Appendix A

Alternatives Development Report

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Long-Term Water Transfers

Environmental Impact Statement/Environmental Impact Report

Alternatives Development Report
Public Draft

Prepared by

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Bureau of Reclamation
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Abbreviations and Acronyms

AF	acre-feet
BARDP	Bay Area Regional Desalination Project
BDCP	Bay Delta Conservation Plan
BMPs	best management practices
CALFED	State (CAL) and Federal (FED) agencies participating in the Bay-Delta Accord
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
Delta	Sacramento-San Joaquin Delta
DWR	Department of Water Resources
EA	Environmental Assessment
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ETAW	evapotranspiration of applied water
FONSI	Finding of No Significant Impact
IPR	indirect potable reuse
M&I	municipal and industrial
MUD	Municipal Utility District
NEPA	National Environmental Policy Act
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries Service
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RPA	Reasonable and Prudent Alternative
SLDMWA	San Luis & Delta-Mendota Water Authority
SWP	State Water Project
USFWS	U.S. Fish and Wildlife Service
WaterSMART	Sustain and Manage America’s Resources for Tomorrow
WD	Water District
WUE	water use efficiency

Chapter 1 Introduction

This report describes the alternatives development process and proposed alternatives for the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

1.1 Background

Hydrologic conditions, climatic variability, and regulatory requirements for operation of water projects commonly affect water supply availability in California, making advance planning for water shortages necessary and routine. This variability can strain water supplies in areas that are dependent on delivery of Central Valley Project (CVP) supplies to meet most, if not all, of the water demand. In the past decades, water entities have been implementing water transfers to supplement decreased water supplies and transfers have become a common tool in water resource planning.

The Bureau of Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) are completing a joint EIS/EIR to provide National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) compliance for water transfers from 2015 through 2024. Reclamation is serving as the Lead Agency under NEPA and SLDMWA is the Lead Agency under CEQA. This report refers to Reclamation and SLDMWA jointly as the Lead Agencies.

The EIS/EIR will evaluate water transfers from willing sellers upstream from the Sacramento-San Joaquin Delta (Delta) to buyers that export water from the Delta. Alternatives in this document only analyze transfers of CVP water supplies that require use of CVP or State Water Project (SWP) facilities and transfers of non-CVP water supplies that require use of CVP facilities. The cumulative analysis will include all potential transfers including SWP transfers. The water would be transferred to water users that are at risk of experiencing water shortages and require supplemental water supplies to meet anticipated demands. Water transfers would only be used to help meet existing demands and would not serve any new demands in the buyers' service areas.

In addition to SLDMWA, several other agencies have identified interest in purchasing transfer water to reduce potential water shortages. These agencies have requested to be included in the EIS/EIR. Table 1-1 summarizes all purchasing agencies, further referred to as buyers in this report. Figure 1-1 on the next page shows the location of buyers (referred to as Buyer Service Area) and the sellers (referred to as Seller Service Area).

Table 1-1. Potential Buyers

Contra Costa Water District
East Bay Municipal Utility District
San Luis & Delta Mendota Water Authority Participating Members
Byron-Bethany Irrigation District
Del Puerto Water District
Eagle Field Water District
Mercy Springs Water District
Pacheco Water District
Panoche Water District
San Benito County Water District
San Luis Water District
Santa Clara Valley Water District
Westlands Water District

To make water available, the seller must take an action to reduce beneficial use. Water transfers must be consistent with Federal and State law. Transfers in the Sacramento and San Joaquin area are governed by existing water rights, Delta pumping capacity, and reservoir storage capacity. The following sections describe past water transfers and regulations applicable to implementing water transfers.

1.1.1 History

The Lead Agencies have participated in water transfers through various past programs or agreements. The Central Valley Project Improvement Act (CVPIA), signed into law in 1992, authorizes water transfers between willing parties as long as transferred water is to be used for project purposes or other beneficial uses recognized under State law (Section 3405). As a result, Reclamation has facilitated and implemented CVP-related water transfers between willing sellers and buyers in need of supplemental water supplies. Transfers have included both in-basin and through-Delta transfers.

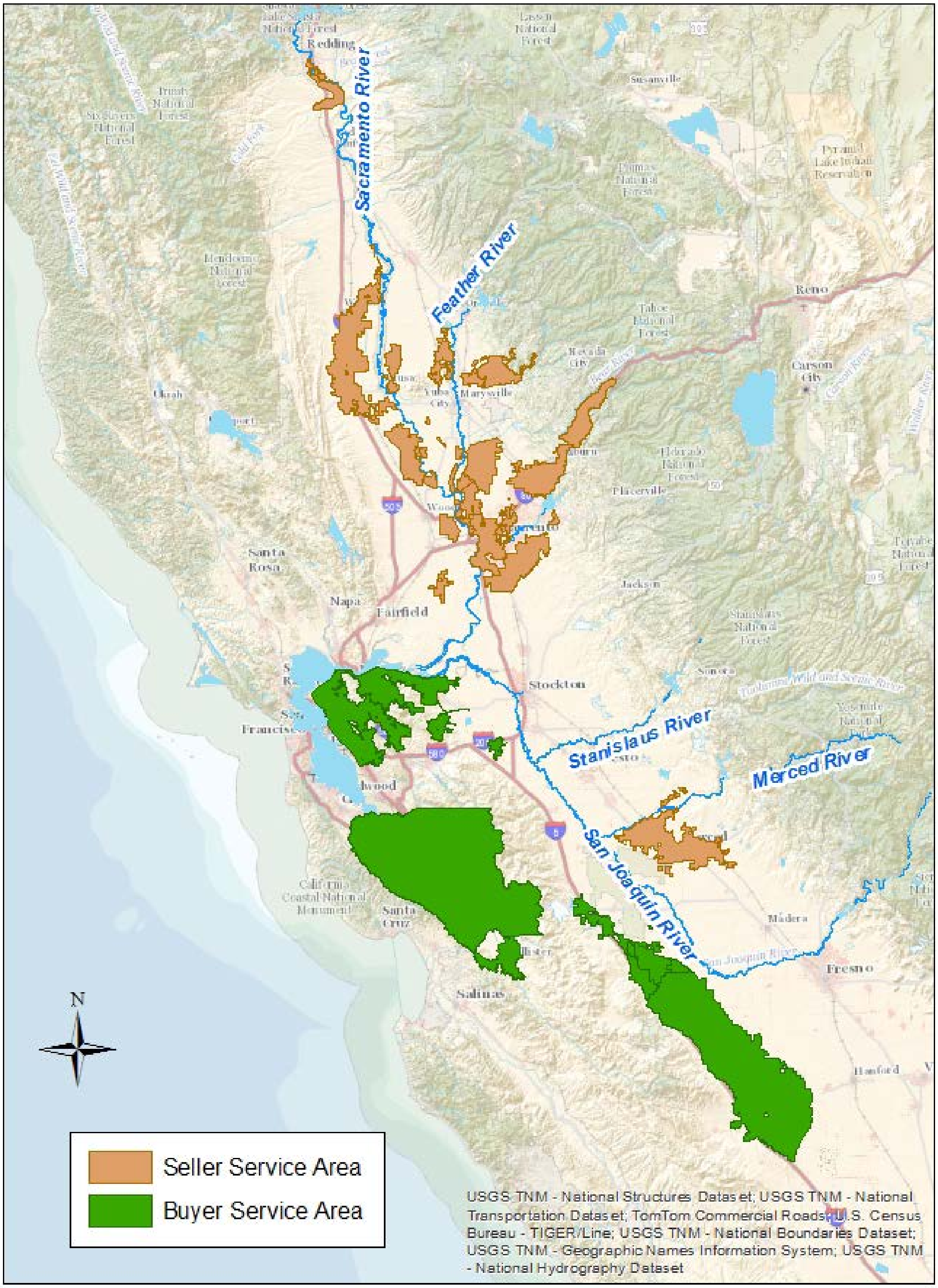

Figure 1-1. Buyer and Seller Service Areas

Reclamation is required to complete NEPA documentation for water transfers. NEPA compliance for transfers has varied in the past decade. Reclamation has developed the following NEPA documents to evaluate multiple through-Delta water transfers:

- Environmental Water Account EIS/EIR - evaluated water transfers from 2003 through 2007.
- Environmental Water Account Supplemental EIS/EIR - evaluated transfers for the 2008 transfer season.
- 2009 Drought Water Bank Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) - evaluated CVP-related transfers that occurred under the 2009 Drought Water Bank.
- 2010-2011 Water Transfer Program EA and FONSI – evaluated through-Delta water transfers for 2010 and 2011 water years. Because of wetter hydrologic conditions, no transfers occurred in 2010 or 2011.
- 2013 Water Transfers EA and FONSI – evaluated through-Delta groundwater substitution transfers in 2013.
- 2014 SLDMWA Water Transfers EA and FONSI – evaluated through Delta transfers made available from groundwater substitution or cropland idling.

Reclamation has also completed multiple EAs that focus on in-basin transfers. In 2010, Reclamation signed two FONSIs for accelerated water transfers and exchanges from 2011 through 2015. One covered transfers between CVP South of Delta Contractors and the other covered transfers between Friant Division and Cross Valley CVP Contractors. Reclamation also worked with the Exchange Contractors, the CEQA lead agency, to complete an EIS/EIR to examine the environmental impacts of the transfer and exchange of the Exchange Contractors CVP water (up to 130,000 acre-feet [AF] per year for the next ten years) within the SLDMWA service area from 2005 through 2014. In 2014, Reclamation completed the 2014 Tehama-Colusa Canal Authority EA and FONSI to assess groundwater substitution and cropland idling transfers within from Sacramento Valley water users to the Tehama-Colusa Canal Authority. Other EAs have been completed for individual, in-basin and out-of-basin transfers.

Reclamation works cooperatively with the California Department of Water Resources (DWR) to develop the *Technical Information for Preparing Water Transfer Proposals* document that provides sellers and buyers with transfer information needed for Reclamation and DWR to facilitate transfers according to CVPIA and State law. Reclamation and DWR have published the paper each year since 2009 and plan to release it annually in the future with updated information on water transfers.

SLDMWA has negotiated water transfers in past years on behalf of the member agencies. SLDMWA member agencies have been identified as a potential buyer in all Reclamation's past transfer programs and many have purchased water in previous years.

While not the subject of this analysis except with regard to cumulative effects, transfers of SWP water have also occurred frequently in the past. DWR facilitates transfers for SWP contractors. DWR has operated several Drought Water Banks to support water transfers during drier hydrologic years, the most recent in 2009. For the 2009 Drought Water Bank, DWR solicited participants and helped connect buyers and sellers. DWR does not plan to implement banks in the future, but continues to facilitate water transfers for SWP contractors. SWP contractors currently identify and negotiate water transfers and submit transfer proposals to DWR.

1.1.2 Regulations Regarding Transfers

1.1.2.1 Federal

The Biological Opinions[1] on the Coordinated Operations of the CVP and SWP (U.S. Fish and Wildlife Service [USFWS] 2008; National Oceanic and Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the Delta from July to September that are up to 600,000 AF in critical and dry years. For all other year types, the maximum transfer amount is up to 360,000 AF. Transfers that exceed these amounts or are outside the transfer window would require new biological opinions. For this EIS/EIR, annual transfers would not reach this capacity and would likely stay in the range of up to 100,000 to 200,000 AF of water transferred annually to buyers.

Several lawsuits were filed challenging the validity of the 2008 USFWS and 2009 NOAA Fisheries Biological Opinions and Reclamation's acceptance of the Reasonable and Prudent Alternative (RPA) included with each (Consolidated Salmonid Cases, Delta Smelt Consolidated Cases). The District Court issued findings that concluded Reclamation had violated NEPA by failing to perform any NEPA analysis before provisionally adopting the 2008 USFWS RPA and 2009 NOAA Fisheries RPA. On December 14, 2010, the District Court found the 2008 USFWS Biological Opinion to be unlawful and remanded the Biological Opinion to USFWS. The District Court issued a similar ruling for the 2009 NOAA Fisheries Biological Opinion on September 20, 2011. On March 13, 2014, the United States Court of Appeals for the Ninth Circuit affirmed in part and reversed in part the finding from the District Court on the USFWS Biological Opinion. The Court of Appeals upheld the determination

[1] A written statement setting forth the opinion of the USFWS or the NOAA Fisheries Service as to whether a federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of a critical habitat. See 16 USCA 1536(b).

that Reclamation must complete NEPA analysis, but it reversed the finding that the scientific basis for the Biological Opinion was arbitrary and capricious. The NOAA Fisheries Biological Opinion is the subject of a future review from the Court of Appeals. Until the legal issues are resolved and new biological opinions are completed (if necessary), the 2008 USFWS and 2009 NOAA Fisheries biological opinions will guide operations of potential water transfers.

Reclamation approves transfers consistent with provisions of the CVPIA and State law that protect against injury to third parties as a result of water transfers. According to the CVPIA Section 3405(a), the following principles must be satisfied for any transfer:

- Transfer may not violate the provisions of Federal or state law;
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver CVP water to its contractors;
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use;
- Transfer will not have significant long-term adverse impact on groundwater conditions;
- Transfer will not adversely affect water supplies for fish and wildlife purposes. Reclamation will not approve any water transfer for which these basic principles have not been adequately addressed; and
- Transfer water must be made available in accordance with the seller's surface water monthly diversion schedule. For example, if the seller's monthly diversion for July is 10,000 AF, then only up to that amount can be transferred in July.

1.1.2.2 State

Several sections of the California Water Code provide authority to carry out transfers. Importantly, Section 1745.07 specifically indicates that transfers fitting within that portion of the Water Code are deemed to be a beneficial use of water and not to interfere with water rights. Section 1745 et seq. also defines types of transfers allowed and protections of water rights and third parties against water transfers. Water Code Section 1810 prohibits owners of conveyance facilities from denying use of unused capacity for transfers upon fair compensation and further specifies that "use of a water conveyance facility is to be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other in-stream beneficial uses and without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred."

1.1.2.3 Local

County governments also have requirements related to transferring water outside of the county, primarily related to groundwater extraction. Reclamation requires transfer participants to comply with local requirements (including ordinances relating to well drilling, well spacing, and groundwater extraction) and local groundwater management plans, as well as compliance with adjudications and with the overdraft protections in Water Code Section 1745 et seq.

1.2 Purpose of the Report

This Alternatives Development Report documents the process to develop the EIS/EIR alternatives. The Lead Agencies are using this structured planning process to delineate a reasonable range of alternatives for evaluation in the EIS/EIR in compliance with NEPA and CEQA.

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Chapter 2
Alternatives Development Process

Both NEPA and CEQA require EISs and EIRs, respectively, to identify a reasonable range of alternatives. To identify and screen alternatives, a structured, documented process was developed that included internal and public scoping (Figure 2-1).

Figure 2-1. Alternatives Development and Screening Process

2.1 NEPA Purpose of and Need for Action/CEQA Project Objectives

The purpose and need statement (under NEPA) and project objectives (under CEQA) describe the underlying need for and purpose of a proposed project. This statement is a critical part of the environmental review process because it helps to set the overall direction of an EIS/EIR, identify the range of reasonable alternatives, and focus the scope of analysis. The Lead Agencies developed the following purpose and need/basic project objectives statement.

