping wells can also be modeled.

Stream flows, lake storages, and their interaction with the aquifer system are also modeled in IGSM2. Stream flow simulation is similar to that used in MODFLOW 2000. Conservation equations for streams, lakes and aquifer system are solved simultaneously to compute the interaction among these components accurately.

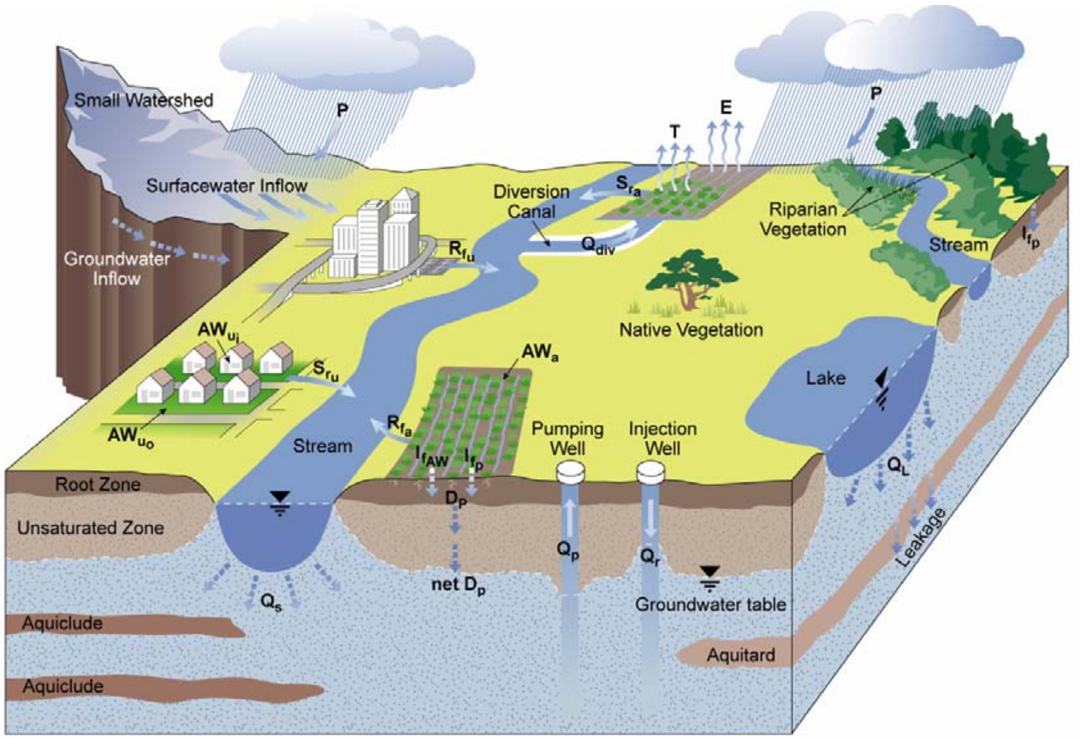
The distribution of four land use types (agricultural with specified crops, urban, native and riparian vegetation) dictate the evapotranspiration, surface runoff and infiltration characteristics (calculated using the NRCS method) as well as the demand for agricultural and urban water supply. The infiltrated water is routed vertically through root and vadose zones to compute the recharge to the groundwater. Stream diversions and groundwater pumping can be specified and distributed to meet agricultural and urban water requirements, and also adjusted dynamically to balance supply and demands. DWR staff also provides technical support of IGSM2.

Hydrologic input to the CalSim-II model includes WY1922-1994 time series for reservoir inflows, local accretions, and projected land-use based demands. The land use based demands are using the Consumptive Use CU model, and local accretions and reservoir inflows are calculated using the Depletion Analysis approach. The CU model is a monthly soil moisture accounting model using known precipitation, crop and urban acreages, and crop soil moisture characteristics to calculate monthly demands (Diversion Requirements) by Depletion Study Area DSA. It calculates monthly demands for both historical (time-varying land use) conditions and projected (constant future land use) demands. Inflows into the reservoirs are calculated using the Depletion Analysis approach developed by both DWR and Reclamation. The procedure begins with measured historical outflows at gauged streams of a DSA which are unimpaired for historical conditions by adding back the historical calculated land-use based demands from the CU model, and re-impairing the flows by subtracting out the future level demands from the CU model. Local accretions are calculated using simple budget analysis, and the results are used as input to CalSim-II.

Local water supply computations (accretions) are currently pre-processed for CalSim-II. The CU model is used to calculate land-use based applied water demands at both historical and projected levels of development. A simple water budgeting approach by DSA then allows for calculating local water supplies (accretions).

The accounting of groundwater in CalSim-II (and its predecessor DWRSIM) has undergone an evolutionary process. In the past the Depletion Model was used to calculate the additional groundwater pumping (above historical) required at a future level of development, along with future recharge of the past-pumped water using simple specified rules. This implicitly also fixed the historical surface-ground water interaction at future levels of development. In the current CalSim-II for the Sacramento Valley, a multiple-cell MC approach was used (each DSA represented by one cell), allowing for the interaction between cells and streams. The MC approach used actually emulated CVGSM in a very simple form, but allowed for ground water elevation accounting, and the stream-aquifer interaction.

With IGSM2/CVGSM2 (or alternative) it is possible to enhance the hydrology input and the modeling of groundwater resources in CalSim-II, by eliminating the use of the CU model and the depletion analysis approach. DWR and Reclamation will investigate the different options of how best to achieve this objective.



LEGEND

P........... *Precipitation*
AW_a..... *Water applied to agricultural lands*
AW_{u_i}.... *Water applied to indoor urban lands*
AW_{u_o}... *Water applied to outdoor urban lands*
E........... *Evaporation*
T........... *Transpiration*
I_{f_p}......... *Infiltration of precipitation*
$I_{f_{AW}}$..... *Infiltration of applied water*
Q_{div}...... *Surface water diversion*
S_{r_a}........ *Agricultural runoff*
S_{r_u}........ *Urban runoff*
R_{f_a}........ *Agricultural return flow*
R_{f_u}........ *Urban return flow*
D_P......... *Deep percolation of water to the unsaturated zone*
net D_p... *Recharge to the groundwater aquifer*
Q_p......... *Pumping from groundwater aquifer*
Q_r......... *Recharge to groundwater aquifer*
Q_s......... *Stream-groundwater interaction*
Q_L......... *Lake-groundwater interaction*

Figure F-1 Hydrologic Processes Modeled in IGSM2

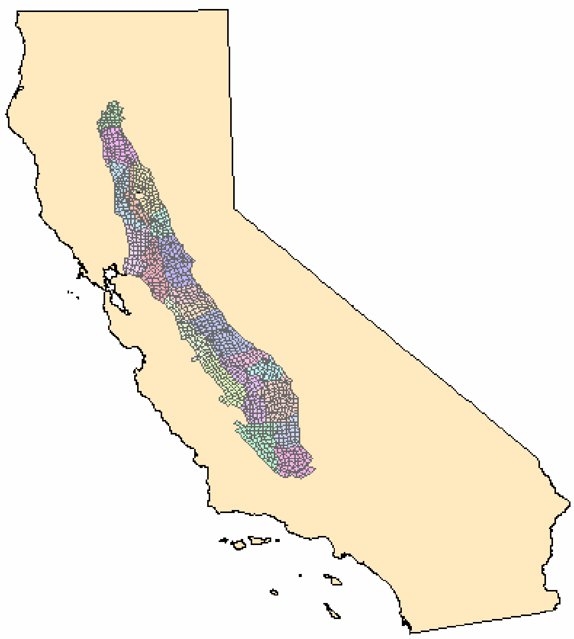


Figure F-2 CVGSM2 Finite Element Grid and Subregions

Table 1. Summary of Peer Review Comments

CONCEPTUAL LEVEL

Type	Comment	Pg	Sec	Prg	#	Resp-onse
Local Projects	Efforts to model local projects should be continued and expanded	19	2.1	9	1	2b,2c
Geographic Scope	Include Friant System, Tulare basin, Southern California, Colorado River. Hierarchical decomposition approach would allow development of separate models that can be linked through iterative process.	27	3.7	2	2	2b,2c
	CalSim-II should be expanded to include major non-CVP/SWP areas, especially the Tulare Basin, the Colorado River, and Southern California.	21	2.2	4	3	2b,2c
Management Scope	CalSim-II does not explicitly represent many of the management options in which policy makers are interested	23	2.2	6	4	1,2
	CalSim-II should be expanded to include local management options such as water conservation, reuse, water transfers, groundwater and conjunctive use management.	21	2.2	4	5	2a,2b
Modular Approach	Common tension for those who wish for greater detail and those who want less detail from the model. Need for more flexible, modular approach to modeling.	2	1	2	6	2
	Too complex. Not sufficiently detailed. Develop linkable modules of different complexity.	7	5.2	2	7	2
	CalSim-II should be modular.	21	2.2	4	8	2b,2c
Real-time Operations	Improve capabilities for real-time operations, gaming, ag demands, water transfers, Delta storage, carryover contract rights, refuge water demands, updated operations for Feather, Stanislaus, Upper American, San Joaquin, Yuba.	8	5.2	3	9	2a,2b
Model Purpose	For CalSim-II to remain a model of only the CVP and SWP seems technically and politically untenable. California's water system asked to be operated in an increasingly integrated manner. Widen geographical and functional scope of model. Better parameterize local supplies and demands.	24	2.2	10	10	2a,2b,2c
Hydropower	CalSim-II should include risk-based power capacity evaluation and incorporation of indexed sequential hydrologic modeling. Hydropower should not be after-the-fact calculation, but explicitly included in system objectives.	25	3.3	1	11	2b
Groundwater	Efforts to include groundwater should be continued	19	2.1	9	12	2a,2b
Analyzing Future Scenarios	Need to examine greater range of long-term scenarios with respect to hydrology, demands, and operational uncertainty	22	2.2	4	13	2b
Operational Objectives	Better capabilities for analyzing economic, water quality and groundwater issues.	8	5.2	3	14	2a,2b,2c
Documentation	Documentation required that describes applicability of model to different problems.	8	5.2	3	15	2a,2b

Type	Comment	Pg	Sec	Prg	#	Response
Objective Function	Need to calibrate the CalSim-II objective function so that CalSim-II model decisions correspond to those operators would make. Unless calibrated the model may produce overly optimistic answers.	4	3	1	16	2b
Hydrologic Uncertainty	Need other approaches to representing hydrologic uncertainty and variability besides using historical record.	22	2.2	4	17	2b,2c
Groundwater	Limited representation. Infinite resource.	8	5.2	3	18	1,2
DWRSIM/PROSIM	Remove ties to DWRSIM and PROSIM	24	3.1	1	19	2
Rule Curves	Documentation required.	27	3.6	1	20	2a,2b
	CalSim-II rule curves should reflect operator's behavior.	29	3.9	1	21	2b,2c
Land Use	Consider a land use that changes over time or responds to hydrologic conditions	8	5.2	3	22	2b
Model Improvements	Develop protocols and records for identifying and correcting model errors and making model improvements.	40	6.10	1	23	2b,2c

Note: The keys to the "Response" column is on page F-10

IMPLEMENTATION LEVEL						
Numerical Model						
Type	***Comment***	***Pg***	***Sec***	***Prg***	***#***	***Response***
Daily Operations	Inclusion of routing requires look-ahead optimization ability. Daily releases are head dependent.	26	3.4	1	24	2a,2b,2c
Groundwater Model	Consider use of response functions. A dynamically linked CalSim-II -CVGSM is not necessary to obtain accurate groundwater predictions. It would also lead to greater run times.	27	3.5	9	25	2b,2c
	Possibility of using ANN for groundwater.	27	3.7	3	26	2b
Soil Moisture	Soil moisture is not dealt with in a realistic manner within the CU model.	27	3.5	10	27	1,2b

Data						
Type	***Comment***	***Pg***	***Sec***	***Prg***	***#***	***Response***
Required Accuracy	Model developers should recognize the requirement that CalSim-II provide absolute values. Additional calibration required.	25	3.2	1	28	2a,2b
	Need to improve CalSim-II's comparative as well as absolute capabilities.	8	5.2	3	29	2a,2b,2c
Data Development	There has not been sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity and operational data. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework. Needs to be greater coordination of data collection and analysis between different administrative units within DWR.	20	2.2	2	30	2a,2b
	Develop protocols for data documentation and development.	70	G	3	31	2a,2b
Groundwater	Details of GW calibration should be available. The San Joaquin system should be added to the multi-cell model. The accuracy of using a coarse representation should be assessed. Better historical groundwater pumping data is needed to confirm whether the use of groundwater in CalSim-II is accurate.	26	3.5	5	32	2a,2b
Hydrologic Data	Needs updating.	20	2.2	2	33	2a,2b
	Develop documentation and testing regime for developed data.	38	6.5	1	34	2a,2b
Agricultural Demands	Update data. Use of economic factors in estimation of water demands. Preferred spatial scale for economic modeling is irrigation district scale.	23	2.2	5	35	2b,2c
Documentation	Documentation required that describe assumptions and limitations.	8	5.2	3	36	2a,2b
Metadata	Provide metadata for data inputs	58	E		37	2a,2b,2c
DWRSIM/PROSIM	Remove ties to DWRSIM and PROSIM	24	3.1	1	38	2

Data Management System

Type	Comment	Pg	Sec	Prg	#	Response
Accountability and Quality Control	Need for quality control and documentation	2	1	2	46	2a,2b
	Need for version control, quality control, calibration, and verification.	8	5.2	3	47	2a,2b
	Develop an explicit quality control program.	37	6.2	1	48	2a,2b
Model runs	Input and output data sets from model runs should be archived in a central location.	58	E		49	2a,2b

Software

Type	Comment	Pg	Sec	Prg	#	Response
Error Checking	Create automated mass balance checking procedure.	5	4	2	50	2a,2b
	Automated input and output checking is needed.	24	2.2	10	51	2a,2b
Non-Linearity	Link linear optimization model with non-linear simulation models.	5	4	3	52	2b
Public Domain	Switch to public domain software for optimization, visualization, file management and data base support.	5	4	4	53	2a,2b,2c
	Eliminate FORTRAN compiler, use public domain MIP solver.	24	2.2	10	54	2a,2b
Multi-period Optimization	Introduce multi-period optimization for decision making based on uncertainty information.	5	4	3	55	2b,2c
	Multi-period optimization could replace rule curves.	8	5.2	3	56	2b,2c
	Performance based optimization should be added to WRIM's capabilities	38	6.7	1	57	2b,2c
Modularity	Ability to change geographic scope, spatial resolution, temporal resolution as required for the analysis.	8	5.2	3	58	2b,2c
Documentation	Improve software documentation.	8	5.2	3	59	2a,2b
GUI	Improved GUI for facilitating model input, setting of constraints and weights, operating the model, displaying and analyzing results.	9	5.2	3	60	2b,2c
	CalSim lacks a comprehensive, graphical user interface for constructing and editing the river basin system topology. The complexity of CalSim would be greatly reduced with development of an object-oriented graphical user interface.	18	1.1	5	61	2b,2c
	Develop GUI tied to databases with GIS display.	24	2.2	10	62	2b,2c
Time-Step	Consider use of shorter time-step for some aspects of the model.	24	2.2	10	63	2b,2c
Post-Processing	Need for better post-processing tools	24	2.2	10	64	2a,2b,2c
Version Control	Need for version control, and database management software and protocols.	24	2.2	10	65	2b
Weights	Need systematic and objective method of setting weights.	24	2.2	10	66	2b
	Need capability to dynamic vary weights, as a function of the state of the system.	27	3.6	1	67	2b
Run Time	Long run times preclude sensitivity analysis. Update solver to gain from efficiency improvements in the Branch and Bound algorithm and better sparse matrix analysis.	29	4.1	1	68	2b,2c
Gaming	Improve capabilities for gaming involving stakeholders.	8	5.2	3	69	2a
Output	Provide access to Lagrange multipliers, identification of binding constraints and value of slack variable	24	2.2	10	70	2a

	Develop output for a wider set of variables other than CVP_SWP e.g. groundwater depletion, water quality, supply reliability for non-project users, hydroelectric generation, indicators of ecological health.	28	3.8	1	71	2a,2b
Infeasibilities	Add capability for automated debugging of infeasibilities.	24	2.2	10	72	2a,2b

Administrative

Type	*Comment*	*Pg*	*Sec*	*Prg*	#	*Response*
Model Peer Review	Shortness of 2003 CalSim/CalSim-II Peer Review precluded technical analysis of CalSim-II. Such a technical review should be carried-out.	3	2	6	73	2b,2c
	A peer review is required for each separate element of the model	2	1	2	74	2a,2b,2c
	CalSim-II should be subject to a systematic and frequent review and testing program	21	2.2	4	75	2a,2b,2c
Sustainability	Develop strategy on how to sustain software development.	5	4	5	76	2a,2b
	Produce strategic document that outlines short-term and long-term efforts, budgets, and responsibilities for model and data improvements, with policy for local agency and stakeholder involvement.	70	G	3	77	2a,2b
Public	Local agencies, system operators, and consulting firms should be actively involved in the development and application of CalSim-II.	21	2.2	3	78	2a,2b
Involvement	Broaden the range of hydrologic expertise involved in hydrology data development.	38	6.6	1	79	2a,2b
Financing	The financing for CalSim/CalSim-II development should be wider than CVP/SWP projects. Funding should be forthcoming from local and regional agencies	21	2.2	4	80	2a,2b
Staff	Not enough knowledgeable modelers	23	2.2	7	81	2
Model Interpretation	Stakeholders and policy makers are poorly guided in how to interpret model results.	23	2.2	8	82	1,2
	Studies have not contained the kind of written discussion and interpretation of results that would demonstrate that the authors have thought about the results and drawn conclusions.	23	2.2	9	83	1,2
Model Management	CalSim-II should no longer be solely responsible to CVP-SWP managers but a broader range of technical managers from additional interests.	35	5	3	84	2
	Create a broader interagency modeling consortium for developing operations planning models. Might require steering committee or governing board.	36	6.1	1	85	2
Training & Education	Hold seminars on CalSim-II to increase public confidence in model.	29	4.2	3	86	2a,2b
	Develop a formal common regimen to train CalSim-II users.	37	6.3	1	87	2a,2b
	Provide centralized support.	8	5.2	3	88	2b
	Develop a users group	37	6.1	1	89	2a

MISCELLANEOUS

Type	*Comment*	*Pg*	*Sec*	*Prg*	#	*Response*
Supporting Models	Documentation, calibration, testing, peer review should be extended to other models that provide data input for CalSim-II.	38	6.4	2	90	2b,2c

CALIBRATION AND VALIDATION						
Type	***Comment***	***Pg***	***Sec***	***Prg***	**#**	***Response***
Calibration	CalSim-II should be calibrated, tested, and documented for absolute and comparative use.	40	6.9	1	39	1,2a,2b,2c
Validation Report	Evaluation of CalSim-II by comparison with historical operations should be more rigorous.	40	6.9	3	40	2a,2b
	Comparison of simulated and historical deliveries suggests that the model over-estimates project deliveries	68	F	3	41	1
	Model rules on carryover storage during drought should be examined so that they reflect the system will be managed in the future.	68	F	4	42	2a,2b
	Comparison of simulated and historical deliveries suggests that the model underestimates storage in San Luis Reservoir.	69	F	6	43	1,2
Sensitivity Analysis	Need for sensitivity and uncertainty analysis.	8	5.2	3	44	2a,2b,2c
Advisory Board	Create external technical advisory body as part of a quality control program.	37	6.2	1	45	2a

<u>Keys to the "Response" column of Table 1:</u>

1 DWR and Reclamation do not agree with the comment stated.

2 DWR and Reclamation agree with the comment stated.

2a DWR and Reclamation agree with the comment stated and staff is currently working on it as part of our immediate needs for CalSim. A work plan is being developed by both DWR and Reclamation and will be shared with the public in the very near future.

2b DWR and Reclamation agree with the comment stated and consider it important to address in the short term with a target date of January 2007.

2c DWR and Reclamation agree with the comment stated but considers it should be addressed on a longer term with a target date of January 2011.

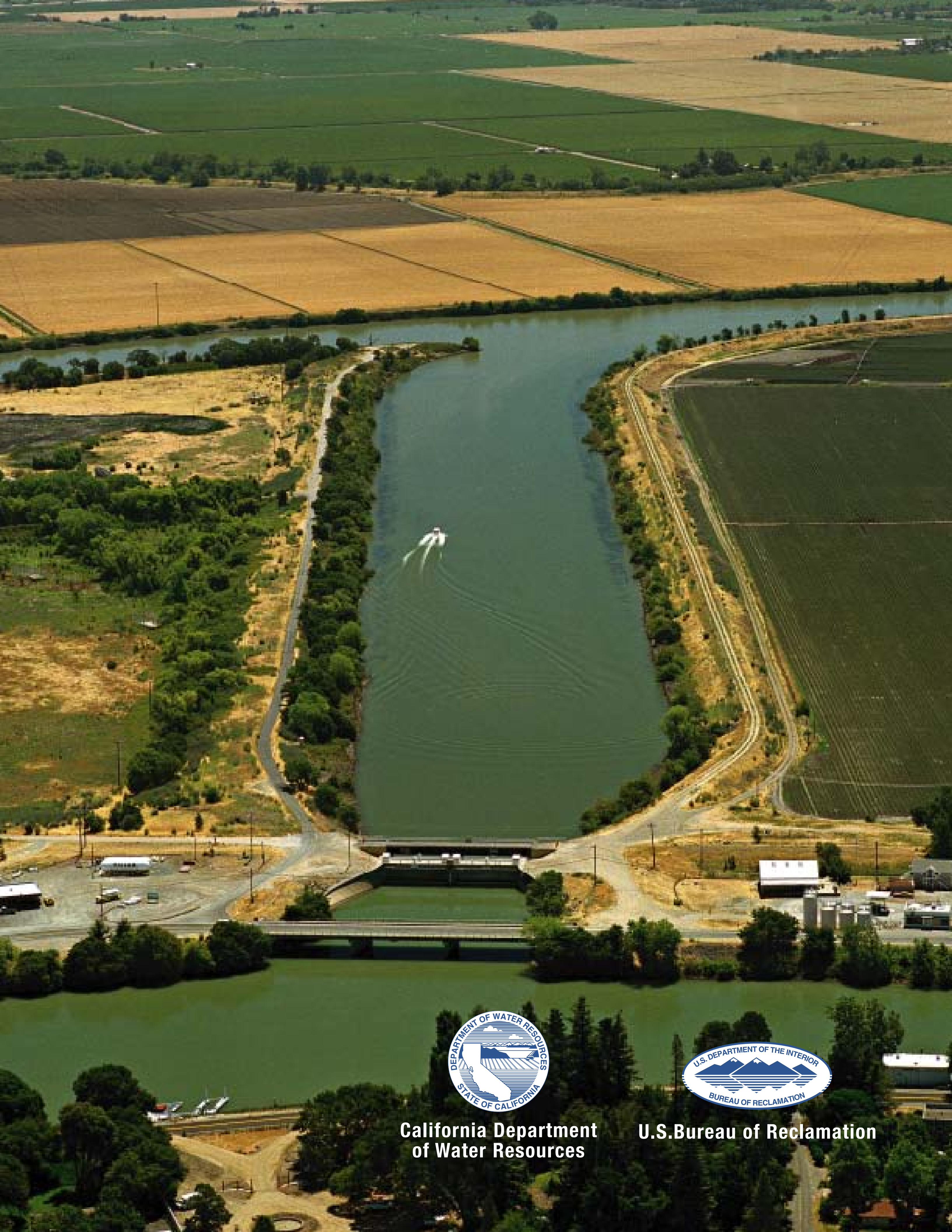
Table 2 Development Priorities

CONCEPTUAL LEVEL				
Task	Current Development	Immediate Needs	Short-Term Development Target January 2007	Long-Term Development Target January 2011
Representation of local projects	Explicitly represent major irrigation districts on the East-Side of the San Joaquin Valley	Explicitly represent major irrigation districts and water agencies in the Sacramento Valley		
Extended geographic scope	Model Friant System			Model Colorado River system
	Model Yuba River			Expand representation of southern California
	Model Bear River		Model Upper Feather River	
	Model Upper American			Tulare Basin
	Model Stony Creek			
Representation of water management options	Develop module for water transfers	Improve capability to model water conservation measures		
		Improve capability to model conjunctive surface water and groundwater operations		
Development of a modular approach		Develop modular approach for irrigation and urban demands in the Sacramento and San Joaquin Valley		
Real-time operations	Integrate planning and operational models	Develop gaming model		
Hydropower	Post-processing of hydropower operations		Add risk-based power capacity evaluation	
Groundwater	Calibration of CVGSM	Refine groundwater representation in the Sacramento Valley	Add groundwater model for the San Joaquin River Valley	
Analyzing Future scenarios			Develop alternate future demand and water use scenarios. Develop ulternate hydrologies	
Operational objectives	Water quality module for the lower San Joaquin River		Use of economic and water quality drivers and performance measures	
Documentation	.	Document applicability and limitations of CalSim-II		
Objective function	Work with operators to define current operating rules and objectives			
Hydrologic uncertainty	Model global climate change study		Develop alternate approaches to representing hydrologic uncertainty and variability	
Groundwater	Develop strategy to more comprehensively model groundwater			
Land use			Dynamic variation of agricultural land use (demand) in response to water supply	

Model improvements		Develop protocols and records for identifying and correcting model errors and making model improvements.		
Daily time step		Assessment of errors due to monthly time step		
Documentation	Document model logic	Document development of rule curves		
IMPLEMENTATION LEVEL				
Numerical Model				
MIP solver	Improve computational efficiency			
Daily operations			Add look ahead optimization functionality	Hydrologic routing
Groundwater model	Link of CalSim-II and CVGSM		Refinement of groundwater model in CalSim-II (unit response function, ANN, or multi-cell model)	
Soil moisture accounting			Replace CU model	
Data				
Required accuracy		Improve CalSim-II's absolute predictive capability		
Data development		Develop protocols for data documentation and development	Develop systematic, transparent and accessible approach to the development of hydrologic data	
Hydrologic Data		Update hydrologic data. Broaden range of expertise involved in hydrology data development. Develop testing regime for data.		
Spatial resolution		Gather data for finer spatial resolution		
Documentation		Document derivation of all data input		
Metadata		Provide metadata for data inputs		
Data Management System				
Accountability and Quality Control		Develop version control for model input data		
		Develop an explicit quality control program		
Model runs		Archive data sets from model runs in a central location		

Software				
Error checking			Automate mass balance checking procedure	
			Add automated algorithms for checking input and output	
Simulation			Improve simulation functionality	
Public domain software	Elimination of FORTRAN compiler			
	Adoption of public domain solver.			
Multi-period optimization		Add automated multi-period optimization functionality		
Modularity		Facilitate ability to change geographic scope, spatial and temporal resolution		
Documentation	Add ability to store metadata	Update and expand user's manual		
GUI	Create geo-referenced network schematic	Develop GUI for constructing and editing river basin system topology, facilitating model input, displaying results		
Time-step	Increase flexibility to switch between daily and monthly time steps			
Post-processing		Improve third-party post-processing tools		
Version control	Use version control for text based inputs	Create centralized database for version control management		
Weights	Add functionality for ynamic conditional setting of weights	Develop automated weight generating algorithm		
Run-time	Restructure WRESL code to eliminate redundant/repetitive calculations			
	Add capability to output intermediate of state variables (rather than their addition to MIP problem)			
	Improve solver computational efficiency			
Gaming		Create gaming model for stakeholder participation		
Output		Output of (Lagrange multipliers, basic and non-basic variables, including slack variables		
		Develop more comprehensive standard output of model variables		
Water quality		Add water quality input tables and post-processor	Add functionality to specify water quality objectives	
Infeasibilities	Automate debugging of solver infeasibilities			

Administrative				
Peer Review		Complete technical reviews of CalSim-II components		
Sustainability			Develop strategy on how to sustain software development.	
		Produce strategic document that outlines short-term and long-term efforts, budgets, and responsibilities for model and data improvements		
Public Involvement			Actively engage local agencies, system operators, and consulting firms in the development and application of CalSim-II.	
Financing			Seek wider financing for CalSim/CalSim-II development	
Model Management	CWEMF modeling strategic vision committee		Create broader interagency modeling consortium for developing operations planning models.	
Training &		Hold seminars on use and interpretation of CalSim-II for managers and policy staff		
Education		Develop a formal common regimen to train CalSim-II users.		
		Provide centralized support.		
		Develop a users group		
MISCELLANEOUS				
Supporting Models	Create documentation of model linkages (model map)	Documentation, calibration, testing, and peer review of supporting models		
	Facilitate communication between models (CalSim-II-CALAG translator)			
CALIBRATION AND VERIFICATION				
Calibration		Calibrate hydrologic parameters using historical data		
Sensitivity Analysis	Carry-out sensitivity analysis	Carry-out uncertainty analysis.		



California Department of Water Resources

U.S.Bureau of Reclamation

H. ANALYSIS OF PROPOSED PROJECT EFFECTS ON RIVER FLOWS (STUDY NO. 5)

Delta Inflow Analysis for Monterey Plus

The accompanying spreadsheets are an analysis of the effects of the proposed project (Monterey Amendment) on flow in the Feather and Sacramento rivers and on Delta inflow. The spreadsheet analysis used estimated deliveries to individual contractors obtained by post-processing CALSIM II output.

The delivery estimates used in this analysis are not identical to the latest delivery estimates that are contained in Appendix F. The differences are very small, however, and would have a negligible effect on the river flow estimates contained herein.

A similar analysis was begun for alternatives to the proposed project. The analysis was not completed because it became apparent that the effects of Monterey Amendment, small as they are, are greater than those of the alternatives.

Explanatory Notes

The changes to Plumas County allocations are excluded from the tables because the mechanisms for delivery to Plumas from Lake Davis affect Feather River flows in a different manner. That analysis is provided later in this section.

Tables 9-CS-1 and 9-CS-2 show the total deliveries of project water to the five upstream-of-Delta contractors and the 24 remaining contractors south of the Delta for 2003 and 2020, under the two baselines, and as defined for the Proposed Project and the alternatives.

Table 9-CS-3 shows deliveries under the 1994 baseline. Note that there is a slight increase from 1994 to 2003 due to increases in demands and other slight allocation changes.

Table 9-CS-4 shows the maximum and minimum total deliveries to the five upstream-of-Delta contractors in thousands of acre-feet for each year type without differentiating among alternatives.

Table 9-CS-5 shows the changes in total deliveries with respect to the 2003 and 2020 baselines. The table compares the maximum and minimum deliveries from Table 4 to the 2003 and 2020 baselines, respectively, to yield the maximum amount of delivery change, covering both increases and decreases.

Table 9-CS-6 provides baseline river flows for 2003 and 2020 for both rivers; uses the delivery increases from Table 9-CS-5 as estimates of possible river flow decreases due to greater deliveries; tabulates those potential flow increases as a percentage of the baseline river flows; presents a second analysis that used the greatest differences between any alternatives, including the baselines as if they were alternatives; and expresses those results as a percentage of river flows.

An additional analysis tabulates the monthly patterns of delivery to the upstream-of-Delta contractors and analyzes the magnitude of changes on a monthly basis by year type. The Proposed Project under 2020 conditions was used to approximate the maximum amount of change. Those results are shown in Table 9-CS-7. The differences do not exceed 0.13%.

An additional analysis looked at the amount of change that would occur to deliveries downstream of Banks Pumping Plant. Table 9-CS-8 shows the increases and decreases among alternatives relative to the 2003 and 2020 baselines. That analysis indicates that there would be delivery changes of less than 1%, with a maximum of 0.6% in critical years.

The flow changes in acre-feet were also computed in cfs to provide an additional measure of the impact of the changes. Table 9-CS-9 shows the flow changes by month and year type for the Proposed Project under 2020 conditions. The maximum flow decrease attributable to the Proposed Project is 0.7 cfs between Thermalito Afterbay and the north end of the Delta, and 19.1 cfs downstream of the North Bay Aqueduct intake. Most months the flow reductions are less than 1 cfs and 14 cfs, respectively.

Comparison of Annual Averages From Spreadsheet "MontereySWP Delivery Summary Tables 052206.xls"
Updated for 6,680 cfs Banks Based on data from Brian Van Lienden from April 21, 2007

Total Average Annual Deliveries from 1922-94 (TAF/yr)

Table 7.3-16 **Table 9-CS-3**

Total Average Annual Deliveries Under 1994 Baseline, TAF

1994 Baseline	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.12	0.12	0.12	0.13	0.11	0.11
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.50	0.48	0.48	0.37	0.38	0.66
Subtotal	0.62	0.60	0.60	0.50	0.49	0.77
Napa County FC&WCD	6.31	7.90	6.58	6.54	5.28	4.42
Solano County	28.39	31.34	30.04	29.95	28.65	19.68
Cumulative Subtotal	35.32	39.84	37.21	36.99	34.43	24.87
All other contractors	2,812	3,275	3,195	3,069	2,789	1,414
Total	2,847	3,315	3,233	3,106	2,823	1,438

Table 7.3-14 **Table 9-CS-1**
(base, PP)

Total Average Annual Deliveries Under 2003 Baseline
and Alternatives Under 2003 Conditions, TAF

2003 Baseline	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Napa County FC&WCD	7.36	8.76	7.40	7.47	7.13	5.03
Solano County	35.13	39.86	38.30	38.41	36.78	18.20
Cumulative Subtotal	43.45	49.56	46.64	46.70	44.71	24.37
All other contractors	3,045	3,540	3,582	3,508	2,831	1,476
Total	3,088	3,589	3,628	3,555	2,876	1,501

2003 Monterey Plus Project	Ann Avg	Wet	AN	BN	Dry	Crit	
County of Butte	0.30	0.28	0.30	0.35	0.29	0.26	
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a	
City of Yuba City	0.66	0.59	0.70	0.64	0.61	0.90	
Subtotal	0.95	0.88	1.00	0.99	0.90	1.15	
Change From Baseline	(0.01)	(0.07)	0.06	0.17	0.11	0.01	
Napa County FC&WCD	7.99	9.84	8.51	8.12	7.46	4.88	
Solano County	36.13	41.78	39.84	37.70	36.12	19.63	37.7
Cumulative Subtotal	45.08	52.50	49.35	46.81	44.48	25.67	
Change From Baseline	1.63	2.94	2.71	0.11	(0.23)	1.30	
All other contractors	3,011	3,471	3,520	3,430	2,809	1,519	
Total	3,056	3,523	3,569	3,477	2,853	1,545	

2003 No Project 1	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.21	8.38	7.24	7.39	7.03	5.20
Solano County	35.12	39.55	38.19	38.32	36.88	18.71
Cumulative Subtotal	43.29	48.87	46.36	46.54	44.69	25.05
Change From Baseline	(0.16)	(0.69)	(0.28)	(0.17)	(0.01)	0.68
All other contractors	3,044	3,527	3,566	3,499	2,833	1,513
Total	3,087	3,576	3,613	3,546	2,878	1,538

2003 No Project 2	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.43	8.91	7.40	7.56	7.14	5.08
Solano County	35.27	40.03	38.30	38.52	36.97	18.37
Cumulative Subtotal	43.66	49.89	46.64	46.90	44.90	24.59
Change From Baseline	0.21	0.33	0.01	0.20	0.20	0.21

Note: There is an issue with the sums provided from the prior sheet.
Sums recomputed here.

Comparison of Monthly Table A Deliveries From Raw Model Output; Not Post-Processed

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	2.44	0.34	0.00	0.00	0.03	0.53	1.85	2.01	1.91	2.52	2.77	3.06	17.45
22-94 Wet	2.29	0.08	0.00	0.00	0.00	0.44	2.48	2.68	2.55	2.52	2.77	3.29	19.09
22-94 AN	2.23	0.49	0.00	0.00	0.00	0.13	2.26	2.51	2.35	3.58	3.53	3.59	20.67
22-94 BN	3.16	0.37	0.00	0.00	0.00	0.82	2.06	2.23	1.91	2.62	3.35	4.17	20.69
22-94 Dry	2.48	0.49	0.00	0.00	0.05	0.53	1.51	1.72	1.65	2.55	2.77	2.80	16.55
22-94 Crit	1.97	0.46	0.00	0.00	0.08	0.67	0.64	0.53	0.79	1.47	1.46	1.27	9.35
No Project A 2020 Monthly Deliveries													
22-94 Avg	2.43	0.34	0.00	0.00	0.03	0.52	1.84	2.00	1.90	2.50	2.76	3.04	17.35
22-94 Wet	2.28	0.08	0.00	0.00	0.00	0.44	2.47	2.68	2.55	2.52	2.77	3.29	19.09
22-94 AN	2.24	0.49	0.00	0.00	0.00	0.13	2.24	2.50	2.34	3.57	3.53	3.58	20.61
22-94 BN	3.16	0.37	0.00	0.00	0.00	0.81	2.03	2.21	1.88	2.57	3.30	4.11	20.43
22-94 Dry	2.45	0.49	0.00	0.00	0.06	0.53	1.50	1.70	1.64	2.54	2.77	2.79	16.46
22-94 Crit	1.95	0.45	0.00	0.00	0.08	0.66	0.63	0.52	0.78	1.45	1.44	1.25	9.22
North Bay Region: Solano, Napa													
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	5.99	5.02	5.13	2.79	3.16	3.92	5.12	5.63	5.77	5.98	5.96	5.77	60.26
22-94 Wet	6.89	5.82	6.03	4.31	4.68	5.32	6.42	6.93	7.10	7.36	7.36	7.15	75.37
22-94 AN	5.78	4.82	4.79	2.86	3.90	5.15	6.49	6.97	7.14	7.41	7.39	7.16	69.84
22-94 BN	6.55	5.52	5.69	2.62	2.91	4.07	5.65	6.53	6.69	6.93	6.91	6.69	66.78
22-94 Dry	5.12	4.28	4.30	2.07	2.29	2.90	4.37	4.85	4.97	5.14	5.10	4.93	50.34
22-94 Crit	5.07	4.21	4.29	1.25	1.36	1.65	2.06	2.24	2.30	2.39	2.36	2.27	31.44
No Project A 2020 Monthly Deliveries													
22-94 Avg	5.95	5.00	5.15	2.74	3.13	3.89	5.09	5.60	5.74	5.95	5.93	5.74	59.92
22-94 Wet	6.84	5.82	6.07	4.26	4.66	5.30	6.42	6.94	7.10	7.37	7.36	7.15	75.29
22-94 AN	5.78	4.83	4.81	2.79	3.84	5.09	6.46	6.94	7.11	7.38	7.36	7.14	69.54
22-94 BN	6.54	5.50	5.79	2.55	2.89	4.04	5.57	6.44	6.60	6.84	6.82	6.59	66.17
22-94 Dry	5.08	4.24	4.29	2.04	2.26	2.86	4.35	4.82	4.94	5.12	5.08	4.90	49.99
22-94 Crit	5.02	4.17	4.21	1.21	1.33	1.62	2.03	2.20	2.27	2.35	2.32	2.24	30.96

Percentage Distribution of Deliveries

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	14%	2%	0%	0%	0%	3%	11%	12%	11%	14%	16%	18%	17.45
22-94 Wet	12%	0%	0%	0%	0%	2%	13%	14%	13%	13%	15%	17%	19.09
22-94 AN	11%	2%	0%	0%	0%	1%	11%	12%	11%	17%	17%	17%	20.67
22-94 BN	15%	2%	0%	0%	0%	4%	10%	11%	9%	13%	16%	20%	20.69
22-94 Dry	15%	3%	0%	0%	0%	3%	9%	10%	10%	15%	17%	17%	16.55
22-94 Crit	21%	5%	0%	0%	1%	7%	7%	6%	8%	16%	16%	14%	9.35
No Project A 2020 Monthly Deliveries													
22-94 Avg	14%	2%	0%	0%	0%	3%	11%	12%	11%	14%	16%	18%	17.35
22-94 Wet	12%	0%	0%	0%	0%	2%	13%	14%	13%	13%	15%	17%	19.09
22-94 AN	11%	2%	0%	0%	0%	1%	11%	12%	11%	17%	17%	17%	20.61
22-94 BN	15%	2%	0%	0%	0%	4%	10%	11%	9%	13%	16%	20%	20.43
22-94 Dry	15%	3%	0%	0%	0%	3%	9%	10%	10%	15%	17%	17%	16.46
22-94 Crit	21%	5%	0%	0%	1%	7%	7%	6%	8%	16%	16%	14%	9.22
North Bay Region: Solano, Napa													
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	10%	8%	9%	5%	5%	7%	8%	9%	10%	10%	10%	10%	60.26
22-94 Wet	9%	8%	8%	6%	6%	7%	9%	9%	9%	10%	10%	9%	75.37
22-94 AN	8%	7%	7%	4%	6%	7%	9%	10%	10%	11%	11%	10%	69.84
22-94 BN	10%	8%	9%	4%	4%	6%	8%	10%	10%	10%	10%	10%	66.78
22-94 Dry	10%	9%	9%	4%	5%	6%	9%	10%	10%	10%	10%	10%	50.34
22-94 Crit	16%	13%	14%	4%	4%	5%	7%	7%	7%	8%	7%	7%	31.44
No Project A 2020 Monthly Deliveries													
22-94 Avg	10%	8%	9%	5%	5%	6%	8%	9%	10%	10%	10%	10%	59.92
22-94 Wet	9%	8%	8%	6%	6%	7%	9%	9%	9%	10%	10%	10%	75.29
22-94 AN	8%	7%	7%	4%	6%	7%	9%	10%	10%	11%	11%	10%	69.54
22-94 BN	10%	8%	9%	4%	4%	6%	8%	10%	10%	10%	10%	10%	66.17
22-94 Dry	10%	8%	9%	4%	5%	6%	9%	10%	10%	10%	10%	10%	49.99
22-94 Crit	16%	13%	14%	4%	4%	5%	7%	7%	7%	8%	7%	7%	30.96

All other contractors	3,030	3,508	3,550	3,497	2,819	1,495
Total	3,073	3,558	3,596	3,544	2,864	1,520
2003 No Project 3						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.22	8.39	7.24	7.35	7.03	5.24
Solano County	35.21	39.62	38.20	38.32	37.06	18.89
Cumulative Subtotal	43.39	48.96	46.38	46.50	44.88	25.28
Change From Baseline	(0.06)	(0.61)	(0.26)	(0.20)	0.18	0.90
All other contractors	3,034	3,506	3,541	3,491	2,824	1,532
Total	3,077	3,555	3,587	3,538	2,869	1,557
2003 No Project 4						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.29	0.28	0.30	0.35	0.29	0.25
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.65	0.58	0.70	0.64	0.60	0.89
Subtotal	0.94	0.86	1.00	1.00	0.88	1.14
Change From Baseline	(0.02)	(0.08)	0.06	0.17	0.09	(0.00)
Napa County FC&WCD	7.98	9.13	8.04	8.20	7.77	5.92
Solano County	31.19	37.76	37.18	35.09	26.82	15.94
Cumulative Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
Change From Baseline	(3.35)	(1.80)	(0.41)	(2.42)	(9.23)	(1.37)
All other contractors	3,047	3,528	3,567	3,501	2,843	1,515
Total	3,087	3,576	3,613	3,546	2,878	1,538

Table 7.3-15
(base, PP)

Table 9-CS-2

Total Average Annual Deliveries Under 2020 Baseline and Alternatives Under 2020 Conditions, TAF

2020 Baseline						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Napa County FC&WCD	20.08	24.52	24.35	22.73	17.76	8.76
Solano County	33.79	41.37	41.08	38.29	29.79	14.55
Cumulative Subtotal	71.39	82.40	85.94	81.86	64.80	40.81
All other contractors	3,242	4,143	3,985	3,622	2,717	1,302
Total	3,313	4,225	4,071	3,704	2,782	1,342
2020 Monterey Plus Project						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.39	12.92	15.29	16.84	13.44	11.60
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.26	3.77	5.28	4.20	3.88	6.00
Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
Change From Baseline	0.12	0.17	0.07	0.19	0.07	0.11
Napa County FC&WCD	23.12	29.60	28.49	25.92	19.25	9.20
Solano County	37.70	48.06	46.56	42.36	31.55	14.92
Cumulative Subtotal	78.46	94.35	95.63	89.32	68.12	41.73

Table 7.3-19
(revised)

Table 9-CS-7

Monthly Flow Changes for Proposed Project Compared to Baseline Under 2020 Conditions, in TAF and as Percentage of River Flows

Flow Differences Distributed Monthly According to Normal Delivery Pattern, TAF

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	(0.02)	(0.00)	0.00	0.00	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.12)
22-94 Wet	(0.02)	(0.00)	0.00	0.00	0.00	(0.00)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.17)
22-94 AN	(0.01)	(0.00)	0.00	0.00	0.00	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)
22-94 BN	(0.03)	(0.00)	0.00	0.00	0.00	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.19)
22-94 Dry	(0.01)	(0.00)	0.00	0.00	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)
22-94 Crit	(0.02)	(0.01)	0.00	0.00	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.11)
North of Delta Region: Feather, Solano, Napa													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	(0.70)	(0.59)	(0.60)	(0.33)	(0.37)	(0.46)	(0.60)	(0.66)	(0.68)	(0.70)	(0.70)	(0.68)	(7.07)
22-94 Wet	(1.09)	(0.92)	(0.96)	(0.68)	(0.74)	(0.84)	(1.02)	(1.10)	(1.13)	(1.17)	(1.17)	(1.13)	(11.95)
22-94 AN	(0.80)	(0.67)	(0.66)	(0.40)	(0.54)	(0.71)	(0.90)	(0.97)	(0.99)	(1.03)	(1.03)	(0.99)	(9.69)
22-94 BN	(0.73)	(0.62)	(0.63)	(0.29)	(0.32)	(0.45)	(0.63)	(0.73)	(0.75)	(0.77)	(0.77)	(0.75)	(7.45)
22-94 Dry	(0.34)	(0.28)	(0.28)	(0.14)	(0.15)	(0.19)	(0.29)	(0.32)	(0.33)	(0.34)	(0.34)	(0.33)	(3.32)
22-94 Crit	(0.15)	(0.12)	(0.13)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.92)

2020 Monthly Baseline River Flows, TAF

2020 Feather River Baseline Flows, TAF	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	153	130	222	284	317	368	189	224	280	431	293	125	3,015
22-94 Wet	171	175	389	621	653	738	413	456	338	445	232	101	4,733
22-94 AN	152	105	222	289	391	541	151	274	261	519	362	114	3,381
22-94 BN	155	119	148	164	211	189	80	105	329	515	406	140	2,560
22-94 Dry	142	103	138	93	90	133	94	101	257	420	314	143	2,030
22-94 Crit	132	119	128	82	91	101	81	82	165	248	183	132	1,545
2020 Sacramento River Baseline Flows, TAF													
22-94 Avg	754	924	1,530	2,009	2,186	2,102	1,462	1,180	1,038	1,130	880	770	15,965
22-94 Wet	898	1,296	2,824	3,427	3,402	3,226	2,531	1,992	1,406	1,246	950	1,003	24,201
22-94 AN	726	958	1,356	2,730	2,940	3,104	1,746	1,362	1,086	1,301	980	798	19,086
22-94 BN	720	798	1,098	1,520	1,969	1,611	1,112	948	1,049	1,213	969	741	13,749
22-94 Dry	686	774	927	978	1,295	1,383	830	734	827	1,077	838	688	11,039
22-94 Crit	657	592	716	875	872	829	606	470	623	758	626	480	8,103

Monthly Flow Changes as a Percentage of Monthly Baseline River Flows
Based on Monterey Plus 2020

2020 Change as % of Feather RiverFlow	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	-0.0114%	-0.0019%	0.0000%	0.0000%	-0.0001%	-0.0010%	-0.0070%	-0.0064%	-0.0049%	-0.0042%	-0.0068%	-0.0175%	-0.0041%
22-94 Wet	-0.0121%	-0.0004%	0.0000%	0.0000%	0.0000%	-0.0005%	-0.0054%	-0.0053%	-0.0068%	-0.0051%	-0.0108%	-0.0292%	-0.0036%
22-94 AN	-0.0053%	-0.0017%	0.0000%	0.0000%	0.0000%	-0.0001%	-0.0054%	-0.0033%	-0.0032%	-0.0025%	-0.0035%	-0.0113%	-0.0022%
22-94 BN	-0.0191%	-0.0029%	0.0000%	0.0000%	0.0000%	-0.0041%	-0.0242%	-0.0201%	-0.0054%	-0.0048%	-0.0077%	-0.0280%	-0.0076%
22-94 Dry	-0.0072%	-0.0020%	0.0000%	0.0000%	-0.0003%	-0.0016%	-0.0066%	-0.0071%	-0.0027%	-0.0025%	-0.0037%	-0.0081%	-0.0034%
22-94 Crit	-0.0169%	-0.0043%	0.0000%	0.0000%	-0.0010%	-0.0075%	-0.0090%	-0.0074%	-0.0054%	-0.0067%	-0.0090%	-0.0109%	-0.0069%
2020 Change as % of Sac River Flows													
22-94 Avg	-0.0931%	-0.0638%	-0.0393%	-0.0163%	-0.0170%	-0.0219%	-0.0411%	-0.0560%	-0.0652%	-0.0621%	-0.0795%	-0.0880%	-0.0443%
22-94 Wet	-0.1215%	-0.0711%	-0.0339%	-0.0200%	-0.0218%	-0.0261%	-0.0402%	-0.0552%	-0.0801%	-0.0937%	-0.1228%	-0.1130%	-0.0494%
22-94 AN	-0.1105%	-0.0698%	-0.0490%	-0.0145%	-0.0184%	-0.0230%	-0.0516%	-0.0710%	-0.0912%	-0.0790%	-0.1047%	-0.1246%	-0.0508%
22-94 BN	-0.1016%	-0.0772%	-0.0578%	-0.0193%	-0.0165%	-0.0282%	-0.0568%	-0.0769%	-0.0712%	-0.0638%	-0.0796%	-0.1007%	-0.0542%
22-94 Dry	-0.0494%	-0.0365%	-0.0306%	-0.0140%	-0.0117%	-0.0138%	-0.0348%	-0.0436%	-0.0397%	-0.0315%	-0.0402%	-0.0473%	-0.0301%
22-94 Crit	-0.0226%	-0.0208%	-0.0175%	-0.0042%	-0.0046%	-0.0058%	-0.0100%	-0.0139%	-0.0108%	-0.0092%	-0.0110%	-0.0139%	-0.0114%
				0.0000%									

	Ann Avg	Wet	AN	BN	Dry	Crit
Change From Baseline	7.07	11.95	9.69	7.45	3.32	0.92
All other contractors	3,219	4,090	3,943	3,626	2,700	1,308
Total	3,297	4,184	4,039	3,715	2,768	1,349
2020 No Project 1						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	20.09	24.47	24.34	22.63	17.70	9.09
Solano County	33.84	41.28	41.06	38.18	29.82	15.10
Cumulative Subtotal	71.45	82.26	85.91	81.65	64.78	41.68
Change From Baseline	0.06	(0.14)	(0.03)	(0.21)	(0.02)	0.87
All other contractors	3,240	4,116	3,967	3,608	2,729	1,353
Total	3,311	4,198	4,053	3,689	2,793	1,394
2020 No Project 2						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	22.85	28.35	27.92	25.76	19.84	9.64
Solano County	37.66	46.82	46.11	42.49	32.59	15.70
Cumulative Subtotal	78.03	91.69	94.53	89.09	69.68	42.83
Change From Baseline	6.64	9.29	8.60	7.23	4.88	2.02
All other contractors	3,235	4,134	3,976	3,615	2,713	1,300
Total	3,313	4,225	4,071	3,704	2,782	1,342
2020 No Project 3						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	19.37	24.22	23.64	21.40	16.55	8.70
Solano County	32.61	40.86	39.87	36.10	27.83	14.45
Cumulative Subtotal	69.50	81.60	84.00	78.35	61.63	40.64
Change From Baseline	(1.89)	(0.81)	(1.93)	(3.52)	(3.17)	(0.17)
All other contractors	3,160	3,950	3,909	3,632	2,615	1,330
Total	3,230	4,032	3,993	3,711	2,677	1,370

SEE TABLE 9-CS-8, LOWER LEFT

cfs x 1.98 x days = AF/Momth

Factor to convert monthly flows to cfs for text: AF / 1.98/days = cfs

2020 Feather River Baseline Flows, cfs	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
22-94 Avg	2,486	2,184	3,621	4,619	5,714	6,000	3,181	3,655	4,708	7,019	4,774	2,099
22-94 Wet	2,786	2,954	6,345	10,113	11,785	12,024	6,960	7,426	5,690	7,251	3,773	1,703
22-94 AN	2,471	1,765	3,611	4,713	7,056	8,809	2,536	4,466	4,393	8,463	5,893	1,925
22-94 BN	2,523	2,005	2,413	2,666	3,806	3,077	1,347	1,704	5,547	8,392	6,612	2,351
22-94 Dry	2,319	1,730	2,255	1,521	1,629	2,165	1,586	1,640	4,333	6,842	5,123	2,410
22-94 Crit	2,153	2,002	2,091	1,337	1,645	1,645	1,369	1,340	2,776	4,043	2,981	2,224
2020 Sacramento River Baseline Flows, cfs												
22-94 Avg	12,287	15,558	24,922	32,737	39,435	34,239	24,609	19,217	17,480	18,410	14,340	12,958
22-94 Wet	14,634	21,819	46,013	55,831	61,365	52,554	42,604	32,447	23,676	20,299	15,483	16,885
22-94 AN	11,823	16,133	22,086	44,485	53,022	50,563	29,386	22,192	18,289	21,199	15,960	13,429
22-94 BN	11,734	13,434	17,896	24,757	35,520	26,249	18,718	15,441	17,667	19,757	15,794	12,479
22-94 Dry	11,173	13,034	15,110	15,928	23,366	22,532	13,970	11,965	13,927	17,552	13,659	11,583
22-94 Crit	10,697	9,963	11,659	14,252	15,725	13,513	10,197	7,656	10,483	12,354	10,204	8,086

Table 7.3-21 (revised)

Table 9-CS-9

Monthly Flow Changes for Proposed Project Compared to Baseline

Under 2020 Conditions, in cfs

2020 Decrease in Feather River Flows and Sacramento River Fows Upstream of North Bay Aqueduct Intake, cfs												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
22-94 Avg	(0.3)	(0.0)	0.0	0.0	(0.0)	(0.1)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.4)
22-94 Wet	(0.3)	(0.0)	0.0	0.0	0.0	(0.1)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.5)
22-94 AN	(0.1)	(0.0)	0.0	0.0	0.0	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)
22-94 BN	(0.5)	(0.1)	0.0	0.0	0.0	(0.1)	(0.3)	(0.3)	(0.3)	(0.4)	(0.5)	(0.7)
22-94 Dry	(0.2)	(0.0)	0.0	0.0	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)
22-94 Crit	(0.4)	(0.1)	0.0	0.0	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.3)	(0.3)	(0.2)
2020 Decrease in Sac River Flows at the Delta, Downstream of North Bay Aqueduct Intake, cfs												
22-94 Avg	(11.4)	(9.9)	(9.8)	(5.3)	(6.7)	(7.5)	(10.1)	(10.8)	(11.4)	(11.4)	(11.4)	(11.4)
22-94 Wet	(17.8)	(15.5)	(15.6)	(11.1)	(13.4)	(13.7)	(17.1)	(17.9)	(19.0)	(19.0)	(19.0)	(19.1)
22-94 AN	(13.1)	(11.3)	(10.8)	(6.5)	(9.8)	(11.6)	(15.2)	(15.8)	(16.7)	(16.7)	(16.7)	(16.7)
22-94 BN	(11.9)	(10.4)	(10.3)	(4.8)	(5.9)	(7.4)	(10.6)	(11.9)	(12.6)	(12.6)	(12.6)	(12.6)
22-94 Dry	(5.5)	(4.8)	(4.6)	(2.2)	(2.7)	(3.1)	(4.9)	(5.2)	(5.5)	(5.5)	(5.5)	(5.5)
22-94 Crit	(2.4)	(2.1)	(2.0)	(0.6)	(0.7)	(0.8)	(1.0)	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)

Feather Max:	0.0
Sacramento Max:	(0.6)

2020 No Project 4	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	17.62	23.64	22.48	18.42	13.38	7.72
Solano County	29.34	39.78	37.70	30.54	21.91	12.61
Cumulative Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
Change From Baseline	(6.92)	(2.47)	(5.25)	(12.06)	(12.25)	(2.99)
All other contractors	3,247	4,119	3,972	3,619	2,739	1,357
Total	3,311	4,199	4,053	3,689	2,791	1,395

(not used)

Table 9-CS-4

Maximum and Minimum Annual Total Deliveries to Feather River Region and North Bay Contractors Among All Alternatives, Excluding Baselines; TAF per Year

2003 Comparison	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Feather Basin Max Subtotal	0.96	0.94	1.00	1.00	0.90	1.15
2003 Feather Basin Min Subtotal	0.94	0.86	0.94	0.82	0.79	1.14
2003 North Bay Max Subtotal	45.08	52.50	49.35	46.90	44.90	25.67
2003 North Bay Min Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
2020 Comparison						
2020 Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
2020 Feather Basin Min Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
2020 North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
2020 North Bay Min Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
All Periods Incl 1994 (not used)						
Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
Feather Basin Min Subtotal	0.62	0.60	0.60	0.50	0.49	0.77
North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
North Bay Min Subtotal	35.32	39.84	37.21	36.99	34.43	24.37

Table 7.3-17
(revised)

Table 9-CS-5

Change in Average Annual Total Deliveries to Feather River and North of Delta Contractors For Proposed Project Compared to Baselines; TAF

Feather River Contractors	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Proposed Project vs. Baseline	-0.01	-0.07	0.06	0.17	0.11	0.01
2020 Proposed Project vs. Baseline	0.12	0.17	0.07	0.19	0.07	0.11
North of Delta Contractors						
2003 Proposed Project vs. Baseline	1.63	2.94	2.71	0.11	-0.23	1.30
2020 Proposed Project vs. Baseline	7.07	11.95	9.69	7.45	3.32	0.92

Table 7.3-18
(revised)

Table 9-CS-6

Flow Changes in Feather and Sacramento Rivers Due to Changes in Deliveries to Feather River and North of Delta Contractors For Proposed Project Compared to Baselines; TAF, and Percentages of River Flows

Annual Baseline River Flows, TAF	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Baseline Feather River Flows	3,022	4,743	3,317	2,565	2,032	1,618
2020 Baseline Feather River Flows	3,015	4,733	3,381	2,560	2,030	1,545
2003 Baseline Sac River Flows	16,074	24,438	19,137	13,840	11,115	8,106
2020 Baseline Sac River Flows	15,965	24,201	19,086	13,749	11,039	8,103
Flow Change Due to Change in Delivery, TAF						
2003 Feather	0.01	0.07	-0.06	-0.17	-0.11	-0.01
2020 Feather	-0.12	-0.17	-0.07	-0.19	-0.07	-0.11
2003 North of Delta	-1.63	-2.94	-2.71	-0.11	0.23	-1.30
2020 North of Delta	-7.07	-11.95	-9.69	-7.45	-3.32	-0.92
Flow Change Due to Change in Delivery, as % of River Flow						
2003 Feather Basin Del./Feather River	0.0002%	0.0014%	-0.0018%	-0.0066%	-0.0054%	-0.0006%
2020 Feather Basin Del./Feather River	-0.0041%	-0.0036%	-0.0022%	-0.0076%	-0.0034%	-0.0069%
2003 North of Delta Del./Sacramento River	-0.0101%	-0.0120%	-0.0142%	-0.0008%	0.0020%	-0.0160%
2020 North of Delta Del./Sacramento River	-0.0443%	-0.0494%	-0.0508%	-0.0542%	-0.0301%	-0.0114%

		Ann Avg	Wet	AN	BN	Dry	Crit
	Flow Change Due to Change in Delivery, as % of Delta Outflow						
	2003	-0.0111%	-0.0105%	-0.0158%	-0.0011%	0.0036%	-0.0273%
	2020	-0.0499%	-0.0444%	-0.0580%	-0.0789%	-0.0541%	-0.0193%
	Used For Max Possible Difference Between any Alternatives						
	Formulas Including Baseline						
	2003 Comparison	Ann Avg	Wet	AN	BN	Dry	Crit
	2003 Feather Basin Max Subtotal	0.96	0.94	1.00	1.00	0.90	1.15
	2003 Feather Basin Min Subtotal	0.94	0.86	0.94	0.82	0.79	1.14
	2003 North Bay Max Subtotal	45.08	52.50	49.35	46.90	44.90	25.67
	2003 North Bay Min Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
	2020 Comparison						
	2020 Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
	2020 Feather Basin Min Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
	2020 North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
	2020 North Bay Min Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
	All Periods (not used)						
	Feather Basin Max Subtotal	17.65					
	Feather Basin Min Subtotal	0.62	Void				
	North Bay Max Subtotal	78.46					
	North Bay Min Subtotal	35.32					
Table 7.3-20		**Table 9-CS-8**					
(revised)	**Change in Average Annual Total Deliveries to South of Delta Contractors**						
	For Proposed Project Compared to Baselines						
	TAF, and Percentage of Delta Inflow						
	2003 and 2020 Delivery Comparisons	Ann Avg	Wet	AN	BN	Dry	Crit
	2003 Baseline - All Other Contractors	3,045	3,540	3,582	3,508	2,831	1,476
	2003 Proposed Project - All Other Contractors	3,011	3,471	3,520	3,430	2,809	1,519
	2020 Baseline - All Other Contractors	3,242	4,143	3,985	3,622	2,717	1,302
	2020 Proposed Project - All Other Contractors	3,219	4,090	3,943	3,626	2,700	1,308
	Change in Deliveries to South of the Delta Contractors						
	2003 Proposed Project vs. Baseline	(34.16)	(68.83)	(62.09)	(78.07)	(22.21)	42.80
	2020 Proposed Project vs. Baseline	(22.96)	(52.91)	(42.20)	4.25	(17.14)	5.97
	Annual Baseline Delta Inflow (Sacramento + San Joaquin)						
	2003 Delta Inflow	18,880	29,340	22,190	16,233	12,654	9,209
	2020 Delta Inflow	18,770	29,126	22,125	16,137	12,564	9,198
	Total Delivery Change to South of Delta Contractors, as % of Sac and San Joaquin Delta Inflow						
	2003 Proposed Project vs. Baseline	-0.1809%	-0.2346%	-0.2798%	-0.4809%	-0.1755%	0.4647%
	2020 Proposed Project vs. Baseline	-0.1223%	-0.1817%	-0.1908%	0.0263%	-0.1364%	0.0649%
	Note that delivery increases downstream of Banks may be met by San Luis Reservoir storage releases.						
	Increases and decreases in deliveries downstream of Banks do not necessarily imply greater Delta pumping in the current period.						
ADDED	Delivery Change to South of Delta Contractors, as % of Baseline S of Delta Deliveries						
	2003	-1.1220%	-1.9445%	-1.7335%	-2.2255%	-0.7845%	2.8987%
	2020	-0.7084%	-1.2771%	-1.0591%	0.1173%	-0.6309%	0.4583%
ADDED	Delta Outflow						
	2003 Baseline (from Table 7.1-14)	14,657	28,016	17,156	9,678	6,373	4,750
	2020 Baseline (from Table 7.1-17)	14,180	26,920	16,699	9,448	6,147	4,772
ADDED	Delivery Change to South of Delta Contractors, as % of Baseline Delta Outflow						
	2020	0.1619%	0.1965%	0.2527%	-0.0450%	0.2789%	-0.1250%
ADDED	Net Change in Delta Outflow (Table A retirements and transfers, allocation procedures)						
	2020 Delta Inflow Change	(7.07)	(11.95)	(9.69)	(7.45)	(3.32)	(0.92)
	2020 Diversion Change	(22.96)	(52.91)	(42.20)	4.25	(17.14)	5.97
	2020 Delta Outflow Change (Inflow - Diversion)	15.89	40.96	32.51	(11.70)	13.82	(6.89)
	Water mgmt provisions <guesses>	50	80	70	50	15	10
		(34.11)	(39.04)	(37.49)	(61.70)	(1.18)	(16.89)

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	129.9	140.0	264.3	331.2	358.1	409.8	202.6	229.1	268.8	337.0	239.1	101.5	3,011.5
22-94 Wet	149.8	206.9	522.2	706.1	699.4	781.2	417.6	454.3	311.6	288.2	168.5	97.0	4,802.8
22-94 AN	106.1	125.0	207.5	357.0	470.7	599.3	172.0	261.0	264.9	414.4	236.2	70.3	3,284.4
22-94 BN	146.3	115.7	180.2	218.1	257.7	224.8	95.0	107.4	294.5	426.3	334.6	88.4	2,489.1
22-94 Dry	120.6	96.5	120.5	104.1	117.8	194.8	119.4	120.1	271.4	363.1	313.7	115.3	2,057.4
22-94 Crit	108.2	121.6	150.5	88.3	104.8	104.1	88.1	95.5	163.9	219.2	154.5	131.9	1,530.6
STDEV													
22-94 Avg	66.5	117.0	296.8	415.1	343.6	434.1	221.9	259.1	114.3	124.0	140.8	55.0	1,453.6
22-94 Wet	79.2	194.8	415.6	561.5	341.4	521.1	305.1	324.2	155.1	118.0	141.4	66.2	1,148.7
22-94 AN	3.6	47.5	253.7	325.9	321.5	468.1	114.2	309.0	89.9	81.3	155.9	32.2	789.5
22-94 BN	76.4	44.0	116.8	175.8	222.2	145.3	61.9	65.1	83.1	104.9	125.6	42.8	518.1
22-94 Dry	65.0	33.9	52.1	54.9	85.1	119.6	69.3	86.6	65.9	65.9	104.2	49.2	358.4
22-94 Crit	50.9	47.4	83.9	51.7	84.3	83.8	54.3	42.7	68.1	121.3	55.7	55.8	414.0
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	727.5	944.5	1,573.5	2,050.7	2,236.8	2,126.4	1,468.1	1,220.6	1,069.2	1,074.4	830.3	784.0	16,106.1
22-94 Wet	885.1	1,346.2	2,990.6	3,464.1	3,420.7	3,224.3	2,519.3	2,059.5	1,477.4	1,186.0	934.8	1,085.2	24,593.1
22-94 AN	661.4	1,014.1	1,315.5	2,812.1	3,050.9	3,111.6	1,776.3	1,396.3	1,097.9	1,219.7	851.9	750.9	19,058.6
22-94 BN	700.7	774.8	1,133.4	1,607.9	2,050.5	1,633.5	1,124.7	981.8	1,028.7	1,162.2	895.3	736.3	13,829.9
22-94 Dry	662.6	782.3	908.1	986.1	1,350.1	1,468.2	840.8	767.0	872.7	1,044.1	844.6	671.9	11,198.5
22-94 Crit	624.7	597.7	709.5	879.1	886.2	836.6	608.7	489.6	640.0	695.9	534.5	489.9	7,992.3
STDEV													
22-94 Avg	277.5	668.6	1,300.2	1,432.5	1,304.9	1,266.7	1,096.3	812.7	485.2	205.8	180.5	251.1	6,876.5
22-94 Wet	405.1	942.5	1,325.3	1,321.9	1,025.9	1,215.1	1,276.0	927.6	652.0	106.3	119.4	233.0	4,719.7
22-94 AN	138.8	729.6	1,179.7	1,455.1	912.3	962.3	921.0	605.5	433.7	95.1	130.8	44.4	2,647.2
22-94 BN	184.8	249.4	912.4	682.8	970.0	488.7	587.4	312.9	128.0	65.6	130.3	89.1	1,285.1
22-94 Dry	183.7	436.7	278.3	275.9	769.1	703.5	226.1	94.8	94.9	91.2	114.1	61.7	916.8
22-94 Crit	183.6	152.5	211.5	362.3	420.5	406.9	106.4	68.1	66.7	149.9	114.3	89.7	1,140.6
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.1	118.7	185.4	272.7	353.3	387.0	361.5	336.3	248.6	140.7	103.1	112.5	2,805.8
22-94 Wet	255.4	160.4	319.5	531.0	623.6	750.7	628.7	597.0	520.9	226.8	133.7	154.3	4,902.1
22-94 AN	135.8	113.9	162.0	324.2	434.0	455.9	402.9	364.9	276.0	139.8	118.8	124.0	3,052.1
22-94 BN	190.2	108.7	165.1	192.9	343.3	298.9	325.0	293.6	133.8	119.1	112.2	108.8	2,391.5
22-94 Dry	164.9	97.5	112.2	110.3	147.3	154.3	197.5	183.4	103.9	99.3	81.9	87.5	1,540.1
22-94 Crit	130.2	89.7	91.5	87.2	99.5	105.9	121.0	109.7	76.0	71.0	53.8	67.6	1,103.2
STDEV													
22-94 Avg	148.7	97.0	223.0	300.1	354.4	425.4	277.6	276.3	338.8	131.3	33.2	48.3	2,166.7
22-94 Wet	217.1	171.4	364.7	406.5	459.9	608.3	351.6	367.2	516.8	220.1	12.0	65.1	2,854.3
22-94 AN	59.2	45.5	142.7	264.7	341.1	202.2	146.8	124.7	227.5	39.8	9.8	24.6	1,056.6
22-94 BN	118.4	25.2	104.5	117.2	214.4	187.2	106.5	106.4	29.1	16.9	15.2	11.8	693.1
22-94 Dry	122.4	16.2	30.5	35.2	85.8	59.0	69.1	61.2	17.2	18.8	27.1	15.2	429.6
22-94 Crit	59.7	16.5	14.5	12.7	21.3	23.9	23.0	24.6	7.8	11.1	13.0	4.2	165.0
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	203.1	220.3	312.2	352.1	289.1	275.6	178.5	168.1	205.3	227.7	245.2	267.8	2,945.0
22-94 Wet	216.6	289.7	374.2	393.6	321.4	307.1	235.2	253.8	303.2	243.7	332.8	357.6	3,628.8
22-94 AN	203.7	240.1	362.0	391.7	355.6	342.3	230.8	199.3	249.9	265.4	225.5	298.7	3,364.8
22-94 BN	218.5	227.9	285.6	345.4	286.0	303.4	213.4	174.2	204.9	294.5	274.3	276.2	3,104.2
22-94 Dry	191.8	188.2	279.5	325.7	280.1	270.2	126.3	115.0	159.5	255.3	250.3	231.2	2,673.2
22-94 Crit	176.4	116.3	236.6	289.3	193.0	139.7	64.6	55.8	58.4	53.6	67.5	123.9	1,575.3
STDEV													
22-94 Avg	99.1	121.9	112.6	112.5	124.1	115.7	85.5	94.3	110.7	128.7	134.2	96.3	822.5
22-94 Wet	101.1	109.4	90.3	114.9	95.4	59.7	60.5	75.5	91.6	139.8	93.8	56.7	595.0
22-94 AN	120.1	123.0	88.3	108.8	97.0	74.4	60.2	70.8	91.2	88.1	125.9	59.6	343.7
22-94 BN	76.5	106.8	102.9	92.2	147.1	102.3	59.3	74.7	55.5	114.1	128.7	61.4	303.8
22-94 Dry	103.2	124.1	122.8	88.9	117.7	125.2	56.7	46.7	62.4	61.8	98.3	46.8	253.8
22-94 Crit	104.3	75.7	102.1	135.1	125.7	125.3	37.6	36.6	50.2	66.1	75.3	59.9	501.9
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6

22-94 BN	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.6
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.7
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.6
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 BN	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.3
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 Crit	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.3
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.8	1.4	1.4	1.1	1.1	1.3	1.6	1.7	1.8	1.8	1.8	1.8	18.5
22-94 Wet	1.9	1.5	1.5	1.4	1.3	1.4	1.7	1.8	1.9	1.9	1.9	1.9	20.1
22-94 AN	1.7	1.4	1.3	1.1	1.3	1.4	1.7	1.8	1.9	2.0	1.9	1.9	20.1
22-94 BN	1.9	1.5	1.5	1.0	1.1	1.4	1.7	1.9	1.9	2.0	2.0	1.9	20.1
22-94 Dry	1.7	1.4	1.3	1.0	1.1	1.3	1.7	1.8	1.9	2.0	1.9	1.9	19.0
22-94 Crit	1.7	1.4	1.3	0.6	0.7	0.8	1.0	1.1	1.2	1.2	1.2	1.2	11.5
STDEV													
22-94 Avg	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.5
22-94 Wet	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
22-94 AN	0.5	0.4	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
22-94 BN	0.1	0.1	0.1	0.5	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.8
22-94 Dry	0.5	0.4	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	1.2
22-94 Crit	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	3.9
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	161.5	144.0	137.9	79.7	108.1	131.3	182.7	249.8	335.2	341.9	335.0	237.9	2,435.2
22-94 Wet	174.5	155.7	149.6	102.9	128.1	147.9	195.8	264.1	358.0	364.4	357.0	249.6	2,640.8
22-94 AN	151.8	135.4	129.8	88.6	130.3	155.6	204.6	276.2	372.8	379.7	372.4	261.9	2,716.9
22-94 BN	166.5	148.6	142.5	75.5	108.3	137.5	199.3	283.3	382.2	389.7	382.7	268.9	2,734.8
22-94 Dry	147.5	131.4	125.6	75.1	102.5	131.7	199.0	271.5	360.2	368.2	360.2	260.8	2,592.0
22-94 Crit	159.5	142.0	135.4	42.9	62.1	74.2	100.5	134.8	175.9	180.6	175.8	130.4	1,281.8

STDEV													
22-94 Avg	44.0	39.3	37.9	41.0	39.6	40.6	49.2	67.7	91.7	93.2	91.9	64.7	638.9
22-94 Wet	26.8	23.9	22.9	20.3	17.9	18.6	20.9	28.6	35.0	36.5	35.8	29.7	288.8
22-94 AN	59.3	52.9	50.8	47.5	23.2	20.5	23.3	32.1	39.7	41.4	40.8	33.0	296.2
22-94 BN	26.3	23.3	21.8	45.3	40.3	33.7	30.3	35.3	41.8	43.7	43.0	37.6	290.4
22-94 Dry	55.1	49.4	47.8	37.9	38.4	34.7	34.8	48.0	65.4	66.3	65.8	46.3	415.0
22-94 Crit	52.8	47.3	45.8	37.0	41.6	46.7	54.6	73.7	99.5	101.2	99.1	70.1	599.6
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	8.8	12.3	52.2	76.3	94.9	105.7	20.0	7.4	3.8	0.6	0.7	2.6	384.9
22-94 Wet	11.4	13.4	62.3	96.0	143.3	160.8	41.3	18.2	10.9	2.1	2.5	9.0	733.2
22-94 AN	7.8	8.4	57.3	87.5	114.5	166.7	31.9	7.4	4.6	0.0	0.0	0.0	514.1
22-94 BN	12.0	23.1	70.1	104.7	94.6	103.0	19.2	6.0	0.0	0.0	0.0	0.0	316.1
22-94 Dry	4.9	7.8	37.2	46.0	62.0	65.4	0.4	0.0	0.0	0.0	0.0	0.0	166.7
22-94 Crit	6.5	7.0	29.6	39.6	38.2	15.3	0.0	0.0	0.0	0.0	0.0	0.0	39.0
STDEV													
22-94 Avg	25.3	28.9	75.6	86.4	80.4	82.9	32.8	21.6	14.0	5.1	6.2	13.6	345.3
22-94 Wet	28.6	30.2	78.6	83.8	51.2	37.8	40.2	31.7	24.0	9.5	11.5	24.7	292.5
22-94 AN	24.7	26.6	77.3	87.4	80.0	35.2	32.5	17.8	9.8	0.0	0.0	0.0	236.9
22-94 BN	30.4	38.0	85.2	94.1	92.7	92.9	32.4	22.4	0.0	0.0	0.0	0.0	250.7
22-94 Dry	19.8	22.7	68.7	82.3	75.1	76.3	1.5	0.0	0.0	0.0	0.0	0.0	181.5
22-94 Crit	22.5	24.2	69.1	74.1	67.8	53.1	0.0	0.0	0.0	0.0	0.0	0.0	84.5
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,230.4	2,279.1	2,358.5	2,480.7	2,625.6	2,768.5	3,012.7	3,118.8	2,943.9	2,587.7	2,344.8	2,251.2	
22-94 Wet	2,460.4	2,549.6	2,704.1	2,816.6	2,925.7	2,953.7	3,298.5	3,491.4	3,447.4	3,212.3	3,083.1	3,029.6	
22-94 AN	2,173.5	2,261.5	2,352.7	2,591.1	2,752.4	2,943.2	3,270.8	3,403.8	3,232.9	2,805.3	2,571.2	2,514.2	
22-94 BN	2,311.2	2,329.5	2,358.9	2,473.9	2,638.3	2,816.7	3,162.5	3,340.2	3,100.7	2,639.4	2,290.1	2,179.4	
22-94 Dry	2,135.8	2,180.4	2,261.9	2,363.4	2,578.2	2,812.2	2,972.3	2,991.7	2,708.7	2,275.1	1,922.4	1,781.7	
22-94 Crit	1,907.1	1,893.0	1,887.1	1,964.9	2,043.1	2,184.3	2,176.4	2,140.5	1,952.4	1,669.6	1,490.8	1,379.7	
STDEV													
22-94 Avg	383.7	386.9	356.5	269.7	227.6	187.0	194.9	218.5	266.5	312.9	320.2	356.4	
22-94 Wet	393.6	340.8	222.9	72.9	0.0	0.0	10.3	48.8	121.2	243.5	237.0	224.2	

22-94 AN	383.5	410.5	358.4	175.3	24.6	0.0	18.2	84.0	198.1	307.7	270.5	337.2	
22-94 BN	405.9	415.4	406.9	259.4	181.9	133.6	105.2	139.4	167.7	238.6	245.5	248.5	
22-94 Dry	368.8	376.5	330.3	270.2	206.1	107.0	124.8	164.1	216.8	246.6	212.9	230.1	
22-94 Crit	375.5	378.8	387.3	357.8	347.1	296.3	272.0	230.4	169.8	128.1	105.5	95.0	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	563.9	610.2	710.6	882.8	950.6	979.2	943.6	852.8	719.1	602.1	507.1	528.4	
22-94 Wet	608.1	711.8	862.6	1,029.2	1,067.0	1,067.0	1,063.3	1,037.1	979.9	860.6	825.4	902.1	
22-94 AN	549.3	631.2	771.7	961.6	1,057.0	1,067.0	1,058.4	976.7	845.1	733.4	582.6	616.6	
22-94 BN	665.3	694.6	744.3	891.8	961.3	1,009.3	988.0	868.8	689.6	587.7	475.9	483.8	
22-94 Dry	533.3	562.3	657.9	843.0	930.6	987.8	897.0	735.5	530.1	411.5	299.4	271.4	
22-94 Crit	421.3	380.3	424.7	603.2	672.7	705.8	648.7	565.0	443.9	311.2	200.7	195.9	
STDEV													
22-94 Avg	383.7	386.9	356.5	269.7	227.6	187.0	194.9	218.5	266.5	312.9	320.2	356.4	
22-94 Wet	393.6	340.8	222.9	72.9	0.0	0.0	10.3	48.8	121.2	243.5	237.0	224.2	
22-94 AN	383.5	410.5	358.4	175.3	24.6	0.0	18.2	84.0	198.1	307.7	270.5	337.2	
22-94 BN	405.9	415.4	406.9	259.4	181.9	133.6	105.2	139.4	167.7	238.6	245.5	248.5	
22-94 Dry	368.8	376.5	330.3	270.2	206.1	107.0	124.8	164.1	216.8	246.6	212.9	230.1	
22-94 Crit	375.5	378.8	387.3	357.8	347.1	296.3	272.0	230.4	169.8	128.1	105.5	95.0	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	151.4	136.7	239.8	319.7	344.8	403.0	191.7	220.5	257.8	367.8	279.1	109.0	3,021.2
22-94 Wet	171.0	185.6	464.6	695.2	694.7	780.8	413.2	454.1	316.0	298.3	180.5	96.4	4,750.6
22-94 AN	153.7	128.6	185.8	336.9	416.2	575.8	140.5	259.9	241.4	462.0	317.7	74.8	3,293.3
22-94 BN	167.1	125.2	164.6	198.8	233.1	208.4	80.7	89.6	296.0	473.5	413.0	95.7	2,545.7
22-94 Dry	123.5	97.7	127.2	100.3	114.2	188.3	110.7	97.1	232.5	404.4	325.7	132.0	2,053.7
22-94 Crit	134.1	122.9	129.2	82.1	110.7	110.9	84.5	96.0	158.4	238.7	201.1	144.3	1,612.8
STDEV													
22-94 Avg	68.2	111.2	280.9	410.9	345.3	432.5	225.6	260.1	115.6	144.0	152.6	67.0	1,421.2
22-94 Wet	80.8	188.6	426.8	556.1	342.6	520.1	308.5	324.3	146.3	118.7	152.4	67.9	1,137.0
22-94 AN	45.5	60.8	184.3	315.8	357.3	457.8	109.6	305.1	108.5	99.2	125.5	36.8	783.2
22-94 BN	74.6	39.8	86.8	172.7	228.6	145.5	56.5	41.1	93.3	82.6	75.3	45.3	534.8
22-94 Dry	52.2	35.4	62.6	53.0	67.8	120.6	84.9	54.1	60.0	108.6	135.5	71.6	423.9
22-94 Crit	63.6	49.3	71.9	48.1	58.0	91.0	53.5	53.9	59.5	161.9	114.0	82.4	441.9
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	748.1	935.8	1,546.8	2,020.4	2,212.3	2,100.5	1,448.5	1,193.3	1,045.3	1,122.1	908.0	785.7	16,066.9
22-94 Wet	888.7	1,316.8	2,918.5	3,446.6	3,419.6	3,219.2	2,505.6	2,023.2	1,465.2	1,187.2	959.1	1,063.9	24,413.5
22-94 AN	706.5	1,011.6	1,323.2	2,786.3	2,976.5	3,073.1	1,735.0	1,383.7	1,074.6	1,275.6	986.5	778.3	19,111.0
22-94 BN	744.5	788.3	1,113.0	1,552.1	1,991.0	1,605.1	1,102.0	960.6	1,016.4	1,213.4	1,010.4	718.5	13,815.4
22-94 Dry	669.3	776.0	898.9	961.7	1,344.4	1,417.6	827.5	730.9	820.0	1,118.6	895.3	691.5	11,151.6
22-94 Crit	646.1	591.4	702.5	844.6	878.2	821.1	592.2	470.1	619.9	778.4	650.7	509.0	8,104.0
STDEV													
22-94 Avg	267.3	644.4	1,261.9	1,439.0	1,297.0	1,267.1	1,095.8	803.4	487.6	196.3	162.8	243.9	6,789.6
22-94 Wet	390.8	919.2	1,273.0	1,336.8	1,027.0	1,210.3	1,281.8	911.3	637.3	96.6	101.9	231.0	4,671.0
22-94 AN	157.5	696.2	1,179.6	1,443.7	938.6	964.6	915.9	599.5	444.6	75.7	67.8	45.4	2,573.2
22-94 BN	174.2	191.3	885.9	683.6	945.3	460.3	574.7	299.4	157.3	85.6	79.0	58.4	1,294.9
22-94 Dry	172.8	420.6	266.5	260.8	752.4	699.2	219.4	90.4	97.3	118.2	131.2	85.3	942.5
22-94 Crit	182.9	155.6	219.2	347.6	362.6	376.9	92.7	71.0	66.3	184.0	153.9	163.9	1,125.7
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.3	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.4	140.7	103.1	112.6	2,805.9
22-94 Wet	255.0	160.4	319.6	531.0	623.5	750.6	628.6	597.0	520.9	227.1	133.9	154.4	4,902.1
22-94 AN	136.6	113.8	162.3	324.2	433.7	455.9	402.9	364.9	275.3	140.1	119.1	124.1	3,052.7
22-94 BN	190.5	109.0	165.0	192.9	343.4	299.0	325.0	293.5	134.0	119.1	112.3	108.9	2,392.6
22-94 Dry	165.1	97.5	112.3	110.4	147.3	154.3	197.5	183.3	103.6	98.9	81.9	87.4	1,539.5
22-94 Crit	130.6	90.0	91.0	87.2	99.5	105.9	121.0	109.7	75.8	70.7	53.8	67.6	1,102.9
STDEV													
22-94 Avg	148.4	96.9	223.1	300.1	354.4	425.4	277.6	276.4	338.8	131.4	33.2	48.3	2,166.7
22-94 Wet	217.4	171.4	364.7	406.5	459.9	608.2	351.5	367.2	516.7	220.0	11.8	65.0	2,854.0
22-94 AN	58.6	45.3	143.7	264.7	341.0	202.2	146.8	124.7	227.8	39.6	9.7	24.5	1,056.0
22-94 BN	117.0	24.7	104.5	117.2	214.4	187.2	106.6	106.7	29.1	17.1	15.4	11.6	693.4
22-94 Dry	122.3	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.0	18.7	26.8	15.2	429.2
22-94 Crit	58.7	16.2	15.1	12.8	21.4	23.9	23.0	24.5	7.8	10.9	13.1	4.2	164.7
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	230.7	217.7	311.2	356.4	316.0	310.4	140.3	85.7	189.8	249.6	272.9	265.5	2,946.1
22-94 Wet	247.0	273.0	355.1	392.8	355.3	382.9	186.3	127.0	293.3	243.2	340.2	355.3	3,551.4
22-94 AN	240.3	254.5	345.7	449.6	385.6	386.4	180.2	100.7	212.8	307.1	291.0	302.8	3,456.7
22-94 BN	239.4	243.6	307.5	364.8	342.4	336.6	151.6	81.4	209.8	330.0	342.6	255.9	3,205.8
22-94 Dry	222.8	173.0	294.1	307.7	292.0	273.4	106.6	57.9	122.8	291.4	239.6	231.1	2,612.4
22-94 Crit	194.4	119.8	232.6	270.2	190.3	139.1	58.2	42.8	55.3	63.2	102.8	134.4	1,603.2
STDEV													
22-94 Avg	101.3	124.7	106.4	113.5	131.0	135.2	61.8	60.5	110.4	144.5	137.4	101.4	835.5
22-94 Wet	102.3	126.1	96.8	105.7	90.3	69.8	53.6	78.6	93.5	137.8	99.4	67.6	610.0
22-94 AN	118.0	134.1	82.3	45.7	83.5	74.0	28.0	52.5	76.7	121.9	120.4	62.5	312.6
22-94 BN	75.9	102.6	110.1	99.3	147.3	125.1	38.6	43.2	59.2	88.1	61.2	54.8	238.8
22-94 Dry	112.8	116.3	103.4	99.7	128.1	123.9	36.1	26.9	57.8	101.4	130.0	60.2	368.1
22-94 Crit	102.0	77.4	103.3	122.6	132.3	128.9	30.7	25.6	50.9	122.6	134.4	100.2	639.4
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	1.0
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.1	0.8
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4

Table A Deliveries to North Bay Aqueduct (TAF)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	4.0	3.3	3.1	2.3	2.4	2.8	3.6	3.9	4.0	4.1	4.1	4.0	41.4
22-94 Wet	4.4	3.6	3.4	3.2	3.0	3.3	3.9	4.2	4.3	4.5	4.4	4.3	46.6
22-94 AN	3.8	3.1	3.0	2.4	2.8	3.3	4.0	4.3	4.4	4.5	4.5	4.4	46.7
22-94 BN	4.3	3.5	3.4	2.1	2.3	3.0	3.9	4.4	4.5	4.7	4.6	4.5	46.2
22-94 Dry	3.7	3.0	2.9	2.1	2.2	2.7	3.7	4.0	4.1	4.2	4.2	4.1	41.0
22-94 Crit	3.7	3.0	2.9	1.3	1.4	1.6	2.1	2.2	2.3	2.4	2.4	2.3	22.5
STDEV													
22-94 Avg	1.0	0.8	0.8	1.2	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	9.8
22-94 Wet	0.2	0.2	0.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
22-94 AN	1.4	1.1	1.1	1.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.9
22-94 BN	0.5	0.4	0.4	1.5	1.0	0.8	0.5	0.3	0.3	0.3	0.3	0.3	2.5
22-94 Dry	1.2	1.0	0.9	1.1	0.9	0.8	0.6	0.6	0.7	0.7	0.7	0.7	6.1
22-94 Crit	1.2	1.0	0.9	1.1	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	8.5

Table A Deliveries South of Delta (TAF)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	198.8	174.6	164.0	90.1	119.2	150.8	187.2	252.2	320.1	337.4	326.2	243.2	2,550.7
22-94 Wet	209.0	183.4	172.4	120.6	146.8	170.9	195.6	256.6	327.0	347.3	335.2	244.7	2,724.0
22-94 AN	206.5	181.4	170.6	96.6	146.3	190.8	225.1	296.6	376.6	396.7	383.6	286.5	3,038.8
22-94 BN	219.6	193.0	181.6	84.2	115.8	165.1	216.0	306.9	389.3	410.0	396.5	296.7	3,040.2
22-94 Dry	174.6	153.2	143.5	82.1	106.9	137.4	189.7	256.3	325.4	340.9	330.0	248.4	2,509.6
22-94 Crit	182.9	160.6	150.6	48.8	68.5	83.6	104.2	138.1	173.1	181.5	175.6	135.2	1,324.6

STDEV													
22-94 Avg	59.0	52.0	49.3	51.3	50.8	53.4	56.2	75.7	96.7	101.1	98.0	73.6	732.4
22-94 Wet	30.7	27.4	26.4	24.1	21.5	23.6	29.1	41.7	52.0	53.5	51.9	42.4	393.2
22-94 AN	81.6	71.8	67.7	55.7	35.0	22.3	24.2	37.2	44.1	46.0	44.4	39.1	348.1
22-94 BN	47.2	41.8	39.6	62.8	56.6	49.1	39.6	30.0	34.0	36.3	35.3	31.7	232.5
22-94 Dry	67.6	59.5	56.1	46.0	50.1	45.9	43.6	59.2	78.9	80.3	78.4	57.0	534.8
22-94 Crit	69.4	61.2	57.9	47.6	51.8	62.1	64.6	86.4	110.5	114.0	110.8	84.8	674.7
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.4	6.9	25.1	52.5	73.6	93.5	12.5	4.4	1.2	0.1	0.4	2.2	278.7
22-94 Wet	7.4	11.1	52.2	74.0	119.4	151.3	32.5	15.0	4.2	0.4	1.3	7.5	587.5
22-94 AN	0.0	0.0	0.0	41.0	78.5	144.4	11.5	0.0	0.0	0.0	0.0	0.0	317.0
22-94 BN	11.1	11.3	26.3	71.3	67.2	84.1	8.4	0.4	0.0	0.0	0.0	0.0	172.0
22-94 Dry	4.9	2.2	11.5	31.6	50.3	52.4	0.0	0.0	0.0	0.0	0.0	0.0	111.4
22-94 Crit	6.5	6.5	15.3	30.3	27.8	15.3	0.0	0.0	0.0	0.0	0.0	0.0	54.2
STDEV													
22-94 Avg	21.6	21.9	59.1	79.0	78.2	80.3	25.6	18.1	6.2	0.9	3.1	12.9	294.8
22-94 Wet	23.5	28.0	72.4	89.3	67.7	49.7	37.1	31.8	11.2	1.8	5.9	23.7	316.7
22-94 AN	0.0	0.0	0.0	67.8	76.7	36.7	12.9	0.0	0.0	0.0	0.0	0.0	198.3
22-94 BN	28.3	28.7	66.8	86.3	86.0	88.3	19.5	1.4	0.0	0.0	0.0	0.0	145.4
22-94 Dry	19.5	8.9	46.0	67.1	71.6	69.5	0.0	0.0	0.0	0.0	0.0	0.0	128.6
22-94 Crit	22.5	22.5	53.1	70.7	63.3	53.1	0.0	0.0	0.0	0.0	0.0	0.0	114.9
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,121.6	2,173.4	2,277.3	2,410.8	2,569.1	2,718.8	2,973.8	3,088.6	2,924.8	2,537.9	2,255.2	2,154.4	
22-94 Wet	2,365.2	2,475.9	2,688.0	2,811.5	2,925.2	2,953.7	3,303.0	3,496.0	3,447.4	3,202.2	3,060.9	3,008.0	
22-94 AN	2,029.3	2,113.1	2,225.7	2,484.2	2,700.1	2,914.4	3,273.5	3,407.4	3,260.0	2,784.8	2,469.3	2,407.9	
22-94 BN	2,192.8	2,200.9	2,245.7	2,380.1	2,569.2	2,763.9	3,124.1	3,319.5	3,078.6	2,570.1	2,142.6	2,024.8	
22-94 Dry	2,033.8	2,077.0	2,151.7	2,256.9	2,475.2	2,715.7	2,884.5	2,927.3	2,683.3	2,208.7	1,844.3	1,687.4	
22-94 Crit	1,806.0	1,790.4	1,805.7	1,889.6	1,961.9	2,096.3	2,092.0	2,055.9	1,873.4	1,571.3	1,346.3	1,223.2	
STDEV													
22-94 Avg	354.1	352.4	343.4	279.3	241.6	209.9	204.7	209.5	261.1	305.4	303.3	336.3	
22-94 Wet	419.6	365.3	273.8	121.1	51.4	15.2	54.4	144.9	221.4	366.0	344.7	348.4	

22-94 AN	282.2	312.8	314.0	209.9	82.0	47.9	63.0	109.9	142.5	246.5	223.8	264.5	
22-94 BN	344.7	383.7	431.0	309.9	206.1	154.4	121.1	149.7	144.3	162.9	199.3	190.2	
22-94 Dry	339.9	328.2	294.6	264.9	247.7	166.7	162.9	170.0	222.3	225.9	189.7	206.6	
22-94 Crit	321.0	316.0	322.2	334.3	335.0	283.0	262.9	231.8	198.4	154.7	116.5	98.2	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	449.6	476.0	584.7	778.2	885.9	936.5	846.5	663.2	529.8	438.4	382.6	404.6	
22-94 Wet	540.2	606.5	747.7	942.2	1,018.0	1,061.0	989.9	827.8	787.8	680.6	656.9	745.0	
22-94 AN	343.8	408.0	560.4	840.9	980.9	1,032.0	954.4	756.3	581.1	493.9	410.7	443.3	
22-94 BN	470.8	499.4	580.4	756.8	899.9	976.0	865.1	630.2	429.6	347.4	303.4	268.8	
22-94 Dry	443.1	453.1	567.4	729.7	845.7	903.9	786.9	573.5	376.1	320.8	241.5	230.2	
22-94 Crit	363.2	307.3	347.5	528.5	612.7	636.1	563.0	455.9	357.4	231.4	159.7	167.5	
STDEV													
22-94 Avg	354.1	352.4	343.4	279.3	241.6	209.9	204.7	209.5	261.1	305.4	303.3	336.3	
22-94 Wet	419.6	365.3	273.8	121.1	51.4	15.2	54.4	144.9	221.4	366.0	344.7	348.4	
22-94 AN	282.2	312.8	314.0	209.9	82.0	47.9	63.0	109.9	142.5	246.5	223.8	264.5	
22-94 BN	344.7	383.7	431.0	309.9	206.1	154.4	121.1	149.7	144.3	162.9	199.3	190.2	
22-94 Dry	339.9	328.2	294.6	264.9	247.7	166.7	162.9	170.0	222.3	225.9	189.7	206.6	
22-94 Crit	321.0	316.0	322.2	334.3	335.0	283.0	262.9	231.8	198.4	154.7	116.5	98.2	

Feather River Flow (TAF)												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8	3,022.3
22-94 Wet	177.1	183.7	448.6	695.1	708.1	779.3	411.9	455.0	303.5	315.7	171.7	93.2	4,742.9
22-94 AN	155.2	128.4	204.2	327.5	416.1	565.9	140.5	267.0	258.0	462.3	317.0	75.1	3,317.2
22-94 BN	166.5	121.0	173.7	195.8	222.7	207.0	80.7	92.8	286.8	486.7	428.6	103.1	2,565.4
22-94 Dry	124.7	96.4	127.4	99.6	106.3	157.8	113.7	97.7	242.3	409.1	331.3	126.0	2,032.4
22-94 Crit	138.0	122.4	130.0	82.1	105.7	110.1	84.3	93.9	151.6	235.5	216.5	148.0	1,618.1
STDEV													
22-94 Avg	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9	1,426.9
22-94 Wet	78.8	189.4	428.0	561.9	339.8	483.2	309.9	323.8	157.3	125.4	142.9	65.5	1,153.4
22-94 AN	50.7	60.7	231.4	298.3	357.3	429.5	109.6	301.2	116.9	105.6	123.2	39.2	803.3
22-94 BN	78.8	44.0	90.6	174.6	212.5	146.5	56.6	40.6	95.5	72.0	70.3	50.9	553.8
22-94 Dry	54.2	33.8	63.1	51.4	58.6	100.1	87.2	62.1	65.0	104.0	137.7	70.9	414.4
22-94 Crit	64.1	49.0	74.2	48.1	59.3	91.4	53.3	50.4	62.8	164.2	116.8	81.6	457.6
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	751.8	931.4	1,542.5	2,022.3	2,212.9	2,100.0	1,448.6	1,195.5	1,042.8	1,129.0	910.1	787.4	16,074.4
22-94 Wet	898.5	1,313.8	2,901.3	3,456.1	3,433.9	3,233.0	2,501.7	2,023.0	1,453.0	1,203.1	960.3	1,060.1	24,437.8
22-94 AN	708.8	1,007.6	1,325.0	2,782.0	2,975.5	3,077.4	1,735.2	1,395.1	1,092.4	1,278.8	979.5	779.4	19,136.9
22-94 BN	749.2	777.9	1,119.6	1,546.2	1,990.3	1,598.9	1,102.4	964.4	1,008.3	1,229.5	1,029.4	724.0	13,840.2
22-94 Dry	664.5	770.2	899.2	963.5	1,335.8	1,399.6	830.8	731.7	823.3	1,117.3	880.2	698.7	11,114.6
22-94 Crit	650.5	592.4	697.3	847.5	870.2	821.1	594.5	468.7	616.6	772.9	665.3	509.0	8,106.1
STDEV													
22-94 Avg	258.1	645.9	1,253.4	1,442.9	1,298.4	1,269.5	1,095.7	803.2	489.1	201.8	158.0	242.1	6,795.4
22-94 Wet	368.1	923.1	1,262.3	1,344.7	1,006.6	1,197.9	1,286.1	909.8	650.1	101.6	98.8	234.3	4,627.8
22-94 AN	152.4	691.7	1,178.9	1,439.2	938.3	961.4	916.0	600.0	438.8	73.7	62.4	41.8	2,577.1
22-94 BN	173.0	199.7	885.1	687.3	939.3	455.6	575.8	299.5	154.1	70.1	79.6	48.2	1,311.2
22-94 Dry	169.4	420.0	265.4	261.7	750.8	695.3	222.5	91.2	100.1	121.0	120.2	84.2	910.8
22-94 Crit	176.7	156.2	224.2	344.5	370.1	377.2	96.6	69.4	68.9	187.7	146.2	164.5	1,123.3
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6	2,806.0
22-94 Wet	255.0	160.5	319.6	531.0	623.6	750.6	628.6	597.0	521.0	227.1	133.9	154.4	4,902.3
22-94 AN	136.9	113.8	162.2	324.2	433.7	455.8	402.9	364.9	275.3	140.1	119.0	124.1	3,052.8
22-94 BN	190.5	109.1	165.1	192.9	343.4	299.0	325.0	293.5	134.0	119.2	112.3	108.9	2,392.7
22-94 Dry	165.0	97.5	112.2	110.3	147.3	154.3	197.5	183.3	103.7	99.0	82.1	87.3	1,539.6
22-94 Crit	130.4	89.8	91.0	87.1	99.5	105.9	121.0	109.7	75.8	70.7	53.8	67.6	1,102.4
STDEV													
22-94 Avg	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3	2,166.7
22-94 Wet	217.5	171.4	364.6	406.5	459.8	608.1	351.5	367.2	516.7	220.0	11.8	65.0	2,854.0
22-94 AN	58.4	45.3	143.5	264.7	341.0	202.1	146.8	124.7	227.8	39.6	9.7	24.5	1,055.8
22-94 BN	116.7	24.7	104.5	117.2	214.4	187.2	106.6	106.6	29.0	16.9	15.3	11.6	693.3
22-94 Dry	122.4	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.1	18.7	26.9	15.1	429.0
22-94 Crit	59.4	16.4	15.1	12.8	21.4	23.9	23.0	24.5	7.8	11.0	13.1	4.2	165.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8	2,984.7
22-94 Wet	256.5	281.1	361.5	392.8	354.1	386.0	191.5	131.1	289.2	266.0	333.6	357.6	3,601.1
22-94 AN	247.4	255.3	344.8	446.0	389.5	392.1	181.3	118.3	223.0	307.2	294.0	300.3	3,499.4
22-94 BN	234.9	234.2	322.3	380.3	346.4	341.8	151.6	86.1	201.3	345.0	345.7	263.4	3,253.1
22-94 Dry	221.8	169.0	299.0	312.4	291.6	264.9	107.0	64.8	131.1	296.9	253.0	235.1	2,646.7
22-94 Crit	196.2	118.6	229.6	279.0	190.5	139.9	58.3	40.7	47.8	64.2	111.6	138.0	1,614.4
STDEV													
22-94 Avg	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4	854.2
22-94 Wet	100.3	117.5	93.3	106.2	91.8	66.9	51.6	78.7	106.8	134.8	107.6	63.3	642.2
22-94 AN	120.7	132.4	82.6	45.8	83.4	70.3	29.9	57.5	72.7	123.5	115.1	62.3	316.0
22-94 BN	86.8	115.8	108.1	104.5	150.8	127.1	38.6	52.1	54.7	77.7	56.3	45.8	239.7
22-94 Dry	107.2	116.6	98.5	101.8	128.0	128.5	36.0	31.1	59.1	98.8	138.8	62.7	363.9
22-94 Crit	103.5	79.5	110.0	124.3	134.7	128.8	30.7	23.9	50.6	122.7	139.2	100.2	650.9
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.9
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.7
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	3.6	3.0	2.8	2.0	2.1	2.5	3.2	3.5	3.6	3.7	3.7	3.6	37.2
22-94 Wet	4.0	3.3	3.1	2.8	2.7	3.0	3.5	3.8	3.9	4.1	4.0	3.9	42.4
22-94 AN	3.5	2.8	2.7	2.1	2.5	3.1	3.6	3.9	4.0	4.1	4.1	4.0	42.5
22-94 BN	3.9	3.2	3.1	1.8	2.0	2.7	3.5	4.0	4.1	4.3	4.2	4.1	41.9
22-94 Dry	3.3	2.7	2.5	1.9	1.9	2.4	3.2	3.5	3.6	3.8	3.7	3.6	36.3
22-94 Crit	3.3	2.7	2.6	1.1	1.2	1.4	1.8	1.9	2.0	2.0	2.0	2.0	19.2
STDEV													
22-94 Avg	0.9	0.8	0.7	1.1	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	9.4
22-94 Wet	0.3	0.2	0.3	0.6	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.8
22-94 AN	1.3	1.0	1.0	1.2	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.8
22-94 BN	0.5	0.4	0.4	1.3	0.9	0.7	0.5	0.3	0.3	0.3	0.3	0.3	2.4
22-94 Dry	1.2	1.0	0.9	1.0	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.6	6.0
22-94 Crit	1.1	0.9	0.9	1.0	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.1	8.1
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	197.9	175.2	165.7	87.7	118.9	151.9	191.5	261.2	334.0	352.9	342.9	249.9	2,616.7
22-94 Wet	209.0	185.1	174.8	119.3	148.7	174.8	202.0	270.9	347.6	368.8	358.3	255.5	2,831.1
22-94 AN	207.0	183.3	173.2	93.9	147.1	193.8	233.3	311.2	399.6	420.7	409.5	298.8	3,155.0
22-94 BN	219.4	194.4	186.0	81.1	113.8	165.3	221.5	317.4	406.6	428.4	416.4	305.2	3,120.3
22-94 Dry	170.8	151.1	142.1	79.7	106.3	136.8	192.7	262.2	335.3	352.7	342.6	252.4	2,546.9
22-94 Crit	181.9	161.0	151.5	45.6	65.8	81.6	101.7	135.7	169.0	180.9	175.0	131.8	1,298.3

STDEV													
22-94 Avg	60.6	53.8	51.8	51.7	52.4	54.8	59.3	79.9	102.5	108.0	105.6	77.4	772.5
22-94 Wet	30.2	27.0	25.7	28.3	24.2	23.2	28.8	40.9	52.4	54.7	54.4	43.1	393.0
22-94 AN	82.1	72.8	69.0	55.3	36.1	22.8	26.5	37.6	44.1	46.3	45.2	39.9	352.3
22-94 BN	49.4	43.7	45.7	62.9	58.6	51.2	41.9	29.0	34.1	35.9	35.2	30.1	233.1
22-94 Dry	69.6	61.7	58.2	43.7	50.0	45.6	45.5	61.4	80.8	83.7	82.4	58.9	546.0
22-94 Crit	71.6	63.6	60.3	47.0	51.1	61.4	65.6	88.1	106.0	117.5	114.2	86.1	689.8
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	3.6	5.4	23.7	45.3	68.6	91.8	11.1	3.9	0.3	0.0	0.0	1.7	255.5
22-94 Wet	4.3	7.4	47.3	75.4	118.2	150.6	30.3	13.6	1.1	0.0	0.0	6.0	537.8
22-94 AN	0.0	0.0	0.0	25.4	63.2	141.8	7.3	0.0	0.0	0.0	0.0	0.0	280.6
22-94 BN	11.1	10.4	26.3	49.7	65.3	82.2	7.4	0.0	0.0	0.0	0.0	0.0	161.1
22-94 Dry	0.1	0.8	11.5	33.0	40.7	49.0	0.0	0.0	0.0	0.0	0.0	0.0	100.4
22-94 Crit	1.5	6.5	15.3	20.5	27.4	15.3	0.0	0.0	0.0	0.0	0.0	0.0	57.7
STDEV													
22-94 Avg	15.7	19.4	57.3	73.2	76.8	80.8	24.3	16.4	1.9	0.0	0.0	10.6	274.2
22-94 Wet	17.1	23.5	68.9	87.8	66.2	51.0	35.6	28.9	3.6	0.0	0.0	19.5	307.5
22-94 AN	0.0	0.0	0.0	41.3	72.4	38.5	8.5	0.0	0.0	0.0	0.0	0.0	181.8
22-94 BN	28.3	26.8	66.8	75.9	84.1	87.8	19.3	0.1	0.0	0.0	0.0	0.0	138.5
22-94 Dry	0.4	3.1	46.0	71.0	68.3	70.6	0.0	0.0	0.0	0.0	0.0	0.0	104.8
22-94 Crit	5.3	22.5	53.1	54.5	63.0	53.1	0.0	0.0	0.0	0.0	0.0	0.0	116.7
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,082.3	2,136.0	2,240.0	2,375.6	2,534.6	2,693.2	2,948.0	3,061.2	2,899.6	2,504.8	2,218.1	2,117.7	
22-94 Wet	2,304.6	2,417.2	2,645.4	2,768.9	2,869.2	2,899.3	3,249.8	3,442.0	3,406.1	3,143.7	3,011.5	2,961.9	
22-94 AN	2,019.7	2,103.6	2,197.9	2,465.7	2,681.7	2,905.9	3,265.0	3,392.0	3,228.1	2,752.6	2,437.9	2,376.4	
22-94 BN	2,177.5	2,189.7	2,225.4	2,362.7	2,562.2	2,758.4	3,118.6	3,310.9	3,079.4	2,557.7	2,114.9	1,989.9	
22-94 Dry	1,965.8	2,010.8	2,085.2	2,191.0	2,417.2	2,688.3	2,854.1	2,896.4	2,642.9	2,163.7	1,793.9	1,643.3	
22-94 Crit	1,789.7	1,774.8	1,789.2	1,873.2	1,950.5	2,085.6	2,081.6	2,047.5	1,872.0	1,573.2	1,332.8	1,206.3	
STDEV													
22-94 Avg	340.6	340.1	333.9	277.6	239.3	213.6	208.4	210.4	251.7	294.2	293.6	325.6	
22-94 Wet	413.4	366.5	278.3	124.5	49.5	16.4	59.0	150.1	230.2	366.3	372.3	386.8	

22-94 AN	239.2	276.5	287.0	201.1	84.0	49.7	65.2	117.3	137.0	226.9	201.5	245.8	
22-94 BN	330.3	356.1	399.4	308.4	206.1	151.2	115.9	122.0	119.2	139.2	167.8	155.5	
22-94 Dry	321.3	305.3	270.2	245.1	224.0	158.2	156.4	164.6	201.2	203.2	172.6	185.0	
22-94 Crit	300.7	297.2	308.8	329.2	326.6	285.4	266.1	239.4	200.3	157.4	119.1	107.1	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	425.2	454.5	565.0	770.3	883.6	933.6	842.6	656.6	507.4	412.2	349.7	372.5	
22-94 Wet	530.4	608.6	750.1	944.0	1,018.7	1,061.0	990.2	822.5	752.6	645.8	601.3	685.7	
22-94 AN	317.5	377.6	526.8	822.0	983.6	1,033.2	954.7	757.2	566.5	461.3	362.5	382.5	
22-94 BN	421.5	445.7	539.9	748.1	897.0	975.9	861.0	620.6	396.7	313.4	255.1	227.4	
22-94 Dry	429.3	440.5	558.3	729.3	851.6	905.2	785.4	570.5	369.3	308.3	239.1	226.1	
22-94 Crit	329.7	277.9	311.0	504.0	590.7	616.1	545.5	439.4	342.5	216.3	156.3	180.5	
STDEV													
22-94 Avg	340.6	340.1	333.9	277.6	239.3	213.6	208.4	210.4	251.7	294.2	293.6	325.6	
22-94 Wet	413.4	366.5	278.3	124.5	49.5	16.4	59.0	150.1	230.2	366.3	372.3	386.8	
22-94 AN	239.2	276.5	287.0	201.1	84.0	49.7	65.2	117.3	137.0	226.9	201.5	245.8	
22-94 BN	330.3	356.1	399.4	308.4	206.1	151.2	115.9	122.0	119.2	139.2	167.8	155.5	
22-94 Dry	321.3	305.3	270.2	245.1	224.0	158.2	156.4	164.6	201.2	203.2	172.6	185.0	
22-94 Crit	300.7	297.2	308.8	329.2	326.6	285.4	266.1	239.4	200.3	157.4	119.1	107.1	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.5	133.4	240.0	317.3	342.1	401.1	191.9	221.5	261.0	370.8	280.6	109.2	3,021.4
22-94 Wet	178.5	184.3	457.9	689.8	694.1	778.8	413.2	454.6	316.8	310.1	180.3	94.8	4,753.1
22-94 AN	150.3	128.5	198.1	335.8	416.2	575.2	140.5	260.5	252.2	459.0	319.3	76.5	3,312.0
22-94 BN	160.2	114.4	166.9	195.8	229.9	208.3	80.7	94.6	295.6	474.3	417.6	96.1	2,534.4
22-94 Dry	122.3	95.4	127.4	99.5	111.2	183.4	111.3	98.6	238.2	404.9	326.4	132.4	2,051.0
22-94 Crit	140.4	121.0	128.7	82.1	103.3	110.2	84.5	92.8	160.6	237.6	203.2	146.3	1,610.7
STDEV													
22-94 Avg	69.2	111.8	282.9	408.8	345.9	429.1	225.7	260.0	116.2	142.5	153.9	67.7	1,426.3
22-94 Wet	80.9	189.2	427.9	554.2	342.7	515.3	308.5	324.0	145.3	121.5	152.0	66.8	1,132.7
22-94 AN	45.7	60.8	221.1	312.8	357.3	444.6	109.6	305.2	114.0	106.3	125.5	43.3	791.2
22-94 BN	77.1	43.6	87.9	174.6	223.2	145.6	56.6	41.8	94.0	84.2	69.6	44.7	557.3
22-94 Dry	52.4	33.0	63.1	51.3	62.8	117.1	86.4	62.3	64.1	103.0	136.4	75.2	426.3
22-94 Crit	63.8	48.6	73.3	48.1	60.6	91.3	53.4	47.5	63.6	158.8	122.7	79.9	459.3
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	750.4	934.0	1,545.2	2,017.9	2,210.8	2,099.7	1,449.0	1,194.7	1,045.9	1,124.0	909.6	784.2	16,065.4
22-94 Wet	895.1	1,316.4	2,913.2	3,446.9	3,419.6	3,217.0	2,505.6	2,022.7	1,466.3	1,198.0	960.6	1,062.3	24,423.7
22-94 AN	704.6	1,014.2	1,324.4	2,783.9	2,976.9	3,079.7	1,735.2	1,387.6	1,087.4	1,275.8	979.4	779.8	19,128.7
22-94 BN	740.9	774.1	1,115.1	1,546.6	1,993.0	1,599.8	1,102.7	966.3	1,016.3	1,217.8	1,016.2	715.1	13,803.9
22-94 Dry	668.7	774.6	903.0	958.4	1,337.2	1,418.1	828.8	732.6	812.4	1,111.4	887.5	692.9	11,125.6
22-94 Crit	655.5	597.2	693.4	841.1	875.6	819.5	592.5	467.5	621.5	775.5	667.5	503.7	8,110.6
STDEV													
22-94 Avg	258.6	644.8	1,258.6	1,438.9	1,298.3	1,267.4	1,096.3	803.3	488.5	198.6	161.7	243.9	6,796.9
22-94 Wet	367.6	920.7	1,266.3	1,329.0	1,025.9	1,211.8	1,283.1	910.5	636.7	92.0	101.8	231.8	4,662.4
22-94 AN	151.6	693.0	1,180.7	1,443.6	938.7	960.6	916.0	602.5	441.1	74.7	63.7	46.8	2,573.3
22-94 BN	179.3	189.2	887.5	685.3	944.4	456.5	577.0	300.2	155.8	90.7	81.2	48.8	1,319.6
22-94 Dry	170.2	420.6	263.8	261.7	753.2	697.5	219.9	91.3	103.6	121.4	134.9	85.0	927.8
22-94 Crit	185.2	158.4	205.8	358.7	364.7	376.4	92.9	68.2	81.7	181.9	166.8	159.6	1,128.2
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.1	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.6	140.7	103.2	112.6	2,805.9
22-94 Wet	255.3	160.4	319.6	531.0	623.5	750.6	628.6	597.0	521.0	227.1	133.9	154.4	4,902.5
22-94 AN	135.7	113.8	162.3	324.2	433.7	455.9	402.9	364.9	276.0	140.1	119.0	124.1	3,052.6
22-94 BN	190.2	108.7	165.1	192.9	343.4	299.0	325.0	293.5	134.0	119.1	112.3	108.9	2,392.0
22-94 Dry	165.0	97.5	112.3	110.4	147.3	154.3	197.5	183.3	103.6	98.9	82.0	87.5	1,539.6
22-94 Crit	130.3	90.1	91.0	87.1	99.5	105.9	121.0	109.7	75.9	70.7	53.8	67.6	1,102.7
STDEV													
22-94 Avg	148.5	96.9	223.1	300.1	354.3	425.3	277.6	276.3	338.8	131.4	33.2	48.3	2,166.7
22-94 Wet	217.2	171.4	364.6	406.5	459.9	608.1	351.5	367.2	516.7	220.0	11.8	65.0	2,853.8
22-94 AN	59.2	45.3	143.6	264.7	341.0	202.2	146.8	124.7	227.5	39.6	9.7	24.5	1,056.0
22-94 BN	117.2	25.2	104.5	117.2	214.4	187.2	106.6	106.6	29.1	17.0	15.3	11.5	693.6
22-94 Dry	122.4	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.1	18.7	26.8	15.2	428.9
22-94 Crit	59.4	16.2	15.1	12.8	21.4	23.9	23.0	24.5	7.8	10.9	13.1	4.2	165.1
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	231.3	215.1	313.7	358.4	319.1	312.2	141.7	87.7	192.2	253.5	275.8	268.2	2,969.0
22-94 Wet	251.8	276.6	359.3	389.8	361.4	383.1	190.9	129.9	295.9	256.3	342.4	356.5	3,593.7
22-94 AN	242.5	251.7	350.7	448.2	389.6	400.7	180.8	110.2	217.4	303.4	297.4	303.5	3,496.0
22-94 BN	230.4	233.7	316.9	373.0	345.1	337.7	151.6	86.1	209.7	332.3	342.6	256.9	3,216.0
22-94 Dry	222.8	168.0	294.9	309.8	292.0	272.3	106.7	58.3	126.7	292.3	245.2	238.1	2,627.0
22-94 Crit	198.8	117.8	224.7	276.5	192.5	138.2	58.5	36.3	56.3	63.5	104.0	137.3	1,604.3
STDEV													
22-94 Avg	102.6	127.0	106.0	114.0	133.2	136.7	62.3	63.2	110.1	142.8	138.2	99.9	844.9
22-94 Wet	101.9	122.8	94.6	107.8	94.1	72.5	51.4	78.4	91.5	132.5	98.4	64.8	601.6
22-94 AN	119.1	137.1	76.0	46.5	82.8	59.2	28.9	54.6	74.8	127.0	116.4	62.9	294.9
22-94 BN	84.8	112.9	107.2	100.8	150.0	125.9	38.6	52.1	59.7	86.4	55.6	47.2	235.1
22-94 Dry	112.4	117.3	103.1	101.3	127.5	124.5	36.0	27.8	59.4	96.7	133.9	67.1	375.3
22-94 Crit	102.6	80.9	100.5	126.3	135.2	131.0	30.8	16.5	50.8	122.5	142.1	97.3	640.0
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	1.0
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.8
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	4.0	3.3	3.1	2.3	2.4	2.8	3.5	3.9	4.0	4.1	4.1	4.0	41.3
22-94 Wet	4.4	3.6	3.4	3.2	3.0	3.3	3.9	4.2	4.3	4.5	4.4	4.3	46.6
22-94 AN	3.8	3.1	3.0	2.4	2.8	3.4	4.0	4.3	4.4	4.5	4.5	4.4	46.7
22-94 BN	4.3	3.5	3.4	2.0	2.2	3.0	3.9	4.4	4.5	4.7	4.6	4.5	46.2
22-94 Dry	3.7	3.0	2.8	2.1	2.2	2.7	3.6	4.0	4.1	4.2	4.2	4.0	40.8
22-94 Crit	3.7	3.0	2.9	1.2	1.4	1.6	2.0	2.2	2.3	2.4	2.3	2.3	22.2
STDEV													
22-94 Avg	1.0	0.8	0.8	1.2	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	9.9
22-94 Wet	0.2	0.2	0.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
22-94 AN	1.4	1.1	1.1	1.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.0
22-94 BN	0.5	0.4	0.4	1.4	1.0	0.8	0.6	0.3	0.3	0.3	0.3	0.3	2.6
22-94 Dry	1.2	1.0	1.0	1.1	0.9	0.8	0.6	0.6	0.6	0.7	0.7	0.6	6.0
22-94 Crit	1.2	1.0	0.9	1.1	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.1	8.6
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	198.2	174.3	164.3	89.1	119.4	151.9	189.9	257.2	327.3	345.3	334.9	246.5	2,585.0
22-94 Wet	208.8	183.6	173.2	120.5	148.1	173.1	200.0	265.5	338.2	359.2	347.9	250.2	2,784.0
22-94 AN	205.6	180.9	170.7	95.0	147.0	192.6	229.5	303.8	387.5	408.4	396.5	292.3	3,094.0
22-94 BN	218.7	192.5	181.8	83.2	115.3	166.3	219.4	312.5	398.0	419.3	407.1	301.0	3,080.9
22-94 Dry	173.3	152.4	143.2	81.4	107.2	137.6	191.1	258.7	329.0	345.7	335.5	249.7	2,523.5
22-94 Crit	182.7	160.7	151.0	46.6	67.1	83.1	103.4	137.2	173.1	181.2	175.5	133.7	1,315.9

STDEV													
22-94 Avg	59.4	52.4	49.8	51.2	51.6	54.2	57.7	77.2	99.1	104.0	101.3	75.1	749.4
22-94 Wet	30.7	27.4	26.4	24.7	21.9	23.5	29.1	39.8	51.1	53.3	52.2	42.6	389.0
22-94 AN	82.4	72.6	68.8	55.1	35.7	22.5	25.2	37.2	43.9	46.0	44.7	39.3	347.7
22-94 BN	48.0	42.5	40.5	62.3	57.3	50.3	41.5	29.9	34.4	36.3	35.8	31.5	240.3
22-94 Dry	68.3	60.1	56.9	44.8	50.2	46.3	43.4	58.9	77.8	80.2	78.7	56.4	531.1
22-94 Crit	68.9	60.8	57.7	47.4	52.0	61.9	64.9	86.8	111.6	115.0	111.9	84.9	680.1
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	5.8	6.4	24.9	47.9	70.0	93.6	11.6	4.1	0.7	0.0	0.1	2.0	267.2
22-94 Wet	6.9	10.8	51.7	74.6	114.4	150.8	31.1	14.4	2.5	0.0	0.3	7.1	570.4
22-94 AN	0.0	0.0	0.0	26.8	73.5	144.1	9.1	0.0	0.0	0.0	0.0	0.0	305.4
22-94 BN	11.1	10.2	26.2	65.2	67.3	83.7	7.3	0.0	0.0	0.0	0.0	0.0	157.2
22-94 Dry	3.2	1.4	11.5	32.7	43.9	54.3	0.0	0.0	0.0	0.0	0.0	0.0	99.7
22-94 Crit	5.9	6.5	15.3	18.7	27.4	15.3	0.0	0.0	0.0	0.0	0.0	0.0	56.7
STDEV													
22-94 Avg	19.7	20.8	58.8	75.7	76.9	79.7	24.5	17.3	4.1	0.0	0.7	12.2	287.0
22-94 Wet	21.9	27.1	71.7	90.0	68.8	50.9	36.2	30.4	7.4	0.0	1.3	22.4	310.4
22-94 AN	0.0	0.0	0.0	46.7	73.5	36.9	10.4	0.0	0.0	0.0	0.0	0.0	200.3
22-94 BN	28.3	26.1	66.7	82.3	86.3	86.1	17.7	0.0	0.0	0.0	0.0	0.0	135.8
22-94 Dry	12.7	5.7	46.0	70.5	67.5	69.6	0.0	0.0	0.0	0.0	0.0	0.0	103.8
22-94 Crit	20.5	22.5	53.1	53.3	62.7	53.1	0.0	0.0	0.0	0.0	0.0	0.0	116.0
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,112.6	2,167.8	2,271.6	2,407.6	2,568.5	2,720.1	2,975.0	3,088.8	2,921.8	2,532.0	2,247.8	2,146.8	
22-94 Wet	2,349.1	2,461.2	2,680.0	2,808.9	2,923.2	2,953.7	3,303.0	3,495.5	3,446.2	3,189.2	3,048.2	2,996.9	
22-94 AN	2,034.2	2,118.3	2,218.6	2,478.2	2,694.2	2,909.0	3,268.1	3,401.5	3,243.3	2,771.1	2,454.1	2,391.1	
22-94 BN	2,192.0	2,210.9	2,253.5	2,390.9	2,583.2	2,778.1	3,138.2	3,328.7	3,088.3	2,579.0	2,146.9	2,028.8	
22-94 Dry	2,019.0	2,064.8	2,139.3	2,245.1	2,466.5	2,711.9	2,880.1	2,921.4	2,671.9	2,196.8	1,831.9	1,674.7	
22-94 Crit	1,796.2	1,782.8	1,798.5	1,882.5	1,962.1	2,097.2	2,093.0	2,060.0	1,875.4	1,574.5	1,347.4	1,222.5	
STDEV													
22-94 Avg	347.2	346.9	337.4	274.0	240.9	210.9	205.7	210.6	256.4	300.0	298.3	329.6	
22-94 Wet	424.1	370.8	279.0	119.5	46.1	14.3	57.7	149.7	224.8	364.9	353.2	361.3	

22-94 AN	254.8	287.3	282.8	197.6	75.4	38.6	67.5	118.8	144.6	242.8	219.7	267.3	
22-94 BN	334.9	374.0	420.0	304.6	206.4	154.5	118.8	126.0	119.4	137.8	171.7	165.5	
22-94 Dry	326.7	316.1	282.3	253.7	241.9	161.6	158.8	173.6	204.9	207.3	174.3	182.1	
22-94 Crit	306.1	301.8	307.2	324.4	327.5	279.2	256.8	227.9	204.2	157.5	111.2	91.6	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	438.5	464.9	574.5	774.3	887.2	936.6	845.6	660.0	518.7	423.4	365.5	389.6	
22-94 Wet	530.6	607.4	747.2	939.1	1,020.4	1,062.5	992.7	825.6	771.3	664.3	633.7	719.9	
22-94 AN	325.1	383.7	542.5	837.2	988.9	1,039.3	956.6	762.4	581.2	484.0	401.0	428.7	
22-94 BN	457.2	477.1	569.8	756.1	902.4	975.4	862.0	627.3	420.2	332.1	278.7	242.9	
22-94 Dry	439.9	446.8	559.4	727.2	849.0	905.8	786.9	570.3	370.3	308.5	236.0	225.8	
22-94 Crit	348.2	293.1	324.5	517.8	602.6	626.7	554.6	442.9	337.6	211.1	140.9	168.7	
STDEV													
22-94 Avg	347.2	346.9	337.4	274.0	240.9	210.9	205.7	210.6	256.4	300.0	298.3	329.6	
22-94 Wet	424.1	370.8	279.0	119.5	46.1	14.3	57.7	149.7	224.8	364.9	353.2	361.3	
22-94 AN	254.8	287.3	282.8	197.6	75.4	38.6	67.5	118.8	144.6	242.8	219.7	267.3	
22-94 BN	334.9	374.0	420.0	304.6	206.4	154.5	118.8	126.0	119.4	137.8	171.7	165.5	
22-94 Dry	326.7	316.1	282.3	253.7	241.9	161.6	158.8	173.6	204.9	207.3	174.3	182.1	
22-94 Crit	306.1	301.8	307.2	324.4	327.5	279.2	256.8	227.9	204.2	157.5	111.2	91.6	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.8	129.5	224.6	286.3	318.3	372.0	190.0	221.1	278.9	426.2	293.9	120.6	3,014.2
22-94 Wet	173.5	175.3	397.5	630.1	654.4	739.7	413.4	456.5	334.5	438.9	232.0	98.2	4,743.9
22-94 AN	150.8	104.0	211.7	290.4	395.0	556.5	150.6	273.9	264.1	516.5	359.2	102.9	3,375.6
22-94 BN	156.5	117.2	147.6	163.1	214.7	189.1	78.0	99.2	330.2	511.7	411.0	146.5	2,564.9
22-94 Dry	137.8	102.7	140.7	93.3	90.3	137.3	100.9	89.8	253.6	414.3	314.6	131.0	2,006.4
22-94 Crit	133.9	120.9	134.5	82.1	91.2	101.0	81.3	82.4	167.9	244.8	183.5	130.4	1,553.9
STDEV													
22-94 Avg	70.2	106.2	254.0	404.3	335.1	401.0	225.9	262.4	120.4	149.1	156.9	77.1	1,457.8
22-94 Wet	76.7	185.5	390.5	582.0	346.4	463.5	308.7	322.9	141.3	130.6	166.8	83.3	1,181.3
22-94 AN	61.1	28.0	218.0	291.3	333.0	399.2	104.9	311.5	120.9	89.0	113.3	57.3	839.8
22-94 BN	80.4	37.4	82.0	172.4	212.6	141.8	54.9	55.7	97.3	75.7	101.9	80.2	605.8
22-94 Dry	62.1	38.6	73.1	43.2	41.1	82.3	80.2	47.3	72.1	133.5	151.8	82.7	458.9
22-94 Crit	63.8	32.5	84.9	48.1	61.6	80.9	47.7	40.7	67.5	154.5	117.3	65.8	428.8
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	753.4	923.2	1,530.2	2,012.1	2,189.3	2,103.8	1,462.2	1,176.6	1,036.2	1,126.6	880.7	766.4	15,960.5
22-94 Wet	901.4	1,293.8	2,830.3	3,426.5	3,401.0	3,229.0	2,528.6	1,993.1	1,404.3	1,241.4	950.4	1,003.7	24,203.6
22-94 AN	719.2	957.0	1,343.0	2,744.7	2,962.3	3,103.4	1,745.6	1,365.7	1,090.3	1,300.4	977.2	786.6	19,095.4
22-94 BN	723.3	795.0	1,097.5	1,518.3	1,970.3	1,616.0	1,103.7	940.6	1,048.4	1,208.6	975.6	750.4	13,747.8
22-94 Dry	680.7	774.0	931.1	978.7	1,298.8	1,384.7	841.3	722.9	817.4	1,073.7	836.6	671.5	11,011.4
22-94 Crit	654.7	595.0	714.5	880.1	867.3	829.4	605.8	470.0	624.4	755.5	626.7	479.4	8,102.8
STDEV													
22-94 Avg	233.1	618.8	1,213.5	1,430.7	1,301.6	1,273.5	1,096.9	784.6	461.0	218.0	181.1	226.4	6,725.7
22-94 Wet	309.6	897.6	1,259.7	1,355.5	1,039.1	1,219.6	1,276.1	880.6	607.9	129.7	104.4	203.8	4,570.7
22-94 AN	143.0	624.6	1,161.3	1,461.9	962.9	957.5	919.2	601.9	431.4	88.8	79.2	61.3	2,592.6
22-94 BN	159.0	196.2	806.8	663.0	931.9	447.8	570.1	276.1	147.4	82.5	109.8	85.2	1,389.2
22-94 Dry	159.2	403.9	255.8	246.7	731.3	676.6	204.7	83.2	103.0	116.8	181.6	102.5	881.9
22-94 Crit	194.3	141.4	216.9	370.8	380.4	384.3	116.2	60.5	102.0	178.2	167.9	151.2	1,178.4
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	177.4	118.6	185.2	272.8	353.8	387.0	362.7	342.5	249.3	140.4	104.2	111.3	2,805.2
22-94 Wet	240.7	160.3	319.0	532.8	626.5	752.8	635.5	617.5	527.2	227.0	134.9	150.4	4,924.4
22-94 AN	134.3	113.7	162.7	323.1	433.0	453.7	400.4	365.6	271.2	140.0	119.8	121.4	3,038.8
22-94 BN	181.7	108.7	165.0	191.9	343.5	299.3	324.8	299.3	133.6	119.0	112.7	109.3	2,388.7
22-94 Dry	157.0	97.4	112.1	110.2	146.5	153.4	196.2	180.6	102.4	98.1	83.5	87.9	1,525.3
22-94 Crit	124.4	89.7	91.0	87.1	99.3	105.3	120.2	108.4	75.3	70.9	54.8	68.2	1,094.5
STDEV													
22-94 Avg	136.7	96.8	223.0	300.0	355.7	427.0	282.4	288.1	338.4	131.0	32.9	44.2	2,176.5
22-94 Wet	205.1	171.2	364.4	405.4	461.7	610.2	359.0	377.4	516.4	219.3	11.9	58.2	2,856.2
22-94 AN	42.8	44.8	144.6	262.1	341.8	202.9	146.2	142.0	203.8	39.7	9.9	18.6	1,060.5
22-94 BN	103.9	24.8	104.1	117.0	213.2	189.2	107.4	121.0	29.7	16.8	15.1	12.0	699.4
22-94 Dry	109.8	16.4	30.6	35.2	85.7	58.9	68.8	59.7	16.7	18.4	26.3	15.2	415.5
22-94 Crit	45.7	16.6	15.1	12.8	21.3	23.8	22.9	24.5	7.9	10.9	12.5	4.1	150.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	258.3	228.8	344.2	375.3	323.3	331.9	149.9	105.3	208.3	291.6	274.9	273.3	3,165.1
22-94 Wet	316.3	314.1	410.3	439.7	379.0	422.4	213.7	177.1	316.8	337.5	345.8	375.8	4,048.6
22-94 AN	257.9	241.5	375.5	439.9	392.1	432.0	184.6	114.7	246.5	350.4	329.1	307.6	3,671.8
22-94 BN	261.2	233.8	335.6	395.2	356.1	357.7	151.8	93.2	224.3	359.3	342.7	278.8	3,389.8
22-94 Dry	222.8	176.3	318.0	326.2	270.5	268.0	111.0	68.1	137.6	297.4	231.3	228.7	2,655.9
22-94 Crit	201.3	133.2	247.6	250.7	200.5	145.2	58.8	35.4	61.9	75.9	84.6	118.5	1,613.4
STDEV													
22-94 Avg	107.3	122.0	99.4	113.0	135.0	140.7	69.4	79.4	118.0	140.3	153.8	105.0	956.1
22-94 Wet	87.0	85.9	34.8	64.5	110.6	51.6	55.2	93.7	92.3	94.5	111.7	38.1	397.7
22-94 AN	109.7	146.7	50.3	70.3	72.2	36.1	38.0	56.9	86.7	89.1	103.4	56.1	317.4
22-94 BN	107.8	100.1	111.4	105.8	152.8	117.2	38.6	48.9	58.5	71.6	100.2	67.8	368.9
22-94 Dry	111.1	114.6	94.7	103.2	113.9	128.5	33.6	38.5	64.3	124.7	154.0	64.2	438.0
22-94 Crit	96.8	92.5	114.1	107.7	124.3	124.2	36.9	19.8	70.8	122.4	136.9	75.8	631.5
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	2.4	0.3	0.0	0.0	0.0	0.5	1.9	2.0	1.9	2.5	2.8	3.1	17.4
22-94 Wet	2.3	0.1	0.0	0.0	0.0	0.4	2.5	2.7	2.6	2.5	2.8	3.3	20.5
22-94 AN	2.2	0.5	0.0	0.0	0.0	0.1	2.3	2.5	2.3	3.6	3.5	3.6	20.4

22-94 BN	3.2	0.4	0.0	0.0	0.0	0.8	2.1	2.2	1.9	2.6	3.4	4.2	20.5
22-94 Dry	2.5	0.5	0.0	0.0	0.1	0.5	1.5	1.7	1.7	2.6	2.8	2.8	15.8
22-94 Crit	2.0	0.5	0.0	0.0	0.1	0.7	0.6	0.5	0.8	1.5	1.5	1.3	8.0
STDEV													
22-94 Avg	1.5	0.6	0.0	0.0	0.1	0.9	1.2	1.1	1.0	1.6	1.7	1.6	6.5
22-94 Wet	1.7	0.2	0.0	0.0	0.0	0.9	1.0	0.8	1.0	1.5	1.5	1.5	3.2
22-94 AN	1.3	0.9	0.0	0.0	0.0	0.3	1.5	1.1	0.7	2.0	2.3	1.6	5.2
22-94 BN	1.5	0.8	0.0	0.0	0.0	1.3	0.9	0.9	0.5	1.6	1.9	1.7	5.4
22-94 Dry	1.8	0.8	0.0	0.0	0.2	0.8	0.9	1.1	0.9	1.5	1.5	1.3	5.2
22-94 Crit	0.9	0.4	0.0	0.0	0.2	0.9	0.8	0.5	0.7	1.0	0.9	0.8	5.0
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.0	5.0	5.1	2.8	3.2	3.9	5.1	5.6	5.8	6.0	6.0	5.8	59.9
22-94 Wet	6.9	5.8	6.0	4.3	4.7	5.3	6.4	6.9	7.1	7.4	7.4	7.1	76.7
22-94 AN	5.8	4.8	4.8	2.9	3.9	5.1	6.5	7.0	7.1	7.4	7.4	7.2	75.4
22-94 BN	6.6	5.5	5.7	2.6	2.9	4.1	5.7	6.5	6.7	6.9	6.9	6.7	67.3
22-94 Dry	5.1	4.3	4.3	2.1	2.3	2.9	4.4	4.9	5.0	5.1	5.1	4.9	49.7
22-94 Crit	5.1	4.2	4.3	1.2	1.4	1.7	2.1	2.2	2.3	2.4	2.4	2.3	22.7
STDEV													
22-94 Avg	2.2	1.9	2.0	1.9	1.7	1.7	1.9	2.0	2.0	2.1	2.1	2.1	21.6
22-94 Wet	1.2	1.1	1.3	1.5	0.9	0.4	0.5	0.5	0.6	0.6	0.6	0.6	6.3
22-94 AN	2.5	2.1	2.1	1.6	1.1	0.5	0.6	0.6	0.7	0.7	0.7	0.7	8.4
22-94 BN	1.9	1.6	1.8	2.2	1.7	1.4	1.2	0.7	0.7	0.8	0.8	0.7	7.1
22-94 Dry	2.7	2.3	2.3	1.2	1.2	1.1	1.4	1.4	1.4	1.5	1.5	1.4	13.4
22-94 Crit	2.3	1.9	2.1	1.4	1.1	1.3	1.4	1.5	1.5	1.6	1.6	1.5	11.9
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	238.4	211.1	202.9	95.0	133.8	173.3	215.9	288.3	351.5	375.1	361.5	280.5	2,912.8
22-94 Wet	273.2	238.8	235.0	147.1	197.7	234.6	267.2	350.1	425.2	453.4	434.9	340.1	3,650.1
22-94 AN	231.0	206.0	193.9	97.4	165.9	228.1	275.1	356.5	437.0	464.0	448.9	345.3	3,635.7
22-94 BN	261.1	233.3	223.4	89.2	123.4	180.8	239.3	336.4	414.1	439.1	424.2	327.7	3,326.6
22-94 Dry	203.7	181.6	171.5	70.1	96.9	128.0	187.3	252.7	307.9	329.7	318.4	246.7	2,478.4
22-94 Crit	203.6	180.0	172.0	41.7	56.6	72.0	87.8	114.8	136.4	149.8	144.8	112.1	1,116.7

STDEV													
22-94 Avg	84.7	76.2	75.0	65.5	72.6	75.3	80.4	102.9	126.4	133.4	128.8	99.7	1,039.4
22-94 Wet	44.3	41.5	45.7	51.5	38.6	18.4	21.9	30.8	37.8	39.4	40.8	29.1	289.3
22-94 AN	98.5	88.7	84.2	56.3	45.4	24.8	27.2	34.2	41.8	44.4	43.8	30.8	358.8
22-94 BN	72.0	65.9	65.3	75.9	74.5	63.3	52.6	38.4	47.2	49.7	48.8	36.8	351.7
22-94 Dry	105.3	94.8	89.8	40.7	52.8	50.2	63.3	79.5	100.2	103.2	100.2	77.9	716.1
22-94 Crit	90.4	81.2	78.5	48.5	49.5	60.5	64.0	84.0	95.0	109.7	106.4	82.4	666.1
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.0	0.0	2.0	17.4	33.9	60.6	6.6	0.5	0.0	0.0	0.0	0.0	121.0
22-94 Wet	0.0	0.0	3.9	34.3	42.4	102.2	12.6	0.0	0.0	0.0	0.0	0.0	190.5
22-94 AN	0.0	0.0	0.0	10.0	42.4	72.6	0.9	0.0	0.0	0.0	0.0	0.0	75.6
22-94 BN	0.0	0.0	0.0	0.0	30.1	57.2	8.5	1.5	0.0	0.0	0.0	0.0	84.0
22-94 Dry	0.0	0.0	0.0	5.7	23.0	35.4	5.5	0.8	0.0	0.0	0.0	0.0	101.3
22-94 Crit	0.0	0.0	5.5	30.3	30.7	15.3	0.0	0.0	0.0	0.0	0.0	0.0	106.6
STDEV													
22-94 Avg	0.0	0.0	11.2	47.9	61.7	70.2	18.8	2.8	0.0	0.0	0.0	0.0	129.6
22-94 Wet	0.0	0.0	15.3	63.4	64.5	59.0	24.4	0.0	0.0	0.0	0.0	0.0	124.2
22-94 AN	0.0	0.0	0.0	31.6	56.0	65.8	2.8	0.0	0.0	0.0	0.0	0.0	64.8
22-94 BN	0.0	0.0	0.0	0.0	56.9	78.9	21.6	5.5	0.0	0.0	0.0	0.0	82.9
22-94 Dry	0.0	0.0	0.0	19.8	62.8	64.3	19.6	3.1	0.0	0.0	0.0	0.0	144.1
22-94 Crit	0.0	0.0	19.2	70.7	71.6	53.1	0.0	0.0	0.0	0.0	0.0	0.0	168.6
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	1,962.0	2,021.0	2,140.0	2,307.0	2,491.8	2,672.3	2,929.4	3,043.3	2,857.7	2,410.9	2,111.6	1,996.6	
22-94 Wet	2,141.3	2,262.4	2,541.5	2,730.0	2,884.1	2,953.7	3,303.0	3,493.2	3,424.9	3,037.3	2,842.6	2,784.9	
22-94 AN	1,959.4	2,068.6	2,155.5	2,460.5	2,697.7	2,931.1	3,280.3	3,399.6	3,228.4	2,696.2	2,336.8	2,244.0	
22-94 BN	2,058.4	2,074.7	2,136.5	2,306.5	2,514.0	2,728.0	3,090.9	3,276.1	3,000.2	2,451.6	2,023.6	1,852.0	
22-94 Dry	1,826.5	1,864.6	1,925.6	2,037.5	2,279.8	2,571.0	2,750.0	2,800.2	2,535.4	2,049.7	1,694.9	1,536.8	
22-94 Crit	1,718.5	1,704.7	1,714.6	1,798.4	1,890.3	2,034.2	2,033.9	2,011.7	1,819.9	1,511.1	1,303.0	1,192.9	
STDEV													
22-94 Avg	697.6	726.3	715.4	649.6	559.5	504.9	564.4	609.6	638.8	606.1	633.8	673.9	
22-94 Wet	703.8	673.9	481.1	340.5	108.4	129.5	97.1	105.2	164.9	281.6	391.0	414.8	

22-94 AN	825.2	898.2	858.5	582.5	306.7	102.7	128.9	186.3	302.5	262.3	312.1	371.5	
22-94 BN	786.8	809.3	822.3	737.7	592.0	513.6	331.5	258.1	214.1	213.9	213.4	259.8	
22-94 Dry	628.0	655.5	647.8	621.0	534.3	465.2	430.6	359.6	331.2	234.8	181.9	222.9	
22-94 Crit	541.9	587.9	618.6	595.1	595.0	589.3	581.6	557.7	501.8	420.6	362.0	345.0	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	324.2	329.3	441.9	671.4	803.3	884.1	778.0	585.3	433.9	356.7	279.9	282.1	
22-94 Wet	374.2	431.5	583.4	811.9	935.0	1,008.4	909.3	731.9	611.6	515.6	419.6	448.8	
22-94 AN	251.9	271.0	427.2	730.4	890.2	1,016.7	893.9	650.5	442.3	348.6	260.9	246.8	
22-94 BN	297.4	287.4	369.5	628.2	801.8	900.8	766.2	509.8	286.1	214.1	152.0	118.6	
22-94 Dry	328.5	309.7	427.7	642.3	760.5	840.1	722.9	521.3	364.6	324.6	254.4	243.8	
22-94 Crit	322.6	274.3	309.8	465.7	559.5	595.5	538.7	447.5	380.7	294.5	234.3	261.9	
STDEV													
22-94 Avg	270.2	268.5	294.6	277.7	257.4	234.1	225.1	231.5	255.9	270.8	235.4	250.8	
22-94 Wet	347.1	321.5	304.5	201.4	178.3	124.0	140.4	215.3	267.3	330.1	289.1	307.7	
22-94 AN	125.7	169.3	232.0	233.3	139.7	61.0	82.3	121.9	177.6	218.5	192.3	209.5	
22-94 BN	241.7	233.8	259.2	277.7	255.2	200.1	168.0	157.2	138.4	133.0	95.4	70.2	
22-94 Dry	250.5	236.3	249.9	271.2	247.7	211.8	222.9	230.8	265.0	274.9	245.3	247.2	
22-94 Crit	284.2	300.8	355.3	323.4	302.9	282.2	277.3	271.4	237.1	197.8	161.0	154.5	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.6	129.8	222.2	283.5	316.8	368.3	188.9	224.3	279.7	430.8	293.0	124.7	3,014.6
22-94 Wet	171.0	175.5	389.5	620.7	653.3	738.0	413.4	455.8	338.0	445.1	231.6	101.2	4,733.2
22-94 AN	151.7	104.9	221.6	289.3	391.2	540.7	150.7	274.1	260.9	519.5	361.7	114.4	3,380.6
22-94 BN	154.9	119.1	148.1	163.6	211.0	188.9	80.0	104.6	329.5	515.1	405.9	139.7	2,560.3
22-94 Dry	142.4	102.7	138.4	93.3	90.3	132.9	94.2	100.6	257.4	420.0	314.4	143.2	2,029.7
22-94 Crit	132.1	118.9	128.3	82.1	91.2	101.0	81.3	82.3	164.9	248.2	183.0	132.1	1,545.3
STDEV													
22-94 Avg	69.8	106.3	254.2	399.7	332.9	397.1	225.2	261.4	122.1	149.6	156.1	83.9	1,457.9
22-94 Wet	74.3	185.5	390.4	576.3	343.1	463.3	308.7	323.1	141.0	131.2	166.4	83.0	1,184.4
22-94 AN	63.3	27.3	229.2	291.5	329.5	375.3	105.0	311.4	121.2	88.0	114.5	67.0	848.9
22-94 BN	79.2	37.8	82.7	172.4	207.4	141.9	54.8	61.1	105.7	78.1	98.1	84.2	625.3
22-94 Dry	65.4	38.6	72.6	43.2	41.1	80.7	63.6	59.7	72.9	130.8	152.1	102.9	492.3
22-94 Crit	63.8	33.1	85.8	48.2	61.6	80.9	47.7	40.7	62.8	158.7	117.6	71.0	435.9
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	754.2	924.1	1,529.7	2,009.4	2,186.3	2,101.6	1,461.8	1,179.5	1,038.3	1,130.0	880.2	769.7	15,964.8
22-94 Wet	898.2	1,296.1	2,824.2	3,426.9	3,402.1	3,225.8	2,530.7	1,991.6	1,406.3	1,246.0	950.4	1,003.0	24,201.3
22-94 AN	725.7	958.3	1,355.6	2,730.5	2,939.6	3,103.6	1,745.5	1,362.1	1,086.4	1,301.2	979.6	797.7	19,085.8
22-94 BN	720.2	798.0	1,098.4	1,519.6	1,969.2	1,611.2	1,111.9	947.8	1,049.4	1,212.7	969.4	741.2	13,749.0
22-94 Dry	685.8	774.2	927.4	977.7	1,295.4	1,383.0	829.8	734.4	827.2	1,077.4	838.4	688.0	11,038.9
22-94 Crit	656.6	591.8	715.6	874.8	871.8	829.4	605.7	470.0	622.7	758.3	626.3	480.3	8,103.2
STDEV													
22-94 Avg	232.9	620.2	1,211.8	1,430.2	1,300.2	1,272.4	1,098.4	783.3	459.4	218.7	179.4	227.0	6,719.3
22-94 Wet	311.0	898.8	1,260.0	1,353.4	1,038.6	1,222.9	1,275.8	884.5	607.1	131.5	104.6	204.1	4,573.3
22-94 AN	141.8	626.7	1,154.2	1,470.8	964.9	956.5	919.0	598.8	433.6	88.9	82.1	62.4	2,582.7
22-94 BN	160.4	195.5	808.9	656.9	930.8	454.4	571.1	281.6	131.5	85.2	104.2	77.7	1,383.1
22-94 Dry	162.0	404.4	258.8	248.8	734.7	657.9	204.3	76.3	95.5	115.1	177.2	122.7	856.8
22-94 Crit	194.0	143.9	236.9	356.4	381.3	384.4	116.2	60.3	101.4	181.1	167.8	154.8	1,198.7
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	177.4	118.6	185.2	272.8	353.8	387.0	362.7	342.5	249.3	140.5	104.1	111.3	2,805.3
22-94 Wet	241.3	160.3	319.0	532.8	626.5	752.8	635.5	617.5	527.2	226.9	134.9	150.4	4,925.0
22-94 AN	134.4	113.7	162.8	323.1	433.0	453.7	400.4	365.6	271.2	140.0	119.8	121.4	3,039.0
22-94 BN	180.9	108.7	165.0	191.9	343.5	299.3	324.8	299.3	133.6	118.9	112.7	109.3	2,387.7
22-94 Dry	157.0	97.4	112.1	110.1	146.4	153.4	196.2	180.7	102.6	98.3	83.6	87.7	1,525.6
22-94 Crit	124.4	89.7	91.0	87.1	99.3	105.3	120.2	108.4	75.3	70.9	54.8	68.2	1,094.5
STDEV													
22-94 Avg	136.6	96.8	223.0	300.0	355.7	427.0	282.4	288.1	338.4	131.0	33.0	44.2	2,176.6
22-94 Wet	204.7	171.2	364.4	405.4	461.7	610.2	359.0	377.4	516.4	219.3	11.9	58.2	2,855.8
22-94 AN	42.8	44.8	144.9	262.1	341.8	202.9	146.2	142.0	203.8	39.7	9.9	18.6	1,060.6
22-94 BN	103.8	24.8	104.1	117.0	213.2	189.2	107.4	121.0	29.7	16.9	15.2	12.0	699.6
22-94 Dry	109.8	16.4	30.6	35.2	85.7	58.9	68.8	59.7	16.7	18.5	26.4	14.9	415.7
22-94 Crit	45.7	16.6	15.1	12.8	21.3	23.8	22.9	24.5	7.9	10.9	12.5	4.1	150.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	257.4	230.0	345.4	377.9	324.5	331.6	148.8	108.7	210.1	296.2	273.7	274.2	3,178.4
22-94 Wet	314.3	316.9	411.4	446.2	379.1	423.5	214.0	175.4	319.4	343.8	345.9	375.1	4,065.1
22-94 AN	257.6	240.9	381.4	439.6	396.9	432.0	184.6	114.7	245.8	354.8	331.7	317.0	3,697.1
22-94 BN	259.1	238.4	337.8	397.0	357.1	357.1	152.4	107.2	229.1	362.3	335.9	274.5	3,408.1
22-94 Dry	224.7	175.9	316.3	326.8	271.6	265.8	105.3	73.8	140.7	302.8	230.5	231.4	2,665.6
22-94 Crit	198.9	131.3	247.2	252.5	200.7	145.0	58.7	35.5	59.3	78.2	84.0	119.0	1,610.4
STDEV													
22-94 Avg	107.6	122.9	100.6	113.3	136.1	142.0	70.6	77.9	119.0	139.6	152.9	105.1	963.0
22-94 Wet	87.9	86.0	33.4	56.6	110.9	51.5	55.4	91.3	93.4	89.8	112.5	40.2	386.4
22-94 AN	109.3	146.9	45.2	70.3	74.4	35.7	38.0	56.9	87.3	87.1	103.7	57.4	321.3
22-94 BN	108.0	97.2	107.0	104.5	155.7	119.3	38.5	54.0	56.9	69.4	96.2	66.1	355.8
22-94 Dry	112.5	115.1	95.6	108.0	113.1	131.2	37.2	37.6	64.9	122.1	153.0	64.5	440.0
22-94 Crit	97.3	94.7	123.3	107.2	125.3	124.2	36.9	19.8	68.9	125.5	136.1	76.2	651.1
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	2.4	0.3	0.0	0.0	0.0	0.5	1.8	2.0	1.9	2.5	2.8	3.0	17.3
22-94 Wet	2.3	0.1	0.0	0.0	0.0	0.4	2.5	2.7	2.5	2.5	2.8	3.3	20.5
22-94 AN	2.2	0.5	0.0	0.0	0.0	0.1	2.2	2.5	2.3	3.6	3.5	3.6	20.3

22-94 BN	3.2	0.4	0.0	0.0	0.0	0.8	2.0	2.2	1.9	2.6	3.3	4.1	20.2
22-94 Dry	2.5	0.5	0.0	0.0	0.1	0.5	1.5	1.7	1.6	2.5	2.8	2.8	15.7
22-94 Crit	2.0	0.5	0.0	0.0	0.1	0.7	0.6	0.5	0.8	1.5	1.4	1.3	7.9
STDEV													
22-94 Avg	1.5	0.6	0.0	0.0	0.1	0.9	1.2	1.1	1.0	1.6	1.7	1.6	6.5
22-94 Wet	1.7	0.2	0.0	0.0	0.0	0.9	1.0	0.8	1.0	1.5	1.5	1.5	3.3
22-94 AN	1.3	0.9	0.0	0.0	0.0	0.3	1.4	1.1	0.7	2.0	2.3	1.6	5.3
22-94 BN	1.5	0.8	0.0	0.0	0.0	1.3	0.9	0.9	0.5	1.5	1.8	1.6	5.3
22-94 Dry	1.8	0.8	0.0	0.0	0.2	0.8	0.9	1.1	0.9	1.5	1.5	1.4	5.2
22-94 Crit	0.9	0.4	0.0	0.0	0.2	0.9	0.8	0.5	0.7	1.0	0.9	0.7	4.8

Table A Deliveries to North Bay Aqueduct (TAF)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.0	5.0	5.1	2.7	3.1	3.9	5.1	5.6	5.7	5.9	5.9	5.7	59.6
22-94 Wet	6.8	5.8	6.1	4.3	4.7	5.3	6.4	6.9	7.1	7.4	7.4	7.2	76.7
22-94 AN	5.8	4.8	4.8	2.8	3.8	5.1	6.5	6.9	7.1	7.4	7.4	7.1	75.2
22-94 BN	6.5	5.5	5.8	2.5	2.9	4.0	5.6	6.4	6.6	6.8	6.8	6.6	66.4
22-94 Dry	5.1	4.2	4.3	2.0	2.3	2.9	4.3	4.8	4.9	5.1	5.1	4.9	49.4
22-94 Crit	5.0	4.2	4.2	1.2	1.3	1.6	2.0	2.2	2.3	2.4	2.3	2.2	22.3
STDEV													
22-94 Avg	2.2	1.9	2.1	1.9	1.7	1.7	1.9	2.0	2.0	2.1	2.1	2.1	21.7
22-94 Wet	1.2	1.1	1.5	1.5	0.9	0.4	0.5	0.5	0.6	0.6	0.6	0.6	6.5
22-94 AN	2.5	2.1	2.2	1.6	1.1	0.6	0.6	0.7	0.7	0.7	0.8	0.8	8.8
22-94 BN	1.8	1.6	1.9	2.1	1.7	1.4	1.1	0.7	0.7	0.8	0.8	0.7	7.2
22-94 Dry	2.6	2.2	2.3	1.2	1.2	1.1	1.4	1.4	1.4	1.5	1.5	1.4	13.1
22-94 Crit	2.3	1.9	2.0	1.4	1.1	1.3	1.3	1.4	1.5	1.5	1.5	1.5	11.6

Table A Deliveries South of Delta (TAF)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	236.3	209.5	203.2	92.9	133.0	172.7	217.4	290.5	356.5	380.2	367.6	282.4	2,927.7
22-94 Wet	270.4	237.1	236.3	144.7	197.6	235.1	270.9	354.0	434.0	461.7	444.7	344.1	3,684.8
22-94 AN	230.0	205.6	194.2	94.7	164.0	226.6	277.8	360.7	444.9	471.8	457.5	349.9	3,665.9
22-94 BN	259.1	231.5	225.2	86.3	123.0	180.1	238.5	336.6	416.9	441.6	427.9	327.2	3,320.7
22-94 Dry	202.0	180.2	170.8	68.9	95.9	126.9	188.7	254.9	310.9	335.1	324.1	248.4	2,491.1
22-94 Crit	201.1	178.0	170.4	40.3	55.5	70.8	87.3	114.4	137.5	150.1	145.2	111.2	1,111.2

STDEV													
22-94 Avg	84.4	75.9	77.7	64.1	72.8	75.5	81.3	104.1	129.0	135.7	131.8	101.2	1,050.5
22-94 Wet	45.1	41.9	54.6	51.0	39.7	18.7	21.7	31.1	38.4	40.3	44.4	30.3	299.4
22-94 AN	98.7	89.2	84.9	54.5	46.6	26.0	28.9	36.2	43.6	46.6	46.0	33.9	378.3
22-94 BN	70.2	64.0	68.3	72.8	74.3	63.6	53.0	39.7	48.8	51.3	50.8	39.1	360.2
22-94 Dry	104.8	94.4	89.8	40.2	51.9	49.4	63.1	80.0	101.9	104.6	101.6	78.2	712.8
22-94 Crit	90.3	81.1	78.6	47.0	48.1	59.1	63.2	83.1	95.5	109.1	106.0	81.1	658.5
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.0	0.0	2.1	16.8	32.4	63.4	7.1	0.4	0.0	0.0	0.0	0.0	122.2
22-94 Wet	0.0	0.0	3.6	33.5	39.8	105.7	13.4	0.0	0.0	0.0	0.0	0.0	188.2
22-94 AN	0.0	0.0	0.0	10.0	42.8	74.9	1.0	0.0	0.0	0.0	0.0	0.0	77.1
22-94 BN	0.0	0.0	0.0	0.0	24.8	59.8	10.1	1.5	0.0	0.0	0.0	0.0	88.9
22-94 Dry	0.0	0.0	0.0	3.7	24.1	40.0	5.4	0.6	0.0	0.0	0.0	0.0	106.3
22-94 Crit	0.0	0.0	6.4	30.3	30.7	15.3	0.0	0.0	0.0	0.0	0.0	0.0	104.5
STDEV													
22-94 Avg	0.0	0.0	12.5	46.4	61.6	70.1	18.8	2.7	0.0	0.0	0.0	0.0	127.7
22-94 Wet	0.0	0.0	16.4	60.2	64.3	56.9	23.5	0.0	0.0	0.0	0.0	0.0	122.1
22-94 AN	0.0	0.0	0.0	31.6	59.0	67.2	3.3	0.0	0.0	0.0	0.0	0.0	67.3
22-94 BN	0.0	0.0	0.0	0.0	55.1	77.6	22.3	5.8	0.0	0.0	0.0	0.0	83.4
22-94 Dry	0.0	0.0	0.0	14.7	62.6	65.3	19.6	2.3	0.0	0.0	0.0	0.0	142.1
22-94 Crit	0.0	0.0	22.2	70.7	71.6	53.1	0.0	0.0	0.0	0.0	0.0	0.0	167.1
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	1,950.2	2,009.0	2,130.4	2,300.1	2,486.4	2,670.6	2,928.8	3,039.5	2,853.2	2,401.8	2,103.4	1,984.5	
22-94 Wet	2,121.4	2,242.3	2,529.4	2,727.3	2,882.4	2,953.7	3,303.0	3,493.8	3,422.1	3,028.3	2,834.1	2,773.4	
22-94 AN	1,949.6	2,057.8	2,134.8	2,440.9	2,681.8	2,931.2	3,280.3	3,399.4	3,231.4	2,696.1	2,334.2	2,230.0	
22-94 BN	2,057.6	2,071.7	2,133.0	2,302.5	2,513.7	2,728.0	3,088.8	3,268.7	2,993.6	2,441.7	2,019.0	1,854.3	
22-94 Dry	1,816.8	1,854.9	1,918.2	2,030.2	2,272.4	2,568.1	2,753.8	2,793.2	2,524.6	2,033.3	1,678.8	1,508.6	
22-94 Crit	1,703.9	1,692.3	1,708.3	1,792.2	1,884.0	2,027.9	2,027.6	2,005.7	1,816.8	1,504.8	1,297.2	1,185.5	
STDEV													
22-94 Avg	704.1	731.9	715.7	650.8	559.5	505.4	566.2	610.4	638.8	607.1	636.4	679.8	
22-94 Wet	724.0	697.4	486.5	347.6	107.7	129.5	97.1	104.5	169.7	287.9	397.4	423.3	

22-94 AN	832.0	909.5	867.8	598.8	312.9	102.6	128.9	186.3	302.8	265.7	319.0	388.7	
22-94 BN	791.1	809.1	824.0	737.9	597.4	522.0	341.5	261.1	212.6	216.3	215.8	267.3	
22-94 Dry	618.9	644.3	638.2	610.0	523.3	451.7	426.9	349.8	316.4	229.1	193.5	251.7	
22-94 Crit	548.5	592.1	620.3	595.4	596.1	589.6	581.8	557.1	502.2	414.4	355.2	337.9	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	313.2	320.3	434.7	669.6	805.7	884.4	775.3	584.3	427.4	349.7	269.1	270.1	
22-94 Wet	357.8	417.8	573.2	808.3	935.0	1,005.9	902.2	717.2	589.1	493.3	391.3	416.6	
22-94 AN	237.5	255.8	415.7	721.6	889.2	1,015.4	889.6	641.9	427.2	331.8	240.5	229.4	
22-94 BN	278.8	274.6	359.3	625.1	805.7	900.9	766.2	525.1	299.4	224.5	152.3	114.4	
22-94 Dry	328.6	310.9	427.4	647.7	768.4	844.8	721.5	527.5	362.7	321.9	253.6	242.7	
22-94 Crit	318.1	269.1	305.8	464.7	559.5	596.6	540.1	448.8	380.4	296.5	236.2	266.0	
STDEV													
22-94 Avg	259.9	258.6	290.4	275.9	257.3	235.1	227.0	225.4	247.3	261.8	226.0	239.4	
22-94 Wet	332.2	304.2	299.2	205.0	183.4	128.2	143.8	214.9	263.8	323.5	281.8	297.1	
22-94 AN	113.8	163.0	230.8	230.1	142.4	62.2	84.3	122.9	177.5	213.1	184.8	197.5	
22-94 BN	225.8	218.4	245.0	262.7	253.1	205.2	171.3	146.1	126.7	118.3	78.9	59.7	
22-94 Dry	247.1	236.8	255.3	280.0	248.7	219.6	238.3	232.2	261.6	273.7	243.8	244.2	
22-94 Crit	276.6	295.6	351.5	319.2	298.7	276.5	272.7	267.5	237.9	196.7	159.7	151.4	

Compare Upstream-of-Delta Table A to Feather River Flows By Month and Alternative													
2020 Proposed Project													
2020 Table A Deliveries as a Percent of Feather River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.60%	0.26%	0.00%	0.00%	0.01%	0.14%	0.97%	0.91%	0.69%	0.59%	0.94%	2.54%	0.58%
22-94 Wet	1.32%	0.04%	0.00%	0.00%	0.00%	0.06%	0.60%	0.59%	0.76%	0.58%	1.19%	3.35%	0.43%
22-94 AN	1.48%	0.47%	0.00%	0.00%	0.00%	0.02%	1.50%	0.92%	0.89%	0.69%	0.98%	3.49%	0.60%
22-94 BN	2.02%	0.32%	0.00%	0.00%	0.00%	0.43%	2.64%	2.25%	0.58%	0.51%	0.82%	2.85%	0.80%
22-94 Dry	1.80%	0.48%	0.00%	0.00%	0.06%	0.38%	1.49%	1.91%	0.65%	0.62%	0.88%	2.13%	0.79%
22-94 Crit	1.47%	0.38%	0.00%	0.00%	0.09%	0.66%	0.79%	0.65%	0.47%	0.60%	0.79%	0.97%	0.52%

Compare North Bay Table A to Sacramento River Flows By Month and Alternative													
2020 Proposed Project													
2020 Table A Deliveries as a Percent of Sacramento River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	0.79%	0.54%	0.34%	0.14%	0.14%	0.19%	0.35%	0.48%	0.56%	0.53%	0.68%	0.75%	0.38%
22-94 Wet	0.76%	0.45%	0.21%	0.13%	0.14%	0.16%	0.25%	0.35%	0.51%	0.59%	0.77%	0.71%	0.32%
22-94 AN	0.80%	0.50%	0.36%	0.10%	0.13%	0.17%	0.37%	0.51%	0.65%	0.57%	0.76%	0.91%	0.39%
22-94 BN	0.91%	0.69%	0.52%	0.17%	0.15%	0.25%	0.51%	0.69%	0.64%	0.57%	0.71%	0.89%	0.49%
22-94 Dry	0.75%	0.55%	0.46%	0.21%	0.18%	0.21%	0.52%	0.67%	0.61%	0.48%	0.61%	0.73%	0.45%
22-94 Crit	0.77%	0.71%	0.60%	0.14%	0.16%	0.20%	0.34%	0.48%	0.37%	0.32%	0.38%	0.47%	0.28%

Compare Upstream-of-Delta Table A to Feather River Flows By Month and Alternative													
2020 Baseline and No Project and Alternatives 1 and 2													
2020 Table A Deliveries as a Percent of Feather River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.59%	0.26%	0.00%	0.00%	0.01%	0.14%	0.97%	0.89%	0.68%	0.58%	0.94%	2.44%	0.57%
22-94 Wet	1.34%	0.04%	0.00%	0.00%	0.00%	0.06%	0.60%	0.59%	0.75%	0.57%	1.20%	3.25%	0.43%
22-94 AN	1.47%	0.47%	0.00%	0.00%	0.00%	0.02%	1.49%	0.91%	0.90%	0.69%	0.97%	3.13%	0.60%
22-94 BN	2.04%	0.31%	0.00%	0.00%	0.00%	0.43%	2.53%	2.11%	0.57%	0.50%	0.81%	2.94%	0.79%
22-94 Dry	1.72%	0.47%	0.00%	0.00%	0.06%	0.40%	1.59%	1.69%	0.64%	0.61%	0.88%	1.95%	0.78%
22-94 Crit	1.48%	0.38%	0.00%	0.00%	0.09%	0.65%	0.78%	0.64%	0.47%	0.58%	0.79%	0.95%	0.51%

Compare North Bay Table A to Sacramento River Flows By Month and Alternative													
2020 Baseline and No Project and Alternatives 1 and 2													
2020 Table A Deliveries as a Percent of Sacramento River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.79%	0.54%	0.34%	0.14%	0.14%	0.19%	0.35%	0.47%	0.55%	0.53%	0.67%	0.75%	0.37%
22-94 Wet	0.76%	0.45%	0.21%	0.12%	0.14%	0.16%	0.25%	0.35%	0.51%	0.59%	0.77%	0.71%	0.32%
22-94 AN	0.80%	0.50%	0.35%	0.10%	0.13%	0.16%	0.37%	0.51%	0.65%	0.57%	0.75%	0.89%	0.39%
22-94 BN	0.91%	0.69%	0.53%	0.17%	0.15%	0.25%	0.50%	0.68%	0.63%	0.56%	0.70%	0.89%	0.48%
22-94 Dry	0.74%	0.55%	0.46%	0.21%	0.17%	0.21%	0.52%	0.66%	0.60%	0.48%	0.61%	0.71%	0.45%
22-94 Crit	0.76%	0.70%	0.59%	0.14%	0.15%	0.20%	0.34%	0.47%	0.36%	0.31%	0.37%	0.47%	0.28%

I. HISTORICAL ANALYSIS REPORT AND MEMORANDUM (STUDY NO. 1)

Effects of the Monterey Amendments and Alternatives on Historic State Water Project Allocations

California Department of Water Resources

August 2007

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EXECUTIVE SUMMARY

The purpose of this study is to use historical data to evaluate the effects of the Monterey Amendments and other alternatives for the Monterey Plus EIR on State Water Project (SWP) water supplies to contractors. The analysis relies on numerous assumptions that may not necessarily reflect what actually could have occurred in the absence of the Monterey Amendments, but the results provide useful data to quantitatively assess some effects of the Monterey Amendments. This study uses historic SWP contractors' requests and other data to evaluate SWP allocations from 1996 to 2005. Because SWP water supplies were not sufficient to meet SWP contractor demands in all years from 1996 to 2005, the Baseline's pre-Monterey Amendments Article 18(a) allocation provisions for water shortages would have substantially affected SWP allocations.

To report the effects of the proposed project, this study organizes the SWP contractors into four groups based on whether a contractor is an Agricultural (AG) or Municipal and Industrial (M&I) contractor and whether a contractor participated in a proposed project-related Table A transfer or retirement (Table HA-6). These are the two most significant factors affecting Table A allocations under the proposed project. The proposed project's Article 18(a) changes reduced M&I Table A allocations in some years of this analysis. M&I contractors that purchased Table A amounts from AG contractors reduced or eliminated the effect of the proposed project's Article 18(a) changes. In contrast to M&I contractors, the proposed project's Article 18(a) changes increased Table A allocations for AG contractors. Agricultural contractors that reduced their Table A amount through a transfer or retirement received less water in some years when this reduction was not offset by the increase in AG Table A allocations caused by the proposed project's Article 18(a) change.

The annual effect of the proposed project's Article 18(a) change depends on the SWP's annual hydrology because the inability of the SWP to satisfy 100% of Table A requests in any year activates the Article 18(a) AG-first reduction in the Baseline. This reduction, however, is limited to a cumulative total of 100% over a seven-year period. Consequently, there may be years in any seven-year period when there is no effect from the proposed project's Article 18(a) changes because the Baseline's cumulative limit on Article 18(a) AG-first reductions has been reached. In these years, the Department applies Article 18(a) the same way in the proposed project and the Baseline. This occurred in 2003-2005.

The proposed project included and possibly facilitated many individual Table A transfers from AG contractors to M&I contractors. In general, AG contractors that sold Table A amounts receive reduced Table A allocations, while M&I contractors that purchased Table A amounts receive increased Table A allocations. The specific change in Table A allocation will vary depending on the size of the Table A amount transferred and the annual SWP Table A allocation. The straightforward effect of a Table A transfer, however, interacts with the other effects of the proposed project, especially the Article 18(a) revision. This occurs because the proposed project's Article 18(a) effects can exercise a greater influence on Table A allocations in some years than the proposed project's Table A amount transfers. In the case of some contractors, such as Zone 7 and Castaic, the Table A amount transfer's effect clearly dominates Table A allocations because these contractors increased their Table A amounts by 33% and 40%, respectively, through proposed project-related transfers.

Finally, the study showed that the Monterey Amendments' retirement of 45,000 AF generally increased allocations by a small amount for most contractors. This effect occurs in every year of the study, but the Article 18(a) changes and Table A transfers overshadow its effect for many contractors. This effect is most noticeable in contractors that did not purchase Table A amounts and in years when the Article 18(a) AG-first shortage provision is not applied.

The No Project Alternative 1 (NPA1) alternative had few Table A allocation effects because it did not include any Table A retirements or any revisions of Article 18(a) procedures. The only effects of NPA1 were changes in specific SWP contractor's Table A allocations if they engaged in Table A amount sales or purchases. Contractors that purchased Table A amounts in NPA1 received higher allocations of Table A water in NPA1 than the Baseline. Contractors that sold Table A amounts received lower Table A allocations than in the Baseline.

The Court-Ordered No Project (CNP) alternatives invoke Article 18(b) of the SWP contracts, which reduces the total SWP Table A amount to 1.9 million acre-feet (MAF) by proportionately reducing all contractors' Table A amounts accordingly. The CNP greatly reduces Table A allocations to all contractors, but there is a much higher likelihood that all contractors will annually receive 100% of their reduced amount. In years when there is less than 1.9 MAF of water available to the SWP, CNP causes no Table A allocation changes.

Under current operations, there would be many years when the SWP water supply available for allocation exceeds 1.9 MAF. In these years, it is unclear how the Department of Water Resources (the Department) would allocate the remaining water after it satisfied all Table A amount requests. For this reason, CNP is subdivided into two possible alternatives, CNP Alternative 3 (CNPA3) and CNP Alternative 4 (CNPA4). The CNPA3 allocates all the remaining water that can be allocated and scheduled for delivery according to each contractor's share of the total Table A amounts. In CNPA3, the water available beyond 1.9 MAF is called XA water, shorthand for ex-Table A water. The CNPA4 allocates all remaining SWP water that can be allocated and scheduled for delivery according to the allocation rules in Article 21 of the pre-Monterey SWP contracts; essentially, the water available beyond 1.9 MAF is referred to and treated as scheduled surplus water. In short, both CNPA3 and CNPA4 reduced water allocations to almost all M&I (Municipal and Industrial) contractors while increasing water allocations to AG (Agricultural) contractors.

CNPA3 reduced overall water deliveries to selected M&I contractors by 9 – 22% during 1999-2002 and caused minimal reduction (1%) in 1996-1998 due to the available water beyond the 1.9 MAF. Article 18(a) was not as beneficial to contractors with M&I Table A amounts in CNP because there is less M&I Table A that received priority when 18(a) was applied. Conversely, contractors with AG Table A received increased allocations, especially in 2001(290%), in years when Article 18(a) was applied. The application of Article 18(a) to only the reduced 1.9 MAF of Table A amount instead of the Baseline's 4.2 MAF is responsible for virtually all the effects of CNPA3.

CNPA4 reduced overall water deliveries to most M&I contractors by 2– 40% during the 1999-2005 time period. During the years from 1996 through 1998, there was enough water to prevent any reduction in deliveries. The reduced application of 18(a) to only 1.9 MAF accounts for some of these changes, but more importantly, the allocation of scheduled surplus water in accordance with the pre-Monterey Article 21 allocates most of the remaining scheduled surplus (SS) water to AG contractors. This increased total water allocations to AG contractors during 1999-2005. A few M&I contractors that were assigned high levels of groundwater replenishment use also received higher allocations in some years in CNPA4.

1.0 INTRODUCTION

This study uses historical data to evaluate the effects of the Monterey Amendments and other alternatives on SWP Table A allocations. It focuses on the provisions in each alternative that have the greatest effect on the Department's SWP allocations to SWP contractors in each alternative. These provisions are changes in the Table A amounts of certain SWP contractors, modification of Article 18(a) provisions, and invocation of Article 18(b).

Note: This report utilizes terms such as: proposed project, No Project Alternative 1, Court-Ordered No Project Alternative 3, etc. These terms are used in order to stay consistent with the Monterey Plus EIR. For a more thorough explanation of the proposed project and alternatives, refer to the appropriate chapter in the main body of the Monterey Plus EIR.

1.1 Period of Analysis

The period 1996-2005 provides an interesting set of years to evaluate the EIR's alternatives. The period 1996-2000 was a consistently "wet" period, while the 2001-2005 period was variable with "dry" and "wet" years. The SWP contractors' Table A requests during 1996-2000 was variable and less than the total maximum Table A amount of the SWP, but requests after 2000 were almost uniformly equal to the contractors' total maximum Table A amounts. As a result, the SWP had sufficient water supply available to satisfy all contractor requests for water during 1996-1999, but the SWP contractors' requests for water exceeded the SWP's water supply during 2000-2005. Also, beginning in 1996, SWP contractors made numerous proposed project-related Table A amount changes and transfers.

In hindsight and assuming that the SWP did not adopt the Monterey Amendments in the mid-1990s, the interaction of California's annual hydrology and SWP contractors' water requests on the SWP's annual water allocations would have challenged the Department's management of the SWP. Unable to fully satisfy all Table A requests, the Department would have had to impose Article 18(a) reductions on agricultural contractors in order to meet the requests of M&I contractors. Tables HA-1 and HA-2 show the probable Article 18(a) allocation actions that the Department would have executed during 1996-2005 under the Baseline contractual provisions that existed prior to implementation of the Monterey Amendments. Due to the post-1999 water allocation shortages, the Baseline's pre-Monterey Amendments Article 18(a) allocation provisions for water shortages would have substantially affected SWP allocations during these years. Comparing each alternative's 1996-2005 allocations to the Baseline's 1996-2005 allocations demonstrates the effects the alternatives' water shortage provisions have on SWP allocations.

The Baseline's Article 18(a) water shortage provisions only affect SWP allocations in years when the SWP does not have enough water available to meet SWP contractors' requests. Analysis of the 1996-1998 period demonstrates that Article 18(a) effects of the proposed project and NPA1 on allocations were non-existent because the SWP had sufficient water supply to fully satisfy requests. In addition, since SWP contractors made relatively few changes to SWP Table

A amounts during 1996-1998[1], the proposed project's and NPA1's various Table A changes did not substantially alter the SWP's allocations during any year within this period. The 1996-1998 years also showed that the CNP did not have a net affect on the amount of water the contractors ultimately received because the SWP had enough available water to satisfy all contractors regardless of invocation of 18(b). For the above reasons, this study focuses on results from 1999 to 2005.

1.2 SWP Allocations vs. SWP Deliveries

This study evaluates the EIR alternatives' effects on SWP Table A allocations[2]. Because the EIR team utilized CALSIM II to simulate SWP deliveries, the analyses of CALSIM II deliveries may show different results than this study's analyses of SWP allocations. The difference between each contractor's requests and the contractor's deliveries varies among contractors and from year to year.

2.0 METHODS

This section describes the variables, assumptions, and analytical methods used in this study.

2.1 Baseline Assumptions

This study uses adjusted SWP Annual Table A amounts to SWP water data to establish annual Baseline deliveries to SWP contractors from 1996-2005.