2.1.1 Purpose and Need

The purpose of the Proposed Action is to facilitate and approve voluntary water transfers from willing sellers upstream of the Delta to water users south of the Delta and in the San Francisco Bay Area. Water users have the need for immediately implementable and flexible supplemental water supplies to alleviate shortages.

2.1.2 Project Objectives

As required by CEQA, a lead agency must identify the objectives sought by the proposed project. SLDMWA has developed the following objectives for long-term water transfers through 2024:

- Develop supplemental water supply for member agencies during times of CVP shortages to meet existing demands.

- Meet the need of member agencies for a water supply that is immediately implementable and flexible and can respond to changes in hydrologic conditions and CVP allocations.

Because shortages are expected due to hydrologic conditions, climatic variability, and regulatory requirements, transfers are needed in most, if not all years.

2.2 Measure Identification

The public provided comments on the scope of the EIS/EIR during the public scoping period. Some of these comments include suggestions for specific measures intended to address the purpose and need/basic project objectives. The Lead Agencies reviewed the purpose and need/basic project objectives, public scoping comments, scientific data, and previous studies in their initial effort to brainstorm measures. This resulted in an initial list of measures in Table 2-1 (described in more detail in Chapter 3).

Table 2-1. Initial Measures

Measures	Measure Description
Agricultural Water Use Efficiency (Buyer Service area)	Increase agricultural water use efficiency in buyer service area to reduce agricultural water use, including improvements to agricultural systems to increase recapture and reuse of irrigation water
Agricultural Water Use Efficiency (Upstream from Delta Region)	Increase agricultural water use efficiency in seller service area to reduce agricultural water use
Conservation – Municipal & Industrial	Increase water conservation for municipal and industrial uses in buyer service area to reduce water demands
Desalination - brackish	Desalinate brackish groundwater supplies and distribute to Buyer Service area to develop new supply
Desalination - seawater	Desalinate seawater and distribute to Buyer Service area to develop new water supply
Reclamation - nonpotable reuse	Treat wastewater for agricultural water use in Buyer Service area
Reclamation - indirect potable reuse (IPR)	Advance treat wastewater and store in groundwater basins for future potable reuse
Cropland Idling Transfers-rice, field crops, and grains	Idle croplands and transfer irrigation water to buyers
Cropland Idling Transfers-pasture and alfalfa	Idle pasture and alfalfa fields and transfer irrigation water to buyers
Land retirement in San Joaquin Valley	Permanently retire lands in San Joaquin Valley and transfer irrigation water to other croplands
Groundwater substitution	Pump groundwater for irrigation rather than use surface water supplies, and transfer surface water to buyers
New surface storage	Build new surface storage facilities to store water for buyers
Groundwater storage	Build new facilities to recharge and extract groundwater for use in Buyer Service area, or expand existing groundwater storage programs by expanding recharge and extraction facilities
Water rights purchase	Purchase water rights for permanent transfer of water
Delta conveyance	Build canal to increase water deliveries south of Delta

Measures	Measure Description
Crop shifting	Shift from a higher water use crop to a lower water use crop and transfer incremental decrease in water use to buyers
Rice decomposition water	Use alternate method to decompose rice straw and transfer rice decomposition water to buyers
Reservoir release	Transfer available water stored in existing, non-CVP or SWP reservoirs
Transfers within the Buyer Service Area	Implement water transfers between buyers and sellers within the Buyer Service area
Groundwater development	Develop new groundwater supplies by constructing new wells and pumps in the Buyer Service area
Modify CVP and SWP contracts	Change CVP and SWP contracts to limit water use in the Buyer Service area
Change cropping patterns in San Joaquin Valley	Plant lower water use crops or increase fallowed land in the Buyer Service area
Limit dairy and cattle ranches in San Joaquin Valley	Limit dairy and cattle ranches in San Joaquin Valley to decrease water use
Enforce seniority system to manage deliveries	Deliver water supplies based on seniority of water rights
Implement policy of no net increase in water availability for expansion	Prohibit use of CVP supplies for newly developed urban or agricultural lands
Pipe water from Canada and northern states	Purchase water and build distribution system to deliver water from northern states to buyers
Fix Owens Valley	Increase water supply available from Owens Valley

2.3 Screening Methods

The Lead Agencies determined that they should screen the initial list of measures before combining the measure into alternatives. The agencies wanted to carry forward measures that had some potential to contribute to the purpose and need/basic project objectives. They based the measure evaluation and screening on NEPA and CEQA guidance:

- NEPA requires that agencies shall "rigorously explore and objectively evaluate all the reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated" (40 Code of Federal Regulations [CFR] Part 1502.14(a)). The Department of the Interior NEPA procedures (43 CFR Part 46.420(b)) define reasonable alternatives as "alternatives that are technically and economically practical or feasible and meet the purpose and need of the proposed action."

- CEQA Guidelines section §15126.6(a) states, "An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project…" An EIR need not consider every conceivable alternative to a project or alternatives that are infeasible. (CEQA Guidelines, §15126.6(a).) State CEQA Guidelines section 15364 defines feasible as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."

Both NEPA and CEQA include provisions that alternatives meet (or meet most of) the purpose and need/basic project objectives, and be potentially feasible. Some alternatives do not fully meet the purpose and need/project objectives, but may be carried forward for additional analysis because they have potential to minimize some types of environmental effects or help create a reasonable range of alternatives for consideration by decision-makers.

The Lead Agencies determined that they would screen the alternatives based on their ability to meet key elements of the purpose and need/basic project objectives:

- Immediate: the term proposed for this EIS/EIR is 2015 through 2024. This period is relatively short, and measures need to be able to provide some measurable benefit within this time period.
- Flexible: project participants need water in some years, but not in others. They need measures that have the flexibility to be used only when needed.
- Provide Water: project participants need measures that have the capability of providing additional water to regions that are experiencing shortages.

Measures need to meet these three criteria to move forward for further evaluation.

2.4 Alternatives Development

The Lead Agencies screened the measures by applying the screening criteria to each measure based on available information and best professional judgment. The measures that will move forward for more detailed analysis in the EIS/EIR are those that best meet the NEPA purpose and need and CEQA basic project objectives, minimize negative effects, are feasible, and represent a range of reasonable alternatives. Chapter 4 describes the screening results in more detail.

The Lead Agencies combined the remaining measures into alternatives. The remaining measures represent potential methods to transfer water. The alternatives examine different combinations of transfer types, with different potential maximum quantities of transfers.

Chapter 3 Measures

This chapter describes measures identified for the alternatives development process. As described in Section 2.2, these measures were developed based on existing studies, past water transfer actions, and public comments received during the scoping period. Chapter 4 includes an evaluation of the measures relative to the purpose and need for long-term water transfers.

3.1 Agricultural Water Use Efficiency (Buyer Service Area)

For the agricultural water use efficiency (WUE) measure in the Buyer Service Area, districts or farmers would increase irrigation efficiency by implementing best management practices (BMPs) to reduce applied water on crops. This measure would also include improvements to agricultural systems to increase recapture and reuse of irrigation water. Reclamation requires CVP contractors to implement cost-effective, BMPs to manage water use. The CVPIA of 1992 and Section 210(b) of the Reclamation Reform Act of 1982 requires the preparation and submittal of a Water Management Plan from certain entities that enter into a repayment contract or water service contract with the Reclamation. Each plan is required to be updated every five years. Reclamation develops criteria to evaluate plans prepared by CVP contractors to meet the water conservation requirements. Criteria require contractors to identify BMPs for efficient water use and an implementation plan.

This measure would increase WUE above current and proposed practices identified in the water management plans. Districts and farmers would need to identify and invest in additional district-level or on-farm practices to improve irrigation efficiencies.

3.2 Agricultural Water Use Efficiency (Upstream from Delta)

Under this measure, districts or farmers could implement agricultural WUE practices and transfer water savings to the Buyer Service Area. Water savings would be transferrable only if it is considered irrecoverable. Irrecoverable losses include water that currently flows to a salt sink, the ocean, an inaccessible or degraded aquifer, or the atmosphere (CALFED 2000). If the water saving is recoverable, the water can be reused and is not a true savings. Water can only be transferred if there is a reduction in beneficial use; therefore, recoverable losses do not qualify for a transfer. Sellers must prove that the water savings is irrecoverable in order to sell the water for transfer. This measure would also include improvements to agricultural systems to increase recapture and reuse of irrigation water. This measure would increase WUE above the current practices, and for CVP contractors, above the current and proposed practices identified in the water management plans (see Section 3.1).

3.3 Conservation - Municipal and Industrial

Under this measure, agencies in the Buyer Service Area would implement municipal and industrial (M&I) conservation actions to reduce water demands above those that are ongoing or proposed. Santa Clara Valley Water District (WD), East Bay Municipal Utility District (MUD), and Contra Costa WD serve large urban areas in the San Francisco Bay Area and currently implement M&I conservation programs and include demand reduction measures in long-term planning documents:

- In its *2009 Water Use Efficiency Strategic Plan*, Santa Clara Valley WD set numeric targets for water conservation by year 2030 (Santa Clara Valley WD 2008). To achieve conservation targets, Santa Clara Valley WD launched several programs to encourage conservation in homes, businesses, and for landscaping, including a rebate program. Details can be found on the Water Conservation website (www.scvwd.dst.ca.us/programs/waterconservation.aspx).

- East Bay MUD summarized conservation efforts in the *East Bay Water 2010-A Status report on Local Water Use and Water Supplies* (East Bay MUD 2010). To meet the state-wide goal for a 20 percent reduction in water use by 2040, East Bay MUD has implemented the WaterSmart Center (East Bay MUD 2011a). The WaterSmart Center serves as a platform for residential and commercial rebates and programs focused on conservation.

- Contra Costa WD offers several programs for the water consumer to encourage water conservation practices, including rebates for water-smart appliances, lawn & landscaping schedules, and a home water survey. Water conservation program details can be found on the Contra Costa WD conservation website (www.ccwater.com/conserve).

These agencies have determined that they have a demand for transfers in addition to the actions that they are already undertaking related to conservation. For conservation to address potential shortages, it would need to be above the conservation efforts already planned by each agency.

3.4 Desalination

Desalination would create additional water supply through the treatment of seawater or brackish groundwater. Desalination would require water agencies to either construct a new facility or expand an existing facility. Buyers would use the desalinated water to make up for reduced deliveries of CVP water.

3.4.1 Desalination - Brackish

A brackish groundwater desalination facility would require new wells and a reverse osmosis treatment plant to pump and treat brackish groundwater from a basin within the Buyer Service Area. The treated water then would need to be conveyed to water users through new or existing distribution systems. The desalination facility would need to dispose of brine left over from the treatment process. Brine is typically discharged into the ocean; however, alternative inland brine disposal processes may be available such as evaporation ponds, deep well injection, or disposal to a salt sink.

3.4.2 Desalination - Seawater

Seawater desalination is fundamentally similar to brackish groundwater desalination but utilizes a coastal treatment plant that draws nearby seawater as the source. The Bay Area Regional Desalination Project (BARDP) is currently being developed by the Contra Costa WD, East Bay MUD, San Francisco Public Utilities Commission, and Santa Clara Valley WD. The BARDP evaluation selected three potential locations for desalination. The highest ranking plant would be co-located with the existing Mirant Power Plant near the confluence of the Sacramento River, New York Slough, and the San Joaquin River. A pilot study was conducted at Mallard Slough from October 2008 through April 2009, to evaluate potential treatment types for the BARDP. Results from the study indicated that desalination is feasible in the region and that site selection is an important part of the design process (MWH 2010). Three potential transfer buyers are participating in the BARDP.

3.5 Water Recycling and Reuse

Water recycling creates new water supply through either the treatment of wastewater for non-potable uses or by recharging groundwater aquifers with advanced treated wastewater for future extraction for potable uses (indirect potable reuse [IPR]). Both recycling and reuse options require a wastewater source, treatment, and distribution facilities.

3.5.1 Reclamation - Nonpotable Reuse

This measure would provide recycled water for irrigation, landscaping, or other suitable uses. A new or expanded existing tertiary treatment plant would be needed to treat wastewater. This measure would also require construction of pipelines to convey recycled water to new users. Most of the urban districts in the Buyer Service Area have existing wastewater treatment plants and use recycled water within their service area. Plans also exist to increase recycled water use. East Bay MUD developed the Water Supply Management Program 2040 long-term plan to meet future water supply needs, which includes the goal of increasing recycled water use to 11 million gallons per day (East Bay MUD

2011b). Santa Clara Valley WD works with wastewater authorities that operate four wastewater treatment plants in Santa Clara County. Santa Clara Valley WD also has plans to expand recycled water use in the coming years, including working with the City of San Jose to build an advanced water treatment facility that will produce up to ten million gallons per day (Santa Clara Valley WD 2011).

3.5.2 Reclamation - Indirect Potable Reuse

In an IPR project, wastewater that has undergone advanced treatment is stored in a groundwater basin for future potable use. This measure would require construction of an advanced wastewater treatment plant, groundwater recharge and extraction facilities, and a transmission system to connect the facilities. The term “indirect” implies that the highly-treated recycled water does not enter the potable distribution system directly. The treated wastewater would be injected into the groundwater basin through wells or placed in spreading basins to percolate into an aquifer. With adequate residence time, the treated water and groundwater would blend, undergo natural settling/treatment, and then be extracted for potable water supply. Extracted water quality must meet Regional Water Quality Control Board standards.

3.6 Cropland Idling Transfers

This measure involves idling cropland and transferring the irrigation water to the Buyer Service Area. Cropland idling water would be available on the same pattern throughout the growing season as it would have been consumed had a crop been planted. The quantity of water made available from cropland idling is determined based on the evapotranspiration of applied water (ETAW). ETAW is the portion of applied surface water that is utilized by the crop and evaporated from the soil and plant surfaces.

For this alternatives development process, cropland idling measures are separated into two categories based on type of crops eligible for transfers. The first crop idling measure includes rice, field crops, and grain crops, which have been idled in past transfer programs. The second crop idling measure includes pasture and alfalfa, which Reclamation has generally not allowed to participate in transfers in the past because of water accounting challenges.

3.6.1 Cropland Idling Transfers - Rice, Field Crops, and Grains

Table 3-1 shows ETAW values for rice, field, and grain crops that are eligible for idling. The ETAW value, less carriage water losses, would be transferred to the buyer. The irrigation season generally extends from April through September; surface water could be made available during the entire irrigation period. However, because of the regulated transfer period, water can only be moved through the Delta during July through September. Reclamation does not guarantee water prior to July can be stored in CVP reservoirs; therefore, the buyer may only receive a portion of the cropland idling transfer water (ETAW from July through September).