2.1.1 SWP Water Supply

This study uses final State Water Project Analysis Office (SWPAO) *Notices to State Water Project Contractors*[3] to determine the total SWP water supply available for meeting contractors' annual requests. The Department usually announces the SWP's final annual water supply in late spring after extensive evaluations of Central Valley hydrological data. This study assumes that the Baseline's SWP water supply and alternatives' water supply in all years would have been identical to the actual historical water supply available to the SWP. In addition, this study assumes in the Baseline and all alternatives that the Department would not have acquired additional water for the SWP to allocate through altered operations or from other sources.

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[1] Dudley Ridge and KCWA collectively retired 45,000 AF of Table A amount, and Mojave acquired 25,000 AF of Table A amount from KCWA in 1998. These actions would have slightly affected the individual allocations to Dudley Ridge and KCWA and Mojave, but the Table A changes did not affect total SWP Table A allocations because all contractor Table A requests were fully met during 1996-1998.

[2] SWP Table A allocations are different from SWP water deliveries. SWP contractors may request their full Table A amounts, receive a smaller Table A allocation, and then take only a portion of their allocated Table A water for delivery in that year. Therefore, a contractor's annual "request" can differ from its actual "demand," and Table A allocations may differ from actual water deliveries.

[3] The SWPAO Allocation Notices are available at http://www.swpao.water.ca.gov/notices/index.cfm.

2.1.2 Table A Amounts

Each contractor's annual Table A amount is an essential component of this historical analysis because it determines the Department's allocation of water among all the SWP contractors. A contractor's Table A amount indicates the maximum amount of Table A water it may request in a particular year and the maximum Table A that the Department will allocate to it in that year. Each contractor determined schedules for their annual Table A amounts during the original SWP contract negotiations and approvals. In general, most contractors' Table A amounts started out fairly low when the project first began operating in the 1960's, but then ramped up in successive years. Some contractors' Table A amounts reached their maximums by 1994, but other contractors' Table A amounts continued to increase. Other contractors amended their contracts to change their scheduled Table A amounts. Because of these complexities, the study carefully tracked Table A amounts in each year to ensure that scheduled contractual increases in Table A amounts did not influence or confound the evaluation of the proposed project or alternatives.

In each year of analysis, the study uses each contractor's actual, historic Table A amount for the years 1996-2005. Since some of these include the proposed project's Table A transfers and Table A retirements, this study computes Baseline Table A amounts by removing the proposed project-related Table A changes from the contractual Table A amounts. Removal of proposed project-related Table A changes and retention of other Table A changes unrelated to the proposed project ensures an accurate determination of effects and not exaggerated or artificial effects due to other unrelated changes in a contractor's Table A amount[4]. The need for careful construction of the Baseline in this analysis is because of the complexity of analyzing the past impacts of proposed project actions that have already been completed in the midst of many other non-proposed project actions that have also been completed in the past. Table HA-3 lists the contractors whose actual, historic Table A amounts were adjusted to create their Baseline Table A amounts. Table HA-3 also indicates the reason for the Table A amount adjustment.

[4] For example, if Contractor X had an actual Table A amount of 100 TAF in the year 2000, but 25 TAF of this was the result of a Project-related Table A amount transfer implemented in the year 2000, then the Baseline Table A amount for Contractor X in 2000 would be 75 TAF (100 - 25 TAF). If Contractor X had a Table A amount in 1999 of 150 TAF, but it entered into an independent, unrelated 10-year agreement with the Department to reduce its Table A amount by 75 TAF in every subsequent year, its Table A amount in the Baseline for the year 2000 would remain 75 TAF. If the year 2000 Baseline Table A amount for Contractor X was set or "frozen" at the 1999 amount, however, it would be 150 AF in 2000. In this case, a comparison of the Baseline to the Project would indicate that the Project caused a reduction in Contractor X's Table A amount of 50 AF in the year 2000 (150 AF compared to 100 AF). This is clearly an erroneous conclusion because the fact is that the Project in this example included a purchase of 25 AF of Table A amount from another contractor, which was implemented in 2000. The real effect of the Project in the year 2000, then, must be an increase in X's Table A amount of 25 AF (100 AF compared to 75 AF). This brief example shows that including the non-Project related Table A amount changes in the Baseline as well as the Project reveals the true effect of the Project and the Project only. Conversely, failing to adjust the Baseline Table A amounts to incorporate actions that have already occurred obscures results and can even lead to opposite, erroneous conclusions about the effects of the Project. In this example, the "frozen" Baseline method would have led to the conclusion that the Project caused a decrease in Contractor X's Table A amount, and related water allocations, when in fact the proper effect determination is that the Project caused an increase in Table A amount and related allocations.

2.1.3 Baseline Table A Requests

The requests[5] of the SWP contractors in each year are another important component of the historical analysis. The study uses the actual historical requests of AG and M&I contractors to estimate SWP contractors' requests for the Baseline. Since the 1980's, Agricultural contractors routinely requested 100% of their Table A amounts. This study assumes that agricultural contractors' requests remained 100% of their Table A amounts for the Baseline and all alternatives[6].

By the 1990's, many M&I contractors were also requesting their full Table A amounts. In 1999 and 2000, there were still a few M&I contractors that did not request 100% of their Table A; the most notable example is MWD, which holds almost 50% of the total SWP Table A. However, in 2001 and all subsequent years, all contractors requested 100% of their Table A amounts.

An important effect of these assumptions is that the Baseline's total AG Table A amounts and total SWP Table A requests are greater than the historic total AG Table A amounts and requests that occurred during 1996-2005. Table HA-4 lists the Table A amount values used by this study for each contractor in each alternative. In these years, the Baseline AG Table A amounts are greater than in the proposed project because the Baseline has no retirement of Table A amounts. Additionally, since this study assumes that AG contractors always request 100% of their Table A amounts and several M&I contractors that acquired Table A amounts did not request 100% of their Table A amounts in several years of this study, the Baseline has a greater total SWP Table A request than the proposed project.

2.2. Assumptions for Evaluation of Alternatives

To represent each alternative most accurately, the study made assumptions about certain variables, particularly those that change in the alternatives. Table HA-5 lists this study's provisions or assumptions for the Baseline and each alternative regarding the major variables that are the focus of this analysis.

2.2.1. Monterey Plus

The proposed project incorporates all Table A actions that occurred after implementation of the Monterey Amendments during the period 1996-2005. The proposed project's Table A amounts include the actual Table A transfers from KCWA and Tulare to SWP M&I contractors. It also includes the retirement of Table A amounts by KCWA and Dudley Ridge. Additionally, the proposed project alternative includes Dudley Ridge's purchase of 3,973 acre-feet (AF) of Table A amount from Tulare. Table HA-4 summarizes Table A amounts under the proposed project.

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[5] Request and demand are often used interchangeably, but the two words have different meanings in the context of the SWP. It is also important to understand that what contractors request often differs from what they actually end up taking from the SWP in the form of deliveries, which complicates any attempt to compare actual delivery values with values predicted by this historic analysis.

[6] The study also assumes that CLWA requests all of the transferred 12,700 AF of Table A that it acquired from Devil's Den.

This study uses the final SWPAO *Notice to State Water Project Contractors* to determine total SWP requests in each year. These actual requests occurred after implementation of the provisions in the Monterey Amendments.

2.2.2 No Project Alternative 1

This study assumes that No Project Alternative 1 (NPA1) does not invoke Article 18(b) and that the Monterey Amendments are not in effect. It also assumes that transfers of Table A amounts remain the same as found in the Baseline. Since this study utilizes historic SWP water supply determinations to determine alternatives' allocations and the SWP did not develop conservation storage in the Kern Fan Element property during 1996-2005, this study does not evaluate the potential water allocation effects of SWP storage in the Kern Fan Element property.

2.2.2.1 NPA1 Table A Amounts

As mentioned, this study incorporates the Table A amount transfers already implemented as part of the proposed project. The NPA1 assumes that no contractor would retire Table A amounts.

To evaluate the effects of Table A transfers, this study maintained the distinction between Agricultural Table A (AG Table A) and Municipal and Industrial Table A (M&I Table A) for each contractor's Table A amount. In this study, the designation of AG or M&I always remains with the Table A amounts regardless of whether they are transferred from an AG contractor to an M&I contractor because this allows Article 18(a) to be effectively implemented.[7]

The study also assumes that the transfers would have been implemented in the NPA1 in the same year they were actually implemented in the proposed project. Table A amounts of other SWP contractors did not change as a result of NPA1 and remained the same as those in the Baseline, listed in Table HA-4.

2.2.2.2 NPA1 Table A Requests

As noted earlier in the Baseline discussion, this study uses the actual historical requests of agricultural and M&I contractors as the requests for the Baseline and the NPAs. Agricultural contractor requests remain 100% of Table A in all scenarios.[8] M&I requests also remain the same in all scenarios. NPA1's Table A requests are greater than the proposed project's total SWP requests, for the same reason as explained in the Baseline discussion.

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[7] Although the SWP long-term water supply contracts did not designate each contactor's Table A amount as "AG" or "M&I" for purposes of applying 18(a), the amounts and proportions of contractors' Table A used for agriculture and Table A used for M&I affected SWP allocations during dry periods. The preservation of the AG and M&I designations is included in the provisions of the 1991 Table A transfer from Devil's Den Water District to Castaic Lake W.A.; Castaic Lake's contract amendment for the Table A acquisition included Castaic Lake's agreement to classify water requests for the acquired Table A amount as agricultural use.

[8] The study also assumes that CLWA requests all of the transferred 12,700 AF of Table A that it acquired from Devil's Den.

NPA1's total of AG Table A amounts is greater than the proposed project total of AG Table A amounts because the NPAs include fewer transfers of AG Table A amounts to M&I contractors and there is no retirement of Table A amount by KCWA and Dudley Ridge. Since M&I contractor requests were not 100% of their Table A until 2001, while agricultural contractors always request 100% of their Table A during the analysis period, some initial Table A transfers reduced requests associated with AG Table A amounts.

2.2.3 Court-Ordered No Projects

In September 2000, the California State Court of Appeal ordered the Department to analyze a no project alternative that included invocation of Article 18(b) of the pre-Monterey Amendments long-term water supply contracts. The Court-Ordered No Projects (CNP) analyze the Department's invocation and implementation of Article 18(b). The proposed project, in fact, eliminated Article 18(b) from the SWP contracts. Part of the value of analyzing the implementation of Article 18(b) in the CNP is to assess the effects of the elimination of Article 18(b). Article 18(b) of the original long-term water supply contracts stated that in the case of a permanent shortage of SWP water the Director could reduce all contractors' Table A amounts to the minimum project yield as determined by special coordinated operations studies conducted by the Department.

Although Article 18(b) was part of the original long-term water supply contracts, the Department had never invoked it during the first 30 years of SWP operation. Consequently, there is no course of practice or routine methodology to guide development of this alternative. This study analyzes the effects of invoking of 18(b) during 1996-2005. As previously mentioned, the CNP results are not only useful to demonstrate the effects of invoking Article 18(b), but also to determine the proposed project's effect of removing Article 18(b) of the SWP contracts because evaluating what possibilities were lost with the removal of Article 18(b) is only possible if the effects and usefulness of invoking Article 18(b) are examined. Department staff developed the CNP based on interpretations and predictions of what might occur (might have occurred) if the Director invoked Article 18(b). Department staff also used the Settlement Agreement, the Third District Court of Appeal's *PCL et al. v. Department of Water Resources* decision, and EIR committee comments to develop CNP's description.

2.2.3.1 CNP Table A Amounts

In the CNP alternatives, the Department reduces the total Table A amount of the SWP to the "minimum project yield." CALSIM II modeling studies performed as part of the Monterey Plus EIR effort determined that the total SWP Table A amount should be reduced to 1.9 MAF. The 1.9 MAF amount is close to, but actually less than, numerous values reported in Department publications.[9]

To determine contractors' Table A amounts, all contractors' Baseline Table A amounts were reduced proportionately regardless of whether they were agricultural or municipal contractors. The reduction procedure multiplied each contractor's Table A amount in a particular year by the

[9] See Bulletins 160-87 (p.24), 160-93 (p.63), 160-98 (p.3-33), 132-90 (p.86), 132-93 (p.18).

fraction of 1.9 million divided by the total Baseline SWP Table A amount for that year. This procedure decreased each contractor's Table A amount by roughly 52% each year. Table A amounts for the CNP are listed in Table HA-4.

2.2.3.2 CNP Table A Requests and Ex-Table A Requests

This study used actual historical requests of each contractor to determine the Table A requests for the CNP. Historically, only a few contractors requested less Table A water than their new, reduced Table A amount under the CNP. As a result, the vast majority of contractors request all their Table A amount in the CNP during 1996-2005.

In most cases, a contractor's historical Table A request exceeds its CNP reduced Table A amount. As a result, requests for SWP water remain after all Table A amounts have been filled. In the Baseline, that requested water is simply part of contractors' Table A requests, but in the CNP it can not be considered part of the Table A requests because the contractors do not have that much Table A amount. Consequently, this study computes the difference between each contractor's historical Table A request and its CNP Table A request and considers this amount an additional request for additional SWP water.[10]

2.3. Allocation Methods

Earlier discussion described the classification of Table A amounts as either AG or M&I. The CNP analysis also keeps AG Table A and M&I Table A separate, chiefly for implementation of Article 18(a).[11]

2.3.1 AG and M&I Table A Amounts

If contractors' requests exceed the SWP's water supply in any year, the Baseline's Article 18(a) requires a reduction in agricultural allocations before reducing municipal allocations. To analyze how Article 18(a) and the revisions of Article 18(a) in the proposed project affect Table A allocations, this study assumes that the AG and M&I labels that were attached to Table A amounts in the Baseline remain with those Table A amounts regardless of whether a contractor transfers Table A amounts in the NPAs. This practice is consistent with the Department's treatment of the 12,700 AF of Table A amount that CLWA purchased from Devil's Den Water District in 1991.

[10] For example, assume Contractor X had a Baseline Table A amount of 100 AF in the year 2000 and requested all 100 AF of its Table A, then Contractor X would only have 45 AF of Table A amount in No Project B in that year. For the year 2000 in No Project B, Contractor X's Table A request would be 45 AF and its additional SWP water request would be 55 AF.

[11] The literal language of Article 18(a) does not expressly call for such a rigid distinction between AG and M&I Table A amounts. Instead, Article 18(a) uses the terminology agricultural, groundwater, and municipal uses.

2.3.2 SWP Water Supply

Each year the SWP determines the amount of Table A water for delivery to its contractors. The amount allocated depends on the hydrology, SWP operational capabilities, and regulatory limitations of that particular year. The SWP water supply for Table A allocation is the most crucial input in the historic analysis.

This study uses the historic final SWP Table A allocations during 1996-2005 to represent the maximum amount of Table A water available to the SWP in each of those years and for all alternatives. In effect, this assumption made the historical SWP allocation in each year the total amount of water that could be allocated as Table A under any of the alternatives in that year.[12] While use of the historic SWP water supply may not be 100% accurate in all years because the SWP may have had additional water available for delivery if contractors had requested it, the assumption is accurate for years when the actual SWP allocation did not fully satisfy requests. This occurred in 2000-2005.

2.3.3 Allocation Calculations

This study's allocation procedure uses the same general methodology for the proposed project and all alternatives. The first step is to distribute the total available historic SWP Table A water supply for each year into two general blocks based on total Agricultural and total M&I Table A requests. This initial distribution of Table A water varies between the Baseline, proposed project, and alternatives because Article 18(a) is applied differently and because the size of the blocks differs depending on the total SWP AG and M&I Table A amounts.

After determination of a bulk quantity for the initial AG and M&I Table A blocks, the study further allocates Table A water to individual SWP contractors based on how much AG and/or M&I Table A amounts they have in a year relative to the total quantity of Table A that all contractors had in that year. If a contractor had both M&I and AG Table A, then the calculations included two separate calculations for that contractor, and the contractor's total allocation was a combination of AG and M&I Table A.

For 1999 and 2000, a few contractors still requested less than 100% of their Table A. For these contractors, the study's initial allocation exceeded those contractors' individual requests. Consequently, the study allocated water to meet 100% of those contractors' requests and allocated the remaining excess water (from the initial allocation of water to these contractors) to other contractors.

[12] As discussed, this assumption may not be totally accurate for years where all contractors received 100% of what they requested (1999-2000) because once all Table A requests have been fulfilled, the SWP may not operate in a manner to maximize current year deliveries and therefore it is uncertain whether additional Table A water could have been allocated if the contractors had asked for it. Typically, when all Table A requests are fulfilled, the Department makes any additional water available as Article 21 water. But if requests for Article 21 water are less than the total supply of Article 21 water available to the project, and all EWA debts to the SWP in San Luis Reservoir have been repaid, the historic deliveries of Article 21 water may also not represent the true maximum possible Article 21 deliveries in that year.

2.3.3.1 Allocation of Table A in the Baseline

The pre-Monterey Article 18(a) applies in the Baseline; therefore, in years when the amount of Table A supply is insufficient to meet both AG and M&I Table A requests this study applies an Article 18(a) AG-first reduction to the initial AG Table A block. Note that the AG-first reduction has two constraints in the Baseline; it can not exceed 50% in any one year, and the size of any reduction can not exceed the 100% cumulative limit on AG-first reductions within a 7-year period. If either of these constraints is exceeded, this study applies equal additional percentage reductions to allocations of both the AG and M&I blocks until the sum of the two blocks equals the Table A water supply available that year (Table HA-8).

2.3.3.2 Allocation of Table A in the Proposed Project

Allocation of Table A in the proposed project is generally similar to the Baseline's method except there is no longer an AG-first reduction to the AG block of water. In any year where the amount of Table A water available to the SWP can not satisfy the AG and M&I requests, this study reduces the percent allocations to the initial AG and M&I blocks simultaneously and equally until the sum of water allocated to the AG and M&I blocks equals the amount of Table A water available to the SWP in that year (Table HA-11).

2.3.3.3 Allocation of Table A in NPA1

The procedures for allocating Table A water in the NPA1 are identical to the Baseline procedures. The actual allocations, however, differ because of Table A transfers that occur in NPA1. These Table A transfers change some contractors' percentage share of the Total AG Table A amounts and consequently change the amount of water a contractor receives from the initial AG block (Table HA-9).

2.3.4 CNP Water Allocations

This study allocates Table A water in CNP the same way as in the Baseline and NPA1; the Department satisfies Table A requests first using the same Article 18(a) provisions as in the Baseline and NPA1. As a practical matter, however, 18(a) applies less frequently because the available water supply to the SWP exceeds 1.9 million AF in most years and this is all the water required to satisfy 100% of the Table A requests in the CNP (Table HA-10).

The more complicated issue is the allocation of the remaining available water supply after satisfying the reduced Table A amount requests in the CNP. In this study, the Department considers two possibilities. One possibility treats the water as XA water, while the other treats the water as scheduled surplus water as discussed in the pre-Monterey Article 21. These methods are described below.

2.3.4.1 Allocating XA Water in CNP Alternative 3

One method to allocate the water remaining after all CNP Table A requests are satisfied is to make the XA water available to the contractors in proportion to their Table A amounts (or requests if a contractor requests less than its full Table A). This allocation would not differentiate between AG and M&I contractors. If a contractor's Table A amount (or Table A request) represents 10% of the total Table A amount of the SWP that year, then the contractor is allocated 10% of the available XA water. This method is called the CNPA3 method.

This allocation procedure results in allocations that are similar to the Baseline in many years, but it reduces the number of times Article 18(a) AG-first shortages need to be applied because the SWP often has 1.9 MAF to allocate. The CNPA3 method applies Article 18(a) and its AG-first shortage provision only to the 1.9 MAF of Table A amount, after that the contractors equally share in any water shortage if the XA water available is less than the total amount of requested water.

2.3.4.2 Allocating Scheduled Surplus Water for CNP Alternative 4

Another method to allocate the remaining water is to consider it scheduled surplus water and follow the applicable provisions of the pre-Monterey Article 21. Article 21 sets out a complicated procedure for allocating all surplus water based on geographic location and percent use of the water for agricultural or groundwater replenishment purposes. The details of the procedures are summarized below.[13]

The pre-Monterey Article 21 makes several geographic distinctions that affect allocations of scheduled surplus water. The first is a distinction between SWP contractors upstream and downstream of Dos Amigos Pumping Plant (Dos Amigos Pumping Plant is located near Los Banos, approximately 100 miles south of Banks Pumping Plant). Upstream contractors include Plumas, Butte, Yuba City, Napa, Solano, Alameda County, Zone 7, Santa Clara, and Oak Flat. All other SWP contractors are considered downstream contractors. Upstream and downstream groups of contractors receive scheduled surplus allocations based on the percent of agricultural and groundwater replenishment use each group has relative to the total agricultural and groundwater replenishment use of both groups.[14]

After this initial "block" distribution, there are additional procedures to allocate the blocks of scheduled surplus water to individual contractors in the upstream and downstream groups. For the upstream group, each contractor simply receives a share of the scheduled surplus designated for upstream contractors proportionate to their share of the total agricultural and groundwater replenishment use of the upstream group as a whole.

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[13] The procedure was developed using MWD's SWP long term water supply contract and any amendments to it that were enacted prior to MWD's execution of the Monterey Amendment.

[14] For example, assume the group upstream of Dos Amigos Pumping Plant has a combined demand of 100 AF for agricultural and groundwater replenishment use and the downstream group has a combined demand of 900 AF for the same use. The supply of scheduled surplus would then be allocated in proportion to each group's respective demand relative to the total demand of both groups; therefore, the upstream group would be allocated 10% of the scheduled surplus and the downstream group would be allocated 90% of the scheduled surplus.

Pre-Monterey Article 21 further subdivides the downstream group of contractors into three groups – San Joaquin, Central Coast, and Southern California contractors. Article 21 specifies that the "block" of scheduled surplus water for the downstream contractors should be split 69% to the San Joaquin group, 29% to the Southern California group, and 2% to the Central Coast group. After this step the scheduled surplus water is allocated to contractors within each group in the same way as it was in the upstream group; each contractor gets a share of the scheduled surplus water designated for its group in proportion to its share of the total agricultural and groundwater replenishment use of its subgroup.

If particular contractors within a group can not take all the scheduled surplus available to them, then other contractors within that group can take water allocated to their group before the water is made available to SWP contractors in other groups for agricultural and groundwater replenishment uses. Scheduled surplus water deliveries to contractors with municipal or industrial uses are a lower priority. The Department developed assumptions about each contractor's use of SWP water for agricultural, groundwater replenishment, and municipal uses to complete this study. Table HA-7 lists these assumptions for each contractor.

3.0 RESULTS

The annual net effect of each alternative is the annual difference between the Baseline's allocation and the alternative's allocation. As emphasized earlier, this study discusses the years 1996-2005 because some of these years demonstrate the alternatives' effects on allocations during a period when the SWP's water supply was less than the SWP contractors' requests.[15] To clarify the alternatives' effects, the discussion focuses on the relative effects of the alternatives' Article 18(a) provisions, Table A transfers, Table A retirements, and the CNP invocation of Article 18(b).

In order to make the presentation of results more concise and focused, this study organizes the SWP contractors into groups. In the proposed project analysis, two critical distinctions define four groups of contractors: the first distinction is whether the contractor is an Agricultural (AG) or Municipal and Industrial (M&I) contractor, while the second distinction is whether the contractor participated in a Table A transfer or retirement. Table HA-5 presents the four categories of contractors. Contractors within each of these groups experienced similar, if not identical, Table A allocation effects in each of the alternatives.

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[15] Although the SWP's 1999 allocation was 100% for all contractors, the 1999 allocation was based on the Monterey Amendment's provisions which included retirement of 45 TAF by agricultural contractors. Because this study fixes the available water supply for allocation in all alternatives at the historic 1999 SWP quantity, utilizes a Baseline that does not include the retirement of 45 TAF of agricultural contractors' Table A amount, assumes that agricultural contractors would have requested an additional 45 TAF of water (associated with the non-retired 45 TAF of Table A amount) in the Baseline, and assumes that the SWP did NOT have an additional 45 TAF of water available for allocation, this study's Baseline allocation includes a difference of 45 TAF between the Baseline's SWP water supply and the Baseline's total SWP contractor requests for Table A. In the absence of the Monterey Amendment's 45 TAF retirement, however, it is very likely that the SWP would have allocated an additional 45 TAF in 1999 and thereby satisfied all contractor requests.

3.1 Effects of the Proposed Project

In the Baseline, the original Article 18(a) “AG-first” shortage provision was applied when total SWP Table A requests exceed the SWP Table A supply during 1999-2002 (Table HA-8). There was no Article 18(a) AG-first cuts in 1996-1998. There was also no Article 18(a) AG-first cuts in 2003-2005 even though Table A requests exceeded Table A water supply in 2003-2005 because AG-first allocation reduction reached the Article 18(a) cumulative cap of 100% in a seven-year period in 2002. After 2002 allocations, the Department could not impose further AG-first reductions until 2006. Therefore, Article 18(a) reduces AG and M&I Table A allocations equally during 2003-2005. Note that the Baseline also applied equally shared reductions to all contractors in 2001 and 2002 in addition to AG first reductions.

Table HA-11 shows the proposed project’s effect on allocations for Agricultural and M&I contractors during 1996-2005. The difference in percent allocation between the proposed project and the Baseline causes the SWP to allocate large quantities of Table A water differently. Tables HA-13 and HA-14 list the quantities of Table A allocation changes for M&I and AG contractors in the proposed project compared to the Baseline. Tables HA-15 and HA-16 list the quantities of Table A allocation changes for M&I and AG contractors to the Baseline under NPA1. Tables HA-17 and HA-18 list the quantities of Table A allocation changes for M&I and AG contractors to the Baseline under the CNP alternatives.

Some contractors’ Table A requests in 1999 and 2000 were not 100% of Table A amounts. MWD and several other M&I contractors requested Table A amounts below their maximum contractual allowance in those years. These less-than-maximum requests made it easier for the Department to satisfy the total Table A request, forestalling application of Article 18(a). However, since 2001, virtually all SWP contractors have requested 100% of their maximum Table A amount in each year The SWP does not have sufficient water to fulfill all Table A requests in most years.

3.1.1 Effects of the Proposed Project on M&I Contractors With No Table A Transfers – Group One

Seventeen SWP M&I contractors that did not participate in transfers or retirements of Table A amounts are in Group One. Table HA-19 shows the proposed project’s effects on selected Group One contractors. The Table displays Santa Clara Valley, whose Table A amount of 100 TAF is a conveniently round number that makes evaluation easier; Santa Barbara, a contractor whose Table A amount is approximately equal to the median M&I Table A amount, and MWDSC, the largest SWP contractor that also has Table A amount changes that are unrelated to the proposed project. Note that Group One also includes KCWA’s M&I Table A amount

The Baseline’s allocations include AG-first cuts during 1999-2002 (Table HA-8). Although the Baseline includes a 6% Article 18(a) AG-first reduction for AG Table A allocations in 1999, the proposed project had no Article 18(a)-related effect on Group One’s Table A allocations in 1999 because the AG-first reduction did not increase M&I Table A allocations. In 2000-2002, the effects of the pre-Monterey Amendments’ Article 18(a) provisions were more pronounced because almost all SWP contractors requested 100% of their Table A (except MWDSC in 2000). In these years, the total SWP Table A requests (AG and M&I combined) were much greater than the SWP's Table A water supply available for allocation. The results demonstrate that the proposed project reduced allocations for all Group One contractors. The proposed project caused annual reductions in Table A allocation of approximately 26%, and 8% in 2001, and 2002, respectively (Table HA-19). The 45,000 AF Table A retirement by KCWA and Dudley Ridge slightly offsets the effect of the proposed project's Article 18(a) revision by slightly increasing allocations to all contractors. This effect is more evident in 2003-2005.

In 2003-2005, total SWP Table A requests were still greater than the water supply available for Table A allocation, but the Department could no longer impose Article 18(a) AG-first cuts in the Baseline because of the Article 18(a) cap of 100% in a seven-year period. Therefore, the Department applied equal reductions to Table A allocations of both M&I and AG Table A amounts. This study shows that in years when the Article 18(a) cap restricts Ag-first cuts, the Baseline's allocation cuts are identical to the proposed project's cuts under the revised Article 18(a); therefore, the proposed project's Article 18(a) provisions had no effect in these years, although the proposed project's 45,000 AF retirement slightly increased M&I allocations during 2003-2005 (Table HA-19).

3.1.2 Effects of the Proposed Project on Agricultural Contractors With No Table A Transfers or Retirements – Group Two

Four contractors are in Group Two: Empire Westside, Oak Flat, Kings, and Tulare. Table HA-20 shows the proposed project's effect on Group Two contractors. In many respects, the proposed project's effect on Group Two is the opposite of the proposed project's effect on Group One contractors. While contractors with M&I Table A lost allocation because of the proposed project's elimination of the AG-first shortage provision of Article 18(a), contractors with AG Table A received higher allocations. The 45,000 AF Table A amount retirement by KCWA and Dudley Ridge also slightly increased allocations for Group Two contractors in 1999-2005. There was no change in Table A allocation for Group Two contractors from 1996 to 1998.

During 1999-2002, Group Two received higher allocations from the proposed project due to the elimination of the Article 18(a) AG-first shortage provision and the 45,000 AF retirement. This beneficial effect was most pronounced in 2001. In that year, the Baseline included a 50% AG-first cut, the maximum allowed under the Baseline's original Article 18(a) provisions. The Baseline also included an additional 47% shared cut to all Table A across the board in 2001. As a consequence, Baseline deliveries to Group Two contractors were extremely low in 2001, approximately 3% of full Table A requests. The deliveries under the proposed project in 2001, on the other hand, were over twelve times these Baseline deliveries.

Once the Article 18(a) AG-first cumulative seven-year 100% cap is reached, the Baseline and proposed project allocations in 2003-2005 are very similar. The only difference is that the proposed project allocates slightly more water to Group Two contractors in each year due to the retirement of 45,000 AF of Table A amount (Table HA-20).

3.1.3 Effects of the Proposed Project on M&I Contractors With Table A Transfers – Group Three

This group includes six SWP M&I contractors that purchased additional Table A amounts from agricultural contractors. For the years prior to each Group Three contractor's Table A acquisition, Group Three contractors experienced the same Article 18(a) and 45,000 AF Table A retirement effects of the proposed project as the Group One contractors (Table HA-21). However, following their respective transfers, Group Three contractors received more water than Group One contractors. From 2002-2005 Group Three contractors received allocation increases of 13-78%.

The acquisition of additional SWP Table A amounts and the effect of AG requests associated with these Table A transfers have unique and direct effects on each Group Three contractor's Table A allocation. The following analysis discusses each of the Group Three contractors separately.

3.1.3.1 Napa County FC&WCD

In 2001, Napa purchased 4,025 AF of AG Table A amount from KCWA. The acquisition of AG Table A increased Napa's Table A allocation in 2001 and subsequent years, but the allocation provided by the additional Table A amount[16] was not enough to offset the effect of the proposed project's change to Article 18(a) in 2001. Napa still received a lower Table A allocation in 2001 than it would have in the Baseline, but the Table A acquisition decreased Napa's allocation reduction from 26% (Group One contractors) to only 9%.

In 2002, Napa's allocation from the Table A transfer[16] provided more water than Napa lost from the proposed project's Article 18(a) revision. Since the 2003-2005 Baseline allocations have no Article 18(a) AG cuts due to the provision's 100% limit, the proposed project's Article 18(a) changes did not reduce Napa's allocation and the 45,000 AF retirement increased Napa's allocation. The proposed project's Table A transfer further increases Napa's allocations so that Napa's final allocations are 14% to 24% above the Baseline's allocations during 2002-2005 (Table HA-21).

3.1.3.2 Solano County WA

Solano's purchase of 5,756 AF of AG Table A amount from KCWA became effective in 2001. Similar to Napa's results, implementation of the Table A transfer increased Solano's Table A allocation in 2001, but the transfer's allocation increases[16] did not offset the effect of the proposed project's Article 18(a) change. But Solano's Project allocation was only 16% less than the Baseline allocation rather than the 26% decline experienced by the Group One contractors.

Solano's 2002-2005 results are also similar to Napa's results. Solano's 2002 allocation from the Table A transfer provided more water than Solano lost from the proposed project's Article 18(a)

[16] The project's retirement of 45 TAF by KCWA and Dudley Ridge also increases all contractors' allocations by a small amount; the retirement-related allocation effects are much smaller than the Table A transfer effects.

revision. Since the 2003-2005 Baseline allocations have no Article 18(a) AG-first cuts due to the provision's 100% limit, differences in Solano's Project allocations in these years are not attributable to the proposed project's Article 18(a) revision. Instead, the differences between the proposed project and Baseline after 2001 result from the proposed project's Table A amount transfer and 45,000 AF Table A amount retirement. These increase Solano's allocations from 5% to 16% during 2002-2005 (Table HA-21).

3.1.3.3 Alameda County FC&WCD, Zone 7

Beginning in 2000, Zone 7 made several proposed project-related purchases of AG Table A amounts from KCWA and Tulare. These purchases increased Zone 7's Table A allocations in 2000 and all subsequent years of the historical study. Zone 7's percent increase in allocation ranged from 28% to 76% during 2000-2005.

Zone 7's acquisitions offset the reductions experienced by Group One contractors due to the proposed project's elimination of the AG-first shortage provision of Article 18(a). In addition, Zone 7's proposed project-related Table A amount acquisitions and the 45,000 AF Table A amount retirement raised Zone 7's SWP allocations above the Baseline allocations. In 2001, although Group One contractors suffered a 26% reduction in Table A allocation, Zone 7 received an allocation 28% greater than its Baseline allocation (Table HA-21).

3.1.3.4 Castaic Lake WA

Castaic previously purchased 12,700 AF of AG Table A amount from Devil's Den in 1991 before implementation of the proposed project; therefore, Castaic has 12,700 AF of AG Table A amount under both the Baseline and proposed project.

In 2000, Castaic purchased an additional 41,000 AF of Table A amount from KCWA.[17] These varying mixtures of Table A amounts in the baseline and proposed project interact to give Castaic a unique series of proposed project effects. The proposed project's elimination of the Article 18(a) AG-first cutback reduces Castaic's allocations for its 41,500 AF of Table A amount while concurrently increasing allocations for Castaic's 12,700 AF of agricultural Table A amount. In combination with Castaic's 41,700 Table A amount acquisition, the proposed project increases Castaic's SWP allocations from 66% to 78% during 2000-2005 (Table HA-21).

3.1.3.5 Mojave WA

Mojave was the first M&I contractor to acquire AG Table A amounts after signing the Monterey Amendments. Consequently, Mojave had 25,000 AF of AG Table A amount from 1998 to 2005 of this historical study. Mojave only requested 20,000 AF of Table A water in 1999, this affected

[17] The Monterey Amendment Settlement Agreement recognizes that this transfer is not finalized and is being implemented by DWR and CLWA on an interim basis. The transfer is included in this study to provide an estimation of the historic allocation effects of interim implementation and to allow predictions of future allocation effects.

its M&I allocation in 1999. Mojave's Table A allocations under the proposed project did increase in 2000-2005 by up to 52% due to the Table A amount acquisition and the previously discussed 45,000 AF Table A amount retirement (Table HA-21).

3.1.3.6 Palmdale WA

Palmdale purchased 4,000 AF of AG Table A amount from KCWA in 2000. This proposed project-related purchase and the 45,000 AF Table A amount retirement increased Palmdale's Table A allocation in five years (2000 and 2002-2005) by 13% to 25%. In 2001, however, Palmdale's Table A acquisition did not provide enough water to counteract the effect of the proposed project's Article 18(a) change, and Palmdale received a 9% reduction in Table A water allocation under the proposed project than it would have under the Baseline. But this reduction of 9% was less than the 26% reduction that Group One contractors experienced—and what Palmdale would have experienced if it had not purchased some AG Table A amount with implementation of the proposed project (Table HA-21).

3.1.4. Effects of Proposed Project on Agricultural Contractors With Table A Transfers or Retirements – Group Four

Group Four contains the two agricultural contractors that had proposed project-related Table A changes. KCWA and Dudley Ridge retired a combined 45,000 AF of Table A amount as specified in Article 53 of the Monterey Amendments. KCWA also transferred Table A amounts to various M&I contractors.

The 45,000 AF Table A amount retirement by KCWA and Dudley Ridge reduced their allocation by up to 8%; however, that reduction was offset by the proposed project's elimination of the Article 18(a) "AG-first" shortage provision. Consequently, the effects of the proposed project on the Group Four contractors vary depending upon the interaction of their Table A amount changes and the Article 18(a) changes. The following analysis discusses each of the Group Four contractors separately (Table HA-22).

3.1.4.1 Dudley Ridge

Dudley Ridge received a slightly lower Table A allocation in 1999 under the proposed project due to its retirement of 4.33 thousand acre-feet (TAF) of Table A amount. The 4.33 TAF retirements represented 8.1% of Dudley Ridge's Baseline Table A amount, but due to the proposed project's Article 18(a) change and KCWA's 40.33 TAF Table A amount retirement, Dudley Ridge's 1999 allocation fell only 2%. In 2001-2002, Dudley Ridge received a higher Table A allocation due to the proposed project's elimination of Article 18(a)'s AG-first allocation provisions and KCWA's Table A retirement.

3.1.4.2 KCWA

KCWA changed its Table A through transfers, sales, and retirement, which complicates its analysis. Similar to other agricultural contractors, KCWA received more water during 2000-

2002, due to the proposed project's Article 18(a) changes and Dudley Ridge's 4.33 TAF Table A amount retirement. The percent increase in KCWA's Table A allocation in each year of this period was less than other agricultural contractors because KCWA transferred AG Table A amounts during this period, which reduced its Table A amount below the Baseline Table A amount. In 2003-2005 when the Article18(a) "AG-first" cuts were not applied in the Baseline, KCWA still received a lower allocation of Table A under the proposed project because of KCWA's transfer and retirement of Table A amounts.

From an amendment to the long-term water supply contract, starting in 1998, KCWA sold Mojave 25,000 AF of its SWP entitlement. This was the first sale under the provisions of the Monterey Amendments that allow for the sale of 130,000 AF of agricultural entitlements to contractors for urban use.

A second factor also complicates any analysis of the proposed project's effects on KCWA. Although KCWA's Table A retirement and transfers confound the proposed project's Article 18(a) and Dudley Ridge Table A retirement effects, KCWA's Table A retirements and transfers apply to specific KCWA member agencies rather than uniformly to all of its member agencies. Thus, the "Group Four" effects described in this section apply to KCWA's member units that transferred Table A amounts.[18] Other member units of KCWA did not modify their SWP Table A amount contracts with KCWA; therefore, the proposed project's effects on these member units[19] are identical to Group Two contractors rather than Group Four (Table HA-22).

3.1.5. Summary of Proposed Project's Effects

As indicated in the introduction, the historical allocation study analyzes the effects of three major changes caused by the Monterey Amendments: Table A transfers, Table A retirements, and the Article 18(a) revision. The following text summarizes the results of these individual changes.

3.1.5.1 Effect of Table A Retirement

The proposed project's Table A retirements from KCWA and Dudley Ridge increase the Table A allocations of all other SWP contractors because the retirements reduce the total Table A requests of KCWA and Dudley Ridge and thereby leave a small amount of additional water available for allocation to all the SWP contractors. Theoretically, KCWA and Dudley Ridge benefit from the others retirement of Table A amount in the same way, but the incremental benefit is not sufficient to offset the allocation losses incurred by each contractor's own Table A amount retirement. The allocation percentage increase attributable to the retirements depends on the amount of water available to the SWP for allocation; however, since the 45,000 AF of Table A amount represents approximately 1% of the SWP's total Table A amount, the Table A retirement generally increased allocations in this study by 1% in years when all contractors requested their full Table A amount. This effect is highlighted in 2003-2005 when the Article

[18] Belridge Water Storage District, Berrenda Mesa Water District, Lost Hills Water District, and Wheeler Ridge-Maricopa WSD

[19] Cawelo WD, Henry Miller WD, Kern Delta WD, Improvement District No. 4, Rosedale-Rio Bravo WSD, Semitropic WSD, Tehachapi-Cummings County WD, and West Kern WD.

18(a) change does not affect allocations because the “agriculture-first” reduction was exhausted during 1999-2002.

3.1.5.2 Effect of Article 18(a) Change

The Baseline’s original Article 18(a) provision of the SWP long term water supply contracts shifted a large amount of Table A allocation from Agricultural to M&I contractors when the SWP could not satisfy all Table A requests. The proposed project eliminated this feature of Article 18(a), and instead required the Department to reduce all SWP contractors’ Table A amounts equally in years when the SWP Table A water supply could not meet all Table A requests.

In general, this change greatly increased agricultural contractors’ Table A allocations and reduces M&I contractors’ Table A allocations. This trend is evident in the analysis period, but the results also emphasize that the annual effects of the Article 18(a) change depend on the SWP’s annual hydrology and application of the Article 18(a) cumulative cap of 100% AG-first cuts over a seven-year period.

3.1.5.3 Effect of Table A Transfers

The proposed project included or possibly facilitated[20] many individual Table A amount transfers. Most of these were from agricultural contractors to M&I contractors. In general, agricultural contractors that sold Table A amounts receive reduced Table A allocations and contractors that purchased Table A amounts received increased allocations. The specific increase in allocation varies depending on the Table A amount purchased and the SWP Table A allocation in any particular year. Some contractors still receive lower or higher Table A allocations despite their participation in a Table A amount transfer because the proposed project’s Article 18(a) effects can exercise a greater influence on Table A allocations in some years than the Table A amount transfers. In other cases, such as Zone 7 and Castaic, the Table A amount transfers clearly had the greatest effect.

3.2 Effects of NPA1

NPA1 differs from the Baseline only because it includes all the Table A amount transfers included in the proposed project, except the 41,000 AF transfer from KCWA to CLWA. Although the EIR’s NPA1 includes operation of a SWP component in the Kern Fan Element property, this study assumes that SWP water supplies remain identical to historical SWP water supplies for 1996-2005; therefore, this study does not evaluate the potential allocation effects of an SWP component in the Kern Fan Element property. NPA1 implements Article 18(a) the same way as the Baseline. The allocation changes as a result of the Table A transfers are the only differences between SWP contractor allocations under the NPA1 and the Baseline. Contractors that purchased Table A amounts receive higher Table A allocations in NPA1 than in the

[20] The Monterey Amendments may have facilitated transfers by improving the reliability of agricultural contractors’ SWP supplies and by improving the value of agricultural contractors’ Table A amounts, making them more desirable to other water users.

Baseline, and contractors that sold Table A amounts receive lower Table A allocations in NPA1 than in the baseline. Tables HA-23 through HA-26 display these effects for the contractors with and without Table A transfers in the NPA1.

3.2.1 Effects of NPA1 on M&I Contractors With No Table A Transfers – Group One

The Group One contractors experienced almost no effects when the Baseline is compared to NPA1 (Table HA-23). These M&I contractors did not participate in any Table A transfers in NPA1; therefore, their allocations under the Baseline and the NPA1 are virtually identical. Castaic Lake Water Agency is a member of Group One because the 41,000 AF Table A amount transfer from KCWA is not included in NPA1. A greater AG-first reduction in any year would benefit Group One contractors because they posses mostly M&I Table A amounts.

3.2.2. Effects of NPA1 on Agricultural Contractors With No Table A Transfers or Retirements – Group Two

Group Two contractors experienced minor (up to 2% in 1999) changes to their allocations in NPA1 because they have no Table A amount changes and administration of Article 18(a) remains unchanged from the baseline (Table HA-24).

3.2.3. Effects of NPA1 on M&I Contractors That Transferred Table A – Group Three

Group Three contractors in NPA1 are the same contractors described in the proposed project with the exception of Castaic Lake Water Agency.[21] Castaic is not a part of Group Three because NPA1 does not incorporate the 41,000 acre-foot transfer of Table A amount that occurs in the proposed project. Consequently, Castaic is part of Group One for purposes of analysis of NPA1. Results are depicted in Table HA-25.

Group Three contractors experienced allocation increases in NPA1 from 2001 through 2005 because their purchases of AG Table A amounts increase their overall Table A amount, while Article 18(a) remains the same as in the Baseline. With the benefits of the AG-first reduction of the pre-Monterey Article 18(a), Group Three contractors gain from any purchase of AG Table A in NPA1. The annual allocation benefit of the purchased AG Table A to any particular contractor, however, varies because it is still subject to the Article 18(a) AG-first reductions. The actual benefit in Table A allocation to a particular Group Three contractor that purchased AG Table A is roughly equal to the amount of AG Table A purchased, discounted by the Baseline SWP allocation percentage to AG Table A in that year.

[21] Group Three in NPA1 includes Napa, Solano, Zone 7, Castaic, Mojave, and Palmdale

An interesting effect of NPA1 is the decreased SWP demand due to KCWA's transfer of 25 TAF of Table A amount to Mojave Water Agency in 1998. The assumptions of this study are that AG contractors requested their maximum Table A amounts since 1995; therefore, KCWA would have requested the 25 TAF of Table A amount in the Baseline. The historic requests, however, reflect that Mojave did not request the additional 25 TAF that it purchased until 2000. Consequently, there is a decrease of 25 TAF of SWP demand in NPA1 during the period 1998-1999. The period 1998-1999, however, was a wet period when contractor demands were not at their maximum and in which every contractor received 100% allocations every year; therefore, this slight decrease in SWP demand during 1998 and 1999 probably did not raise SWP Table A allocations for other contractors (Table HA-25).

3.2.4. Effects of NPA1 on Agricultural Contractors That Transferred Table A – Group Four

This analysis divided Group Four contractors into two categories. KCWA transferred Table A amounts to other contractors and thereby reduced its Table A amount during the analysis period. Dudley Ridge did not make any Project related transfers and therefore it experienced minor (up to 2% in 1999) changes to its allocation, similar to the NPA1 related effects to Group Two contractors. KCWA received lower Table A allocations after transferring Table A amounts. The amount of the reduction in Table A allocation depends on how much Table A amount was cumulatively transferred. This generally increased throughout the analysis period as KCWA more Table A amounts. As noted earlier in Section 3.1.4.2, KCWA's Table A amount transfers apply to specific KCWA member agencies rather than uniformly to all KCWA member agencies. KCWA member agencies that did not modify their portion of KCWA's SWP Table A amount have water supply effects identical to Group Two contractors.

While all AG contractors in this group are still subject to the AG-first reductions of Article 18(a), this effect is the same as in the Baseline and the only actions that affect Table A allocations in this analysis are the amounts of Table A possessed by each contractor. (See Table HA-26)

3.2.5. Summary of NPA1 Effects

NPA1's one major effect is either an increase or decrease in particular contractor's Table A allocations depending upon whether they purchased or sold Table A amounts. Contractors that did not change Table A amount experience no Table A allocation changes.

3.2.5.4 Long-Term Effects of NPA1

NPA1 and the Baseline demonstrate some of the implications of the mismatch between SWP contractors' Table A requests and SWP water supplies that began in the 1990's. Beginning during the 1996-2005 period and likely into the foreseeable future, the SWP could expect that contractors' water requests would exceed the SWP's available water supply for allocation in most years. The extent of this difference would depend upon annual hydrology and any additional facilities or projects the SWP completes in the future. In any event, the Department would be required to apply Article 18(a) AG-first reductions as often as permitted by Article 18(a). Only a string of multiple wet years where SWP water supplies for allocation exceeded contractors' requests (generally 4.2 MAF but perhaps as low as 3.3 MAF in some years when contractors' service areas experience exceptionally wet conditions) would interrupt this cycle of water allocation reductions.

Agricultural contractors would experience a reduced and unpredictable water supply as M&I Table A requests increased under both the Baseline and NPA1; however, under NPA1, some Agricultural contractors would receive even less water than in the Baseline because of participation in Table A amount transfers. On the other hand, M&I contractors would receive the same amount of water under the Baseline and NPA1, unless they purchased additional Table A amount which would increase their Table A allocation under NPA1.

3.3 Effects of CNP

<u>Table A Allocations</u>
CNP allocates Table A water using the same general method as the Baseline and NPA1; however, the Table A amounts possessed by the SWP contractors are lowest in CNP. As previously mentioned in the discussion of the Baseline and NPA1, Article 18(a) is applied in years when the SWP's Table A water supply is less than the total Table A amount request of all the contractors. In CNP, as in the Baseline and NPA1, the Article 18(a) AG-first reduction is limited to up to 50% in any one year and a seven-year running total of 100%. After all Table A amount requests have been satisfied, then any remaining water is allocated as scheduled surplus or XA water.

During the years 1996-2005, the SWP was able deliver 100% allocations of Table A water to both AG and M&I contractors in CNP every year except 2001. Conditions were so dry in 2001 that even though the SWP Table A amount totaled only 1.9 MAF there was still a need to apply the shortage provisions of Article 18(a) because there was roughly only 1.6 MAF of water available to the SWP to deliver. In 2001, M&I Table A requests received a virtually full allocation of 99.25%, but AG Table A requests only received an allocation of 49.25% (Table HA-10). As indicated by the percentages, the AG-first shortage was applied to the fullest extent allowed (50%) and then an additional shared reduction of 0.75% was imposed on both AG and M&I Table A requests. The Table A allocations in CNPA3 and CNP Alternative 4 (CNPA4) are identical. Differing allocations of so-called XA water and scheduled surplus cause the real differences in water allocations between the two CNP.

Several factors help clarify the results reported for the CNP. One factor to understand is that the effect of Article 18(a) in CNP is different from its effect in the Baseline because 18(a) is applied more frequently in the Baseline when the SWP Table A amount is not reduced. Refer to Table HA-12 to see the Table A water allocations for CNP. Secondly, the EIR assumes that there are no Table A transfers in CNP, so any effects of CNP are attributable to the difference in application of Article 18(a) and the difference in allocation of scheduled surplus and XA water.

3.3.1 Effects of CNPA3

Many contractors experienced the same effects as other contractors in CNPA3. As with the other discussions, the contractors can be grouped in categories. The general effects on each group of contractors are discussed below.

3.3.1.1 Effects of CNPA3 on M&I Contractors

CNPA3 reduced overall water deliveries to most M&I contractors by 9 – 22% during 1999-2002 and caused minimal reduction (1%) in 1996-1998 due to the available water beyond the 1.9 MAF. Article 18(a) was not as beneficial to contractors with M&I Table A amounts in CNP because there is less M&I Table A that received priority when 18(a) was applied.

M&I contractors that received only M&I Table A amounts were affected by CNPA3 similarly. Every contractor in this group requested 100% of its M&I Table A amount during 1996-2005. In general, all these contractors experienced a decrease in allocations of from 9% to 22% in 1999-2002, but CNPA3 had little effect on allocations during 2003-2005. The results for all contractors in this group are detailed in Table HA-28.

Note that MWD and Mojave did not request the maximum amount of water in 1998 and 1999. Consequently, CNPA3 affected these contractors differently than the rest of the group in those years (Table HA-28).

CNPA3's effect from 1999 to 2002 is a result of the reduced effect of Article 18(a) in CNPA3 compared to the Baseline. Recall that one of Article 18(a)'s biggest effects is to shift allocation from AG to M&I Table A amounts through application of the AG-first shortage provision when SWP Table A supplies are less than Table A requests. In CNPA3, however, Article 18(a)'s effect is reduced because it only applies to the first 1.9 MAF of SWP contractor requests.

Consequently, when SWP supplies are less than the Table A and XA water demand, M&I contractors only receive the Article 18(a) benefits for their initial Table A amount requests, which are lower than in the Baseline. After receiving their Table A allocation, these contractors get the remaining XA water allocation in proportion to the share of their Table A amounts compared to the total Table A amounts of the SWP. Article 18(a) does not apply to XA water allocations. This means that if there is a shortage of XA water, these contractors must equally share any reduction in XA water deliveries with all other contractors, including those with AG Table A amounts.

3.3.1.2 Effects of CNPA3 on Agricultural Contractors

AG contractors with only AG Table A amounts experienced the same allocation effects from CNPA3: reductions of 17% and 1% in 1999 and 2000, increases of 290% in 2001, and 31% increases in 2002. Contractors in this group received from 63% to 290% more allocation from the SWP from 1999-2002, but then experienced mixed effects from 2003-2005. Table HA-29 shows the detailed results for this group.

The increase in allocation for this group is basically the inverse of the previous group of M&I contractors. Article 18(a)'s AG-first shortage provision plays a decreased role in CNP because there is a lower total M&I Table A request that must be satisfied first. As mentioned, when Article 18(a) AG-first reductions are applied, it increases the allocation to M&I Table A amounts at the expense of AG Table A amounts. The years 1999-2002 are years when the AG-first reduction is applied in the Baseline, but it is only applied in 2001 in CNP. Contractors with AG Table A received increased allocations, especially in 2001(290%), in years when Article 18(a) was applied.

3.3.2 Effects of CNPA4

CNPA4 is more complicated than CNPA3 because the remaining available water is allocated according to the pre-Monterey Article 21 provisions. As discussed in Section 2.3.5.2, agricultural and groundwater replenishment use had the highest priority for allocation of scheduled surplus under this method. One of the key assumptions, therefore, is how much groundwater replenishment and agricultural use should be assigned to each contractor. Table HA-7 lists the assumptions used for development and analysis of this allocation method.

Because the Article 21 allocation method applied to scheduled surplus water contains numerous procedures, most contractors experience unique individual effects in CNPA4; however, they can be grouped into three general categories for discussion purposes. The three groups are agricultural contractors, M&I contractors with little agricultural and groundwater use, and M&I contractors with high agricultural or groundwater replenishment use. Tables HA-30 and HA-31 provide results for selected agricultural and M&I contractors.

3.3.2.1 Effects of CNPA4 on AG Contractors

Contractors in this group received more water in CNPA4 than in the Baseline in every year for two major reasons (the years 1996-1998 saw no allocation changes for either scenario). First, these contractors have high rates of agricultural and groundwater replenishment use, which receives priority in CNPA4's Article 21 allocation provisions. Second, they all are geographically located in the San Joaquin group of contractors, which receives 69% of the scheduled surplus water that is directed to the contractors downstream of Dos Amigos Pumping Plant. Due to the Article 18(b) invocation and application of Article 21 provisions, AG contractors receive a general increase in allocations in every year of the analysis (Table HA-31).

3.3.2.2 Effects of CNPA4 on M&I Contractors

Contractors in this group have low scheduled surplus water requests for groundwater replenishment or agricultural use. Two major factors caused this group to receive lower allocations of SWP water in every year of the analysis. First, these contractors all have very high municipal water use rates and little agriculture and groundwater replenishment use. Second, many of these contractors are in the Southern California contractor sub-group, which receives only 29% of the scheduled surplus water delivered to contractors downstream of Dos Amigos Pumping Plant.

Individual contractor's results vary for several reasons. The EIR assumes that some of these contractors have some amount of agricultural or groundwater replenishment use, and these uses elevate the priority of the M&I contractor's request for scheduled surplus water, which increases the contractor's scheduled surplus water allocation. The geographic group the contractor is in causes another slight variation in scheduled surplus allocations. Contractors in this analysis group fall into several geographic groups for purposes of Article 21's allocation provisions. These geographic groups are upstream of Dos Amigos Pumping Plant, Central Coast, and Southern California (Table HA-30).

3.3.2.3 Effects of CNPA4 on M&I Contractors with high amounts of groundwater replenishment or agricultural water use

These M&I contractors have a relatively high amount of groundwater replenishment or agricultural water uses as specified in Article 21. As a result, this group has a higher priority for scheduled surplus water than the other M&I contractors without such water uses. The contractors in this group, Mojave and Coachella were assessed a 100% groundwater replenishment value; therefore, each contractor experienced the same effects from CNPA4. These contractors are in the Southern California sub-group; since Article 21 initially allocates only 29% of the scheduled surplus water supply available downstream from Dos Amigos Pumping Plant to this sub-group, these M&I contractors receive lower scheduled surplus water allocations than San Joaquin Valley agricultural contractors.

CNPA4 only caused a reduction in allocation to Coachella in 2001 because that is the only year when Article 18(a) AG-first cuts had to be imposed. Recall that the AG-first reduction provision of Article 18(a) has less value in CNP because the total AG Table A has been reduced and there is proportionately less AG Table A to cut for the benefit of M&I contractors. In the years 2002-2005, these contractors experienced increased allocations under CNPA4 ranging from 12% - 37%. Table HA-30 details the effects of CNPA4 for each of these contractors.

3.4 Summary of CNP Effects

3.4.1 Table A

CNP reduced Table A allocations because Table A amount were reduced by approximately 55%. During 1996-2005, SWP Contractors received 100% allocations of Table A in every year except 2001. 2001 was the only year that Article 18(a) was applied to impose a 50% AG-first reduction and a very slight shared reduction of less than 1%. It appears that in CNP, contractors would be more likely to get full Table A amount allocations, but these would be considerably lower than Table A allocations in the Baseline in almost all years.

3.4.2 Article 18(a)

Both CNP alternatives applied Article 18(a) less frequently because the Table A amounts of all contractors were reduced. Article 18(a) will only apply when the SWP supply is less than 1.9 MAF. Under similar circumstances in the Baseline, the SWP supply would have to be near 4.2 MAF every year to avoid application of Article 18(a). This indicates that Article 18(a)'s effects on Table A allocations in the CNP would be less than Article 18(a)'s effects in the Baseline.

3.4.3 Scheduled Surplus and EX-Table A Water

Ex-Table A water or scheduled surplus water, makes up a considerable amount of deliverable water in many years under the CNP alternatives. As expected this analysis shows that both the apportioned and surplus allocation methods in CNP increase water allocations to agricultural contractors and reduce allocations to M&I contractors. In the apportioned method all contractors receive scheduled surplus based on their share of the total SWP Table A amount. This reduces the advantage that M&I contractors have from Article 18(a) AG-first reductions. In the scheduled surplus method, M&I contractors are further disadvantaged because their scheduled surplus requests are usually not for the higher priority uses of groundwater replenishment or agriculture specified in Article 21. As a result, agricultural contractors get much more of the water as scheduled surplus under this method than they would as Table A in the Baseline.

3.4.4. Long-Term Effects of CNP

Both CNP alternatives would require the Department to invoke Article 18(a) much less frequently because in many years the SWP would have 1.9 MAF to allocate. Neither CNP alternatives would reduce the SWP's annual water deliveries, but they would complicate the SWP's allocation accounting and modify the distribution of water to SWP contractors. The results of this analysis indicate that most M&I contractors would receive less water in most years under either CNP alternative. This appears to run counter to the purposes of the SWP, and sends reduced amounts of water to the contractors who have paid and will pay the most for the construction, operation, and maintenance of the SWP.

Note: For purposes of space and readability, some of the tables use the term "Project" instead of "Proposed Project".

Table HA-1. List of Article 18(a) actions in the Baseline and NPA1.

Year	Water Year Type	No Table A Allocation Reductions[22]	AG-First Allocation Reductions	AG-First Allocation Reductions & Additional Allocation Reductions for All Contractors	No AG-First Allocation Reductions [23] & Allocation Reductions for All Contractors
1996	W	X			
1997	W	X			
1998	W	X			
1999	W	X			
2000	AN		X		
2001	D			X	
2002	D			X	
2003	AN				X
2004	BN				X
2005	AN				X

[22] Allocation reduction as used in this table denotes a reduction in allocations of Table A water.
[23] No agriculture-first Article 18(a) allocation cuts occur in these years due to the limit of cumulative 100% allocation cuts in a seven-year period

Table HA-2. List of Article 18(a) actions in the CNP.

Year	Water Year Type	No Table A Allocation Reductions[24]	AG-First Allocation Reductions	AG-First Allocation Reductions & Additional Allocation Reductions for All Contractors	No AG-First Allocation Reductions [25] & Allocation Reductions for All Contractors
1996	W	X			
1997	W	X			
1998	W	X			
1999	W	X			
2000	AN	X			
2001	D			X	
2002	D	X			
2003	AN	X			
2004	BN	X			
2005	AN	X			

[24] Allocation reduction as used in this table denotes a reduction in allocations of Table A water.
[25] No agriculture-first Article 18(a) allocation cuts occur in these years due to the limit of cumulative 100% allocation cuts in a seven-year period

Table HA-3. Revisions of Bulletin 132 Table B-4 Values to Convert Published Monterey Amendments (Project) Table A Amounts to Baseline Table A Amounts

Year	Contractor	MA Change to Baseline	Reason
1996	KCWA	Increase Table AG by 40,670 af	Reverse retirement by KCWA
1996	Dudley Ridge	Increase Table A by 4,330 af	Reverse retirement by Dudley Ridge
1998	KCWA	Increase AG Table A by 25,000 af	Reverse transfer to Mojave
1998	Mojave	Decrease AG Table A by 25,000 af	Reverse transfer from KCWA
2000	KCWA	Increase AG Table A by 22,000 af	Reverse transfer to Zone 7
2000	KCWA	Increase AG Table A by 4,000 af	Reverse transfer to Palmdale
2000	KCWA	Increase AG Table A by 41,000 af	Reverse transfer to Castaic
2000	Zone 7	Decrease AG Table A by 22,000 af	Reverse transfer from KCWA
2000	Palmdale	Decrease AG Table A by 4,000 af	Reverse transfer from KCWA
2000	Castaic	Decrease AG Table A by 41,000 af	Reverse transfer from KCWA
2001	KCWA	Increase AG Table A by 4,025 af	Reverse transfer to Napa
2001	KCWA	Increase AG Table A by 5,756 af	Reverse transfer to Solano
2001	KCWA	Increase AG Table A by 12,219 af	Reverse transfer to Zone 7
2001	Napa	Decrease AG Table A by 4,025 af	Reverse transfer from KCWA
2001	Solano	Decrease AG Table A by 5,756 af	Reverse transfer from KCWA
2001	Zone 7	Decrease AG Table A by 12,219 af	Reverse transfer from KCWA

Table HA-4. SWP Contractors' Table A amounts in Baseline, Project, and Alternatives.

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Napa County	1996	10,425	0	10,425	0	10,425	0	4,766	0
	1997	11,065	0	11,065	0	11,065	0	5,091	0
	1998	11,710	0	11,710	0	11,710	0	5,386	0
	1999	15,850	0	15,850	0	15,850	0	7,231	0
	2000	16,325	0	16,325	0	16,325	0	7,444	0
	2001	16,700	0	16,700	4,025	16,700	4,025	7,611	1834
	2002	17,075	0	17,075	4,025	17,075	4,025	7,780	1834
	2003	17,450	0	17,450	4,025	17,450	4,025	8,021	0
	2004	17,825	0	17,825	4,025	17,825	4,025	8,114	1832
	2005	18,200	0	18,200	4,025	18,200	4,025	8,291	1834
Solano County	1996	37,800	0	37,800	0	37,800	0	17,280	0
	1997	38,250	0	38,250	0	38,250	0	17,597	0
	1998	38,710	0	38,710	0	38,710	0	17,804	0
	1999	39,170	0	39,170	0	39,170	0	17,870	0
	2000	39,620	0	39,620	0	39,620	0	18,067	0
	2001	40,080	0	40,080	5,756	40,080	5,756	18,266	2623
	2002	40,540	0	40,540	5,756	40,540	5,756	18,471	2623
	2003	41,000	0	41,000	5,756	41,000	5,756	18,845	0
	2004	41,450	0	41,450	5,756	41,450	5,756	18,869	2620
	2005	41,500	0	41,500	5,756	41,500	5,756	18,906	2622
Alameda Zone 7	1996	44,000	0	44,000	0	44,000	0	20,114	0
	1997	46,000	0	46,000	0	46,000	0	21,163	0
	1998	46,000	0	46,000	0	46,000	0	21,157	0
	1999	46,000	0	46,000	0	46,000	0	20,986	0
	2000	46,000	0	46,000	22,000	46,000	22,000	20,976	10032
	2001	46,000	0	46,000	34,219	46,000	32,000	20,964	14583
	2002	46,000	0	46,000	34,219	46,000	32,000	20,959	14580
	2003	46,000	0	46,000	34,219	46,000	32,000	21,143	0
	2004	46,000	400	46,000	34,619	46,000	34,619	20,940	15759
	2005	46,000	400	46,000	34,619	46,000	34,619	20,956	15771
Alameda	1996	42,000	0	42,000	0	42,000	0	19,200	0
	1997	42,000	0	42,000	0	42,000	0	19,323	0
	1998	42,000	0	42,000	0	42,000	0	19,317	0
	1999	42,000	0	42,000	0	42,000	0	19,161	0
	2000	42,000	0	42,000	0	42,000	0	19,152	0
	2001	42,000	0	42,000	0	42,000	0	19,141	0
	2002	42,000	0	42,000	0	42,000	0	19,137	0
	2003	42,000	0	42,000	0	42,000	0	19,305	0
	2004	42,000	0	42,000	0	42,000	0	19,119	0
	2005	42,000	0	42,000	0	42,000	0	19,134	0

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Santa Clara Valley WD	**1996**	100,000	0	100,000	0	100,000	0	45,713	0
	1997	100,000	0	100,000	0	100,000	0	46,006	0
	1998	100,000	0	100,000	0	100,000	0	45,993	0
	1999	100,000	0	100,000	0	100,000	0	45,622	0
	2000	100,000	0	100,000	0	100,000	0	45,600	0
	2001	100,000	0	100,000	0	100,000	0	45,573	0
	2002	100,000	0	100,000	0	100,000	0	45,563	0
	2003	100,000	0	100,000	0	100,000	0	45,963	0
	2004	100,000	0	100,000	0	100,000	0	45,522	0
	2005	100,000	0	100,000	0	100,000	0	45,556	0
SLO	**1996**	25,000	0	25,000	0	25,000	0	11,428	0
	1997	6,215	0	6,215	0	6,215	0	2,859	0
	1998	6,215	0	6,215	0	6,215	0	2,858	0
	1999	25,000	0	25,000	0	25,000	0	11,406	0
	2000	25,000	0	25,000	0	25,000	0	11,400	0
	2001	25,000	0	25,000	0	25,000	0	11,393	0
	2002	25,000	0	25,000	0	25,000	0	11,391	0
	2003	25,000	0	25,000	0	25,000	0	11,491	0
	2004	25,000	0	25,000	0	25,000	0	11,380	0
	2005	25,000	0	25,000	0	25,000	0	11,389	0
Santa Barbara	**1996**	45,486	0	45,486	0	45,486	0	20,793	0
	1997	38,986[26]	0	38,986	0	38,986	0	17,936	0
	1998	38,986	0	38,986	0	38,986	0	17,931	0
	1999	45,486	0	45,486	0	45,486	0	20,752	0
	2000	45,486	0	45,486	0	45,486	0	20,742	0
	2001	45,486	0	45,486	0	45,486	0	20,729	0
	2002	45,486	0	45,486	0	45,486	0	20,725	0
	2003	45,486	0	45,486	0	45,486	0	20,907	0
	2004	45,486	0	45,486	0	45,486	0	20,706	0
	2005	45,486	0	45,486	0	45,486	0	20,722	0
Dudley Ridge	**1996**	0	57,700	0	53,370	0	57,700	0	26377
	1997	0	57,700	0	53,370	0	57,700	0	26546
	1998	0	57,700	0	53,370	0	57,700	0	26538
	1999	0	57,700	0	53,370	0	57,700	0	26324
	2000	0	57,700	0	53,370	0	57,700	0	26311
	2001	0	57,700	0	53,370	0	57,700	0	26296
	2002	0	61,673	0	57,343	0	61,673	0	28100
	2003	0	61,673	0	57,343	0	61,673	0	28347
	2004	0	61,673	0	57,343	0	61,673	0	28075
	2005	0	61,673	0	57,343	0	61,673	0	28096

[26] For the years 1997and 1998, Santa Barbara saw a reduction of Table A entitlement of 6,500 AF due to the execution of an amendment to Santa Barbara's long- term water supply by the Department.

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Empire West Side	1996	0	3,000	0	3,000	0	3,000	0	1371
	1997	0	3,000	0	3,000	0	3,000	0	1380
	1998	0	3,000	0	3,000	0	3,000	0	1380
	1999	0	3,000	0	3,000	0	3,000	0	1369
	2000	0	3,000	0	3,000	0	3,000	0	1368
	2001	0	3,000	0	3,000	0	3,000	0	1367
	2002	0	3,000	0	3,000	0	3,000	0	1367
	2003	0	3,000	0	3,000	0	3,000	0	1379
	2004	0	3,000	0	3,000	0	3,000	0	1366
	2005	0	3,000	0	3,000	0	3,000	0	1367
KCWA	1996	134,600	1,023,130	134,600	982,460	134,600	1,023,130	61,530	467706
	1997	134,600	1,018,800	134,600	978,130	134,600	1,018,800	61,925	468713
	1998	134,600	1,018,800	134,600	953,130	134,600	993,800	61,907	457083
	1999	134,600	1,018,800	134,600	953,130	134,600	993,800	61,407	453393
	2000	134,600	1,018,800	134,600	886,130	134,600	926,800	61,378	422624
	2001	134,600	1,021,019	134,600	866,349	134,600	907,019	61,341	413356
	2002	134,600	1,021,019	134,600	866,349	134,600	907,019	61,328	413267
	2003	134,600	1,021,019	134,600	866,349	134,600	907,019	61,866	469293
	2004	134,600	1,018,800	134,600	864,130	134,600	904,800	61,273	411883
	2005	134,600	1,018,800	134,600	864,130	134,600	904,800	61,318	412191
Kings	1996	0	4,000	0	4,000	0	4,000	0	1829
	1997	0	4,000	0	4,000	0	4,000	0	1840
	1998	0	4,000	0	4,000	0	4,000	0	1840
	1999	0	4,000	0	4,000	0	4,000	0	1825
	2000	0	4,000	0	4,000	0	4,000	0	1824
	2001	0	4,000	0	4,000	0	4,000	0	1823
	2002	0	4,000	0	4,000	0	4,000	0	1823
	2003	0	9,000	0	9,000	0	9,000	0	4137
	2004	0	9,000	0	9,000	0	9,000	0	4097
	2005	0	9,000	0	9,000	0	9,000	0	4100
Oak Flat Irrigation District	1996	0	5,700	0	5,700	0	5,700	0	2606
	1997	0	5,700	0	5,700	0	5,700	0	2622
	1998	0	5,700	0	5,700	0	5,700	0	2622
	1999	0	5,700	0	5,700	0	5,700	0	2600
	2000	0	5,700	0	5,700	0	5,700	0	2599
	2001	0	5,700	0	5,700	0	5,700	0	2598
	2002	0	5,700	0	5,700	0	5,700	0	2597
	2003	0	5,700	0	5,700	0	5,700	0	2620
	2004	0	5,700	0	5,700	0	5,700	0	2595
	2005	0	5,700	0	5,700	0	5,700	0	2597

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Tulare	1996	0	118,500	0	118,500	0	118,500	0	54170
	1997	0	118,500	0	118,500	0	118,500	0	54518
	1998	0	118,500	0	118,500	0	118,500	0	54502
	1999	0	118,500	0	118,500	0	118,500	0	54062
	2000	0	118,500	0	118,500	0	118,500	0	54036
	2001	0	118,500	0	118,500	0	118,500	0	54004
	2002	0	111,527	0	111,527	0	111,527	0	50815
	2003	0	111,127	0	111,127	0	111,127	0	51077
	2004	0	96,227	0	96,227	0	96,227	0	43804
	2005	0	96,227	0	96,227	0	96,227	0	43837
AVEK	1996	138,400	0	138,400	0	138,400	0	63,267	0
	1997	138,400	0	138,400	0	138,400	0	63,673	0
	1998	138,400	0	138,400	0	138,400	0	63,655	0
	1999	138,400	0	138,400	0	138,400	0	63,141	0
	2000	138,400	0	138,400	0	138,400	0	63,111	0
	2001	138,400	0	138,400	0	138,400	0	63,073	0
	2002	138,400	3,000	138,400	3,000	138,400	3,000	63,059	1367
	2003	138,400	3,000	138,400	3,000	138,400	3,000	63,613	1379
	2004	138,400	3,000	138,400	3,000	138,400	3,000	63,002	1366
	2005	138,400	3,000	138,400	3,000	138,400	3,000	63,050	1367
Castaic	1996	41,500	12,700	41,500	12,700	41,500	12,700	18,971	5806
	1997	41,500	12,700	41,500	12,700	41,500	12,700	19,093	5843
	1998	41,500	12,700	41,500	12,700	41,500	12,700	19,087	5841
	1999	41,500	12,700	41,500	12,700	41,500	12,700	18,933	5794
	2000	41,500	12,700	41,500	53,700	41,500	53,700	18,924	24487
	2001	41,500	12,700	41,500	53,700	41,500	53,700	18,913	24473
	2002	41,500	12,700	41,500	53,700	41,500	53,700	18,909	24467
	2003	41,500	12,700	41,500	53,700	41,500	53,700	19,075	5837
	2004	41,500	12,700	41,500	53,700	41,500	53,700	18,892	24445
	2005	41,500	12,700	41,500	53,700	41,500	53,700	18,906	24464
Coachella	1996	23,100	0	23,100	0	23,100	0	10,560	0
	1997	23,100	0	23,100	0	23,100	0	10,627	0
	1998	23,100	0	23,100	0	23,100	0	10,624	0
	1999	23,100	0	23,100	0	23,100	0	10,539	0
	2000	23,100	0	23,100	0	23,100	0	10,534	0
	2001	23,100	0	23,100	0	23,100	0	10,527	0
	2002	23,100	0	23,100	0	23,100	0	10,525	0
	2003	23,100	0	23,100	0	23,100	0	10,617	0
	2004	23,100	9,900	23,100	9,900	23,100	9,900	10,516	4507
	2005	111,200	9,900	111,200	9,900	111,200	9,900	50,658	4510

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Crestline	1996	5,800	0	5,800	0	5,800	0	2,651	0
	1997	5,800	0	5,800	0	5,800	0	2,668	0
	1998	5,800	0	5,800	0	5,800	0	2,668	0
	1999	5,800	0	5,800	0	5,800	0	2,646	0
	2000	5,800	0	5,800	0	5,800	0	2,645	0
	2001	5,800	0	5,800	0	5,800	0	2,643	0
	2002	5,800	0	5,800	0	5,800	0	2,643	0
	2003	5,800	0	5,800	0	5,800	0	2,666	0
	2004	5,800	0	5,800	0	5,800	0	2,640	0
	2005	5,800	0	5,800	0	5,800	0	2,642	0
Desert	1996	38,100	0	38,100	0	38,100	0	17,417	0
	1997	38,100	0	38,100	0	38,100	0	17,528	0
	1998	38,100	0	38,100	0	38,100	0	17,524	0
	1999	38,100	0	38,100	0	38,100	0	17,382	0
	2000	38,100	0	38,100	0	38,100	0	17,374	0
	2001	38,100	0	38,100	0	38,100	0	17,363	0
	2002	38,100	0	38,100	0	38,100	0	17,360	0
	2003	38,100	0	38,100	0	38,100	0	17,512	0
	2004	38,100	0	38,100	0	38,100	0	17,344	0
	2005	50,000	0	50,000	0	50,000	0	22,778	0
Littlerock	1996	2,300	0	2,300	0	2,300	0	1,051	0
	1997	2,300	0	2,300	0	2,300	0	1,058	0
	1998	2,300	0	2,300	0	2,300	0	1,058	0
	1999	2,300	0	2,300	0	2,300	0	1,049	0
	2000	2,300	0	2,300	0	2,300	0	1,049	0
	2001	2,300	0	2,300	0	2,300	0	1,048	0
	2002	2,300	0	2,300	0	2,300	0	1,048	0
	2003	2,300	0	2,300	0	2,300	0	1,057	0
	2004	2,300	0	2,300	0	2,300	0	1,047	0
	2005	2,300	0	2,300	0	2,300	0	1,048	0
Mojave	1996	50,800	0	50,800	0	50,800	0	23,222	0
	1997	50,800	0	50,800	0	50,800	0	23,371	0
	1998	50,800	0	50,800	25,000	50,800	25,000	23,365	11498
	1999	50,800	0	50,800	25,000	50,800	25,000	23,176	11406
	2000	50,800	0	50,800	25,000	50,800	25,000	23,165	11400
	2001	50,800	0	50,800	25,000	50,800	25,000	23,151	11393
	2002	50,800	0	50,800	25,000	50,800	25,000	23,146	11391
	2003	50,800	0	50,800	25,000	50,800	25,000	23,349	11491
	2004	50,800	0	50,800	25,000	50,800	25,000	23,125	11380
	2005	50,800	0	50,800	25,000	50,800	25,000	23,142	11389

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Palmdale	**1996**	17,300	0	17,300	0	17,300	0	7,908	0
	1997	17,300	0	17,300	0	17,300	0	7,959	0
	1998	17,300	0	17,300	0	17,300	0	7,957	0
	1999	17,300	0	17,300	0	17,300	0	7,893	0
	2000	17,300	0	17,300	4,000	17,300	4,000	7,889	1824
	2001	17,300	0	17,300	4,000	17,300	4,000	7,884	1823
	2002	17,300	0	17,300	4,000	17,300	4,000	7,882	1823
	2003	17,300	0	17,300	4,000	17,300	4,000	7,952	0
	2004	17,300	0	17,300	4,000	17,300	4,000	7,875	1821
	2005	17,300	0	17,300	4,000	17,300	4,000	7,881	1822
San Bernardino	**1996**	102,600	0	102,600	0	102,600	0	46,902	0
	1997	102,600	0	102,600	0	102,600	0	47,203	0
	1998	102,600	0	102,600	0	102,600	0	47,189	0
	1999	102,600	0	102,600	0	102,600	0	46,808	0
	2000	102,600	0	102,600	0	102,600	0	46,786	0
	2001	102,600	0	102,600	0	102,600	0	46,758	0
	2002	102,600	0	102,600	0	102,600	0	46,748	0
	2003	102,600	0	102,600	0	102,600	0	47,158	0
	2004	102,600	0	102,600	0	102,600	0	46,706	0
	2005	102,600	0	102,600	0	102,600	0	46,741	0
San Gabriel	**1996**	28,800	0	28,800	0	28,800	0	13,165	0
	1997	28,800	0	28,800	0	28,800	0	13,250	0
	1998	28,800	0	28,800	0	28,800	0	13,246	0
	1999	28,800	0	28,800	0	28,800	0	13,139	0
	2000	28,800	0	28,800	0	28,800	0	13,133	0
	2001	28,800	0	28,800	0	28,800	0	13,125	0
	2002	28,800	0	28,800	0	28,800	0	13,122	0
	2003	28,800	0	28,800	0	28,800	0	13,237	0
	2004	28,800	0	28,800	0	28,800	0	13,110	0
	2005	28,800	0	28,800	0	28,800	0	13,120	0
San Gorgonio	**1996**	0	0	0	0	0	0	0	0
	1997	0	0	0	0	0	0	0	0
	1998	0	0	0	0	0	0	0	0
	1999	2,000	0	2,000	0	2,000	0	912	0
	2000	3,000	0	3,000	0	3,000	0	1,368	0
	2001	4,000	0	4,000	0	4,000	0	1,823	0
	2002	4,000	0	4,000	0	4,000	0	1,823	0
	2003	5,000	0	5,000	0	5,000	0	2,298	0
	2004	6,000	0	6,000	0	6,000	0	2,731	0
	2005	6,500	0	6,500	0	6,500	0	2,961	0

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
MWD	1996	2,011,500	0	2,011,500	0	2,011,500	0	920,482	0
	1997	2,011,500	0	2,011,500	0	2,011,500	0	925,417	0
	1998	2,011,500	0	2,011,500	0	2,011,500	0	925,159	0
	1999	2,011,500	0	2,011,500	0	2,011,500	0	917,689	0
	2000	2,011,500	0	2,011,500	0	2,011,500	0	917,252	0
	2001	2,011,500	0	2,011,500	0	2,011,500	0	916,701	0
	2002	2,011,500	0	2,011,500	0	2,011,500	0	916,504	0
	2003	2,011,500	0	2,011,500	0	2,011,500	0	924,549	0
	2004	2,011,500	0	2,011,500	0	2,011,500	0	915,674	0
	2005	1,911,500	0	1,911,500	0	1,911,500	0	870,804	0
Ventura	1996	20,000	0	20,000	0	20,000	0	9,143	0
	1997	20,000	0	20,000	0	20,000	0	9,201	0
	1998	20,000	0	20,000	0	20,000	0	9,199	0
	1999	20,000	0	20,000	0	20,000	0	9,124	0
	2000	20,000	0	20,000	0	20,000	0	9,120	0
	2001	20,000	0	20,000	0	20,000	0	9,115	0
	2002	20,000	0	20,000	0	20,000	0	9,113	0
	2003	20,000	0	20,000	0	20,000	0	9,193	0
	2004	20,000	0	20,000	0	20,000	0	9,104	0
	2005	20,000	0	20,000	0	20,000	0	9,111	0
Yuba	1996	9,600	0	9,600	0	9,600	0	4,388	0
	1997	9,600	0	9,600	0	9,600	0	4,417	0
	1998	9,600	0	9,600	0	9,600	0	4,415	0
	1999	9,600	0	9,600	0	9,600	0	4,380	0
	2000	9,600	0	9,600	0	9,600	0	4,378	0
	2001	9,600	0	9,600	0	9,600	0	4,375	0
	2002	9,600	0	9,600	0	9,600	0	4,374	0
	2003	9,600	0	9,600	0	9,600	0	4,412	0
	2004	9,600	0	9,600	0	9,600	0	4,370	0
	2005	9,600	0	9,600	0	9,600	0	4,373	0
Butte	1996	1,200	0	1,200	0	1,200	0	549	0
	1997	1,200	0	1,200	0	1,200	0	552	0
	1998	1,200	0	1,200	0	1,200	0	552	0
	1999	2,890	0	2,890	0	2,890	0	1,318	0
	2000	2,890	0	2,890	0	2,890	0	1,318	0
	2001	3,500	0	3,500	0	3,500	0	1,595	0
	2002	3,500	0	3,500	0	3,500	0	1,595	0
	2003	3,500	0	3,500	0	3,500	0	1,609	0
	2004	3,500	0	3,500	0	3,500	0	1,593	0
	2005	1,200	0	1,200	0	1,200	0	547	0

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Plumas	**1996**	1,300	0	1,300	0	1,300	0	594	0
	1997	1,350	0	1,350	0	1,350	0	621	0
	1998	1,400	0	1,400	0	1,400	0	644	0
	1999	1,450	0	1,450	0	1,450	0	662	0
	2000	1,510	0	1,510	0	1,510	0	689	0
	2001	1,570	0	1,570	0	1,570	0	715	0
	2002	1,630	0	1,630	0	1,630	0	743	0
	2003	1,690	0	1,690	0	1,690	0	777	0
	2004	1,750	0	1,750	0	1,750	0	797	0
	2005	0	0	0	0	0	0	0	0

Table HA-5 – Historical Analysis Assumptions for Baseline, Project, and Alternatives.

Issue	Assumptions for EIR Alternatives				
	Baseline	**Proposed Project**	**NPA1**	**CNPA3**	**CNPA4**
Article 18 provisions for allocation of Table A Water	Uses 1994 contract provisions	Uses Monterey Plus provisions	Uses 1994 contract provisions	Uses 1994 contract provisions	Uses 1994 contract provisions
Table A changes and transfers	A contractor's Table A changes only if original SWP contract specified or through another action unrelated to Project.	Baseline values and includes 22 TAF of transfers from TLBWD to M& I contractors during 2000-05, (2) 114 TAF of transfers from KCWA to M&I contractors during 1998-2003.	Same as Baseline	Baseline values reduced proportionately so that total SWP Table A amounts equal 1.9 MAF in each year. No transfers of Table A amount between SWP contractors.	Same as CNPA3
Table A Retirements by KCWA (40,670) and DRWD (4,330)	No retirement. KCWA and DRWD retain Table A amounts.	Table A amounts are retired in 1996	Same as Baseline.	Same as Baseline.	Same as Baseline.
Invocation of Article 18(b)	Contracts retain Article 18(b) but DWR does not invoke Article 18(b).	Elimination of Article 18(b) from the SWP contracts.	Same as Baseline.	DWR invokes Article 18(b) in 1996.	DWR invokes Article 18(b) in 1996.

Table HA-6. Four Groupings of SWP Contractors for Interpretation of Project Effects*.		
SWP Contractors With …	**M&I Contractors**	**Agricultural Contractors**
No Monterey Amendment-related Transfers or Retirements	***Group 1*** Plumas, Butte, Yuba City, Alameda, Santa Clara, San Luis Obispo, Santa Barbara, Crestline, Desert, Littlerock Creek, MWD, San Bernardino Valley, San Gabriel Valley, San Gorgonio Pass, Coachella, AVEK & Ventura	***Group 2*** Oak Flat, Kings, Tulare & Empire Westside
Table A Transfers or Retirements	***Group 3*** Napa, Solano, Zone 7, Castaic, Mojave & Palmdale	***Group 4*** KCWA (AG), & Dudley Ridge

* Note that these groupings apply only to Project effects. Different groupings are used to present the effects of other alternatives.

Table HA-7. Study Assumptions Regarding SWP contractors' Agricultural, Groundwater Replenishment, and Municipal uses of Scheduled Surplus Water in CNPA4.

Contractor	Agricultural Use	Groundwater Replenishment Use (%)	Municipal or other use (%)
Butte	0%	0%	100%
Yuba	0%	0%	100%
Plumas	0%	0%	100%
Napa	10%	0%	90%
Solano	0%	0%	100%
Alameda County	0%	10%	90%
Zone 7	10%	0%	90%
Santa Clara	10%	10%	80%
Oak Flat	100%	0%	0%
Kings	100%	0%	0%
Dudley	100%	0%	0%
Empire	100%	0%	0%
KCWA	90%	0%	10%
Tulare	100%	0%	0%
San Luis Obispo	0%	0%	100%
Santa Barbara	0%	0%	100%
AVEK	30%	0%	70%
Castaic	0%	0%	100%
Coachella	0%	100%	0%
Crestline	0%	0%	100%
Desert	0%	0%	100%
Littlerock	30%	0%	70%
Mojave	0%	100%	0%
Palmdale	0%	0%	100%
San Bernardino	0%	0%	100%
San Gabriel	0%	100%	0%
San Gorgonio	5%	0%	95%
MWD	7%	20%	73%
Ventura	0%	0%	100%

Table HA-8. Implementation of Article 18(a) cuts in the Baseline			
Year	Baseline's Article 18(a) Reductions[27]		
	AG-first Reduction	Cumulative 7-year Total Ag-first Reduction	AG and M&I shared Reduction
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	6%	6%	0
2000	21%	27%	0
2001	50%	77%	47%
2002	23%	100%	24%
2003	0	100%	11%
2004	0	100%	36%
2005	0	100%	10%

Table HA-9. Implementation of Article 18(a) cuts in NPA1			
Year	NPA1's Article 18(a) Reductions		
	AG-first Reduction	Cumulative 7-year Total Ag-first Reduction	AG and M&I Shared Reduction
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	4%	4%	0
2000	21%	25%	0
2001	50%	75%	47%
2002	25%	100%	23%
2003	0	100%	11%
2004	0	100%	36%
2005	0	100%	10%

[27] Percentages are rounded to the nearest whole percent.

Table HA-10. Implementation of Article 18(a) cuts in CNP			
Year	CNP's Article 18(a) Reductions		
	AG-first Reduction	Cumulative 7-year Total Ag-first Reduction	AG and M&I Shared Reduction
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	50%	50%	1%
2002	0	50%	0
2003	0	50%	0
2004	0	50%	0
2005	0	50%	0

Table HA-11. Baseline and Project Table A Allocations				
Year	AG Table A Allocation (%)		M&I Table A Allocation (%)	
	Baseline	Project	Baseline	Project
1996	100%	100%	100%	100%
1997	100%	100%	100%	100%
1998	100%	100%	100%	100%
1999	94%	100%	100%	100%
2000	79%	90%	100%	90% (96%)[28]
2001	3%	39%	53%	39%
2002	53%	70%	76%	70%
2003	89%	90%	89%	90%
2004	64%	65%	64%	65%
2005	89%	90%	89%	90%

[28] MWDSC allocation was 100% of its request, while all other M&I requests received 90% allocation. Overall, SWP M&I Table A allocation was 96% of total M&I Table A requests in 2000.