Table 3-1. Estimated ETAW Values (in AF/acre) For Various Crops Suitable for Idling

Crop	ETAW
Bean	1.5
Corn	1.8
Cotton	2.3
Melon	1.1
Milo	1.6
Onion	1.1
Pumpkin	1.1
Rice	3.3
Sudan Grass	3.0
Sugar Beets	2.5
Sunflower	1.4
Tomato	1.8
Vine Seed/ Cucurbits	1.1
Wild Rice	2.0

Source: DWR and Reclamation 2013

3.6.2 Cropland Idling Transfers - Pasture and Alfalfa

Alfalfa and pasture idling have been excluded from past transfer programs due to regional variation in ETAW values. Alfalfa is a perennial crop, and is typically grown for three to four years until yields decline. An alfalfa transfer program would require managers to follow typical harvest and growing practices in spring and early summer. Fields must then be completely disced by July 1 to prevent deep roots from using groundwater during summer months. Water that would have been used to irrigate in July through September would then be made available for transfer. Alfalfa has an ETAW of 1.7 AF/acre from July through September, but only alfalfa grown in the Sacramento Valley floor north of the American River would be allowed for transfers.

Pasture is also a multi-year crop, but the type and quality of pasture may vary significantly. This makes it difficult to assign a specific ETAW value for pasture idling. Like with alfalfa idling, pasture managers would irrigate through spring and early summer, disc fields by July 1, and then generate transfer water July through September. Pasture ETAW would need to be determined on a case-by-case basis.

3.7 Land Retirement in San Joaquin Valley

Land retirement in San Joaquin Valley involves permanently retiring lands from agricultural production and transferring the irrigation water to the buyer. Reclamation is implementing a land retirement program through the San Luis

Unit Drainage Program, which retires land in drainage impaired areas of the San Joaquin Valley. The program aims to retire 194,000 acres of farmland (Reclamation 2006). This measure would retire land in addition to that proposed for the existing program.

3.8 Groundwater Substitution

This measure involves North of Delta sellers pumping groundwater for irrigation in lieu of using their surface water supply. Surface water would then be transferred to the buyer. Transfer water from groundwater substitution would be made available during the irrigation season from April through October. If Reclamation cannot store water prior to the transfer season, irrigators could use surface water from April through June and switch to groundwater in July when surface water can be transferred.

3.9 New Surface Storage

This measure includes building new surface storage facilities to store additional CVP water that could increase CVP deliveries to the Buyer Service Area and reduce potential shortages. Reclamation and DWR are partnering on five surface storage projects that were identified in the CALFED Record of Decision. One project (Los Vaqueros Reservoir Expansion) is already complete and fully utilized; therefore, it does not have available capacity to meet the purpose and need for this effort. The remaining project studies are in various phases of environmental review and feasibility study.

Shasta Lake Water Resources Investigation. This project proposes to raise Shasta Dam to increase water storage for agricultural, M&I, and environmental purposes and encourage Sacramento River salmon population growth. Reclamation has released a public draft EIS/EIR and feasibility report and is working to address comments and finalize these documents (Reclamation 2012).

North-of-the-Delta Offstream Storage. This project proposes to build Sites Reservoir, a new off-stream reservoir in Glenn County, to store additional CVP and SWP water supplies. Reclamation and DWR released a Preliminary Administrative Draft EIS/EIR and Preliminary Engineering Design Report in May 2014 (DWR 2014). The agencies are continuing work towards public draft documents.

In-Delta Storage Project. This project would construct new storage in the Delta region provided by two storage islands and two habitat islands. DWR and Reclamation completed the In-Delta Storage Program State Feasibility Study in 2004 and Draft Supplemental Feasibility Report in 2006. Further work on the In-Delta Storage Project has been suspended since July 2006 (DWR 2013).

Upper San Joaquin River Basin Storage Investigation. This project would construct new storage in the Upper San Joaquin River watershed to expand water storage capacity, increase reliability, and contribute to restoration efforts. Current efforts are focused on a new dam and reservoir between Friant and Kerckhoff dams (Reclamation 2014). Reclamation released a Draft Feasibility Report in February 2014 and is scheduled to complete a Draft EIS/EIR later in 2014 (Reclamation 2014).

3.10 Groundwater Storage

Groundwater storage could include construction of new groundwater storage facilities or becoming a banking partner with an existing groundwater bank. Groundwater banking is defined as the intentional storage of supplies in subsurface aquifers with the expectation of a subsequent retrieval for beneficial use by the depositor (Reclamation 2008). Groundwater storage would allow buyers to acquire and store water throughout the year and carry water over from a wet year to a subsequent dry year when they may experience shortages.

New groundwater storage includes the construction of new facilities to recharge and extract groundwater for use in Buyer Service Area. Groundwater storage requires the ability to recharge water into a groundwater basin and extract it later to return water to the banking partner. Buyers could also increase participation in existing groundwater banks, which would involve negotiating a lease agreement with an entity that operates a groundwater banking program. The agreement would require payment for use of recharge and extraction facilities, as well as charges for occupying or reserving the storage space.

3.11 Water Rights Purchase

A water rights purchase would involve the purchase of an appropriative water right from a private party for the permanent transfer of water to the buyer. The quantity and terms of the water right would become transferrable water. Water rights could either be purchased within the Buyer Service Area or upstream from the Delta. The water rights holder would cease use of the water, which could result in retired agricultural lands. A water rights purchase would require a legal contract and conveyance infrastructure to move water to the Buyer Service Area, if existing infrastructure or exchange agreement is not available. Few water rights purchases have occurred in the region.

3.12 Delta Conveyance

New Delta conveyance includes changes to the existing through Delta CVP and SWP conveyance system to improve water supply deliveries to south of Delta contractors. New conveyance facilities could address restrictions on Delta exports and help reduce associated shortages. The Bay Delta Conservation Plan (BDCP) is investigating potential options for Delta conveyance, including facilities that would divert water from the north Delta and move water it through tunnels to the south Delta. The Draft BDCP and associated Draft EIS/EIR are available for public review.

3.13 Crop Shifting in the Seller Service Area

Crop shifting is the practice of substituting a low water use crop for a high water use crop. The difference in water use from the shift would be available for transfer. Farmers generally rotate between several crops to maintain soil quality, and it may be difficult to predict what would have been planted absent a transfer. To calculate the amount of water made available from crop shifting, agencies would compare the change in consumptive water use (see ETAW values, Table 3.1) during the transfer year to the average water use during a five-year baseline period.

3.14 Rice Decomposition Water

Traditional management practices for rice straw decomposition require surface water diversions in the fall and winter months to flood harvested fields. Under this measure, farmers would use alternate methods to decompose rice straw, such as mechanical chopping and discing or bailing, and would transfer the water that would have been used for flooding to the buyer. About one AF per acre is used for flooding fields. Rice decomposition water is used in the fall and winter after the July-September transfer window. If a transfer occurs, water would need to be stored until the following July, which would put it at risk of spill. The consumptive use of rice decomposition available for transfer is not yet determined.

3.15 Reservoir Release

Reservoir release transfers involve the transfer of available water stored in existing non-CVP or -SWP reservoirs. Transferred water would be limited to the quantity that would not have otherwise been released downstream.

When the willing seller releases stored reservoir water for transfer, these reservoirs are drawn down to levels lower than without the water transfer. To refill the reservoir, a seller must prevent some flow from going downstream. Sellers must refill the storage at a time when downstream users would not have otherwise captured the water, either in downstream Project reservoirs or with Project pumps in the Delta. Typically, refill can only occur during Delta excess conditions when there is more water than the Projects can pump. Additionally, if the non-Project reservoir has a Project reservoir downstream, refill must occur at a time when the Project reservoir cannot capture the water because of flood storage requirements in the reservoir.

3.16 Transfers within the Buyer Service Area

This measure would transfer water from water users within the Buyer Service Area. Transfer participants would shift CVP water supplies to meet irrigation demand or M&I requirements. Transfers occur frequently within the Buyer Service Area. Reclamation has developed EAs to facilitate implementation of in-basin transfers without additional environmental analysis. The first EA covered transfers from 2006 through 2010 for CVP contractors south of the Delta and in the Friant Division. Reclamation has completed two new EAs to continue in-basin transfers from 2011 through 2015:

- 2011-2015 Accelerated Water Transfers and Exchanges between South of Delta Contractors for Contract Years 2011to 2015 as outlined in 2010 EA (Reclamation 2010a).

- Accelerated Water Transfer Program for Friant Division and Cross Valley CVP Contractors from 2011to 2015 as outlined in 2010 EA (Reclamation 2010b).

Reclamation also worked with the Exchange Contractors, the CEQA lead agency, to complete an EIS/EIR to examine the environmental impacts of the transfer and exchange of the Exchange Contractors CVP water (up to 130,000 AF per year for the next ten years) within the SLDMWA service area from 2005 through 2014. Other EAs have been completed for individual, in-basin transfers.

This measure contemplates transfers above those that are already implemented under existing programs.

3.17 Groundwater Development

Under this measure, additional groundwater development would be used to offset CVP delivery reductions. Groundwater development would require the construction of new wells and pumps in the Buyer Service Area to increase groundwater production.

Much of the groundwater resources in the region are already managed through ongoing activities such as the Westlands Water District Groundwater Management Plan (Westlands Water District 1996) and the Santa Clara Valley WD Groundwater Management Plan (Santa Clara Valley WD 2013). Generally, in the Buyer Service Area, groundwater levels fluctuate over time. Monitoring shows substantial drawdown in drier years when more users turn to groundwater supplies because surface water supplies are limited (Westlands Water District 2012, DWR 2006, Santa Clara Valley WD 2013). This action would include groundwater extraction in addition to what is already occurring under existing conditions.

3.18 Modify CVP Contracts

This measure would change CVP contracts to limit water use in the buyer service area. CVP contract modifications would focus on reducing demands in the Buyer Service Area to reduce potential shortages in the future. Such reduction would likely result in land retirement and reduced agricultural production.

3.19 Change Cropping Patterns in San Joaquin Valley

This measure would encourage farmers to plant lower water use crops or increase fallowed land to reduce water demands in the Buyer Service Area. San Joaquin Valley farmers would alter cropping patterns to reduce water deliveries during shortage periods. Such changes would be in addition to those implemented annually by farmers who select crops in response to both water and market conditions. The number of acres now improved with permanent crops either limits cropping pattern change flexibility in the short term or must consider the economic effects of sacrificing investments in the permanent crops.

3.20 Limit Dairies in San Joaquin Valley

This measure would limit the number of dairies in the Buyer Service Area to decrease water demand. Dairy operations would need to relocate to areas outside of the Buyer Service Area. The land could not be used for a different purpose that would involve consumptive use of water to allow the action to produce water to help address shortages.

3.21 Enforce Seniority System to Manage Deliveries

This measure would enforce seniority systems to manage deliveries and water supply would be delivered based on seniority of water rights. CVP deliveries are based on a seniority system where settlement contractors receive waters first and M&I contractors typically receive a higher allocation than agricultural users when supplies are limited.

3.22 Implement Policy of No Net Increase in Water Availability for Urban or Agricultural Expansion

This measure proposes implementing a policy of no net increase in CVP water availability for urban or agricultural expansion. CVP water could not be used to support new urban development or increase the amount of irrigated land in production. This measure would limit CVP water use to existing urban and agricultural uses.

3.23 Pipe Water from Canada and Northern States

This measure would involve the purchase of water from Washington, Oregon, and Canada. A new water source would need to be identified and a purchase contract would need to be implemented that involves crossing state and/or Federal boundaries. Construction of new distribution facilities would be required to deliver purchased water to the Buyer Service Area.

3.24 Fix Owens Valley

The Owens Valley is a main water source for the City of Los Angeles. The city diverts most of the surface water in the valley into the Owens River–Los Angeles Aqueduct system. Additionally, ground water is pumped or flows from wells to supplement the surface-water diversions to the river–aqueduct system. Increased exports caused water levels in the valley to decline and resulted in substantial losses of native vegetation and habitat degradation. The Los Angeles Department of Water and Power is working with local agencies and stakeholders in Inyo County to restore vegetation and improve water management, including conjunctive use of groundwater and surface water supplies. Under this measure, the city would implement identified restoration programs to maintain water supplies from Owens Valley to serve city demands.

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Chapter 4
Measures Screening Evaluation

4.1 Screening Evaluation

The screening process described in Chapter 2 was applied to all measures. As described in Section 2.3, the Lead Agencies developed three criteria to address the purpose and need statement and basic project objectives:

- Immediate: the term proposed for this EIS/EIR is 2015 through 2024. This period is relatively short, and measures need to be able to provide some measurable benefit within this time period.
- Flexible: project participants need water in some years, but not in others. They need measures that have the flexibility to be used only when needed.
- Provide Substantial Water: project participants need measures that have the capability of providing additional water to regions that are experiencing shortages.

If a measure did not meet a criterion, it was considered a fatal flaw and screened out from further consideration. Measures that met all purpose and need criteria move forward to the alternatives formulation phase. The following sections present the evaluation of each measure relative to the above screening criteria. Chapter 3 defines each measure.

4.1.1 Agricultural Water Use Efficiency (Buyer Service Area)

Immediate: no
Flexible: yes
Provide Substantial Water: no

As described in Section 3.2, CVP contractors currently implement WUE BMPs, as required by CVPIA Section 3405(e). Reclamation also supports WUE through the WaterSMART program. This measure proposes additional WUE to existing and proposed plans. As part of the existing plans, CVP contractors have already implemented (or are currently implementing) WUE measures. Additional measures would generally require substantial infrastructure and investment and would not be immediately implementable. Flexibility depends on how the measures are implemented; WUE could be flexible, but the flexibility decreases when the measures are implemented for permanent crops.

The purpose and need for water transfers is to provide additional water to reduce shortages. Buyers are taking actions to address shortages, such as WUE measures, within the No Action/No Project, and these measures would help users accommodate shortages but would not provide any additional supply. Implementing agricultural WUE in the Buyer Service Area would not provide water to users with existing demands affected by CVP shortages.

4.1.2 Agricultural Water Use Efficiency (Upstream from Delta)

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

This measure would be both immediate and flexible upstream from the Delta for measures such as weed control. Agricultural WUE practices can be implemented relatively quickly. Sellers would need to prove that water saved is irrecoverable and reduces a beneficial use. Water could then be sold to buyers. Buyers could call on the transfer annually as needed. Transfer water would provide water to existing demands in the Buyer Service Area to reduce potential shortages.

4.1.3 Conservation – M&I

Immediate: yes
Flexible: yes
Provide Substantial Water: no

Buyers serving urban demands currently implement M&I conservation measures and have incorporated additional measures in long-range plans to meet conservation goals. Measures could generally be implemented within the project timeframe. Conservation could occur year round and implemented in any year. Similar to agricultural WUE, implementing additional M&I conservation in the Buyer Service Area would not provide water to meet existing demands affected by CVP shortages. Additionally, implementing conservation measures in addition to existing planned measures would be challenging because M&I conservation goals are very high under existing conditions.

4.1.4 Desalination – Brackish

Immediate: no
Flexible: yes
Provide Substantial Water: yes

This measure would not be immediate to provide water to reduce shortages from 2015 to 2024. Planning, pilot testing, design, permitting, and construction of a brackish water desalination plant and distribution system take many years. Brackish water desalination would be flexible if the basin is influenced by seawater and water is available year-round for extraction and treatment. This measure could provide enough water to reduce CVP shortages.

4.1.5 Desalination - Seawater

Immediate: no
Flexible: yes
Provide Substantial Water: yes

Planning, pilot testing, design, permitting, and construction of an ocean water desalination plant and distribution system takes many years. The BARDP is still in the planning process. Therefore, operation of ocean water desalination plant would not occur in time to provide substantial benefits during the 2015 to 2024 timeframe. Ocean water desalination would be flexible as water is available year round and could provide enough water to reduce CVP shortages.

4.1.6 Reclamation - Nonpotable Reuse

Immediate: no
Flexible: yes
Provide Substantial Water: yes

Non-potable reuse requires identifying a wastewater source, planning, design, and construction of a wastewater treatment plant, and conveyance to agricultural distribution systems. This measure would not be implemented to provide benefits during the entire 2015 to 2024 timeframe. This measure would be flexible because recycled water would be available year round. Assuming an adequate wastewater source can be identified, this measure would provide water to reduce shortages.

4.1.7 Reclamation - Indirect Potable Reuse

Immediate: no
Flexible: yes
Provide Substantial Water: yes

An IPR project would provide a new potable water source. IPR projects require feasibility studies, pilot studies, design, construction and often a lengthy public education and outreach program. An IPR project would not be implemented in time to provide benefits during the entire 2015 to 2024 timeframe. Water provided by an IPR project would be flexible because it would be pumped from the groundwater basin as needed. Assuming an adequate wastewater source can be identified, this measure would provide water to reduce shortages.

4.1.8 Cropland Idling Transfers - Rice, Field, Grain Crops

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

Cropland idling transfers can occur immediately in that farmers can choose to idle land generally up to the time of planting. Water would be transferred the starting in July of the same year. Cropland idling transfers are also flexible because buyers can use rainfall in the winter months to help predict CVP water needs for the irrigation season. If the transfer water is no longer needed or export capacity appears to be restrictive, buyers could opt out of the transfer without a very large investment. Multi-year contracts would likely include an option fee, but it would not be as large as if infrastructure were developed and no longer needed. Cropland idling can also provide a substantial amount of water for transfer. The Sacramento Valley has extensive irrigated crop acreage and past transfers actions have shown that farmers are willing to idle land and sell irrigation water.

4.1.9 Cropland Idling Transfers - Pasture and Alfalfa

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

Similar to cropland idling for rice, field, and grain crops, pasture and alfalfa idling would also be immediate, flexible and provide water to reduce CVP shortages. Some areas of alfalfa, including the Delta Region and the Sacramento River area south of the American River confluence, would not be allowed for idling because groundwater levels in these regions are relatively high and fields intended for idling may consume groundwater. In these instances, alfalfa idling would not result in a reduction of consumptive use. Because of water accounting issues, Reclamation must evaluate alfalfa idling transfers on an individual basis.

Pasture idling would have less certainty than alfalfa, and would be difficult to verify that consumptive use has been reduced to make water available for transfer. For this reason, pasture transfers are screened out.

4.1.10 Land Retirement in the San Joaquin Valley

Immediate: no
Flexible: no
Provide Substantial Water: no

Under the San Luis Drainage Feature Re-evaluation, Reclamation is working to retire 194,000 acres of drainage impaired farmland. Irrigation water for retired lands will be distributed to other lands in the San Luis Unit. This measure proposes to retire additional land above the 194,000 acres. Identifying and negotiating land retirement agreements with willing landowners would take several years to implement. This measure is not flexible because land would go out of irrigated agricultural production permanently. Further, land retirement does not provide additional water to address basin-wide CVP shortages, but rather provides a way for users to address shortages in the No Action/No Project Alternative.

4.1.11 Groundwater Substitution

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

Under this measure, sellers in the Upstream from Delta Region would use groundwater in lieu of surface water supplies. Surface water would be transferred to the Buyer Service Area. Groundwater substitution transfers would be both immediate and flexible. Farmers can turn on and off groundwater pumps and switch between surface and groundwater supplies at any time. Similar to cropland idling transfers, buyers can negotiate groundwater substitution transfers in the year of the transfer and have flexibility to opt of out the transfer if water is not needed. Groundwater basins in the Upstream from Delta Region can provide substantial amounts of water for local irrigators and allow for CVP water to be transferred to the Buyer Service Area to reduce potential shortages.

4.1.12 New Surface Storage

Immediate: no
Flexible: yes
Provide Substantial Water: yes

Reclamation is investigating new storage opportunities that could increase CVP deliveries. The studies are in the planning phases and projects would not likely be implemented to provide benefits from 2015 through 2024. Once implemented, storage projects would provide water and be flexible.

4.1.13 Groundwater Storage

Immediate: yes
Flexible: yes
Provide Substantial Water: no

This measure would be implemented in the Buyer Service Area. Developing new groundwater storage would require construction of recharge, extraction, and conveyance facilities and could not occur immediately. Participation in existing banks, however, could move forward immediately with existing facilities. Once fully implemented, the measure could be flexible because farmers can pump groundwater for irrigation when needed. The success of groundwater storage, however, depends on having an available source of water to recharge and withdraw later during shortages. Agencies in the Buyer Service Area face water shortages in most years and would not have additional water available for recharge. Without an adequate source of recharge water, this measure would not provide sufficient water to reduce CVP shortages.

4.1.14 Water Rights Purchase

Immediate: no
Flexible: yes
Provide Substantial Water: no

This measure would require identifying and negotiating water right purchases with interested sellers. Few water rights sales have occurred in past years. It may take several years to identify sellers and provide enough water to provide benefits to CVP contractors and undertake the legal process to purchase the water right. Therefore, this measure would not be immediate or provide water.

4.1.15 Delta Conveyance

Immediate: no
Flexible: yes
Provide Substantial Water: yes

Reclamation is studying Delta conveyance measures through the BDCP process. The BDCP is in the early stages of the planning process. It is not likely that a measure would provide be implemented during the 2015 though 2024 timeframe. New Delta conveyance would be flexible and provide water to south of Delta contractors because it would not have the same pumping restrictions that currently exist at Jones and Banks pumping plants.

4.1.16 Crop Shifting in Seller Service Area

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

Similar to cropland idling, crop shifting would also be immediate and flexible. Crop shifting would generally provide less water than a crop idling transfer on a per acre basis; however, because of the extensive irrigated acreage and crop variability in the Sacramento Valley, crop shifting transfer could potentially provide a substantial amount of water to reduce CVP shortages.

4.1.17 Rice Decomposition Water

Immediate: yes
Flexible: yes
Provide Substantial Water: no

Rice water decomposition transfers would be immediate and flexible. Buyers can negotiate with sellers on an annual basis prior to fall flooding. The transfers would be flexible because buyers could opt out if transfer water is not needed. The Sacramento Valley has extensive rice acreage that is flooded during the fall. The schedule of when this water is available, however, means that it cannot provide substantial water when it is needed. Water would be available in the fall after the irrigation season in which it is needed.

4.1.18 Reservoir Release

Immediate: yes
Flexible: yes
Provide Substantial Water: yes

Some agencies in the Upstream from Delta Region have local (non-CVP) reservoirs that could provide water for transfer. Under this measure, sellers would release water stored in local reservoirs for transfer through the Delta to the Buyer Service Area. Water eligible for transfer would not have otherwise been released downstream. Reservoir release transfers are both immediate and flexible. Water would be released from an existing reservoir and conveyed using existing infrastructure. Buyers would have the option of calling on transfers annually prior to the irrigation season and can opt out if needed. This measure could provide water to reduce potential CVP shortages.

4.1.19 Transfers within Buyer Service Area

Immediate: yes
Flexible: yes
Provide Substantial Water: no

Buyers currently transfer water within the basin to help reduce the effects of CVP delivery reductions. Additional transfers could be immediate and flexible to assist water users in selecting where limited water will be applied but would not provide substantial water to reduce CVP shortages. Even after in-basin transfers occur, CVP contractors continue to face shortages.

4.1.20 Groundwater Development

Immediate: no
Flexible: yes
Provide Substantial Water: no

This measure would be implemented in the Buyer Service Area. Groundwater development would require planning, locating, and installing new wells and conveyance to on-farm systems. Planning and construction of the new system would not likely be developed prior to 2015. Once installed, groundwater use is flexible because farmers can turn pumps on or off as needed. New groundwater development in the Buyer Service Area would not provide a substantial supply to water users to reduce CVP shortages. In response to the previous dry years and reduced CVP water supplies, users have pumped additional groundwater for irrigation. As a result, groundwater levels have reduced and typically do not recover without additional recharge. Therefore, new groundwater development would not provide enough water annually to reduce CVP shortages.

4.1.21 Modify CVP Contracts

Immediate: no
Flexible: no
Provide Substantial Water: no

Reclamation has long-term contracts with CVP contractors and cannot modify contracts to reduce contract water supplies. This measure would not provide any water or flexibility to CVP contractors to meet a potential shortage.

4.1.22 Change Cropping Patterns in San Joaquin Valley

Immediate: yes
Flexible: yes
Provide Substantial Water: no

Changing cropping patterns would not reduce potential CVP shortages. Farmers commonly change cropping patterns as normal farm practices and to respond to reduced water supplies or market prices. In the San Joaquin Valley, many farmers have planted lower water use crops to reduce irrigation needs during a particular year. At the same time, in order to support their investments in WUE equipment and higher priced supplemental supplies, many farmers have now planted permanent crops that create the same demand in all years. This measure would not provide enough benefits to farmers experiencing shortages.

4.1.23 Limit Dairies in San Joaquin Valley

Immediate: no
Flexible: yes
Provide Substantial Water: no

This measure would limit new dairies in the Buyer Service Area. There are not many existing dairies in the Buyer Service Area. In addition, Reclamation would need to work with counties or cities to enforce relocation or a policy to restrict new farms. Furthermore, to the extent such farms have an allocation of irrigation water, removing those uses would not necessarily change the need for water to irrigate the same acres. This measure would not provide much, if any, water to alleviate shortages.

4.1.24 Enforce Seniority System to Manage Deliveries

Immediate: no
Flexible: no
Provide Substantial Water: no

Modifying deliveries would need to occur after long-term contracts have expired. Under current contracts, CVP contractors do receive water based on seniority. Settlement and exchange contractors receive water before other CVP contractors. Regardless of seniority, modifying contracts would not provide any additional water. CVP contractors in the Buyer Service Area would continue to face shortage in dry years and due to regulatory restrictions.

4.1.25 Implement Policy of No Net Increase in Water Availability for Agricultural and Urban Expansion

Immediate: no
Flexible: no
Provide Substantial Water: no

This measure would not be immediate or flexible. Agricultural land in the San Joaquin Valley is considered to be fully developed; therefore, a no net increase policy would not be effective for agricultural water supplies. Buyers have also stated they plan to use water for existing demands and transfers would not be used to meet new demands. This measure would also not provide any water to CVP contractors to meet existing demands during a shortage.

4.1.26 Pipe Water from Canada and Northern States

Immediate: no
Flexible: yes
Provide Substantial Water: yes

This measure requires purchasing a water source from Canada or northern states, including Oregon, Washington, or Idaho, and transporting the water to the Buyer Service Area. Infrastructure would be required to move water. This measure would take years to negotiate and implement and would not provide benefits during the 2015 to 2024 timeframe. This measure would be flexible if the water can be called on when needed. This measure would provide water to reduce CVP shortages in the Buyer Service Area.

4.1.27 Fix Owens Valley

Immediate: no
Flexible: no
Provide Substantial Water: no

CVP contractors do not receive water from Owens Valley; therefore, this measure would not be flexible or provide water to reduce CVP shortages.

4.2 Screening Results

Table 4-1 summarizes the screening evaluation results. An “x” indicates that the measure met the criterion. A “-” indicates the criterion was not met and the measure was screened out for further analysis.

Table 4-1. Screening Evaluation Results

Transfer Measures	Purpose and Need Criteria		
	Immediate	Flexible	Provides water
Agricultural water use efficiency (Buyer Service Area)	-	X	-
Agricultural water use efficiency (Upstream from Delta)	X	X	X
Conservation – municipal & industrial	X	X	-
Desalination - brackish	-	X	X
Desalination - seawater	-	X	X
Reclamation - nonpotable reuse	-	X	X
Reclamation - indirect potable reuse	-	X	X
Cropland idling transfers- rice, field crops, grains	X	X	X
Cropland idling transfers-pasture and alfalfa	X	X	X
Land retirement in San Joaquin Valley	-	-	-
Groundwater substitution	X	X	X
New surface storage	-	X	X
Groundwater storage	X	X	-
Water rights purchase	-	X	-
Delta conveyance	-	X	X
Crop shifting in Seller Service Area	X	X	X
Rice decomposition water	X	X	-
Reservoir release	X	X	X
Transfers within the Buyer Service Area	X	X	-
Groundwater development	-	X	-
Modify CVP contracts	-	-	-
Change cropping patterns in San Joaquin Valley	X	X	-
Limit dairies in San Joaquin Valley	-	X	-
Enforce seniority system to manage deliveries	-	-	-
Implement policy of no net increase in water availability for urban or agricultural expansion	-	-	-
Pipe water from Canada and northern states	-	X	X
Fix Owens Valley	-	-	-

4.3 Measures Carried Forward to Alternatives Formulation

The following measures met all purpose and need criteria and will be combined into alternatives to be analyzed in the EIS/EIR:

- Agricultural WUE (Upstream from Delta)
- Cropland Idling Transfers - rice, field crops, grains
- Cropland Idling Transfers - alfalfa
- Groundwater Substitution
- Crop Shifting
- Reservoir Release

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Chapter 5 Alternatives

This chapter presents alternatives developed based on the evaluation described in Chapter 4. Alternatives for the EIS/EIR include different combinations of potential measures and a No Action/No Project Alternative. Transfers would only be implemented through agreements between willing sellers and buyers. The alternatives propose a menu of measures that buyers and sellers can select from to implement a transfer. Some measures in an alternative may not be implemented if there are no willing sellers or buyers interested in that particular measure. The next steps in alternative development will identify willing sellers, proposed transfer measures, and potential quantities for transfer. The Lead Agencies have identified preliminary sellers and transfer quantities for each alternative.

Reclamation's role would be to facilitate transfers that comply with Federal and state law and would not include negotiating transfer measures among buyers and sellers. SLDMWA, on behalf of its member agencies, and other interested buyers would negotiate transfers with willing sellers, including agreeing upon transfer measures and quantities included in the proposed alternatives.

5.1 Alternative 1 – No Action/No Project

CEQA requires an EIR to include a No Project Alternative. CEQA Guidelines Section 15126.6(e)(2) states that "the "no project" analysis shall discuss the existing conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." NEPA requires an EIS to "include the alternative of no action" (40 CFR Part 1502.14(d)).

The No Action/No Project Alternative represents the state of the environment without the Proposed Action or any of the alternatives. Under the No Action/No Project Alternative, some agricultural and urban water users may face potential shortages in the absence of water transfers. To the extent transfer water is not available; there will be demand will go unmet by surface water. Demand may be met by increasing groundwater pumping, idling cropland, reducing landscape irrigation, or rationing water.