Table HA-12. NPA1 and CNP Table A Allocations				
Year	AG Table A Allocation (%)		M&I Table A Allocation (%)	
	NPA1	CNP	NPA1	CNP
1996	100%	100%	100%	100%
1997	100%	100%	100%	100%
1998	100%	100%	100%	100%
1999	96%	100%	100%	100%
2000	79%	100%	100%	100%
2001	3%	49%	53%	99%
2002	51%	100%	77%	100%
2003	89%	100%	89%	100%
2004	64%	100%	64%	100%
2005	89%	100%	89%	100%

Table HA-13. Project Effects on Total M&I Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	2,931,611	2,931,611	0	0%
1997	2,909,466	2,909,466	0	0%
1998	2,910,621	2,910,621	0	0%
1999	2,063,859	2,063,859	0	0%
2000	2,394,920	2,394,920	0	0%
2001	1,562,830	1,150,007	-412,823	-26%
2002	2,241,720	2,064,742	-176,978	-8%
2003	2,623,456	2,652,015	28,559	1%
2004	1,890,183	1,919,717	29,534	2%
2005	2,625,755	2,655,257	29,503	1%
Total	24,154,420	23,652,215	-502,205	-2%

Table HA-14. Project Effects on Total AG Table A Allocations				
Year	AG Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	1,224,730	1,179,730	-45,000	-4%
1997	1,220,400	1,175,400	-45,000	-4%
1998	1,220,400	1,175,400	-45,000	-4%
1999	1,147,176	1,175,400	28,224	2%
2000	1,012,932	1,057,860	44,928	4%
2001	36,679	459,271	422,593	1152%
2002	648,200	824,333	176,133	27%
2003	1,090,810	1,062,251	-28,559	-3%
2004	781,056	764,010	-17,046	-2%
2005	1,086,156	1,057,860	-28,296	-3%
Total	9,468,539	9,931,516	462,977	5%

Table HA-15. NPA1 Effects on Total M&I Table A Allocations				
	M&I Table A Allocations (AF)		**Allocation Difference (AF)**	**Percent Change**
Year	**Baseline**	**Project**		
1996	2,931,611	2,931,611	0	0%
1997	2,909,466	2,909,466	0	0%
1998	2,910,621	2,910,621	0	0%
1999	2,063,859	2,063,859	0	0%
2000	2,394,920	2,394,920	0	0%
2001	1,562,830	1,562,830	0	0%
2002	2,241,720	2,241,720	0	0%
2003	2,623,456	2,624,850	1,394	0%
2004	1,890,183	1,890,183	0	0%
2005	2,625,755	2,625,755	0	0%
Total	24,154,420	24,155,814	1,394	0%

Table HA-16. NPA1 Effects on Total AG Table A Allocations				
	AG Table A Allocations (AF)		**Allocation Difference (AF)**	**Percent Change**
Year	**Baseline**	**Project**		
1996	1,224,730	1,224,730	0	0%
1997	1,220,400	1,220,400	0	0%
1998	1,220,400	1,220,400	0	0%
1999	1,147,176	1,171,584	24,408	2%
2000	1,012,932	1,025,136	12,204	1%
2001	36,679	36,612	-67	0%
2002	648,200	646,812	-1,388	0%
2003	1,090,810	1,089,416	-1,394	0%
2004	781,056	781,056	0	0%
2005	1,086,156	1,086,156	0	0%
Total	9,468,539	9,502,302	33,764	0%

Table HA-17. CNP Effects on Total M&I Table A Allocations				
	M&I Table A Allocations (AF)		**Allocation Difference (AF)**	**Percent Change**
Year	**Baseline**	**Project**		
1996	2,931,611	1,340,136	-1,591,475	-54%
1997	2,909,466	1,338,539	-1,570,927	-54%
1998	2,910,621	1,338,696	-1,571,925	-54%
1999	2,063,859	1,334,716	-729,143	-35%
2000	2,394,920	1,335,882	-1,059,038	-44%
2001	1,562,830	1,316,951	-245,879	-16%
2002	2,241,720	1,343,947	-897,773	-40%
2003	2,623,456	1,356,615	-1,266,841	-48%
2004	1,890,183	1,344,450	-545,733	-29%
2005	2,625,755	1,344,034	-1,281,721	-49%
Total	24,154,420	13,393,964	-10,760,456	-45%

Table HA-18. CNP Effects on Total AG Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	1,224,730	559,864	-664,866	-54%
1997	1,220,400	561,461	-658,939	-54%
1998	1,220,400	561,304	-659,096	-54%
1999	1,147,176	556,772	-590,404	-51%
2000	1,012,932	556,507	-456,425	-45%
2001	36,679	278,086	241,408	658%
2002	648,200	556,053	-92,147	-14%
2003	1,090,810	575,559	-515,251	-47%
2004	781,056	555,550	-225,506	-29%
2005	1,086,156	555,966	-530,190	-49%
Total	9,468,539	5,317,125	-4,151,414	-44%

Table HA-19. Effects of Project on Historic SWP Table A Allocations To Selected M&I Contractors With No Project-Related Table A Changes (Group One)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	100,000	0	100,000	0	0%
	1997	100,000	0	100,000	100,000	0	100,000	0	0%
	1998	100,000	0	100,000	100,000	0	100,000	0	0%
	1999	100,000	0	100,000	100,000	0	100,000	0	0%
	2000	100,000	0	100,000	100,000	0	100,000	0	0%
	2001	53,000	0	53,000	39,000	0	39,000	-14,000	-26%
	2002	76,000	0	76,000	70,000	0	70,000	-6,000	-8%
	2003	88,885	0	88,885	89,852	0	89,852	968	1%
	2004	64,000	0	64,000	65,000	0	65,000	1,000	2%
	2005	89,000	0	89,000	90,000	0	90,000	1,000	1%
	Total	870,885	0	870,885	853,852	0	853,852	-17,032	-2%
Santa Barbara	1996	45,486	0	45,486	45,486	0	45,486	0	0%
	1997	38,986	0	38,986	38,986	0	38,986	0	0%
	1998	38,986	0	38,986	38,986	0	38,986	0	0%
	1999	45,486	0	45,486	45,486	0	45,486	0	0%
	2000	45,486	0	45,486	45,486	0	45,486	0	0%
	2001	24,108	0	24,108	17,740	0	17,740	-6,368	-26%
	2002	34,569	0	34,569	31,840	0	31,840	-2,729	-8%
	2003	40,430	0	40,430	40,870	0	40,870	440	1%
	2004	29,111	0	29,111	29,566	0	29,566	455	2%
	2005	40,483	0	40,483	40,937	0	40,937	455	1%
	Total	383,131	0	383,131	375,383	0	375,383	-7,747	-2%
MWD	1996	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1997	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1998	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1999	1,180,000	0	1,180,000	1,180,000	0	1,180,000	0	0%
	2000	1,507,136	0	1,507,136	1,507,136	0	1,507,136	0	0%
	2001	1,066,095	0	1,066,095	784,485	0	784,485	-281,610	-26%
	2002	1,528,740	0	1,528,740	1,408,050	0	1,408,050	-120,690	-8%
	2003	1,787,916	0	1,787,916	1,807,380	0	1,807,380	19,463	1%
	2004	1,287,360	0	1,287,360	1,307,475	0	1,307,475	20,115	2%
	2005	1,701,235	0	1,701,235	1,720,350	0	1,720,350	19,115	1%
	Total	16,092,982	0	16,092,982	15,749,376	0	15,749,376	-343,607	-2%

Table HA-20. Effects of Project on SWP Table A Allocations To Agricultural Contractors With No Project-Related Table A Changes (Group Two)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Empire West Side	**1996**	0	3,000	3,000	0	3,000	3,000	0	0%
	1997	0	3,000	3,000	0	3,000	3,000	0	0%
	1998	0	3,000	3,000	0	3,000	3,000	0	0%
	1999	0	2,820	2,820	0	3,000	3,000	180	6%
	2000	0	2,490	2,490	0	2,700	2,700	210	8%
	2001	0	90	90	0	1,170	1,170	1,080	1200%
	2002	0	1,590	1,590	0	2,100	2,100	510	32%
	2003	0	2,667	2,667	0	2,696	2,696	29	1%
	2004	0	1,920	1,920	0	1,950	1,950	30	2%
	2005	0	2,670	2,670	0	2,700	2,700	30	1%
	Total	0	23,247	23,247	0	25,316	25,316	2,069	9%
Oak Flat Irrigation District	**1996**	0	5,700	5,700	0	5,700	5,700	0	0%
	1997	0	5,700	5,700	0	5,700	5,700	0	0%
	1998	0	5,700	5,700	0	5,700	5,700	0	0%
	1999	0	5,358	5,358	0	5,700	5,700	342	6%
	2000	0	4,731	4,731	0	5,130	5,130	399	8%
	2001	0	171	171	0	2,223	2,223	2,052	1200%
	2002	0	3,021	3,021	0	3,990	3,990	969	32%
	2003	0	5,066	5,066	0	5,122	5,122	55	1%
	2004	0	3,648	3,648	0	3,705	3,705	57	2%
	2005	0	5,073	5,073	0	5,130	5,130	57	1%
	Total	0	44,168	44,168	0	48,100	48,100	3,931	9%

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Kings	1996	0	4,000	4,000	0	4,000	4,000	0	0%
	1997	0	4,000	4,000	0	4,000	4,000	0	0%
	1998	0	4,000	4,000	0	4,000	4,000	0	0%
	1999	0	3,760	3,760	0	4,000	4,000	240	6%
	2000	0	3,320	3,320	0	3,600	3,600	280	8%
	2001	0	120	120	0	1,560	1,560	1,440	1200%
	2002	0	2,120	2,120	0	2,800	2,800	680	32%
	2003	0	8,000	8,000	0	8,087	8,087	87	1%
	2004	0	5,760	5,760	0	5,850	5,850	90	2%
	2005	0	8,010	8,010	0	8,100	8,100	90	1%
	Total	0	43,090	43,090	0	45,997	45,997	2,907	7%
Tulare	1996	0	118,500	118,500	0	118,500	118,500	0	0%
	1997	0	118,500	118,500	0	118,500	118,500	0	0%
	1998	0	118,500	118,500	0	118,500	118,500	0	0%
	1999	0	111,390	111,390	0	118,500	118,500	7,110	6%
	2000	0	98,355	98,355	0	106,650	106,650	8,295	8%
	2001	0	3,555	3,555	0	46,215	46,215	42,660	1200%
	2002	0	59,109	59,109	0	78,069	78,069	18,960	32%
	2003	0	98,775	98,775	0	99,850	99,850	1,075	1%
	2004	0	61,585	61,585	0	62,548	62,548	962	2%
	2005	0	85,642	85,642	0	86,604	86,604	962	1%
	Total	0	873,912	873,912	0	953,936	953,936	80,024	9%

Table HA-21. Effects of Project on SWP Table A Allocations To M&I Contractors With Project-Related Table A Changes (Group Three)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Napa County	1996	10,425	0	10,425	10,425	0	10,425	0	0%
	1997	11,065	0	11,065	11,065	0	11,065	0	0%
	1998	11,710	0	11,710	11,710	0	11,710	0	0%
	1999	15,850	0	15,850	15,850	0	15,850	0	0%
	2000	16,325	0	16,325	16,325	0	16,325	0	0%
	2001	8,851	0	8,851	6,513	1,570	8,083	-768	-9%
	2002	12,977	0	12,977	11,953	2,818	14,770	1,793	14%
	2003	15,510	0	15,510	15,679	3,617	19,296	3,785	24%
	2004	11,408	0	11,408	11,586	2,616	14,203	2,795	24%
	2005	16,198	0	16,198	16,380	3,623	20,003	3,805	23%
	Total	130,319	0	130,319	127,486	14,243	141,729	11,409	9%
Solano County	1996	37,800	0	37,800	37,800	0	37,800	0	0%
	1997	38,250	0	38,250	38,250	0	38,250	0	0%
	1998	38,710	0	38,710	38,710	0	38,710	0	0%
	1999	39,170	0	39,170	39,170	0	39,170	0	0%
	2000	39,620	0	39,620	39,620	0	39,620	0	0%
	2001	21,242	0	21,242	15,631	2,245	17,876	-3,366	-16%
	2002	30,810	0	30,810	28,378	4,029	32,407	1,597	5%
	2003	36,443	0	36,443	36,839	5,172	42,011	5,569	15%
	2004	26,528	0	26,528	26,943	3,741	30,684	4,156	16%
	2005	36,935	0	36,935	37,350	5,180	42,530	5,595	15%
	Total	345,509	0	345,509	338,691	20,368	359,059	13,550	4%
Alameda Zone 7	1996	44,000	0	44,000	44,000	0	44,000	0	0%
	1997	46,000	0	46,000	46,000	0	46,000	0	0%
	1998	46,000	0	46,000	46,000	0	46,000	0	0%
	1999	46,000	0	46,000	46,000	0	46,000	0	0%
	2000	46,000	0	46,000	46,000	19,800	65,800	19,800	43%
	2001	24,380	0	24,380	17,940	13,345	31,285	6,905	28%
	2002	34,960	212	35,172	32,200	23,953	56,153	20,981	60%
	2003	40,887	0	40,887	41,332	30,747	72,079	31,192	76%
	2004	29,440	256	29,696	29,900	22,502	52,402	22,706	76%
	2005	40,940	356	41,296	41,400	31,157	72,557	31,261	76%
	Total	398,607	824	399,431	390,772	141,505	532,277	132,846	33%

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Mojave	1996	50,800	0	50,800	50,800	0	50,800	0	0%
	1997	50,800	0	50,800	50,800	0	50,800	0	0%
	1998	50,800	0	50,800	50,800	25,000	75,800	25,000	49%
	1999	20,000	0	20,000	20,000	25,000	45,000	25,000	125%
	2000	20,000	0	20,000	20,000	22,500	42,500	22,500	113%
	2001	26,924	0	26,924	19,812	9,750	29,562	2,638	10%
	2002	38,608	0	38,608	35,560	17,500	53,060	14,452	37%
	2003	45,153	0	45,153	45,645	22,463	68,108	22,955	51%
	2004	32,512	0	32,512	33,020	16,250	49,270	16,758	52%
	2005	45,212	0	45,212	45,720	22,500	68,220	23,008	51%
	Total	380,809	0	380,809	372,157	160,963	533,120	152,311	40%
Castaic	1996	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1997	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1998	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1999	41,500	11,938	53,438	41,500	12,700	54,200	762	1%
	2000	41,500	10,541	52,041	41,500	48,330	89,830	37,789	73%
	2001	21,995	381	22,376	16,185	20,943	37,128	14,752	66%
	2002	31,540	6,731	38,271	29,050	37,590	66,640	28,369	74%
	2003	36,887	11,288	48,176	37,289	48,251	85,539	37,364	78%
	2004	26,560	8,128	34,688	26,975	34,905	61,880	27,192	78%
	2005	36,935	11,303	48,238	37,350	48,330	85,680	37,442	78%
	Total	361,417	98,410	459,828	354,349	289,149	643,497	183,670	40%
Palmdale	1996	17,300	0	17,300	17,300	0	17,300	0	0%
	1997	17,300	0	17,300	17,300	0	17,300	0	0%
	1998	17,300	0	17,300	17,300	0	17,300	0	0%
	1999	17,300	0	17,300	17,300	0	17,300	0	0%
	2000	17,300	0	17,300	17,300	3,600	20,900	3,600	21%
	2001	9,169	0	9,169	6,747	1,560	8,307	-862	-9%
	2002	13,148	0	13,148	12,110	2,800	14,910	1,762	13%
	2003	15,377	0	15,377	15,544	3,594	19,139	3,761	24%
	2004	11,072	0	11,072	11,245	2,600	13,845	2,773	25%
	2005	15,397	0	15,397	15,570	3,600	19,170	3,773	25%
	Total	150,663	0	150,663	147,716	17,754	165,471	14,807	10%

Table HA-22. Effects of Project on SWP Table A Allocations To Agricultural Contractors With Project-Related Table A Changes (Group Four)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1997	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1998	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1999	0	54,238	54,238	0	53,370	53,370	-868	-2%
	2000	0	47,891	47,891	0	48,033	48,033	142	0%
	2001	0	1,731	1,731	0	20,814	20,814	19,083	1102%
	2002	0	32,687	32,687	0	40,140	40,140	7,453	23%
	2003	0	54,818	54,818	0	51,524	51,524	-3,294	-6%
	2004	0	39,471	39,471	0	37,273	37,273	-2,198	-6%
	2005	0	54,889	54,889	0	51,609	51,609	-3,280	-6%
	Total	0	458,824	458,824	0	462,873	462,873	4,049	1%
KCWA	1996	134,600	1,023,130	1,157,730	134,600	982,460	1,117,060	-40,670	-4%
	1997	134,600	1,018,800	1,153,400	134,600	978,130	1,112,730	-40,670	-4%
	1998	134,600	1,018,800	1,153,400	134,600	953,130	1,087,730	-65,670	-6%
	1999	134,600	957,672	1,092,272	134,600	953,130	1,087,730	-4,542	0%
	2000	134,600	845,604	980,204	134,600	797,517	932,117	-48,087	-5%
	2001	71,338	30,631	101,969	52,494	337,876	390,370	288,402	283%
	2002	102,296	541,140	643,436	94,220	606,444	700,664	57,228	9%
	2003	119,639	907,530	1,027,169	120,941	778,435	899,376	-127,793	-12%
	2004	86,144	652,032	738,176	87,490	561,685	649,175	-89,002	-12%
	2005	119,794	906,732	1,026,526	121,140	777,717	898,857	-127,669	-12%
	Total	1,172,211	7,902,071	9,074,281	1,149,285	7,726,524	8,875,809	-198,473	-2%

Table HA-23. Effects of NPA1 Historic SWP Table A Allocations To M&I Contractors With No Table A Changes (Group One)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	100,000	0	100,000	0	0%
	1997	100,000	0	100,000	100,000	0	100,000	0	0%
	1998	100,000	0	100,000	100,000	0	100,000	0	0%
	1999	100,000	0	100,000	100,000	0	100,000	0	0%
	2000	100,000	0	100,000	100,000	0	100,000	0	0%
	2001	53,000	0	53,000	53,000	0	53,000	0	0%
	2002	76,000	0	76,000	76,000	0	76,000	0	0%
	2003	88,885	0	88,885	88,932	0	88,932	47	0%
	2004	64,000	0	64,000	64,000	0	64,000	0	0%
	2005	89,000	0	89,000	89,000	0	89,000	0	0%
	Total	870,885	0	870,885	870,932	0	870,932	47	0%
Santa Barbara	1996	45,486	0	45,486	45,486	0	45,486	0	0%
	1997	38,986	0	38,986	38,986	0	38,986	0	0%
	1998	38,986	0	38,986	38,986	0	38,986	0	0%
	1999	45,486	0	45,486	45,486	0	45,486	0	0%
	2000	45,486	0	45,486	45,486	0	45,486	0	0%
	2001	24,108	0	24,108	24,108	0	24,108	0	0%
	2002	34,569	0	34,569	34,569	0	34,569	0	0%
	2003	40,430	0	40,430	40,452	0	40,452	21	0%
	2004	29,111	0	29,111	29,111	0	29,111	0	0%
	2005	40,483	0	40,483	40,483	0	40,483	0	0%
	Total	383,131	0	383,131	383,152	0	383,152	21	0%
MWD	1996	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1997	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1998	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1999	1,180,000	0	1,180,000	1,180,000	0	1,180,000	0	0%
	2000	1,507,136	0	1,507,136	1,507,136	0	1,507,136	0	0%
	2001	1,066,095	0	1,066,095	1,066,095	0	1,066,095	0	0%
	2002	1,528,740	0	1,528,740	1,528,740	0	1,528,740	0	0%
	2003	1,787,916	0	1,787,916	1,788,866	0	1,788,866	950	0%
	2004	1,287,360	0	1,287,360	1,287,360	0	1,287,360	0	0%
	2005	1,701,235	0	1,701,235	1,701,235	0	1,701,235	0	0%
	Total	16,092,982	0	16,092,982	16,093,932	0	16,093,932	950	0%

Table HA-24. Effects of NPA1 on SWP Table A Allocations To Agricultural Contractors With No Table A Changes (Group Two)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Empire West Side	1996	0	3,000	3,000	0	3,000	3,000	0	0%
	1997	0	3,000	3,000	0	3,000	3,000	0	0%
	1998	0	3,000	3,000	0	3,000	3,000	0	0%
	1999	0	2,820	2,820	0	2,880	2,880	60	2%
	2000	0	2,490	2,490	0	2,520	2,520	30	1%
	2001	0	90	90	0	90	90	0	0%
	2002	0	1,590	1,590	0	1,590	1,590	0	0%
	2003	0	2,667	2,667	0	2,668	2,668	1	0%
	2004	0	1,920	1,920	0	1,920	1,920	0	0%
	2005	0	2,670	2,670	0	2,670	2,670	0	0%
	Total	0	23,247	23,247	0	23,338	23,338	91	0%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	5,700	5,700	0	0%
	1997	0	5,700	5,700	0	5,700	5,700	0	0%
	1998	0	5,700	5,700	0	5,700	5,700	0	0%
	1999	0	5,358	5,358	0	5,472	5,472	114	2%
	2000	0	4,731	4,731	0	4,788	4,788	57	1%
	2001	0	171	171	0	171	171	0	0%
	2002	0	3,021	3,021	0	3,021	3,021	0	0%
	2003	0	5,066	5,066	0	5,069	5,069	3	0%
	2004	0	3,648	3,648	0	3,648	3,648	0	0%
	2005	0	5,073	5,073	0	5,073	5,073	0	0%
	Total	0	44,168	44,168	0	44,342	44,342	174	0%
Kings	1996	0	4,000	4,000	0	4,000	4,000	0	0%
	1997	0	4,000	4,000	0	4,000	4,000	0	0%
	1998	0	4,000	4,000	0	4,000	4,000	0	0%
	1999	0	3,760	3,760	0	3,840	3,840	80	2%
	2000	0	3,320	3,320	0	3,360	3,360	40	1%
	2001	0	120	120	0	120	120	0	0%
	2002	0	2,120	2,120	0	2,120	2,120	0	0%
	2003	0	8,000	8,000	0	8,004	8,004	4	0%
	2004	0	5,760	5,760	0	5,760	5,760	0	0%
	2005	0	8,010	8,010	0	8,010	8,010	0	0%
	Total	0	43,090	43,090	0	43,214	43,214	124	0%
Tulare	1996	0	118,500	118,500	0	118,500	118,500	0	0%
	1997	0	118,500	118,500	0	118,500	118,500	0	0%
	1998	0	118,500	118,500	0	118,500	118,500	0	0%
	1999	0	111,390	111,390	0	113,760	113,760	2,370	2%
	2000	0	98,355	98,355	0	99,540	99,540	1,185	1%
	2001	0	3,555	3,555	0	3,555	3,555	0	0%
	2002	0	59,109	59,109	0	59,109	59,109	0	0%
	2003	0	98,775	98,775	0	98,827	98,827	52	0%
	2004	0	61,585	61,585	0	61,585	61,585	0	0%
	2005	0	85,642	85,642	0	85,642	85,642	0	0%
	Total	0	873,912	873,912	0	877,519	877,519	3,607	0%

Table HA-25. Effects of NPA1 on SWP Table A Allocations To M&I Contractors With Table A Changes (Group Three)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Napa County	1996	10,425	0	10,425	10,425	0	10,425	0	0%
	1997	11,065	0	11,065	11,065	0	11,065	0	0%
	1998	11,710	0	11,710	11,710	0	11,710	0	0%
	1999	15,850	0	15,850	15,850	0	15,850	0	0%
	2000	16,325	0	16,325	16,325	0	16,325	0	0%
	2001	8,851	0	8,851	8,851	121	8,972	121	1%
	2002	12,977	0	12,977	12,977	2,133	15,110	2,133	16%
	2003	15,510	0	15,510	15,519	3,580	19,098	3,588	23%
	2004	11,408	0	11,408	11,408	2,576	13,984	2,576	23%
	2005	16,198	0	16,198	16,198	3,582	19,780	3,582	22%
	Total	130,319	0	130,319	130,328	11,992	142,319	12,000	9%
Solano County	1996	37,800	0	37,800	37,800	0	37,800	0	0%
	1997	38,250	0	38,250	38,250	0	38,250	0	0%
	1998	38,710	0	38,710	38,710	0	38,710	0	0%
	1999	39,170	0	39,170	39,170	0	39,170	0	0%
	2000	39,620	0	39,620	39,620	0	39,620	0	0%
	2001	21,242	0	21,242	21,242	173	21,415	173	1%
	2002	30,810	0	30,810	30,810	3,051	33,861	3,051	10%
	2003	36,443	0	36,443	36,462	5,119	41,581	5,138	14%
	2004	26,528	0	26,528	26,528	3,684	30,212	3,684	14%
	2005	36,935	0	36,935	36,935	5,123	42,058	5,123	14%
	Total	345,509	0	345,509	345,528	17,149	362,677	17,168	5%
Alameda Zone 7	1996	44,000	0	44,000	44,000	0	44,000	0	0%
	1997	46,000	0	46,000	46,000	0	46,000	0	0%
	1998	46,000	0	46,000	46,000	0	46,000	0	0%
	1999	46,000	0	46,000	46,000	0	46,000	0	0%
	2000	46,000	0	46,000	46,000	18,480	64,480	18,480	40%
	2001	24,380	0	24,380	24,380	960	25,340	960	4%
	2002	34,960	212	35,172	34,960	16,960	51,920	16,748	48%
	2003	40,887	0	40,887	40,909	28,458	69,367	28,480	70%
	2004	29,440	256	29,696	29,440	22,156	51,596	21,900	74%
	2005	40,940	356	41,296	40,940	30,811	71,751	30,455	74%
	Total	398,607	824	399,431	398,629	117,825	516,454	117,023	29%

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Mojave	1996	50,800	0	50,800	50,800	0	50,800	0	0%
	1997	50,800	0	50,800	50,800	0	50,800	0	0%
	1998	50,800	0	50,800	50,800	25,000	75,800	25,000	49%
	1999	20,000	0	20,000	20,000	24,000	44,000	24,000	120%
	2000	20,000	0	20,000	20,000	21,000	41,000	21,000	105%
	2001	26,924	0	26,924	26,924	750	27,674	750	3%
	2002	38,608	0	38,608	38,608	13,250	51,858	13,250	34%
	2003	45,153	0	45,153	45,177	22,233	67,410	22,257	49%
	2004	32,512	0	32,512	32,512	16,000	48,512	16,000	49%
	2005	45,212	0	45,212	45,212	22,250	67,462	22,250	49%
	Total	380,809	0	380,809	380,833	144,483	525,316	144,507	38%
Castaic	1996	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1997	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1998	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1999	41,500	11,938	53,438	41,500	12,192	53,692	254	0%
	2000	41,500	10,541	52,041	41,500	45,108	86,608	34,567	66%
	2001	21,995	381	22,376	21,995	1,611	23,606	1,230	5%
	2002	31,540	6,731	38,271	31,540	28,461	60,001	21,730	57%
	2003	36,887	11,288	48,176	36,907	47,756	84,663	36,488	76%
	2004	26,560	8,128	34,688	26,560	34,368	60,928	26,240	76%
	2005	36,935	11,303	48,238	36,935	47,793	84,728	36,490	76%
	Total	361,417	98,410	459,828	361,437	255,389	616,826	156,999	34%
Palmdale	1996	17,300	0	17,300	17,300	0	17,300	0	0%
	1997	17,300	0	17,300	17,300	0	17,300	0	0%
	1998	17,300	0	17,300	17,300	0	17,300	0	0%
	1999	17,300	0	17,300	17,300	0	17,300	0	0%
	2000	17,300	0	17,300	17,300	3,360	20,660	3,360	19%
	2001	9,169	0	9,169	9,169	120	9,289	120	1%
	2002	13,148	0	13,148	13,148	2,120	15,268	2,120	16%
	2003	15,377	0	15,377	15,385	3,557	18,943	3,565	23%
	2004	11,072	0	11,072	11,072	2,560	13,632	2,560	23%
	2005	15,397	0	15,397	15,397	3,560	18,957	3,560	23%
	Total	150,663	0	150,663	150,671	15,277	165,949	15,285	10%

Table HA-26. Effects of NPA1 on SWP Table A Allocations To Agricultural Contractors With Project-Related Table A Changes (Group Four)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	57,700	57,700	0	0%
	1997	0	57,700	57,700	0	57,700	57,700	0	0%
	1998	0	57,700	57,700	0	57,700	57,700	0	0%
	1999	0	54,238	54,238	0	55,392	55,392	1,154	2%
	2000	0	47,891	47,891	0	48,468	48,468	577	1%
	2001	0	1,731	1,731	0	1,731	1,731	0	0%
	2002	0	32,687	32,687	0	32,687	32,687	0	0%
	2003	0	54,818	54,818	0	54,847	54,847	29	0%
	2004	0	39,471	39,471	0	39,471	39,471	0	0%
	2005	0	54,889	54,889	0	54,889	54,889	0	0%
	Total	0	458,824	458,824	0	460,584	460,584	1,760	0%
KCWA	1996	134,600	1,023,130	1,157,730	134,600	1,023,130	1,157,730	0	0%
	1997	134,600	1,018,800	1,153,400	134,600	1,018,800	1,153,400	0	0%
	1998	134,600	1,018,800	1,153,400	134,600	993,800	1,128,400	-25,000	-2%
	1999	134,600	957,672	1,092,272	134,600	954,048	1,088,648	-3,624	0%
	2000	134,600	845,604	980,204	134,600	778,512	913,112	-67,092	-7%
	2001	71,338	30,631	101,969	71,338	27,211	98,549	-3,420	-3%
	2002	102,296	541,140	643,436	102,296	480,720	583,016	-60,420	-9%
	2003	119,639	907,530	1,027,169	119,702	806,630	926,332	-100,837	-10%
	2004	86,144	652,032	738,176	86,144	579,072	665,216	-72,960	-10%
	2005	119,794	906,732	1,026,526	119,794	805,272	925,066	-101,460	-10%
	Total	1,172,211	7,902,071	9,074,281	1,172,274	7,467,194	8,639,469	-434,813	-5%

Table HA-27. Effects of CNPA3 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNP3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA[29]	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	45,713	0	53,204	98,917	-1,083	-1%
	1997	100,000	0	100,000	46,006	0	52,904	98,910	-1,090	-1%
	1998	100,000	0	100,000	45,993	0	52,917	98,911	-1,089	-1%
	1999	100,000	0	100,000	45,622	0	32,036	77,658	-22,342	-22%
	2000	100,000	0	100,000	45,600	0	36,603	82,203	-17,797	-18%
	2001	53,000	0	53,000	44,662	0	301	44,962	-8,038	-15%
	2002	76,000	0	76,000	45,563	0	23,669	69,232	-6,768	-9%
	2003	88,885	0	88,885	45,963	0	42,393	88,356	-529	-1%
	2004	64,000	0	64,000	45,522	0	18,777	64,299	299	0%
	2005	89,000	0	89,000	45,556	0	43,473	89,029	29	0%
	Total	870,885	0	870,885	456,202	0	356,277	812,478	-58,407	-7%
Santa Barbara	1996	45,486	0	45,486	20,793	0	24,200	44,994	-492	-1%
	1997	38,986	0	38,986	17,936	0	20,625	38,561	-425	-1%
	1998	38,986	0	38,986	17,931	0	20,630	38,561	-425	-1%
	1999	45,486	0	45,486	20,752	0	14,572	35,323	-10,163	-22%
	2000	45,486	0	45,486	20,742	0	16,649	37,391	-8,095	-18%
	2001	24,108	0	24,108	20,315	0	137	20,451	-3,656	-15%
	2002	34,569	0	34,569	20,725	0	10,766	31,491	-3,078	-9%
	2003	40,430	0	40,430	20,907	0	19,283	40,190	-240	-1%
	2004	29,111	0	29,111	20,706	0	8,541	29,247	136	0%
	2005	40,483	0	40,483	20,722	0	19,774	40,496	13	0%
	Total	383,131	0	383,131	201,528	0	155,178	356,705	-26,425	-7%
MWD	1996	2,011,500	0	2,011,500	919,523	0	1,070,199	1,989,722	-21,778	-1%
	1997	2,011,500	0	2,011,500	925,417	0	1,064,165	1,989,582	-21,918	-1%
	1998	2,011,500	0	2,011,500	925,159	0	1,064,430	1,989,588	-21,912	-1%
	1999	1,180,000	0	1,180,000	917,689	0	644,399	1,562,088	382,088	32%
	2000	1,507,136	0	1,507,136	917,252	0	736,261	1,653,512	146,376	10%
	2001	1,066,095	0	1,066,095	898,367	0	6,047	904,414	-161,681	-15%
	2002	1,528,740	0	1,528,740	916,504	0	476,106	1,392,610	-136,130	-9%
	2003	1,787,916	0	1,787,916	924,549	0	852,734	1,777,283	-10,633	-1%
	2004	1,287,360	0	1,287,360	915,674	0	377,704	1,293,378	6,018	0%
	2005	1,701,235	0	1,701,235	870,804	0	830,984	1,701,788	553	0%
	Total	16,092,982	0	16,092,982	9,130,937	0	7,123,029	16,253,967	160,985	1%

[29] XA as used in this table refers to ex-Table A water.

Table HA-28. Effects of CNPA3 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Alameda	1996	42,000	0	42,000	19,200	0	22,346	41,545	-455	-1%
	1997	42,000	0	42,000	19,323	0	22,220	41,542	-458	-1%
	1998	42,000	0	42,000	19,317	0	22,225	41,542	-458	-1%
	1999	42,000	0	42,000	19,161	0	13,455	32,616	-9,384	-22%
	2000	42,000	0	42,000	19,152	0	15,373	34,525	-7,475	-18%
	2001	22,260	0	22,260	18,758	0	126	18,884	-3,376	-15%
	2002	31,920	0	31,920	19,137	0	9,941	29,078	-2,842	-9%
	2003	37,332	0	37,332	19,305	0	17,805	37,110	-222	-1%
	2004	26,880	0	26,880	19,119	0	7,886	27,006	126	0%
	2005	37,380	0	37,380	19,134	0	18,259	37,392	12	0%
	Total	365,772	0	365,772	191,605	0	149,636	341,241	-24,531	-7%
Santa Clara Valley	1996	100,000	0	100,000	45,713	0	53,204	98,917	-1,083	-1%
	1997	100,000	0	100,000	46,006	0	52,904	98,910	-1,090	-1%
	1998	100,000	0	100,000	45,993	0	52,917	98,911	-1,089	-1%
	1999	100,000	0	100,000	45,622	0	32,036	77,658	-22,342	-22%
	2000	100,000	0	100,000	45,600	0	36,603	82,203	-17,797	-18%
	2001	53,000	0	53,000	44,662	0	301	44,962	-8,038	-15%
	2002	76,000	0	76,000	45,563	0	23,669	69,232	-6,768	-9%
	2003	88,885	0	88,885	45,963	0	42,393	88,356	-529	-1%
	2004	64,000	0	64,000	45,522	0	18,777	64,299	299	0%
	2005	89,000	0	89,000	45,556	0	43,473	89,029	29	0%
	Total	870,885	0	870,885	456,202	0	356,277	812,478	-58,407	-7%
SLO	1996	25,000	0	25,000	11,428	0	13,301	24,729	-271	-1%
	1997	6,215	0	6,215	2,859	0	3,288	6,147	-68	-1%
	1998	6,215	0	6,215	2,858	0	3,289	6,147	-68	-1%
	1999	25,000	0	25,000	11,406	0	8,009	19,414	-5,586	-22%
	2000	25,000	0	25,000	11,400	0	9,151	20,551	-4,449	-18%
	2001	13,250	0	13,250	11,165	0	75	11,241	-2,009	-15%
	2002	19,000	0	19,000	11,391	0	5,917	17,308	-1,692	-9%
	2003	22,221	0	22,221	11,491	0	10,598	22,089	-132	-1%
	2004	16,000	0	16,000	11,380	0	4,694	16,075	75	0%
	2005	22,250	0	22,250	11,389	0	10,868	22,257	7	0%
	Total	180,151	0	180,151	96,768	0	69,191	165,959	-14,192	-8%

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Santa Barbara	1996	45,486	0	45,486	20,793	0	24,200	44,994	-492	-1%
	1997	38,986	0	38,986	17,936	0	20,625	38,561	-425	-1%
	1998	38,986	0	38,986	17,931	0	20,630	38,561	-425	-1%
	1999	45,486	0	45,486	20,752	0	14,572	35,323	-10,163	-22%
	2000	45,486	0	45,486	20,742	0	16,649	37,391	-8,095	-18%
	2001	24,108	0	24,108	20,315	0	137	20,451	-3,656	-15%
	2002	34,569	0	34,569	20,725	0	10,766	31,491	-3,078	-9%
	2003	40,430	0	40,430	20,907	0	19,283	40,190	-240	-1%
	2004	29,111	0	29,111	20,706	0	8,541	29,247	136	0%
	2005	40,483	0	40,483	20,722	0	19,774	40,496	13	0%
	Total	383,131	0	383,131	201,528	0	155,178	356,705	-26,425	-7%
Crestline	1996	5,800	0	5,800	2,651	0	3,086	5,737	-63	-1%
	1997	5,800	0	5,800	2,668	0	3,068	5,737	-63	-1%
	1998	5,800	0	5,800	2,668	0	3,069	5,737	-63	-1%
	1999	5,800	0	5,800	2,646	0	1,858	4,504	-1,296	-22%
	2000	5,800	0	5,800	2,645	0	2,123	4,768	-1,032	-18%
	2001	3,074	0	3,074	2,590	0	17	2,608	-466	-15%
	2002	4,408	0	4,408	2,643	0	1,373	4,015	-393	-9%
	2003	5,155	0	5,155	2,666	0	2,459	5,125	-31	-1%
	2004	3,712	0	3,712	2,640	0	1,089	3,729	17	0%
	2005	5,162	0	5,162	2,642	0	2,521	5,164	2	0%
	Total	50,511	0	50,511	26,460	0	20,664	47,124	-3,388	-7%

Table HA-29. Effects of CNPA3 SWP Allocations To AG Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA[30]	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	26,377	30,699	57,075	-625	-1%
	1997	0	57,700	57,700	0	26,546	30,526	57,071	-629	-1%
	1998	0	57,700	57,700	0	26,538	30,533	57,071	-629	-1%
	1999	0	54,238	54,238	0	26,324	18,485	44,809	-9,429	-17%
	2000	0	47,891	47,891	0	26,311	21,120	47,431	-460	-1%
	2001	0	1,731	1,731	0	6,574	173	6,747	5,016	290%
	2002	0	32,687	32,687	0	28,100	14,598	42,698	10,011	31%
	2003	0	54,818	54,818	0	28,347	26,145	54,492	-326	-1%
	2004	0	39,471	39,471	0	28,075	11,580	39,655	185	0%
	2005	0	54,889	54,889	0	28,096	26,811	54,907	18	0%
	Total	0	458,824	458,824	0	251,287	210,669	461,957	3,132	1%
Kings	1996	0	4,000	4,000	0	1,829	2,128	3,957	-43	-1%
	1997	0	4,000	4,000	0	1,840	2,116	3,956	-44	-1%
	1998	0	4,000	4,000	0	1,840	2,117	3,956	-44	-1%
	1999	0	3,760	3,760	0	1,825	1,281	3,106	-654	-17%
	2000	0	3,320	3,320	0	1,824	1,464	3,288	-32	-1%
	2001	0	120	120	0	456	12	468	348	290%
	2002	0	2,120	2,120	0	1,823	947	2,769	649	31%
	2003	0	8,000	8,000	0	4,137	3,815	7,952	-48	-1%
	2004	0	5,760	5,760	0	4,097	1,690	5,787	27	0%
	2005	0	8,010	8,010	0	4,100	3,913	8,013	3	0%
	Total	0	43,090	43,090	0	23,769	19,483	43,253	163	0%
Empire West Side	1996	0	3,000	3,000	0	1,371	1,596	2,968	-32	-1%
	1997	0	3,000	3,000	0	1,380	1,587	2,967	-33	-1%
	1998	0	3,000	3,000	0	1,380	1,588	2,967	-33	-1%
	1999	0	2,820	2,820	0	1,369	961	2,330	-490	-17%
	2000	0	2,490	2,490	0	1,368	1,098	2,466	-24	-1%
	2001	0	90	90	0	342	9	351	261	290%
	2002	0	1,590	1,590	0	1,367	710	2,077	487	31%
	2003	0	2,667	2,667	0	1,379	1,272	2,651	-16	-1%
	2004	0	1,920	1,920	0	1,366	563	1,929	9	0%
	2005	0	2,670	2,670	0	1,367	1,304	2,671	1	0%
	Total	0	23,148	23,148	0	13,051	11,512	24,563	1,415	6%

[30] XA as used in this table refers to ex-Table A water.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	2,606	3,033	5,638	-62	-1%
	1997	0	5,700	5,700	0	2,622	3,016	5,638	-62	-1%
	1998	0	5,700	5,700	0	2,622	3,016	5,638	-62	-1%
	1999	0	5,358	5,358	0	2,600	1,826	4,426	-932	-17%
	2000	0	4,731	4,731	0	2,599	2,086	4,686	-45	-1%
	2001	0	171	171	0	649	17	667	496	290%
	2002	0	3,021	3,021	0	2,597	1,349	3,946	925	31%
	2003	0	5,066	5,066	0	2,620	2,416	5,036	-30	-1%
	2004	0	3,648	3,648	0	2,595	1,070	3,665	17	0%
	2005	0	5,073	5,073	0	2,597	2,478	5,075	2	0%
	Total	0	44,168	44,168	0	24,107	20,308	44,415	247	1%
Tulare	1996	0	118,500	118,500	0	54,170	63,047	117,217	-1,283	-1%
	1997	0	118,500	118,500	0	54,518	62,691	117,209	-1,291	-1%
	1998	0	118,500	118,500	0	54,502	62,707	117,209	-1,291	-1%
	1999	0	111,390	111,390	0	54,062	37,962	92,025	-19,365	-17%
	2000	0	98,355	98,355	0	54,036	43,374	97,410	-945	-1%
	2001	0	3,555	3,555	0	13,501	356	13,857	10,302	290%
	2002	0	59,109	59,109	0	50,815	26,398	77,213	18,104	31%
	2003	0	98,775	98,775	0	51,077	47,110	98,188	-587	-1%
	2004	0	61,585	61,585	0	43,804	18,069	61,873	288	0%
	2005	0	85,642	85,642	0	43,837	41,833	85,670	28	0%
	Total	0	873,912	873,912	0	474,324	403,547	877,871	3,959	0%

Table HA-30. Effects of CNPA4 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
Santa Barbara	1996	45,486	0	45,486	20,793	0	23,766	44,559	-927	-2%
	1997	38,986	0	38,986	17,936	0	20,247	38,183	-803	-2%
	1998	38,986	0	38,986	17,931	0	20,253	38,184	-802	-2%
	1999	45,486	0	45,486	20,752	0	21,791	42,542	-2,944	-6%
	2000	45,486	0	45,486	20,742	0	18,297	39,039	-6,447	-14%
	2001	24,108	0	24,108	20,315	0	0	20,315	-3,793	-16%
	2002	34,569	0	34,569	20,725	0	0	20,725	-13,844	-40%
	2003	40,430	0	40,430	20,907	0	15,099	36,005	-4,425	-11%
	2004	29,111	0	29,111	20,706	0	0	20,706	-8,405	-29%
	2005	40,483	0	40,483	20,722	0	14,874	35,596	-4,887	-12%
	Total	383,131	0	383,131	201,528	0	134,326	335,854	-47,277	-12%
MWD	1996	2,011,500	0	2,011,500	919,523	0	1,062,048	1,981,571	-29,929	-1%
	1997	2,011,500	0	2,011,500	925,417	0	1,055,841	1,981,258	-30,242	-2%
	1998	2,011,500	0	2,011,500	925,159	0	1,056,144	1,981,303	-30,197	-2%
	1999	1,180,000	0	1,180,000	917,689	0	239,522	1,157,211	-22,789	-2%
	2000	1,507,136	0	1,507,136	917,252	0	477,681	1,394,933	-112,203	-7%
	2001	1,066,095	0	1,066,095	898,367	0	2,986	901,352	-164,743	-15%
	2002	1,528,740	0	1,528,740	916,504	0	234,797	1,151,301	-377,439	-25%
	2003	1,787,916	0	1,787,916	924,549	0	780,895	1,705,444	-82,472	-5%
	2004	1,287,360	0	1,287,360	915,674	0	183,757	1,099,431	-187,929	-15%
	2005	1,701,235	0	1,701,235	870,804	0	737,288	1,608,092	-93,143	-5%
	Total	16,092,982	0	16,092,982	9,130,937	0	5,830,959	14,961,897	-1,131,086	-7%
Palmdale	1996	17,300	0	17,300	7,908	0	9,039	16,947	-353	-2%
	1997	17,300	0	17,300	7,959	0	8,985	16,944	-356	-2%
	1998	17,300	0	17,300	7,957	0	8,987	16,944	-356	-2%
	1999	17,300	0	17,300	7,893	0	8,288	16,180	-1,120	-6%
	2000	17,300	0	17,300	7,889	1,824	5,610	15,323	-1,977	-11%
	2001	9,169	0	9,169	7,726	911	0	8,638	-531	-6%
	2002	13,148	0	13,148	7,882	1,823	0	9,705	-3,443	-26%
	2003	15,377	0	15,377	7,952	0	5,743	13,694	-1,683	-11%
	2004	11,072	0	11,072	7,875	1,821	0	9,696	-1,376	-12%
	2005	15,397	0	15,397	7,881	1,822	4,563	14,266	-1,131	-7%
	Total	150,663	0	150,663	78,923	8,201	51,214	138,338	-12,325	-8%

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
Mojave	1996	50,800	0	50,800	23,222	0	27,578	50,800	0	0%
	1997	50,800	0	50,800	23,371	0	27,429	50,800	0	0%
	1998	50,800	0	50,800	23,365	11,498	15,937	50,800	0	0%
	1999	20,000	0	20,000	20,000	11,406	0	31,406	11,406	57%
	2000	20,000	0	20,000	20,000	11,400	0	31,400	11,400	57%
	2001	26,924	0	26,924	22,688	5,697	164	28,549	1,625	6%
	2002	38,608	0	38,608	23,146	11,391	12,916	47,453	8,845	23%
	2003	45,153	0	45,153	23,349	11,491	15,960	50,800	5,647	13%
	2004	32,512	0	32,512	23,125	11,380	10,120	44,626	12,114	37%
	2005	45,212	0	45,212	23,142	11,389	16,269	50,800	5,588	12%
	Total	380,809	0	380,809	225,409	85,652	126,372	437,433	56,623	15%
Coachella	1996	23,100	0	23,100	10,560	0	12,540	23,100	0	0%
	1997	23,100	0	23,100	10,627	0	12,473	23,100	0	0%
	1998	23,100	0	23,100	10,624	0	12,476	23,100	0	0%
	1999	23,100	0	23,100	10,539	0	12,561	23,100	0	0%
	2000	23,100	0	23,100	10,534	0	12,566	23,100	0	0%
	2001	12,243	0	12,243	10,317	0	127	10,444	-1,799	-15%
	2002	17,556	0	17,556	10,525	0	9,987	20,512	2,956	17%
	2003	20,532	0	20,532	10,617	0	12,483	23,100	2,568	13%
	2004	14,784	6,336	21,120	10,516	4,507	11,165	26,188	5,068	24%
	2005	98,968	8,811	107,779	50,658	4,510	65,932	121,100	13,321	12%
	Total	279,583	15,147	294,730	145,517	9,017	162,309	316,843	22,113	8%

Table HA-31. Effects of CNPA4 on SWP Allocations To AG Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS[31]	Total	AF	%
Empire West Side	1996	0	3,000	3,000	0	1,371	1,629	3,000	0	0%
	1997	0	3,000	3,000	0	1,380	1,620	3,000	0	0%
	1998	0	3,000	3,000	0	1,380	1,620	3,000	0	0%
	1999	0	2,820	2,820	0	1,369	1,631	3,000	180	6%
	2000	0	2,490	2,490	0	1,368	1,632	3,000	510	20%
	2001	0	90	90	0	684	20	703	613	682%
	2002	0	1,590	1,590	0	1,367	1,566	2,932	1,342	84%
	2003	0	2,667	2,667	0	1,379	1,621	3,000	333	13%
	2004	0	1,920	1,920	0	1,366	1,255	2,621	701	36%
	2005	0	2,670	2,670	0	1,367	1,633	3,000	330	12%
	Total	0	23,247	23,247	0	13,030	14,227	27,256	4,010	17%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	2,606	3,094	5,700	0	0%
	1997	0	5,700	5,700	0	2,622	3,078	5,700	0	0%
	1998	0	5,700	5,700	0	2,622	3,078	5,700	0	0%
	1999	0	5,358	5,358	0	2,600	3,100	5,700	342	6%
	2000	0	4,731	4,731	0	2,599	3,101	5,700	969	20%
	2001	0	171	171	0	1,299	38	1,337	1,166	682%
	2002	0	3,021	3,021	0	2,597	2,975	5,572	2,551	84%
	2003	0	5,066	5,066	0	2,620	3,080	5,700	634	13%
	2004	0	3,648	3,648	0	2,595	2,384	4,979	1,331	36%
	2005	0	5,073	5,073	0	2,597	3,103	5,700	627	12%
	Total	0	44,168	44,168	0	24,757	27,031	51,787	7,619	17%
Dudley Ridge	1996	0	57,700	57,700	0	26,377	31,323	57,700	0	0%
	1997	0	57,700	57,700	0	26,546	31,154	57,700	0	0%
	1998	0	57,700	57,700	0	26,538	31,162	57,700	0	0%
	1999	0	54,238	54,238	0	26,324	31,376	57,700	3,462	6%
	2000	0	47,891	47,891	0	26,311	31,389	57,700	9,809	20%
	2001	0	1,731	1,731	0	13,148	381	13,529	11,798	682%
	2002	0	32,687	32,687	0	28,100	32,184	60,285	27,598	84%
	2003	0	54,818	54,818	0	28,347	33,326	61,673	6,855	13%
	2004	0	39,471	39,471	0	28,075	25,798	53,872	14,402	36%
	2005	0	54,889	54,889	0	28,096	33,577	61,673	6,784	12%
	Total	0	458,824	458,824	0	257,861	281,671	539,532	80,708	18%

[31] SS as used in this table refers to scheduled surplus water.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
KCWA	**1996**	134,600	1,023,130	1,157,730	61,530	467,706	626,134	1,155,370	-2,360	0%
	1997	134,600	1,018,800	1,153,400	61,925	468,713	620,387	1,151,025	-2,375	0%
	1998	134,600	1,018,800	1,153,400	61,907	457,083	631,994	1,150,984	-2,416	0%
	1999	134,600	957,672	1,092,272	61,407	453,393	631,000	1,145,800	53,528	5%
	2000	134,600	845,604	980,204	61,378	422,624	651,955	1,135,958	155,754	16%
	2001	71,338	30,631	101,969	60,114	206,678	7,445	274,237	172,268	169%
	2002	102,296	541,140	643,436	61,328	413,267	587,574	1,062,170	418,733	65%
	2003	119,639	907,530	1,027,169	61,866	469,293	600,374	1,131,533	104,364	10%
	2004	86,144	652,032	738,176	61,273	411,883	470,080	943,235	205,059	28%
	2005	119,794	906,732	1,026,526	61,318	412,191	652,737	1,126,247	99,721	10%
	Total	1,172,211	7,902,071	9,074,281	614,047	4,182,830	5,479,680	10,276,558	1,202,276	13%
Kings	**1996**	0	4,000	4,000	0	1,829	2,171	4,000	0	0%
	1997	0	4,000	4,000	0	1,840	2,160	4,000	0	0%
	1998	0	4,000	4,000	0	1,840	2,160	4,000	0	0%
	1999	0	3,760	3,760	0	1,825	2,175	4,000	240	6%
	2000	0	3,320	3,320	0	1,824	2,176	4,000	680	20%
	2001	0	120	120	0	911	26	938	818	682%
	2002	0	2,120	2,120	0	1,823	2,087	3,910	1,790	84%
	2003	0	8,000	8,000	0	4,137	4,863	9,000	1,000	13%
	2004	0	5,760	5,760	0	4,097	3,765	7,862	2,102	36%
	2005	0	8,010	8,010	0	4,100	4,900	9,000	990	12%
	Total	0	43,090	43,090	0	24,225	26,484	50,710	7,620	18%
Tulare	**1996**	0	118,500	118,500	0	54,170	64,330	118,500	0	0%
	1997	0	118,500	118,500	0	54,518	63,982	118,500	0	0%
	1998	0	118,500	118,500	0	54,502	63,998	118,500	0	0%
	1999	0	111,390	111,390	0	54,062	64,438	118,500	7,110	6%
	2000	0	98,355	98,355	0	54,036	64,464	118,500	20,145	20%
	2001	0	3,555	3,555	0	27,002	783	27,785	24,230	682%
	2002	0	59,109	59,109	0	50,815	58,201	109,016	49,907	84%
	2003	0	98,775	98,775	0	51,077	60,050	111,127	12,352	13%
	2004	0	61,585	61,585	0	43,804	40,251	84,056	22,471	36%
	2005	0	85,642	85,642	0	43,837	52,390	96,227	10,585	12%
	Total	0	873,912	873,912	0	487,825	532,887	1,020,712	146,800	17%

J. TERRESTRIAL BIOLOGICAL RESOURCES

Introduction

This document provides additional information on special status plant and wildlife species and sensitive habitats that could occur within the Monterey Amendment project areas (Table 1, in back). These species and habitats were determined based on a review of the following sources:

- A California Natural Diversity Database (CNDDB) query and United States Fish and Wildlife Service (USFWS) official species lists for the following 7.5 minute topographic quadrangle maps, including the Department facility and surrounding quads in an approximately 10-mile radius:
  - For Lake Perris – Riverside East, Sunnymead, El Casco, Steele Peak, Perris, Lakeview, Lake Elsinore, Romoland, and Winchester quads;
  - For Castaic Lake - Black Mountain, Liebre Mountain, Burnt Peak, Lake Hughes, Green Valley, Warm Springs Mountain, Whitaker Peak, Cobblestone Mountain, Piru, Val Verde, Newhall, and Mint Canyon quads;
  - For San Luis Reservoir – Mustang Peak, Crevison Peak, Howard Ranch, Ingomar, Pacheco Peak, Pacheco Pass, San Luis Dam, Volta, Three Sisters, Mariposa Peak, Los Banos Valley, and Ortigalita Peak NW quads; and
  - For the Kern Fan Element – Lokern, Buttonwillow, Rio Bravo, Rosedale, Stevens, Tupman, East Elk Hills, West Elk Hills, Fellows, Taft, Mouth of Kern and Millux quads;
- A CNDDB query and USFWS official species lists of Plumas County; and
- A CNDDB query for a 200-foot wide corridor along the Feather River, from Lake Oroville to where it joints the Sacramento River; and the Sacramento River from where it joins the Feather River to the Delta.

South San Joaquin Valley

The Monterey Amendment resulted in the transfer or retirement of Table A amounts that ultimately resulted in a reduction of irrigation water for the following water districts in the southern San Joaquin Valley: Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Wheeler Ridge-Maricopa WD, the Kings County WD, the Dudley Ridge WD and the Tulare Lake Basin WD. The Belridge WSD, Berrenda Mesa WD, Lost Hills WD, and Wheeler Ridge-Maricopa WD are located within the KCWA boundaries along western Kern County. The Kings County WD, the Dudley Ridge WD and the Tulare Lake Basin WD are located in Kings County, although a small portion of the Tulare Lake Basin WD is located in Tulare County.

Sensitive Communities

<u>Northern Hardpan Vernal Pool</u>

Northern hardpan vernal pool habitat consists of shallow ephemeral water bodies found in depressions (up to several hectares in size) occurring in grasslands and open woodlands throughout intermountain valleys of California and Oregon. Northern hardpan vernal pools are formed by an indurated clay or cemented hardpan that retains water from surface runoff through winter and some portion of the spring, but typically dry down entirely by the early summer months. This habitat typically occurs in areas with a hummocky micro-relief. Characteristic plant species include downingia (*Downingia* spp.), quillwort (*Isoetes orcuttii*), America pillwort (*Pilularia* *americana*), white brodiaea (*Triteleia hyacinthina*), spikerush (*Eleocharis* spp.), coyote thistle (*Eryngium* ssp.), popcornflower (*Plagiobothrys* spp.), speedwell (*Veronica peregrina*), annual hairgrass (*Deschampsia* sp.), and water starwort (*Callitriche* spp.) As these pools dry in the spring and early summer, the plants grow and bloom often forming concentric rings of similar vegetation. Due to their isolation in upland-dominated landscapes, many endemic plant species are common in vernal pools. Northern hardpan vernal pool habitat has been recorded approximately nine miles east of the Kings County WD.

Valley Saltbush Scrub

Valley saltbush scrub is found in the southern and southwestern San Joaquin Valley on dissected alluvial fans with low relief. Soils are typically sandy to loamy without surface alkalinity. This vegetation community is dominated by gray-green or blue-gray shrubs of the Goosefoot family *(Chenopodiaceae)* and a low herbaceous annual understory. Characteristic shrubs include alkali saltbrush *(Atriplex polycarpa),* spinescale *(A. spinifera),* arrow saltbush *(A. phyllostegia),* alkali heath *(Frankenia salina)* and alkali goldenbush *(Haplopappus acradenius).* Understory species include recurved larkspur *(Delphinium recurvatum),* bird's eyes *(Gilia tricolor),* spikeweed *(Hemizonia pungens),* and cream cups *(Platystemon californicus).* Valley saltbrush scrub habitat has been recorded within the Dudley Ridge WD and the Belridge WSD.

Valley Sacaton Grassland

Valley sacaton grassland habitat is largely vegetation by alkali sacaton *(Sporobolus airoides),* a tussock, or tuft forming grass. Additional species include saltgrass *(Distichlis spicata),* and low barley *(Hordeum depressum).* This habitat is found in areas with fine textured, poorly drained and usually alkaline soils, that have either seasonally high water tables or are flooded during the winter. Valley sacaton grassland is greatly reduced from its historically extensive range in the Tulare Lake Basin and along the San Joaquin Valley trough. Valley sacaton grassland habitat has been recorded in the Kings County WD.

Special Status Plants

Bakersfield Cactus (*Opuntia basilaris* var, *treleasei*)

Bakersfield cactus is a state and federal endangered species and is listed as a CNPS 1B plant (rare, threatened or endangered in California and elsewhere). A recovery plan for this species is provided in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. Bakersfield cactus is a perennial low growing cactus (Cactaceae). It typically spreads to form extensive thickets. It generally forms fleshy, flattened green beavertail-like pads (flattened stems) 3 to 4 inches wide by 5 to 7 inches long that produce showy magenta flowers. The eye-spots on the pads contain spines in addition to bristles. The species occurs on flood plains, ridges, bluffs and rolling hills in saltbush scrub plant communities, and occasionally in blue oak woodland or riparian woodland at elevations from 460 to 1,800 feet. Distribution is restricted to a limited area of central Kern County near Bakersfield. The most serious threats are residential development near Bakersfield and habitat conversion to agriculture. Bakersfield cactus has been recorded within the Wheeler Ridge-Maricopa WSD.

Brittlescale (*Atriplex depressa*)

Brittlescale is a CNPS List 1B plant. A dicot in the family Chenopodiaceae, it is an annual herb that is native to California and is endemic to California. *Atriplex* ssp. are herbs or shrubs, usually grayish or whitish. Brittlescale is found on alkaline or clay soils in alkali flats in largely grassland areas of the Sacramento Valley and San Joaquin Valley less than 650 feet in elevation. It has been recorded in the Kings County WD.

California Jewel-flower (*Caulanthus californicus*)

The California jewel-flower is a state and federal endangered species and is listed as a CNPS List 1B plant. A recovery plan for this species is provided in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. California jewel-flower is an annual herb in the mustard family (Brassicaceae), with flattened, sword-shaped fruits. Its stems are erect, up to about 1 foot tall, and produce several flowering branches. The leaves are wavy-margined and most are in a basal rosette. Known populations of California jewel-flower occur in nonnative grassland, upper sonoran subshrub scrub, and cismontane juniper woodland and scrub communities. Potential threats to remaining populations include competition from nonnative plants, pesticide effects on pollinators, small population size and development on private land in the Santa Barbara Canyon area. California jewel-flower has been recorded in the Berrenda Mesa WD and Belridge WSD.

Comanche Point Layia (*Layia leucopappa*)

Comanche Point layia is a CNPS List 1B plant. It has glandular stems that grow up to 24 inches tall. The leaves are oblong, fleshy, and lobed. Comanche Point layia is distinguished from other members of the genus that have white ray flowers by the fleshy leaves and microscopic characteristics of the flower head and achenes. The typical flowering period for Comanche Point layia, an annual, is March to April. Comanche Point layia is endemic to Kern County. It occurred historically in three general areas of the extreme southern San Joaquin Valley and adjacent hills to the east: (1) the Comanche and Tejon Hills (including the type locality), (2) between Edison and Bena, and (3) on the Valley floor near the southern end of Kern Lake. The formerly extensive occurrences of Comanche Point layia on the Valley floor apparently have been eliminated by conversion to agriculture. Populations in the Comanche and Tejon Hills potentially are threatened by urban development and are subject to grazing. This species has been recorded in the Wheeler Ridge-Maricopa WSD.

Earlimart Orache (*Atriplex erecticaulis*)

Earlimart orache is a CNPS List 1B plant. It grows at elevations below 100 meters in dry areas between vernal pools, but not actually in the pools or depressions, and along roadsides. This plant is endemic to California and known from Tulare, Kern and Kings counties in uncultivated areas. While its distribution is presently restricted, it was likely more broadly distributed before the implementation of current agricultural practices, which removed its habitat. This species has been recorded in Kings County WD.

Kern Mallow (*Eremalche kernensis*)

Kern mallow is a federally endangered species and is listed as a CNPS List 1B plant. Recovery of this species is addressed in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. Kern mallow is a small, annual herb belonging to the mallow family (Malvaceae). It has predominantly white to sometimes pale lavender, hollyhock-like flowers. The species typically occurs in valley saltbush scrub communities, where it grows under and around spiny and common saltbushes and in patches with other herbaceous plants. Kern mallow is known from a single metapopulation consisting of intermittent occurrences within an area of approximately 40 square miles at the eastern base of the Temblor Range in the Lokern area of western Kern County. The distribution runs from the vicinity of McKittrick to near Buttonwillow. This species has been recorded in the Belridge WSD and Lost Hills WD.

Lemmon's Jewel-flower (*Caulanthus coulteri* var. *lemmonii*)

Lemmon's jewel-flower is a CNPS List 1B plant. This is an annual herb, with whitish or cream-colored, purple or dark veined flowers that bloom March to May. It is found in valley and foothill grassland and pinyon and juniper woodland habitats at elevations between 250 and 4,000 feet. Threats include loss of habitat, primarily through development. This species has been documented in the Wheeler Ridge-Maricopa WD.

Lost Hills Crownscale (*Atriplex vallicola*)

Lost Hills crownscale is a CNPS List 1B plant. This species is an annual that flowers from May to August. The short stems have few branches and alternate, egg-shaped leaves with entire margins. The individual flowers are inconspicuous because they are tiny and have no petals. Lost Hills crownscale typically grows in the dried beds of alkaline pools within scrub or annual grassland communities, although one population in southern Kern County occurs on exposed slopes rich in gypsum. Historical locations for Lost Hills crownscale were in Fresno, Kern, and San Luis Obispo counties. Two large centers of concentration remain today. One overlaps the Kern-Kings county boundary near the community of Lost Hills, and the other is on the Carrizo Plain in San Luis Obispo County. Much smaller populations are known from the Kerman Ecological Reserve in Fresno County, the Lokern-McKittrick area of Kern County, and southwestern Merced County. Other historically-known occurrences and much suitable valley-floor habitat have been destroyed by conversion to agriculture. This species has been recorded in the Lost Hills WD and Belridge WSD.

Recurved Larkspur (*Delphinium recurvatum*)

Recurved larkspur is a CNPS List 1B plant. This perennial herb in the buttercup (Ranunculaceae) family occurs in chenopod scrub and valley grassland on alkaline, poorly drained soils in scattered locations throughout the Central Valley and Central Coast. Recurved larkspur produces flowers with light blue sepals and white lower petals from March through June. Occurrences of recurved larkspur have been recorded in Kings County WD, Lost Hills WD and Belridge WSD.

San Joaquin Woollythreads (*Lembertia congdonii*)

San Joaquin woollythreads are a federally endangered and CNPS List 1B plant. It is an annual herb in the sunflower family (Asteraceae) that produces small yellow disk flowers from March to April. It is associated with the valley saltbrush scrub habitat, often found in drifted sand or clayey, alkaline soil. San Joaquin woollythreads have been documented in the Dudley Ridge WD, Lost Hills WD, and Belridge WSD.

<u>Subtle Orache (*Atriplex subtilis*)</u>

Subtle orache is a CNPS List 1B species. It is a member of the goosefoot family that blooms from August to October. It inhabits valley and foothill grassland from elevations between 40 to 100 meters and is known from the southern San Joaquin Valley, from Merced County in the north to Kern County in the south. Subtle orache has been recorded in Kings County WD.

<u>Tejon Poppy (*Eschscholzia lemmonii* ssp. *kernensis*)</u>

Tejon poppy is a CNPS List 1B plant. It is an annual herb that flowers from March to April. The deeply-divided leaves of Tejon poppy are mostly clustered at the base of the plant. Each flowering stem is taller than the leaves and bears a single, erect, hairless bud that develops into a showy orange flower with four petals. It grows on adobe clay soils in sparsely-vegetated grasslands between 250 and 600 meters in elevation. Tejon poppy is restricted to Kern County. It occurred historically in six areas in the low hills that surround the southern tip of the San Joaquin Valley, from Dry Bog Knoll (between Bakersfield and Woody) on the northeast to Elk Hills on the northwest. Tejon poppy has not been reported since 1969 but is assumed to remain in all areas where it was reported formerly because habitats have not been modified substantially. It has been recorded in the Wheeler Ridge Maricopa WD.

Special Status Wildlife

<u>Invertebrates</u>

Doyen's Trigonoscuta Dune Weevil (*Trigonoscuta* sp.)

Doyen's trigonoscuta dune weevil is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. Little is known about the biology or habits of dune weevils of the genus *Trigonoscuta* other than they are restricted to sandy soils of unstabilized dunes or similar accumulations of sand. Flightless and nocturnal, weevils in this genus are associated with a wide variety of plant types; the larvae feed on the roots and the adults on the leaves. All *Trigonoscuta* species are associated with either coastal, desert, or other inland sand dunes. Most inland species of the genus are found in the southwestern deserts. The primary threats to this species are the random effects of environmental and population processes facing all small, single populations. Other threats include off-road vehicle use and road widening, sand stabilization, or other highway maintenance activities by Caltrans. It has been recorded in the Dudley Ridge WD.

Molestan Blister Beetle (*Lytta molesta*)

The Molestan blister beetle is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. It is a member of the family Meloidae. Beetles of this family are variable in form, but generally have a down-turned head, soft bodies, and leathery wings. Species of the genus *Lytta* are believed to be parasites of ground-nesting bees of the genus *Anthophora*. Adults eat the flowers and pollen of various flowers, including *Lupinus* sp. and *Erodium cicutarium*. Adult Lytta beetles are typically observed in March and April, in non-native grassland and vernal pool habitats at localities in the San Joaquin Valley from Contra Costa County south to Kern and Tulare counties. CNDDB records indicate a distribution along the grassy plains and low foothills of the Sierra Nevada along the east side of the Central Valley, and throughout the Coast Ranges, from Kern County to Brentwood in Contra Costa County.

Little is known about the status of the molestan blister beetle due to the lack of definitive studies of its distribution. The specific habitat requirements for the molestan blister beetle would be the presence of beetle-type wildflowers for adults and anthophorid bee nests for larvae in a grassland setting; proximity to vernal pools may be important, but this may not be an essential requirement. This species has been recorded in the Lost Hills WD.

San Joaquin Dune Beetle (*Coelus gracilis*)

The San Joaquin dune beetle is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. Little information exists on the feeding habitats of this species, though it is probably a detritivore, feeding on decomposing vegetation buried in the sand. The hot summer climate of the San Joaquin Valley prevents a majority of beetles from emerging from the sand, so active periods range from about November through April. Activity also coincides with the growth period of the winter ephemeral plants under which San Joaquin dune beetles reside. Historically, the range of the San Joaquin dune beetle extended from Antioch, Contra Costa County, in the north to the Kettleman Hills, Kings County in the south. They inhabited inland sand dunes within this range. Currently, this beetle is restricted to small isolated sand dunes (250 - 10,000 m^2) along the western edge of the San Joaquin Valley. Although no direct evidence exists of a population decline of San Joaquin dune beetles, it is inferred from the widespread loss of sand dune communities in the Valley and apparent disappearance from near Antioch, Contra Costa County, California. This species has been recorded at the Dudley Ridge WD.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

Vernal pool fairy shrimp are federally listed as threatened. They are small (11 to 27 mm) crustaceans adapted to survive the annual flooding and drying of vernal pools. They grow for about two weeks, breed, and produce eggs that the females carry in an egg sac until they mature. As the vernal pool dries, the adults die, and the eggs become embedded in the mud at the bottom of the pool. These “resting” eggs are protected by thick outer coverings that resist cold, heat, and desiccation during the summer months. The egg bank in the soil may contain eggs from several years of breeding. Vernal pool fairy shrimp occur throughout most of the length of California's Central Valley, from the Millville Plains and Stillwater Plains in Shasta County to Pixley in Tulare County with disjunct populations in the Santa Rosa Plateau near Rancho Santa California in Riverside County. They are threatened by commercial and residential development; conversion of land to agricultural uses; habitat fragmentation (which leads to the loss of genetic variability and related problems of inbreeding); off-road vehicle use; disposal of garbage into their habitat; water, flood control, highway, and utility projects; changes in the hydrologic patterns of their vernal pool and swale habitat; inadequate regulatory mechanisms that protect sites inhabited by these species; overgrazing; and potential extinction by virtue of the small isolated nature of the remaining populations. This species has been recorded in the Kings County WD.

Vernal Pool Tadpole Shrimp (*Lepidurus packardi*)

Vernal pool tadpole shrimp are federally listed as endangered. Vernal pool tadpole shrimp are small to moderate sized crustaceans adapted to survive in deeper or longer lasting vernal pools and other seasonal wetlands. Like the fairy shrimp, they grow over a period of a few weeks, breed, and produce eggs that the females carry in an egg sac until they mature. As the vernal pool dries, the adults die, and the eggs become embedded in the mud at the bottom of the pool.

These “resting” eggs are protected by thick outer coverings that resist cold, heat, and desiccation during the summer months. Vernal pool tadpole shrimp are found throughout the Central Valley. This species has been recorded in the Kings County WD.

<u>Amphibians</u>

California Tiger Salamander (*Ambystoma californiense*)

The California tiger salamander (CTS) is federally listed as threatened and a California species of special concern. CTS is most commonly found in annual grassland habitat, but also occurs in grassy understory of open valley-foothill hardwood habitats. The species occurs from near Petaluma, Sonoma County, east through the Central Valley to Yolo and Sacramento counties and south to Tulare County, and from the vicinity of San Francisco Bay south at least to Santa Barbara County. Adults spend most of the year in subterranean refugia, especially burrows of California ground squirrels (*Spermophilus beecheyi*) and occasionally man-made structures. The primary cause of decline of CTS populations is the loss and fragmentation of habitat from human activities and the encroachment of nonnative predators. All of the estimated seven genetic populations of this species have been significantly reduced because of urban and agricultural development, land conversion, and other human-caused factors. This species has been recorded in the Kings County WD.

Western Spadefoot (*Scaphiopus hammondii*)

Western spadefoot is a California species of special concern. This species occurs primarily in grasslands, but occasional populations also occur in valley-foothill hardwood woodlands. Grasslands with shallow temporary pools are optimal habitats for this species. Breeding and egg laying occur in shallow temporary pools. They spend most of their time in underground burrows, which they construct themselves or that have been constructed by burrowing mammals. During the first rains of fall, this species initiates surface movements. Breeding activities normally conclude by the end of March. This species has been recorded in Belridge WSD and Kings County WD.

<u>Reptiles</u>

Blunt-nosed Leopard Lizard *(Gambelia sila)*

Blunt-nosed leopard lizard (BNLL) is a federal and state-listed endangered species and a state “fully protected” species. BNLL are endemic to the San Joaquin Valley and not found above 800 meters in elevation. BNLL are generally found in sparsely vegetated alkali and desert scrub habitats throughout scattered locations in the San Joaquin Valley and adjacent foothills. They do not excavate their burrows, seeking cover in mammal burrows, under shrubs, or under structures such as fence posts. In the southern San Joaquin Valley, extent populations of BNLL are known to occur on the Pixley National Wildlife Refuge, Liberty Farms, Allensworth, Kern National Wildlife Refuge, Antelope Plain, Buttonwillow, Elk Hills, and Tupman Essential Habitat Areas, on the Carrizo and Elkhorn Plains, north of Bakersfield around Poso Creek, and in western Ken County. This species has been recorded in Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Wheeler-Ridge Maricopa WD, Dudley Ridge WD and Tulare Lake Basin WD.

San Joaquin Whipsnake (*Masticophis flagellum ruddocki*)

The San Joaquin whipsnake is listed as a California species of special concern. The San Joaquin whipsnake's range extends from Colusa County in the Sacramento Valley southward to the Grapevine in the Kern County portion of the San Joaquin Valley and westward into the inner South Coast Ranges and the Carrizo Plain. The San Joaquin whipsnake occurs in open, dry, vegetative associations with little or no tree cover. In the western San Joaquin Valley, it occurs in valley grassland and saltbush scrub associations and is known to climb bushes for viewing prey and potential predators. The San Joaquin whipsnake requires one or more mammal associates as prey and uses burrows for refuge and probably for egg-laying sites. This species has been recorded in the Lost Hills WD.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles, including both the northwestern (ssp. *marmorata*) and southwestern (ssp. *pallida*) subspecies, are California species of special concern. The drab brown or khaki-colored turtle lacks prominent markings on its carapace. Western pond turtles occur in a variety of permanent and intermittent aquatic habitats, such as ponds, marshes, rivers, streams, and ephemeral pools. Pond turtles require suitable basking and haul-out sites, such as emergent rocks or floating logs, and an upland nest site in the vicinity of the aquatic habitat, often within 200 meters. Western pond turtles range throughout the state of California, from southern coastal California and the Central Valley, east to the Cascade Range and Sierra Nevadas. They have been recorded in the Kings County WD.

Birds

Burrowing Owl *(Athene cunicularia)*

Burrowing owl is a California species of special concern. They are found in open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Burrowing owls are subterranean nesters that are dependent on burrowing mammals (e.g., California ground squirrel) to create their burrows. It breeds from March through August. This species has been recorded in the Wheeler Ridge Maricopa WD, Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Tulare Basin WD and Kings County WD.

Le Conte's Thrasher (*Toxostoma lecontei)*

The Le Conte's thrasher is a California species of special concern. It is pale gray-brown on the upperparts and pale buff on the underparts. The long tail is dark brown to blackish, and contrasts with the pale body. The undertail coverts are buffy. The wings are short and rounded, typical of sedentary, terrestrial birds. The Le Conte's Thrasher inhabits desert flats, washes and alluvial fans with sandy and/or alkaline soil and scattered shrubs. Loss of habitat throughout its range is the main threat to the Le Conte's Thrasher. This species has been recorded in the Belridge WSD.

Mountain Plover (*Charadrius montanus*)

The mountain plover is a California species of special concern. It is endemic to North America and nests in the High Plains of the West. After nesting, it migrates southwest-ward to spend the winter in California and the U.S./Mexico borderlands. One of the most important wintering sites is the Imperial Valley where up to 40 percent of the global population may spend the winter in agricultural fields and pastures, especially those recently burned or grazed. Significant numbers of mountain plovers also winter in upland areas of the Sacramento-San Joaquin Delta, the western San Joaquin Valley, the Carrizo Plain and Antelope Valley, north of Los Angeles. This species has been recorded in the Berenda Mesa WD.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk is a state-listed threatened species. It breeds in stands with few trees in juniper-sage flats, riparian areas, or oak savannah adjacent to suitable foraging habitat such as grasslands, alfalfa or grainfields with rodent populations. Threats to Swainson's hawk include development, resulting in the loss of foraging and nesting habitat. It breeds from March to October. This species has been recorded in the Kings County WD.

Tricolored Blackbird (*Agelaius tricolor*)

The tricolored blackbird is a California species of special concern. Although tricolored blackbirds occur sparingly in northwestern Baja California and south central Oregon, they are primarily endemic to the Central Valley and coastal valleys of California. They are a highly gregarious bird, forming large flocks in both breeding and non-breeding seasons. Nests are built near or over water, and occasionally in agricultural fields. Recently, tricolored blackbirds have displayed tendencies toward increased nesting in patches of blackberry, willows, mustard, thistles, nettles, and even grasses. It breeds from April through July. This species has been recorded in the Wheeler Ridge Maricopa WD, Lost Hills WD and Dudley Ridge WD.

White-faced ibis (*Plegadis chihi*)

The white-faced ibis is a California species of special concern. It is a medium-sized wading bird with an iridescent bronze-brown overall color, a thin band of white feathers around a bare red face, and a long, down curved bill. It breeds from Oregon, sporadically east to Minnesota, and south to southeastern New Mexico and Texas, and east to coastal Louisiana. It winters from southern California and the Gulf coast of Texas and Louisiana to El Salvador. Preferred habitats include salt and freshwater marshes in the west, and coastal marshes and brushy islands in Louisiana and Texas. This species has been recorded in the Tulare Basin WD and Lost Hills WD.

<u>Mammals</u>

American Badger (*Taxidea taxus*)

The American badger is a California species of special concern. The badger is a heavy-bodied, short-legged mammal with long fore claws, long yellowish gray to reddish brown fur, a short bushy tail and a white middorsal stripe that often extends down the back. They are most abundant in the drier open stages of most shrub, forest, and herbaceous habitats with friable soils. Badgers are basically solitary, nocturnal creatures, foraging at night and then remaining underground during the daylight hours. Historically, badgers ranged throughout California except for the humid coastal forests of the northwestern state. This species has been recorded in the Wheeler Ridge Maricopa WD and Dudley Ridge WD.

Buena Vista Lake Shrew *(Sorex ornatus relictus)*

The Buena Vista lake shrew is a federal-listed endangered species and a California species of special concern. Critical habitat for this species was designated on January 24, 2005, and is located just north of the Wheeler Ridge Maricopa WD. It is distinctly darker, grayish-black (not brown), slightly larger, and has a shorter tail than the other shrews that inhabit the same area. It historically inhabited wetlands around Buena Vista Lake and presumably throughout the Tulare Basin. The draining of the natural wetlands and lakes resulting in the decline of this species and its current status is largely unknown. The Buena Vista Lake shrew is a limited local endemic species that is restricted to areas of marshy wetland habitat. This species has been recorded in the Wheeler Ridge Maricopa WD.

Giant Kangaroo Rat (*Dipodomys ingens*)

The giant kangaroo rat is state and federally listed as endangered. Its recovery is addressed in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. The giant kangaroo rat is the largest of more than 20 species in the genus *Dipodomys*, which is in the family Heteromyidae. Adult giant kangaroo rats range from 4.6 to 6.4 ounces in weight and 12.2 to 13.7 inches in length. Giant kangaroo rats are distinguished from the similar San Joaquin kangaroo rats (*D. nitratoides*) by the number of toes on their hind feet. Giant kangaroo rats have five toes, San Joaquin kangaroo rats have four. Giant kangaroo rats prefer annual grassland on gentle slopes of generally less than 10 degrees, with friable, sandy-loam soils. However, most remaining populations are on poorer, marginal habitats which include shrub communities on a variety of soil types and on slopes up to about 22 degrees. The historical distribution of giant kangaroo rats encompassed a narrow band of gently sloping ground along the western edge of the San Joaquin Valley, with occasional colonies on steeper slopes and ridge tops, from the base of the Tehachapi Mountains, Kern County, in the south, to near Los Banos, Merced County, in the north. The population is currently fragmented into six major geographic units. The units located in the southern San Joaquin Valley are: the Kettleman Hills in Kings County; and western Kern County in the area of the Lokern, Elk Hills, and other uplands around McKittrick, Taft, and Maricopa. This species has been recorded in the Belridge WSD and Dudley Ridge WD.

Nelson's (San Joaquin) Antelope Squirrel *(Ammospermophilus nelsoni)*

Nelson's (San Joaquin) antelope squirrel is a state-listed threatened species. This species is found in the western San Joaquin Valley on dry, sparsely vegetated loam soils from elevations of 200 to 1,200 feet above mean sea level. San Joaquin antelope squirrels dig their burrows or use the burrows of kangaroo rats. They typically occur in association with widely scattered shrubs, forbs, and grasses in broken terrain with gullies and washes. Antelope squirrels had been nearly eliminated from the floor of the Tulare basin, and existed mainly in marginal habitat in the mountainous areas bordering its western edge. Substantial populations were found only in and around Lokern and Elk Hills in western Kern County, and on the Carrizo and Elkhorn Plains in eastern San Luis Obispo County. This species has been recorded at the Dudley Ridge WD, Lost Hills WD, Berenda Mesa WD, Belridge WSD, and Wheeler Ridge Maricopa WD.

San Joaquin Kit Fox *(Vulpes macrotis mutica)*

San Joaquin kit fox (SJKF) is listed as a federal-listed endangered and state-listed threatened species. SJKF typically occupy annual grasslands or grassy open stages within scattered shrubby vegetation throughout the semi-arid habitats of the San Joaquin Valley. This species requires loose-textured soils for burrowing and a suitable prey base. SJKF dens usually range between 11 to 21 cm at the narrowest measurable horizontal breadth, and are typically higher than they are wide. However, SJKF dens can vary greatly in size and shape. Historically, SJKF were found throughout the San Joaquin Valley and western portions of the Sacramento Valley. Due to the loss of suitable habitat, the SJKF's range has been highly fragmented to remaining areas of natural habitat. This species' range includes portions of all seven water districts.

San Joaquin Pocket Mouse (*Perognathus inornatus inornatus*)

The San Joaquin pocket mouse has no state or federal listing, but is included on the CDFG Special Animals list. This species is endemic to California's Central Valley. It constructs burrows in grassy and weedy areas where fine textured or sandy soils are present. Pocket mice are in the same family (Heteromyidae) as kangaroo rats, and many aspects of their biology and life history are similar. Like kangaroo rats, pocket mice are graniverous and nocturnal. During periods of intense weather or food shortage, pocket mice may enter an inactive state of torpor. This species has been recorded in the Wheeler Ridge Maricopa WD, Belridge WSD and Lost Hills WD.

Short-nosed Kangaroo Rat (Dipodomys nitratoides brevinasus)

The short-nosed kangaroo rat is California species of special concern. This species is one of three subspecies of the San Joaquin kangaroo rat. Typically, short-nosed kangaroo rats inhabit grasslands with scattered shrubs and desert-shrub associations on powdery soils. Their historic distribution is unknown, but they have been documented in arid grassland and shrubland associations along the western half of the San Joaquin Valley floor and hills on the western edge of the Valley floor from the Los Banos area, Merced County, south to the foothills of the Tehachapi Range and extending east and northward inland above the edges of the Valley floor to near Poso Creek, north of Bakersfield. They also occurred on the Carrizo Plain and the upper Cuyama Valley. The extent of its current distribution is also unknown. Populations are known from the Coalinga area, Fresno County, a few scattered locations in the Kettlemen and Lost Hills, Kings and Kern counties, the Lokern, Elk Hills, San Emigdio, and Wheeler Ridge regions of western Kern County, the Carrizo Plain Natural Area, and the Caliente Mountains at the edge of the Cuyama Valley. The extensive agricultural development of the 1960's and 1970's within its historic range is the main cause of the decline of the short-nosed kangaroo rat. This species has been recorded in the Belridge WD.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*)

The Tipton kangaroo rat is a federal and state-listed endangered species. It is one of three subspecies of the San Joaquin kangaroo rat, differing from the other two in range and size (the Tipton kangaroo rat is larger than the Fresno kangaroo rat and smaller than the short-nosed kangaroo rat). Historically this rat lived within the area of the Tulare Basin floor in the southern San Joaquin Valley, spreading east and south to the foothills of the Tehachapi Mountains in arid-land vegetative communities with level or nearly level terrain. The current range is restricted to scattered populations, west of Tipton, Pixley, and Earlimart and in areas in southern Kern County. This species has been recorded in the Wheeler Ridge Maricopa WD, and Lost Hills WD.

Tulare Grasshopper Mouse (*Onychomys torridus tularensis*)

The Tulare grasshopper mouse is a California species of special concern. The Tulare grasshopper mouse, a subspecies of the southern grasshopper mouse, fits the general description of the genus *Onychomys* by having a stout body with a short, club-like tail. They are sharply bicolored with the head and upperparts pale brown to gray or pinkish-cinnamon and the underparts white. The tail is usually bicolored with a white tip. Typically, Tulare grasshopper mice inhabit arid shrubland communities in hot, arid grassland and shrubland associations, including blue oak woodlands, upper sonoran subshrub scrub community; alkali sink and mesquite associations on Valley Floor; and grasslands associations on the sloping margins of the San Joaquin Valley and Carrizo Plain region. Specific habitat requirements are unknown. Like most of the other sensitive species of the San Joaquin Valley, habitat reduction, fragmentation, and degradation are the principal causes of the decline of the Tulare grasshopper mouse. Historically, the Tulare grasshopper mouse ranged from western Merced and eastern San Benito counties east to Madera County and south to the Tehachapi Mountains. Currently, they are known to occur in these areas: along the western margin of the Tulare Basin, including western Kern County; Carrizo Plain Natural Area; along the Cuyama Valley side of the Caliente Mountains, San Luis Obispo County; and the Ciervo-Panoche Region, in Fresno and San Benito counties. This species has been recorded in the Tulare Lake Basin WD, Belridge WSD, and Wheeler Ridge Maricopa WD.

Kern Fan Element

The Kern Fan Element, now known as the Kern Water Bank (KWB), was established in 1997, after approval of the Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan in October of that year. The KWB consists of a water recharge and recovery operation, farming, and conservation bank and habitat conservation activities for 19,900 acres in Kern County.

Of the 19,000 acres, 5,900 are used for routine recharge activities, 960 acres will be in preserved for known populations of special status plants, 5,592 acres will revert to natural habitat, 530 acres will be preserved and managed for mitigation of DWR projects, 481 acres will be used for permanent water banking facilities, 3,170 acres for farming, and 3,267 acres for a conservation bank. At this time, 4,853 acres have been developed as permanent water recharge basins, and an additional 2,349 acres have been developed for recharge to relieve emergency flood conditions during El Nino weather events. Water recharge basins were constructed through the creation of approximately 63 miles of levees that were approximately three feet high along natural contour lines. 73 wells are currently on the site and more may be built or recovered in the future.

Prior to DWR's purchase of the KFE, approximately 17,068 acres of the property was under extensive cultivation. The remaining property was leased for oil recovery facilities and contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland. No wetland habitat was present in the project area except canals used to convey agricultural water.

In 1994, approximately 16,500 acres were undesignated, previously irrigated farmland. 288 acres were actively irrigated for agriculture. Approximately 2,690 acres were native or disturbed farmland, including open areas, and land maintained under dry farming for vegetation management. The additional 490 acres consisted of roads, canals, and oil and gas facilities on disturbed lands containing non-native vegetation.

Sensitive Communities

Great Valley Mesquite Scrub

Great Valley mesquite scrub is primarily vegetated by honey mesquite *(Prosopis glandulosa torreyana),* a perennial deep-rooted shrub that requires a high water table. Additional vegetation includes alkali saltbush and introduced annual grasses, which are more abundant in good rainfall years. Honey mesquite cover is usually low with densities of two to three per acre. The soils are sandy loams, of alluvial origin, often with wind modified micro-topography. Climate conditions consist of moist, foggy winters and hot dry summers. Great Valley mesquite scrub habitat was historically extensive in the southern San Joaquin Valley from Bakersfield to the Inner South Coast Ranch at Tupman and Buena Vista Lake, but has been virtually extirpated by flood control, agricultural development and groundwater pumping. Recorded occurrences of this habitat type are located along the north, east and south boundaries of the KWB.

Valley Sacaton Grassland

Valley sacaton grassland habitat is described above in the South San Joaquin Valley discussion. This habitat has been recorded approximately 1.5 miles south of the KWB.