5.2 Alternative 2 – Full Range of Transfers

This alternative combines all potential transfer measures that met the purpose and need and were carried forward through the screening process, as identified in Chapter 4. Measures in the Full Range of Transfers Alternative include:

- Agricultural WUE (Upstream from Delta Region)
- Cropland idling transfers – rice, field, grains
- Cropland idling transfers – alfalfa
- Groundwater substitution
- Crop shifting
- Reservoir release

Table 5-1 identifies preliminary sellers and transfers under this alternative. The quantities represent the upper limit for transfer. Because of the uncertainty of hydrologic and operating conditions in the future, it is likely that only a portion of the potential transfers identified in Table 5-1 would occur. Additionally, many agencies are uncertain about whether they would participate through groundwater substitution or cropland idling/crop shifting transfers. They have included their potential upper limit for both types of transfers, but they would not sell the maximum amount of both types in the same year. Entities requiring Reclamation approval that are not listed in this table may decide that they are interested in selling water, but those transfers may require supplemental NEPA and Endangered Species Act analysis to allow Reclamation to complete the evaluation of the transfers. This alternative would be the least restrictive for buyers and sellers and provides the most potential water by offering the whole range of transfer measures. No sellers for rice water decomposition transfers have been identified at this time, but could potentially occur in the future under this alternative.

Table 5-1. Alternative 2 Potential Sellers (Upper Limits)

Water Agency	April – June				July - September			
	Groundwater Substitution	Cropland Idling/ Crop Shifting	Stored Reservoir Release	Conservation	Groundwater Substitution	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation
Sacramento River Area of Analysis								
Anderson-Cottonwood Irrigation District	2,613				2,613			
Conaway Preservation Group	21,550	7,899			13,450	13,450		
Cordua Irrigation District					12,000			
Cranmore Farms	5,140	925			2,860	1,575		
Eastside Mutual Water Company	1,067				1,163			
Glenn-Colusa Irrigation District	12,500	24,420			12,500	41,580		
Natomas Central Mutual Water Company	15,000				15,000			
Pelger Mutual Water Company	2,151	939			1,599	1,599		
Pleasant Grove-Verona Mutual Water Company	8,000	3,330			10,000	5,670		
Reclamation District 108	7,500	7,400			7,500	12,600		
Reclamation District 1004		3,700			7,175	6,300		
River Garden Farms	4,000				5,000			
Sycamore Mutual Water Company	7,500	3,700			7,500	6,300		
Te Velde Revocable Family Trust	2,700	2,581			4,394	4,394		
American River Area of Analysis								
City of Sacramento					5,000			
Placer County Water Agency							47,000	
Sacramento County Water Agency					15,000			

Water Agency	April – June				July - September			
	Groundwater Substitution	Cropland Idling/ Crop Shifting	Stored Reservoir Release	Conservation	Groundwater Substitution	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation
Sacramento Suburban Water District	15,000				15,000			
Yuba River Area of Analysis								
Browns Valley Irrigation District							5,000	3,100
Feather River Area of Analysis								
Butte Water District					5,500	11,500		
Garden Highway Mutual Water Company	6,500				7,500			
Gilsizer Slough Ranch	1,500				2,400			
Goose Club Farms and Teichert Aggregates	4,000	3,700			6,000	6,300		
South Sutter Water District							15,000	
Tule Basin Farms	3,800				3,520			
Merced River Area of Analysis								
Merced Irrigation District							30,000	
Delta Region Area of Analysis								
Reclamation District 2068	2,250	2,775			2,250	4,725		
Pope Ranch	1,400				1,400			
Total[1]	124,171	61,369	0	0	166,324	115,993	97,000	3,100

Note:
[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. Table 5-1 reflects the total upper limit for each agency.

5.3 Alternative 3 – No Cropland Modifications

The No Cropland Modifications Alternative includes the following measures:

- Agricultural WUE (Upstream from Delta Region)
- Reservoir release
- Groundwater substitution

The Lead Agencies developed this alternative because buyers are not certain they are interested in cropland idling and crop shifting transfers due to operational restrictions. Buyers would need to purchase the entire ETAW for a cropland idling or shifting transfer; however, they may only receive the portion of ETAW during the July through September transfer period.

Table 5-2 identifies preliminary sellers and transfers under Alternative 3. Similar to Table 5-1, the quantities in Table 5-2 are maximum amounts and would not likely be transferred each year. Alternative 3 includes less water to be transferred than Alternative 2.

Table 5-2. Alternative 3 Potential Sellers (Upper Limits)

Water Agency	April – June			July - September		
	Groundwater Substitution	Stored Reservoir Release	Conservation	Groundwater Substitution	Stored Reservoir Release	Conservation
Sacramento River Area of Analysis						
Anderson-Cottonwood Irrigation District	2,613			2,613		
Conaway Preservation Group	21,550			13,450		
Cordua Irrigation District				12,000		
Cranmore Farms	5,140			2,860		
Eastside Mutual Water Company	1,067			1,163		
Glenn-Colusa Irrigation District	12,500			12,500		
Natomas Central Mutual Water Company	15,000			15,000		
Pelger Mutual Water Company	2,151			1,599		
Pleasant Grove-Verona Mutual Water Company	8,000			10,000		
Reclamation District 108	7,500			7,500		
Reclamation District 1004				7,175		
River Garden Farms	4,000			5,000		
Sycamore Mutual Water Company	7,500			7,500		
Te Velde Revocable Family Trust	2,700			4,394		
American River Area of Analysis						
City of Sacramento				5,000		
Placer County Water Agency					47,000	
Sacramento County Water Agency				15,000		
Sacramento Suburban Water District	15,000			15,000		
Yuba River Area of Analysis						
Browns Valley Irrigation District					5,000	3,100
Feather River Area of Analysis						
Butte Water District				5,500		
Garden Highway Mutual Water Company	6,500			7,500		
Gilsizer Slough Ranch	1,500			2,400		
Goose Club Farms and Teichert Aggregates	4,000			6,000		

Water Agency	April – June			July - September		
	Groundwater Substitution	Stored Reservoir Release	Conservation	Groundwater Substitution	Stored Reservoir Release	Conservation
South Sutter Water District					15,000	
Tule Basin Farms	3,800			3,520		
Merced River Area of Analysis						
Merced Irrigation District					30,000	
Delta Region Area of Analysis						
Reclamation District 2068	2,250			2,250		
Pope Ranch	1,400			1,400		
Total	124,171	0	0	166,324	97,000	3,100

5.4 Alternative 4 – No Groundwater Substitution

The No Groundwater Substitution Alternative includes the following measures:

- Agricultural WUE (Upstream from Delta Region)
- Cropland idling transfers– rice, field and grains
- Cropland idling transfers– alfalfa
- Crop shifting
- Reservoir release

Public comment received during the scoping period included many concerns regarding groundwater impacts associated with groundwater substitution transfers. The Lead Agencies have developed this alternative to address these comments and create an alternative that could reduce potential environmental effects of the Proposed Action. Table 5-3 identifies preliminary sellers and transfers under Alternative 3. The quantities in Table 5-3 are maximum amounts and would not likely be transferred each year. This alternative has the smallest quantity of water transferred.

Table 5-3. Alternative 4 Potential Sellers (Upper Limits)

Water Agency	April – June			July - September		
	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation
Sacramento River Area of Analysis						
Anderson-Cottonwood Irrigation District						
Conaway Preservation Group	7,899			13,450		
Cordua Irrigation District						
Cranmore Farms	925			1,575		
Eastside Mutual Water Company						
Glenn-Colusa Irrigation District	24,420			41,580		
Natomas Central Mutual Water Company						
Pelger Mutual Water Company	939			1,599		
Pleasant Grove-Verona Mutual Water Company	3,330			5,670		
Reclamation District 108	7,400			12,600		
Reclamation District 1004	3,700			6,300		
River Garden Farms						
Sycamore Mutual Water Company	3,700			6,300		
Te Velde Revocable Family Trust	2,581			4,394		
American River Area of Analysis						
City of Sacramento						
Placer County Water Agency					47,000	
Sacramento County Water Agency						
Sacramento Suburban Water District						
Yuba River Area of Analysis						
Browns Valley Irrigation District					5,000	3,100
Feather River Area of Analysis						
Butte Water District				11,500		
Garden Highway Mutual Water Company						
Gilsizer Slough Ranch						
Goose Club Farms and Teichert Aggregates	3,700			6,300		
South Sutter Water District					15,000	

Water Agency	April – June			July - September		
	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation	Cropland Idling/Crop Shifting	Stored Reservoir Release	Conservation
Tule Basin Farms						
Merced River Area of Analysis						
Merced Irrigation District					30,000	
Delta Region Area of Analysis						
Reclamation District 2068	2,775			4,725		
Pope Ranch						
Total	61,369	0	0	115,993	97,000	3,100

Appendix B

Water Operations Assessment

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Appendix B
Water Operations Assessment

B.1 Background

Hydrologic conditions, climatic variability, and regulatory requirements for operation of water projects commonly affect water supply availability in California. This variability strains water supplies, making advance planning for water shortages necessary and routine. In the past decades, water entities have been implementing water transfers to supplement available water supplies to serve existing demands and transfers have become a common tool in water resource planning.

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) manages the Central Valley Project (CVP), which includes storage in reservoirs (such as Shasta, Folsom, and Trinity reservoirs) and diversion pumps in the Sacramento-San Joaquin Delta (Delta) to deliver water to users in the San Joaquin Valley and San Francisco Bay area. When these users experience water shortages, they may look to water transfers to help reduce potential impacts of those shortages.

A water transfer involves an agreement between a willing seller and a willing buyer. To make water available for transfer, the willing seller must take an action to reduce the consumptive use of water or reduce reservoir storage. This water would be conveyed to the buyers' service area for beneficial use. Water transfers would only be used to help meet existing demands and would not serve any new demands in the buyers' service areas.

Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) are completing a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR), in compliance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), for water transfers from 2015 through 2024. Reclamation is serving as the Lead Agency under NEPA and SLDWMA is the Lead Agency under CEQA. Reclamation would facilitate transfers proposed by buyers and sellers. The SLDMWA, consisting of federal and exchange water service contractors in western San Joaquin Valley, San Benito, Santa Clara, and Stanislaus counties, helps negotiate transfers in years when the member agencies could experience shortages.

This EIS/EIR evaluates water transfers that originate from entities located upstream of the Delta. Purchasing agencies are in areas south of the Delta or in the San Francisco Bay Area. Water transfers are subject to federal and state law.

The transfers included in this EIS/EIR are only those involving CVP supplies or CVP facilities. These transfers require approval from Reclamation, which necessitates compliance with NEPA. Other transfers not involving CVP supplies or use of CVP facilities could occur during the same time period, subject to their own environmental review (as necessary). Non-CVP transfers are analyzed in combination with the potential alternatives in the cumulative analysis.

B.2 Purpose of Water Operations Analysis

An analysis of water operations is necessary to assist in evaluation of potential environmental impacts associated with the Long-Term Water Transfer Project (the Project). Water transfers have the potential to affect both the natural system and operation of the CVP and State Water Project (SWP). The purpose of this analysis is to simulate water made available by various sellers included in the Project, how that water moves through the system and potentially effects operations, and how and where transfer water is diverted by buyers. Output from the water operations analysis for parameters such as stream flow, reservoir storage, Delta outflow, and CVP and SWP Delta exports provides a basis for environmental assessment.

B.3 Analytical Approach

Water transfer analysis is performed with several analytical tools. Separate tools are used to evaluate the surface water and groundwater systems with information and results passed between the tools. Analysis relies on the use and interaction of three different models: CalSim II, the Sacramento Valley Finite Element Groundwater Model (SACFEM2013), and Transfer Operations Model (TOM). Model results of a baseline condition, the No Action/No Project Alternative, without proposed water transfers are compared to model results with proposed water transfers under each Project alternative to determine the extent and significance of any differences resulting from the Project.

CalSim II serves as the basis for simulating the surface water system. A baseline model of CVP/SWP operations for the Sacramento and San Joaquin river systems and the Delta was developed and provided by Reclamation. This model baseline represented the best available model assumptions developed by Reclamation as of January 2014.

Estimated groundwater pumping associated with groundwater substitution transfers was added to baseline groundwater pumping under existing conditions and input to SACFEM2013 to simulate the effects of groundwater substitution transfers on Sacramento Valley aquifers. SACFEM2013 also simulates interaction between groundwater and surface water systems at the streambed interface. Groundwater pumping can affect the surface water system because a hydraulic connection exists between the groundwater and surface water systems in the Sacramento Valley. SACFEM2013 was used to simulate effects on the groundwater system and the change in stream-aquifer interaction. SACFEM2013 model results for the change in stream-aquifer interaction were incorporated into the water operations analysis.

A separate model, TOM, was developed to simulate changes in the surface water system. TOM is a spreadsheet model developed by MBK Engineers to assess how water made available for transfer moves through the river system and is diverted by buyers. Additionally, TOM analyzes how changes in stream-aquifer interaction due to groundwater substitution transfers affect the CVP and SWP. TOM was developed to quickly and effectively assess changes from a variety of transfer sources and mechanisms to a variety of different buyers.

TOM relies on the CalSim II baseline simulation of CVP and SWP operations and then layers on operational changes of water transfers. Post-processing CalSim II results allows for simulation of specific water transfers and their associated constraints while maintaining compliance with the regulatory requirements simulated in CalSim II. TOM uses output from both CalSim II and SACFEM2013 to simulate the operational changes that result from water transfers.

Figure B-1 illustrates the models, input information, and output flow used to in the water operations analysis.

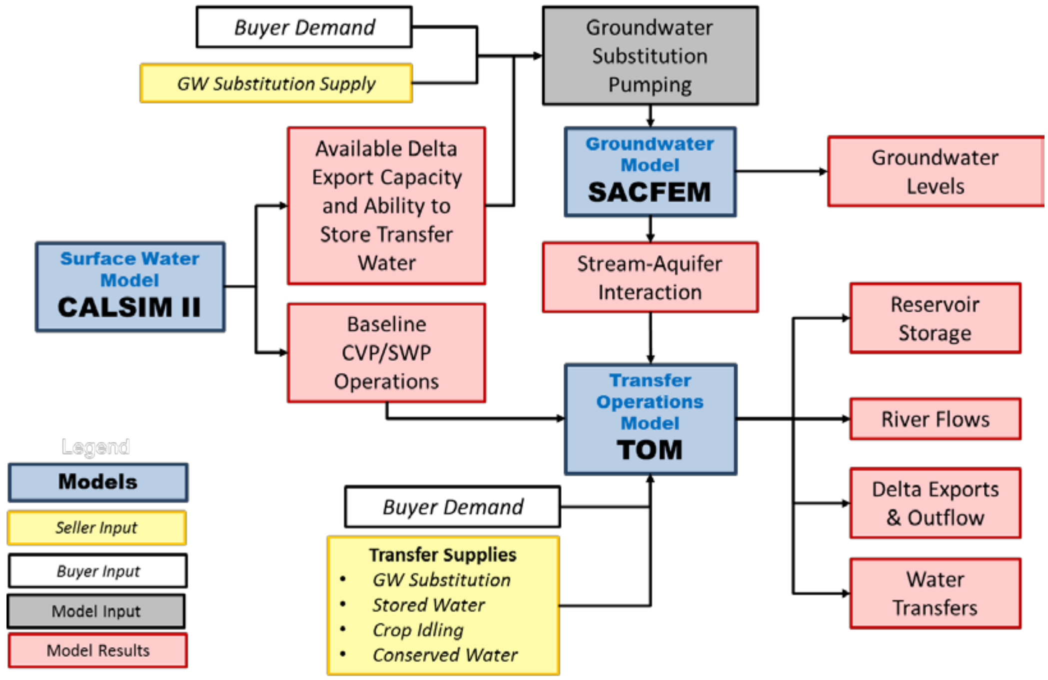

Figure B-1. Analytical Process and Modeling

B.4 Model Descriptions

A description of models used in water operations analysis, primarily CalSim II and TOM, and their underlying assumptions are outlined in more detail in the following sections. A brief description of SACFEM2013 is also provided. Additional documentation and results from SACFEM2013 are presented in Appendix D.

B.4.1 CalSim II

CalSim II is a planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems. CalSim II simulates flood control operating criteria, water delivery policies, in-stream flow requirements, Delta outflow requirements, and CVP/SWP (Project) Delta export operations. CalSim II is the best available tool for modeling CVP and SWP operations and is the primary system-wide hydrologic model used by Reclamation and the California Department of Water Resources (DWR) to conduct planning and impact analyses of potential projects.

CalSim II is a simulation by optimization model. CalSim II simulates operations by solving a mixed-integer linear program to maximize an objective function for each month of the simulation. CalSim II was developed to simulate operation of the CVP and SWP for defined physical conditions and a set of regulatory requirements. CalSim II simulates these conditions using 82 years of historical hydrology from water year 1922 through 2003.

CalSim II modeling conducted for the Long Term Water Transfer Project is built upon the Common Assumption model package, developed jointly by Reclamation and DWR. This model package has been revised and updated to reflect the operational requirements contained in the U.S. Fish and Wildlife Service (USFWS) 2008 Biological Opinion (BO) on delta smelt and the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) 2009 BO on Chinook salmon. Regulatory requirements included in baseline CalSim II simulation, including those specified in the BOs, are summarized in Attachment 1.

Reclamation provided the project team the CalSim II baseline studies in January 2014. The Reclamation study was at a projected future level of development and was consistent with Reclamation's operating assumptions at that time. The project team worked collaboratively with Reclamation modelers to revise the baseline study for an existing level of development, requirements, and projects. This existing level study is used as the baseline and the basis for TOM.

B.4.2 SACFEM2013

SACFEM2013 is a full water budget based, transient groundwater flow model that incorporates all groundwater and surface water budget components on a monthly time-step over the period of simulation. SACFEM2013 provides very high resolution estimates of groundwater levels and stream flow effects due to groundwater pumping within the Sacramento Valley. SACFEM2013 is an application of the MicroFEM© groundwater modeling package. SACFEM2013 simulates a 41-year period, corresponding to historical hydrology from water year 1970 through 2010, on a monthly time-step. Additional information and description of SACFEM2013 can be found in Appendix D.

B.4.3 TOM

TOM was developed to analyze effects of the Long-Term Water Transfer Project on the CVP, SWP, major rivers, and the Delta. TOM was developed to quickly and effectively simulate water made available from various sellers as it moves through the system, the effects on CVP and SWP operations, and diversion of transfer water by buyers. TOM simulates operations on a monthly time-step for the 34-year period, water year 1970 through 2003, common to both CalSim II and SACFEM2013. TOM relies on output from both SACFEM2013 and CalSim II.

Facilitating water transfers in actual operations presents numerous challenges. In real-time operations, transfer water cannot be tracked separately as it moves through the system in the same way it can be tracked and accounted for in a model. Water made available for transfer is released into the system, or not diverted from the system, and managed as part of the total available water within the system at any given time. This requires an increased level of coordination between CVP and SWP operators. When facilitating actual water transfers, CVP and SWP operators identify the volume of transfer water to be made available in advance of the actual transfer. This volume of water is considered when determining operations before, during, and after the transfer period. Transfer water becomes co-mingled with CVP/SWP water and unregulated flows in the system and re-diverted at downstream locations such as CVP and SWP pumping facilities in the south Delta. Transfer water affects accounting under the Coordinated Operation Agreement (COA) between the CVP and SWP, and can require COA accounting adjustments. Transfer water can also change the timing of when CVP and SWP Project water is moved. A portion of transfer water is typically used as carriage water to maintain Delta water quality when transfer water is moved through the Delta. This requires initial estimates for carriage water that must later be verified and adjusted. All the additional accounting and adjustments for transfers are layered onto the already complex task of operating the CVP and SWP for numerous in-stream flow, water temperature, water quality, and water supply constraints.

TOM was developed in consultation with Reclamation and with an understanding of both actual operations and CalSim II model assumptions. Rules used in TOM to simulate operational responses to water transfers and changes in stream-aquifer interaction were reviewed with CVP operations staff. Assumptions and logic used in TOM are described in the following sections.

B.4.3.1 TOM Operations and Assumptions

TOM begins with a baseline CalSim II simulation of the CVP/SWP system and Delta operations, and then layers on water transfer operations. TOM uses information on the timing and volume of transfer water to be made available from various transfer sources as input and simulates the effects of those transfers.

B.4.3.1.1 Buyer Demands and Seller Supplies

The Project team developed estimates of both buyer’s demand for transfer water and seller’s supplies of transfer water. CVP contractors identified as buyers include East Bay Municipal Utility District (MUD), Contra Costa Water District (WD), and the SLDMWA. Annual transfer demands for East Bay MUD were provided directly by the agency. The volume of annual transfer demand for Contra Costa WD was provided the district and the years when demand for transfer water were identified and discussed with the district.

SLDMWA demand for transfer water often exceeds the available capacity to move the water through the Delta. Therefore, an estimate of annual available Delta export capacity was developed from baseline CalSim II output. Available Delta export capacity was used as a surrogate for SLDMWA demand for transfer water from Sacramento Valley sellers. Additionally, water made available by Merced Irrigation District (ID) can be moved to SLDMWA through a variety of facilities that connect the lower San Joaquin River with the Delta-Mendota Canal (DMC) without going through CVP or SWP Delta export facilities. Therefore, additional demands were assumed for SLDMWA in years when CVP south-of-Delta agricultural water service contract allocations were less than 65 percent. In these years, SLDMWA demand for transfer water exceeded Merced ID's available transfer supply and was assumed to be all of the available supply.

Figure B-2 illustrates the annual demands simulated in TOM for each potential buyer with demands for SLDMWA limited by available Delta export capacity and available supply.

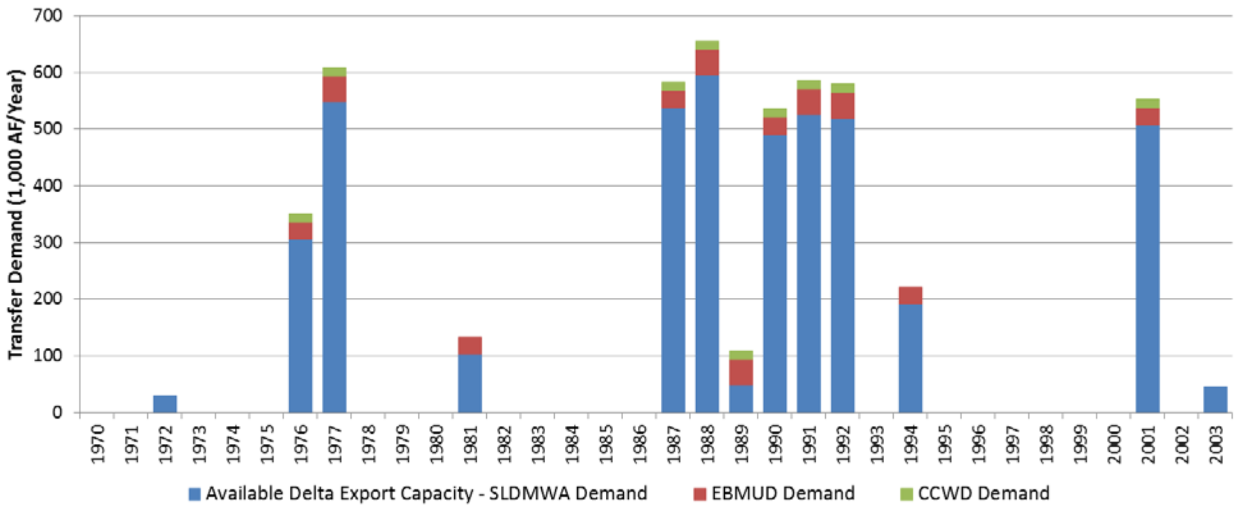

Figure B-2. Annual Demand for Transfer Water by CVP Buyers

The Project team also developed estimates of water supplies that can be made available for transfer from willing sellers interested in participating in the Project. Estimates of available supply were developed in consultation with potential sellers. Sellers include CVP contractors and non-CVP contractors with the ability to provide water to the buyer's points of diversion. Sellers can make water available through several different transfer mechanisms including groundwater substitution, crop idling, conserved water, and reservoir release. Available water transfer supply is typically less than demand for transfer water, and can be less than the available capacity to move the water from seller to buyer. Therefore, the volume of water transferred on an annual basis is typically limited by available water transfer supply. Different alternatives were developed to analyze effects of making transfer water available with different mechanisms. Figure B-3 illustrates annual available supplies for the alternative that includes all transfer mechanisms.

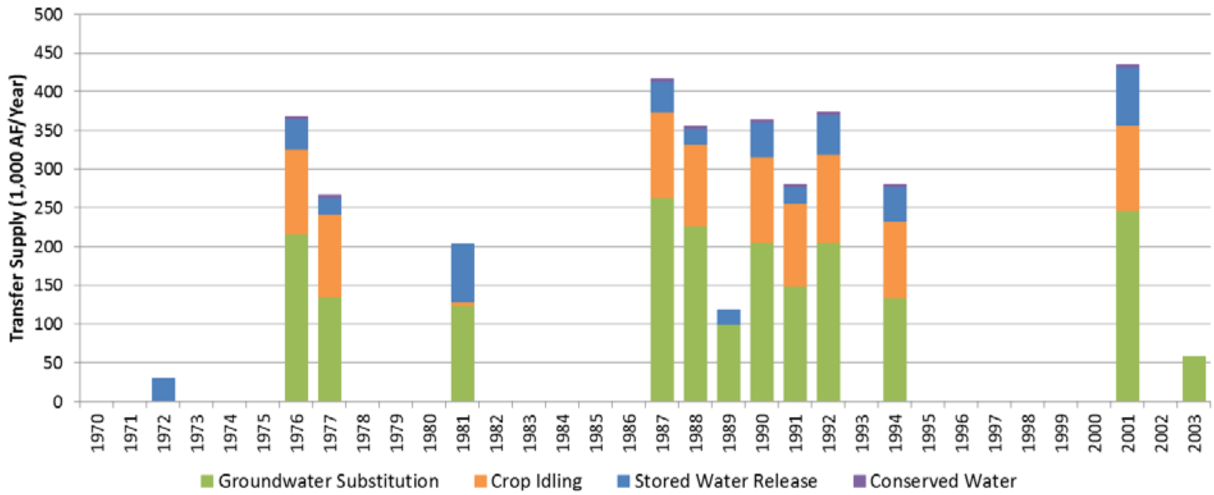

Figure B-3. Annual Available Water Transfer Supply

Comparison of Figure B-2 and Figure B-3 shows demand for transfer water frequently exceeds the available water transfer supply.

B.4.3.1.2 Transfer Operations and Priorities

TOM uses an assumed priority for transfer mechanisms used to make water available under Project alternatives. Transfer mechanisms are prioritized based on the likelihood of the mechanism being utilized and the operational flexibility inherent in the mechanism. For example, groundwater substitution and reservoir release are more likely transfer mechanisms than crop idling and are therefore a higher priority. Groundwater substitution has less operational flexibility than reservoir releases and is given a higher priority. TOM simulates the four transfer mechanisms in the following order:

- Groundwater substitution – for alternatives that include this mechanism
- Reservoir release
- Conserved water
- Crop idling – for alternatives that include this mechanism

Priorities for transfer mechanisms are necessary to develop groundwater pumping inputs to SACFEM2013 and simulate all transfers in TOM. Priorities were developed solely for this purpose.

TOM simulates water made available under each transfer mechanism, subject to various constraints. The following sections describe each transfer mechanism and associated constraints and operational considerations.

B.4.3.1.2 Groundwater Substitution Transfers

Groundwater substitution transfers involve pumping groundwater to meet a demand for water that would otherwise be met from surface water diversion. Surface water not diverted is then available for transfer. The volume of water made available for transfer is the volume of groundwater pumped during the transfer period. Groundwater substitution transfers allow a limited degree of flexibility in the timing of transfer because the transfer period starts and ends based on when groundwater pumping occurs. The Project includes groundwater substitution transfers in the Sacramento Valley. Figure B-4 illustrates annual groundwater substitution transfer supply identified by the sellers for years with available export capacity/transfer demand.

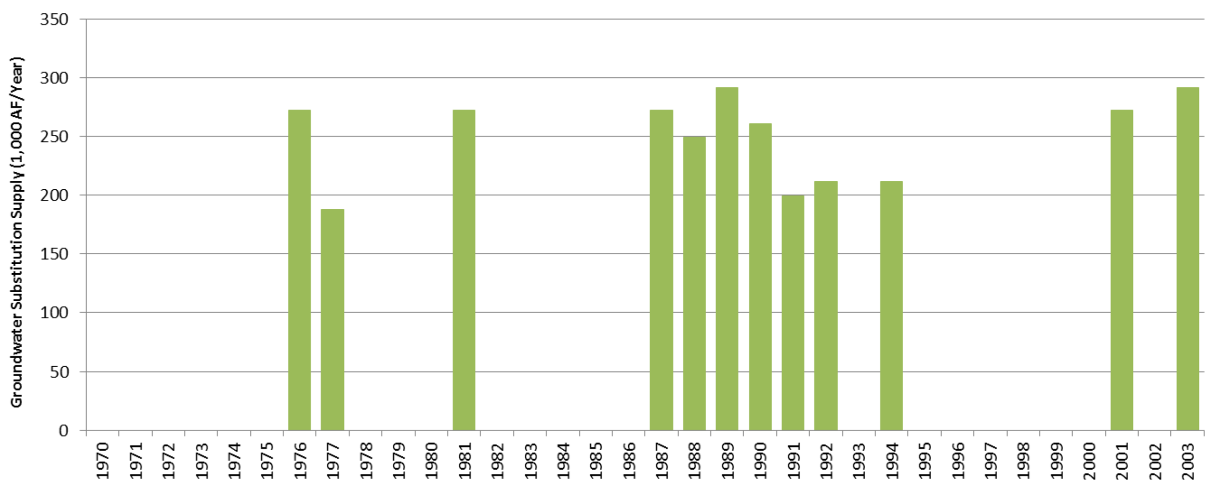

Figure B-4. Annual Groundwater Substitution Transfer Supply

Groundwater substitution transfers from the Sacramento Valley have the potential to create changes in stream-aquifer interaction that affect other parts of the water delivery system. Change in stream-aquifer interaction can be determined by comparing SACFEM2013 results from a baseline, without-transfer simulation to a with-transfer simulation that includes groundwater substitution pumping. Change in stream-aquifer interaction is calculated at each stream node for rivers and streams explicitly modeled in SACFEM2013. Changes are aggregated for nodes above specific locations that affect CVP/SWP operations, such as Wilkins Slough on the Sacramento River or total Delta inflow. Changes in stream-aquifer interaction due to groundwater substitution transfers include increased stream loss to the aquifer and decreased aquifer contribution to stream flow.