Special Status Plants

Hoover's Woolly Star (*Eriastrum hooveri*)

The Hoover's woolly star was delisted from the federal threatened species list on October 7, 2003 and is CNPS List 4 species (plants of limited distribution- Watch list). This annual herb blooms from March through July and is in the phlox (Polemoniaceae) family. Habitat for this plant has been better defined as alkali sinks, washes, on both north-and south-facing slopes and on ridge tops in the southern San Joaquin Valley and adjoining coastal ranges. Hoover’s woolly start occurs within the KWB in small native plant communities located around historic oil field facilities. These areas are either designated as sensitive habitat areas, or compatible habitat, with one questionable occurrence in an area designated as a recharge basin, which had been established prior to DWR's purchase of the land. It was observed on approximately 620 acres of the KWB during the 1990-1991 *DFG/DWR* surveys.

Recurved Larkspur (*Delphinium recurvatum*)

Recurved larkspur was described above under the South San Joaquin Valley discussion. This species was observed on the KWB during the 1990-1991 DFG/DWR surveys within the KWB. Plants occurred in small remnant native plant communities, located around historic oil field facilities. Most areas have been included in designated sensitive habitat areas, or in designated compatible habitat. Recuvred larkspur was listed as a Group 1 species under the USFWS HCP.[1]

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[1] Group 1 species are those species, which, due to their rarity and smaller preferred habitats have a significant chance of both becoming established in the KWB and being listed during the life of the permit.

<u>San Joaquin Woollythreads *(Lembertia congdonii)*</u>

San Joaquin woollythreads were described above under the South San Joaquin Valley discussion. This species has been found on approximately 160 acres at the KWB in small remnant native plant communities located around historic oil field facilities. Its location has been designated as sensitive habitat areas under the HCP. San Joaquin woollythreads were listed as a Group 1 species under the USFWS HCP.

<u>Slough Thistle (*Cirsium crassicaule*)</u>

Slough thistle is a CNPS List 1B plant. The genus Cirsium, in the sunflower (Asteraceae) family, contains thistle like plants with more than one white, pink or purplish flowers per head. Slough thistle is an annual or biennial herb, one to three meters high, endemic to California and only found in Kern, Kings, and San Joaquin counties. It blooms from May to August and its habitat is sloughs, riverbanks, and marshy areas in chenopod and riparian scrub. Slough thistle has been found in mesic areas throughout Kern County, and one population has been recorded by DWR at the KWB. Slough thistle was listed as a Group 1 species under the USFWS HCP.

Special Status Wildlife

Wildlife monitoring has occurred at the KWB since 1996, in order to measure population trends of sensitive wildlife species, their competitors, and predators, as well as water associated bird species. Surveys were targeted for San Joaquin kit fox and Tipton kangaroo rat, and also documented other large and small mammals or birds encountered. Additional special status species that could be located on the KWB are described below.

<u>Amphibians</u>

Western Spadefoot (*Scaphiopus hammondii*)

Described above in the South San Joaquin Valley discussion, western spadefoot has been recorded within the KWB. The closest recorded occurrence in the CNDDB is approximately 2.5 miles east of the KWB boundary. Western spadefoot was listed as a Group 1 species under the USFWS HCP.

<u>Reptiles</u>

Blunt-nosed Leopard Lizard *(Gambelia sila)*

Blunt-nosed leopard lizards were described above in the South San Joaquin Valley discussion. This species has been recorded within the KWB during the 1991 DWR surveys, associated with poor soils, sparse vegetation and areas of open ground. Blunt-nosed leopard lizard was listed as a Group 1 species under the USFWS HCP.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They were observed during the 1991 DWR surveys on the north side of the Kern River in the KWB. Western pond turtle was listed as a Group 1 species under the USFWS HCP.

Birds

Burrowing Owl *(Athene cunicularia)*

Burrowing owls were described above in the South San Joaquin Valley discussion. This species has been observed throughout the KWB and there has been an increase in observations of this species in the KWB according to the 2004 Annual Wildlife Monitoring Report, prepared by Quad Knopf. The burrowing owl was listed as a Group 1 species under the USFWS HCP.

Double-crested Cormorant (*Phalacrocorax auritus*)

The double-crested cormorant is California species of special concern. This cormorant is a yearlong resident along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. They feed on fish, crustaceans and amphibians and prefers hunting in waters less than 30 feet deep with rocky or gravel bottoms. The birds rests in the daytime and roost overnight beside the water on offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Perching sites must be barren of vegetation, and the birds must visit the perches periodically in the day to dry its plumage. Many nesting colonies in California have been abandoned after human disturbance and habitat destruction. It breeds from April to July or August. The double-crested cormorant is associated with both fresh and marine bodies of water, such as lakes, ponds, coastal bays and shorelines, and was observed at the KWB during the Kern Audubon Society Christmas Bird Count in December, 2002. It was listed as a Group 2 species under the USFWS HCP.[2]

Loggerhead Shrike *(Lanius ludovicianus)*

The loggerhead shrike is a California species of special concern. This bird has a stout, hooked, all-dark bill, a bluish-gray head and back, a broad black mask extending above eye and thinly across top of bill, a gray to whitish rump, a black tail with white tip and large white patches in black wings. The breeding range of loggerhead shrikes extends from southern Canada to southern Mexico. Loggerhead shrikes prefer open habitat characterized by grasses interspersed with shrubs or low trees, although they occur in a wide variety of habitats such as prairies, grazed grasslands, fencerows of agricultural fields, riparian areas, open woodlands, suburban areas, mowed roadsides, and golf courses. They prefer "edge" habitats and frequently nest along roadsides and hedgerows in agricultural areas. Loggerhead shrikes forage primarily on mice and small birds in the winter and grasshoppers, beetles and other large insects in the summer. It breeds from March to August. This bird was observed during the 1990 DFG/DWR surveys of the KWB. It was listed as a Group 1 species under the USFWS HCP.

Northern Harrier *(Circus cyaneus)*

Northern harrier is a California species of special concern. This bird is a slim, medium-sized hawk with long, broad wings, long legs and tails and a characteristic facial ruff that gives them an owl-like appearance. The adult female is dark brown above and buffy below, with some streaking on the underparts and a barred tail. The adult male is pale gray above and white below with reddish spots on the underparts. The wingtips are edged with black. Harriers occur throughout the state except for the Sierra Nevada and the Cascade Range. Loss of wetland and

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[2] Group 2 species are those species which, due to a larger current population or larger or incompatible (compared to that found at the KWB) preferred habitat, are relatively unlikely to both be listed and become established at the KWB during the life of the permit.

grassland habitats has reduced the harrier population in California. Breeding usually occurs between April and September in shrubby vegetation within marshes although nesting may also occur in grasslands or other dry habitats away from water. Harriers forage primarily on small mammals that inhabit a variety of wet and dry habitats. This bird was observed in the KWB during the Kern Audubon Society Christmas Bird Count in December 2002. The northern harrier was listed as a Group 2 species under the USFWS HCP.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were discussed above under the South San Joaquin Valley. There are two recorded occurrences of this species in the CNDDB within half a mile. Tricolored blackbirds were listed as a Group 1 species under the USFWS HCP.

<u>Mammals</u>

American Badger (*Taxidea taxus*)

The American badger was described above under the South San Joaquin Valley discussion and has been recorded within the KWB. This species was listed as a Group 1 species under the USFWS HCP.

Buena Vista Lake Shrew *(Sorex ornatus relictus)*

The Buena Vista lake shrew was described above under the South San Joaquin Valley discussion. It has been recorded at the Kern Fan Water Recharge Area, which is adjacent to the KWB. Critical habitat was designated on January 24, 2005 but excluded the KWB. This species was listed as a Group 1 species under the USFWS HCP.

Nelson's (San Joaquin) Antelope Squirrel *(Ammospermophilus nelsoni)*

A description of the San Joaquin antelope squirrel was provided above under the South San Joaquin Valley discussion. This species has been documented in the KWB.

San Joaquin Kit Fox *(Vulpes macrotis mutica)*

The San Joaquin kit fox was described above in the South San Joaquin Valley discussion. This species has been regularly surveyed for since 1996 and has been documented within the KWB.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*)

The Tipton kangaroo rat was described above in the South San Joaquin Valley discussion. This species has been regularly surveyed for since 1996 and has been documented within the KWB.

Castaic Lake

Castaic Lake is located in southern California at the confluence of Castaic Creek and Elizabeth Lake Canyon Creek, approximately 45 miles northwest of the City of Los Angeles. This facility consists of two bodies of water - the lagoon, or lower lake is for non-power boating or canoeing, and the upper lake is used for sailing, power boating, and water and jet skiing. Castaic Lake has approximately 29 miles of shoreline.

Vegetation communities surrounding Castaic Lake include coastal scrub, chamise-redshank chaparral, and mixed chaparral. Due to the steep topography, fluctuating water levels and minimal shoreline, little aquatic vegetation is associated with the lake margin. Castaic Lagoon, surrounded by coastal scrub habitat, is located below Castaic Dam, and has gentler slopes and constant water levels, which allows for the establishment of vegetation. In addition, the lagoon has maintained public beaches and campgrounds vegetated with grasses, shrubs and trees, such as pines and eucalyptus. No sensitive habitats are known to occur within the lake margin of Castaic Lake that would be affected by the proposed project. Castaic Lake provides habitat for a variety of waterfowl, and foraging habitat for raptors. The upland surrounding the lake provides habitat for those species adapted to the arid conditions of southern California, similar to the species found at Lake Perris.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Castaic Lake.

Special Status Plants

No special status plants are known to occur in the vicinity of Castaic Lake.

Special Status Wildlife

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. Western pond turtles have not been observed at Castaic Lake, but they are likely to occur there since they have been reported upstream in Castaic Creek.

Birds

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle is a federal-listed threatened species, proposed for delisting, and is a state-listed endangered and fully protected species. In 1995, the bald eagle was reclassified from federally endangered to threatened. Bald eagle nesting and wintering habitat is afforded protection under both federal and State ESAs. In California, bald eagles breed almost exclusively within Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. Wintering activity occurs throughout the state except for the desert regions east of the Los Angeles Basin. Suitable nesting and foraging habitat is usually associated with large bodies of water including reservoirs, natural lakes, or rivers and nesting almost never occurs more than 3 kilometers (2 miles) from water. It breeds from February to June. This species has been observed wintering at Castaic Lake.

Mammals

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat is a California species of special concern. he largest bat occurring in the United States, this species weighs from 60 to 70 grams (2.1 to 2.5 ounces), and has a wingspan of 53 to 58 centimeters (21 to 23 inches). It has been recorded at locations throughout much of the Central Valley and adjacent foothills, along the coast from Sonoma County south to San Diego County, and throughout the southern portion of the state from Kern and San Bernardino Counties south into Baja California. Western mastiff bats roost in cliff-face crevices and other high perches such as large trees and bridges that can provide them enough vertical distance to become airborne. Western mastiff bats forage over a wide variety of habitat types such as grasslands, deserts, woodlands and forests. Factors that limit the suitability of habitat for this species include the presence of suitable roost sites and large bodies of surface water for drinking. The western mastiff bat has been recorded near Lake Piru, which is approximately seven miles west of Castaic Lake. Given the presence of this large body of water, the bats could use Castaic Lake as foraging habitat.

Lake Perris

Lake Perris is located in Riverside County, approximately 13 miles southeast of the City of Riverside and 65 miles east of the City of Los Angeles. Vegetation communities surrounding Lake Perris include riparian vegetation on the northeast and eastern border, and sage scrub habitat along the northern and southern borders. The eastern border has a significant stand of riparian vegetation, containing willows *(Salix* sp.) and mulefat *(Baccharis salicifolia).* Beyond the riparian stand is annual grassland habitat. The immediate northern shoreline is maintained as part of the Lake Perris State Recreation Area (SRA), containing grassy lawns and shade trees such as pepper, eucalyptus, cypress, palm and pine trees. The Russell Mountains, located beyond the tended areas to the north, contains primarily sage scrub habitat, dominated by brittlebush *(Encelia farniosa).* The Bernasconi Hills, located to the south is primarily sage scrub habitat, dominated by California sagebrush *(Artemisia californica).*

The riparian habitat located along the northeastern side of Lake Perris consists of a band approximately 2.2 miles long and can best be described as southern willow scrub. Riparian habitats throughout the state have been greatly reduced and have been identified as rare communities by CDFG. The riparian habitat at Lake Perris is dominated by several willow species *(Salix sp.)* growing thick as to prevent much understory growth. The limited understory present contains mulefat and stinging nettles *(Urtica holosencea).* The soils commonly found at this habitat are loose, sandy, or fine gravelly alluvium deposited near stream channels during flood flows. Southern willow scrub was formerly extensive along the rivers of coastal southern California, but has been greatly reduced by urban expansion, flood control and channel "improvements."

Terrestrial wildlife at Lake Perris is associated with the aquatic habitat, the riparian habitat on the northeast and eastern shore and the upland habitats. Creation of the reservoir provided a large body of water in the generally arid region of southern California, which now provides habitat for large numbers of waterfowl, such as western grebes *(Aechmophoru occidentalis),* Canada geese *(Branta canadensis),* mallards *(Anas playrbynchos)* and American coots *(Fulica americana).* The upland habitat surrounding the lake supports wildlife species adapted to arid, rocky conditions such as lizards and snakes, and birds and mammals that do not need permanent water or much vegetated cover. The riparian zone provides contrasting conditions to the arid uplands, providing shade, shelter, food and perch sites for a number of bird species, many of which migrate through the area. It also provides nesting habitat for waterfowl.

The vegetation communities at Lake Perris are the same under current conditions as they were in 1994. The riparian vegetation community has remained stable and healthy and now provides habitat for least Bell's vireo, a federal and state-listed endangered species. Efforts to improve the habitat include tamarisk and Arundo removal. A thorough assessment of the habitat has never occurred, but should if changes in water levels would be significant.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Lake Perris.

Special Status Plants

No special status plants are known to occur in the vicinity of Lake Perris.

Special Status Wildlife

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They have not been recorded at Lake Perris, but have been recorded in the San Jacinto River. According to the Western Riverside Multiple Species Habitat Conservation Plan (MSHCP),[3] it is potential habitat as the western pond turtle has been found at other lakes in the area. Lake Perris is one of several potential conservation areas according to the MSHCP.

Birds

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle was described above under the Castaic Lake discussion. This bird has been observed wintering at the Lake Perris State Recreation Area. The closest recorded CNDDB occurrence is approximately 10 miles west at Lake Matthews. Lake Perris was included in the Western Riverside MSHCP as a conservation area for this species.

Cooper's Hawk (*Accipiter cooperii*)

The Cooper's hawk is California species of special concern. Cooper's hawk are medium-sized raptors with blue-gray upperparts and reddish barred underparts, have short, rounded wings and proportionately long, banded tails. Historically, the Cooper's hawk nested throughout most of California, primarily in riparian zones from valley river bottoms up to an elevation of

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[3] The County of Riverside Transportation and Land Management Agency has prepared the Western Riverside MSHCP which serves as an HCP pursuant to Section 10(a)(1)(B) of the 1973 FESA, as well as a Natural Communities Conservation Plan (NCCP) under the California NCCP Act of 2001. This plan, similar in function to the Kern Water Bank HCP/NCCP, covers an area of 1.26 million acres in western Riverside County, including Lake Perris.

approximately 6,500 feet. During the winter months, Cooper's hawks primarily inhabit the bottomlands and foothills of California. Cooper's hawks in California demonstrate a preference for lowland riparian forests where nest stands typically include scattered stands of live or blue oaks. It breeds from March through August. The closest recorded CNDDB occurrence is approximately eight miles west. Lake Perris was included in the MSHCP as a conservation area.

Double-crested Cormorant (*Phalacrocorax auritus*)

The double-crested cormorant was described under the Kern Fan Element discussion. This species has been observed at Lake Perris.

Golden Eagle (*Aquila chrysaetos*)

The golden eagle is a California species of special concern and a state fully protected species. Habitat for golden eagles includes rolling foothills, mountain areas, sage-juniper flats, and desert areas. Grasslands, deserts, savannahs, and early successional stages of forest and shrub habitats are primary foraging habitats for this species. It nests on cliffs of all heights and in large trees in open areas. The breeding season for golden eagle is from January through July. Golden eagles have been observed at Lake Perris State Recreation Area and there is a recorded occurrence approximately eight miles south of Lake Perris.

Lawrence's Goldfinch (*Carduelis lawrencei*)

Lawrence's goldfinch is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This species breeds in central California (west of the Sierra Nevadas) south to northern Baja California, often nesting in dense foliage in conifers 1 to 12 meters above ground. It winters in north-central California, central Arizona, southwestern New Mexico and (at least formerly) extreme western Texas south to northern Baja California, northern Sonora, and southern Arizona. They use oak woodland, chaparral, riparian woodland, pinyon-juniper associations and weedy areas in arid regions but usually near water. The closest recorded occurrence is approximately seven miles northwest from Lake Perris.

Least Bell's Vireo *(Vireo bellii pusillus)*

Least Bell's vireo is a federal and state-listed endangered species. This small songbird is relatively nondescript, colored gray above and white below, with one or two faint pale wing bars on otherwise dark wings and indistinct spectacles. Its nesting habitat consists of cottonwood-willow forest, oak woodland, shrubby thickets, and dry washes with willow thickets at the edges, in arid areas, but often near water. They prefer dense cover within one to two meters of the ground and a dense stratified canopy. Peak egg laying occurs from May to June. Wintering habitat consists of open woodland and brush. The species was historically found throughout California and northern Baja. Its range has been restricted to southern California south of the Tehachapi Mountains and northwestern Baja California. Least Bell's vireo has been observed at Lake Perris State Recreation Area during surveys of the riparian habitat located on the east margin of the lake.

Loggerhead Shrike *(Lanius ludovicianus)*

The loggerhead shrike was described above in the Kern Fan Element discussion. The closest recorded occurrence for this species is approximately five miles west of Lake Perris.

Northern Harrier *(Circus cyaneus)*

Northern harrier was described above in the Kern Fan Element discussion. It has been observed at the Lake Perris State Recreation Area and could use the riparian area to nest.

Osprey *(Pandion haliaetus)*

Osprey is a California species of special concern. This almost eagle-sized bird is dark brown above, and white underneath, with a white head and prominent dark brown eye stripe. Inhabiting every continent except Antarctica, osprey can be found near large bodies of water that support fish and have forest habitats nearby. They build nests in exposed locations, often in the tops of old trees, or in snags in beaver swamps. In California, breeding populations are found in the Cascade and Sierra mountain ranges and wintering populations can be found throughout the state. It breeds from March to September. Although there is no evidence of breeding populations at Lake Perris, this species has been observed there.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Southwestern willow flycatcher (SWWF) is a federal and state-listed endangered species. This almost sparrow sized bird is greenish or brownish gray above, with a white throat that contrasts with a pale olive breast, and pale yellow belly. The SWWF is insectivorous and catches insects in mid-flight. The habitat of the SWWF is extensive willow thickets. Breeding populations are found only in isolated meadows of the Sierra Nevada, and along the Kern, Santa Margarita, San Luis Rey, and Santa Ynez Rivers in southern California. SWWF breed from June to August. Loss and degradation of riparian habitat is the principal reason for the decline of SWWF populations and the decrease in geographic range of the species. Threats to SWWF include livestock grazing and nest parasitism by brown-headed cowbirds. The closest recorded occurrence is approximately nine miles north of Lake Perris.

White-tailed Kite *(Elanus leucurus)*

White-tailed (or black-shouldered) kite is a state fully protected species. This mostly white bird, with black shoulders, is a common to uncommon resident in coastal and valley lowlands throughout California. Nests are usually constructed of loosely piled sticks placed near the tops of dense oak, willow, or other tree stands. Kites forage over grasslands, marshes, agricultural areas, and wetlands where they prey mostly on small mammals. It breeds from February to October. White-tailed kites have been observed at the Lake Perris State Recreation Area, but the closest CNDDB recorded occurrence is approximately 10 miles west of Lake Perris.

Yellow Warbler (*Dendroica petechia brewsteri*)

Yellow warbler is a California species of special concern. This short-tailed and plump small bird (total body length of five inches) is primarily yellow with yellowish-olive wings, back, and tail and a prominent dark eye. The historical breeding distribution of the yellow warbler included riparian habitat throughout the western portion of the state, from Modoc west to Del Norte counties and south to San Diego County along the coast excluding the deserts of southeastern California.

Currently, the California yellow warbler nests throughout its historical range, but has been greatly reduced in the Sacramento and San Joaquin valleys, southern coastal area, and San Francisco, Marin, and Siskiyou counties. Preferred foraging and nesting habitat is streamside thickets of tangled, thick underbrush interspersed among alders, cottonwoods, and willows. It breeds from April to August. Yellow warblers have been observed at the Lake Perris State Recreation Area and could use the riparian habitat to nest. The closest recorded CNDDB occurrence is approximately 8.5 miles north of Lake Perris.

Mammals

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat was described above under the Castaic Lake discussion. This bat has been recorded approximately 10 miles southwest of Lake Perris.

Stephens' Kangaroo Rat (*Dipodomys stephensi*)

Stephens' kangaroo rat is a federal-listed endangered and state-listed threatened species. This species is associated with sparsely vegetated habitats and frequently found in close association with dirt roads, previously and currently disturbed areas, and/ or sites with a high percentage of bare ground. It is primarily found in annual grassland or sparse sage scrub habitats were perennial cover is less than 30 percent. Certain non-native grasses (e.g. *Bromus diandrus)* can exclude this species from otherwise suitable habitat. As a fossorial (burrowing) animal, the Stephens' kangaroo rat typically is found in sandy and sandy loam soils with a low clay to gravel content. The geographic distribution of the Stephens' kangaroo rat includes the San Jacinto Valley and adjacent areas of western Riverside, southwestern San Bernardino, and northwestern San Diego counties. Lake Perris is identified as a core recovery area for this species, which has been documented just north of the lake, along its northern edge.

Yuma Myotis *(Myotis yumanensis)*

Yuma myotis is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This small bat has short fur, shaded tan or brown on top, while their underparts are whitish or buffy. They are similar to the little brown myotis *(M. lucifugus)* and the two species have been known to interbreed. The range of this species extends north to British Columbia, Canada, through the western United States (as far east as Oklahoma) and south into central Mexico. It is more closely associated with water than most other North American bats and can be found in a wide variety of upland and lowland habitats, including riparian, desert scrub, moist woodlands and forests. Nursery colonies usually are in buildings, caves and mines, and under bridges. Little information regarding its habitat in California is available, but this bat has been observed at the Lake Perris State Recreation Area.

San Luis Reservoir

The San Luis Reservoir is located in western Merced County, just east of the Merced/Santa Clara County line. Vegetation habitats surrounding the San Luis Reservoir and the O'Neill Forebay include annual grassland, coastal sage scrub and riparian habitats. Terrestrial wildlife at the San Luis Reservoir and O'Neill Forebay is associated with the aquatic habitat, the riparian habitat and the surrounding upland habitats. Although development has significantly changed the habitats that were historically present, the San Luis Reservoir State Recreation Area supports a variety of wildlife species including jackrabbits, ground squirrels, raccoons, opossums, skunks, feral pigs, and various snakes. It provides wintering habitat for migratory birds including golden eagles, white-tailed kites, the occasional bald eagle, geese and several species of ducks.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of the San Luis Reservoir.

Special Status Plants

No special status plants are known to occur in the vicinity of the San Luis Reservoir.

Special Status Wildlife

Amphibians

California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog (CRLF) is a federal-listed threatened species and a California species of special concern. The San Luis Reservoir is located within the critical habitat designation, finalized in 2001. A recovery plan for this species was published in 2002. This large brown to reddish-brown frog historically occurred over much of the state from the Sierra Nevada foothills to the Coast. CRLF inhabit ponds, slow moving creeks, and streams with deep pools that are lined with dense emergent marsh or shrubby riparian vegetation. Submerged root masses and undercut banks are important habitat features for this species. However, this species is capable of inhabiting a wide variety of perennial aquatic habitats as long as there is sufficient cover, and bullfrogs or non-native predatory fish are not present. CRLF is known to survive in ephemeral streams, although only if deep pools with vegetative cover persist through the dry season. Factors that have contributed to the decline of CRLF include destruction of riparian habitat due to development, agriculture, or flood control practices, and the introduction of exotic predators such as bullfrogs, crayfish, and a variety of non-native fishes. CRLF have been recorded in the streams that feed into the reservoir.

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They have been documented approximately two miles west of the San Luis Reservoir.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was described above in the Castaic Lake discussion. The closest recorded occurrence of this bird is approximately 40 miles northwest at Lake Del Valle.

Osprey *(Pandion haliaetus)*

Osprey are described above under the Lake Perris discussion. This species has been recorded approximately 40 miles west of the San Luis Reservoir.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This bird has been recorded along the southeastern edge of the San Luis Reservoir.

White-tailed Kite *(Elanus leucurus)*

White-tailed kites were described above in the Lake Perris discussion. The closest recorded occurrence is approximately 25 miles west of the San Luis Reservoir.

<u>Mammals</u>

San Joaquin Kit Fox (*Vulpes macrotis mutica*)

The San Joaquin kit fox was described above in the South San Joaquin Valley discussion. This species' range follows the eastern edge of the San Luis Reservoir.

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat was described above under the Castaic Lake discussion. This bat has been recorded approximately 35 miles southeast of the San Luis Reservoir.

Yuma Myotis *(Myotis yumanensis)*

Yuma myotis was described above under the Lake Perris discussion. This species has been recorded approximately three miles south of the San Luis Reservoir.

Lake Oroville

Lake Oroville, with a maximum surface area of 15,000 acres is located on the Feather River, in Butte County, approximately 75 miles north of Sacramento. The reservoir is fed by the North, Middle, and South Forks of the Feather River and was formed in 1964 by the construction of the Oroville Dam. Other facilities associated with the lake include the Thermalito Forebay, the Thermalito Afterbay, the Feather River Hatchery, and the Feather River Low Flow Channel. Vegetation at the lake is limited due to loss of soil from wave action and periodic inundation followed by severe desiccation.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Lake Oroville.

Special Status Plants

Brandegee's Clarkia (*Clarkia biloba* ssp. *brandegeeae*)

Brandegee's clarkia is a CNPS List 1B plant. It is a member of the evening primrose (Onagraceae) family and blooms from May to July. This annual herbaceous plant grows less than one meter tall, has linear to lanceolate leaves, and lavender-colored petals. It grows in chaparral cismontane woodlands often along roadcuts at elevations between 225 and 915 meters. This species is threatened by road maintenance and fire suppression. This species has been recorded along the banks of Lake Oroville, with several occurrences along the South Fork of the Feather River, after it enters Lake Oroville.

Cut-leaved Ragwort (*Senecio eurycephalus* var. *lewisrosei*)

Cut-leaved ragwort is a CNPS List 1B plant. This herbaceous perennial belongs to the sunflower (Asteraceae) family and blooms from March to July. The plant occurs in Butte and Plumas counties at elevations ranging from 285 to 1,890 meters above mean sea level. It grows in chaparral, cismontane woodland, and lower montane coniferous forest habitats with serpentinite soil. It is threatened by mining and road maintenance. This species has been recorded along the West Branch of the Feather River, after it enters Lake Oroville.

Mildred's Clarkia (*Clarkia mildrediae* ssp. *mildrediae*)

Mildred's clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to August. The plant occurs in Butte and Plumas counties at elevations ranging from 245 to 1,710 meters above mean sea level. It grows in cismontane woodland to lower montane coniferous forest habitats with sandy or granitic soils. It is threatened by roadway construction. This species has been recorded along the North Fork of the Feather River, after it enters Lake Oroville.

Mosquin's Clarkia (*Clarkia mosquinii*)

Mosquin's clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to July. The plant occurs in Butte and Plumas counties at elevations ranging from 185 to 1,170 meters above mean sea level. It grows in cismontane woodland to lower montane coniferous forest habitats with rocky soil, or along roadsides. It is threatened by roadway construction. This species has been recorded along the South and Middle Forks of the Feather River, after they enter Lake Oroville.

White-stemmed Clarkia (*Clarkia gracilis* ssp. *albicaulis*)

White-stemmed clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to July. The plant occurs in Butte, Lake, and Tehama counties at elevations ranging from 245 to 1,085 meters above mean sea level. It grows in chaparral cismontane woodland habitats, usually with serpentinite soil. This plant is known from fewer than twenty occurrences and is threatened by urbanization. This species has been recorded along the North and Middle Forks of the Feather River, after they enter Lake Oroville.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was described above in the Castaic Lake discussion. This species has been recorded along the North and Middle Forks of the Feather River, after they enter Lake Oroville.

Northern Goshawk (*Accipiter gentilis*)

The northern goshawk is a California species of special concern. It is largest of the three accipiters at 19 to 26 inches in length and a wingspan of 40 to 48 inches. The female is significantly larger than the male. The northern goshawk inhabits old-growth forests throughout the United States, Canada, and northern Mexico. Nesting begins in late March or early April, with two to four bluish-white eggs laid in April that are incubated by both sexes for about 30 days. This species has been recorded along the South Fork of the Feather River, after it enters Lake Oroville.

Sacramento River

The lower Sacramento River, from where it meets the Feather River to where it enters the Sacramento/San Joaquin Delta, is predominantly channelized, leveed, and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has reduced water clarity and habitat diversity, relative to the upper portion of the river. The American River joins the Sacramento River in the City of Sacramento. As with the Feather River, the Sacramento River supports a fragmented and narrow riparian forest.

Sensitive Communities

Coastal Brackish Marsh

Coastal brackish marsh is dominated by perennial, emergent, herbaceous monocots up to two meters tall. Cover is often complete and dense. This community is similar to both salt marshes and freshwater marshes with some plant characteristics from each. Salinity may vary considerably, and may increase at high tide or during seasons of low freshwater runoff or both. This community usually intergrades with coastal salt marshes toward the ocean and occasionally with freshwater marshes at the mouths of rivers, especially in the Sacramento-San Joaquin River Delta. This community is usually at the interior edges of coastal bays and estuaries or in coastal lagoons. Characteristic species include Harford's sedge (*Carex harfordii*), slough sedge (*Carex obnupta*), *Carex* ssp., saltgrass (*Distichlis spicata* var. *spicata*), *Juncus* spp., pickleweed (*Salicornia* spp.), *Scirpus* spp., and broad-leaved cattail (*Typha latifolia*). This community has been recorded within the Delta near the confluence of the Sacramento and San Joaquin Rivers.

Elderberry Savanna

Elderberry savanna is an open, winter-deciduous shrub savanna dominated by blue elderberry (*Sambucus mexicana*), usually with an understory of introduced annual grasses and forbs. This community rapidly succeeds to Great Valley Mixed Riparian Forest without grazing, flooding, or fire. Old stands of this community are frequently overrun by wild grape (*Vitis californica*). The distribution of this community is scattered among surviving stands of riparian vegetation throughout the Sacramento and northern San Joaquin valleys. The elderberry savanna occurs some distance from the active channel but still be subject to flooding during high water. This community has been recorded just west of the confluence of the Sacramento and American rivers.

Great Valley Cottonwood Riparian Forest

The Great Valley cottonwood riparian forest has a diverse, and typically dense mixture of tall mature cottonwood (*Populus fremontii*) and willows (*Salix* spp.), as well as California sycamore (*Platanus racemosa*), box elder (*Acer negundo* var. *californicum*), black walnut (*Juglans hindsii*), and white alder (*Alnus rhombifolia*). The understory includes shrub species such as California button bush (*Cephalanthus occidentalis*), Himalayan blackberry (*Rubus discolor*), poison oak (*Toxicodendron diversilobum*), wild grape and California Dutchman's pipe (*Aristolochia debilis*). Perennial grasses such as creeping wild rye (*Leymus triticoides*), and sedges may form dense pockets in the understory. Openings within this community may also support elderberry savanna. The Great Valley cottonwood riparian forest may occur some distance from the active channel but may still be subject to over bank flooding. This community has been recorded just west of the confluence of the Sacramento and American rivers.

Great Valley Mixed Riparian Forest

Great Valley mixed riparian forest is a tall, dense, winter-deciduous, broad-leafed riparian forest. The tree canopy usually is fairly well closed and moderately to densely stocked with several species including box elder, black walnut, sycamore, cottonwood, Goodding's black willow (*Salix gooddingii*), red willow (*Salix laevigata*), and shining willow (*Salix lasiandra*). Understories consist of these taxa plus shade-tolerant shrubs like California button bush and Oregon ash (*Fraxinus latifolia*). This community is found on relatively fine-textured alluvium somewhat back from active river channels and is subject to overbank flooding. It occurs in the floodplains of low-gradient, depositional streams of the Great Valley, usually below about 500 feet mean sea level. Formerly very extensive in the Sacramento and northern San Joaquin valleys, this forest largely has been cleared for agriculture, flood control, and urban expansion. This habitat has been recorded along the Sacramento River, just west of its confluence with the Feather River.

Special Status Plants

Carquinez Goldenbush (*Isocoma arguta*)

Carquinez goldenbush is a CNPS List 1B plant. This perennial herb is a member of the sunflower (Asteraceae) family, and occurs in valley and foothill grasslands with alkaline substrates. The flowering period for this species is August to December, and it occurs at elevations ranging from 1 to 20 meters. It is threatened by development and agriculture. This species has been recorded within the Delta near the confluence of the Sacramento and San Joaquin Rivers.

Delta Mugwort (*Limosella subulata*)

Delta mudwort is a CNPS List 2 plant (rare, threatened, or endangered in California, but more common elsewhere). It is a perennial rhizomatous herbaceous plant in the figwort (Scrophulariaceae) family found on mud banks of the Sacramento/San Joaquin River Delta in marshy or scrubby riparian associations, often with Mason's lilaeopsis. Its blooming period is from May through August and its elevation range is zero to four meters. Threats to Delta mudwort include habitat destruction. This species has been recorded along the Sacramento River, in various locations starting approximately 11 miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Delta Tule Pea (*Lathyrus jepsonii* var. *jepsonii*)

Delta tule pea is a CNPS List 1B plant. It is a perennial herbaceous plant in the legume (Fabaceae) family found in freshwater and brackish marshes and seasonal wetlands with cattails, Suisun Marsh aster, and rushes (*Juncus* spp). Most of its distribution is restricted to the Sacramento/San Joaquin River Delta at elevations of zero to four meters. Its blooming period is from May through September. The Delta tule pea is threatened by agriculture, water diversions, and erosion. This species has been recorded along the Sacramento River, in various locations starting approximately 18 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

Mason's Lilaeopsis (*Lilaeopsis masonii*)

Mason's lilaeopsis is a state-listed rare and CNPS List 1B plant. It is a member of the carrot (Apiaceae) family, and occurs in tidal freshwater and brackish marshes and riparian scrub habitats, with muddy or silty soil formed through river deposition or riverbank erosion. Endemic (restricted) to California, Mason's lilaeopsis is known to occur in six counties. It occurs at elevations ranging from 0 to 10 meters, and the flowering period is April through November. Threats to the continued existence of this species include erosion, channel stabilization, developing flood control projects, recreation, agriculture, shading resulting from marsh succession and competition with non-native plants. This species has been recorded along the Sacramento River, in various locations starting approximately 16 miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Northern California Black Walnut (*Juglans hindsii*)

Northern California black walnut is CNPS List 1B plant. It is a member of the walnut (Juglandaceae) family and is a perennial deciduous tree that occurs in riparian forests and woodlands. Its blooming period is from April through May and it occurs at elevations ranging from 0 to 440 meters above mean sea level. Threats include hybridization with orchard trees, urbanization, and conversion to agriculture. This species has been recorded along the Sacramento River from just south of the town of Freeport to the Delta.

Rose Mallow (*Hibiscus lasiocarpus*)

Rose mallow is a CNPS List 2 plant. It is perennial rhizomatous emergent herb in the mallow (Malvaceae) family, and occurs in freshwater marshes and swamps, preferring moist freshwater-soaked riverbanks and low peat islands in sloughs. It blooms from June through September, at elevations ranging from 0 to 150 meters. Threats include development, agriculture, recreation, and channelization of the Sacramento River and its tributaries. This species has been recorded along the Sacramento River, in various locations starting approximately 12 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

San Joaquin Spearscale (*Atriplex joaquiniana*)

San Joaquin spearscale is a CNPS List 1B plant. It is a member of the goosefoot (Chenopodiaceae) family, and occurs in chenopod scrub, meadows and seeps, playas, and valley and foothill grasslands with alkaline soils. It is an annual herb, blooming from April to October that occurs at elevations ranging from 0 to 835 meters. Threats include agriculture and competition between non-native plants. This species has been recorded along the Sacramento River, in various locations starting approximately 12 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

Suisun Marsh Aster (*Aster lentus*)

Suisun Marsh aster is a CNPS List 1B plant. It is a perennial rhizomatous herb in the sunflower (Asteraceae) family that blooms May through November. A species endemic to the Sacramento/San Joaquin River Delta, the Suisun Marsh aster is most often seen along sloughs with reeds, bulrush, blackberry and cattails in brackish and freshwater marshes and swamps. Threats to this plant include marsh habitat alteration and loss. Elevations range from 0 to 3 meters. This species has been recorded along the Sacramento River, in various locations starting just east of the town of Franklin.

Special Status Wildlife

<u>Invertebrates</u>

Antioch Dunes Anthicid Beetle (*Anthicus antiochensis*)

Antioch Dunes anthicid beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. Habitat for this species includes interior sand dunes and sand bars. It is commonly collected in pitfall traps in bare, unvegetated sand. This species is apparently extirpated from the type locality at Antioch Dunes. Stabilization of the dunes in the 1950s may have eliminated the loose, sandy substrate preferred by this species. In the early 1990s it was collected along the Sacramento River in Glenn, Tehama, Shasta, and Solano counties, and from one site at Nicolaus on the Feather River in Sutter County. This species has been recorded just west of the confluence of the Deep Water Channel and the Sacramento River.

Sacramento Anthicid Beetle (*Anthicus sacramento*)

Sacramento anthicid beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. Habitat for this species includes interior sand dunes and sand bars, but has also been found in dredge spoil heaps. It is found along the Sacramento and San Joaquin rivers, from Shasta to San Joaquin counties, and at one site along the Feather River in Nicolaus. This species may once have been more widely distributed in loose sands along the Sacramento River, but man-made alterations to the riverbank have probably reduced its preferred habitat. However, dredging of the river channel has also created suitable habitat by depositing loose dredge material along the banks. This species has been recorded in three locations along the Sacramento River: (1) just before its confluence with the Deep Water Channel; (2) just west of the confluence of the Deep Water Channel and the Sacramento River and (3) approximately 2.5 miles south of the confluence of the Deep Water Channel and the Sacramento River.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

Valley elderberry longhorn beetle (VELB) is a federal-listed threatened species that occurs throughout the year in riparian woodlands and other Central Valley habitats containing elderberry shrubs (*Sambucus* spp.), upon which the VELB are completely dependent for all stages of their life cycle. The females lay their eggs in crevices in the bark. After hatching, the larvae burrow into the stems of the tree where they will feed on the interior wood for the next one to two years. The larvae then form pupae from which the adults emerge. The adults then bore their way out of the stems, leaving a distinctive oval shaped hole. As the larvae and adults are rarely seen, these bore holes are often the only evidence of this species' presence. After emergence from the stems, the adults remain in association with the elderberries, where they will feed on the elderberry foliage and eventually reproduce. All elderberry shrubs within the known range of the VELB, which have one or more stems with diameters of one inch or greater at ground level, are considered potential habitat for this species. This species or its habitat has been documented along the Sacramento River.

<u>Reptiles</u>

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. Although not documented in the CNDDB, this species has been observed along the Sacramento River.

<u>Birds</u>

Bank Swallow (*Riparia riparia*)

The bank swallow is a state-listed threatened species. The bird builds nests in deep burrows that it digs perpendicularly into nearly vertical earthen banks along streams, coastal bluffs, and sand and gravel pits. In California, it relies on naturally eroding habitats of major lowland river systems. The species is colonial and migratory, breeding in California from April to August in the Central Valley and wintering in South America. The bank swallow once bred throughout the lowlands of the state with major populations on the broad river valleys of central California. The current population is restricted to portions of the upper Sacramento River, primarily between Redding and Colusa, about four or five central and north coast colonies, and scattered colonies in northern and northeastern California. This species has been recorded along the Sacramento River, upstream from its confluence with the Feather River.

Burrowing Owl *(Athene cunicularia)*

Burrowing owls were described above in the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River just north of the Town of Freeport.

Great Blue Heron (*Ardea herodias*)

The great blue heron is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This heron is a colonial nester in tall trees, cliff sides, and sequestered spots on marshes. The rookery sites are close in proximity to foraging habitat, such as marshes, lake margins, tide-flats, rivers and streams, and wet meadows. It breeds from February through July. This species is commonly observed along the Sacramento River and a rookery has been recorded along the Sacramento River, at a location approximately seven miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Great Egret (*Ardea albus*)

Great egret is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a common yearlong resident throughout California, except for high mountains and deserts. It requires groves of trees suitable for nesting and roosting, relatively isolated from human activities, near aquatic foraging areas. Nests are built of sticks and stems of marsh plants and usually occur near water, at a height of 6 to 12 meters above ground and are sheltered from prevailing winds. The nesting season is between March and July. This species is commonly observed along the Sacramento River and a rookery has been recorded within a mile of the river, approximately five miles south of its confluence with the Feather River.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk was described above under the South San Joaquin Valley discussion. Recorded nest sites are all along the Sacramento River.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River, near its confluence with the Feather River.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The western yellow-billed cuckoo is a state-listed endangered species and a federal-listed candidate species. Historically, the yellow-billed cuckoo bred throughout much of North America. They breed from mid- to late-May to July in dense willow and cottonwood stands in river floodplains. The greatest threat to the species is loss of riparian habitat. It has been estimated that 90% of the cuckoo's stream-side habitat has been lost. Habitat loss in the west is attributed to agriculture, dams and river flow management, overgrazing and competition from exotic plants such as tamarisk. This species has been recorded along the Sacramento River, near the Town of Clarksburg.

Feather River

Sensitive Communities

Great Valley Mixed Riparian Forest

The Great Valley mixed riparian forest habitat was described above under the Sacramento River discussion. It is located along the Feather River, in a couple of different locations, the largest of which is approximately eight miles south of Marysville/Yuba City.

Special Status Plants

Hartweg's Golden Sunburst (*Pseudobahia bahiifolia*)

Hartweg's golden sunburst is a federal and state-listed endangered species and a CNPS 1B plant. It is an herbaceous annual in the sunflower (Asteraceae) family that blooms in March and April. The plant is known to occur mostly in the San Joaquin Valley at elevations ranging from 15 to 150 meters above mean sea level. It grows in valley and foothill grasslands and woodland habitats with clay soils. It is seriously threatened by development, agriculture, overgrazing, and trampling. CNDDB contains one record of this plant from 1848 in the vicinity of the Yuba and Feather River confluence.

Pink Creamsacs (*Castillieja rubicundula ssp. rubicundula*)

Pink creamsacs is a CNPS List 1B plant. This annual herb belongs to the Scrophulariaceae (Figwort) family. It occurs in open areas of chaparral, in cismontane woodland, meadows and seeps and on serpentinite substrate in valley and foothill grasslands. It is found at elevations between 20 and 900 meters and blooms from April to June. This species has been recorded at the Thermalito Diversion Pool.

Veiny Monardella (*Mondardella douglasii* ssp. *venosa*)

Veiny monardella is a CNPS List 1B plant. This herbaceous annual belongs to the mint (Lamiaceae) family and blooms from May to July. It occurs in valley and foothill grasslands and woodland habitats at elevations ranging from 60 to 410 meters above mean sea level. It is threatened by development of wastewater treatment plants. There is one record for veiny monardella from 1854 near Corduas Farm, on the north bank of the Yuba River near the confluence of the Yuba and Feather rivers.

Special Status Wildlife

Invertebrates

Sacramento Valley Tiger Beetle (*Cicindela hirticollis abrupta*)

Sacramento Valley tiger beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a littoral-riparian species that inhabits fine-grained sandy shorelines of lakes and rivers. Since the 1970's, this beetle has been known only from the shoreline and sand bars of the Feather River near the town of Nicolaus in Sutter County. This species can be distinguished from related subspecies by the maculation patter on its elytra.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

The valley elderberry longhorn beetle was described above under the Sacramento River discussion. This species has been recorded along the Feather River in several locations – at Star Bend, in the Oroville Wildlife Area, and approximately two miles south of the Feather River/Honcut Creek confluence.

Reptiles

Giant Garter Snake (*Thamnophis gigas*)

The giant garter snake (GGS) is a federal and state-listed threatened species. Habitat requirements for GGS include adequate water during the snake's active season (early spring through mid-fall) to provide food and cover; emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; grassy banks and openings in waterside vegetation for basking; and higher elevation uplands for cover and refuge from flood waters during the snake's winter dormant season. Permanent freshwater marshes, agricultural canals, ditches and drains associated with rice fields, streams, and sloughs, particularly with mud bottoms provide habitat. To avoid inundation in the winter, giant garter snake (GGS) overwinter in upland, non-marsh sites in small mammal burrows or under debris in close proximity to summer habitat. This species has been recorded along the Feather River approximately three miles north of its confluence with the Sacramento River.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. This species has been documented in the Feather River, just south of the Oroville Dam and just north of the Feather River/Bear River confluence.

Birds

Bank Swallow (*Riparia riparia*)

Bank swallows were described above under the Sacramento River discussion. This species has been recorded at more than 25 locations along the Feather River.

Osprey *(Pandion haliaetus)*

Osprey were described above under the Lake Perris discussion. They have been recorded along the Thermalito Diversion Pool.

Swainson’s Hawk (*Buteo swainsoni*)

Swainson’s hawk was described above under the South San Joaquin Valley discussion. This species has been recorded at more than 25 locations along the Feather River.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River, near its confluence with the Feather River.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

Western yellow-billed cuckoo was described above under the Sacramento River discussion. This species has been recorded in four locations along the Feather River – two near Marysville and two near the Feather River/Bear River confluence.

Mammals

Silver-haired Bat (*Lasionycteris noctivagans*)

Silver-haired bat is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a medium sized bat that is nearly black, with silvery-tipped hairs on its back. It is a solitary, tree roosting species of deciduous and coniferous forests. In summer, it roosts in protected spots such as under bark or in dead trees, woodpecker holes, or bird nests. This species migrates south during the winter and hibernates in trees, crevices, buildings, and other protected places. This species has been recorded along the Feather River, south of the Thermilato Diversion Pool.

Plumas County

Plumas County is located in northeastern California, where the Sierra Nevada and Cascade mountain ranges meet. It boasts more than 100 lakes, 1,000 miles of rivers and streams with over a million acres of national forest, including portions of the Plumas National Forest and Lassen Volcanic National Park.

The various lakes throughout Plumas County, which include Bucks, Almanor, Davis, and Frenchman's Reservoir, provide numerous activities such as water-skiing, swimming, and canoeing. Feather River is designated as a National Wild & Scenic River through Plumas County.

The CNDDB was queried for all of Plumas County, but only species and habitats that occur along streams are discussed below.

Sensitive communities

No sensitive communities are known to occur along stream habitats in Plumas County.

Special Status Plants

Cut-leaved Ragwort (*Senecio eurycephalus* var. *lewisrosei*)

Cut-leaved ragword was described above under the Sacramento River discussion. This species has been recorded along the North Fork of the Feather River in western Plumas County.

Mildred's Clarkia (*Clarkia mildrediae* ssp. *mildrediae*)

Mildred's clarkia was described above under the Sacramento River discussion. This species has been recorded along the North Fork of the Feather River in western Plumas County.

Mingan moonwort (*Botrychium minganense*)

The mingan moonwort is a CNPS List 2 plant. It is found in montane coniferous forests between elevations of 1,500 and 2,055 meters along creek banks, mesic woods, meadows, and sand dunes. This perennial fern consists of an upright stem that terminates in a cluster of tiny ball-like structures, resembling a bunch of grapes (hence the nickname "grapefern"). Fern-like leaf blades of a dull green color measure approximately 10 centimeters long and 2.5 centimeters wide. Leaflets are fan-shaped. It is located throughout northern North America, extending south to the western mountains of southern California and northern Arizona, and to Minnesota, Wisconsin, and Michigan. This species has been recorded in five locations in Plumas County, but the locations are suppressed.

Mosquin's Clarkia (*Clarkia mosquinii*)

Mosquin's clarkia was described above under the Sacramento River discussion. This species has been recorded along the Fall River at the western Plumas County line.

Northwestern moonwort (*Botrychium pinnatum*)

The northwestern moonwort is a CNPS List 2 plant. It is found in creek banks, meadows, seeps, and the shrubby slopes of montane coniferous forests between elevations of 1,770 and 2,010 meters. This perennial fern has bright green, deeply-lobed leaves which measure approximately 8 centimeters long and 5 centimeters wide, and are doubly-pinnate. Its range is the Klamath Mountain Range and the High Cascade Range, and extends as far north as Alaska and east to Colorado. This species has been recorded at one location in Plumas County, but it is suppressed.

Nuttall's pondweed (*Potamogeton epihydrus* ssp. *nuttallii*)

Nuttall's pondweed is a CNPS List 2 plant. It is found in shallow freshwater marshes and swamps, as well as ponds, lakes, streams, and irrigation ditches. This monocot favors elevations between 370 and 2,110 meters. It is a perennial rhizomatous herb that is less than 170 centimeters in height, with submersed, sessile leaves that are from 5 to 25 centimeters in length and less than 1 centimeter in width. Leaves are ribbon-like and linear, with a rounded tip and a long petiole. The range of this native Californian plant is the outer northern coastal mountain ranges of California, the high Sierra Nevada, and the Modoc Plateau. Outside California, it is found in areas throughout Oregon and Washington to southeastern Alaska, and extends eastward as far as Colorado. It has been recorded in one location in eastern Plumas County.

Sheldon's sedge (*Carex sheldonii*)

Sheldon's sedge is a CNPS List 2 plant. It is found along creeks, wet meadows, marshes, swamps, and montane coniferous forests between elevations of 1,065 to 1,755 meters. It is a perennial herb with a three-sided stem, and parallel-veined leaf blades which measure approximately three to six centimeters wide and are notably hairy. Its range is the northern portion of the high Sierra Nevada Mountain Range and the Modoc Plateau. It has been recorded in 14 locations throughout Plumas County.

Western Goblin (*Botrychium montanum*)

The western goblin is a CNPS List 2 plant. It is found along creek banks where the soil is very moist and very high in organic matter, in dark, old growth montane coniferous forests between elevations of 1,500 and 1,830 meters. It also grows in meadows and seeps with high mineral contents. This rhizomatous herb is gray-green and usually 4 to 12.5 centimeters in height, with oblong, pointed leaves that have 2 to 4 teeth or lobes at the blade tip. Its range is the northern portion of California, through Oregon and Washington to southeastern Alaska, and extends eastward as far as Idaho and Montana. It has been recorded at Milkhouse Flat in Plumas County.

<u>Yellow Willowherb (*Epilobium luteum*)</u>

The yellow willowherb is a CNPS List 2 plant. Yellow willowherb is an upright, bushy wildflower with slender stalks and numerous finely toothed alternate leaves each about three inches long. Its leaf shape is lanceolate (narrow, pointed at each end) to ovate (egg-shaped). The 4-petaled creamy-yellow flowers grow singly from the upper leaf axils on a plant that grows from 6 to 28 inches high. The native range of yellow willowherb is from Alaska south to Vancouver Island, Oregon, Washington, and parts of California. It is found in lower montane forests along streams and seeps between 1,500 and 1,750 meters in elevation. This species has been recorded along a U.S. Forest Service road in southern Plumas County.

Special Status Wildlife

<u>Amphibians</u>

California Red-legged Frog (*Rana aurora draytonii*)
The California red-legged frog was described under the San Luis Reservoir discussion. They have been recorded in Plumas County, approximately 4.5 miles southeast of Janesville in Plumas National Forest.

Cascades Frog (*Rana cascadae*)
The Cascades frog is a California species of special concern. This moderate-sized brown, red-brown, or slightly greenish brown frog has prominent dorsolateral folds and a distinct light jaw stripe. In California, this species was distributed from the Shasta-Trinity region eastward toward the Modoc Plateau and southward to the Lassen region and the upper Feather River system. It occurs and reproduces in both ephemeral and permanent ponds or streams but probably cannot survive in ephemeral situations where at least some of the substrate does not remain saturated. This species has been recorded at 10 locations in northwestern Plumas County.

Foothill yellow-legged Frog (*Rana boylii*)
The foothill yellow-legged frog is a California species of concern. It is a moderate-sized, variably colored frog, but usually dark to light gray, brown, green, or yellow with a somewhat mottled appearance. The underside surfaces of the legs and lower belly are yellow or orangish-yellow. Historically, this species was known to occur in most Pacific drainages from the Santiam River system in Oregon (Mehama, Marion County) to the San Gabriel River system (Los Angeles County) in California. It requires shallow, flowing water, apparently prefering small to moderate-sized streams situations with at least some cobble-sized substrate. It needs at least 15 weeks to attain metamorphosis. This species has been recorded in Slate Creek, three miles southeast of Little Grass Valley Reservoir and in Spanish Creek, 200 meters north of Forest Road 24N30.

Mountain Yellow-legged Frog (*Rana muscosa*)
The mountain yellow-legged frog is federally-listed as endangered for the populations in the San Gabriel, San Jacinto, and San Bernardino Mountains, and a California species of special concern. This moderate-sized, highly variably colored frog has a dorsal pattern that ranges from discrete dark spots that can be few and large to smaller and more numerous ones with a mixture of size and shapes. The belly and undersurfaces of the high limbs are yellow, which ranges in hue from pale lemon yellow to an intense sun yellow. This near endemic to California is distributed more or less continuously in the Sierra Nevada from the vicinity of La Porte (southern Plumas County) southward to Taylor and French Joe Meadows (southern Tulare County). This species is inhabits ponds, lakes, and streams at moderate to high elevations. This species has been recorded at 12 locations throughout Plumas County.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)
The bald eagle was described above in the Castaic Lake discussion. There are over 20 occurrences of this species throughout Plumas County.

Bank Swallow (*Riparia riparia*)
Bank swallows were described above under the Sacramento River discussion. This species has been recorded in Lights and Indian Creeks.

Osprey *(Pandion haliaetus)*
Osprey were described above under the Lake Perris discussion. This species has been recorded at over 30 locations throughout Plumas County.

Willow Flycatcher (*Empidonaz trailii*)
The willow flycatcher is state-listed endangered species. It is found in extensive swampy thickets of low, dense willows on the edge of wet meadows. It also occurs in upland pastures, abandoned orchards, wooded lakeshores, ponds, and along streams and floodplains. Standing only 15 centimeters in height, this species features dull gray-green feathers above and whitish-yellow feathers below, with two dull white wing bars and an almost undetectable narrow white eye ring on each side. Its range starts at the northern boundaries of British Columbia, Alberta, North Dakota, New York, and Maine, and extends south to central California, Nevada, Arkansas, and Virginia. It favors elevations between 2,000 and 8,000 meters. Winters are spent in the tropics. It breeds from June to August, and requires dense willow thickets for nesting and roosting. A small clutch of three to four eggs are incubated for an average of 13 days by the female in a nest built the fork of a small shrub. This species has been recorded 12 locations throughout Plumas County.

Mammals

American Badger (*Taxidea taxus*)
The American badger was described above under the South San Joaquin Valley discussion. This species has been recorded in four locations throughout Plumas County.

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Plants												
Bakersfield cactus *Opuntia basilaris* var. *treleasei*		E/E/1B	Flood plains, ridges, bluffs and rolling hills in saltbush scrub plant communities.	X								
Brittlescale *Atriplex depressa*		-/-/1B	Alkaline or clay soils in alkali flats.	X								
Brandegee's clarkia *Clarkia biloba* ssp. *brandegeeae*	-/-/-	-/-/1B	Chaparral cismontane woodland often in roadcuts.						X			
California jewel-flower *Caulanthus californicus*		E/E/1B	Nonnative grasslands, upper sonoran subshrub scrub, and cismontane juniper woodland and scrub communities	X								
Comanche Point Layia *Layia leucopappa*		-/-/1B	Sparsely-vegetated microhabitats in nonnative grassland	X								
Carquinez goldenbush *Isocoma arguta*	C2/-/1B	-/-/1B	Valley and foothill grassland with alkaline soils.							X		
Cut-leaved ragwort *Senecio eurycephalus* var. *lewisrosei*	-/-/1B	-/-/1B	Chaparral, cismontane woodland in lower montane coniferous forest with serpentinite soil.						X		X	X
Delta mudwort *Limosella subulata*	-/-/2	-/-/2	Freshwater and brackish marshes and swamps.							X		
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	C2/-/1B	-/-/1B	Freshwater and brackish marshes and swamps.							X		
Earlimart orache *Atriplex erecticaulis*		-/-/1B	In dry areas between vernal pools and along roadsides	X								

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status(1) Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
	1994	2006										
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B	E/E/1B	Cismontane woodland, valley and foothill grassland with clay soils.	X							X	
Hoover's wolly-star (eriastrum) *Eriastrum hooveri*	T/-/4	D/-/4	Alkali sinks, washes. Usually on silty to sandy soils.		X							
Kern mallow *Eremalche kernensis*		E/-/1B	Valley saltbush scrub	X								
Lemmon's jewel-flower *Caulanthus coulteri* var. *lemmonii*		-/-/1B	Valley and foothill grassland and pinyon and juniper woodland habitats	X								
Lost Hills crownscale *Atriplex vallicola*		-/-/1B	Dried beds of alkaline pools within scrub or annual grassland communites	X								
Mason's lilaeopsis *Lilaeopsis masonii*	C2/R/ 1B	-/R/1B	Freshwater or brackish marshes, swamps, or riparian scrub.							X		
Midred's clarkia *Clarkia mildrediae* ssp. *mildrediae*	-/-/4	-/-/1B	Cismontane woodland, lower montane coniferous forest with sandy usually granitic soils.						X		X	X
Mingan moonwort *Botrychium minganense*		-/-/2	Creek banks, mesic woods meadows and sand dunes									X
Mosquin's clarkia *Clarkia mosquinii*	C2/-/1B	-/-/1B	Cismontane woodland in lower montane coniferous forest with rocky soils, and along roadsides.						X		X	X

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status(1) Federal/State/CNPS 1994	Status(1) Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Northern California black walnut *Juglans hindsii*	C2/-/1B	-/-/1B	Riparian forests and woodlands.							X		
Northwestern moonwort *Botrychium pinnatum*		-/-/2	Creek banks, meadows, seeps and shrubby slopes of montane coniferous forests									X
Nuttall's ponweed *Potamogeton epihydrus* ssp. *nuttallii*		-/-/2	Shallow freshwater marshes, and swamps, ponds, lakes, streams and irrigation ditches									X
Pink creamsacs *Castillieja rubicundula* ssp. *rubicundula*		-/-1B	Open areas of chaparral, in cismontane woodlands, meadows and seeps on sepentinite substrate								X	
Recurved larkspur *Delphinium recurvatum*	C2/-/1B	-/-/1B	Chenopod scrub and valley grassland with alkaline soils.	X	X							
Rose mallow *Hibiscus lasiocarpus*	C2/-/2	-/-/2	Freshwater marshes and swamps.							X		
San Joaquin spearscale *Atriplex joaquiniana*	C2/-/1B	-/-/1B	Chenopod scrub, meadows and seeps, playas, valley and foothill grasslands with alkaline soil.							X		
San Joaquin woollythreads *Monolopia* (*Lembertia*) *congdoni*	E/-/1B	E/-/1B	Alkaline or loamy plains, sandy soils.	X	X							
Sheldon's sedge *Carex sheldonii*		-/-/2	Creeks, wet meadows, marshes, swamps, and montane coniferous forests									X

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Slough thistle *Cirsium crassicaule*	C2/-/1B	SC/-/1B	Sloughs, riverbanks, and marshy areas.		X							
Subtle orache *Atriplex subtilis*		-/-/1B	Valley and foothill grassland	X								
Suisun marsh aster *Aster lentus*	C2/-/1B	-/-/1B	Freshwater and brackish marshes and swamps.							X		
Tejon poppy *Eschscholzia lemmonii* ssp. *kernensis*		-/-/1B	Adobe clay soils in sparsely-vegetated grasslands	X								
Veiny monardella *Monardella douglasii var. venosa*	C2/-/1B	-/-/1B	Cismontane woodland, valley and foothill grasslands with heavy clay soils.								X	
Western goblin *Botyrchium montanum*		-/-/2	Moist creek banks with high organic matter									X
White-stemmed clarkia *Clarkia gracilis* ssp. *albicaulis*	-/-/1B	-/-/1B	Chaparral cismontane woodland, sometimes with serpentinite soil.						X			
Yellow willowherb *Epilobium luteum*		-/-/2	Along streams and seeps in lower montane forests									X
Invertebrates												
Antioch Dunes anthicid beetle *Anthicus antiochensis*	C2/-	-/SAL	Found in loose sand of sand bars and sand dunes.							X		

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	1994	2006										
Doyen's trigonoscuta dune weevil *Trigonoscuta* sp.		-/SAL	Sand dunes	X								
Molestan blister beetle *Lytta molesta*		-/SAL	Non-native grassland; vernal pools	X								
Sacramento anthicid beetle *Anthicus sacramento*	C2/-	-/-	Found in sand slip-faces among willows; associated with riparian and other aquatic habitats.							X		
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	C2/-	-/-	Found in association with fine-grained sands along river shorelines and sand bars.								X	
San Joaquin dune beetle *Coelus gracilis*		-/SAL	Sand dunes	X								
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/-	T/-	Riparian and oak savanna habitats with elderberry shrubs; its hold plant is elderberry (*Sambucus* sp.).	X						X	X	
Vernal pool fairy shrimp *Branchinecta lynchi*		T/-	Vernal pool and seasonal wetland habitats	X								
Vernal pool tadpole shrimp *Lepidurus packardi*		E/-	Vernal pools and seasonal wetland habitats	X								

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Amphibians												
California red-legged frog *Rana aurora draytonii*	C2/CSC	T/CSC	Slow-flowing portions of perennial streams, ephemeral streams, and hillside seeps that maintain pool environments (including ponds) or saturated soils throughout the summer months.					X				X
California tiger salamander *Ambystoma californiense*		T/CSC	Annual grassland habitat; understory of open valley-foothill hardwood habitats	X								
Cascades frog *Rana cascadae*		-/SCS	Ephemeral and permanent ponds and streams									X
Foothill yellow-legged frog *Rana boylii*		-/CSC	Small to moderate sized streams with cobble sized substrate									X
Mountain yellow-leeged frog *Rana muscosa*		E/CSC	Ponds, lakes and streams at moderate to high elelvations									X
Western spadefoot *Scaphiopus hammondii*	C2/CSC	-/CSC	Primarily grassland habitats, requires vernal pools for breeding and egg-laying.	X	X							
Reptiles												
Blunt-nosed leopard lizard *Gambelia sila*	E/E, FP	E/E, FP	Sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	X	X			X				

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS		Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
	1994	2006										
Giant garter snake *Thamnophis gigas*	PE/E	T/T	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.								X	
San Joaquin whipsnake *Masticophis flagellum ruddocki*		-/CSC	Open, dry vegetative associations with little or no tree cover. Valley grassland and saltbush scrub.	X								
Western pond turtle *Clemmys marmorata (includes both subspecies)*	C2/CSC	-/CSC	Permanent or nearly permanent bodies of water; requires basking sites, and suitable nesting sites.	X	X	X	X			X	X	
Birds												
Bald eagle *Haliaeetus leucocephalus*	E/E	PD,T/ E, FP	Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. General habitats include ocean shore, lake margins, and rivers for both nesting and wintering.			X	X	X	X			X
Bank swallow *Riparia riparia*	-/T	-/T	Require fine-textured or sandy banks or cliffs to dig horizontal nesting tunnels along large rivers.							X	X	X

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	1994	2006										
Burrowing owl *Athene cunicularia*	C2/CSC	-,BCC/ CSC	Subterranean nester, dependant upon burrowing mammals, Burrow sites typically in open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation.	X	X					X		
California thrasher *Toxostoma redivivum*	-/-	-/-	Lowland and coastal chaparral, riparian thickets							X		
Cooper's hawk *Accipiter cooperii*	-/CSC	-/CSC	Nests in riparian growths of deciduous trees, as in canyon bottoms of river floodplains, within open, interrupted or marginal woodland.				X					
Double-crested cormorant *Phalacrocorax auritus*	-/CSC	-/CSC	Fresh, brackish, and salt water, along coastal regions and inland lakes		X		X					
Golden eagle *Aquila chrysaetos*	--/CSC	-,BCC/ CSC,FP	Found in open country with rolling foothills, mountain areas, sage-juniper flats, and desert habitats. Nests sites are often on rock ledges of cliffs or large trees.				X					
Great blue heron *Ardea herodias*	-/-	-/-	Estuaries and coastal areas with tree groves for nesting.							X		
Great egret *Ardea albus*	-/-	-/-	Nests and roosts in mixed colonies in low trees. Forages in shallow water or in grassy marshes.							X		

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Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Lawrence's goldfinch *Carduelis lawrencei*	-/-	-,BCC/ -	Oak and riparian woodland, chaparral, pinion/juniper woodland, and weedy areas near water.				X					
Le Conte's thrasher *Toxostoma lecontei*		-/CSC	Desert flats, washes and alluvial fans with sand and/or alkaline soil and scatter shrubs	X								
Least bell's vireo *Vireo bellii pusillus*	E/E	E,BCC/E	Summer resident of southern California, in low riparian habitat in the vicinity of water or in dry river bottoms; nests placed along margins of bushes or on twigs projecting into pathways, usually on willow, baccharis, or mesquite.				X					
Loggerhead Shrike *Lanius ludovicianus*	C2/CSC	-,BCC/ CSC	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.		X		X					
Mountain Plover *Charadrius montanus*		-/CSC	Winters in agricultural fields and pastures	X								
Northern Goshawk Accipiter gentiles		-/CSC	Old growth forests						X			

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Northern Harrier *Circus cyaneus*	-/CSC	-/CSC	Breeds in shrubby vegetation within marshes, or grasslands.		X		X					
Osprey *Pandion haliaetus*	-/CSC	-/CSC	Large bodies of water supporting fish. Nest in exposed locations, often in the tops of trees or in snags in beaver swamps.				X				X	X
Southwestern willow flycatcher *Empidonax traillii extimus*	PE/E	E/E	Riparian woodlands in southern California.				X					
Swainson's hawk *Buteo swainsoni*	-/T	-,BCC/T	Breeds in stands with few trees in Juniper-sage flats, riparian areas and oak savannahs. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X						X	X	
Tricolored blackbird *Agelaius tricolor*	C2/CSC	-,BCC/ CSC	Marshes with dense stands of cattails, blackberries, or dense stands of tall herbs such as thistles.	X	X					X	X	

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	1994	2006										
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	-/E	C,BCC/E	Requires dense, large tracts of riparian woodlands with well developed understories for breeding. Occurs in deciduous trees and shrubs, especially willows which are required for roost and nest sites. During the breeding season, associated with moist habitats along slow-moving watercourses where humidity is high.							X	X	X
White-faced ibis *Plegadis chihi*		-/CSC	Salt and freshwater marshes; flooded agricultural fields	X								
White-tailed (black shouldered) kite *Elanus leucurus*	-/*	-/FP	Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. General nesting habitat is rolling foothill/valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland.				X					
Willow flycatcher *Empidonaz trailii*		-/E	Dense willow thickets for nesting									X
Yellow headed blackbird *Xanthocephalus xanthocephalus*	-/-	-/-	Nests in colonies in emergent marsh, such as tules and cattails. Forages in marshes, agricultural fields, and pastures.	X								

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	1994	2006										
Yellow warbler *Dendroica petechia brewsteri*	-/CSC	-/CSC	Nests in riparian habitat, often in willows, cottonwoods, aspens, sycamores and alders. Also nests in montane shrubbery in open conifer forests.				X					
Mammals												
American badger Taxidea taxus	-/CSC	-/SA (CSC in 2006)	Need friable soils and open, uncultivated ground in drier open stages of most shrub, forest, and herbaceous habitats.	X	X			X X				X
Buena Vista Lake shrew *Sorex ornatus relictus*	C1/CSC	E/CSC	Marshlands and riparian areas in the Tulare Basin. Prefers moist soil. Uses stumps, logs and litter for cover.	X	X							
Giant kangaroo rat *Dipodomys ingens*		E/E	Annual grassland on gentle slopes of generally less than 10 degrees, with friable, sandy-loam soils	X								
Western mastiff bat *Eumops perotis californicus*	C2/CSC	-/CSC	Roosts in crevices in cliff faces, high buildings, trees and tunnels; uses many open, semi-arid to arid habitats including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc.			X	X					

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Nelson's (San Joaquin) antelope squirrel *Ammospermophilus nelsoni*	C2/T	-/T	Western San Joaquin Valley on dry, sparsely vegetated loam soils. Need widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes	X	X							
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	E/T	Needs loose-textured sandy soils for burrowing, and suitable prey base, in annual grasslands or grassy open stages with scattered shrubby vegetation.	X	X							
San Joaquin pocket mouse *Perognathus inornatus inornatus*		-/SAL	Fine textured or sandy soils	X								
Short-nosed kangaroo rat *Dipodomys nitratoides brevinasus*		/CSC	Arid grasslands with scattered shrubs and desert-shrub associations	X								
Silver-haired bat *Lasionycteris noctivagans*	-/-	-/-	Deciduous and coniferous forests. In summer roosts under bark or in dead trees, woodpecker holes, or bird nests. In winter hibernates in trees, crevices, buildings, and other protected places.								X	

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Stephens' kangaroo rat *Dipodomys stephensi*	E/T	E/T	Open grasslands and sparse coastal sage scrub. Typical habitat consists of native and non-native annual herbs and grasses.				X					
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	E/E	Needs soft friable soils which escape seasonal flooding within saltbrush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley.	X	X							
Tulare grasshopper mouse *Onychomys torridus tularensis*		-/CSC	Arid shrub land communities in hot, arid grassland and shrub land associations	X								
Yuma myotis *Myotis yumanensis*	C2/-/-	-/-	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution in closely tied to the bodies of water. Maternity colonies in caves, mines, buildings or crevices.				X					
Natural Communities												
Coastal brackish marsh			Dominated by perennial, emergent, herbaceous monocots to 2 m tall. Cover is often complete and dense. Similar to coastal salt marshes, but brackish from freshwater input.							X		

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	1994	2006										
Elderberry savanna			An open, winter decidous shrub savanna dominated by elderberry shrubs (*Sambucus* ssp.). The understory is usually forbs and nonnative annual grasses.							X		
Great Valley cottonwood riparian forest			A dense, broad-leafed, winter deciduous riparian forest dominated by Fremont cottonwood (*Populus fremontii*) and one or more species of willow. The understory vegetation is dense and including seedlings and saplings of shade tolerant species.							X		
Great Valley Mesquite Scrub			Primarily vegetated by honey mesquite (*Prosopis glandulosa torreyana*), a perennial deep-rooted shrub that requires a high water table. Climate conditions consist of moist, foggy winters and hot dry summers.		X							
Great Valley mixed riparian forest			Dense mixture of tall mature cottonwood (*Populus fremontii*) and willows (*Salix* spp.), California sycamore (*Platanus racemosa*), box elder, black walnut and white alder (Alnus rhombifolia).							X	X	

TABLE 1

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Northern hardpan vernal pool			Consists of shallow ephemeral water bodies found in depressions (up to several hectares in size) occurring in grasslands and open woodlands throughout intermountain valleys of California, and Oregon.	X								
Valley Sacaton Grassland			Vegetation dominated by alkali sacaton (*Sporobolus airoides*), a tussock, or tuft forming grass. This habitat is found in areas with fine textured, poorly drained and usually alkaline soils, that have either seasonally high water tables or are flooded during the winter.	X	X							
Valley saltbrush scrub			Valley saltbush scrub is found in the southern and southwestern San Joaquin Valley on dissected alluvial fans with low relief. Community is dominated by shrubs of the Goosefoot family (Chenopodiaceae) and a low herbaceous annual understory.	X								

TABLE 1

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Notes 1. Status explanation
Federal
E Listed as endangered under the Federal Endangered Species Act.
T Listed as threatened under the Federal Endangered Species Act.
PE Proposed as endangered under the Federal Endangered Species Act.
C1 Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.
C2 Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.
SC Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing. In 2006, the USFWS stopped maintaining a Federal Species of Concern list.
D Delisted – Delisted species are monitored for five years after being delisted.
BCC US Fish and Wildlife Service, Bird of Conservation Concern
MNBMC US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern
- No listing

State
E Listed as endangered under the California Endangered Species Act.
T Listed as threatened under the California Endangered Species Act.
CSC California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
FP Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.
* Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution , or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).
SAL Taxa found on the 2006 Special Animals List
- No listing.

Other – California Native Plant Society
1A Presumed Extinct in California
1B Rare, threatened or endangered in California and elsewhere
2 Rare, threatened, or endangered in California, but more common elsewhere.
4 Plants of limited distribution.

Sources:
USFWS List of Candidate Fauna from California and Nevada as of 31 August 1994 (59 FR 58982)
Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, August 20, 1994.
State and Federal Endangered Animals for California and Listing Dates, Department of Fish and Game, Revised January 1994.
California Department of Fish and Game Natural Diversity Data Base Special Animals, December 1992 (The 1994 version could not be located).

K. ANALYSIS OF HISTORICAL OPERATIONS (STUDY NOS. 2 AND 3)

EFFECTS OF

MONTEREY AMENDMENT

ON HISTORICAL

SWP OPERATIONS

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EFFECTS OF MONTEREY AMENDMENT ON HISTORICAL SWP OPERATIONS

1.0 INTRODUCTION

The Monterey Amendment contains a number of provisions that have the potential to result in changes in deliveries of State Water Project (SWP) and other water through SWP facilities. These delivery changes can result in changes in storage in the SWP share of San Luis Reservoir, which can in turn affect diversions from the Delta at Banks Pumping Plant. This study presents the results of two similar but separate analyses conducted to determine the historical effects of Monterey Amendment provisions on SWP operations, focusing on storage in the SWP share of San Luis Reservoir and diversions at Banks Pumping Plant.

The purpose of the first analysis is to estimate the actual impacts of the Monterey Amendment on SWP operations from 1996 through 2004. This analysis includes nearly all of the provisions of the Monterey Amendment, including the water management provisions and the permanent retirement of 45,000 acre-feet of Table A amount.

The purpose of the second analysis is to provide a basis for estimating the future effects of the water management provisions of the Monterey Amendment on SWP operations. The second analysis looks at the effects of only the water management provisions, considered in isolation from the remaining Monterey Amendment provisions. Like the first analysis, this analysis also uses data from 1996 through 2004. This period includes both a series of wet years and a series of drier years, and provides a reasonable estimate of the effects that might be anticipated in the future.

The purpose of both analyses is to evaluate the effects of certain Monterey Amendment provisions on historical SWP operations and water deliveries. The analyses start with historical monthly SWP operations and delivery data for 1996 through 2004, modify that historical monthly operation by removing or adding those deliveries that were determined to result from the Monterey Amendment provisions specified, and describe SWP water supply and operational changes that would likely have occurred with the change in deliveries under these provisions.

2.0 MONTEREY AMENDMENT PROVISIONS

The Monterey Amendment contains a number of provisions, including provisions that: change the way SWP water is allocated among contractors, provide for the permanent transfer and retirement of Table A amounts, and provide water management opportunities for contractors to better manage the SWP supplies available to them. These provisions are briefly summarized and then described in more detail below.

2.1 Allocation and Table A Amount Transfer and Retirement Provisions

The original SWP contracts specified how available SWP supplies were to be allocated among contractors. The allocation of Table A supplies was specified in Article 18, and the allocation of surplus supplies was specified in Article 21. The Monterey Amendment revised the allocation provisions in both Articles 18 and 21. Article 53 of the Monterey Amendment provides for the SWP agricultural contractors to make available for permanent transfer to municipal and industrial (M&I) contractors 130,000 acre-feet of Table A amount, and for the permanent retirement of 45,000 acre-feet of Table A amount.

The current and future effects of these three provisions are analyzed in a set of separate analyses, under current and future demands over a range of hydrologic conditions, using the CALSIM II model (see Appendix F of the DEIR). However, those analyses do not capture the effects of these provisions on historical SWP operations, given the actual operations, demands, and hydrologic conditions that occurred from 1996 through 2004. Since that is the purpose of the first of the two analyses included in this study (i.e., the historical impact analysis), the first analysis includes those of the three provisions summarized above determined to have a potential effect, that can be included without undue speculation. For reasons discussed further below, of these three provisions, only the permanent retirement of Table A amount is included in the historical impact analysis included in this study.

2.1.1 Allocation of SWP Supplies

Article 18 of the original SWP contracts specified how Table A supplies would be allocated among contractors, during both temporary shortage conditions (in Article 18(a)) and permanent shortage conditions (in Article 18(b)). The Monterey Amendment revised the temporary shortage provision of Article 18(a) to eliminate the initial reduction in supplies for agricultural use, and specified that the available Table A supply would be allocated among all contractors in proportion to each contractor's Table A amount. The Monterey Amendment eliminated Article 18(b).

Article 21 of the SWP contracts specified how surplus water would be allocated among contractors. Surplus water was made available to contractors when the Department had supplies beyond what was needed to meet Table A deliveries, reservoir storage targets, and Delta regulatory requirements. The Monterey Amendment revised Article 21 to eliminate the category of "surplus water," which had been made available for scheduled delivery throughout the year. Article 21 was also revised to rename the category of "unscheduled water" as "interruptible water," and to change the allocation of this supply from being made available first to contractors for agricultural use or groundwater replenishment, to being allocated among all requesting contractors in proportion to each requesting contractor's Table A amount, regardless of use.

These allocation provisions do not affect the total amount of Table A or surplus water supplies made available by the Department, only how that total supply is divided up among the contractors. While the Monterey Amendment's revised allocation provisions affect how the available total supply is allocated to individual contractors, these changes would not have any noticeable effect on SWP operations at SWP San Luis Reservoir or Banks Pumping Plant. Therefore, the effect of these allocation changes is not included in the historical impact analysis included in this study. The effect of these allocation changes on historical SWP Table A supply allocations to individual contractors is included in a separate analysis (see Appendix I of the DEIR).

2.1.2 Transfers of Table A Amounts

Article 53 provides that SWP agricultural contractors will make available 130,000 acre-feet of Table A amounts and related transportation capacity, for permanent transfer to SWP M&I contractors or to non-contractors on a willing buyer - willing seller basis. Kern County Water Agency (KCWA) is responsible for making available any portion of the 130,000 acre-feet not previously made available under this article by the other agricultural contractors. By 2004, most of this Table A amount had been transferred from KCWA to various M&I contractors.

This provision has the potential to have some affect on SWP operations, related both to differences in the timing of deliveries between agricultural and M&I contractors during the year (agricultural contractors typically have lower winter demands and higher summer demands than M&I contractors), and temporary reductions in demand associated with the transferred Table A amounts (the M&I contractors acquired the transferred Table A amount primarily to meet future, not current demand, and to improve dry-year supply reliability). For this analysis, however, trying to discern how much of the transferred water was actually delivered and for what purpose, and how it would have been delivered in the absence of the transfer was deemed to require too many speculative assumptions. Therefore, this provision is not included in the historical impact analysis included in this study.

If this provision were included, it would likely show that some portion of the Table A water associated with the transferred Table A amount was not delivered to M&I contractors during this period which, in the absence of the transfer, would have been delivered to KCWA. This lower delivery would be reflected in higher storage at SWP San Luis Reservoir and potential reductions in diversions at Banks Pumping Plant, which would have offset some or all of the potential diversion increases resulting from the water management provisions. Because the inclusion of this provision would likely show a reduction in impacts (or even a benefit), the exclusion of this provision in the historical analysis in this study results in a conservative estimate of historical impacts.

2.1.3 Retirement of Table A Amounts

Article 53 required KCWA and Dudley Ridge WD to permanently retire a total of 45,000 acre-feet of Table A amount in exchange for the transfer of the Kern Fan Element property. Since KCWA and Dudley Ridge WD typically use all of the Table A supply allocated to them, the retirement of this Table A amount resulted in a permanent reduction in deliveries to them. Because this delivery reduction could affect SWP operations and that effect could be readily estimated, this provision is included in the historical impact analysis in this study.

2.2 Water Management Provisions

The water management provisions are intended to provide greater flexibility in SWP contractors' use of existing SWP storage and conveyance facilities and to encourage more efficient use of available SWP supplies by promoting groundwater banking, conjunctive use of local and SWP water sources, and voluntary annual transfers of Table A water. These provisions are included in Articles 52, 54, 55, and 56 of the Monterey Amendment.

Article 52 provides for the transfer of the Kern Fan Element property to KCWA for local development of the Kern Water Bank (KWB) water storage and recovery program. Article 54 of the Monterey Amendment provides certain contractors the flexibility to borrow water from Castaic Lake and Lake Perris, provided that those contractors replace that water within five years of withdrawal. Article 55 provides for conveyance of non-project water using SWP facilities. Article 56 of the Monterey Amendment gives prior Department approval for contractors to store allocated SWP water outside their service areas for later use within their service areas, including: storage in groundwater banks, storage in surface water reservoirs owned by the SWP (i.e., carryover storage), or storage in surface water reservoirs owned by others. Another provision of Article 56 establishes a turnback pool for annual transfers of allocated SWP Table A water.

2.2.1 Transfer of Kern Fan Element Property

Article 52 provides for the transfer by the Department of about 20,000 acres of state-owned property in the Kern Fan area, known as the Kern Fan Element property, to KCWA. As was intended, this property was then transferred by KCWA to the Kern Water Bank Authority and was developed into the locally owned and operated KWB.

2.2.2 Contractors' Use of Castaic Lake and Lake Perris

Article 54 provides certain contractors participating in repayment of capital costs of Castaic Lake and Lake Perris the flexibility to withdraw SWP water from these reservoirs in amounts in addition to their allocated SWP supplies, unless withdrawal of water would have adverse effects on other contractors participating in the repayment of that reach. The Metropolitan Water District of Southern California (MWDSC), Ventura County FC&WCD, and Castaic Lake WA participate in the repayment of capital costs for Castaic Lake and may collectively withdraw up to 160,000 acre-feet from the reservoir. MWDSC is the only contractor eligible to withdraw water from Lake Perris and may withdraw up to 65,000 acre-feet from the reservoir. The contractors' allocations for withdrawal may be adjusted among themselves providing there are no adverse impacts upon another contractor participating in the reach. Contractors are required to replace the withdrawn water within five years after the withdrawal occurs. The withdrawal and replacement delivery schedules are subject to approval by the Department.

2.2.3 Transport of Non-Project Water

Article 55 provides contractual terms for the conveyance and delivery of non-project water to the contractors' service areas through SWP facilities when sufficient capacity is available. Prior to the Monterey Amendment, the Department had conveyed and delivered non-project water for requesting contractors on a number of occasions (e.g., for delivery of contractor non-project water purchases under the Governor's 1991 and 1992 Drought Water Banks, and under the Department's 1994 dry-year water purchase program), as required under Water Code Sections 1810 through 1814. This article provides contractual approval for this conveyance and specifies details regarding delivery and costs of delivery. Because of the Water Code requirements for this type of delivery, Department conveyance of non-project water for contractors would have occurred with or without the Monterey Amendment in effect. Since this provision does not result in any change in deliveries, it is not considered further in these analyses.

2.2.4 Storage Outside Contractors' Service Areas

Article 56(a) gives prior Department approval for SWP contractors to store SWP water outside their service area for later use within their service area. This water supply management practice was allowed prior to the Monterey Amendment (e.g., MWDSC had begun water storage in a groundwater bank in the Semitropic WD in 1993), but Department approval was provided on a case-by-case basis.

Under Article 56(c), contractors may store SWP water in SWP and non-project surface reservoirs or groundwater banks outside their service areas. Article 56(c) limits the amount of SWP water that can be added to storage each year in surface reservoirs outside contractors' service areas but places no limit on the amounts of SWP water that can be added to storage each year in groundwater banks outside contractors' service areas.

2.2.5 Carryover Storage

Article 56(c) also allows SWP contractors to store their allocated Table A water and non-project water in SWP conservation reservoirs when the storage capacity is not needed by the Department for SWP purposes. The most likely location of available SWP storage capacity is San Luis Reservoir. Contractors submit requests to the Department to carry over allocated Table A water from one year to the next and the Department allocates available storage among requesting contractors in proportion to their annual Table A amounts. As the Department needs the storage space for SWP purposes, the carryover water stored for contractors reverts to SWP supply at the same rate the Department would otherwise have been able to fill that storage.

2.2.6 Turnback Pool

Article 56(d) establishes a program that allows a contractor with more allocated SWP water than it needs in a particular year to offer its excess Table A water for sale to other contractors or to the Department. Contractors having excess allocated Table A water can turn back water to the SWP turnback pool program early in the year for sale to other SWP contractors for their use, or to the Department for SWP carryover storage for the following year. In return, that contractor is paid a rate equal to a percentage of the Delta water rate. Previously when a portion of a contractor's allocated Table A water was not taken, it became available, either late in the year or in the following year, for other SWP purposes including reallocation to other contractors with unmet needs. The turnback pool enables contractors to be partially compensated for unused allocated Table A water purchased by other SWP contractors and increases the likelihood that any excess allocated water would be available to other contractors early enough in the year to be managed and used more efficiently.

3.0 ANALYSIS METHODOLOGY

The general methodology followed in both the historical impact analysis and the separate water management provision analysis is the same. To determine the effects of the specified provisions of the Monterey Amendment on SWP operations and deliveries, the analyses use historical SWP operations and delivery data to determine actual monthly SWP operations from 1996 through 2004, modify that historical monthly operation by removing or adding those deliveries that were determined to result from those provisions, and describe SWP water supply and operational changes that would likely have occurred with the change in deliveries under these provisions. This analysis is then used to show: 1) the actual effects of the Monterey Amendment on SWP operations from 1996 through 2004, and 2) the actual effects on SWP operations of only the water management provisions, which then can be used in conjunction with the CALSIM II model results to estimate the future effects of the Monterey Amendment. The general steps in the analysis are described below.

1. Historical end-of-month storage data for SWP San Luis Reservoir and monthly contractor deliveries made under the Monterey Amendment water management

provisions were obtained for 1996 through 2004 (from the California Data Exchange Center and DWR water delivery files, respectively).

2. Contractor deliveries under each provision were reviewed and an assessment was made regarding whether these deliveries would or would not have been likely to occur in the absence of these provisions. For example, in the historical impact analysis, contractors that stored water outside their service areas that had other existing available storage would likely still have taken delivery of that water, but would have stored it elsewhere.

3. Those deliveries that it was determined would not have been made were backed out of actual SWP operations by initially assuming that this water was not delivered and instead remained in storage in SWP San Luis Reservoir.

4. Given this higher storage in SWP San Luis Reservoir, the amount of additional water the Department would likely have made available to contractors was estimated, including: a) increases in the amount of Table A water allocated to contractors, b) making scheduled surplus water available under the pre-Monterey Amendment contract provision of Article 21, or c) making Article 21 unscheduled water available sooner than it otherwise would have. Any estimated increases in supply were limited by estimated contractor demand for that water.

5. The effect on storage in SWP San Luis Reservoir resulting from the net change in deliveries of SWP water (i.e., the net difference between reductions in deliveries without Monterey Amendment water management provisions determined under step 2, and increases in deliveries of Table A and Article 21 water determined under step 4) was then determined.

6. Effects on diversions at Banks Pumping Plant were then determined. This was assumed to occur when all contractor demands for SWP water that would likely have been made available were already being met, and SWP San Luis storage was already full (with “full” here including any historical amount of surcharge into CVP San Luis Reservoir storage). In this situation, it was determined that diversions at Banks would have been reduced.

4.0 ANALYSIS ASSUMPTIONS

The assumptions that follow are specific to the delivery data used in the analysis, determinations made about deliveries that would or would not have been without the Monterey Amendment provisions analyzed, and estimated changes in SWP operations and supply decisions that would likely have been made. Assumptions specific to the historical impact analysis are described in Section 4.1, and those specific to the water management provision analysis are described in Section 4.2.

4.1 Historical Impact Analysis 1996 - 2004

The analysis of historical impacts of the Monterey Amendment on SWP Operations is shown in Table 1. References to specific columns in the assumptions described below refer to the column numbers shown in that table.

4.1.1. Historical Water Delivery Data

The following describe specific assumptions made with regard to the historical delivery data used in the analysis. In general, these assumptions were made to ensure an accurate assessment of the effects on SWP San Luis Reservoir storage and Banks Pumping Plant diversions resulting from the deliveries made under the Monterey Amendment provisions, and to avoid the double counting of deliveries of certain water types.