Figure B-5 illustrates the time-series of total change in stream-aquifer interaction in the Sacramento Valley (at the Delta) that result from groundwater substitution transfers proposed in the Project. Change in stream-aquifer interaction illustrated in Figure B-5 is a reduction in Delta inflow.

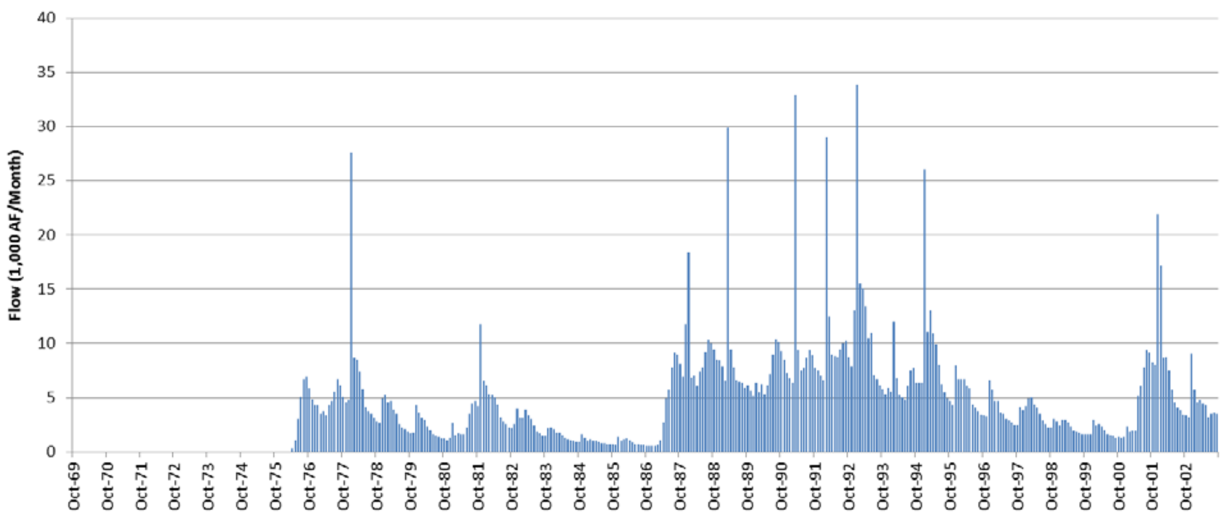

Figure B-5. Total Change in Stream-Aquifer Interaction due to Groundwater Substitution Transfers

The timing of when changes in stream-aquifer interaction reduce stream flow is the key to understanding and simulating how changes may affect CVP/SWP operations. CVP/SWP operations will change in response to reduced stream flows under two conditions:

- When stream flow at minimum flow compliance locations (such as the Sacramento River at Wilkins Slough, the lower Feather River, or the American River at H Street) is at minimum levels and controlling upstream reservoir release.

- When the Delta is in balanced conditions.

The Delta can be in either a balanced or surplus condition. Balanced conditions, as defined in COA, are those periods when DWR and Reclamation agree that releases from upstream reservoirs plus unregulated flow approximately equals the water needed to meet Sacramento Valley in-basin uses plus exports. Conversely, excess or surplus conditions are periods when it is agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses plus exports. Sacramento Valley in-basin uses include Delta water quality.

TOM simulates how changes in stream-aquifer interaction affect CVP and SWP operations. Time-series of the change in stream-aquifer interaction calculated from SACFEM2013 results for specific locations that affect CVP/SWP operations are input to TOM. Logic in TOM simulates changes in CVP/SWP operations that occur as a result of these changes in stream flow.

Stream flow reductions when the Delta is in surplus and river flows exceed minimum flow requirements will not affect CVP/SWP operations. During these periods TOM simulates the reduction in stream flow in the major river systems and Delta outflow. Surplus conditions occur approximately half of the time. Figure B-6 illustrates changes in stream-aquifer interaction that occur during Delta balanced and surplus conditions.

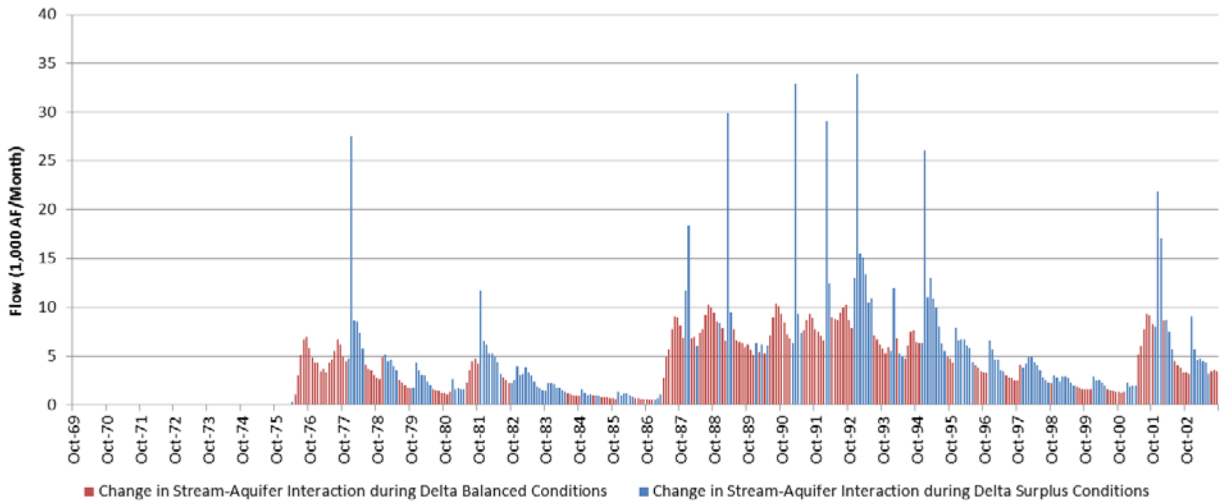

Figure B-6. Change in Stream-Aquifer Interaction during Delta Balanced and Surplus Conditions

During periods when the Delta is in balanced conditions and/or flows on affected rivers and streams are at minimum flow requirements the CVP/SWP would respond to stream flow reductions that result from groundwater substitution transfers. TOM assumes the CVP/SWP will fully compensate for changes during these periods to maintain compliance with regulatory requirements. TOM includes logic to simulate the CVP/SWP operational response based on the location of the change in stream flow and CVP/SWP conditions. For example, the CVP would respond to reductions in Sacramento River flow at Wilkins Slough by increasing release from Shasta to comply with minimum flow requirements at that location. TOM simulates these types of operational responses.

There can be a variety of operational responses to changes in Delta inflow. TOM uses assumptions based reservoir storage conditions, minimum flow requirements, the portion of CVP and SWP water in the Delta, COA accounting, and Delta exports to simulate these operational responses by the CVP and SWP. Operational responses include increased release from upstream reservoirs and decreased Delta exports.

Changes in Delta inflow affect the CVP and SWP differently based on system conditions at the time and COA accounting. The obligation of each project to respond to reductions in Delta inflow is generally governed by the accounting split illustrated below in Figure B.7. However, during some periods the CVP may already be providing water in excess of the COA obligation and the CVP's ability to export CVP water at Jones. In these instances, the effects of reductions in Delta inflow as a result of groundwater substitution transfers primarily affect the SWP.

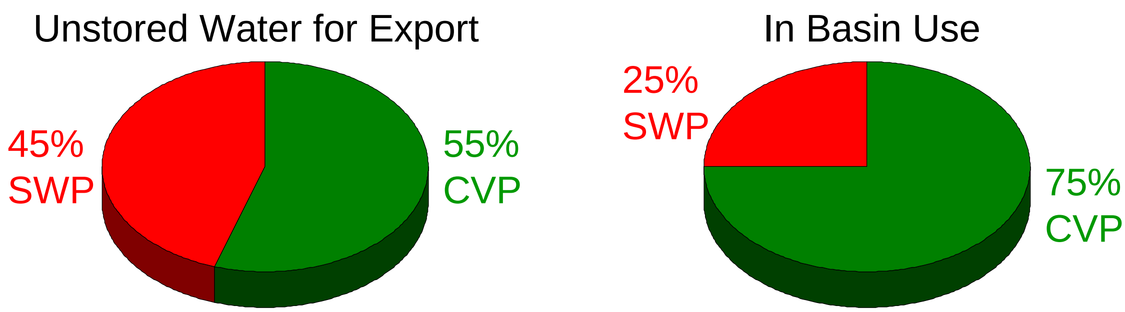

Figure B-7. COA Accounting

B.4.3.1.3 Reservoir Release

The Long-Term Water Transfer Project includes reservoir release transfers from four water districts who own and operate reservoirs that can provide water to CVP buyers. These agencies and associated reservoirs are Placer County Water Agency and the Middle Fork Project (MFP) reservoirs of French Meadows and Hell Hole on the American River upstream of Folsom Reservoir, South Sutter WD and Camp Far West Reservoir on the Bear River, Browns Valley ID and Merle Collins Reservoir on French Dry Creek a tributary to the Yuba River, and Merced ID and Lake McClure on the Merced River.

In most instances, reservoir release transfers offer a higher degree of flexibility than other transfer mechanisms. Reservoir releases can be timed to coincide with available capacity and modified to accommodate other regulatory restrictions.

Annual volumes of water available through reservoir release transfers were developed and provided by the sellers. Annual time-series were input to TOM. TOM simulates operation of the seller's reservoirs to analyze the effects on reservoir storage, flow downstream, and reservoir refill. Figure B-8 illustrates the annual volume of reservoir release water available from each seller in years with available export capacity/transfer demand.

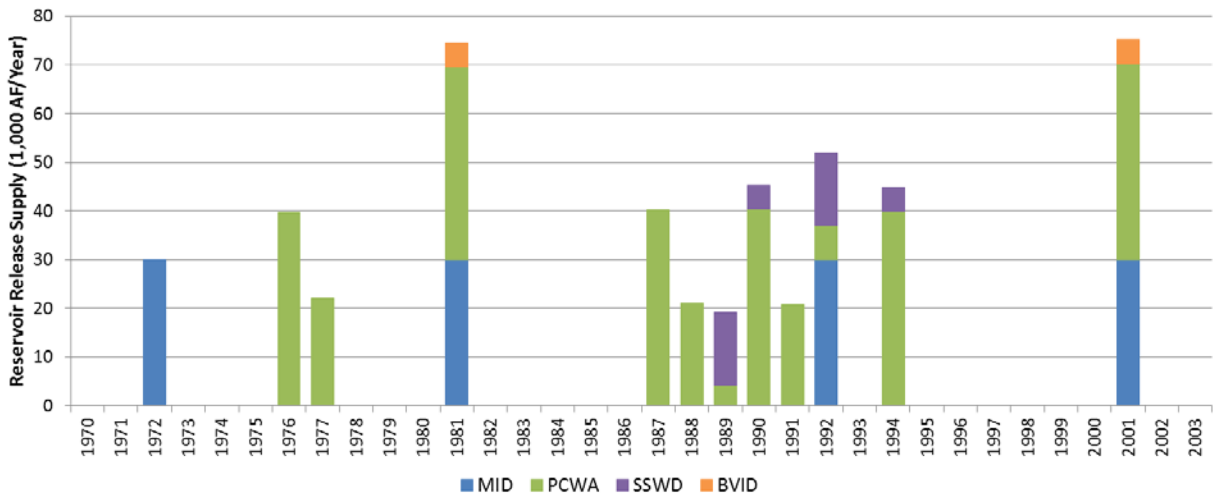

Figure B-8. Annual Reservoir Release Transfer Supply

Transfer water released from Placer County Water Agency's MFP reservoirs flows into and through Folsom Reservoir. Transfer water made available from Placer County Water Agency must be in Folsom before being released for transfer, or moved through Folsom during the transfer, i.e. transfer water is not released from Folsom before being released from Placer County Water Agency reservoirs. Placer County Water Agency provided output from their MFP model for both a baseline and with-transfer scenario. Output included reservoir storage in French Meadows and Hell Hole and North Fork American River flow into Folsom. This model output was used to determine when transfer water flowed into Folsom and when MFP reservoirs refilled. Logic in TOM releases transfer water out of Folsom without bypassing hydropower generation.

Transfer water released from South Sutter WD's Camp Far West Reservoir flows down the Bear River, into the Feather River and eventually the Delta. There are no operational constraints that limit South Sutter WD's ability to release transfer water and therefore TOM assumes these transfers occur when there is demand, available capacity to divert the water, and the Delta is in balanced conditions. Logic in TOM for the operation of Camp Far West is based on a CalSim II module of the Bear River and is used to determine when Camp Far West refills.

Reservoir release transfers from Browns Valley ID's Merle Collins Reservoir are simulated in TOM. Browns Valley ID provided a baseline operation of Merle Collins Reservoir from a spreadsheet model owned by the district. Browns Valley ID also provided guidance on the years and conditions when the district would consider making a reservoir release transfer. This information was incorporated into TOM and logic developed to simulate the operation of Merle Collins Reservoir for a with-transfer scenario.

A reservoir release transfer from Merced ID's Lake McClure flows down the Merced River and is conveyed to SLDMWA. There are a variety of potential conveyance options to move transfer water from the Merced River to SLDMWA. Conveyance options include:

- Diversion at Merced ID's Crocker-Huffman Diversion Dam on the Merced River, conveyance through Merced ID's canals and distribution system to the Eastside Canal, through new conveyance facilities and into Turner Island WD and San Luis Canal Company, SLDMWA member agencies.
- Release down the Merced River to the lower San Joaquin River and diversion into facilities that connect the lower San Joaquin River and the Delta-Medota Canal. Three different facilities exist across the following districts: Patterson ID, West Stanislaus ID, and Banta Carbona ID. Connections through Patterson ID and West Stanislaus ID are located off the San Joaquin River upstream of the confluence with the Tuolumne River. The connection through Banta Carbona ID is located on the San Joaquin River downstream from Vernalis.
- Release down the Merced River, into the San Joaquin River for diversion at CVP, SWP, or Contra Costa WD's diversion facilities.

Assumptions input to TOM prioritize utilizing these conveyance options on an upstream to downstream priority, subject to physical capacities. A greater degree of flexibility exists for transfers from Merced ID because transfers can be scheduled based on available capacity to convey the water, and because there are multiple options for conveying transfer water without going through CVP/SWP facilities in the south Delta. However, transfers that affect water quality in the San Joaquin River are limited to periods when New Melones Reservoir is not releasing to meet water quality requirements at Vernalis.

B.4.3.1.4 Conserved Water

Conserved water is made available by Browns Valley ID from their pre-1914 Yuba River water rights. In 1990, Browns Valley ID implemented the Upper Main Water Conservation Project for the purpose of conserving water. Details of this project and documentation of the 3,100 acre-feet of annual conserved water are contained in the report *Analysis of Water Conserved Under the Upper Main Water Conservation Project* (MBK Engineers, 2002). Browns Valley ID's conserved water is available for transfer every year, but is only simulated as transferred in years with demand and available Delta export capacity (see Figure B-3). Conserved water is stored in Yuba County Water Agency's New Bullards Bar Reservoir and released for transfer in years with demand and capacity.