1. **KWB (column 4):** Because the purpose of this analysis is to determine potential effects on the SWP, the analysis considers only deliveries of SWP water to the KWB and excludes deliveries to the KWB from other sources. The deliveries shown include deliveries to the KWB by KWB participants located within Kern County (i.e., those located within the KCWA service area). Deliveries to the KWB from the only participant in the KWB located outside the KCWA service area, i.e., Dudley Ridge WD, are excluded here but are included in deliveries to storage outside of contractors' service areas (column 6).

2. **Contractor use of Castaic and Perris lakes (column 5):** Contractor borrowing and replacement of water from the terminal reservoirs of Castaic and Perris (sometimes referred to as flexible storage) may potentially affect upstream SWP operations or SWP supplies only when borrowed water is replaced. Therefore, the deliveries shown include only the delivery of replacement water to the Castaic and Perris lakes.

   When the replacement occurs in the same year as the withdrawal, the result is merely a shift in the timing of conveyance of that water to the terminal reservoirs. It is assumed that this same-year replacement has no effect on the availability of SWP supplies to other contractors or to SWP diversions from Banks Pumping Plant. Therefore, the deliveries shown include only the delivery of replacement water that occurred in a calendar year subsequent to that in which the withdrawal was made.

3. **Contractor storage outside service areas (column 6):** Contractors may store any source (SWP or non-project) or SWP type of water outside their service areas. The deliveries shown include all types of SWP water delivered to out-of-service area storage, including Table A water, Article 21 water, and contractor carryover water. As noted under assumption 1, deliveries by Dudley Ridge WD to the KWB are included in these deliveries.

   In the early 1990s, the Semitropic Water Storage District, a member agency of KCWA, developed a groundwater bank within its service area. MWDSC acquired a portion of the capacity in that water bank, stored water in the bank in 1993 with Department approval for temporary storage, and signed a long-term storage agreement with Semitropic in 1994. Because this all occurred prior to the Monterey Amendment, MWDSC's participation in and deliveries to Semitropic are assumed to occur with or without the Monterey Amendment. Therefore, MWDSC deliveries to Semitropic are excluded from total contractor deliveries to out-of-service area storage.

4. **Turnback Pool (column 7):** Table A water allocated to a contractor may be offered through the Turnback Pool for sale to other contractors or the

Department. In some years, the amount of Turnback Pool water that contractors purchased was more than was actually delivered to them. The deliveries shown are actual deliveries to contractors, since any water that was purchased but not delivered would have remained in SWP San Luis Reservoir and would be reflected in the historical storage data. Similarly, any purchase of Turnback Pool water by the Department would have remained in SWP San Luis and would be reflected in the historical storage data, and thus is excluded from the data shown.

5. **Carryover water (column 8):** Contractors may carry over allocated water from one year to the next under both Articles 12(e) and 56(c). Article 12(e) was available prior to the Monterey Amendment, so carryover deliveries under this provision were assumed to occur with or without the Monterey Amendment. The deliveries shown in column 8 are carryover deliveries under the Monterey Amendment's Article 56(c).

   Carryover water may be delivered to any location to which a contractor has approval to deliver any other SWP water, including to its service area, to out-of-service area storage, or to Castaic or Perris lakes for replacement of borrowed flexible storage. To avoid double counting of deliveries already included in other columns, the deliveries shown only include deliveries to a contractor's service area. Carryover deliveries to out-of-service area storage are included in column 6, and carryover deliveries to replace flexible storage are included in column 5. Also, since the focus of this analysis is on effects to SWP San Luis storage and Banks diversions, carryover deliveries to North Bay contractors, which are not made directly from SWP San Luis, are excluded.

4.1.2 Deliveries Without Monterey Amendment

The following describe specific assumptions made with regard to determinations about these historical deliveries and whether they would or would not have been made without the Monterey Amendment in place. In some cases, such as SWP deliveries to the KWB or to storage outside the service area, at least some of these deliveries would have been made regardless, but would have been delivered instead to other existing storage programs. In other cases, the deliveries would not likely have occurred.

1. **KWB (column 10):** KCWA was asked to review the deliveries of SWP water to the KWB and determine how much of that water it could have stored in other storage programs to which KCWA had access that were existing at the time of delivery. The other existing storage programs KCWA considered were limited to projects in the Kern Fan area, including: the Berrenda Mesa Project; City of Bakersfield 2800 acres; and the Pioneer Project, including the Kern River Channel. KCWA conducted a detailed monthly analysis of these storage programs, looking at the historical deliveries that were made to those programs, estimating the remaining recharge capacity that would have been available for additional deliveries, and comparing the SWP deliveries to the KWB to this remaining available recharge capacity. The results of KCWA's analysis show that from 1995 through 2004 all SWP water deliveries to the KWB by KWB participants located within Kern County could have been recharged in available capacity in these other Kern Fan projects (see Section VII of Appendix E of the DEIR). Therefore, it was assumed that all SWP water delivered to the KWB by KWB participants located within Kern County would have still been delivered to KCWA without the Monterey Amendment's transfer of the Kern Fan Element property. These deliveries are shown in column 10.

2. **Contractor storage outside service areas (column 11):** Similar to what was done for the KWB, each contractor that stored water outside its service area was asked to review its deliveries to out-of-service area storage and determine how much of that water it could have stored in other existing storage programs within its service area or elsewhere. Santa Clara Valley WD determined that it would have been able to use or store within its service area all of the SWP water it stored outside its service area.

   MWDSC determined that it would have been able to store nearly all of the water it stored outside its service area (excluding its deliveries to the Semitropic banking program since that program was approved prior to the Monterey Amendment). To reach this determination, MWDSC considered these deliveries and its ability to store this water in its other storage programs that existed at the time of the deliveries, including: Desert Water/Coachella Valley Water District

Advance Delivery Account, Diamond Valley Lake, Semitropic Water Storage Program, Hayfield Storage Program, and conjunctive use programs and cyclic storage programs within MWDSC's service area. MWDSC conducted a detailed monthly analysis of these storage programs, looking at the historical storage in and deliveries to those programs, estimating the remaining storage and monthly recharge capacity that would have been available for additional deliveries, and comparing its SWP deliveries to outside-of-service area storage to this remaining available recharge capacity.

It was determined that the other four of the six storing contractors had no additional demand for or place to store this water. Therefore, it was assumed that all the SWP water delivered to out-of-service area storage for these four contractors would not have been delivered without this Monterey Amendment provision. These deliveries are not included in column 11.

3. **Table A deliveries from retired Table A amounts (column 12):** Without the Monterey Amendment, KCWA and Dudley Ridge WD would not have permanently retired 45,000 acre-feet of Table A amount. Since they both typically take delivery of all the Table A supply allocated to them, it was assumed that they would have taken delivery of the additional Table A water that would have been allocated to them without the retirement. The amount of additional annual delivery was determined based on the amount of Table A retired and the actual Table A allocation in each year. The monthly delivery distribution of these annual amounts was assumed to be in proportion to actual Table A deliveries to KCWA and Dudley Ridge WD in each year.

4. **Contractor use of Castaic and Perris lakes, Turnback Pool, and Carryover water:** Without the Monterey Amendment provisions, it was assumed that there would be: a) no deliveries to replace flexible storage withdrawals at Castaic and Perris lakes, b) no deliveries of Turnback Pool water, and c) no deliveries of Article 56(c) carryover water. Therefore, it was assumed that all the SWP water delivered under these provisions would not have been delivered.

5. **Change in SWP water deliveries related to Monterey Amendment provisions (column 13):** The total change in SWP water deliveries related to Monterey Amendment provisions represents the net change in deliveries, compared to what was delivered historically, that would have occurred without the Monterey Amendment provisions in place. This net change is calculated as a reduction from historical deliveries, based on the total of the historical deliveries made under these provisions (column 9), less those deliveries that would have been made without those provisions in place (columns 10 - 12).

4.1.3 Changes in SWP Operations and Supply Decisions Without Monterey Amendment

The assumptions that follow are specific to the estimated changes in SWP operations and supply decisions that would likely have been made if deliveries under the Monterey Amendment had not been made. In general, water not delivered under the water management provisions would have been partly offset by increased deliveries related to the Table A amount not retired. The net reduction in deliveries would either have been re-allocated and delivered to other contractors or would have remained in storage in San Luis Reservoir. Any increase in San Luis Reservoir storage that would have led to an earlier fill of the reservoir would in turn have increased the availability of unscheduled surplus water under Article 21. Only after these demands had been met would diversions at Banks Pumping Plant have been reduced.

1. **General SWP operations:** It was assumed that general SWP operations would not have changed. In other words, the Department would have continued to maximize diversions at Banks Pumping Plant, within the constraints of existing hydrologic conditions and regulatory and operational requirements, to meet contractor SWP water demands.

2. **Change in water deliveries:** The net change in water deliveries without the Monterey Amendment provisions in place (column 13) was assumed to directly change storage in the SWP share of San Luis Reservoir (i.e., any water that would not have been delivered was assumed instead to remain in SWP San Luis storage). This water was then assumed to either be reallocated and delivered to

other contractors with unmet SWP demands, or if demands were met, remain in SWP San Luis storage.

3. **Table A water deliveries (column 14):** In years when historical Table A allocations were less than 100 percent, the water not delivered under the Monterey Amendment provisions was assumed to be used to increase the allocation percentage, resulting in an increase in allocation and delivery to contractors with unmet Table A demands. The amount of any additional Table A deliveries that would have resulted from a Table A allocation increase was estimated based on the following. In years when historical Table A allocations were less than 90 percent, it was assumed that there would have been enough unmet contractor demand to take an additional Table A delivery of the entire amount of those deliveries not made under the water management provisions. In years when historical Table A allocations were 90 percent or more, unmet contractor Table A demands might have limited any additional Table A deliveries to something less than the deliveries not made. To be conservative, it was assumed in these years that additional Table A deliveries would have been limited to the demands of those contractors with known, but what would have been unmet, demands (i.e., based on actual deliveries to those contractors that purchased water from the Turnback Pool or the Department's dry-year purchase programs, or that used all of their 90 percent allocation).

   In addition, it was assumed that deliveries of carryover water to contractor service areas were used to meet direct contractor demands, and that in the absence of this carryover water, these deliveries would instead have been made with Table A water.

4. **Article 21 surplus water (column 15):** Under the terms of Article 21 of the SWP contract as it existed prior to the Monterey Amendment, when SWP supplies were available in excess of contractors' demands for Table A water, the Department could make surplus water available to contractors. Like Table A water, this surplus water was available for scheduled delivery throughout the year. In two years (1996 and 1999), SWP supplies were abundant enough that all requests for Table A water were met (i.e., historical Table A allocations were

100 percent) and, without the deliveries made under the Monterey Amendment provisions, additional water would have been available for delivery on a scheduled basis. In these two years, it was assumed that the Department would have made scheduled surplus water available to contractors. The amount of any additional deliveries that would have resulted from the availability of surplus water was estimated based on the demands of those contractors with known, but what would have been unmet, demands (i.e., based on actual deliveries to those contractors that purchased water from the Turnback Pool).

5. **Article 21 unscheduled surplus water (column 16):** It was assumed that any of the water not delivered under the Monterey Amendment provisions (column 13) that wasn't delivered as additional Table A water (column 14) or scheduled surplus water (column 15) would have remained in storage in San Luis Reservoir. Any increase in San Luis Reservoir storage that would have led to an earlier fill of the reservoir would have resulted in the Department making Article 21 unscheduled water available to the contractors sooner than happened historically. The amount of any additional deliveries of Article 21 unscheduled water was limited by estimated contractor demand for that water.

6. **Total change in SWP deliveries (column 17):** The total change in SWP water deliveries represents the net change in total SWP deliveries, compared to what was delivered historically, that would likely have occurred without the Monterey Amendment provisions in place. This net change from historical deliveries is calculated as the sum of the change in water delivered related to Monterey Amendment provisions (column 13) and the increase in deliveries of Table A water, scheduled surplus water, and unscheduled surplus water (columns 14 - 16).

7. **Change in diversions at Banks Pumping Plant (column 18):** The historical diversions at Banks Pumping Plant (as well as historical SWP deliveries) are reflected in the historical change in SWP San Luis Reservoir storage (column 3). A change in the historical diversions at Banks was assumed to occur when all contractor demands for SWP water that would have been made available were

already being met, and SWP San Luis storage was already full (with "full" here including any historical amount of surcharge into CVP San Luis Reservoir storage, as is discussed further below). In this situation, it was determined that diversions at Banks would have been reduced by the amount that SWP San Luis storage would have exceeded full capacity (defined below).

8. **SWP San Luis Reservoir storage (column 19):** The SWP storage in San Luis Reservoir represents the storage as it would have been without the Monterey Amendment provisions in place, considering changes both in SWP deliveries and in diversions at Banks Pumping Plant. This storage was calculated each month, as the previous month storage (starting with historical storage at the beginning of the first month of the analysis), plus the historical change in SWP San Luis storage (column 3, which reflects historical Banks Pumping Plant diversions and SWP deliveries), minus any change in total SWP deliveries (column 17), plus any change in diversions at Banks (column 18). Because storage capacity can limit diversions at Banks Pumping Plant, an initial storage calculation, without any change in diversions, was made to determine if storage would exceed full. If it did, then it was assumed that Banks diversions (column 18) would be reduced by the amount of that excess.

   In determining what would be considered "full" in this analysis, historical storage amounts were used as a guide. For example, when historical SWP San Luis storage was close to or in excess of SWP storage capacity of 1,062,000 AF, the historical storage values were used as a limit (e.g., December 1996 through March 1997). This reflects the assumption that any change in SWP deliveries without the Monterey Amendment water management provisions in place would have had no effect on the amount of surcharge into available CVP storage space the Department would have found to be acceptable.[1] Similarly, after implementation of the EWA, the Department historically, at times, limited the amount of water it physically stored, in anticipation of the replacement by EWA of

[1] When SWP storage in San Luis is full but CVP storage is not, the Department sometimes continues adding to SWP storage, in excess of SWP capacity (1,062,000 AF). This excess storage, called surcharge, is only available on a temporary basis until the CVP can fill its share of San Luis Reservoir. The Department determines the amount and timing of any SWP surcharge it deems appropriate on a real-time basis, considering a number of operational factors.

water debt EWA had incurred. In this situation, SWP San Luis storage in this analysis was limited to the historical storage value even though it was less than SWP capacity (e.g., March 2003).

9. **Annual assumptions (column 21):** Descriptions of specific assumptions made in each year of the analysis are included in column 21.

4.2 Water Management Provision Analysis

The water management provision impact analysis is shown in Table 3. This analysis is similar to the historical impact analysis described in Section 4.1, but excludes the effects of the Monterey Amendment's permanent retirement of Table A amounts and makes a different assumption regarding outside-of-service area storage. Except as identified below, the assumptions for both analyses are the same. References to specific columns in the assumptions described below refer to the column numbers shown in Table 3. (Note that because this analysis excludes the effects of Table A retirement, column numbers between the two analyses shown in Tables 1 and 3 differ slightly past column 11.)

4.2.1. Historical Water Delivery Data

The historical delivery data used in the water management provision analysis is the same as used in the historical impact analysis. See Section 4.1.1 for specific assumptions regarding the data shown in columns 4 through 8.

4.2.2 Deliveries Without Monterey Amendment Water Management Provisions

The specific assumptions made with regard to whether these historical deliveries would or would not have been made without the Monterey Amendment in place are the same as used in the historical impact analysis, with two notable exceptions. Those exceptions are the exclusion of the effects of the retirement of Table A amounts, and a different assumption regarding outside-of-service area storage, as discussed further below. See Section 4.1.2 for specific assumptions regarding: KWB (column 10); and contractor use of Castaic and Perris lakes, Turnback Pool, and carryover water.

1. **Contractor storage outside service areas (column 11):** For the purpose of estimating future effects of the water management provisions, it was assumed that none of the SWP water delivered to out-of-service area storage for the storing contractors would have been delivered without this Monterey Amendment provision. In the historical impact analysis, it was assumed that that portion of the water delivered to out-of-service area storage that could have been delivered to other existing storage programs available to the storing contractors, would have been delivered even without this Monterey Amendment provision. At some point, however, those other existing storage programs would fill, and additional deliveries would be made to the added out-of-service area storage available through this provision. In other words, total available storage has increased, along with the potential for increased deliveries to storage. Therefore, for the purpose of estimating the future effects of this provision, the deliveries to this additional out-of-service area storage are assumed to be additional deliveries that would not otherwise have been made.

2. **Table A deliveries from retired Table A amounts:** Because the purpose of this analysis is to estimate the future effects of the water management provisions, and because the future effects of this provision are already included in the CALSIM II model studies mentioned in Section 2.1, it is excluded from this analysis.

3. **Change in SWP water deliveries under water management programs (column 12):** The change in SWP water deliveries under water management programs represents the net change in deliveries, compared to what was delivered historically, that would have occurred without the Monterey Amendment water management provisions in place. This net change is calculated as a reduction from historical deliveries, based on the total of the historical deliveries made under these provisions (column 9), less those deliveries that would have been made even without those provisions in place (columns 10 - 11).

4.2.3 Changes in SWP Operations and Supply Decisions Without Monterey Amendment Water Management Provisions

The assumptions specific to the estimated changes in SWP operations and supply decisions that would likely have been made if deliveries under the Monterey Amendment water management provisions had not been made, are the same as used in the historical impact analysis. See Section 4.1.3 for specific assumptions regarding the data shown in columns 13 through 20. Note that while the assumptions are the same, the specific decisions made on the basis of those assumptions (i.e., the data shown), differs somewhat because of differing deliveries and storage levels.

(Also note that because the water management provision analysis excludes the effects of the Table A retirement included in the historical impact analysis, and therefore excludes that data column, the column numbers for the two analyses beyond column 11 differ by one (e.g., column 14 in Table 1 is comparable to column 13 in Table 3)).

5.0 RESULTS

5.1 Historical SWP Operations Impact Analysis 1996 - 2004

The historical impact analysis in Table 1 shows that the Monterey Amendment resulted in an estimated increase in diversions at Banks Pumping Plant of a total of 44,000 acre-feet during the period from 1996 through 2004. This increase in diversions occurred during six months out of this nine-year period, as is summarized in Table 2. As is shown in both Table 2 and Figure 1, these increases in diversions are small relative to total diversions at Banks Pumping Plant, and occurred in months when Delta outflow was high.

The estimated changes in storage in the SWP share of San Luis Reservoir that resulted from the Monterey Amendment's historical operations are shown in Figure 2. These storage changes were small, typically ranging from zero to about 30,000 acre-feet during this period, out of a total SWP San Luis Reservoir capacity of 1,062,000 acre-feet. The largest storage difference occurred between August 2000 and February 2001, when storage would have been nearly 200,000 acre-feet higher without the Monterey Amendment in effect.

As was discussed in more detail in Section 2.1.2 above, the permanent transfer of Table A amounts was not included in this analysis. If it had been, it would likely show lower deliveries during this period due to temporarily lower demands between the selling and buying contractors. This would be reflected in higher storage at SWP San Luis Reservoir and potential reductions in diversions at Banks Pumping Plant, which would have offset some or all of the potential diversion increases resulting from the water management provisions. Because the inclusion of this provision would likely show a reduction in impacts (or even a benefit), the exclusion of this provision in the historical analysis in this study results in an over-estimate of historical impacts from 1996 through 2004.

5.2 Water Management Provision Analysis

The water management provision analysis in Table 3 shows that the Monterey Amendment water management provisions resulted in an estimated increase in diversions at Banks Pumping Plant of a total of 449,000 acre-feet over the nine-year period from 1996 through 2004, or an average of 50,000 acre-feet per year. This increase in diversions occurred during 11 months out of this nine-year period, as is summarized in Table 4. As is shown in both Table 4 and Figure 3, these increases in diversions are small relative to total diversions at Banks Pumping Plant, and occurred in months when Delta outflow was high.

The estimated changes in storage in the SWP share of San Luis Reservoir that resulted from the Monterey Amendment water management provisions are shown in Figure 4. These storage changes were small, typically ranging from zero to up to about 100,000 acre-feet, out of a total SWP San Luis Reservoir capacity of 1,062,000 acre-feet. The largest storage difference occurred between August 2000 and February 2001, when storage would have been 200,000 to more than 300,000 acre-feet higher without the Monterey Amendment in effect.

This analysis is intended to provide a basis for estimating the future effects of the water management provisions of the Monterey Amendment on SWP operations. While this analysis is based on historical data from 1996 through 2004, because this period includes both a series of wet years and a series of drier years, it provides a reasonable estimate of the effects that might be anticipated in the future.

TABLE 1

HISTORICAL IMPACT ANALYSIS: 1996 – 2004

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= -(cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	= col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	230	208	0	0	0	208	0	1,061,203	-208	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to 45,000 AF of Table A amount that would not have been retired. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule. - Without Monterey, SWP San Luis would have been slightly surcharged into CVP San Luis storage by year end, although at a lower level than historically. With this lower storage, diversions at Banks would not have been reduced.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	987	-75	0	0	0	-75	0	1,076,779	-133	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	1,672	1,004	0	0	0	1,004	0	1,057,583	-1,137	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	2,221	-25,069	0	27,000	0	1,931	0	969,002	-3,068	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	4,264	-15,368	0	20,000	0	4,632	0	835,534	-7,701	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	25,000	7,307	-24,467	0	32,000	0	7,533	0	771,994	-15,234	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	20,000	9,189	-25,585	0	35,000	0	9,415	0	725,698	-24,648	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	8,172	-42,193	0	44,000	0	1,807	0	602,420	-26,456	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	2,391	-14,883	0	17,000	0	2,117	0	711,806	-28,573	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	1,484	1,484	0	0	0	1,484	0	813,112	-30,058	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	938	938	0	0	0	938	0	1,017,482	-30,996	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	1,813	-566	0	0	0	-566	0	1,078,728	-30,430	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	20	-94	0	0	0	-94	0	1,071,531	-30,336	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Since SWP San Luis did not quite fill by the end of December, there would have been no additional deliveries of Article 21 water and no need to reduce diversions at Banks.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	249	249	0	0	0	249	0	1,074,566	-30,585	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	2,173	-2,155	0	0	0	-2,155	0	1,057,032	-28,430	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	3,243	3,243	0	0	0	3,243	0	913,246	-31,672	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	5,444	-4,061	0	0	0	-4,061	0	693,968	-27,611	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	35,000	7,917	-3,588	0	0	0	-3,588	0	569,060	-24,023	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	10,626	-11,878	0	0	0	-11,878	0	433,059	-12,144	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	9,651	2,357	0	0	0	2,357	0	320,047	-14,502	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	1,379	-5,463	0	0	0	-5,463	0	452,610	-9,039	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	1,191	-5,107	0	0	0	-5,107	0	543,983	-3,932	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	1,267	-3,676	0	0	0	-3,676	0	713,467	-256	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	1,486	1,841	-3,968	0	0	0	-3,968	0	957,300	3,712	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= -(cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	=sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	10,973	2,579	-23,591	26,000	0	0	2,409	-1,000	1,068,486	303	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. - Without Monterey, SWP San Luis would have filled earlier in November, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by the amount of water made available. - SWP would have surcharged into CVP San Luis storage space in November. Increased Art. 21 deliveries would have limited surcharge amount to historic level by the end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	336	275	-298	0	0	0	-298	0	1,062,878	601	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	427	427	0	0	0	427	0	1,063,508	174	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	912	912	0	0	0	912	0	1,061,489	-738	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	1,618	-13,382	0	0	15,000	1,618	0	1,059,524	-2,356	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	23,800	3,886	-11,114	0	0	15,000	3,886	0	1,054,639	-6,241	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	9,512	-11,238	0	0	0	-11,238	0	1,009,084	4,997	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	1,759	11,369	-3,631	0	0	0	-3,631	0	882,622	8,628	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	12,519	6,007	-9,049	0	0	0	-9,049	0	917,677	17,677	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	4,147	3,452	-1,133	0	0	0	-1,133	0	1,033,600	18,810	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	1,625	1,625	0	0	7,000	8,625	0	1,073,780	10,185	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	3,339	3,039	0	0	7,000	10,039	0	1,074,392	146	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	600	578	-833	0	0	0	-833	0	1,104,928	979	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Without Monterey, SWP diversion reductions at Banks would have been needed in February and March to limit surcharge into CVP San Luis space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was slightly higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	5,390	672	-158	0	0	0	-158	-1,000	1,097,458	137	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	15,661	970	-2,210	0	0	0	-2,210	-2,000	1,062,148	348	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	11,688	1,841	-5,447	0	0	0	-5,447	0	1,017,445	5,795	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	6,185	4,479	-5,707	0	500	0	-5,207	0	874,256	11,002	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	24,945	7,230	-37,907	0	15,000	0	-22,907	0	589,382	33,909	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	10,666	-19,734	0	27,000	0	7,266	0	502,858	26,643	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	8,798	-10,736	0	20,000	0	9,264	0	468,428	17,379	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	2,958	3,779	-30,724	0	34,000	0	3,276	0	605,899	14,103	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	137	3,301	-42,272	0	44,000	0	1,728	0	585,921	12,374	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	4,292	1,760	-42,413	0	44,000	0	1,587	0	693,914	10,787	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	4,369	926	-30,564	0	31,500		936	0	726,806	9,851	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
Month	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= -(cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	= col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	12,049	424	-79,557	80,000	0	0	443	0	924,125	9,408	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Table A deliveries would have been made related to the Table A amount that would not have been retired. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	9,685	1,408	-74,089	73,000	0	0	-1,089	-10,000	1,058,072	497	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	8,520	1,232	-3,458	0	0	0	-3,458	-4,000	1,061,835	-45	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	10,801	4,182	-5,818	9,300	0	0	3,482	0	965,817	-3,526	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	6,287	-5,813	17,300	0	0	11,487	0	747,051	-15,013	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	21,130	11,416	-7,624	17,300	0	0	9,676	0	555,760	-24,689	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	24,803	6,559	-130,023	17,300	0	0	-112,723	0	489,319	88,034	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	16,675	3,900	-110,960	17,300	0	0	-93,660	0	489,285	181,694	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	27,166	2,493	-2,248	17,300	0	0	15,052	0	554,277	166,642	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	21,119	1,572	-14,610	17,300	0	0	2,690	0	585,256	163,952	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	15,752	540	540	12,000	0	0	12,540	0	611,589	151,412	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	5,761	488	488	8,000	0	0	8,488	0	624,601	142,924	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	0	-131,245	80,000	0	0	-51,245	0	751,099	194,169	- SWP allocation in 2001 was 39%. Since all Table A demand was not met and with higher initial SWP storage, allocations would have been slightly higher early in the year, allowing additional Table A deliveries early in the year. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited by ability to take delivery those months. - Water otherwise delivered through the Turnback Pool would have essentially offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	0	-78,523	78,000	0	45,000	44,477	0	897,096	149,692	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	128	-82,740	72,000	0	160,000	149,260	0	997,196	432	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	150	-8,041		0	0	-8,041	0	993,090	8,473	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	2,019	1,098		0	0	1,098	0	823,209	7,375	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	5,032	4,950		0	0	4,950	0	644,673	2,425	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	4,024	-924		0	0	-924	0	552,409	3,350	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	2,225	209		0	0	209	0	518,338	3,141	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	2,170	1,223		0	0	1,223	0	517,925	1,918	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	1,364	969		0	0	969	0	358,649	949	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	378	378		0	0	378	0	413,406	570	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	60	-3,269		0	0	-3,269	0	679,834	3,839	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= -(cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	=sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	3,311	453	-109,939	80,000	0	0	-29,939	0	946,110	33,778	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool, less Table A deliveries that would have been made related to the Table A amount that would not have been retired, would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	1,450	-10,018	34,000	0	0	23,982	0	1,040,666	9,795	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	2,202	356	0	0	9,000	9,356	0	1,078,612	439	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	1,131	-5,149	8,800	0	0	3,651	0	970,245	-3,212	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	2,291	-7,840	16,300	0	0	8,460	0	733,112	-11,672	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	7,532	-5,792	16,300	0	0	10,508	0	465,941	-22,180	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	7,223	-24,468	16,300	0	0	-8,168	0	384,645	-14,012	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	4,937	-12,059	16,300	0	0	4,241	0	449,693	-18,253	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	2,148	-6,184	16,300	0	0	10,116	0	365,425	-28,370	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	1,673	-27,614	16,300	0	0	-11,314	0	220,426	-17,056	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	191	-16,559	11,300	0	0	-5,259	0	207,427	-11,797	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	-2,785	267	-20,301	7,500	0	0	-12,801	0	320,807	1,004	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	86	-15,200	9,000	0	0	-6,200	0	577,042	7,204	- SWP allocation in 2003 was 90%. While not all Table A demand was met, allocations would not have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	411	-28,510	26,000	0	0	-2,510	0	846,852	9,715	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	1,328	-39,249	41,000	0	8,000	9,751	0	984,520	-36	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	877	-15,129		0	0	-15,129	0	935,335	15,092	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	5,477	3,150	-6,850		0	0	-6,850	0	706,285	21,942	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	34,827	6,826	-3,647		0	0	-3,647	0	583,338	25,589	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	13,290	10,977	1,638		0	0	1,638	0	545,831	23,951	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	19,706	6,449	6,397		0	0	6,397	0	547,498	17,554	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	10,900	2,908	2,908		0	0	2,908	0	667,390	14,646	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	5,020	2,648	2,648		0	0	2,648	0	619,362	11,998	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	675	2,417	2,417		0	0	2,417	0	623,059	9,582	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	3,870	2,424	2,074		0	0	2,074	0	623,277	7,508	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= -(cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	=sum(cols 13 thru 16)	Estimated	= col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	0	-126,642	100,000	0	0	-26,642	0	843,183	34,150	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would not quite have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	6	-179,913	100,000	0	50,000	-29,913	0	1,035,782	64,063	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	907	-12,348	50,000	0	0	37,652	-26,000	1,069,857	411	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	3,406	-1,409		0	0	-1,409	0	940,365	1,821	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	4,485	-590		0	0	-590	0	676,427	2,410	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	7,086	684		0	0	684	0	436,539	1,727	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	8,006	5,715		0	0	5,715	0	365,751	-3,988	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	3,707	1,050		0	0	1,050	0	403,664	-5,038	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	1,096	1,096		0	0	1,096	0	507,402	-6,134	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	318	318		0	0	318	0	515,724	-6,452	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	11	11		0	0	11	0	596,947	-6,463	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	223	223		0	0	223	0	665,495	-6,686	
1996-2004																				
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**478,997**	**334,970**	**-1,851,814**	**1,107,500**	**391,000**	**316,000**	**-37,314**	**-44,000**			

TABLE 2

HISTORICAL IMPACT ANALYIS: 1996 – 2004

Effects of Monterey Amendment on Banks Diversions

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1998	January	4,399,140	196,584	-1,000
1999	February	5,487,282	52,203	-1,000
1999	March	4,249,136	182,800	-2,000
2000	February	5,412,226	421,683	-10,000
2000	March	5,400,323	343,011	-4,000
2004	March	3,459,039	423,147	-26,000
96-04 Total				-44,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/indexo.html).

TABLE 3

WATER MANAGEMENT PROVISION ANLYSIS

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	=sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	-22	0	0	0	-22	0	1,061,433	22	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	-1,062	0	0	0	-1,062	0	1,077,996	1,084	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	-668	0	0	0	-668	0	1,060,472	1,752	- Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule.
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	-27,290	0	27,000	0	-290	0	974,112	2,042	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	-19,632	0	20,000	0	368	0	844,909	1,674	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	0	-56,774	0	32,000	0	-24,774	0	813,676	26,448	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	0	-54,774	0	35,000	0	-19,774	0	796,568	46,222	- Without Monterey water management program deliveries, SWP San Luis would have been more full by year end. Storage would have been maintained at levels similar to historic storage in November and December, necessitating a reduction in SWP diversions at Banks in November and December.
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	-50,365	0	44,000	0	-6,365	0	681,463	52,587	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	-17,274	0	17,000	0	-274	0	793,240	52,861	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	0	0	0	0	0	0	896,031	52,861	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	0	0	0	0	0	0	1,101,339	52,861	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	-2,379	0	0	0	-2,379	-55,000	1,109,398	240	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	-114	0	0	0	-114	0	1,102,221	354	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,105,505	354	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	-4,328	0	0	0	-4,328	0	1,090,144	4,682	- Without Monterey water management program deliveries, SWP San Luis would have nearly filled in December, and Art. 21 unscheduled water would have been made available that month.
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	0	0	0	0	0	0	949,600	4,682	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	-9,505	0	0	0	-9,505	0	735,766	14,187	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	0	-46,505	0	0	0	-46,505	0	653,775	60,692	- Unmet demands by Turnback Pool buyers (Dudley, Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water in December. Their demand would be limited only by their ability to take delivery during December.
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	-22,504	0	0	0	-22,504	0	528,399	83,196	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	-7,294	0	0	0	-7,294	0	425,039	90,490	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	-6,842	0	0	0	-6,842	0	558,981	97,332	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	-6,298	0	0	0	-6,298	0	651,545	103,630	- Since SWP San Luis did not quite fill by the end of December, there would have been no need to reduce diversions at Banks.
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	-4,943	0	0	0	-4,943	0	822,296	108,573	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	0	-7,295	0	0	16,000	8,705	0	1,053,456	99,868	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	= -(cols 9 - 10 - 11)	Estimated	Estimated	Estimated	=sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	0	-37,143	26,000	0	0	-11,143	-111,000	1,068,194	11	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. Greater efforts would have been made to meet as much Turnback Pool demand as possible in these two months. - Without Monterey water management program deliveries, SWP San Luis would have filled in October, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by their total take of Turnback Pool water in 1998. - SWP would have surcharged into CVP San Luis storage space in October. SWP diversions at Banks would have been reduced in November and December to limit
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	0	-909	0	0	0	-909	0	1,063,197	920	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064,254	920	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,063,147	920	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	-15,000	0	0	20,000	5,000	0	1,057,800	-4,080	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	0	-38,800	0	0	30,000	-8,800	0	1,065,600	4,720	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	-20,750	0	0	0	-20,750	0	1,029,557	25,470	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	0	-16,759	0	0	0	-16,759	0	916,223	42,229	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	0	-27,575	0	0	0	-27,575	0	969,804	69,804	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	0	-8,732	0	0	15,000	6,268	0	1,078,326	63,536	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	0	0	0	10,000	10,000	-40,000	1,077,131	13,536	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	-300	0	0	0	-300	-13,000	1,075,082	836	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	0	-2,011	0	0	0	-2,011	-2,000	1,104,796	847	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP diversion reductions at Banks would have been needed from January through March to limit surcharge into CVP San Luis storage space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	0	-6,220	0	0	0	-6,220	-7,000	1,097,388	67	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	0	-18,841	0	0	0	-18,841	-18,000	1,062,708	908	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	0	-18,976	0	0	0	-18,976	0	1,031,534	19,884	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	0	-16,371	0	500	0	-15,871	0	899,009	35,755	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	0	-70,082	0	15,000	0	-55,082	0	646,310	90,837	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	-30,400	0	27,000	0	-3,400	0	570,452	94,237	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	-19,534	0	20,000	0	466	0	544,820	93,771	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	0	-37,461	0	34,000	0	-3,461	0	689,028	97,232	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	0	-45,710	0	44,000	0	-1,710	0	672,489	98,942	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	0	-48,465	0	44,000	0	-4,465	0	786,534	103,407	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	0	-35,859	0	31,500	0	-4,359	0	824,721	107,766	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	= -(cols 9 - 10 - 11)	Estimated	Estimated	Estimated	=sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	0	-92,030	80,000	0	13,000	970	0	1,021,513	106,796	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Since SWP Lan Luis nearly filled in January, Art. 21 unscheduled water would have been made available late that month, with demand limited only by contractors' ability to take delivery during that limited period. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	0	-85,182	73,000	0	0	-12,182	-119,000	1,057,553	-22	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	0	-13,210	0	0	0	-13,210	-13,000	1,062,068	188	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	0	-20,801	9,300	0	0	-11,501	0	981,032	11,689	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	-12,100	17,300	0	0	5,200	0	768,553	6,489	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	0	-40,170	17,300	0	0	-22,870	0	609,808	29,359	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	0	-161,385	17,300	0	0	-144,085	0	574,729	173,444	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	0	-131,535	17,300	0	0	-114,235	0	595,270	287,679	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	0	-31,907	17,300	0	0	-14,607	0	689,921	302,286	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	0	-37,301	17,300	0	0	-20,001	0	743,591	322,287	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	0	-15,752	12,000	0	0	-3,752	0	786,216	326,039	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	0	-5,761	8,000	0	0	2,239	0	805,477	323,800	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	-131,245	80,000	0	0	-51,245	0	931,975	375,045	- SWP allocation in 2001 was 39%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited only by their ability to take delivery in those months. - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in March to limit SWP San Luis storage to historic levels. - Water otherwise delivered through Turnback Pool would have been available for
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	-78,523	78,000	0	175,000	174,477	0	947,972	200,568	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	-82,868	72,000	0	160,000	149,132	-51,000	997,200	436	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	-8,191	1,300	0	0	-6,891	0	991,944	7,327	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	-921	2,300	0	0	1,379	0	821,782	5,948	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	-82	2,300	0	0	2,218	0	645,978	3,730	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	-4,948	2,300	0	0	-2,648	0	555,437	6,378	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	-2,016	2,300	0	0	284	0	521,291	6,094	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	-947	2,300	0	0	1,353	0	520,748	4,741	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	-395	2,300	0	0	1,905	0	360,536	2,836	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	414,072	1,236	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	-3,329	1,100	0	0	-2,229	0	679,460	3,465	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	= col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	0	-113,703	80,000	0	0	-33,703	0	949,500	37,168	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey water management program deliveries, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	-11,468	34,000	0	0	22,532	0	1,045,507	14,636	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	-1,846	0	0	16,000	14,154	0	1,078,655	482	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	-6,280	10,500	0	0	4,220	0	969,719	-3,738	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	-10,131	19,500	0	0	9,369	0	731,677	-13,107	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	-13,324	19,500	0	0	6,176	0	468,838	-19,283	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	-31,691	19,500	0	0	-12,191	0	391,565	-7,092	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	-16,996	19,500	0	0	2,504	0	458,350	-9,596	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	-8,332	19,500	0	0	11,168	0	373,031	-20,764	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	-29,287	19,500	0	0	-9,787	0	226,505	-10,977	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	-16,750	13,500	0	0	-3,250	0	211,497	-7,727	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	0	-17,783	9,000	0	0	-8,783	0	320,859	1,056	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	-15,286	9,000	0	0	-6,286	0	577,180	7,342	- SWP allocation in 2003 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December. - Any Table A delivery increase from April on would have been limited to those contractors that purchased from the Turnback Pool (Zone 7, Alameda, Santa Clara, Oak Flat, Co. Kings, Dudley, KCWA, Tulare, AVEK, Castaic, Desert, Coachella, MWD) or dry-year purchase program (Dudley, KCWA), or that used all of their 90% allocation.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	-28,921	26,000	0	0	-2,921	0	847,400	10,263	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	-40,577	41,000	0	10,000	10,423	0	984,396	-160	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	-16,006	9,800	0	0	-6,206	0	926,289	6,046	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	0	-15,477	18,200	0	0	2,723	0	687,666	3,323	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	0	-45,300	18,200	0	0	-27,100	0	588,172	30,423	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	0	-22,629	18,200	0	0	-4,429	0	556,732	34,852	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	0	-19,758	18,200	0	0	-1,558	0	566,354	36,410	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	0	-10,900	18,200	0	0	7,300	0	681,854	29,110	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	0	-5,020	18,200	0	0	13,180	0	623,294	15,930	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	0	-675	12,600	0	0	11,925	0	617,482	4,005	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	0	-4,220	8,400	0	0	4,180	0	615,594	-175	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	= col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	=sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	=sum(cols 12 thru 15)	Estimated	= col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	-126,642	100,000	0	0	-26,642	0	835,500	26,467	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	-179,919	100,000	0	50,000	-29,919	0	1,028,105	56,386	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	-13,255	50,000	0	0	36,745	-20,000	1,069,087	-359	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	-4,815	1,500	0	0	-3,315	0	941,500	2,956	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	-5,075	2,700	0	0	-2,375	0	679,348	5,331	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	-6,402	2,700	0	0	-3,702	0	443,845	9,033	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	-2,291	2,700	0	0	409	0	378,363	8,624	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	-2,657	2,700	0	0	43	0	417,283	8,581	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	519,417	5,881	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	525,357	3,181	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	0	1,900	0	0	1,900	0	604,691	1,281	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	0	1,300	0	0	1,300	0	672,162	-19	
1996-2004																			
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**0**	**-2,665,781**	**1,310,800**	**391,000**	**515,000**	**-448,981**	**-449,000**			
Annual Average			**30,778**	**9,283**	**81,586**	**102,522**	**102,807**	**326,976**	**30,778**	**0**	**-296,198**	**145,644**	**43,444**	**57,222**	**-49,887**	**-49,889**			

TABLE 4

WATER MANAGEMENT PROVISION ANLYSIS

Effects of Monterey Amendment Water Management Provisions on Banks Diversions

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1996	December	5,198,059	211,225	-55,000
1998	January	4,399,140	196,584	-111,000
1998	November	1,227,905	129,489	-40,000
1998	December	2,904,722	128,026	-13,000
1999	January	2,337,832	85,366	-2,000
1999	February	5,487,282	52,203	-7,000
1999	March	4,249,136	182,800	-18,000
2000	February	5,412,226	421,683	-119,000
2000	March	5,400,323	343,011	-13,000
2001	March	1,439,070	360,751	-51,000
2004	March	3,459,039	423,147	-20,000
96-04 Total				-449,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/inde

FIGURE 1

HISTORICAL IMPACT ANLYSIS: 1996 - 2004

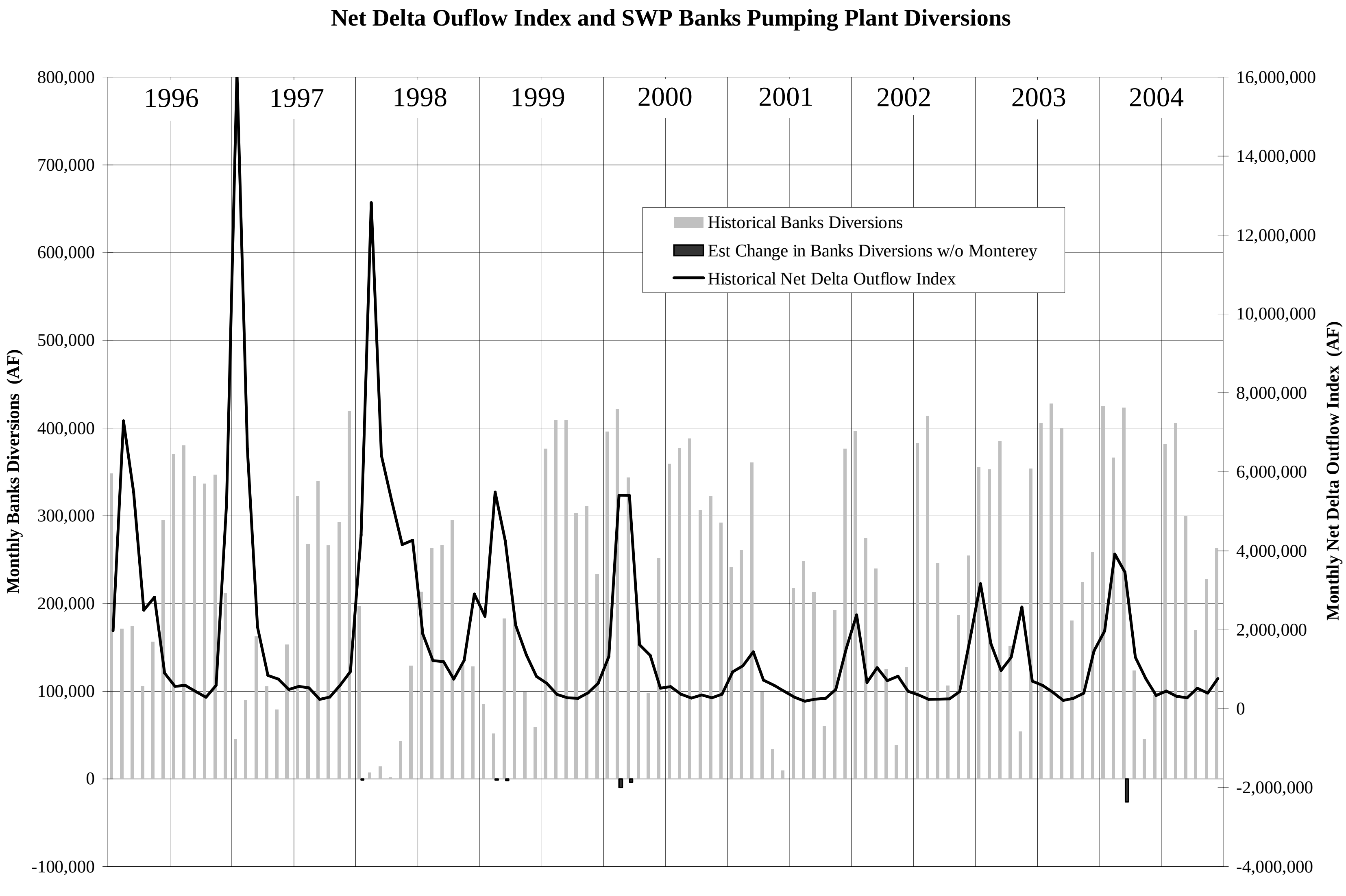


FIGURE 2

HISTORICAL IMPACT ANLYSIS: 1996 - 2004

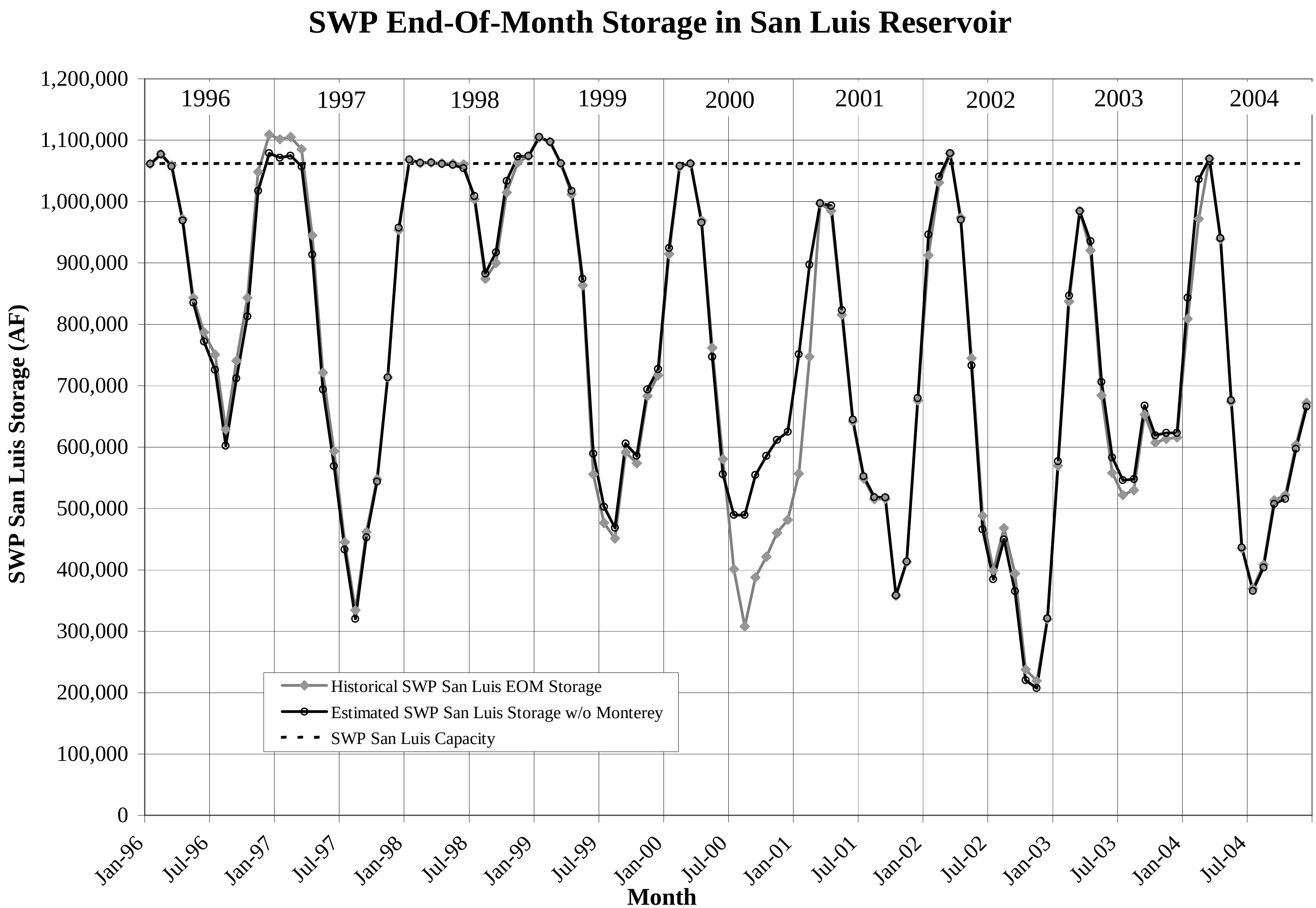


FIGURE 3

WATER MANAGEMENT PROVISION ANLYSIS

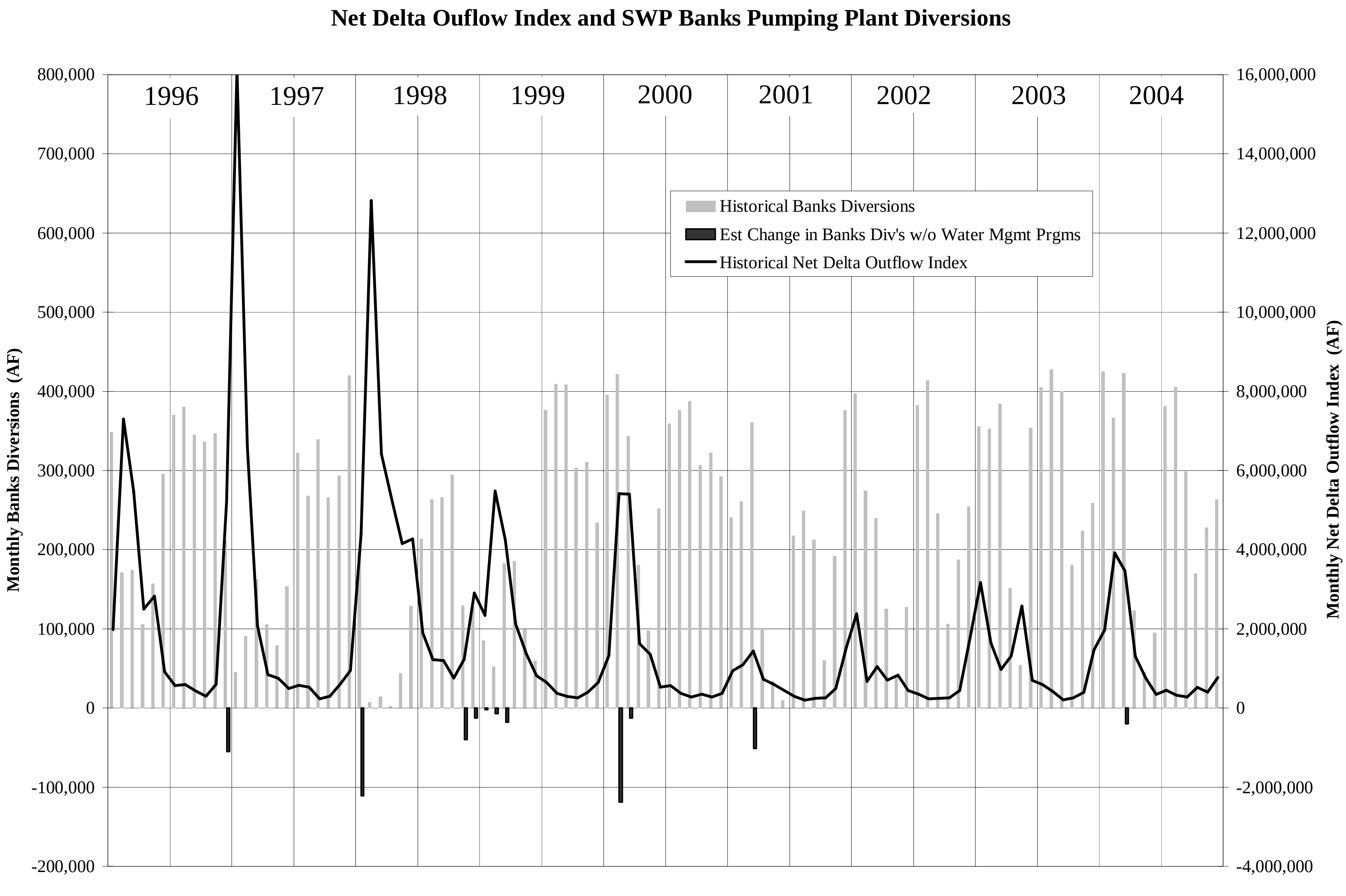
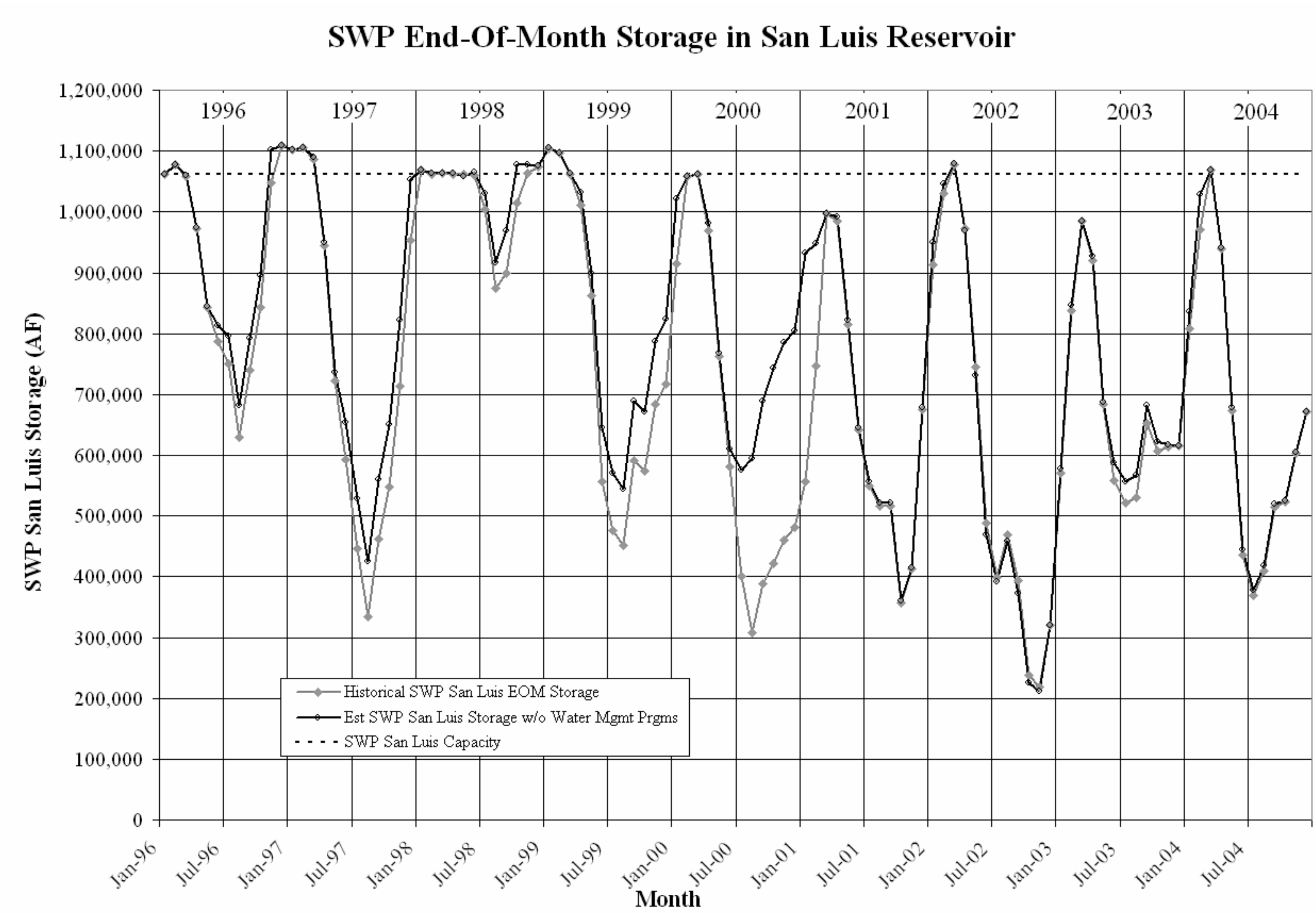


FIGURE 4

WATER MANAGEMENT PROVISION ANLYSIS



Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
Month	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	230	208	0	0	0	208	0	1,061,203	-208	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to 45,000 AF of Table A amount that would not have been retired. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule. - Without Monterey, SWP San Luis would have been slightly surcharged into CVP San Luis storage by year end, although at a lower level than historically. With this lower storage, diversions at Banks would not have been reduced.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	987	-75	0	0	0	-75	0	1,076,779	-133	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	1,672	1,004	0	0	0	1,004	0	1,057,583	-1,137	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	2,221	-25,069	0	27,000	0	1,931	0	969,002	-3,068	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	4,264	-15,368	0	20,000	0	4,632	0	835,534	-7,701	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	25,000	7,307	-24,467	0	32,000	0	7,533	0	771,994	-15,234	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	20,000	9,189	-25,585	0	35,000	0	9,415	0	725,698	-24,648	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	8,172	-42,193	0	44,000	0	1,807	0	602,420	-26,456	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	2,391	-14,883	0	17,000	0	2,117	0	711,806	-28,573	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	1,484	1,484	0	0	0	1,484	0	813,112	-30,058	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	938	938	0	0	0	938	0	1,017,482	-30,996	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	1,813	-566	0	0	0	-566	0	1,078,728	-30,430	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	20	-94	0	0	0	-94	0	1,071,531	-30,336	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Since SWP San Luis did not quite fill by the end of December, there would have been no additional deliveries of Article 21 water and no need to reduce diversions at Banks.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	249	249	0	0	0	249	0	1,074,566	-30,585	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	2,173	-2,155	0	0	0	-2,155	0	1,057,032	-28,430	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	3,243	3,243	0	0	0	3,243	0	913,246	-31,672	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	5,444	-4,061	0	0	0	-4,061	0	693,968	-27,611	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	35,000	7,917	-3,588	0	0	0	-3,588	0	569,060	-24,023	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	10,626	-11,878	0	0	0	-11,878	0	433,059	-12,144	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	9,651	2,357	0	0	0	2,357	0	320,047	-14,502	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	1,379	-5,463	0	0	0	-5,463	0	452,610	-9,039	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	1,191	-5,107	0	0	0	-5,107	0	543,983	-3,932	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	1,267	-3,676	0	0	0	-3,676	0	713,467	-256	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	1,486	1,841	-3,968	0	0	0	-3,968	0	957,300	3,712	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	10,973	2,579	-23,591	26,000	0	0	2,409	-1,000	1,068,486	303	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. - Without Monterey, SWP San Luis would have filled earlier in November, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by the amount of water made available. - SWP would have surcharged into CVP San Luis storage space in November. Increased Art. 21 deliveries would have limited surcharge amount to historic level by the end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	336	275	-298	0	0	0	-298	0	1,062,878	601	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	427	427	0	0	0	427	0	1,063,508	174	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	912	912	0	0	0	912	0	1,061,489	-738	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	1,618	-13,382	0	0	15,000	1,618	0	1,059,524	-2,356	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	23,800	3,886	-11,114	0	0	15,000	3,886	0	1,054,639	-6,241	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	9,512	-11,238	0	0	0	-11,238	0	1,009,084	4,997	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	1,759	11,369	-3,631	0	0	0	-3,631	0	882,622	8,628	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	12,519	6,007	-9,049	0	0	0	-9,049	0	917,677	17,677	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	4,147	3,452	-1,133	0	0	0	-1,133	0	1,033,600	18,810	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	1,625	1,625	0	0	7,000	8,625	0	1,073,780	10,185	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	3,339	3,039	0	0	7,000	10,039	0	1,074,392	146	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	600	578	-833	0	0	0	-833	0	1,104,928	979	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Without Monterey, SWP diversion reductions at Banks would have been needed in February and March to limit surcharge into CVP San Luis space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was slightly higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	5,390	672	-158	0	0	0	-158	-1,000	1,097,458	137	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	15,661	970	-2,210	0	0	0	-2,210	-2,000	1,062,148	348	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	11,688	1,841	-5,447	0	0	0	-5,447	0	1,017,445	5,795	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	6,185	4,479	-5,707	0	500	0	-5,207	0	874,256	11,002	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	24,945	7,230	-37,907	0	15,000	0	-22,907	0	589,382	33,909	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	10,666	-19,734	0	27,000	0	7,266	0	502,858	26,643	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	8,798	-10,736	0	20,000	0	9,264	0	468,428	17,379	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	2,958	3,779	-30,724	0	34,000	0	3,276	0	605,899	14,103	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	137	3,301	-42,272	0	44,000	0	1,728	0	585,921	12,374	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	4,292	1,760	-42,413	0	44,000	0	1,587	0	693,914	10,787	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	4,369	926	-30,564	0	31,500		936	0	726,806	9,851	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: Under Article 56: Turnback Pool Water	Historical: Under Article 56: Carryover Water (delivered to service area)	Historical: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Table A Deliveries from Retired Table A Amounts	Estimated: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Article 21 Surplus Water Deliveries	Estimated: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n)* - col 2:(row *n-1)*	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	12,049	424	-79,557	80,000	0	0	443	0	924,125	9,408
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	9,685	1,408	-74,089	73,000	0	0	-1,089	-10,000	1,058,072	497
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	8,520	1,232	-3,458	0	0	0	-3,458	-4,000	1,061,835	-45
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	10,801	4,182	-5,818	9,300	0	0	3,482	0	965,817	-3,526
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	6,287	-5,813	17,300	0	0	11,487	0	747,051	-15,013
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	21,130	11,416	-7,624	17,300	0	0	9,676	0	555,760	-24,689
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	24,803	6,559	-130,023	17,300	0	0	-112,723	0	489,319	88,034
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	16,675	3,900	-110,960	17,300	0	0	-93,660	0	489,285	181,694
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	27,166	2,493	-2,248	17,300	0	0	15,052	0	554,277	166,642
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	21,119	1,572	-14,610	17,300	0	0	2,690	0	585,256	163,952
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	15,752	540	540	12,000	0	0	12,540	0	611,589	151,412
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	5,761	488	488	8,000	0	0	8,488	0	624,601	142,924
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	0	-131,245	80,000	0	0	-51,245	0	751,099	194,169
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	0	-78,523	78,000	0	45,000	44,477	0	897,096	149,692
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	128	-82,740	72,000	0	160,000	149,260	0	997,196	432
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	150	-8,041		0	0	-8,041	0	993,090	8,473
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	2,019	1,098		0	0	1,098	0	823,209	7,375
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	5,032	4,950		0	0	4,950	0	644,673	2,425
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	4,024	-924		0	0	-924	0	552,409	3,350
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	2,225	209		0	0	209	0	518,338	3,141
Sep-01	516,007	810	0	0	0	947	0	947	0	0	2,170	1,223		0	0	1,223	0	517,925	1,918
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	1,364	969		0	0	969	0	358,649	949
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	378	378		0	0	378	0	413,406	570
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	60	-3,269		0	0	-3,269	0	679,834	3,839

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Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements

2000 (Jan-00 – Dec-00):

- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%.
- Table A deliveries would have been made related to the Table A amount that would not have been retired.
- Carryover water deliveries in January and February would have been Table A deliveries instead.
- Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings).
- Without Monterey, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space.
- SWP San Luis storage would have been higher by the end of 2000 but would not have filled.

2001 (Jan-01 – Dec-01):

- SWP allocation in 2001 was 39%. Since all Table A demand was not met and with higher initial SWP storage, allocations would have been slightly higher early in the year, allowing additional Table A deliveries early in the year.
- Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water.
- Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited by ability to take delivery those months.
- Water otherwise delivered through the Turnback Pool would have essentially offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	3,311	453	-109,939	80,000	0	0	-29,939	0	946,110	33,778	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool, less Table A deliveries that would have been made related to the Table A amount that would not have been retired, would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	1,450	-10,018	34,000	0	0	23,982	0	1,040,666	9,795	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	2,202	356	0	0	9,000	9,356	0	1,078,612	439	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	1,131	-5,149	8,800	0	0	3,651	0	970,245	-3,212	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	2,291	-7,840	16,300	0	0	8,460	0	733,112	-11,672	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	7,532	-5,792	16,300	0	0	10,508	0	465,941	-22,180	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	7,223	-24,468	16,300	0	0	-8,168	0	384,645	-14,012	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	4,937	-12,059	16,300	0	0	4,241	0	449,693	-18,253	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	2,148	-6,184	16,300	0	0	10,116	0	365,425	-28,370	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	1,673	-27,614	16,300	0	0	-11,314	0	220,426	-17,056	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	191	-16,559	11,300	0	0	-5,259	0	207,427	-11,797	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	-2,785	267	-20,301	7,500	0	0	-12,801	0	320,807	1,004	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	86	-15,200	9,000	0	0	-6,200	0	577,042	7,204	- SWP allocation in 2003 was 90%. While not all Table A demand was met, allocations would not have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	411	-28,510	26,000	0	0	-2,510	0	846,852	9,715	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	1,328	-39,249	41,000	0	8,000	9,751	0	984,520	-36	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	877	-15,129		0	0	-15,129	0	935,335	15,092	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	5,477	3,150	-6,850		0	0	-6,850	0	706,285	21,942	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	34,827	6,826	-3,647		0	0	-3,647	0	583,338	25,589	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	13,290	10,977	1,638		0	0	1,638	0	545,831	23,951	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	19,706	6,449	6,397		0	0	6,397	0	547,498	17,554	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	10,900	2,908	2,908		0	0	2,908	0	667,390	14,646	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	5,020	2,648	2,648		0	0	2,648	0	619,362	11,998	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	675	2,417	2,417		0	0	2,417	0	623,059	9,582	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	3,870	2,424	2,074		0	0	2,074	0	623,277	7,508	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	0	-126,642	100,000	0	0	-26,642	0	843,183	34,150	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would not quite have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	6	-179,913	100,000	0	50,000	-29,913	0	1,035,782	64,063	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	907	-12,348	50,000	0	0	37,652	-26,000	1,069,857	411	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	3,406	-1,409		0	0	-1,409	0	940,365	1,821	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	4,485	-590		0	0	-590	0	676,427	2,410	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	7,086	684		0	0	684	0	436,539	1,727	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	8,006	5,715		0	0	5,715	0	365,751	-3,988	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	3,707	1,050		0	0	1,050	0	403,664	-5,038	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	1,096	1,096		0	0	1,096	0	507,402	-6,134	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	318	318		0	0	318	0	515,724	-6,452	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	11	11		0	0	11	0	596,947	-6,463	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	223	223		0	0	223	0	665,495	-6,686	
TOTALS																				
1996-2003			**260,595**	**83,547**	**686,357**	**905,457**	**649,364**	**2,585,320**	**260,595**	**478,997**	**305,720**	**-1,540,008**	**857,500**	**391,000**	**266,000**	**-25,508**	**-18,000**			
1996-2004			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**478,997**	**334,970**	**-1,851,814**	**1,107,500**	**391,000**	**316,000**	**-37,314**	**-44,000**			

EFFECTS OF MONTEREY AMENDMENT ON BANKS DIVERSIONS

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1998	January	4,399,140	196,584	-1,000
1999	February	5,487,282	52,203	-1,000
1999	March	4,249,136	182,800	-2,000
2000	February	5,412,226	421,683	-10,000
2000	March	5,400,323	343,011	-4,000
2004	March	3,459,039	423,147	-26,000
96-04 Total				-44,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/indexo.html).

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	All SWP Water Delivered	Del'd for Kern Co. Particps	Could Not Have Stored	Could've Stored Elsewhere	FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54 — Article 21 Water CLWA	Article 21 Water MWD	Article 21 Water Total	Article 56 Carryover CLWA	Article 56 Carryover MWD	Article 56 Carryover Total	Table A Water CLWA	Table A Water MWD	Table A Water Total	Local Supply CLWA	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	DELIVERIES FROM NOD UNDER ARTICLE 55 — Non-Project Water from N of Delta MWA	Non-Project Water from N of Delta MWD	Non-Project Water from N of Delta SCVWD	Non-Project Water from N of Delta Total	Article 21 Water ACWD	Article 21 Water CLWA	Article 21 Water DRWD	Article 21 Water MWD	Article 21 Water SCVWD	Article 21 Water Zone 7	Article 21 Water Total
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2-3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 +	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 22 thru 27)
Jan-96	11,587	11,565	0	11,565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	22
Feb-96	10,740	9,678	0	9,678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	1,062
Mar-96	6,497	5,829	0	5,829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	668
Apr-96	1,409	1,409	0	1,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-96	2,103	2,103	0	2,103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-96	255	255	0	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-96	2,015	2,015	0	2,015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-96	11,456	11,456	0	11,456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-96	10,695	10,695	0	10,695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-96	9,079	9,079	0	9,079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	5,601	5,601	0	5,601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	16,055	13,676	0	13,676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**87,492**	**83,361**	**0**	**83,361**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,752**	**0**	**0**	**0**	**1,752**
Jan-97	987	873	0	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	114
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	5,627	1,299	0	1,299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	4,328
Apr-97	2,772	2,772	0	2,772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-97	2,769	2,769	0	2,769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-97	2,563	2,563	0	2,563	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	0	0	0	0	0	0
Nov-97	11,165	11,165	0	11,165	0	0	0	0	0	0	645	0	645	0	645	0	645	0	0	0	0	0	0	0	0	0	0	0
Dec-97	14,166	13,266	0	13,266	0	0	0	0	0	0	611	0	611	0	611	0	611	0	0	0	0	0	0	0	0	0	0	0
Total	**40,049**	**34,707**	**0**	**34,707**	**0**	**0**	**0**	**0**	**0**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**1,600**	**0**	**0**	**1,600**	**0**	**0**	**4,442**	**0**	**0**	**0**	**4,442**
Jan-98	13,952	13,541	0	13,541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	411	0	0	0	411
Feb-98	3,118	2,545	0	2,545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573	0	0	0	573
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-98	6,447	6,391	0	6,391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-98	15,270	10,685	0	10,685	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-98	3,804	3,804	0	3,804	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	8,564	8,264	0	8,264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**51,155**	**45,230**	**0**	**45,230**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**984**	**0**	**0**	**0**	**984**
Jan-99	1,525	204	0	204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	1,321	0	600	0	2,011
Feb-99	1,149	1,149	0	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	830	0	0	0	5,390	0	6,220
Mar-99	1,022	1,022	0	1,022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,140	0	0	0	7,620	2,040	10,800
Apr-99	2,274	2,274	0	2,274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	1,870	870	3,060
May-99	347	347	0	347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-99	5,758	5,758	0	5,758	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-99	10,780	10,780	0	10,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-99	3,156	3,156	0	3,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**26,011**	**24,690**	**0**	**24,690**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,380**	**0**	**1,321**	**0**	**15,480**	**2,910**	**22,091**
Jan-00	224	224	0	224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-00	4,896	4,733	0	4,733	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	880	0	163	0	5,210	1,340	7,593
Mar-00	14,002	13,212	0	13,212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,500	0	790	0	8,520	2,400	13,210
Apr-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	0	0	0	3,471	3,471	0	3,471	3,471	0	0	0	0	0	0	0	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month					FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55										
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water						
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2-3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 +	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 22 thru 27)
Aug-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	900	0	900	0	0	0	0	0	0	0
Nov-00	333	333	0	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**19,455**	**18,502**	**0**	**18,502**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,471**	**3,471**	**0**	**3,471**	**3,471**	**0**	**0**	**900**	**0**	**900**	**2,380**	**0**	**953**	**0**	**13,730**	**3,740**	**20,803**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-01	10,030	8,297	0	8,297	0	4,710	4,710	0	0	0	0	0	0	0	4,710	0	4,710	0	0	0	0	0	0	933	0	0	0	933
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	2,589	2,589	0	2,589	0	0	0	0	0	0	0	0	0	0	0
Total	**10,030**	**8,297**	**0**	**8,297**	**0**	**4,710**	**4,710**	**0**	**0**	**0**	**0**	**0**	**0**	**2,589**	**7,299**	**0**	**7,299**	**0**	**0**	**0**	**0**	**0**	**0**	**933**	**0**	**0**	**0**	**933**
Jan-02	0	-140	0	-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-02	3,039	2,793	0	2,793	0	1,190	1,190	0	0	0	0	0	0	0	1,190	0	1,190	0	0	0	0	0	0	246	0	0	397	643
Apr-02	3,341	2,991	0	2,991	0	4,760	4,760	0	0	0	0	0	0	0	4,760	0	4,760	0	0	0	0	83	0	350	0	0	1,087	1,520
May-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	0	0	16,468	16,468	0	16,468	0	16,468	0	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0	0
Total	**6,380**	**5,644**	**0**	**5,644**	**0**	**5,950**	**5,950**	**0**	**0**	**0**	**0**	**69,042**	**69,042**	**0**	**74,992**	**0**	**74,992**	**0**	**0**	**0**	**0**	**83**	**0**	**596**	**0**	**0**	**1,484**	**2,163**
Jan-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-03	0	0	0	0	0	0	0	0	7,100	7,100	0	0	0	0	7,100	7,100	0	0	0	0	0	0	0	0	0	0	0	0
Mar-03	4,632	4,632	0	4,632	0	13,139	13,139	0	38,500	38,500	0	0	0	0	51,639	51,639	0	0	0	0	0	0	0	0	0	0	0	0
Apr-03	0	0	0	0	0	4,483	4,483	0	0	0	0	32,575	32,575	0	37,058	37,058	0	0	0	0	0	0	0	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-03	2,413	2,413	0	2,413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0	0
Nov-03	16,789	16,789	0	16,789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-03	16,540	16,190	0	16,190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**40,374**	**40,024**	**0**	**40,024**	**0**	**17,622**	**17,622**	**0**	**45,600**	**45,600**	**0**	**32,575**	**32,575**	**0**	**95,797**	**95,797**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Jan-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-04	1,914	1,914	0	1,914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-04	16,151	14,494	0	14,494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,657	0	0	0	1,657
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	50,061	50,061	0	50,061	50,061	0	0	0	0	0	0	0	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**18,065**	**16,408**	**0**	**16,408**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50,061**	**50,061**	**0**	**50,061**	**50,061**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**1,657**	**0**	**0**	**0**	**1,657**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month					FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55										
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water						
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2-3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 +	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 22 thru 27)
Jan-05	29,486	28,593	0	28,593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	845	0	0	0	845
Feb-05	39,919	37,596	0	37,596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,323	0	0	0	2,323
Mar-05	50,106	46,729	0	46,729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	3,377
Apr-05	49,900	46,946	0	46,946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	2,954
May-05	14,278	13,629	0	13,629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	0	764	0	1,413
Jun-05	30,897	29,833	0	29,833	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064	0	2,351	0	3,415
Jul-05	234	234	0	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-05	11,025	11,025	0	11,025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-05	25,520	25,520	0	25,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-05	32,256	30,756	0	30,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-05	21,818	20,818	0	20,818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-05	21,979	20,045	0	20,045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,934	0	0	0	1,934
Total	**327,418**	**311,724**	**0**	**311,724**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,146**	**0**	**3,115**	**0**	**16,261**
Totals																												
96-03	**280,946**	**260,455**	**0**	**260,455**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**105,088**	**106,344**	**2,589**	**182,815**	**99,268**	**83,547**	**1,600**	**900**	**3,100**	**5,600**	**4,843**	**0**	**10,981**	**0**	**29,210**	**8,134**	**53,168**
96-04	**299,011**	**276,863**	**0**	**276,863**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**12,638**	**0**	**29,210**	**8,134**	**54,825**
96-05	**626,429**	**588,587**	**0**	**588,587**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**25,784**	**0**	**32,325**	**8,134**	**71,086**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
	Article 56 Carryover							Table A and other SWP Water							Total							Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
Feb-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	0	0	0	0	0	0	0
Mar-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	0	0	0	0	0	0	0
Apr-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,290	0	0	0	0	0
May-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,632	0	0	0	0	0
Jun-96	0	0	0	0	0	0	0	0	0	0	0	25,000	0	25,000	25,000	0	0	25,000	25,000	31,774	0	0	0	0	0
Jul-96	0	0	0	0	0	0	0	0	0	0	0	20,000	0	20,000	20,000	0	0	20,000	20,000	34,774	0	0	0	0	0
Aug-96	0	0	0	0	0	0	0	6,200	0	0	0	0	0	6,200	6,200	0	0	0	0	44,165	0	0	0	0	0
Sep-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,274	0	0	0	0	0
Oct-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	0	0	0	0	0	0	0	0	0	2,379	0	0	0	2,379	2,379	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,200**	**0**	**2,379**	**0**	**45,000**	**0**	**53,579**	**55,331**	**0**	**0**	**45,000**	**45,000**	**174,909**	**0**	**0**	**0**	**0**	**0**
Jan-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	0	0	0	0	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	0	0	0	0	0	0	0
Apr-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,505	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	35,000	0	35,000	35,000	0	0	35,000	35,000	11,505	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	10,000	0	0	0	0	0	10,000	10,000	0	0	0	0	12,504	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,294	0	0	0	0	0
Sep-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,842	0	0	0	0	0
Oct-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,298	0	0	0	0	0
Nov-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,298	0	0	0	0	0
Dec-97	0	0	0	0	0	0	0	0	0	900	1,486	0	0	2,386	2,386	0	1,486	0	1,486	4,298	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10,000**	**0**	**900**	**1,486**	**35,000**	**0**	**47,386**	**51,828**	**0**	**1,486**	**35,000**	**36,486**	**62,544**	**0**	**0**	**0**	**0**	**0**
Jan-98	0	0	0	8,797	0	0	8,797	0	0	0	2,176	0	0	2,176	11,384	0	10,973	0	10,973	0	34,963	407	8,797	0	25,759
Feb-98	0	0	0	0	0	0	0	0	0	0	336	0	0	336	909	0	336	0	336	0	0	0	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,000	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	23,800	0	23,800	23,800	0	0	23,800	23,800	15,000	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	3,780	0	0	0	0	1,970	5,750	5,750	0	0	0	0	15,000	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	1,759	0	0	1,759	1,759	0	1,759	0	1,759	15,000	0	0	0	0	0
Sep-98	0	0	0	0	0	0	0	0	0	56	12,519	0	0	12,575	12,575	0	12,519	0	12,519	15,000	0	0	0	0	0
Oct-98	0	0	0	0	0	0	0	0	0	4,585	4,147	0	0	8,732	8,732	0	4,147	0	4,147	0	0	0	0	0	0
Nov-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	0	0	0	0	0	0	0	0	0	300	0	0	0	300	300	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**8,797**	**0**	**0**	**8,797**	**3,780**	**0**	**4,941**	**20,937**	**23,800**	**1,970**	**55,428**	**65,209**	**0**	**29,734**	**23,800**	**53,534**	**75,000**	**34,963**	**407**	**8,797**	**0**	**25,759**
Jan-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,011	0	0	600	600	0	0	0	0	0	0
Feb-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,220	0	0	5,390	5,390	0	0	0	0	0	0
Mar-99	0	0	0	0	0	0	0	0	0	0	8,041	0	0	8,041	18,841	0	8,041	7,620	15,661	0	0	0	0	0	0
Apr-99	0	0	0	0	0	0	0	0	0	0	15,916	0	0	15,916	18,976	6,098	9,818	1,870	11,688	0	0	0	0	0	0
May-99	0	0	0	0	0	0	0	0	0	0	16,024	0	0	16,024	16,024	9,839	6,185	0	6,185	347	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	12,620	0	0	10,425	14,520	17,300	54,865	54,865	0	10,425	14,520	24,945	15,217	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	1,100	0	0	0	0	2,700	3,800	3,800	0	0	0	0	26,600	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,534	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	2,958	0	0	2,958	2,958	0	2,958	0	2,958	34,503	0	0	0	0	0
Oct-99	0	0	0	0	0	0	0	0	0	0	137	0	0	137	137	0	137	0	137	45,573	0	0	0	0	0
Nov-99	0	0	0	0	0	0	0	0	0	0	4,292	0	0	4,292	4,292	0	4,292	0	4,292	44,173	0	0	0	0	0
Dec-99	0	0	0	0	0	0	0	0	0	0	4,369	0	0	4,369	4,369	0	4,369	0	4,369	31,490	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,720**	**0**	**0**	**62,162**	**14,520**	**20,000**	**110,402**	**132,493**	**15,937**	**46,225**	**30,000**	**76,225**	**217,437**	**0**	**0**	**0**	**0**	**0**
Jan-00	0	0	0	12,049	0	0	12,049	0	0	0	0	0		0	12,049	0	12,049	0	12,049	0	93,447	1,417	12,049	0	79,981
Feb-00	0	0	0	4,475	0	0	4,475	0	0	0	0	0	0	0	12,068	0	4,475	5,210	9,685	0	77,589	0	4,475	0	73,114
Mar-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,210	0	0	8,520	8,520	0	0	0	0	0	0
Apr-00	0	0	0	0	0	0	0	0	0	0	10,801	0	0	10,801	10,801	0	10,801	0	10,801	10,000	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,100	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	3,750	0	0	21,130	0	3,000	27,880	27,880	0	21,130	0	21,130	12,290	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	5,750	0	0	24,803	0	8,000	38,553	38,553	0	24,803	0	24,803	122,832	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																			Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs				Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Article 56 Carryover							Table A and other SWP Water							Total										
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Aug-00	0	0	0	0	0	0	0	0	0	0	16,675	0	8,000	24,675	24,675	0	16,675	0	16,675	106,860	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	1,500	0	0	17,166	10,000	1,200	29,866	29,866	0	17,166	10,000	27,166	2,041	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	21,119	0	0	21,119	21,119	0	21,119	0	21,119	16,182	0	0	0	0	0
Nov-00	0	0	0	0	0	0	0	0	0	0	15,752	0	0	15,752	15,752	0	15,752	0	15,752	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	5,761	0	0	5,761	5,761	0	5,761	0	5,761	0	0	0	0	0	0
Total	**0**	**0**	**0**	**16,524**	**0**	**0**	**16,524**	**11,000**	**0**	**0**	**133,207**	**10,000**	**20,200**	**174,407**	**211,734**	**0**	**149,731**	**23,730**	**173,461**	**282,305**	**171,036**	**1,417**	**16,524**	**0**	**153,095**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133,186	1,941	0	0	131,245
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,326	803	0	0	78,523
Mar-01	0	0	800	0	0	5,000	5,800	0	0	0	0	0	0	0	6,733	0	0	0	0	0	77,225	0	5,800	0	71,425
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,191	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	921	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,948	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,016	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	947	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	395	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	740	0	0	0	0	0
Total	**0**	**0**	**800**	**0**	**0**	**5,000**	**5,800**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,733**	**0**	**0**	**0**	**0**	**18,240**	**289,737**	**2,744**	**5,800**	**0**	**281,193**
Jan-02	0	0	0	0	0	1,081	1,081	0	0	140	0	3,311	0	3,451	4,532	0	0	3,311	3,311	0	110,529	277	1,081	0	109,171
Feb-02	0	0	0	0	0	6,919	6,919	0	0	0	0	0	0	0	6,919	0	0	0	0	0	11,587	119	6,919	0	4,549
Mar-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	643	0	0	0	0	0	545	532	0	0	13
Apr-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,520	0	0	0	0	0	776	776	0	0	0
May-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,501	290	290	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,694	660	660	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,061	714	714	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	1,000	0	0	0	0	15,996	316	316	0	0	0
Sep-02	0	0	0	0	0	0	0	2,000	3,332	0	0	0	3,000	8,332	8,332	0	0	0	0	0	59	59	0	0	0
Oct-02	0	0	0	0	0	0	0	0	12,819	0	0	0	0	12,819	12,819	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	3,408	0	0	0	0	3,408	3,408	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	4,441	0	0	0	0	4,441	4,441	2,785	-2,785	0	-2,785	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**8,000**	**8,000**	**2,000**	**24,000**	**140**	**0**	**3,311**	**4,000**	**33,451**	**43,614**	**2,785**	**-2,785**	**3,311**	**526**	**45,252**	**125,476**	**3,743**	**8,000**	**0**	**113,733**
Jan-03	2,000	0	0	0	0	3,800	5,800	0	0	0	0	0	0	0	5,800	0	0	0	0	0	15,286	0	5,800	0	9,486
Feb-03	700	0	0	0	0	2,700	3,400	0	0	0	0	0	0	0	3,400	0	0	0	0	0	36,021	0	3,400	7,100	25,521
Mar-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,077	0	0	38,500	40,577
Apr-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,006	0	0	0	0	0
May-03	0	0	0	0	0	0	0	10,000	0	0	5,477	0	0	15,477	15,477	0	5,477	0	5,477	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	6,100	0	0	14,827	20,000	0	40,927	40,927	0	14,827	20,000	34,827	4,373	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	13,290	0	0	13,290	13,290	0	13,290	0	13,290	9,339	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	19,706	0	0	19,706	19,706	0	19,706	0	19,706	52	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	1,400	9,500	0	10,900	10,900	0	1,400	9,500	10,900	0	0	0	0	0	0
Oct-03	0	0	0	0	0	0	0	0	0	0	1,520	3,500	0	5,020	5,020	0	1,520	3,500	5,020	0	0	0	0	0	0
Nov-03	0	0	0	0	0	0	0	0	0	0	675	0	0	675	675	0	675	0	675	0	0	0	0	0	0
Dec-03	0	0	0	0	0	0	0	0	0	350	3,870	0	0	4,220	4,220	0	3,870	0	3,870	0	0	0	0	0	0
Total	**2,700**	**0**	**0**	**0**	**0**	**6,500**	**9,200**	**16,100**	**0**	**350**	**60,765**	**33,000**	**0**	**110,215**	**119,415**	**0**	**60,765**	**33,000**	**93,765**	**29,770**	**130,384**	**0**	**9,200**	**45,600**	**75,584**
Jan-04	0	803	0	0	0	5,740	6,543	0	0	0	0	0	0	0	6,543	0	0	0	0	0	127,492	850	6,543	0	120,099
Feb-04	4,000	27,004	0	0	0	0	31,004	0	0	0	0	0	0	0	31,004	0	0	0	0	0	180,703	784	31,004	0	148,915
Mar-04	0	4,715	0	0	0	0	4,715	0	0	0	0	0	0	0	6,372	0	0	0	0	0	11,613	15	4,715	0	6,883
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,815	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,075	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,402	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	291	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	657	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**4,000**	**32,522**	**0**	**0**	**0**	**5,740**	**42,262**	**4,000**	**0**	**0**	**0**	**0**	**0**	**4,000**	**47,919**	**0**	**0**	**0**	**0**	**17,240**	**319,808**	**1,649**	**42,262**	**0**	**275,897**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																			Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs				Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Article 56 Carryover							Table A and other SWP Water							Total										
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-05	1,952	0	48	0	4,554	845	7,399	0	0	0	0	0	0	0	8,244	0	0	4,554	4,554	0	113,543	947	7,399	0	105,197
Feb-05	2,648	0	0	0	7,079	4,895	14,622	0	0	0	0	0	0	0	16,945	0	0	7,079	7,079	0	55,665	877	14,622	0	40,166
Mar-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	0	0	0	0	0	0	0
Apr-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	0	0	0	0	0	0	0
May-05	0	0	0	0	0	0	0	0	0	0	1,138	0	0	1,138	2,551	0	1,138	764	1,902	0	0	0	0	0	0
Jun-05	0	0	0	0	0	0	0	0	0	0	1,324	0	0	1,324	4,739	0	1,324	2,351	3,675	0	0	0	0	0	0
Jul-05	0	0	0	0	0	0	0	10,100	0	0	10,000	23,041	0	43,141	43,141	0	10,000	23,041	33,041	32,844	0	0	0	0	0
Aug-05	0	0	0	0	0	0	0	15,600	0	0	2,538	7,792	0	25,930	25,930	0	2,538	7,792	10,330	5,089	0	0	0	0	0
Sep-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342	0	0	0	0	0
Oct-05	0	0	0	0	0	0	0	0	0	1,500	576	0	0	2,076	2,076	0	576	0	576	0	0	0	0	0	0
Nov-05	0	0	0	0	0	0	0	0	12,869	1,000	0	0	0	13,869	13,869	0	0	0	0	0	0	0	0	0	0
Dec-05	0	0	0	0	0	0	0	0	7,131	0	0	1,500	0	8,631	10,565	0	0	1,500	1,500	0	0	0	0	0	0
Total	**4,600**	**0**	**48**	**0**	**11,633**	**5,740**	**22,021**	**25,700**	**20,000**	**2,500**	**15,576**	**32,333**	**0**	**96,109**	**134,391**	**0**	**15,576**	**47,081**	**62,657**	**38,275**	**169,208**	**1,824**	**22,021**	**0**	**145,363**
Totals																									
96-03	**2,700**	**0**	**800**	**25,321**	**0**	**19,500**	**48,321**	**62,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**584,868**	**686,357**	**18,722**	**285,156**	**193,841**	**478,997**	**905,457**	**751,596**	**8,311**	**48,321**	**45,600**	**649,364**
96-04	**6,700**	**32,522**	**800**	**25,321**	**0**	**25,240**	**90,583**	**66,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**588,868**	**734,276**	**18,722**	**285,156**	**193,841**	**478,997**	**922,697**	**1,071,404**	**9,960**	**90,583**	**45,600**	**925,261**
96-05	**11,300**	**32,522**	**848**	**25,321**	**11,633**	**30,980**	**112,604**	**92,500**	**44,000**	**11,210**	**294,133**	**196,964**	**46,170**	**684,977**	**868,667**	**18,722**	**300,732**	**240,922**	**541,654**	**960,972**	**1,240,612**	**11,784**	**112,604**	**45,600**	**1,070,624**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

SAN LUIS RESERVOIR STORAGE

Elevation: 543' · SAN LUIS CR basin · Operator: CA Dept of Water Resources
Provisional data, subject to change.
Data obtained from CDEC 5/15/2006

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)		CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-95	1,789,637	1,091,587		698,050	1,789,637	0
Feb-95	2,024,025	1,171,880		852,145	2,024,025	0
Mar-95	2,034,447	1,169,817		864,630	2,034,447	0
Apr-95	2,026,819	1,086,588		940,231	2,026,819	0
May-95	2,009,440	1,061,812		947,628	2,009,440	0
Jun-95	1,876,744	1,048,887		827,857	1,876,744	0
Jul-95	1,763,906	1,073,430		690,476	1,763,906	0
Aug-95	1,499,314	1,077,656		421,658	1,499,314	0
Sep-95	1,524,232	1,081,845		442,387	1,524,232	0
Oct-95	1,637,786	1,133,031		504,755	1,637,786	0
Nov-95	1,664,769	1,048,190		616,579	1,664,769	0
Dec-95	1,646,822	911,417		735,465	1,646,882	60
Jan-96	1,934,442	1,061,411		873,031	1,934,442	0
Feb-96	2,024,533	1,076,912		947,621	2,024,533	0
Mar-96	2,023,644	1,058,720		964,924	2,023,644	0
Apr-96	1,885,781	972,070		913,711	1,885,781	0
May-96	1,643,454	843,235		800,219	1,643,454	0
Jun-96	1,350,109	787,228		562,881	1,350,109	0
Jul-96	979,318	750,346		228,972	979,318	0
Aug-96	753,481	628,876		124,605	753,481	0
Sep-96	914,750	740,379		174,371	914,750	0
Oct-96	1,175,411	843,170		332,241	1,175,411	0
Nov-96	1,596,193	1,048,478		547,719	1,596,197	4
Dec-96	1,903,404	1,109,158	r	794,246	1,903,404	0
Jan-97	1,999,062	1,101,867		897,195	1,999,062	0
Feb-97	1,978,868	1,105,151		873,717	1,978,868	0
Mar-97	2,009,693	1,085,462		924,231	2,009,693	0
Apr-97	1,778,698	944,918		833,780	1,778,698	0
May-97	1,266,881	721,579		545,302	1,266,881	0
Jun-97	871,579	593,083		278,496	871,579	0
Jul-97	553,683	445,203		108,480	553,683	0
Aug-97	396,307	334,549		61,758	396,307	0
Sep-97	593,428	461,649		131,779	593,428	0
Oct-97	827,147	547,915		279,232	827,147	0
Nov-97	1,165,611	713,723		451,888	1,165,611	0
Dec-97	1,642,982	953,588		649,394	1,602,982	-40,000
Jan-98	1,858,715	1,068,183		790,532	1,858,715	0
Feb-98	2,025,549	1,062,277		963,272	2,025,549	0
Mar-98	2,028,090	1,063,334		964,756	2,028,090	0
Apr-98	1,999,821	1,062,227		937,594	1,999,821	0
May-98	2,028,725	1,061,880		966,845	2,028,725	0
Jun-98	2,024,025	1,060,880		963,145	2,024,025	0
Jul-98	1,824,308	1,004,087		820,221	1,824,308	0
Aug-98	1,566,459	873,994		692,465	1,566,459	0
Sep-98	1,613,068	900,000		713,008	1,613,008	-60

STORAGE (from CDEC) (AF)

Date	Total	SWP	CVP	Total Check	Diff
	(1)	(2)	(3)	(4)	(5)
				(2+3)	(4-1)
Oct-98	1,861,058	1,014,790	846,268	1,861,058	0
Nov-98	1,970,810	1,063,595	904,215	1,967,810	-3,000
Dec-98	1,898,186	1,074,246	823,940	1,898,186	0
Jan-99	1,929,319	1,103,949	825,370	1,929,319	0
Feb-99	1,985,676	1,097,321	888,355	1,985,676	0
Mar-99	2,027,831	1,061,800	966,035	2,027,835	4
Apr-99	1,913,855	1,011,650	902,205	1,913,855	0
May-99	1,496,796	863,254	633,542	1,496,796	0
Jun-99	936,402	555,473	380,929	936,402	0
Jul-99	611,617	476,215	135,402	611,617	0
Aug-99	520,283	451,049	69,234	520,283	0
Sep-99	702,409	591,796	110,613	702,409	0
Oct-99	801,279	573,547	227,732	801,279	0
Nov-99	1,073,901	683,127	390,774	1,073,901	0
Dec-99	1,187,142	716,955	470,187	1,187,142	0
Jan-00	1,505,272	914,717	590,555	1,505,272	0
Feb-00	1,825,778	1,057,575	768,203	1,825,778	0
Mar-00	2,026,438	1,061,880	964,558	2,026,438	0
Apr-00	1,876,126	969,343	906,783	1,876,126	0
May-00	1,462,484	762,064	700,520	1,462,584	100
Jun-00	1,051,334	580,449	470,885	1,051,334	0
Jul-00	771,746	401,285	370,461	771,746	0
Aug-00	666,538	307,591	358,947	666,538	0
Sep-00	850,828	387,635	463,193	850,828	0
Oct-00	1,051,945	421,304	630,641	1,051,945	0
Nov-00	1,299,262	460,177	839,085	1,299,262	0
Dec-00	1,470,439	481,677	988,762	1,470,439	0

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-01	1,595,959	556,930	1,039,029	1,595,959	0
Feb-01	1,797,186	747,404	1,049,782	1,797,186	0
Mar-01	1,977,986	996,764	981,222	1,977,986	0
Apr-01	1,910,991	984,617	926,374	1,910,991	0
May-01	1,493,135	815,834	677,301	1,493,135	0
Jun-01	1,033,071	642,248	390,823	1,033,071	0
Jul-01	829,778	549,059	280,719	829,778	0
Aug-01	760,039	515,197	244,842	760,039	0
Sep-01	829,590	516,007	313,583	829,590	0
Oct-01	764,056	357,700	406,356	764,056	0
Nov-01	964,447	412,836	551,611	964,447	0
Dec-01	1,385,632	675,995	709,637	1,385,632	0
Jan-02	1,807,066	912,332	894,734	1,807,066	0
Feb-02	1,925,324	1,030,871	894,453	1,925,324	0
Mar-02	2,027,963	1,078,173	949,790	2,027,963	0
Apr-02	1,844,188	973,457	870,731	1,844,188	0
May-02	1,402,950	744,784	658,166	1,402,950	0
Jun-02	873,969	488,121	385,848	873,969	0
Jul-02	646,887	398,657	248,230	646,887	0
Aug-02	643,876	467,946	175,930	643,876	0
Sep-02	688,435	393,795	294,640	688,435	0
Oct-02	649,730	237,482	412,248	649,730	0
Nov-02	787,573	219,224	568,349	787,573	0
Dec-02	1,010,089	319,803	690,286	1,010,089	0
Jan-03	1,437,576	569,838	867,738	1,437,576	0
Feb-03	1,739,389	837,137	902,252	1,739,389	0
Mar-03	1,953,851	984,556	969,295	1,953,851	0
Apr-03	1,818,676	920,243	898,433	1,818,676	0
May-03	1,428,330	684,343	743,987	1,428,330	0
Jun-03	1,217,645	557,749	659,896	1,217,645	0
Jul-03	918,347	521,880	396,467	918,347	0
Aug-03	787,480	529,944	257,536	787,480	0
Sep-03	939,243	652,744	286,499	939,243	0
Oct-03	961,975	607,364	354,611	961,975	0
Nov-03	1,122,517	613,477	509,040	1,122,517	0
Dec-03	1,316,540	615,769	700,771	1,316,540	0
Jan-04	1,664,413	809,033	855,380	1,664,413	0
Feb-04	1,878,476	971,719	906,757	1,878,476	0
Mar-04	2,020,089	1,069,446	950,643	2,020,089	0
Apr-04	1,768,145	938,544	829,601	1,768,145	0
May-04	1,213,592	674,017	539,575	1,213,592	0
Jun-04	719,890	434,812	285,078	719,890	0
Jul-04	492,864	369,739	123,125	492,864	0
Aug-04	498,397	408,702	89,695	498,397	0
Sep-04	670,373	513,536	156,837	670,373	0
Oct-04	787,850	522,176	265,674	787,850	0
Nov-04	1,057,649	603,410	454,239	1,057,649	0
Dec-04	1,283,146	672,181	610,965	1,283,146	0
Jan-05	1,810,485	1,013,425	797,060	1,810,485	0
Feb-05	1,968,294	1,099,874	868,420	1,968,294	0
Mar-05	2,029,615	1,063,312	966,303	2,029,615	0

STORAGE (from CDEC) (AF)

Date	Total	SWP	CVP	Total Check	Diff
	(1)	(2)	(3)	(4)	(5)
				(2+3)	(4-1)
Apr-05	1,898,434	933,372	965,062	1,898,434	0
May-05	1,696,202	801,190	895,012	1,696,202	0
Jun-05	1,566,575	764,709	801,866	1,566,575	0
Jul-05	1,343,373	773,382	569,991	1,343,373	0
Aug-05	1,197,211	819,673	377,538	1,197,211	0
Sep-05	1,328,065	925,423	402,642	1,328,065	0
Oct-05	1,462,938	990,340	472,598	1,462,938	0
Nov-05	1,627,412	1,022,206	605,206	1,627,412	0
Dec-05	1,893,469	1,167,668	725,801	1,893,469	0
Jan-06	2,030,250	1,153,152	877,098	2,030,250	0
Feb-06	2,019,836	1,144,384	875,452	2,019,836	0
Mar-06	2,031,649	1,063,143	968,506	2,031,649	0
Apr-06	2,024,025	1,059,354	964,671	2,024,025	0

HISTORIC AND ESTIMATED
ADDITIONAL
ARTICLE 21 DELIVERIES

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-96	2,117	0	2,117	0
Feb-96	22,519	0	22,519	0
Mar-96	4,011	0	4,011	0
Apr-96	0	0	0	0
May-96	0	0	0	0
Jun-96	0	0	0	0
Jul-96	0	0	0	0
Aug-96	0	0	0	0
Sep-96	0	0	0	0
Oct-96	0	0	0	0
Nov-96	0	0	0	0
Dec-96	0	0	0	0
Jan-97	3,044	0	3,044	0
Feb-97	1,572	0	1,572	0
Mar-97	16,420	0	16,420	0
Apr-97	396	0	396	0
May-97	0	0	0	0
Jun-97	0	0	0	0
Jul-97	0	0	0	0
Aug-97	0	0	0	0
Sep-97	0	0	0	0
Oct-97	0	0	0	0
Nov-97	0	0	0	0
Dec-97	0	0	0	0
Jan-98	9,576	58	9,518	0
Feb-98	1,208	482	726	0
Mar-98	62	0	62	0
Apr-98	0	0	0	0
May-98	614	614	0	15,000
Jun-98	1,497	1,497	0	15,000
Jul-98	3,549	3,549	0	0
Aug-98	3,782	3,782	0	0
Sep-98	0		0	0
Oct-98	0		0	0
Nov-98	0		0	7,000
Dec-98	0		0	7,000
Jan-99	28,555	161	28,394	0
Feb-99	27,220	425	26,795	0
Mar-99	73,062	168	72,894	0
Apr-99	29,233	0	29,233	0
May-99	0	0	0	0
Jun-99	0	0	0	0
Jul-99	0	0	0	0
Aug-99	0	0	0	0
Sep-99	0	0	0	0
Oct-99	0	0	0	0
Nov-99	0	0	0	0
Dec-99	0	0	0	0

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-00	0	0	0	0
Feb-00	94,467	0	94,467	0
Mar-00	214,318	1,337	212,981	0
Apr-00	0	0	0	0
May-00	0	0	0	0
Jun-00	0	0	0	0
Jul-00	0	0	0	0
Aug-00	0	0	0	0
Sep-00	0	0	0	0
Oct-00	0	0	0	0
Nov-00	0	0	0	0
Dec-00	0	0	0	0
Jan-01	0	0	0	0
Feb-01	1,324	1,324	0	45,000
Mar-01	45,833	988	44,845	160,000
Apr-01	0	0	0	0
May-01	0	0	0	0
Jun-01	0	0	0	0
Jul-01	0	0	0	0
Aug-01	0	0	0	0
Sep-01	0	0	0	0
Oct-01	0	0	0	0
Nov-01	0	0	0	0
Dec-01	988	988	0	0
Jan-02	532	532	0	0
Feb-02	46	46	0	0
Mar-02	9,709	355	9,354	9,000
Apr-02	29,842	340	29,502	0
May-02	1,796	1,769	27	0
Jun-02	0	0	0	0
Jul-02	0	0	0	0
Aug-02	0	0	0	0
Sep-02	0	0	0	0
Oct-02	0	0	0	0
Nov-02	0	0	0	0
Dec-02	0	0	0	0
Jan-03	0	0	0	0
Feb-03	0	0	0	0
Mar-03	49,616	376	49,240	8,000
Apr-03	7,928	0	7,928	0
May-03	1,210	1,210	0	0
Jun-03	1,070	1,070	0	0
Jul-03	0	0	0	0
Aug-03	0	0	0	0
Sep-03	0	0	0	0
Oct-03	0	0	0	0
Nov-03	0	0	0	0
Dec-03	0	0	0	0
Jan-04	1,145	1,145	0	0
Feb-04	658	658	0	50,000
Mar-04	209,741	482	209,259	0
Apr-04	1,126	1,126	0	0
May-04	5,786	5,786	0	0
Jun-04	0	0	0	0
Jul-04	0	0	0	0
Aug-04	0	0	0	0
Sep-04	0	0	0	0
Oct-04	0	0	0	0
Nov-04	0	0	0	0
Dec-04	40	40	0	0
Total	905,612	30,308	875,304	316,000

Deliveries from Retired Table A Amounts

Month	Annual SWP Allocation	KCWA			DRWD			Total Calculated Deliveries from Retired Table A Amounts
		Retired Table A	1996 = 36,340 1997 on = 40,670		Retired Table A	1996 on = 4,330		
		Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	
	(%)	(AF)	(%)	(AF)	(AF)	(%)	(AF)	(AF)
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Source / Formula	Actual	DWR del'y files	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	Bulletin 132	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	= col 4 + 7
Jan-96	100%	5,710	0.6%	217	148	0.3%	13	230
Feb-96		23,468	2.5%	893	1,053	2.2%	93	987
Mar-96		41,482	4.3%	1,579	1,046	2.1%	93	1,672
Apr-96		50,591	5.3%	1,926	3,334	6.8%	295	2,221
May-96		102,320	10.7%	3,896	4,166	8.5%	369	4,264
Jun-96		169,473	17.8%	6,452	9,651	19.7%	855	7,307
Jul-96		212,593	22.3%	8,094	12,365	25.3%	1,095	9,189
Aug-96		189,487	19.9%	7,214	10,820	22.1%	958	8,172
Sep-96		58,419	6.1%	2,224	1,890	3.9%	167	2,391
Oct-96		34,968	3.7%	1,331	1,729	3.5%	153	1,484
Nov-96		24,246	2.5%	923	170	0.3%	15	938
Dec-96		41,756	4.4%	1,590	2,524	5.2%	224	1,813
Total		954,513	100.0%	36,340	48,896	100.0%	4,330	40,670
Jan-97	100%	402	0.0%	19	4	0.0%	0	20
Feb-97		4,087	0.5%	197	513	1.2%	51	249
Mar-97		42,557	5.1%	2,055	1,182	2.7%	119	2,173
Apr-97		59,887	7.1%	2,891	3,501	8.1%	351	3,243
May-97		100,221	11.9%	4,839	6,033	14.0%	605	5,444
Jun-97		144,890	17.2%	6,995	9,183	21.3%	921	7,917
Jul-97		197,688	23.5%	9,544	10,777	25.0%	1,081	10,626
Aug-97		182,440	21.7%	8,808	8,403	19.5%	843	9,651
Sep-97		26,734	3.2%	1,291	885	2.1%	89	1,379
Oct-97		22,643	2.7%	1,093	975	2.3%	98	1,191
Nov-97		24,970	3.0%	1,206	616	1.4%	62	1,267
Dec-97		35,877	4.3%	1,732	1,081	2.5%	108	1,841
Total		842,396	100.0%	40,670	43,153	100.0%	4,330	45,000
Jan-98	100%	45,386	6.3%	2,575	43	0.1%	4	2,579
Feb-98		4,835	0.7%	274	4	0.0%	0	275
Mar-98		6,347	0.9%	360	733	1.5%	67	427
Apr-98		14,569	2.0%	827	944	2.0%	86	912
May-98		27,266	3.8%	1,547	777	1.6%	71	1,618
Jun-98		58,541	8.2%	3,322	6,210	13.0%	564	3,886
Jul-98		149,012	20.8%	8,455	11,642	24.4%	1,057	9,512
Aug-98		180,157	25.1%	10,222	12,628	26.5%	1,147	11,369
Sep-98		95,526	13.3%	5,420	6,465	13.6%	587	6,007
Oct-98		55,513	7.7%	3,150	3,331	7.0%	302	3,452
Nov-98		24,244	3.4%	1,376	2,742	5.7%	249	1,625
Dec-98		55,375	7.7%	3,142	2,169	4.5%	197	3,339
Total		716,771	100.0%	40,670	47,688	100.0%	4,330	45,000
Jan-99	100%	10,763	1.1%	435	1,599	3.3%	143	578
Feb-99		14,362	1.4%	580	1,021	2.1%	92	672
Mar-99		21,463	2.1%	867	1,151	2.4%	103	970
Apr-99		38,454	3.8%	1,553	3,210	6.6%	288	1,841
May-99		94,937	9.4%	3,834	7,192	14.9%	645	4,479
Jun-99		157,802	15.7%	6,372	9,568	19.8%	858	7,230
Jul-99		242,820	24.1%	9,805	9,600	19.9%	861	10,666
Aug-99		196,552	19.5%	7,937	9,600	19.9%	861	8,798
Sep-99		83,937	8.3%	3,389	4,346	9.0%	390	3,779
Oct-99		79,541	7.9%	3,212	997	2.1%	89	3,301
Nov-99		43,591	4.3%	1,760	0	0.0%	0	1,760
Dec-99		22,934	2.3%	926	0	0.0%	0	926
Total		1,007,156	100.0%	40,670	48,284	100.0%	4,330	45,000
Jan-00	90%	6,151	1.0%	374	494	1.3%	50	424
Feb-00		21,716	3.6%	1,319	877	2.3%	89	1,408
Mar-00		20,283	3.4%	1,232	0	0.0%	0	1,232
Apr-00		61,658	10.2%	3,745	4,309	11.2%	436	4,182
May-00		94,243	15.6%	5,725	5,557	14.4%	562	6,287
Jun-00		172,025	28.5%	10,450	9,546	24.8%	966	11,416
Jul-00		91,963	15.3%	5,586	9,607	24.9%	972	6,559
Aug-00		61,370	10.2%	3,728	1,704	4.4%	172	3,900
Sep-00		35,156	5.8%	2,136	3,532	9.2%	357	2,493
Oct-00		22,644	3.8%	1,376	1,940	5.0%	196	1,572
Nov-00		8,206	1.4%	498	409	1.1%	41	540
Dec-00		7,148	1.2%	434	532	1.4%	54	488
Total		602,563	100.0%	36,603	38,507	100.0%	3,897	40,500

Month	Annual SWP Allocation	KCWA: Actual Table A Deliveries to Service Area	KCWA: Percent Distribution of Actual Table A Deliveries	KCWA: Calculated Deliveries for Retired Table A Amount	DRWD: Actual Table A Deliveries to Service Area	DRWD: Percent Distribution of Actual Table A Deliveries	DRWD: Calculated Deliveries for Retired Table A Amount	Total Calculated Deliveries from Retired Table A Amounts
		Retired Table A	1996 = 36,340; 1997 on = 40,670		Retired Table A	1996 on = 4,330		
	(%)	(AF)	(%)	(AF)	(AF)	(%)	(AF)	(AF)
	1	2	3	4	5	6	7	8
Source / Formula	Actual	DWR del'y files	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	Bulletin 132	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	= col 4 + 7
Jan-01	39%	0	0.0%	0	0	0.0%	0	0
Feb-01		0	0.0%	0	0	0.0%	0	0
Mar-01		1,702	0.8%	128	0	0.0%	0	128
Apr-01		0	0.0%	0	1,642	8.9%	150	150
May-01		23,541	11.2%	1,773	2,682	14.5%	245	2,019
Jun-01		62,788	29.8%	4,729	3,307	17.9%	303	5,032
Jul-01		48,131	22.9%	3,625	4,352	23.6%	398	4,024
Aug-01		28,985	13.8%	2,183	453	2.5%	41	2,225
Sep-01		24,186	11.5%	1,822	3,804	20.6%	348	2,170
Oct-01		15,905	7.6%	1,198	1,819	9.9%	166	1,364
Nov-01		4,920	2.3%	371	86	0.5%	8	378
Dec-01		427	0.2%	32	308	1.7%	28	60
Total		210,585	100.0%	15,861	18,453	100.0%	1,689	17,550
Jan-02	70%	9,532	1.6%	453	0	0.0%	0	453
Feb-02		28,910	4.8%	1,375	892	2.5%	75	1,450
Mar-02		39,103	6.5%	1,860	4,050	11.3%	343	2,202
Apr-02		21,543	3.6%	1,025	1,257	3.5%	106	1,131
May-02		45,678	7.6%	2,172	1,400	3.9%	118	2,291
Jun-02		144,343	24.1%	6,865	7,881	22.0%	667	7,532
Jul-02		134,801	22.5%	6,411	9,600	26.8%	812	7,223
Aug-02		98,664	16.5%	4,692	2,888	8.1%	244	4,937
Sep-02		38,071	6.4%	1,811	3,991	11.1%	338	2,148
Oct-02		31,073	5.2%	1,478	2,309	6.4%	195	1,673
Nov-02		2,650	0.4%	126	769	2.1%	65	191
Dec-02		4,225	0.7%	201	781	2.2%	66	267
Total		598,593	100.0%	28,469	35,818	100.0%	3,031	31,500
Jan-03	90%	1,630	0.2%	86	0	0.0%	0	86
Feb-03		3,446	0.5%	181	2,312	5.9%	229	411
Mar-03		20,468	2.9%	1,076	2,540	6.5%	252	1,328
Apr-03		12,373	1.8%	650	2,288	5.8%	227	877
May-03		50,130	7.2%	2,635	5,189	13.2%	515	3,150
Jun-03		114,180	16.4%	6,003	8,296	21.1%	823	6,826
Jul-03		190,415	27.3%	10,010	9,745	24.8%	967	10,977
Aug-03		107,059	15.4%	5,628	8,267	21.0%	820	6,449
Sep-03		55,209	7.9%	2,902	61	0.2%	6	2,908
Oct-03		49,607	7.1%	2,608	399	1.0%	40	2,648
Nov-03		45,967	6.6%	2,417	0	0.0%	0	2,417
Dec-03		45,768	6.6%	2,406	177	0.5%	18	2,424
Total		696,252	100.0%	36,603	39,274	100.0%	3,897	40,500
Jan-04	65%	0	0.0%	0	0	0.0%	0	0
Feb-04		108	0.0%	6	0	0.0%	0	6
Mar-04		16,102	3.1%	825	980	2.9%	82	907
Apr-04		62,260	12.1%	3,189	2,586	7.7%	217	3,406
May-04		79,726	15.4%	4,083	4,784	14.3%	402	4,485
Jun-04		125,126	24.2%	6,408	8,060	24.1%	677	7,086
Jul-04		147,845	28.6%	7,572	5,169	15.4%	434	8,006
Aug-04		60,301	11.7%	3,088	7,359	22.0%	618	3,707
Sep-04		19,190	3.7%	983	1,345	4.0%	113	1,096
Oct-04		1,217	0.2%	62	3,047	9.1%	256	318
Nov-04		0	0.0%	0	125	0.4%	11	11
Dec-04		4,295	0.8%	220	38	0.1%	3	223
Total		516,170	100.0%	26,436	33,493	100.0%	2,815	29,250
Jan-05	90%	0	0.0%	0	0	0.0%	0	0
Feb-05		5,931	0.8%	290	0	0.0%	0	290
Mar-05		15,961	2.1%	781	100	0.2%	9	790
Apr-05		32,223	4.3%	1,576	2,205	5.3%	207	1,784
May-05		40,474	5.4%	1,980	3,014	7.3%	283	2,264
Jun-05		123,770	16.5%	6,055	6,576	15.9%	618	6,673
Jul-05		113,387	15.2%	5,547	10,109	24.4%	951	6,498
Aug-05		162,910	21.8%	7,970	8,341	20.1%	784	8,754
Sep-05		92,113	12.3%	4,506	5,292	12.8%	498	5,004
Oct-05		80,049	10.7%	3,916	2,791	6.7%	262	4,179
Nov-05		59,177	7.9%	2,895	212	0.5%	20	2,915
Dec-05		22,201	3.0%	1,086	2,797	6.8%	263	1,349
Total		748,196	100.0%	36,603	41,437	100.0%	3,897	40,500
Totals								
96-03		**5,628,829**	**8**	**275,886**	**320,073**	**8**	**29,834**	**305,720**
96-04		**6,144,999**	**9**	**302,322**	**353,566**	**9**	**32,648**	**334,970**
96-05		**6,893,195**	**10**	**338,925**	**395,003**	**10**	**36,545**	**375,470**

Net Delta Outflow Index and Diversions at Banks Pumping Plant

Date	Historic Data		Estimated Data			Annual Totals				
	Net Delta Outflow Index[1] (AF)	Total Diversns at Banks Pumpg Plant[2,3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)	Net Delta Outflow Index (AF)	Total Diversns at Banks Pumping Plant[3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)
Jan-96	1,976,479	348,376	0	1,976,479	348,376					
Feb-96	7,300,090	171,418	0	7,300,090	171,418					
Mar-96	5,481,485	174,082	0	5,481,485	174,082					
Apr-96	2,501,101	105,770	0	2,501,101	105,770					
May-96	2,829,723	156,749	0	2,829,723	156,749					
Jun-96	908,612	295,490	0	908,612	295,490					
Jul-96	562,986	370,341	0	562,986	370,341					
Aug-96	589,805	379,999	0	589,805	379,999					
Sep-96	433,942	344,926	0	433,942	344,926					
Oct-96	291,578	336,186	0	291,578	336,186					
Nov-96	597,120	346,661	0	597,120	346,661					
Dec-96	5,198,059	211,225	0	5,198,059	211,225	28,670,980	3,241,223	0	28,670,980	3,241,223
Jan-97	16,129,761	45,266	0	16,129,761	45,266					
Feb-97	6,591,947	90,350	0	6,591,947	90,350					
Mar-97	2,072,091	162,393	0	2,072,091	162,393					
Apr-97	841,525	105,648	0	841,525	105,648					
May-97	753,673	78,830	0	753,673	78,830					
Jun-97	487,902	153,328	0	487,902	153,328					
Jul-97	570,976	322,379	0	570,976	322,379					
Aug-97	531,217	268,048	0	531,217	268,048					
Sep-97	232,923	339,410	0	232,923	339,410					
Oct-97	296,727	265,902	0	296,727	265,902					
Nov-97	604,147	293,437	0	604,147	293,437					
Dec-97	943,910	419,695	0	943,910	419,695	30,056,800	2,544,686	0	30,056,800	2,544,686
Jan-98	4,399,140	196,584	-1,000	4,400,140	195,584					
Feb-98	12,820,968	7,285	0	12,820,968	7,285					
Mar-98	6,421,827	14,315	0	6,421,827	14,315					
Apr-98	5,259,868	1,871	0	5,259,868	1,871					
May-98	4,157,282	43,225	0	4,157,282	43,225					
Jun-98	4,268,561	128,947	0	4,268,561	128,947					
Jul-98	1,897,277	213,401	0	1,897,277	213,401					
Aug-98	1,223,161	263,272	0	1,223,161	263,272					
Sep-98	1,193,669	266,204	0	1,193,669	266,204					
Oct-98	755,082	294,791	0	755,082	294,791					
Nov-98	1,227,905	129,489	0	1,227,905	129,489					
Dec-98	2,904,722	128,026	0	2,904,722	128,026	46,529,461	1,687,410	-1,000	46,530,461	1,686,410
Jan-99	2,337,832	85,366	0	2,337,832	85,366					
Feb-99	5,487,282	52,203	-1,000	5,488,282	51,203					
Mar-99	4,249,136	182,800	-2,000	4,251,136	180,800					
Apr-99	2,112,934	185,666	0	2,112,934	185,666					
May-99	1,361,205	99,261	0	1,361,205	99,261					
Jun-99	813,084	59,277	0	813,084	59,277					
Jul-99	643,315	376,107	0	643,315	376,107					
Aug-99	364,641	409,354	0	364,641	409,354					
Sep-99	284,666	408,580	0	284,666	408,580					
Oct-99	261,832	303,546	0	261,832	303,546					
Nov-99	404,817	310,792	0	404,817	310,792					
Dec-99	643,569	233,883	0	643,569	233,883	18,964,313	2,706,835	-3,000	18,967,313	2,703,835
Jan-00	1,324,485	395,929	0	1,324,485	395,929					
Feb-00	5,412,226	421,683	-10,000	5,422,226	411,683					
Mar-00	5,400,323	343,011	-4,000	5,404,323	339,011					
Apr-00	1,620,468	180,473	0	1,620,468	180,473					
May-00	1,356,250	97,696	0	1,356,250	97,696					
Jun-00	525,019	251,955	0	525,019	251,955					
Jul-00	560,955	359,191	0	560,955	359,191					
Aug-00	370,417	376,809	0	370,417	376,809					
Sep-00	275,036	387,824	0	275,036	387,824					
Oct-00	351,975	306,668	0	351,975	306,668					
Nov-00	282,180	322,182	0	282,180	322,182					
Dec-00	368,684	292,231	0	368,684	292,231	17,848,018	3,735,652	-14,000	17,862,018	3,721,652

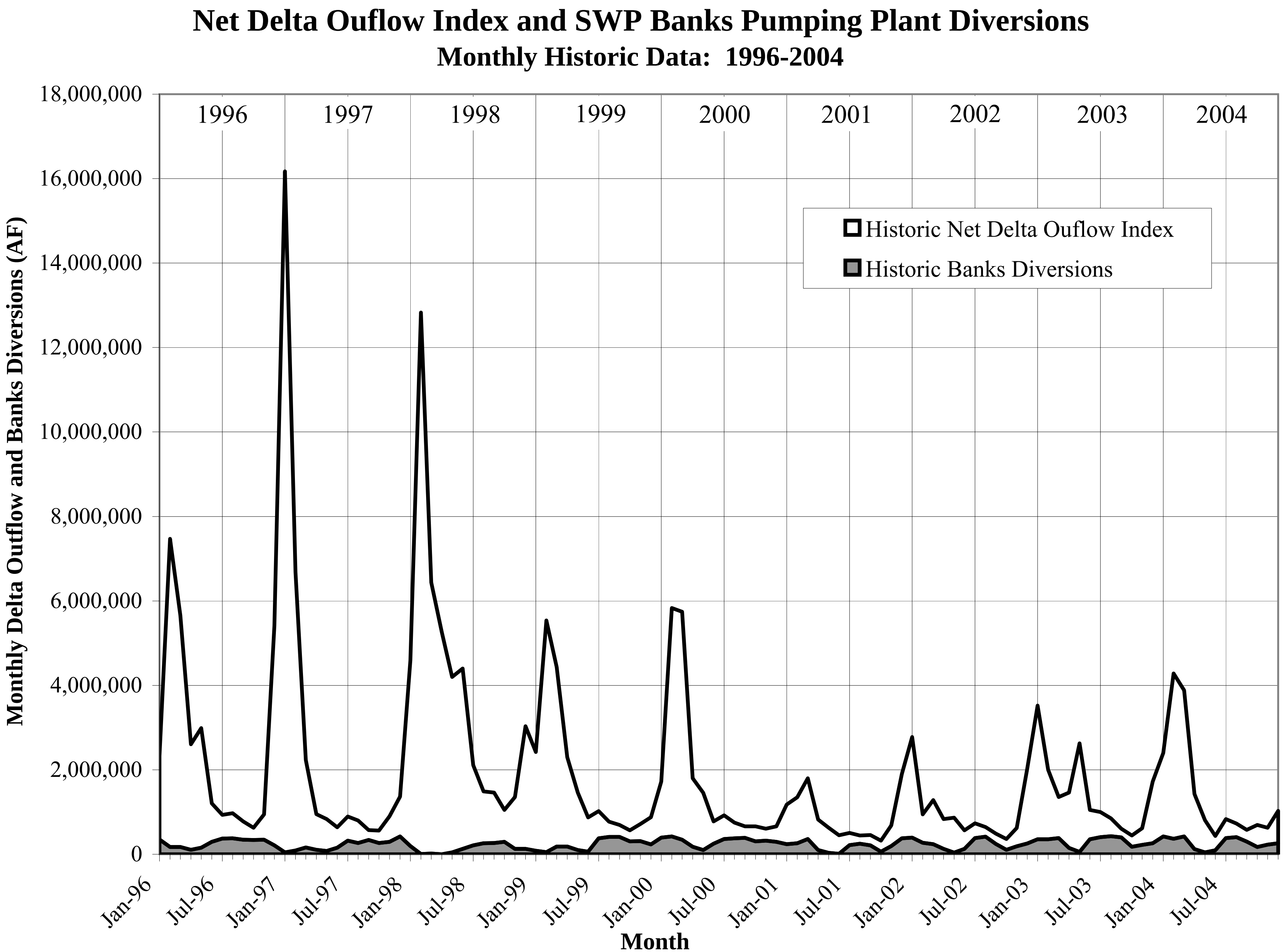
Date	Historic Data: Net Delta Outflow Index[1] (AF)	Historic Data: Total Diversns at Banks Pumpg Plant[2,3] (AF)	Estimated Data: Change in Diversions at Banks PP (AF)	Estimated Data: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Estimated Data: Diversions at Banks w/ Change in Banks Div's (AF)	Annual Totals: Net Delta Outflow Index (AF)	Annual Totals: Total Diversns at Banks Pumping Plant[3] (AF)	Annual Totals: Change in Diversions at Banks PP (AF)	Annual Totals: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Annual Totals: Diversions at Banks w/ Change in Banks Div's (AF)
Jan-01	935,280	240,845	0	935,280	240,845					
Feb-01	1,086,720	260,853	0	1,086,720	260,853					
Mar-01	1,439,070	360,751	0	1,439,070	360,751					
Apr-01	723,447	98,528	0	723,447	98,528					
May-01	590,993	33,823	0	590,993	33,823					
Jun-01	440,594	9,233	0	440,594	9,233					
Jul-01	285,612	217,665	0	285,612	217,665					
Aug-01	193,843	248,539	0	193,843	248,539					
Sep-01	245,322	212,698	0	245,322	212,698					
Oct-01	261,870	60,306	0	261,870	60,306					
Nov-01	488,210	192,176	0	488,210	192,176					
Dec-01	1,520,785	376,553	0	1,520,785	376,553	8,211,744	2,311,970	0	8,211,744	2,311,970
Jan-02	2,381,690	397,017	0	2,381,690	397,017					
Feb-02	668,037	274,484	0	668,037	274,484					
Mar-02	1,043,088	239,304	0	1,043,088	239,304					
Apr-02	707,623	125,217	0	707,623	125,217					
May-02	829,043	38,455	0	829,043	38,455					
Jun-02	438,772	127,719	0	438,772	127,719					
Jul-02	348,127	382,608	0	348,127	382,608					
Aug-02	231,693	413,948	0	231,693	413,948					
Sep-02	244,463	245,835	0	244,463	245,835					
Oct-02	257,288	106,270	0	257,288	106,270					
Nov-02	436,243	187,071	0	436,243	187,071					
Dec-02	1,776,079	254,341	0	1,776,079	254,341	9,362,146	2,792,269	0	9,362,146	2,792,269
Jan-03	3,162,940	355,592	0	3,162,940	355,592					
Feb-03	1,645,127	352,731	0	1,645,127	352,731					
Mar-03	969,098	384,529	0	969,098	384,529					
Apr-03	1,310,801	151,526	0	1,310,801	151,526					
May-03	2,574,908	54,101	0	2,574,908	54,101					
Jun-03	697,299	353,803	0	697,299	353,803					
Jul-03	592,205	405,355	0	592,205	405,355					
Aug-03	422,678	427,610	0	422,678	427,610					
Sep-03	205,091	399,796	0	205,091	399,796					
Oct-03	263,675	180,443	0	263,675	180,443					
Nov-03	394,288	223,840	0	394,288	223,840					
Dec-03	1,464,633	258,531	0	1,464,633	258,531	13,702,742	3,547,857	0	13,702,742	3,547,857
Jan-04	1,973,974	424,781	0	1,973,974	424,781					
Feb-04	3,916,633	366,266	0	3,916,633	366,266					
Mar-04	3,459,039	423,147	-26,000	3,485,039	397,147					
Apr-04	1,305,985	123,026	0	1,305,985	123,026					
May-04	759,616	45,042	0	759,616	45,042					
Jun-04	336,236	95,039	0	336,236	95,039					
Jul-04	449,905	381,724	0	449,905	381,724					
Aug-04	319,958	405,404	0	319,958	405,404					
Sep-04	278,231	299,316	0	278,231	299,316					
Oct-04	523,137	170,003	0	523,137	170,003					
Nov-04	399,136	227,664	0	399,136	227,664					
Dec-04	765,485	263,441	0	765,485	263,441	14,487,334	3,224,853	-26,000	14,513,334	3,198,853

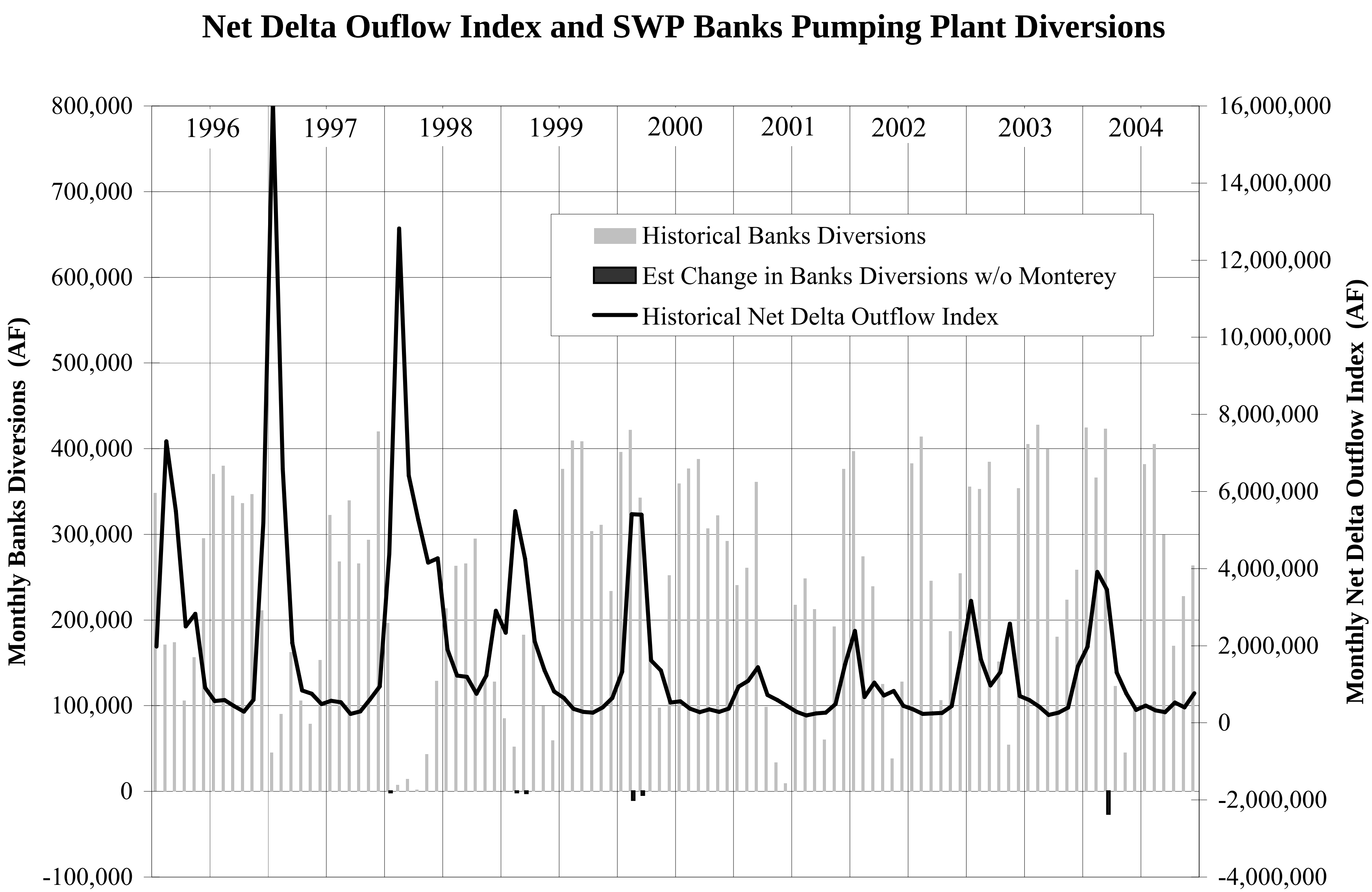
Notes: 1. Historic Net Delta Outflow Index data is from IEP's Dayflow calculations (accessed from http://iep.water.ca.gov/dayflow/output/index.html). Monthly volumes were determined by summing the average daily cfs for all the days in each month and multiplying those sum by 1.983471 to convert from cfs to acre-feet.

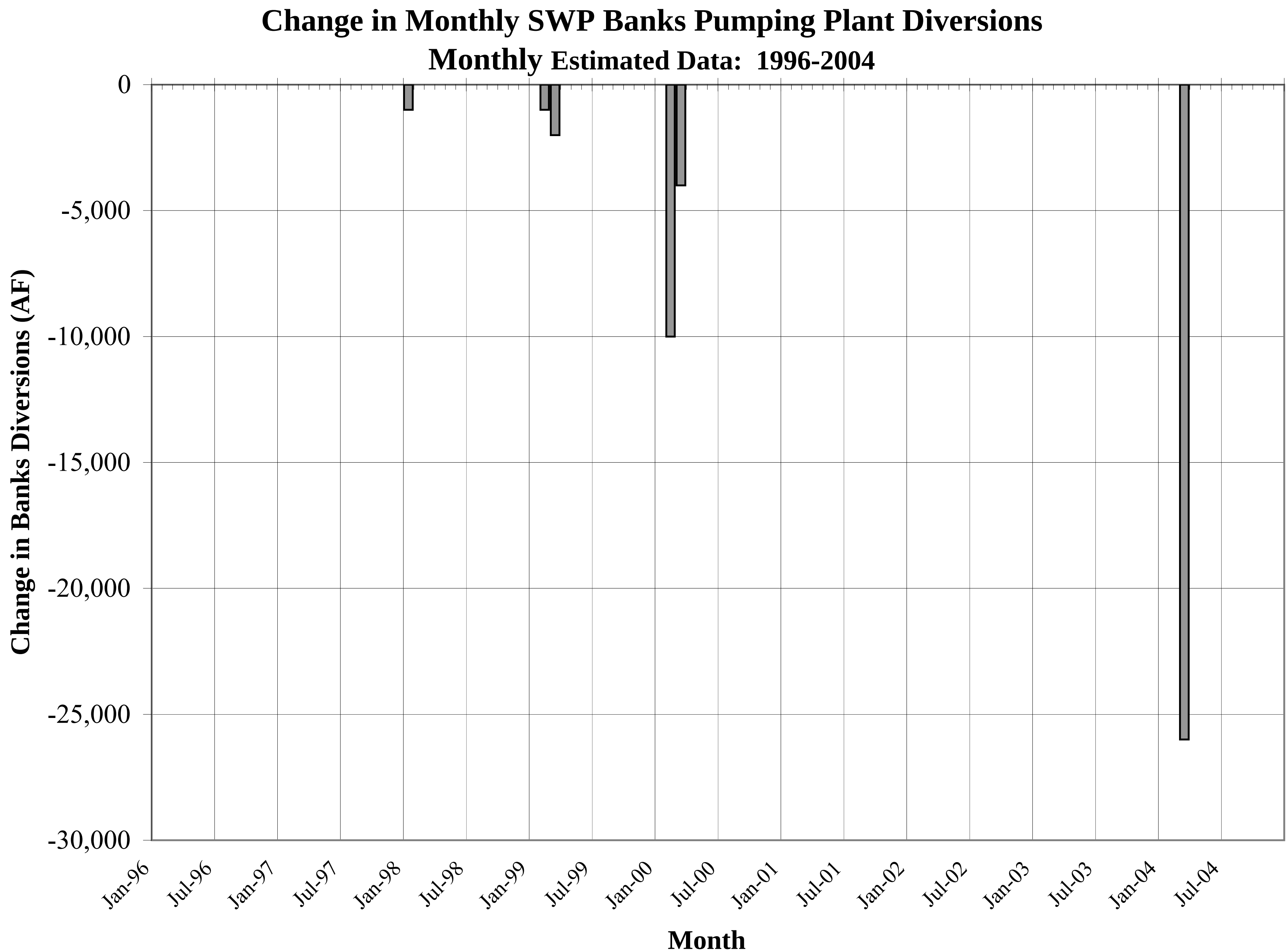
2. Historic Total Diversions at Banks Pumping Plant data is from DWR Division of Operations and Maintenance annual and monthly reports of operations. Data for 1996 through 2001 is from the "State Water Project Annual Report of Operations" reports for each of those years, from Table 1. Data from 2002 through 2004 is from the "State Water Project Operations Data" reports for each month, from Table 9.

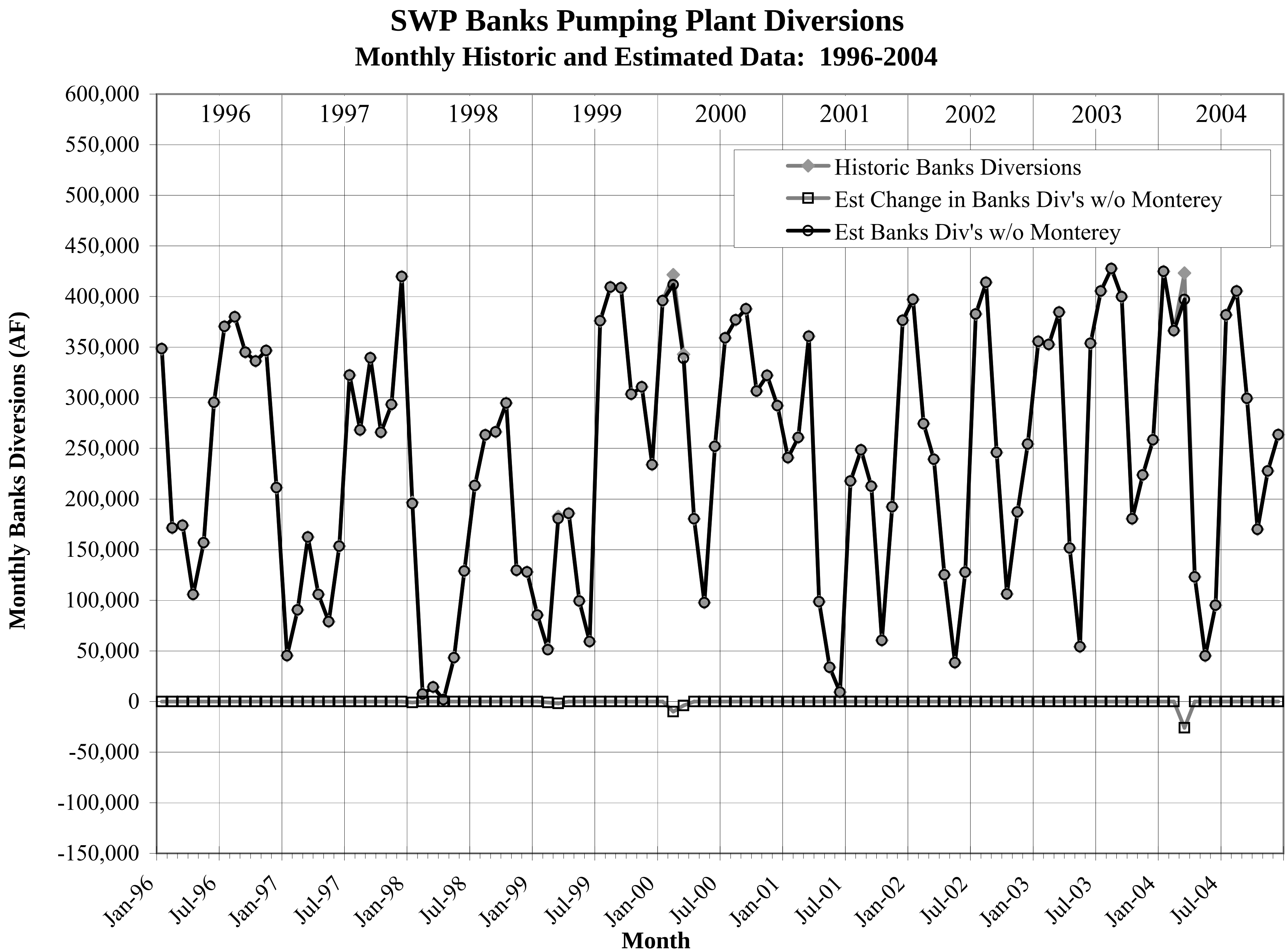
3. Total Diversions at Banks Pumping Plant are <u>total</u> diversions, including diversions for SWP, CVP, and others.

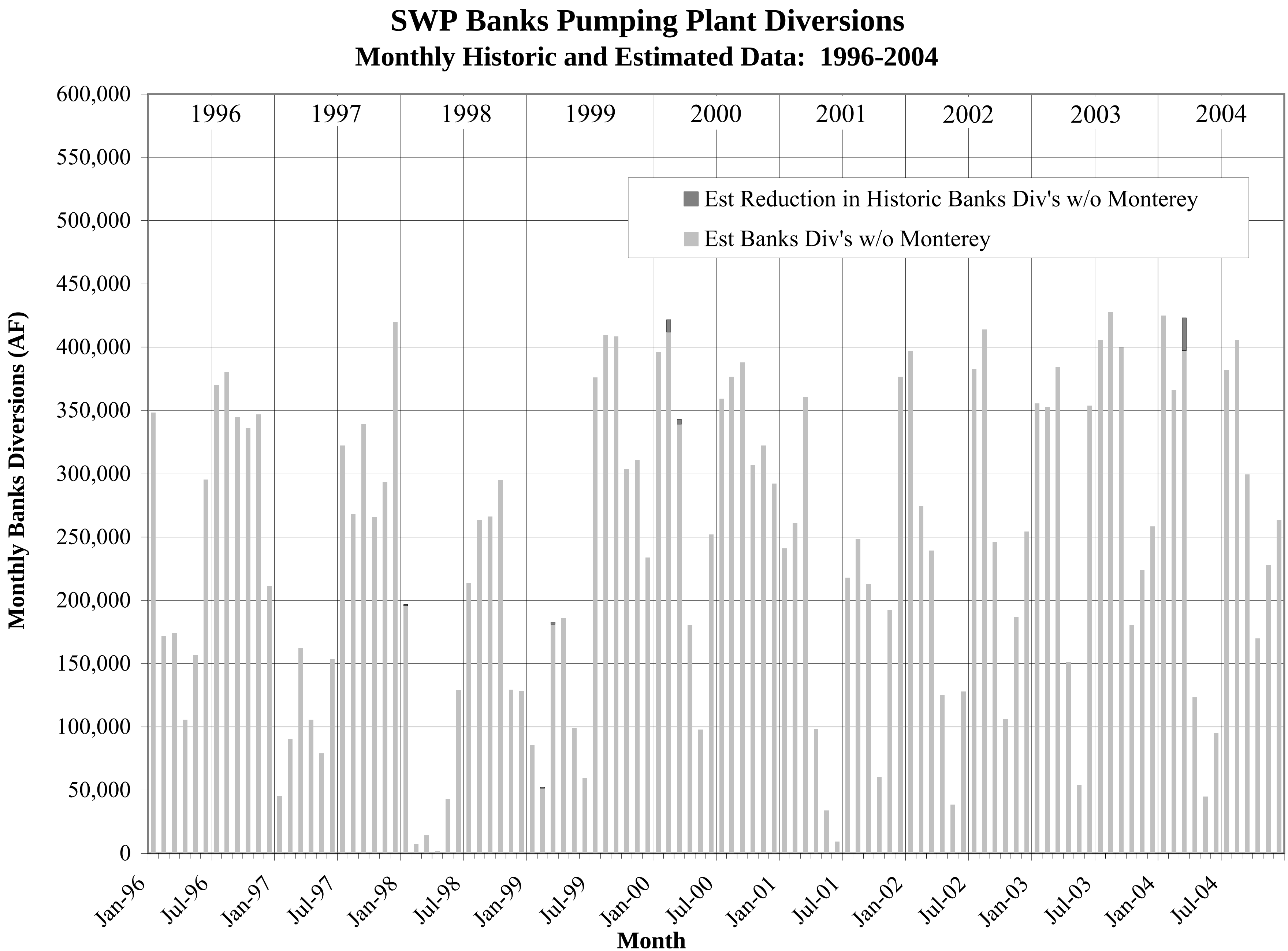
(highlighted) Month where diversions for CVP and/or others is greater than zero (i.e., diversions for SWP purposes is less than amount shown).


Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions
Monthly Historic Data: 1996-2004
Monthly Delta Outflow and Banks Diversions (AF)
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Historic Net Delta Ouflow Index
Historic Banks Diversions
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month

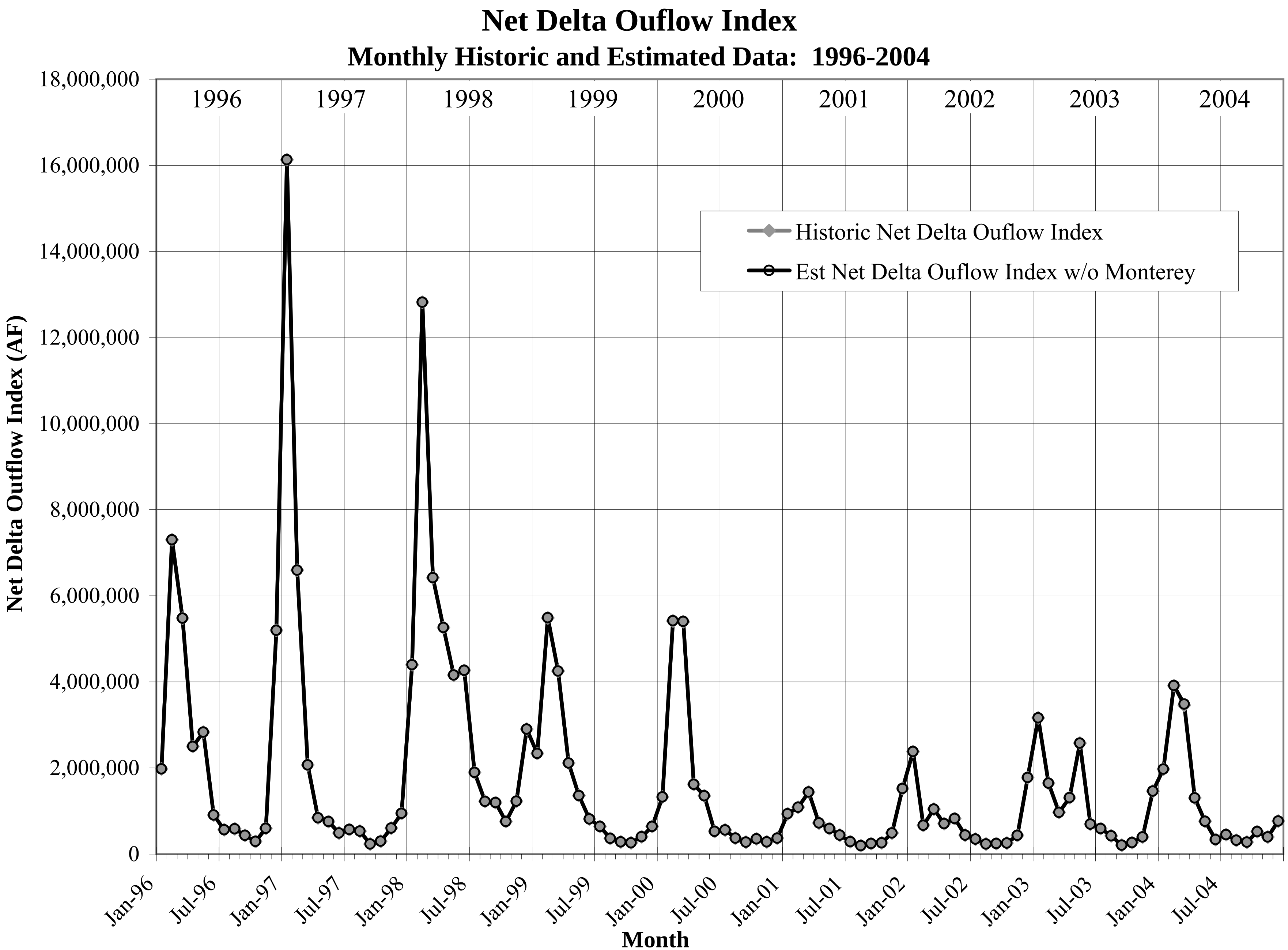

Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions
Historical Banks Diversions
Est Change in Banks Diversions w/o Monterey
Historical Net Delta Outflow Index
Monthly Banks Diversions (AF)
Monthly Net Delta Outflow Index (AF)
1996
1997
1998
1999
2000
2001
2002
2003
2004
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
-100,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
-2,000,000
-4,000,000


Change in Monthly SWP Banks Pumping Plant Diversions
Monthly Estimated Data: 1996-2004
Change in Banks Diversions (AF)
0
-5,000
-10,000
-15,000
-20,000
-25,000
-30,000
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month

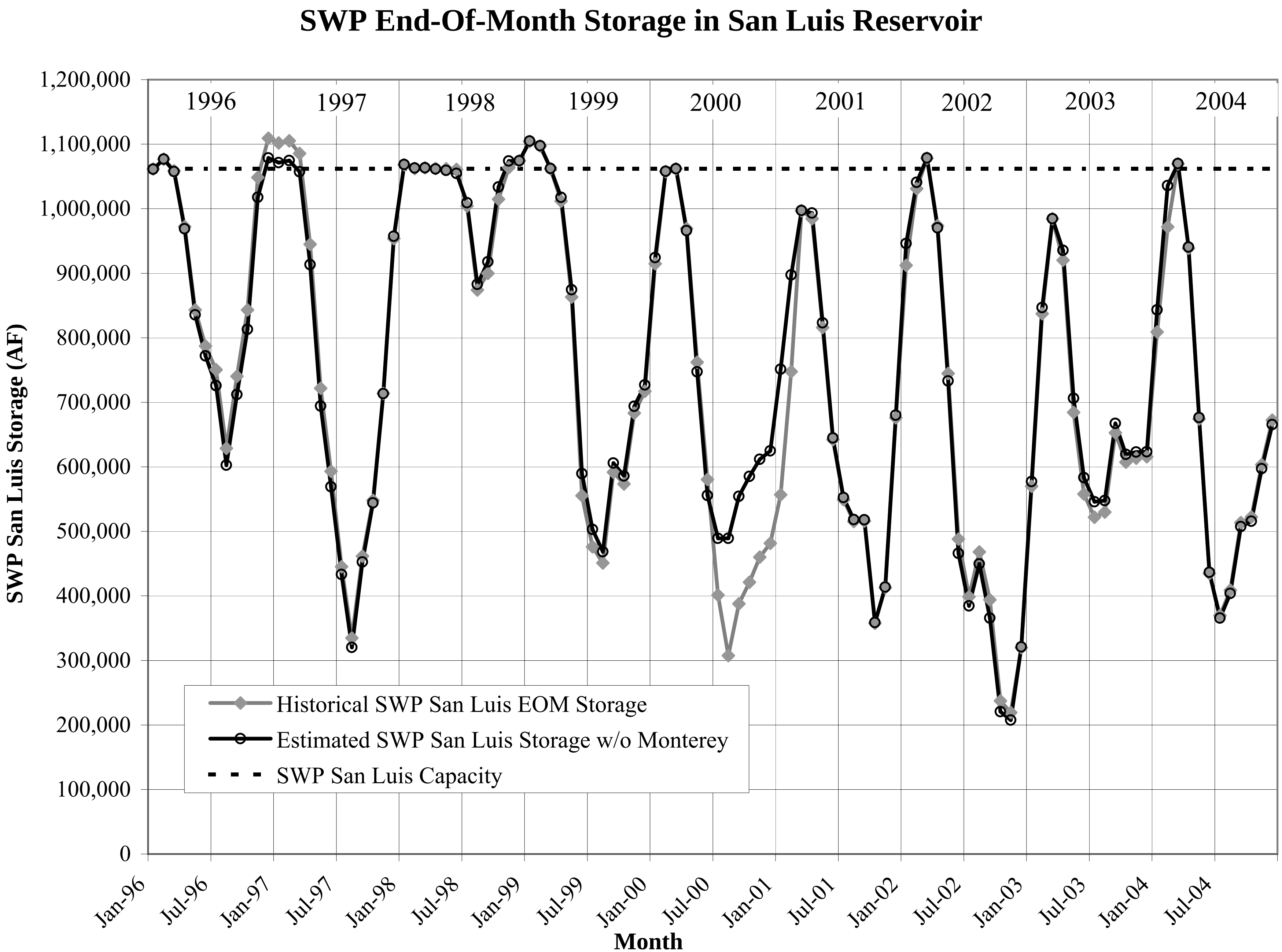

SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004
Monthly Banks Diversions (AF)
Month
Historic Banks Diversions
Est Change in Banks Div's w/o Monterey
Est Banks Div's w/o Monterey
600,000
550,000
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
-100,000
-150,000
1996
1997
1998
1999
2000
2001
2002
2003
2004
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04

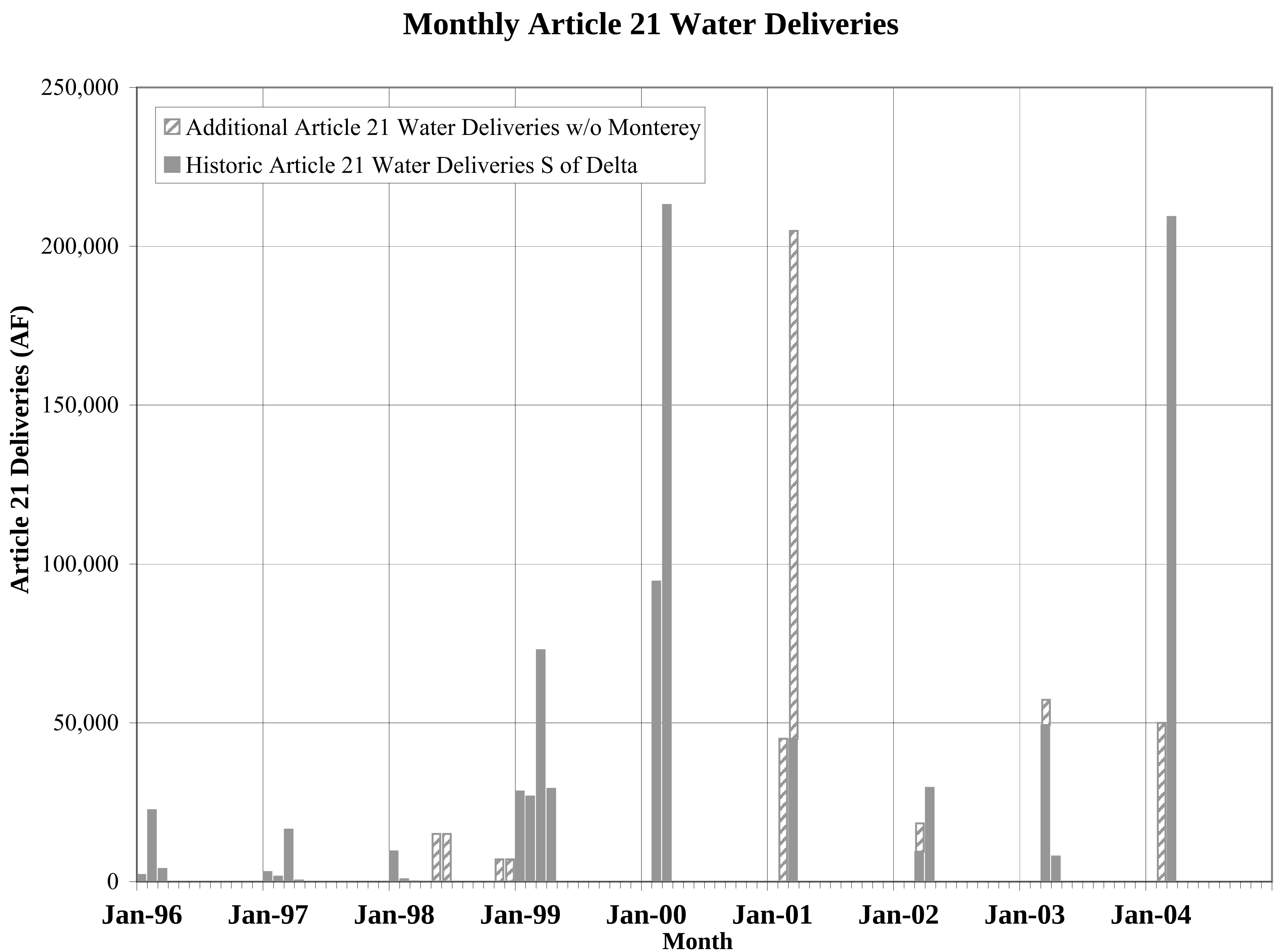


SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004
Est Reduction in Historic Banks Div's w/o Monterey
Est Banks Div's w/o Monterey
Monthly Banks Diversions (AF)
600,000
550,000
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month



Net Delta Ouflow Index
Monthly Historic and Estimated Data: 1996-2004
Net Delta Outflow Index (AF)
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Historic Net Delta Ouflow Index
Est Net Delta Ouflow Index w/o Monterey
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month


SWP End-Of-Month Storage in San Luis Reservoir
1996
1997
1998
1999
2000
2001
2002
2003
2004
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
SWP San Luis Storage (AF)
Historical SWP San Luis EOM Storage
Estimated SWP San Luis Storage w/o Monterey
SWP San Luis Capacity
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month


Monthly Article 21 Water Deliveries
Additional Article 21 Water Deliveries w/o Monterey
Historic Article 21 Water Deliveries S of Delta
Article 21 Deliveries (AF)
250,000
200,000
150,000
100,000
50,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Month

Monterey Historical Operations Analysis Without Storage Assumption

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF) — SWP San Luis Storage: End-of-Month Storage	Historical — SWP San Luis Storage: Change in Storage from Previous Month	Historical — SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical — SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical — SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical — SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical — SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical — Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF) — Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated — Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated — Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated — Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated — Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated — Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated — Total Change in all SWP Deliveries	Estimated — Change in Diversions at Banks Pumping Plant	Estimated — SWP San Luis Storage: End-of-Month Storage	Estimated — SWP San Luis Storage: Change in Storage Compared to Historic	**Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	-22	0	0	0	-22	0	1,061,433	22	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule. - Without Monterey water management program deliveries, SWP San Luis would have been more full by year end. Storage would have been maintained at levels similar to historic storage in November and December, necessitating a reduction in SWP diversions at Banks in November and December.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	-1,062	0	0	0	-1,062	0	1,077,996	1,084	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	-668	0	0	0	-668	0	1,060,472	1,752	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	-27,290	0	27,000	0	-290	0	974,112	2,042	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	-19,632	0	20,000	0	368	0	844,909	1,674	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	0	-56,774	0	32,000	0	-24,774	0	813,676	26,448	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	0	-54,774	0	35,000	0	-19,774	0	796,568	46,222	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	-50,365	0	44,000	0	-6,365	0	681,463	52,587	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	-17,274	0	17,000	0	-274	0	793,240	52,861	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	0	0	0	0	0	0	896,031	52,861	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	0	0	0	0	0	0	1,101,339	52,861	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	-2,379	0	0	0	-2,379	-55,000	1,109,398	240	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	-114	0	0	0	-114	0	1,102,221	354	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in December, and Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Dudley, Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water in December. Their demand would be limited only by their ability to take delivery during December. - Since SWP San Luis did not quite fill by the end of December, there would have been no need to reduce diversions at Banks.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,105,505	354	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	-4,328	0	0	0	-4,328	0	1,090,144	4,682	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	0	0	0	0	0	0	949,600	4,682	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	-9,505	0	0	0	-9,505	0	735,766	14,187	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	0	-46,505	0	0	0	-46,505	0	653,775	60,692	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	-22,504	0	0	0	-22,504	0	528,399	83,196	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	-7,294	0	0	0	-7,294	0	425,039	90,490	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	-6,842	0	0	0	-6,842	0	558,981	97,332	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	-6,298	0	0	0	-6,298	0	651,545	103,630	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	-4,943	0	0	0	-4,943	0	822,296	108,573	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	0	-7,295	0	0	16,000	8,705	0	1,053,456	99,868	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	0	-37,143	26,000	0	0	-11,143	-111,000	1,068,194	11	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. Greater efforts would have been made to meet as much Turnback Pool demand as possible in these two months. - Without Monterey water management program deliveries, SWP San Luis would have filled in October, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by their total take of Turnback Pool water in 1998. - SWP would have surcharged into CVP San Luis storage space in October. SWP diversions at Banks would have been reduced in November and December to limit surcharge amount to historic level by end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	0	-909	0	0	0	-909	0	1,063,197	920	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064,254	920	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,063,147	920	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	-15,000	0	0	20,000	5,000	0	1,057,800	-4,080	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	0	-38,800	0	0	30,000	-8,800	0	1,065,600	4,720	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	-20,750	0	0	0	-20,750	0	1,029,557	25,470	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	0	-16,759	0	0	0	-16,759	0	916,223	42,229	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	0	-27,575	0	0	0	-27,575	0	969,804	69,804	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	0	-8,732	0	0	15,000	6,268	0	1,078,326	63,536	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	0	0	0	10,000	10,000	-40,000	1,077,131	13,536	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	-300	0	0	0	-300	-13,000	1,075,082	836	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	0	-2,011	0	0	0	-2,011	-2,000	1,104,796	847	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP diversion reductions at Banks would have been needed from January through March to limit surcharge into CVP San Luis storage space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	0	-6,220	0	0	0	-6,220	-7,000	1,097,388	67	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	0	-18,841	0	0	0	-18,841	-18,000	1,062,708	908	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	0	-18,976	0	0	0	-18,976	0	1,031,534	19,884	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	0	-16,371	0	500	0	-15,871	0	899,009	35,755	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	0	-70,082	0	15,000	0	-55,082	0	646,310	90,837	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	-30,400	0	27,000	0	-3,400	0	570,452	94,237	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	-19,534	0	20,000	0	466	0	544,820	93,771	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	0	-37,461	0	34,000	0	-3,461	0	689,028	97,232	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	0	-45,710	0	44,000	0	-1,710	0	672,489	98,942	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	0	-48,465	0	44,000	0	-4,465	0	786,534	103,407	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	0	-35,859	0	31,500	0	-4,359	0	824,721	107,766	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	0	-92,030	80,000	0	13,000	970	0	1,021,513	106,796	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Since SWP Lan Luis nearly filled in January, Art. 21 unscheduled water would have been made available late that month, with demand limited only by contractors' ability to take delivery during that limited period. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	0	-85,182	73,000	0	0	-12,182	-119,000	1,057,553	-22	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	0	-13,210	0	0	0	-13,210	-13,000	1,062,068	188	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	0	-20,801	9,300	0	0	-11,501	0	981,032	11,689	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	-12,100	17,300	0	0	5,200	0	768,553	6,489	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	0	-40,170	17,300	0	0	-22,870	0	609,808	29,359	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	0	-161,385	17,300	0	0	-144,085	0	574,729	173,444	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	0	-131,535	17,300	0	0	-114,235	0	595,270	287,679	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	0	-31,907	17,300	0	0	-14,607	0	689,921	302,286	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	0	-37,301	17,300	0	0	-20,001	0	743,591	322,287	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	0	-15,752	12,000	0	0	-3,752	0	786,216	326,039	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	0	-5,761	8,000	0	0	2,239	0	805,477	323,800	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	-131,245	80,000	0	0	-51,245	0	931,975	375,045	- SWP allocation in 2001 was 39%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited only by their ability to take delivery in those months. - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in March to limit SWP San Luis storage to historic levels. - Water otherwise delivered through Turnback Pool would have been available for increased allocation and delivery as additional Table A water from April-December.
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	-78,523	78,000	0	175,000	174,477	0	947,972	200,568	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	-82,868	72,000	0	160,000	149,132	-51,000	997,200	436	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	-8,191	1,300	0	0	-6,891	0	991,944	7,327	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	-921	2,300	0	0	1,379	0	821,782	5,948	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	-82	2,300	0	0	2,218	0	645,978	3,730	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	-4,948	2,300	0	0	-2,648	0	555,437	6,378	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	-2,016	2,300	0	0	284	0	521,291	6,094	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	-947	2,300	0	0	1,353	0	520,748	4,741	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	-395	2,300	0	0	1,905	0	360,536	2,836	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	414,072	1,236	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	-3,329	1,100	0	0	-2,229	0	679,460	3,465	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	0	-113,703	80,000	0	0	-33,703	0	949,500	37,168	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey water management program deliveries, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	-11,468	34,000	0	0	22,532	0	1,045,507	14,636	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	-1,846	0	0	16,000	14,154	0	1,078,655	482	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	-6,280	10,500	0	0	4,220	0	969,719	-3,738	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	-10,131	19,500	0	0	9,369	0	731,677	-13,107	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	-13,324	19,500	0	0	6,176	0	468,838	-19,283	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	-31,691	19,500	0	0	-12,191	0	391,565	-7,092	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	-16,996	19,500	0	0	2,504	0	458,350	-9,596	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	-8,332	19,500	0	0	11,168	0	373,031	-20,764	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	-29,287	19,500	0	0	-9,787	0	226,505	-10,977	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	-16,750	13,500	0	0	-3,250	0	211,497	-7,727	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	0	-17,783	9,000	0	0	-8,783	0	320,859	1,056	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	-15,286	9,000	0	0	-6,286	0	577,180	7,342	- SWP allocation in 2003 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December. - Any Table A delivery increase from April on would have been limited to those contractors that purchased from the Turnback Pool (Zone 7, Alameda, Santa Clara, Oak Flat, Co. Kings, Dudley, KCWA, Tulare, AVEK, Castaic, Desert, Coachella, MWD) or dry year purchase program (Dudley, KCWA), or that used all of their 90% allocation.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	-28,921	26,000	0	0	-2,921	0	847,400	10,263	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	-40,577	41,000	0	10,000	10,423	0	984,396	-160	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	-16,006	9,800	0	0	-6,206	0	926,289	6,046	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	0	-15,477	18,200	0	0	2,723	0	687,666	3,323	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	0	-45,300	18,200	0	0	-27,100	0	588,172	30,423	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	0	-22,629	18,200	0	0	-4,429	0	556,732	34,852	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	0	-19,758	18,200	0	0	-1,558	0	566,354	36,410	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	0	-10,900	18,200	0	0	7,300	0	681,854	29,110	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	0	-5,020	18,200	0	0	13,180	0	623,294	15,930	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	0	-675	12,600	0	0	11,925	0	617,482	4,005	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	0	-4,220	8,400	0	0	4,180	0	615,594	-175	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	**Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	-126,642	100,000	0	0	-26,642	0	835,500	26,467	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	-179,919	100,000	0	50,000	-29,919	0	1,028,105	56,386	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	-13,255	50,000	0	0	36,745	-20,000	1,069,087	-359	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	-4,815	1,500	0	0	-3,315	0	941,500	2,956	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	-5,075	2,700	0	0	-2,375	0	679,348	5,331	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	-6,402	2,700	0	0	-3,702	0	443,845	9,033	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	-2,291	2,700	0	0	409	0	378,363	8,624	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	-2,657	2,700	0	0	43	0	417,283	8,581	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	519,417	5,881	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	525,357	3,181	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	0	1,900	0	0	1,900	0	604,691	1,281	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	0	1,300	0	0	1,300	0	672,162	-19	
1996-2004																			
1996-2003			**260,595**	**83,547**	**686,357**	**905,457**	**649,364**	**2,585,320**	**260,595**	**0**	**-2,324,725**	**1,039,900**	**391,000**	**465,000**	**-428,825**	**-429,000**			
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**0**	**-2,665,781**	**1,310,800**	**391,000**	**515,000**	**-448,981**	**-449,000**			
Annual Average			**30,778**	**9,283**	**81,586**	**102,522**	**102,807**	**326,976**	**30,778**	**0**	**-296,198**	**145,644**	**43,444**	**57,222**	**-49,887**	**-49,889**			

EFFECTS OF MONTEREY AMENDMENT WATER MANAGEMENT PROVISIONS ON BANKS DIVERSIONS

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1996	December	5,198,059	211,225	-55,000
1998	January	4,399,140	196,584	-111,000
1998	November	1,227,905	129,489	-40,000
1998	December	2,904,722	128,026	-13,000
1999	January	2,337,832	85,366	-2,000
1999	February	5,487,282	52,203	-7,000
1999	March	4,249,136	182,800	-18,000
2000	February	5,412,226	421,683	-119,000
2000	March	5,400,323	343,011	-13,000
2001	March	1,439,070	360,751	-51,000
2004	March	3,459,039	423,147	-20,000
96-04 Total				-449,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/inde

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55										
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water						
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols
Jan-96	11,587	11,565	0	11,565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	22
Feb-96	10,740	9,678	0	9,678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	1,062
Mar-96	6,497	5,829	0	5,829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	668
Apr-96	1,409	1,409	0	1,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-96	2,103	2,103	0	2,103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-96	255	255	0	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-96	2,015	2,015	0	2,015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-96	11,456	11,456	0	11,456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-96	10,695	10,695	0	10,695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-96	9,079	9,079	0	9,079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	5,601	5,601	0	5,601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	16,055	13,676	0	13,676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**87,492**	**83,361**	**0**	**83,361**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,752**	**0**	**0**	**0**	**1,752**
Jan-97	987	873	0	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	114
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	5,627	1,299	0	1,299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	4,328
Apr-97	2,772	2,772	0	2,772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-97	2,769	2,769	0	2,769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-97	2,563	2,563	0	2,563	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	0	0	0	0	0	0
Nov-97	11,165	11,165	0	11,165	0	0	0	0	0	0	645	0	645	0	645	0	645	0	0	0	0	0	0	0	0	0	0	0
Dec-97	14,166	13,266	0	13,266	0	0	0	0	0	0	611	0	611	0	611	0	611	0	0	0	0	0	0	0	0	0	0	0
Total	**40,049**	**34,707**	**0**	**34,707**	**0**	**0**	**0**	**0**	**0**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**1,600**	**0**	**0**	**1,600**	**0**	**0**	**4,442**	**0**	**0**	**0**	**4,442**
Jan-98	13,952	13,541	0	13,541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	411	0	0	0	411
Feb-98	3,118	2,545	0	2,545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573	0	0	0	573
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-98	6,447	6,391	0	6,391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-98	15,270	10,685	0	10,685	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-98	3,804	3,804	0	3,804	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	8,564	8,264	0	8,264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**51,155**	**45,230**	**0**	**45,230**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**984**	**0**	**0**	**0**	**984**
Jan-99	1,525	204	0	204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	1,321	0	600	0	2,011
Feb-99	1,149	1,149	0	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	830	0	0	0	5,390	0	6,220
Mar-99	1,022	1,022	0	1,022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,140	0	0	0	7,620	2,040	10,800
Apr-99	2,274	2,274	0	2,274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	1,870	870	3,060
May-99	347	347	0	347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-99	5,758	5,758	0	5,758	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-99	10,780	10,780	0	10,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-99	3,156	3,156	0	3,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**26,011**	**24,690**	**0**	**24,690**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,380**	**0**	**1,321**	**0**	**15,480**	**2,910**	**22,091**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES: All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54 — Article 21 Water: CLWA	MWD	Total	Article 56 Carryover: CLWA	MWD	Total	Table A Water: CLWA	MWD	Total	Local Supply: CLWA	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16
Jan-00	224	224	0	224	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-00	4,896	4,733	0	4,733	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-00	14,002	13,212	0	13,212	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	0	0	0	3,471	3,471	0	3,471	3,471	0
Jul-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-00	333	333	0	333	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**19,455**	**18,502**	**0**	**18,502**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,471**	**3,471**	**0**	**3,471**	**3,471**	**0**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-01	10,030	8,297	0	8,297	0	4,710	4,710	0	0	0	0	0	0	0	4,710	0	4,710
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	2,589	2,589	0	2,589
Total	**10,030**	**8,297**	**0**	**8,297**	**0**	**4,710**	**4,710**	**0**	**0**	**0**	**0**	**0**	**0**	**2,589**	**7,299**	**0**	**7,299**
Jan-02	0	-140	0	-140	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-02	3,039	2,793	0	2,793	0	1,190	1,190	0	0	0	0	0	0	0	1,190	0	1,190
Apr-02	3,341	2,991	0	2,991	0	4,760	4,760	0	0	0	0	0	0	0	4,760	0	4,760
May-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630
Jun-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630
Jul-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	0	0	16,468	16,468	0	16,468	0	16,468
Nov-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342
Dec-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342
Total	**6,380**	**5,644**	**0**	**5,644**	**0**	**5,950**	**5,950**	**0**	**0**	**0**	**0**	**69,042**	**69,042**	**0**	**74,992**	**0**	**74,992**
Jan-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-03	0	0	0	0	0	0	0	0	7,100	7,100	0	0	0	0	7,100	7,100	0
Mar-03	4,632	4,632	0	4,632	0	13,139	13,139	0	38,500	38,500	0	0	0	0	51,639	51,639	0
Apr-03	0	0	0	0	0	4,483	4,483	0	0	0	0	32,575	32,575	0	37,058	37,058	0
May-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-03	2,413	2,413	0	2,413	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-03	16,789	16,789	0	16,789	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-03	16,540	16,190	0	16,190	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**40,374**	**40,024**	**0**	**40,024**	**0**	**17,622**	**17,622**	**0**	**45,600**	**45,600**	**0**	**32,575**	**32,575**	**0**	**95,797**	**95,797**	**0**

Month	DELIVERIES FROM NOD UNDER ARTICLE 55 — Non-Project Water from N of Delta: MWA	MWD	SCVWD	Total	Article 21 Water: ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total
	18	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols
Jan-00	0	0	0	0	0	0	0	0	0	0	0
Feb-00	0	0	0	0	880	0	163	0	5,210	1,340	7,593
Mar-00	0	0	0	0	1,500	0	790	0	8,520	2,400	13,210
Apr-00	0	0	0	0	0	0	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	0	0	0
Oct-00	0	900	0	900	0	0	0	0	0	0	0
Nov-00	0	0	0	0	0	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**900**	**0**	**900**	**2,380**	**0**	**953**	**0**	**13,730**	**3,740**	**20,803**
Jan-01	0	0	0	0	0	0	0	0	0	0	0
Feb-01	0	0	0	0	0	0	0	0	0	0	0
Mar-01	0	0	0	0	0	0	933	0	0	0	933
Apr-01	0	0	0	0	0	0	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**933**	**0**	**0**	**0**	**933**
Jan-02	0	0	0	0	0	0	0	0	0	0	0
Feb-02	0	0	0	0	0	0	0	0	0	0	0
Mar-02	0	0	0	0	0	0	246	0	0	397	643
Apr-02	0	0	0	0	83	0	350	0	0	1,087	1,520
May-02	0	0	0	0	0	0	0	0	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	0	0	0	0	0	0	0	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**83**	**0**	**596**	**0**	**0**	**1,484**	**2,163**
Jan-03	0	0	0	0	0	0	0	0	0	0	0
Feb-03	0	0	0	0	0	0	0	0	0	0	0
Mar-03	0	0	0	0	0	0	0	0	0	0	0
Apr-03	0	0	0	0	0	0	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0
Oct-03	0	0	3,100	3,100	0	0	0	0	0	0	0
Nov-03	0	0	0	0	0	0	0	0	0	0	0
Dec-03	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55										
					Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total			Non-Project Water from N of Delta				Article 21 Water						
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA		Replaced Same Yr as Withdrl	Total that Could Impact Supply	MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 22 thru
Jan-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-04	1,914	1,914	0	1,914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-04	16,151	14,494	0	14,494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,657	0	0	0	1,657
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	50,061	50,061	0	50,061	50,061	0	0	0	0	0	0	0	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**18,065**	**16,408**	**0**	**16,408**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50,061**	**50,061**	**0**	**50,061**	**50,061**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**1,657**	**0**	**0**	**0**	**1,657**
Jan-05	29,486	28,593	0	28,593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	845	0	0	0	845
Feb-05	39,919	37,596	0	37,596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,323	0	0	0	2,323
Mar-05	50,106	46,729	0	46,729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	3,377
Apr-05	49,900	46,946	0	46,946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	2,954
May-05	14,278	13,629	0	13,629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	0	764	0	1,413
Jun-05	30,897	29,833	0	29,833	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064	0	2,351	0	3,415
Jul-05	234	234	0	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-05	11,025	11,025	0	11,025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-05	25,520	25,520	0	25,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-05	32,256	30,756	0	30,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-05	21,818	20,818	0	20,818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-05	21,979	20,045	0	20,045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,934	0	0	0	1,934
Total	**327,418**	**311,724**	**0**	**311,724**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,146**	**0**	**3,115**	**0**	**16,261**
Totals																												
96-03	**280,946**	**260,455**	**0**	**260,455**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**105,088**	**106,344**	**2,589**	**182,815**	**99,268**	**83,547**	**1,600**	**900**	**3,100**	**5,600**	**4,843**	**0**	**10,981**	**0**	**29,210**	**8,134**	**53,168**
96-04	**299,011**	**276,863**	**0**	**276,863**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**12,638**	**0**	**29,210**	**8,134**	**54,825**
96-05	**626,429**	**588,587**	**0**	**588,587**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**25,784**	**0**	**32,325**	**8,134**	**71,086**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
	Article 56 Carryover							Table A and other SWP Water							Total							Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
Feb-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	0	0	0	0	0	0	0
Mar-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	0	0	0	0	0	0	0
Apr-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,290	0	0	0	0	0
May-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,632	0	0	0	0	0
Jun-96	0	0	0	0	0	0	0	0	0	0	0	25,000	0	25,000	25,000	0	0	25,000	25,000	31,774	0	0	0	0	0
Jul-96	0	0	0	0	0	0	0	0	0	0	0	20,000	0	20,000	20,000	0	0	20,000	20,000	34,774	0	0	0	0	0
Aug-96	0	0	0	0	0	0	0	6,200	0	0	0	0	0	6,200	6,200	0	0	0	0	44,165	0	0	0	0	0
Sep-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,274	0	0	0	0	0
Oct-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	0	0	0	0	0	0	0	0	0	2,379	0	0	0	2,379	2,379	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,200**	**0**	**2,379**	**0**	**45,000**	**0**	**53,579**	**55,331**	**0**	**0**	**45,000**	**45,000**	**174,909**	**0**	**0**	**0**	**0**	**0**
Jan-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	0	0	0	0	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	0	0	0	0	0	0	0
Apr-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,505	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	35,000	0	35,000	35,000	0	0	35,000	35,000	11,505	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	10,000	0	0	0	0	0	10,000	10,000	0	0	0	0	12,504	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,294	0	0	0	0	0
Sep-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,842	0	0	0	0	0
Oct-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,298	0	0	0	0	0
Nov-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,298	0	0	0	0	0
Dec-97	0	0	0	0	0	0	0	0	0	900	1,486	0	0	2,386	2,386	0	1,486	0	1,486	4,298	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10,000**	**0**	**900**	**1,486**	**35,000**	**0**	**47,386**	**51,828**	**0**	**1,486**	**35,000**	**36,486**	**62,544**	**0**	**0**	**0**	**0**	**0**
Jan-98	0	0	0	8,797	0	0	8,797	0	0	0	2,176	0	0	2,176	11,384	0	10,973	0	10,973	0	34,963	407	8,797	0	25,759
Feb-98	0	0	0	0	0	0	0	0	0	0	336	0	0	336	909	0	336	0	336	0	0	0	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,000	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	23,800	0	23,800	23,800	0	0	23,800	23,800	15,000	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	3,780	0	0	0	0	1,970	5,750	5,750	0	0	0	0	15,000	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	1,759	0	0	1,759	1,759	0	1,759	0	1,759	15,000	0	0	0	0	0
Sep-98	0	0	0	0	0	0	0	0	0	56	12,519	0	0	12,575	12,575	0	12,519	0	12,519	15,000	0	0	0	0	0
Oct-98	0	0	0	0	0	0	0	0	0	4,585	4,147	0	0	8,732	8,732	0	4,147	0	4,147	0	0	0	0	0	0
Nov-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	0	0	0	0	0	0	0	0	0	300	0	0	0	300	300	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**8,797**	**0**	**0**	**8,797**	**3,780**	**0**	**4,941**	**20,937**	**23,800**	**1,970**	**55,428**	**65,209**	**0**	**29,734**	**23,800**	**53,534**	**75,000**	**34,963**	**407**	**8,797**	**0**	**25,759**
Jan-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,011	0	0	600	600	0	0	0	0	0	0
Feb-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,220	0	0	5,390	5,390	0	0	0	0	0	0
Mar-99	0	0	0	0	0	0	0	0	0	0	8,041	0	0	8,041	18,841	0	8,041	7,620	15,661	0	0	0	0	0	0
Apr-99	0	0	0	0	0	0	0	0	0	0	15,916	0	0	15,916	18,976	6,098	9,818	1,870	11,688	0	0	0	0	0	0
May-99	0	0	0	0	0	0	0	0	0	0	16,024	0	0	16,024	16,024	9,839	6,185	0	6,185	347	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	12,620	0	0	10,425	14,520	17,300	54,865	54,865	0	10,425	14,520	24,945	15,217	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	1,100	0	0	0	0	2,700	3,800	3,800	0	0	0	0	26,600	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,534	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	2,958	0	0	2,958	2,958	0	2,958	0	2,958	34,503	0	0	0	0	0
Oct-99	0	0	0	0	0	0	0	0	0	0	137	0	0	137	137	0	137	0	137	45,573	0	0	0	0	0
Nov-99	0	0	0	0	0	0	0	0	0	0	4,292	0	0	4,292	4,292	0	4,292	0	4,292	44,173	0	0	0	0	0
Dec-99	0	0	0	0	0	0	0	0	0	0	4,369	0	0	4,369	4,369	0	4,369	0	4,369	31,490	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,720**	**0**	**0**	**62,162**	**14,520**	**20,000**	**110,402**	**132,493**	**15,937**	**46,225**	**30,000**	**76,225**	**217,437**	**0**	**0**	**0**	**0**	**0**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																			Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
	Article 56 Carryover							Table A and other SWP Water							Total						Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-00	0	0	0	12,049	0	0	12,049	0	0	0	0	0		0	12,049	0	12,049	0	12,049	0	93,447	1,417	12,049	0	79,981
Feb-00	0	0	0	4,475	0	0	4,475	0	0	0	0	0	0	0	12,068	0	4,475	5,210	9,685	0	77,589	0	4,475	0	73,114
Mar-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,210	0	0	8,520	8,520	0	0	0	0	0	0
Apr-00	0	0	0	0	0	0	0	0	0	0	10,801	0	0	10,801	10,801	0	10,801	0	10,801	10,000	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,100	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	3,750	0	0	21,130	0	3,000	27,880	27,880	0	21,130	0	21,130	12,290	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	5,750	0	0	24,803	0	8,000	38,553	38,553	0	24,803	0	24,803	122,832	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	16,675	0	8,000	24,675	24,675	0	16,675	0	16,675	106,860	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	1,500	0	0	17,166	10,000	1,200	29,866	29,866	0	17,166	10,000	27,166	2,041	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	21,119	0	0	21,119	21,119	0	21,119	0	21,119	16,182	0	0	0	0	0
Nov-00	0	0	0	0	0	0	0	0	0	0	15,752	0	0	15,752	15,752	0	15,752	0	15,752	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	5,761	0	0	5,761	5,761	0	5,761	0	5,761	0	0	0	0	0	0
Total	**0**	**0**	**0**	**16,524**	**0**	**0**	**16,524**	**11,000**	**0**	**0**	**133,207**	**10,000**	**20,200**	**174,407**	**211,734**	**0**	**149,731**	**23,730**	**173,461**	**282,305**	**171,036**	**1,417**	**16,524**	**0**	**153,095**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133,186	1,941	0	0	131,245
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,326	803	0	0	78,523
Mar-01	0	0	800	0	0	5,000	5,800	0	0	0	0	0	0	0	6,733	0	0	0	0	0	77,225	0	5,800	0	71,425
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,191	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	921	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,948	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,016	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	947	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	395	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	740	0	0	0	0	0
Total	**0**	**0**	**800**	**0**	**0**	**5,000**	**5,800**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,733**	**0**	**0**	**0**	**0**	**18,240**	**289,737**	**2,744**	**5,800**	**0**	**281,193**
Jan-02	0	0	0	0	0	1,081	1,081	0	0	140	0	3,311	0	3,451	4,532	0	0	3,311	3,311	0	110,529	277	1,081	0	109,171
Feb-02	0	0	0	0	0	6,919	6,919	0	0	0	0	0	0	0	6,919	0	0	0	0	0	11,587	119	6,919	0	4,549
Mar-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	643	0	0	0	0	0	545	532	0	0	13
Apr-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,520	0	0	0	0	0	776	776	0	0	0
May-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,501	290	290	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,694	660	660	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,061	714	714	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	1,000	0	0	0	0	15,996	316	316	0	0	0
Sep-02	0	0	0	0	0	0	0	2,000	3,332	0	0	0	3,000	8,332	8,332	0	0	0	0	0	59	59	0	0	0
Oct-02	0	0	0	0	0	0	0	0	12,819	0	0	0	0	12,819	12,819	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	3,408	0	0	0	0	3,408	3,408	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	4,441	0	0	0	0	4,441	4,441	2,785	-2,785	0	-2,785	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**8,000**	**8,000**	**2,000**	**24,000**	**140**	**0**	**3,311**	**4,000**	**33,451**	**43,614**	**2,785**	**-2,785**	**3,311**	**526**	**45,252**	**125,476**	**3,743**	**8,000**	**0**	**113,733**
Jan-03	2,000	0	0	0	0	3,800	5,800	0	0	0	0	0	0	0	5,800	0	0	0	0	0	15,286	0	5,800	0	9,486
Feb-03	700	0	0	0	0	2,700	3,400	0	0	0	0	0	0	0	3,400	0	0	0	0	0	36,021	0	3,400	7,100	25,521
Mar-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,077	0	0	38,500	40,577
Apr-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,006	0	0	0	0	0
May-03	0	0	0	0	0	0	0	10,000	0	0	5,477	0	0	15,477	15,477	0	5,477	0	5,477	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	6,100	0	0	14,827	20,000	0	40,927	40,927	0	14,827	20,000	34,827	4,373	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	13,290	0	0	13,290	13,290	0	13,290	0	13,290	9,339	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	19,706	0	0	19,706	19,706	0	19,706	0	19,706	52	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	1,400	9,500	0	10,900	10,900	0	1,400	9,500	10,900	0	0	0	0	0	0
Oct-03	0	0	0	0	0	0	0	0	0	0	1,520	3,500	0	5,020	5,020	0	1,520	3,500	5,020	0	0	0	0	0	0
Nov-03	0	0	0	0	0	0	0	0	0	0	675	0	0	675	675	0	675	0	675	0	0	0	0	0	0
Dec-03	0	0	0	0	0	0	0	0	0	350	3,870	0	0	4,220	4,220	0	3,870	0	3,870	0	0	0	0	0	0
Total	**2,700**	**0**	**0**	**0**	**0**	**6,500**	**9,200**	**16,100**	**0**	**350**	**60,765**	**33,000**	**0**	**110,215**	**119,415**	**0**	**60,765**	**33,000**	**93,765**	**29,770**	**130,384**	**0**	**9,200**	**45,600**	**75,584**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																								
	Storage Outside Service Area (all water types)																			Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)															Could Not Have Stored	Could Have Been Stored in Other Existing Programs				Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Article 56 Carryover							Table A and other SWP Water							Total										
	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-04	0	803	0	0	0	5,740	6,543	0	0	0	0	0	0	0	6,543	0	0	0	0	0	127,492	850	6,543	0	120,099
Feb-04	4,000	27,004	0	0	0	0	31,004	0	0	0	0	0	0	0	31,004	0	0	0	0	0	180,703	784	31,004	0	148,915
Mar-04	0	4,715	0	0	0	0	4,715	0	0	0	0	0	0	0	6,372	0	0	0	0	0	11,613	15	4,715	0	6,883
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,815	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,075	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,402	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	291	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	657	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**4,000**	**32,522**	**0**	**0**	**0**	**5,740**	**42,262**	**4,000**	**0**	**0**	**0**	**0**	**0**	**4,000**	**47,919**	**0**	**0**	**0**	**0**	**17,240**	**319,808**	**1,649**	**42,262**	**0**	**275,897**
Jan-05	1,952	0	48	0	4,554	845	7,399	0	0	0	0	0	0	0	8,244	0	0	4,554	4,554	0	113,543	947	7,399	0	105,197
Feb-05	2,648	0	0	0	7,079	4,895	14,622	0	0	0	0	0	0	0	16,945	0	0	7,079	7,079	0	55,665	877	14,622	0	40,166
Mar-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	0	0	0	0	0	0	0
Apr-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	0	0	0	0	0	0	0
May-05	0	0	0	0	0	0	0	0	0	0	1,138	0	0	1,138	2,551	0	1,138	764	1,902	0	0	0	0	0	0
Jun-05	0	0	0	0	0	0	0	0	0	0	1,324	0	0	1,324	4,739	0	1,324	2,351	3,675	0	0	0	0	0	0
Jul-05	0	0	0	0	0	0	0	10,100	0	0	10,000	23,041	0	43,141	43,141	0	10,000	23,041	33,041	32,844	0	0	0	0	0
Aug-05	0	0	0	0	0	0	0	15,600	0	0	2,538	7,792	0	25,930	25,930	0	2,538	7,792	10,330	5,089	0	0	0	0	0
Sep-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342	0	0	0	0	0
Oct-05	0	0	0	0	0	0	0	0	0	1,500	576	0	0	2,076	2,076	0	576	0	576	0	0	0	0	0	0
Nov-05	0	0	0	0	0	0	0	0	12,869	1,000	0	0	0	13,869	13,869	0	0	0	0	0	0	0	0	0	0
Dec-05	0	0	0	0	0	0	0	0	7,131	0	0	1,500	0	8,631	10,565	0	0	1,500	1,500	0	0	0	0	0	0
Total	**4,600**	**0**	**48**	**0**	**11,633**	**5,740**	**22,021**	**25,700**	**20,000**	**2,500**	**15,576**	**32,333**	**0**	**96,109**	**134,391**	**0**	**15,576**	**47,081**	**62,657**	**38,275**	**169,208**	**1,824**	**22,021**	**0**	**145,363**
Totals																									
96-03	**2,700**	**0**	**800**	**25,321**	**0**	**19,500**	**48,321**	**62,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**584,868**	**686,357**	**18,722**	**285,156**	**193,841**	**478,997**	**905,457**	**751,596**	**8,311**	**48,321**	**45,600**	**649,364**
96-04	**6,700**	**32,522**	**800**	**25,321**	**0**	**25,240**	**90,583**	**66,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**588,868**	**734,276**	**18,722**	**285,156**	**193,841**	**478,997**	**922,697**	**1,071,404**	**9,960**	**90,583**	**45,600**	**925,261**
96-05	**11,300**	**32,522**	**848**	**25,321**	**11,633**	**30,980**	**112,604**	**92,500**	**44,000**	**11,210**	**294,133**	**196,964**	**46,170**	**684,977**	**868,667**	**18,722**	**300,732**	**240,922**	**541,654**	**960,972**	**1,240,612**	**11,784**	**112,604**	**45,600**	**1,070,624**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

SAN LUIS RESERVOIR STORAGE

Elevation: 543' · SAN LUIS CR basin · Operator: CA Dept of Water Resources
Provisional data, subject to change.
Data obtained from CDEC 5/15/2006

STORAGE (from CDEC) (AF)

Date	Total	SWP	CVP	Total Check	Diff
	(1)	(2)	(3)	(4)	(5)
				(2+3)	(4-1)
Jan-95	1,789,637	1,091,587	698,050	1,789,637	0
Feb-95	2,024,025	1,171,880	852,145	2,024,025	0
Mar-95	2,034,447	1,169,817	864,630	2,034,447	0
Apr-95	2,026,819	1,086,588	940,231	2,026,819	0
May-95	2,009,440	1,061,812	947,628	2,009,440	0
Jun-95	1,876,744	1,048,887	827,857	1,876,744	0
Jul-95	1,763,906	1,073,430	690,476	1,763,906	0
Aug-95	1,499,314	1,077,656	421,658	1,499,314	0
Sep-95	1,524,232	1,081,845	442,387	1,524,232	0
Oct-95	1,637,786	1,133,031	504,755	1,637,786	0
Nov-95	1,664,769	1,048,190	616,579	1,664,769	0
Dec-95	1,646,822	911,417	735,465	1,646,882	60
Jan-96	1,934,442	1,061,411	873,031	1,934,442	0
Feb-96	2,024,533	1,076,912	947,621	2,024,533	0
Mar-96	2,023,644	1,058,720	964,924	2,023,644	0
Apr-96	1,885,781	972,070	913,711	1,885,781	0
May-96	1,643,454	843,235	800,219	1,643,454	0
Jun-96	1,350,109	787,228	562,881	1,350,109	0
Jul-96	979,318	750,346	228,972	979,318	0
Aug-96	753,481	628,876	124,605	753,481	0
Sep-96	914,750	740,379	174,371	914,750	0
Oct-96	1,175,411	843,170	332,241	1,175,411	0
Nov-96	1,596,193	1,048,478	547,719	1,596,197	4
Dec-96	1,903,404	1,109,158 r	794,246	1,903,404	0
Jan-97	1,999,062	1,101,867	897,195	1,999,062	0
Feb-97	1,978,868	1,105,151	873,717	1,978,868	0
Mar-97	2,009,693	1,085,462	924,231	2,009,693	0
Apr-97	1,778,698	944,918	833,780	1,778,698	0
May-97	1,266,881	721,579	545,302	1,266,881	0
Jun-97	871,579	593,083	278,496	871,579	0
Jul-97	553,683	445,203	108,480	553,683	0
Aug-97	396,307	334,549	61,758	396,307	0
Sep-97	593,428	461,649	131,779	593,428	0
Oct-97	827,147	547,915	279,232	827,147	0
Nov-97	1,165,611	713,723	451,888	1,165,611	0
Dec-97	1,642,982	953,588	649,394	1,602,982	-40,000
Jan-98	1,858,715	1,068,183	790,532	1,858,715	0
Feb-98	2,025,549	1,062,277	963,272	2,025,549	0
Mar-98	2,028,090	1,063,334	964,756	2,028,090	0
Apr-98	1,999,821	1,062,227	937,594	1,999,821	0
May-98	2,028,725	1,061,880	966,845	2,028,725	0
Jun-98	2,024,025	1,060,880	963,145	2,024,025	0
Jul-98	1,824,308	1,004,087	820,221	1,824,308	0
Aug-98	1,566,459	873,994	692,465	1,566,459	0
Sep-98	1,613,068	900,000	713,008	1,613,008	-60
Oct-98	1,861,058	1,014,790	846,268	1,861,058	0
Nov-98	1,970,810	1,063,595	904,215	1,967,810	-3,000
Dec-98	1,898,186	1,074,246	823,940	1,898,186	0
Jan-99	1,929,319	1,103,949	825,370	1,929,319	0
Feb-99	1,985,676	1,097,321	888,355	1,985,676	0
Mar-99	2,027,831	1,061,800	966,035	2,027,835	4
Apr-99	1,913,855	1,011,650	902,205	1,913,855	0
May-99	1,496,796	863,254	633,542	1,496,796	0
Jun-99	936,402	555,473	380,929	936,402	0
Jul-99	611,617	476,215	135,402	611,617	0
Aug-99	520,283	451,049	69,234	520,283	0
Sep-99	702,409	591,796	110,613	702,409	0
Oct-99	801,279	573,547	227,732	801,279	0
Nov-99	1,073,901	683,127	390,774	1,073,901	0
Dec-99	1,187,142	716,955	470,187	1,187,142	0
Jan-00	1,505,272	914,717	590,555	1,505,272	0
Feb-00	1,825,778	1,057,575	768,203	1,825,778	0
Mar-00	2,026,438	1,061,880	964,558	2,026,438	0
Apr-00	1,876,126	969,343	906,783	1,876,126	0
May-00	1,462,484	762,064	700,520	1,462,584	100
Jun-00	1,051,334	580,449	470,885	1,051,334	0
Jul-00	771,746	401,285	370,461	771,746	0
Aug-00	666,538	307,591	358,947	666,538	0
Sep-00	850,828	387,635	463,193	850,828	0
Oct-00	1,051,945	421,304	630,641	1,051,945	0
Nov-00	1,299,262	460,177	839,085	1,299,262	0
Dec-00	1,470,439	481,677	988,762	1,470,439	0

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-01	1,595,959	556,930	1,039,029	1,595,959	0
Feb-01	1,797,186	747,404	1,049,782	1,797,186	0
Mar-01	1,977,986	996,764	981,222	1,977,986	0
Apr-01	1,910,991	984,617	926,374	1,910,991	0
May-01	1,493,135	815,834	677,301	1,493,135	0
Jun-01	1,033,071	642,248	390,823	1,033,071	0
Jul-01	829,778	549,059	280,719	829,778	0
Aug-01	760,039	515,197	244,842	760,039	0
Sep-01	829,590	516,007	313,583	829,590	0
Oct-01	764,056	357,700	406,356	764,056	0
Nov-01	964,447	412,836	551,611	964,447	0
Dec-01	1,385,632	675,995	709,637	1,385,632	0
Jan-02	1,807,066	912,332	894,734	1,807,066	0
Feb-02	1,925,324	1,030,871	894,453	1,925,324	0
Mar-02	2,027,963	1,078,173	949,790	2,027,963	0
Apr-02	1,844,188	973,457	870,731	1,844,188	0
May-02	1,402,950	744,784	658,166	1,402,950	0
Jun-02	873,969	488,121	385,848	873,969	0
Jul-02	646,887	398,657	248,230	646,887	0
Aug-02	643,876	467,946	175,930	643,876	0
Sep-02	688,435	393,795	294,640	688,435	0
Oct-02	649,730	237,482	412,248	649,730	0
Nov-02	787,573	219,224	568,349	787,573	0
Dec-02	1,010,089	319,803	690,286	1,010,089	0
Jan-03	1,437,576	569,838	867,738	1,437,576	0
Feb-03	1,739,389	837,137	902,252	1,739,389	0
Mar-03	1,953,851	984,556	969,295	1,953,851	0
Apr-03	1,818,676	920,243	898,433	1,818,676	0
May-03	1,428,330	684,343	743,987	1,428,330	0
Jun-03	1,217,645	557,749	659,896	1,217,645	0
Jul-03	918,347	521,880	396,467	918,347	0
Aug-03	787,480	529,944	257,536	787,480	0
Sep-03	939,243	652,744	286,499	939,243	0
Oct-03	961,975	607,364	354,611	961,975	0
Nov-03	1,122,517	613,477	509,040	1,122,517	0
Dec-03	1,316,540	615,769	700,771	1,316,540	0
Jan-04	1,664,413	809,033	855,380	1,664,413	0
Feb-04	1,878,476	971,719	906,757	1,878,476	0
Mar-04	2,020,089	1,069,446	950,643	2,020,089	0
Apr-04	1,768,145	938,544	829,601	1,768,145	0
May-04	1,213,592	674,017	539,575	1,213,592	0
Jun-04	719,890	434,812	285,078	719,890	0
Jul-04	492,864	369,739	123,125	492,864	0
Aug-04	498,397	408,702	89,695	498,397	0
Sep-04	670,373	513,536	156,837	670,373	0
Oct-04	787,850	522,176	265,674	787,850	0
Nov-04	1,057,649	603,410	454,239	1,057,649	0
Dec-04	1,283,146	672,181	610,965	1,283,146	0
Jan-05	1,810,485	1,013,425	797,060	1,810,485	0
Feb-05	1,968,294	1,099,874	868,420	1,968,294	0
Mar-05	2,029,615	1,063,312	966,303	2,029,615	0
Apr-05	1,898,434	933,372	965,062	1,898,434	0
May-05	1,696,202	801,190	895,012	1,696,202	0
Jun-05	1,566,575	764,709	801,866	1,566,575	0
Jul-05	1,343,373	773,382	569,991	1,343,373	0
Aug-05	1,197,211	819,673	377,538	1,197,211	0
Sep-05	1,328,065	925,423	402,642	1,328,065	0
Oct-05	1,462,938	990,340	472,598	1,462,938	0
Nov-05	1,627,412	1,022,206	605,206	1,627,412	0
Dec-05	1,893,469	1,167,668	725,801	1,893,469	0
Jan-06	2,030,250	1,153,152	877,098	2,030,250	0
Feb-06	2,019,836	1,144,384	875,452	2,019,836	0
Mar-06	2,031,649	1,063,143	968,506	2,031,649	0
Apr-06	2,024,025	1,059,354	964,671	2,024,025	0

HISTORIC AND ESTIMATED
ADDITIONAL
ARTICLE 21 DELIVERIES

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-96	2,117	0	2,117	0
Feb-96	22,519	0	22,519	0
Mar-96	4,011	0	4,011	0
Apr-96	0	0	0	0
May-96	0	0	0	0
Jun-96	0	0	0	0
Jul-96	0	0	0	0
Aug-96	0	0	0	0
Sep-96	0	0	0	0
Oct-96	0	0	0	0
Nov-96	0	0	0	0
Dec-96	0	0	0	0
Jan-97	3,044	0	3,044	0
Feb-97	1,572	0	1,572	0
Mar-97	16,420	0	16,420	0
Apr-97	396	0	396	0
May-97	0	0	0	0
Jun-97	0	0	0	0
Jul-97	0	0	0	0
Aug-97	0	0	0	0
Sep-97	0	0	0	0
Oct-97	0	0	0	0
Nov-97	0	0	0	0
Dec-97	0	0	0	16,000
Jan-98	9,576	58	9,518	0
Feb-98	1,208	482	726	0
Mar-98	62	0	62	0
Apr-98	0	0	0	0
May-98	614	614	0	20,000
Jun-98	1,497	1,497	0	30,000
Jul-98	3,549	3,549	0	0
Aug-98	3,782	3,782	0	0
Sep-98	0		0	0
Oct-98	0		0	15,000
Nov-98	0		0	10,000
Dec-98	0		0	0
Jan-99	28,555	161	28,394	0
Feb-99	27,220	425	26,795	0
Mar-99	73,062	168	72,894	0
Apr-99	29,233	0	29,233	0
May-99	0	0	0	0
Jun-99	0	0	0	0
Jul-99	0	0	0	0
Aug-99	0	0	0	0
Sep-99	0	0	0	0
Oct-99	0	0	0	0
Nov-99	0	0	0	0
Dec-99	0	0	0	0

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-00	0	0	0	13,000
Feb-00	94,467	0	94,467	0
Mar-00	214,318	1,337	212,981	0
Apr-00	0	0	0	0
May-00	0	0	0	0
Jun-00	0	0	0	0
Jul-00	0	0	0	0
Aug-00	0	0	0	0
Sep-00	0	0	0	0
Oct-00	0	0	0	0
Nov-00	0	0	0	0
Dec-00	0	0	0	0
Jan-01	0	0	0	0
Feb-01	1,324	1,324	0	175,000
Mar-01	45,833	988	44,845	160,000
Apr-01	0	0	0	0
May-01	0	0	0	0
Jun-01	0	0	0	0
Jul-01	0	0	0	0
Aug-01	0	0	0	0
Sep-01	0	0	0	0
Oct-01	0	0	0	0
Nov-01	0	0	0	0
Dec-01	988	988	0	0
Jan-02	532	532	0	0
Feb-02	46	46	0	0
Mar-02	9,709	355	9,354	16,000
Apr-02	29,842	340	29,502	0
May-02	1,796	1,769	27	0
Jun-02	0	0	0	0
Jul-02	0	0	0	0
Aug-02	0	0	0	0
Sep-02	0	0	0	0
Oct-02	0	0	0	0
Nov-02	0	0	0	0
Dec-02	0	0	0	0
Jan-03	0	0	0	0
Feb-03	0	0	0	0
Mar-03	49,616	376	49,240	10,000
Apr-03	7,928	0	7,928	0
May-03	1,210	1,210	0	0
Jun-03	1,070	1,070	0	0
Jul-03	0	0	0	0
Aug-03	0	0	0	0
Sep-03	0	0	0	0
Oct-03	0	0	0	0
Nov-03	0	0	0	0
Dec-03	0	0	0	0
Jan-04	1,145	1,145	0	0
Feb-04	658	658	0	50,000
Mar-04	209,741	482	209,259	0
Apr-04	1,126	1,126	0	0
May-04	5,786	5,786	0	0
Jun-04	0	0	0	0
Jul-04	0	0	0	0
Aug-04	0	0	0	0
Sep-04	0	0	0	0
Oct-04	0	0	0	0
Nov-04	0	0	0	0
Dec-04	40	40	0	0
Total	905,612	30,308	875,304	515,000

Net Delta Outflow Index and Diversions at Banks Pumping Plant

Date	Historic Data		Estimated Data			Annual Totals				
	Net Delta Outflow Index[1] (AF)	Total Diversns at Banks Pumpg Plant[2,3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)	Net Delta Outflow Index (AF)	Total Diversns at Banks Pumping Plant[3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)
Jan-96	1,976,479	348,376	0	1,976,479	348,376					
Feb-96	7,300,090	171,418	0	7,300,090	171,418					
Mar-96	5,481,485	174,082	0	5,481,485	174,082					
Apr-96	2,501,101	105,770	0	2,501,101	105,770					
May-96	2,829,723	156,749	0	2,829,723	156,749					
Jun-96	908,612	295,490	0	908,612	295,490					
Jul-96	562,986	370,341	0	562,986	370,341					
Aug-96	589,805	379,999	0	589,805	379,999					
Sep-96	433,942	344,926	0	433,942	344,926					
Oct-96	291,578	336,186	0	291,578	336,186					
Nov-96	597,120	346,661	0	597,120	346,661					
Dec-96	5,198,059	211,225	-55,000	5,253,059	156,225	28,670,980	3,241,223	-55,000	28,725,980	3,186,223
Jan-97	16,129,761	45,266	0	16,129,761	45,266					
Feb-97	6,591,947	90,350	0	6,591,947	90,350					
Mar-97	2,072,091	162,393	0	2,072,091	162,393					
Apr-97	841,525	105,648	0	841,525	105,648					
May-97	753,673	78,830	0	753,673	78,830					
Jun-97	487,902	153,328	0	487,902	153,328					
Jul-97	570,976	322,379	0	570,976	322,379					
Aug-97	531,217	268,048	0	531,217	268,048					
Sep-97	232,923	339,410	0	232,923	339,410					
Oct-97	296,727	265,902	0	296,727	265,902					
Nov-97	604,147	293,437	0	604,147	293,437					
Dec-97	943,910	419,695	0	943,910	419,695	30,056,800	2,544,686	0	30,056,800	2,544,686
Jan-98	4,399,140	196,584	-111,000	4,510,140	85,584					
Feb-98	12,820,968	7,285	0	12,820,968	7,285					
Mar-98	6,421,827	14,315	0	6,421,827	14,315					
Apr-98	5,259,868	1,871	0	5,259,868	1,871					
May-98	4,157,282	43,225	0	4,157,282	43,225					
Jun-98	4,268,561	128,947	0	4,268,561	128,947					
Jul-98	1,897,277	213,401	0	1,897,277	213,401					
Aug-98	1,223,161	263,272	0	1,223,161	263,272					
Sep-98	1,193,669	266,204	0	1,193,669	266,204					
Oct-98	755,082	294,791	0	755,082	294,791					
Nov-98	1,227,905	129,489	-40,000	1,267,905	89,489					
Dec-98	2,904,722	128,026	-13,000	2,917,722	115,026	46,529,461	1,687,410	-164,000	46,693,461	1,523,410
Jan-99	2,337,832	85,366	-2,000	2,339,832	83,366					
Feb-99	5,487,282	52,203	-7,000	5,494,282	45,203					
Mar-99	4,249,136	182,800	-18,000	4,267,136	164,800					
Apr-99	2,112,934	185,666	0	2,112,934	185,666					
May-99	1,361,205	99,261	0	1,361,205	99,261					
Jun-99	813,084	59,277	0	813,084	59,277					
Jul-99	643,315	376,107	0	643,315	376,107					
Aug-99	364,641	409,354	0	364,641	409,354					
Sep-99	284,666	408,580	0	284,666	408,580					
Oct-99	261,832	303,546	0	261,832	303,546					
Nov-99	404,817	310,792	0	404,817	310,792					
Dec-99	643,569	233,883	0	643,569	233,883	18,964,313	2,706,835	-27,000	18,991,313	2,679,835
Jan-00	1,324,485	395,929	0	1,324,485	395,929					
Feb-00	5,412,226	421,683	-119,000	5,531,226	302,683					
Mar-00	5,400,323	343,011	-13,000	5,413,323	330,011					
Apr-00	1,620,468	180,473	0	1,620,468	180,473					
May-00	1,356,250	97,696	0	1,356,250	97,696					
Jun-00	525,019	251,955	0	525,019	251,955					
Jul-00	560,955	359,191	0	560,955	359,191					
Aug-00	370,417	376,809	0	370,417	376,809					
Sep-00	275,036	387,824	0	275,036	387,824					
Oct-00	351,975	306,668	0	351,975	306,668					
Nov-00	282,180	322,182	0	282,180	322,182					
Dec-00	368,684	292,231	0	368,684	292,231	17,848,018	3,735,652	-132,000	17,980,018	3,603,652

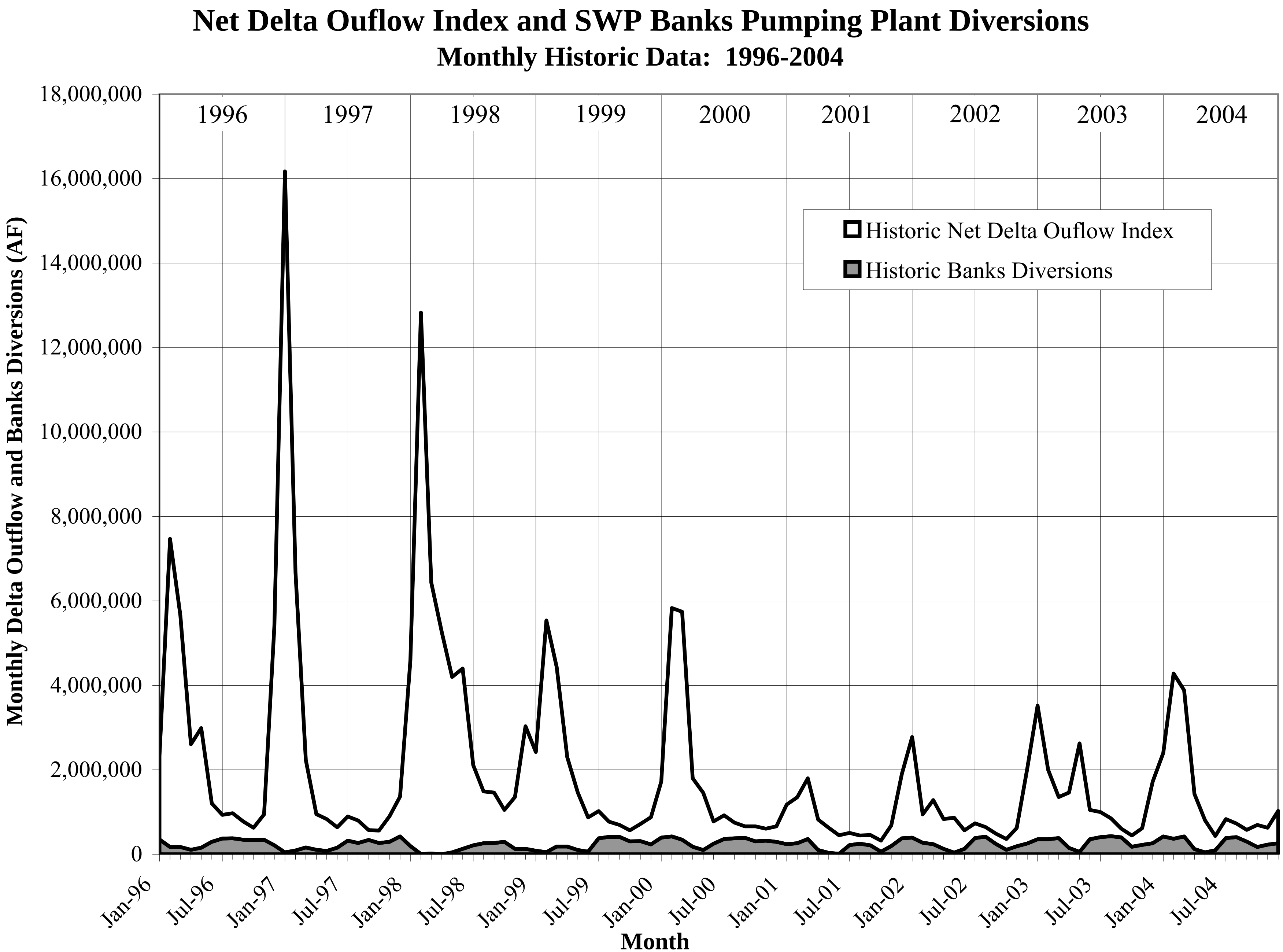
Date	Historic Data		Estimated Data			Annual Totals				
	Net Delta Outflow Index[1] (AF)	Total Diversns at Banks Pumpg Plant[2,3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)	Net Delta Outflow Index (AF)	Total Diversns at Banks Pumping Plant[3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)
Jan-01	935,280	240,845	0	935,280	240,845					
Feb-01	1,086,720	260,853	0	1,086,720	260,853					
Mar-01	1,439,070	360,751	-51,000	1,490,070	309,751					
Apr-01	723,447	98,528	0	723,447	98,528					
May-01	590,993	33,823	0	590,993	33,823					
Jun-01	440,594	9,233	0	440,594	9,233					
Jul-01	285,612	217,665	0	285,612	217,665					
Aug-01	193,843	248,539	0	193,843	248,539					
Sep-01	245,322	212,698	0	245,322	212,698					
Oct-01	261,870	60,306	0	261,870	60,306					
Nov-01	488,210	192,176	0	488,210	192,176					
Dec-01	1,520,785	376,553	0	1,520,785	376,553	8,211,744	2,311,970	-51,000	8,262,744	2,260,970
Jan-02	2,381,690	397,017	0	2,381,690	397,017					
Feb-02	668,037	274,484	0	668,037	274,484					
Mar-02	1,043,088	239,304	0	1,043,088	239,304					
Apr-02	707,623	125,217	0	707,623	125,217					
May-02	829,043	38,455	0	829,043	38,455					
Jun-02	438,772	127,719	0	438,772	127,719					
Jul-02	348,127	382,608	0	348,127	382,608					
Aug-02	231,693	413,948	0	231,693	413,948					
Sep-02	244,463	245,835	0	244,463	245,835					
Oct-02	257,288	106,270	0	257,288	106,270					
Nov-02	436,243	187,071	0	436,243	187,071					
Dec-02	1,776,079	254,341	0	1,776,079	254,341	9,362,146	2,792,269	0	9,362,146	2,792,269
Jan-03	3,162,940	355,592	0	3,162,940	355,592					
Feb-03	1,645,127	352,731	0	1,645,127	352,731					
Mar-03	969,098	384,529	0	969,098	384,529					
Apr-03	1,310,801	151,526	0	1,310,801	151,526					
May-03	2,574,908	54,101	0	2,574,908	54,101					
Jun-03	697,299	353,803	0	697,299	353,803					
Jul-03	592,205	405,355	0	592,205	405,355					
Aug-03	422,678	427,610	0	422,678	427,610					
Sep-03	205,091	399,796	0	205,091	399,796					
Oct-03	263,675	180,443	0	263,675	180,443					
Nov-03	394,288	223,840	0	394,288	223,840					
Dec-03	1,464,633	258,531	0	1,464,633	258,531	13,702,742	3,547,857	0	13,702,742	3,547,857
Jan-04	1,973,974	424,781	0	1,973,974	424,781					
Feb-04	3,916,633	366,266	0	3,916,633	366,266					
Mar-04	3,459,039	423,147	-20,000	3,479,039	403,147					
Apr-04	1,305,985	123,026	0	1,305,985	123,026					
May-04	759,616	45,042	0	759,616	45,042					
Jun-04	336,236	95,039	0	336,236	95,039					
Jul-04	449,905	381,724	0	449,905	381,724					
Aug-04	319,958	405,404	0	319,958	405,404					
Sep-04	278,231	299,316	0	278,231	299,316					
Oct-04	523,137	170,003	0	523,137	170,003					
Nov-04	399,136	227,664	0	399,136	227,664					
Dec-04	765,485	263,441	0	765,485	263,441	14,487,334	3,224,853	-20,000	14,507,334	3,204,853

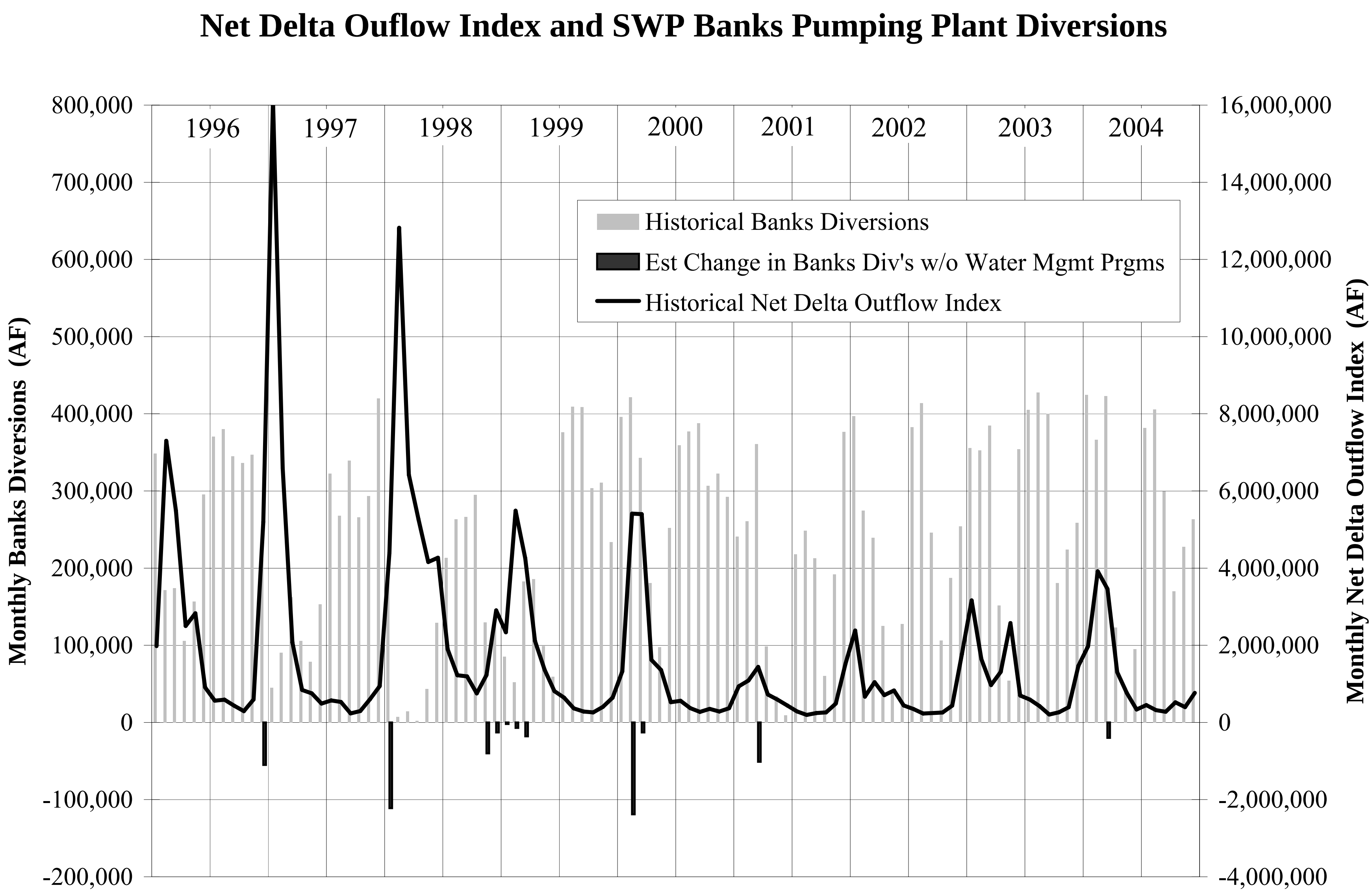
Notes: 1. Historic Net Delta Outflow Index data is from IEP's Dayflow calculations (accessed from http://iep.water.ca.gov/dayflow/output/index.html). Monthly volumes were determined by summing the average daily cfs for all the days in each month and multiplying those sum by 1.983471 to convert from cfs to acre-feet.

2. Historic Total Diversions at Banks Pumping Plant data is from DWR Division of Operations and Maintenance annual and monthly reports of operations. Data for 1996 through 2001 is from the "State Water Project Annual Report of Operations" reports for each of those years, from Table 1. Data from 2002 through 2004 is from the "State Water Project Operations Data" reports for each month, from Table 9.

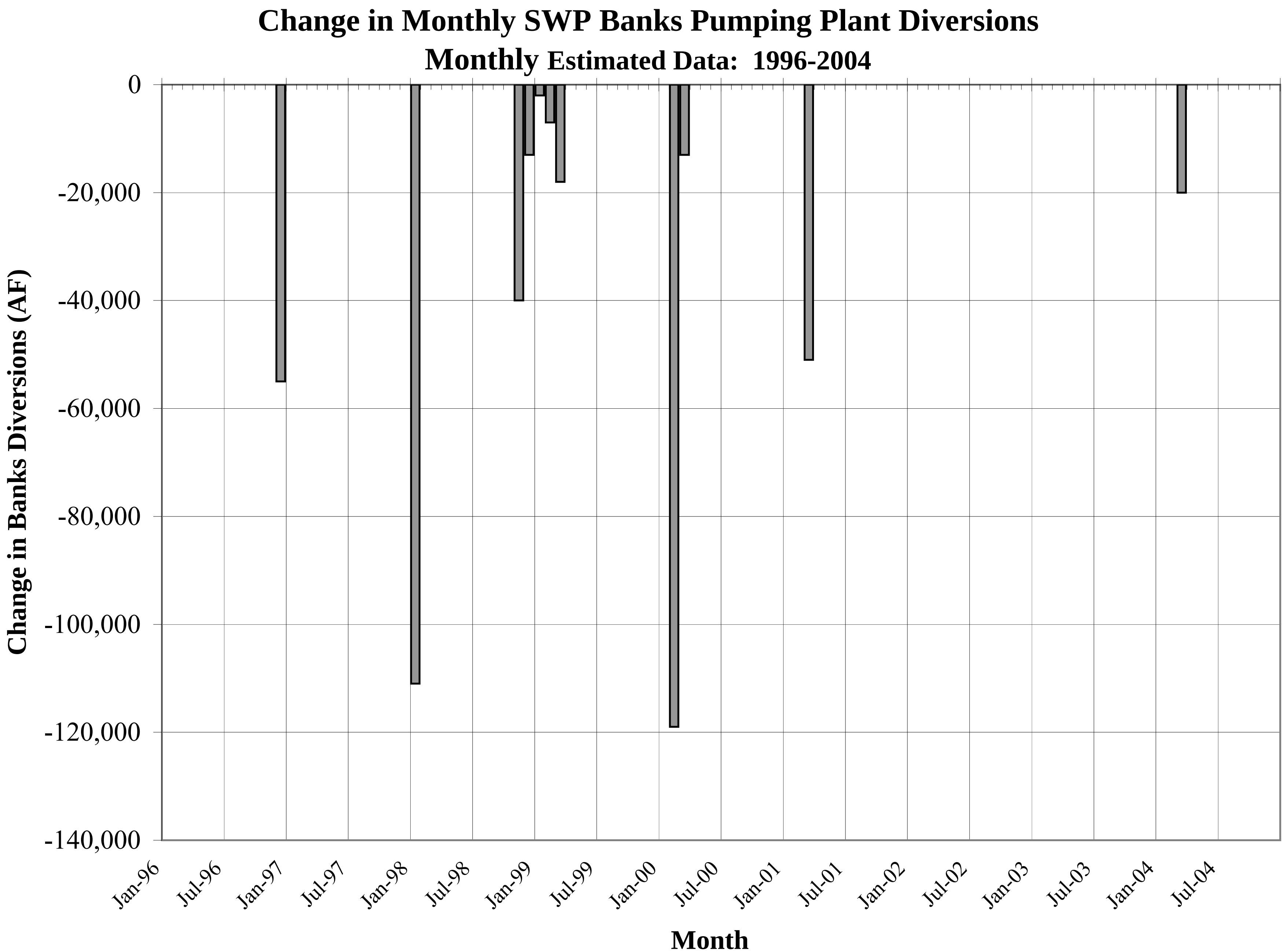
3. Total Diversions at Banks Pumping Plant are total diversions, including diversions for SWP, CVP, and others.

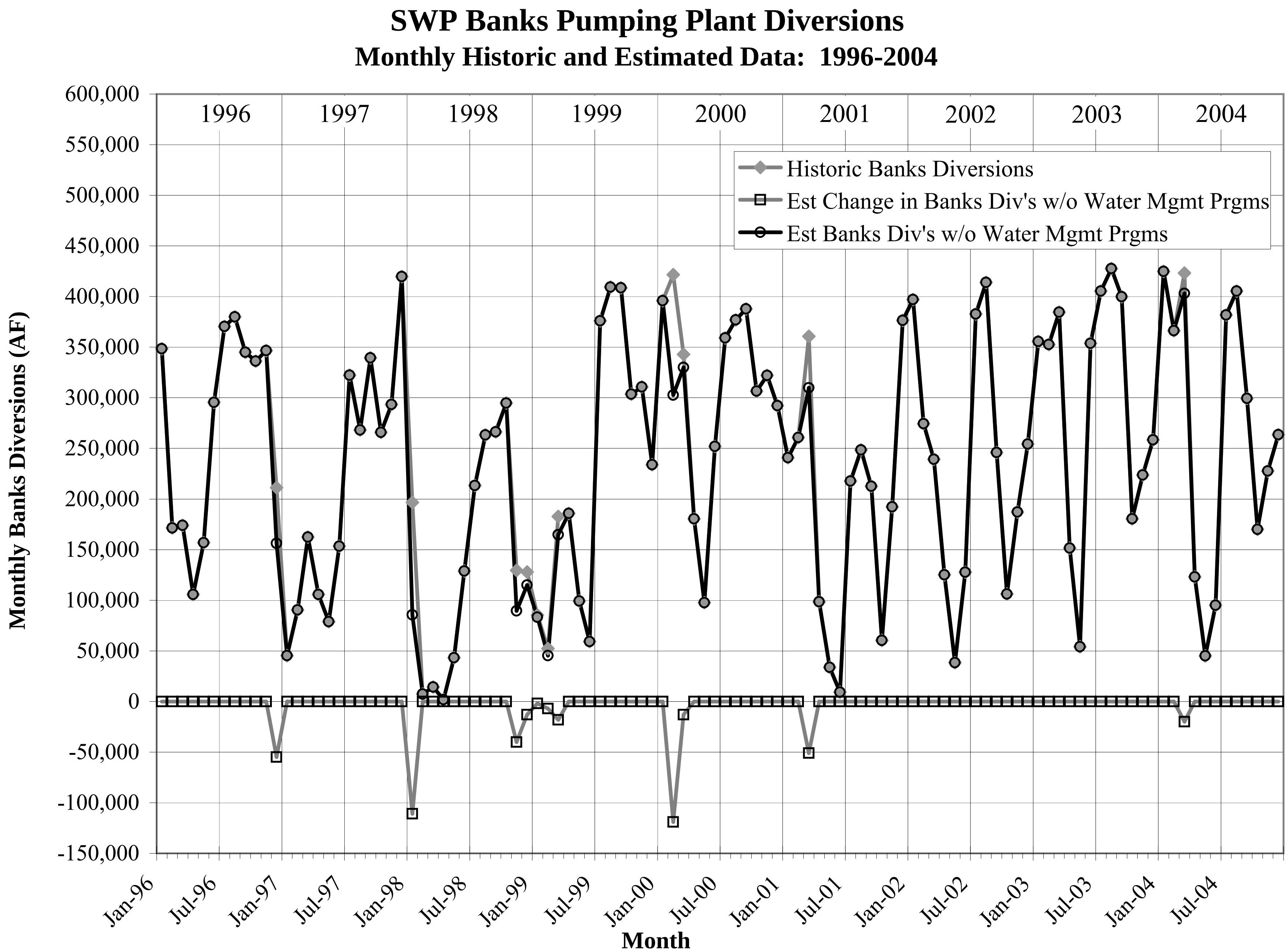
Month where diversions for CVP and/or others is greater than zero (i.e., diversions for SWP purposes is less than amount shown).

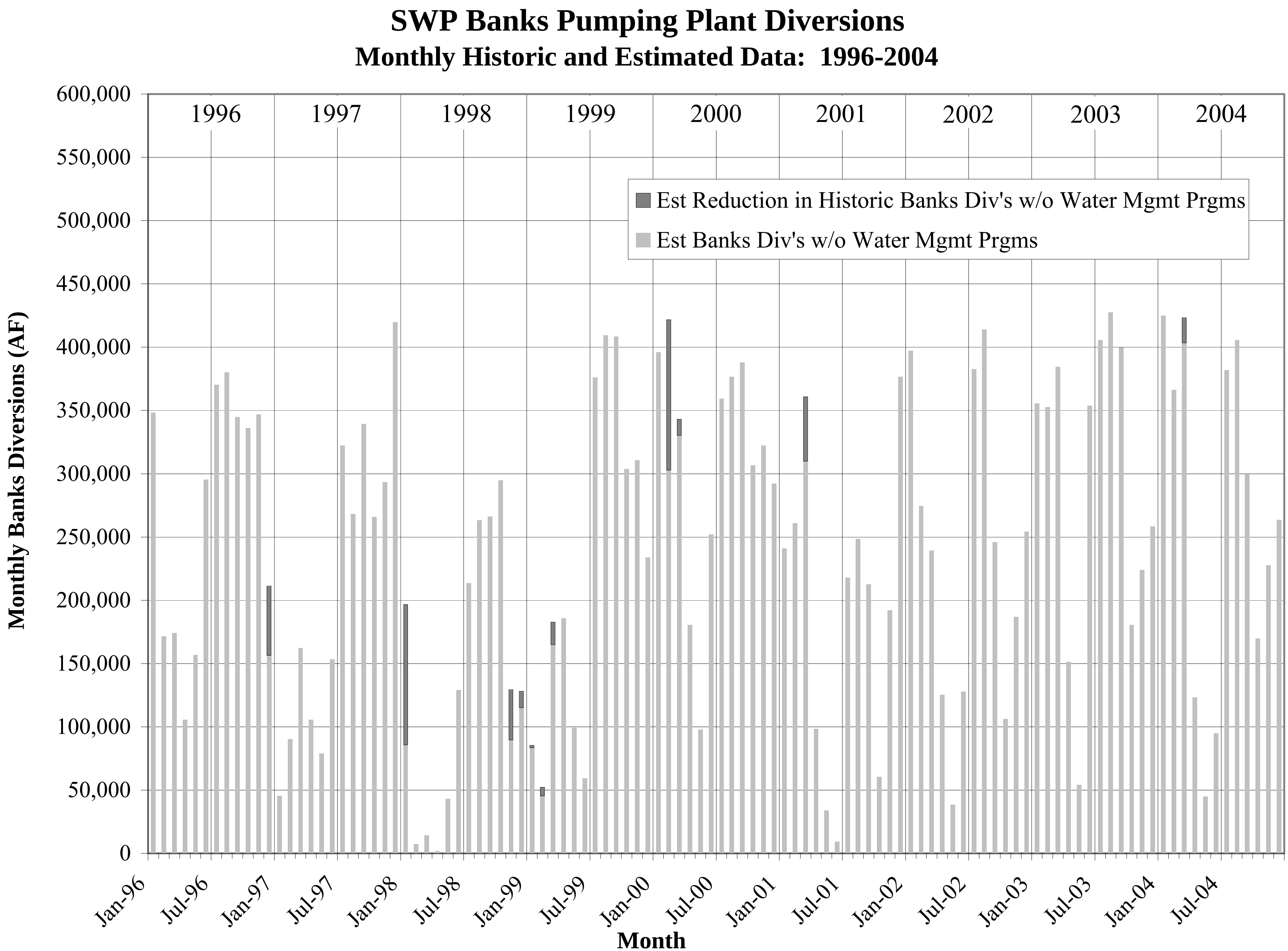

Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions
Monthly Historic Data: 1996-2004
Monthly Delta Outflow and Banks Diversions (AF)
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Historic Net Delta Ouflow Index
Historic Banks Diversions
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month



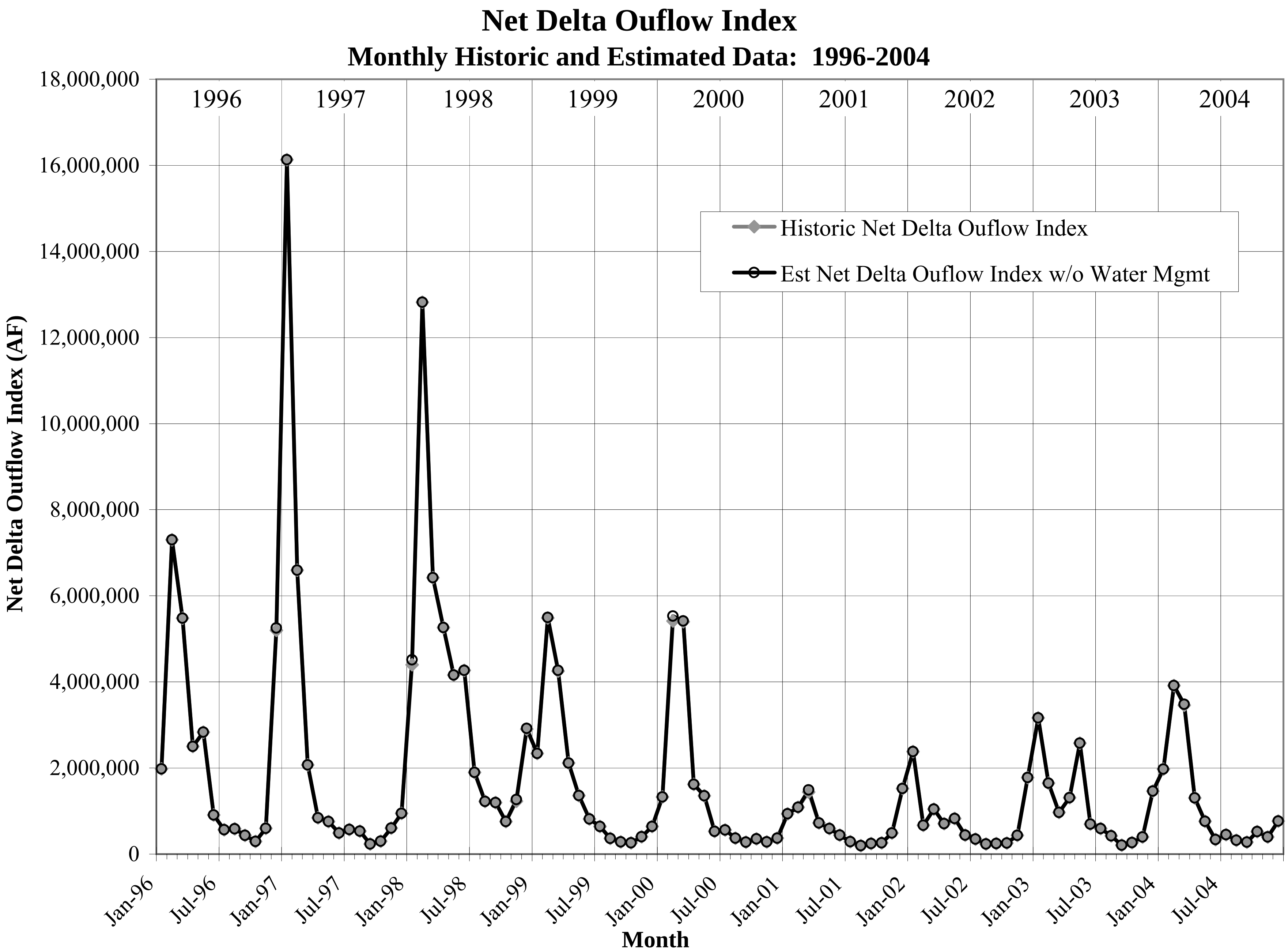
Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions
Historical Banks Diversions
Est Change in Banks Div's w/o Water Mgmt Prgms
Historical Net Delta Outflow Index
Monthly Banks Diversions (AF)
Monthly Net Delta Outflow Index (AF)
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
-100,000
-200,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
-2,000,000
-4,000,000
1996
1997
1998
1999
2000
2001
2002
2003
2004


Change in Monthly SWP Banks Pumping Plant Diversions
Monthly Estimated Data: 1996-2004
Change in Banks Diversions (AF)
0
-20,000
-40,000
-60,000
-80,000
-100,000
-120,000
-140,000
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month

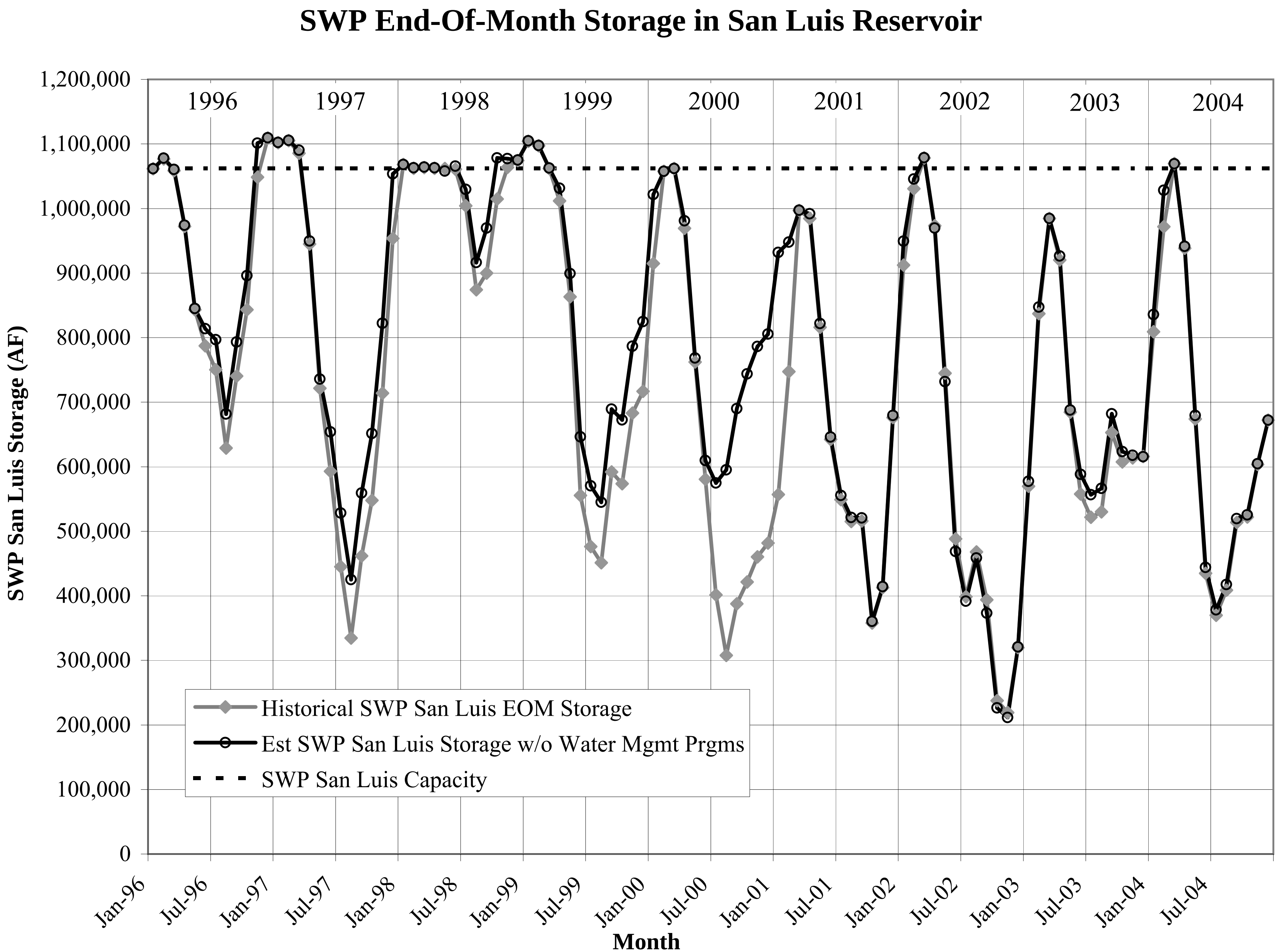

SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004
Historic Banks Diversions
Est Change in Banks Div's w/o Water Mgmt Prgms
Est Banks Div's w/o Water Mgmt Prgms
Monthly Banks Diversions (AF)
600,000
550,000
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
-100,000
-150,000
1996
1997
1998
1999
2000
2001
2002
2003
2004
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month



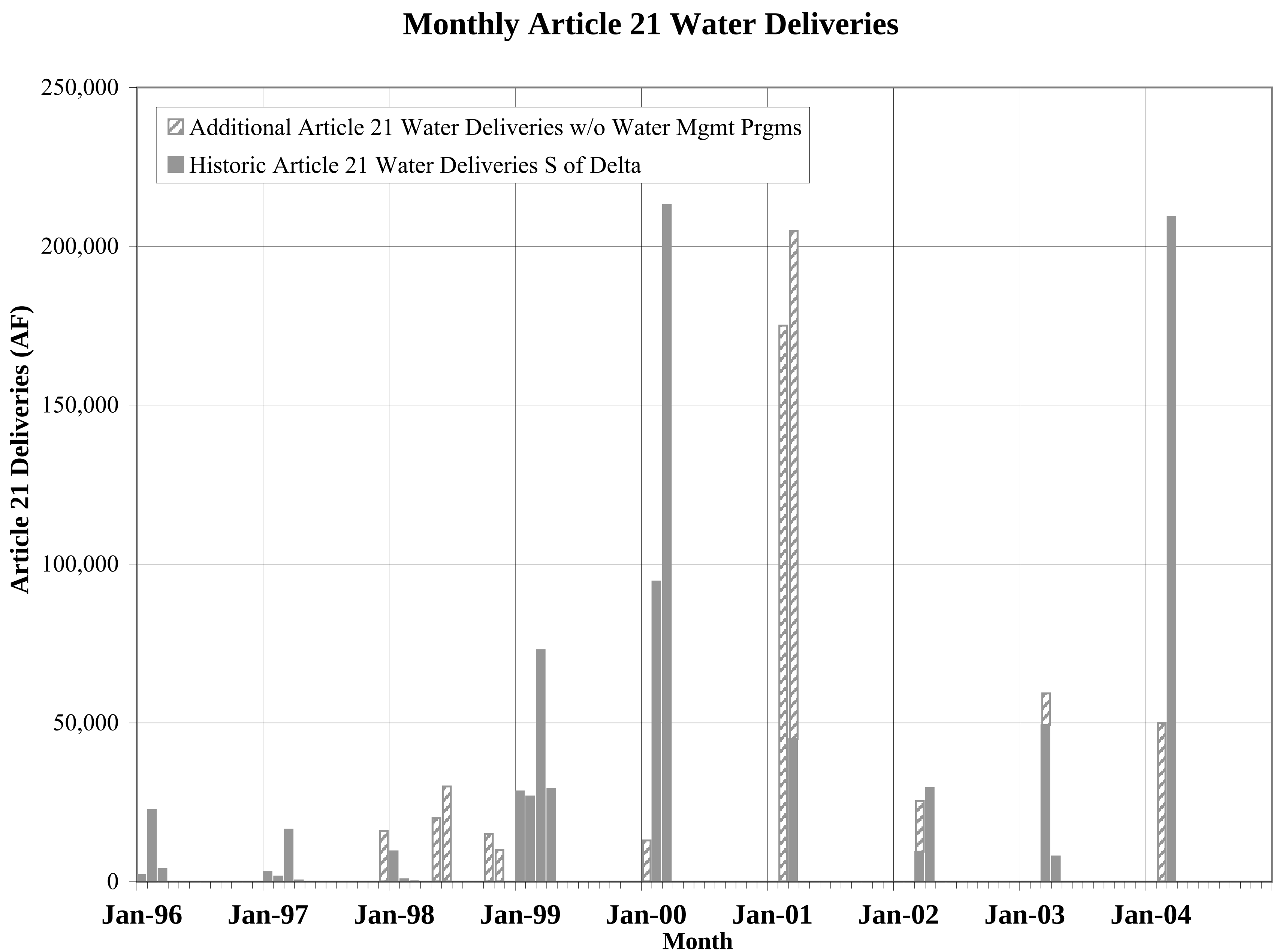
SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004
Est Reduction in Historic Banks Div's w/o Water Mgmt Prgms
Est Banks Div's w/o Water Mgmt Prgms
Monthly Banks Diversions (AF)
Month
1996
1997
1998
1999
2000
2001
2002
2003
2004
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
450,000
500,000
550,000
600,000
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04



Net Delta Ouflow Index
Monthly Historic and Estimated Data: 1996-2004
Historic Net Delta Ouflow Index
Est Net Delta Ouflow Index w/o Water Mgmt
Net Delta Outflow Index (AF)
Month
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04



SWP End-Of-Month Storage in San Luis Reservoir
SWP San Luis Storage (AF)
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Historical SWP San Luis EOM Storage
Est SWP San Luis Storage w/o Water Mgmt Prgms
SWP San Luis Capacity
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Month



Monthly Article 21 Water Deliveries
Additional Article 21 Water Deliveries w/o Water Mgmt Prgms
Historic Article 21 Water Deliveries S of Delta
Article 21 Deliveries (AF)
250,000
200,000
150,000
100,000
50,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Month

L. ANALYSIS OF EFFECTS ON CVP USE OF JPOD (STUDY NO. 6)

Effect of Monterey Amendment (Proposed Project) on CVP Use of JPOD to Fill CVP San Luis Reservoir

Historical

The Department analyzed the historical record to determine whether the Proposed Project had any impact on the CVP share of San Luis Reservoir storage any time between 1995 and 2005. Any impacts would have been confined to those periods when the SWP Banks Pumping Plant was continuing to operate at its full permitted capacity under the Proposed Project in periods when the pumping rate would have otherwise been reduced in the baseline circumstances. There are 12 months in the historical period when the Department estimates such pumping differences occurred.

Each of the 12 months was reviewed carefully to determine whether the CVP would have been likely to want to use Joint Point of Diversion (JPOD) to fill CVP San Luis Reservoir, supplementing the capacity at the Tracy Pumps. The use of JPOD involves added energy costs for the CVP, and the decision whether to use JPOD is also dependent on Reclamations' judgment of whether the CVP share of San Luis Reservoir can be filled using only the Tracy pumps.

The CVP would only use any Banks capacity freed up due to reductions in SWP Delta diversions if storage in CVP San Luis was not anticipated to fill (and power cost considerations might limit that even further). Actual CVP San Luis filled in every year but one year (1997), and in that year was only short by about 40,000 acre-feet. Given conditions in that year, it appears that there was already available JPOD capacity that the USBR chose not to use. Therefore, the Department has concluded that there would have been no additional usage of Banks capacity by CVP during this analysis period, and thus there was no impact of the Proposed Project on the CVP use of JPOD.

Future

The Department also analyzed the potential for future impacts on CVP use of JPOD to fill CVP San Luis Reservoir. The analysis was performed by reviewing CALSIM II data on SWP San Luis storage and CVP San Luis storage from both the 2020 baseline and 2020 Proposed Project model studies to identify candidate years when the CVP might desire to use JPOD. Identification of these candidate years provides the maximum potential for JPOD use by CVP. For a number of reasons discussed in more detail below, it would be extremely difficult to determine in these candidate years whether or not Reclamation would elect to use JPOD, or how the Proposed Project, including the water management provisions not modeled in CALSIM, would have affected this use. Therefore, the analysis focuses on identifying the maximum potential JPOD use to fill CVP San Luis. Any effects of the Proposed Project on CVP JPOD use would likely be considerably less than this maximum potential impact.

Maximum Potential Impact

The analysis focused on those times when the SWP share of San Luis Reservoir was full because those are the times that added pumping at Banks may occur due to the Monterey Amendment actions described for the Proposed Project. While the CVP may seek and use JPOD at other times, the only impact of the Proposed Project on CVP JPOD use would occur when the SWP share of San Luis Reservoir is full and the CVP share is not full.

The analysis was performed by first comparing the timing of fill for the SWP and CVP shares of San Luis Reservoir between the baseline and Proposed Project model studies. Because the timing of fill was nearly identical between the two studies, the analysis focused on specific data from the 2020 Proposed Project study. The next step was to determine if SWP San Luis Reservoir filled; in years when it did not fill there would be no impact on CVP potential to use Banks to fill the CVP share of San Luis because the SWP would generally be making the full use of Banks pumps consistent with upstream releases, Delta inflow, and permitting constraints.

The next step was to determine whether and when CVP San Luis filled. If both CVP and SWP shares of the reservoir filled within a month of each other, it would be unlikely that Reclamation would request the use of Banks to help fill the CVP share of San Luis Reservoir because Reclamation would be able to project that the reservoir could be filled from the Tracy pumps alone, without the added energy costs of CVP JPOD use at Banks. Such years were excluded from the analysis. Also, in years when both CVP and SWP San Luis demonstrated a strong fill rate early, showing a likelihood of CVP San Luis filling by March, it was assumed that Reclamation would not request JPOD use.

In those years when the SWP share of San Luis filled (1,062,180 acre-feet) and the CVP share (965,660 acre-feet) did not fill, or the CVP share filled two months later than the SWP share, the potential for CVP use of JPOD was identified. Those years, and the judgment as to possible JPOD use, are tabulated below.

Table L-1
Analysis of Potential Use of JPOD by the CVP to Fill CVP San Luis Reservoir

Year	Data	Judgment on JPOD Use
1940	SWP filled March, dropped quickly in April; CVP only 644 TAF max	Possibly yes, but brief – less than a month; SWP full only in one month.
1943	SWP almost filled early in December 1942, full in January 1943, slightly lower in February, full again in March; CVP filled late: March	Probably yes.

Year	Data	Judgment on JPOD Use
1951	SWP filled in January; CVP filled late: March	Probably not; CVP nearly full in January and CVP likely assumed could fill on own.
1952	SWP filled in March; CVP at 871 in March, 943 in April	Probably not; CVP likely assumed could fill on own.
1954	SWP filled in March, dropped quickly in April; CVP only at 856 TAF max	Probably yes; brief – less than a month, SWP full only in one month.
1958	SWP filled in March, but nearly full in February; CVP filled late, in April	Probably yes.
1963	SWP filled in March; CVP at 905 at March, 887 April	Probably yes; for a brief period only – month or less.
1966	SWP filled in January; CVP just shy of full in March: 951 TAF	Probably not; CVP likely assumed could fill on own.
1973	SWP filled in January; CVP filled March, nearly full in February	Probably not; CVP likely assumed could fill on own.
1974	SWP filled in March, dropped quickly in April; CVP nearly full in March at 913 TAF, dropped quickly in April	Possibly yes; for a brief period only – month or less.
1975	SWP filled in March; CVP at 924 TAF in March, 919 TAF in April	Probably yes; for a brief period only – month or less.
1978	SWP filled January, CVP filled March	Probably not; CVP likely assumed could fill on own.

From the analysis summary above, it was concluded that the CVP may have wanted to use JPOD to help fill CVP San Luis reservoir in 7 of 73 years, or in other words, there was about a 10% probability of CVP JPOD use. To estimate the maximum potential impact of the Monterey Amendment on CVP JPOD use, it was assumed that all of the possible or probable use identified above would be precluded by the Proposed Project and would not occur. The magnitude of the maximum potential impact was based on CALSIM II output of San Luis storage and a rough estimate of the available fill period. The impact was limited by the amount of the unfilled storage in the CVP share of San Luis reservoir for each year of potential impact. Other factors, listed later in this section, may further limit any impact on the CVP. If CVP San Luis eventually filled, there was no water supply impact.

For each of the above years, the following results were determined:

1940: CVP could have used JPOD for less than a month around the end of March; no more than 100,000 acre-feet (CVP San Luis was 322,000 acre-feet less than full)
1943: CVP filled late March: no water supply impact
1951: CVP filled late March: no water supply impact
1952: CVP could have used JPOD for a month or less in late March-early April, until VAMP; probably would not have requested JPOD considering close to

full; if had requested JPOD, might have filled CVP San Luis (CVP San Luis was 23,000 acre-feet less than full)

1954: CVP could have used JPOD for less than a month around the end of March; no more than 100,000 acre-feet (CVP San Luis was 110,000 acre-feet less than full)

1963: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 61,000 acre-feet less than full)

1974: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 53,000 acre-feet less than full)

1975: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 42,000 acre-feet less than full)

Based on these results, in six of 73 years, or about an 8% probability of occurrence, there could be a water supply impact to the CVP. The maximum potential impact would occur if the Proposed Project completely foreclosed CVP JPOD use in any of those years because Banks was meeting increased SWP diversions related to the Proposed Project. The maximum water supply impact is estimated at a maximum of 100,000 acre-feet in any year, which occurred in two years (about a 3% probability of occurrence), and in smaller amounts ranging from 23,000 to 61,000 acre-feet in four years (about a 5% probability of occurrence). The average of this maximum potential impact over the 73-year study period is about 5,000 acre-feet per year.

Note that given the monthly time step of the CALSIM II model output, the short durations available for JPOD use to fill CVP San Luis when the SWP share is full (frequently less than a month or two), fluctuations in demand as influenced by daily weather conditions, and the daily real-time operation of the Delta, these estimates derived from CALSIM II results are rough approximations. The fisheries evaluation in this EIR provides estimates of the daily impact of the Proposed Project on the availability of added capacity at Banks. The reader may want to review that analysis for added insight into the daily accounting that influences the availability of Banks for JPOD.

Factors That May Reduce Potential Impact

As noted previously, Reclamation does not necessarily use JPOD every time it is available, even when it is unsure of whether it can completely fill CVP San Luis. The maximum potential impacts identified above would be reduced if for financial reasons Reclamation chose not to use JPOD in a particular year (to avoid the added energy costs it would be charged for that use), or if any of a number of operational factors constrained the amount of JPOD pumping that could physically occur. The operational factors that can reduce the magnitude of the maximum potential impact on CVP JPOD use include:

- SWP demands, which would determine the maximum amount of pumping potentially available to the CVP for JPOD use;

- CVP demands from Tracy, and permitted Tracy pumping capacity, which would determine the amount of water pumped at Tracy that could be used to fill CVP San Luis;
- the pumping capacity of the Gianelli Pumping-Generating Plant as a function of the water surface in San Luis Reservoir: the effective pumping rate decreases as the reservoir fills and the head (lift from O'Neill Forebay to the water surface in San Luis Reservoir) increases;
- the difference between the amount of water pumped at Tracy that could be used to fill CVP San Luis Reservoir and the capacity of the Gianelli pumps to lift the water into San Luis Reservoir: if Tracy is already providing sufficient flows to meet the capacity of the Gianelli pumps, there is no need for JPOD; otherwise JPOD use at Banks would be limited to the difference in these rates;
- the number of days that a difference would occur, as influenced by the start of VAMP or an increase in demands requiring releases from San Luis Reservoir;
- use of JPOD by the EWA Program or its successor to repay debt accrued in San Luis Reservoir and to develop EWA assets in San Luis Reservoir. The EWA Operating Principles Agreement grants EWA a 50% share of JPOD when it can use it; this sharing of JPOD is most beneficial to EWA when San Luis Reservoir is full, and would reduce the CVP use of JPOD by 50% in such instances; and
- relevant SWRCB permitting requirements, specifically approved water quality, water level, and fish response plans. If approved plans are not in place, or physical conditions are not acceptable (e.g., Delta water levels are low enough to adversely affect in-Delta diversions), JPOD use may not be allowed.

Note that the effective rate at which the CVP might be able to use JPOD to fill the CVP share of San Luis Reservoir can vary during the period JPOD is available with changes in SWP and CVP demands during that period, changes in the permitted pumping rate at Banks and Tracy, the EWA's need to share JPOD with the CVP, and the decreasing rate of fill of San Luis Reservoir as it nears 100% of total capacity.

The financial and operational considerations discussed above can limit CVP JPOD use in any year, under both baseline and Proposed Project conditions. Whether the Proposed Project would further limit this use would be difficult to determine. While CALSIM II models certain provisions of the Proposed Project (Table A retirement, permanent Table A transfers, and water allocations), it does not model the water management provisions of Articles 54 and 56.

Some of the water management provisions (such as storage outside a contractor's service area under Article 56) might at times result in an increase in SWP water demand, and thereby increase or extend Banks pumping in the wet winter months, with a potential adverse impact on possible CVP JPOD use. However, as contractor demands increase in the future, any demand increases due to these provisions would likely decrease in magnitude and frequency (due to less unused water to store as demand increases), with a corresponding decrease in potential adverse impacts on CVP JPOD use.

Another water management provision, carryover storage under Article 56, would have a beneficial effect on CVP use of JPOD. Under this provision, SWP contractors would leave more of their supplies in SWP San Luis at year-end as a hedge against the next year's allocations, which would have the effect of allowing SWP San Luis to fill earlier in many years and increase the opportunities for the CVP to use JPOD to fill CVP San Luis. It would be difficult to impossible to estimate the impact of carryover storage on San Luis fill dates, and to determine how that earlier fill might free up added JPOD capacity for the CVP. However, there would be some beneficial effect on CVP use of JPOD because of the carryover storage provision of the Proposed Project, which would likely more than offset any adverse impacts due to the potential, occasional demand increases of other water management provisions.

M. ANALYSIS OF EFFECTS ON THE ENVIRONMENTAL WATER ACCOUNT (STUDY NO. 7)

Impact of Monterey on the Environmental Water Account

As described in Section 7.3.1.2, the EWA provides resources to permit flexibility in Delta pumping to provide protection to the fish of the Bay-Delta estuary through environmentally beneficial changes in the operations of the SWP and CVP. These benefits occur by changing project pumping from the Delta, augmenting streamflows, and increasing Delta outflow at times to benefit fish.

The most common action of the EWA Agencies is to reduce pumping at times when fish are most sensitive to the impacts of Delta export pumping. The costs to the EWA program for reductions in pumping are computed as the difference between the permitted pumping rate that otherwise would have occurred and the reduced pumping rate agreed upon by the five EWA agencies at the Banks and C. W. “Bill” Jones pumps for the duration of the curtailment.

The impact of Monterey on EWA will depend on whether there is a higher level of pumping occurring at the Banks pumps as a result of greater water deliveries under Monterey Project conditions at the times that the EWA Agencies initiate pumping reductions at Banks. An impact on EWA can only occur at those times when Delta pumping would otherwise have been cut back to just meet project demands and all SWP storage was full and EWA debt was otherwise paid.

There can be two types of impact during these periods. The first type of impact is an increased cost to EWA because of a higher base pumping level at the Banks pumps during an EWA-initiated pumping curtailment. The second type of impact is a deferral or elimination of EWA’s ability to use Banks capacity to offset prior debt from earlier pumping curtailments. Both types of impact leave EWA with a greater water debt to offset in the future, either through added water purchases or through operational assets.

Figure M-1 provides a graphical guide to determining the times when there could be an impact on the EWA as a result of the Monterey Amendment and other alternatives.

During those times when there could be an impact, the amount of the impact would depend on the duration of an EWA-initiated pumping curtailment (if in effect), the reduced pumping level targeted by the EWA agencies, the distribution of the reduction between the Banks and Jones pumps, contractor requests for deliveries, the baseline Banks pumping rate under the No-Project conditions, the Banks pumping rate under the respective alternatives, and the potential ability for EWA to offset the costs by using operational flexibility at Banks after San Luis Reservoir has been filled and all contractor demands are met.

The complexity of these variables makes estimates of impacts on EWA highly speculative. However, to estimate the frequency with which they might occur, the frequency and duration of the times when there could be an impact can be estimated by review of the historical record from January 1996-December 2004. As noted elsewhere, there were 12 months during this nine-year period when there would likely have been a higher level of pumping occurring at the Banks pumps as a result of greater water deliveries under Monterey Project conditions. Those months are tabulated below together with a notation of the likelihood that EWA pumping curtailments might have occurred, the maximum estimated pumping difference between the baseline pumping and the Monterey Project pumping, and the likelihood that EWA would repay the cost of the curtailment in the same season using operational flexibility.

In some of those 12 months, EWA would have been able to use the operational flexibility at Banks to pump added water to refill San Luis Reservoir before the start of VAMP and repay the added debt incurred during the earlier fish action. This exercise of operational flexibility, granted in the CALFED ROD, would be dependent on whether the additional pumping would be compatible with fish conditions in the Delta and on the availability of sufficient time prior to the start of VAMP to offset the EWA debt.

An estimate of possible EWA costs is also presented in Table M-1 assuming that all of the curtailment was experienced at Banks and none at Jones; the maximum duration of the EWA action would be two weeks; the maximum daily EWA cost would be 2,000 cfs (about 4,000 acre-feet per day, or 56,000 acre-feet maximum in any month); and that the EWA would use operational flexibility to repay debt whenever the action occurred before March. When the action occurred in March, the potential for repayment exists in the first two weeks of April as well as the last part of March, depending on the exact dates of the action; however, the table notes that such while repayment may be possible, no repayment of the debt is assumed, thereby maintaining a conservative analysis.

Table M-1
Estimated Maximum Impact of Proposed Project on EWA Water Costs

Month/Year of Banks Changes	Banks Diversion Change	EWA Action Likelihood?	Was There an EWA Action?	Initial EWA Impact	Can EWA Offset Any Impact?	Maximum EWA Impact
November 1996	53,000	No	N/A	0	N/A	0
December 1996	2,000	Unlikely	N/A	0	Yes	0
January 1998	110,000	Possible	N/A	56,000	Yes	0
November 1998	40,000	No	N/A	0	N/A	0
December 1998	13,000	Unlikely	N/A	0	Yes	0
January 1999	2,000	Possible	N/A	2,000	Yes	0
February 1999	7,000	Possible	N/A	7,000	Yes	0
March 1999	18,000	Possible	N/A	18,000	Possibly	18,000

Month/Year of Banks Changes	Banks Diversion Change	EWA Action Likelihood?	Was There an EWA Action?	Initial EWA Impact	Can EWA Offset Any Impact?	Maximum EWA Impact
February 2000	119,000	Possible	N/A	56,000	Yes	0
March 2000	13,000	Possible	N/A	13,000	Possibly	13,000
March 2001	46,000	Possible	Yes	46,000	No	46,000
March 2004	30,000	Possible	No	0	Possibly	0

The EWA began operation in December 2000. It should be noted that there was only one fish action (March 2001) that coincided with a time when there could have been an impact of the Monterey Project on EWA from 2000-2004. Whether there was an actual impact on EWA costs in March 2001 depends on the exact timing and duration of the fish action relative to the exact period when the added pumping was occurring. Those variables have not been determined, as the analysis has been conducted using a monthly time step. However, in the 2001 historical case, EWA was unable to use operational flexibility at that time to offset accumulated EWA debt in San Luis Reservoir of 203,000 acre-feet for fish actions from January through March 2001 because pumping curtailments for fish were continued into April.

As noted earlier, during those times when Banks pumping continues at a higher rate under Monterey (such as the twelve months identified earlier), the ability of EWA to use its operational flexibility at Banks to reduce previously accumulated debt in San Luis Reservoir may be reduced. Such events would effectively increase EWA's debt and require greater purchases of water to offset EWA debt. The events in 2001 are illustrative of that type of occurrence. The impact of such events is not possible to estimate absent a daily analysis of the historical period, although the estimates for 2001 above include that aspect of the potential impact.

Based on the above analysis, there could be an impact on EWA costs in roughly one-third of years, with the magnitude depending on a range of factors that are not readily predictable. The average impact in the three years out of nine when it is postulated to occur would be about 26,000 acre-feet. The EWA has averaged about 250,000 acre-feet of pumping curtailments at Banks and Jones combined from 2001-2006. Thus the impact of the added burden on EWA from the times when Banks is pumping at its full permitted rate for a greater amount of time with the Monterey Project than it would pump under No-Project conditions would impact overall EWA actions by about 10% in each of the years when such an impact would occur. As noted above, that impact is postulated to occur in one-third of the years.

The future of the EWA is currently under evaluation in context with the decline in pelagic fish species in the Delta. The EWA Program has allowed a relatively small shift in project pumping to benefit fish (an average of 250,000 acre-feet annually out of as much as 4,500,000 acre-feet pumped at Banks and 3,000,000 acre-feet pumped at Jones). Part of the scientific investigation currently underway is intended to determine causes of the decline and indicate the relative magnitude and type of resources needed to address the decline. The ultimate role of the EWA or a successor program is not known at this time.

State funding for the EWA is available through 2008 with no state revenue sources identified beyond that time. The CEQA and NEPA coverage for the EWA currently covers the program through December 31, 2007. A supplement to the EWA EIS/EIR is under preparation to allow extension of the current program until a new long-term EWA program is developed and CEQA/NEPA coverage is in place; an equivalent program for fish protection is developed as part of the Bay-Delta Conservation Planning effort, and its CEQA/NEPA coverage is in place; or the EWA program is terminated.

From the federal perspective, Congress has authorized the EWA Program through 2010, and has authorized $90 million for the program. Annual appropriations are required to continue the program operations.

Thus the continuation of the EWA Program as of the time that this EIR is adopted is uncertain, and the impacts outlined above are estimates based on limited data.

Mitigation Measures

The impacts on EWA can be offset by providing offsetting assets to the EWA or a successor program.

Figure M-1
Evaluation of Potential EWA Impact of Monterey