TOM simulates operation of New Bullards Bar Reservoir and Yuba River flow below New Bullards Bar to analyze effects on reservoir storage, Yuba River flow, and reservoir refill.

B.4.3.1.5 Crop Idling

Water can be made available through crop idling by not growing and irrigating a crop with available surface water and instead making that water available for transfer. The volume of water that may be transferred with a crop idling transfer is limited to the evapotranspiration of applied water (ETAW) that would have been consumed by the crop. The ETAW limit is intended to help protect third parties in the area of the seller. Crop idling transfers analyzed for the Project are from the Sacramento Valley only.

Annual volumes of crop idling water to be made available were provided by individual sellers. The volume of crop idling water to be made available can vary between Project alternatives. Figure B-9 illustrates the maximum annual volumes identified by sellers in the Sacramento Valley for years with available export capacity/transfer demand.

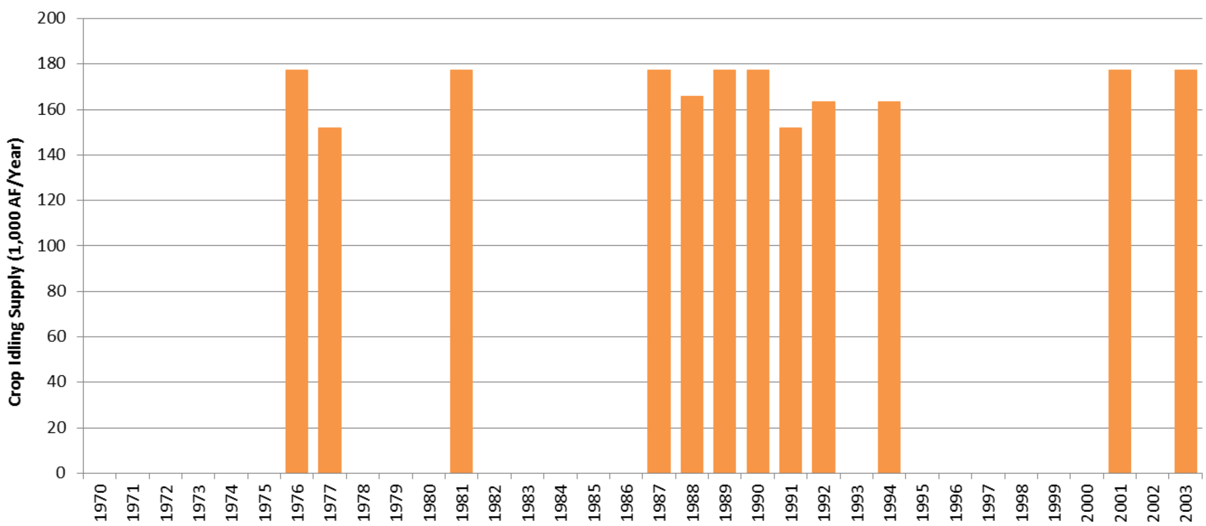

Figure B-9. Maximum Annual Crop Idling Transfer Supply

Annual volumes were assumed to be made available on a monthly pattern based on the ETAW of rice, the assumed crop to be idled. Figure B-10 illustrates the monthly ETAW pattern for rice. This monthly ETAW pattern has been used in the execution of water transfers for numerous years and is referenced in "Cropland Idling, Issue No. 1 – DRAFT Rice Water Transfer Pattern" (Reclamation 2009).

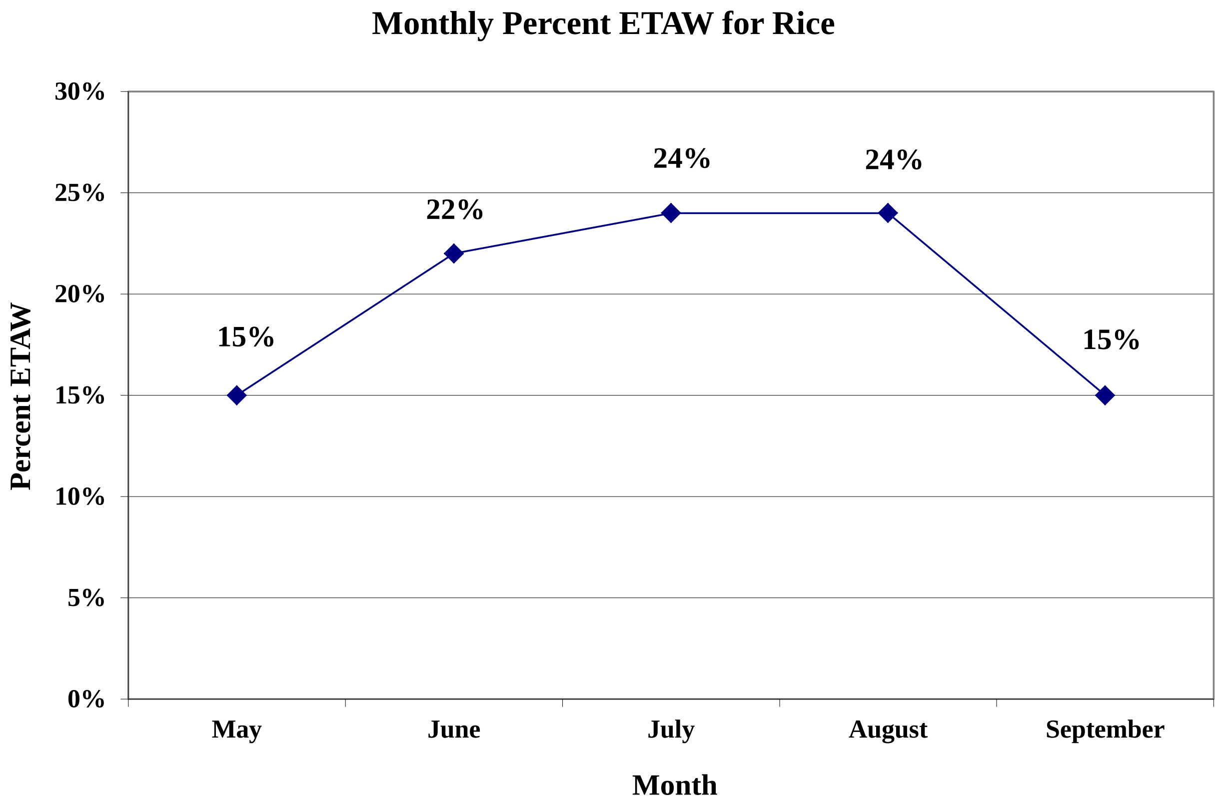

Figure B-10. Monthly ETAW Pattern for Rice

Crop idling transfers offer the least flexibility of all transfer mechanisms. The decision to enter into crop idling transfers is typically made in spring months when there is still considerable uncertainty in the water supply forecast and the ability to convey water through the Delta. Crop idling transfers make water available on the fixed schedule illustrated in Figure B-10. Therefore, transfer water made available in May and June, a total of 37 percent of the annual volume, can be lost or not diverted by the seller because there is rarely available export capacity at CVP or SWP pumping plants in those months and it may not be held in upstream storage.

B.4.3.1.6 Storing Transfer Water in CVP/SWP Reservoirs Upstream of the Delta

The BOs limit the season for water transfers through the Delta for export at CVP/SWP pumping facilities to July through September (NOAA Fisheries 2009, USFWS 2008). However, it may be possible to make water available prior to July and that water may be stored temporarily in CVP/SWP reservoirs upstream of the Delta. Transfer water stored prior to July would be released and moved through the Delta from July through September. It is difficult to predict when these conditions may occur, and therefore it is not possible to guarantee the ability to store water in every year.

In order for transfer water to be stored in upstream reservoirs two conditions must be met: 1) there must be surplus flow (flow in excess of minimum requirements for flow and temperature) upstream from where the transfer water is made available (the point of non-diversion), and 2) the CVP/SWP reservoir where the water will be stored must be operated to meet a requirement downstream from the point of non-diversion. Under these conditions it may be possible to temporarily store transfer water in CVP or SWP reservoirs. Transfer water would be stored in upstream reservoirs by reducing releases from those reservoirs when transfer water is made available.

Analysis of the baseline CalSim II simulation of CVP and SWP operations was performed to identify potential opportunities to store both groundwater substitution and crop idling transfer water made available from April through June in upstream CVP and SWP reservoirs. This information was used to determine months when groundwater substitution pumping was simulated in SACFEM2013. These same assumptions were incorporated into TOM to simulate the resulting changes in river flows, reservoir levels, and operations. These assumptions are made only for the purpose of analysis conducted for the environmental document to provide a conservative estimate of potential environmental impacts and may not be appropriate or applicable under actual operations in a particular year.

B.4.3.1.7 Shift in CVP/SWP Exports to Facilitate Transfers

As previously described, there are numerous considerations and adjustments made by Project operators to facilitate water transfers through CVP and SWP export facilities. One such adjustment can be to shift the timing of when Project water is moved from north-of-Delta reservoirs through the Delta. The timing of Project water movement can shift to assist in making export capacity for transfers available on a pattern that better matches the period of transfer. These shifts are more common at SWP facilities because the larger capacity at Banks provides greater flexibility.

TOM simulates shifts in timing of Project water movement at SWP facilities by adjusting baseline Oroville releases and Banks pumping from July through September of some years. Logic in TOM adjusts Oroville releases and Banks pumping to create a more regular monthly pattern of available export capacity.

B.4.3.1.8 Diversion of Transfer Water by Sellers

Water made available by sellers is conveyed through the system and diverted by CVP buyers. Diversions by buyers are made at existing points of diversion. A buyer's ability to divert transfer water is subject to available capacity and regulatory constraints as described in the following section.

B.4.3.1.8.1 East Bay MUD

East Bay MUD diverts both CVP Project water and transfer water at the Freeport Regional Water Project on the Sacramento River near Freeport. The location of these diversion facilities may provide additional flexibility for when transfer water may be diverted to East Bay MUD. Diversions at Freeport do not affect the Delta in the same way as CVP/SWP diversions in the southern Delta. Therefore, it may be possible for East Bay MUD to divert transfer water in months when there is typically no available export capacity at CVP/SWP facilities. East Bay MUD's Freeport diversions are limited to 155 cubic feet per second (cfs) capacity, East Bay MUD's share of the total Freeport Regional Water Project capacity.

Additionally, East Bay MUD diversions at Freeport are not subject to a "carriage water" adjustment to the volume of water made available for transfer. Carriage water is defined as the extra water needed to carry a unit of water across the Delta to CVP/SWP export facilities while maintaining a constant salinity. Because the transfer water is made available and diverted at the upstream edge of the Delta it is assumed that there is no change in Delta salinity associated with the transfer.

B.4.3.1.8.2 Contra Costa WD

Contra Costa WD diverts water under existing water rights, a CVP water service contract, and transfer water from multiple points of diversion in the Delta. The baseline CalSim II simulation includes diversions under Contra Costa WD's water rights and CVP contract. Diversion of transfer water is simulated in TOM to occur at three locations: Rock Slough, Old River, and Victoria Canal. Transfer diversions are simulated to occur at the location with the best water quality and available capacity after diversions under Contra Costa WD's water rights and CVP contract. Assumptions on the specific location of transfer diversions are necessary for analysis of Delta water quality performed in the Delta Salinity Model 2. Transfers to Contra Costa WD assume a 20 percent carriage water adjustment to maintain Delta salinity.

B.4.3.1.8.2 SLDMWA

SLDMWA member agencies receive water diverted at CVP/SWP export facilities in the southern Delta. Transfer water purchased by SLDMWA is conveyed through available export capacity at Jones and Banks pumping plants. Transfers from the Sacramento River assume a 20 percent carriage water adjustment to maintain Delta salinity. Transfers from Merced ID that enter the Delta from the San Joaquin River assume a ten percent carriage water adjustment.

Additionally, water made available by Merced ID can be conveyed directly to SLDMWA member agencies through facilities that connect to Merced ID's internal conveyance system and facilities that join the lower San Joaquin River and the DMC without going through CVP/SWP export facilities.

B.4.4 Level of Development

The Long Term Water Transfer Project is intended to provide environmental assessment for water transfers over a ten-year period. Therefore, analysis conducted to support environmental assessments was conducted at an existing level of development with consideration of reasonably foreseeable projects that may be constructed over the next ten years.

CalSim II simulations at a projected Level of Development (LOD) are used to depict how the modeled water system might operate with an assumed physical and institutional configuration imposed on a long-term hydrologic sequence. An existing LOD study assumes that current land use, facilities, and operational objectives are in place for each year of simulation (water year 1922 through 2003). The results are a depiction of the current environment which provides a basis for comparison of project effects for the impact analysis under CEQA. A future LOD study is needed to explore how the system may perform under an assumed future set of physical and institutional conditions and is used for the Future No Action Condition for NEPA analysis. The Project's ten-year period allows simulation of a single level of development under the assumptions that conditions are not likely to change significantly over such a short time horizon.

B.5 Model and Analysis Limitations

There are limitations in the ability of models to accurately address all of the intricacies of complex water management operations. Professional judgment is required to interpret results and determine benefits and impacts. Analysis for the Long Term Water Transfer Project is based on three primary models: CalSim II, SACFEM2013, and TOM. The overall analysis is therefore subject to the individual and combined limitations of all three models. While it is important to recognize and acknowledge the limitations of models as they are applied for this analysis, collectively these three models represent the best available tools for performing the analysis to serve as the basis for determining environmental impacts.

Model limitations and uncertainty for SACFEM2013 is described in Appendix D. Model limitations in CalSim II and TOM stem primarily from challenges of using computer models and fixed algorithms to simulate human decision-making processes. CVP/SWP operations are based on numerous regulatory requirements, a multitude of real-time data, and some degree of discretion on the part of operators. Numerous simplifying assumptions are necessary to simulate these complex operations. Computer models are capable of simulating many, but not all, regulatory requirements. Computer models are typically based on a more limited set of available data and use generalized rules that attempt to represent typical operator decisions. Computer models are far from perfect. However, these imperfections and simplifications do not render models useless. The regular and continued use of CalSim II for planning studies and environmental assessment by Reclamation, DWR, and others indicates the model is adequate for these purposes.

B.6 Project Alternatives and Results

B.6.1 Alternative 1: No Action/No Project Alternative

CEQA requires an EIR to include a No Project Alternative. The No Project Alternative allows for a comparison between the impacts of the proposed project with future conditions of not approving the proposed project. The No Project Alternative may include some reasonably foreseeable changes in existing conditions and changes that would be reasonably expected to occur in the foreseeable future if the project were not approved.

Under the No Action/No Project Alternative CVP related water transfers through the Delta would not occur from 2015-2024. However, other transfers that do not involve the CVP could occur under the No Action/No Project Alternative. Additionally, CVP transfers within basins could continue and would still require Reclamation's approval. Some CVP entities may decide that they are interested in selling water to buyers in export areas under the No Action/No Project Alternative; however, they would need to complete individual NEPA and Endangered Species Act compliance for each transfer to allow Reclamation to complete the evaluation of the transfers for approval.

Alternative 1 is simulated with the baseline CalSim II model provided by Reclamation and other information and model results provided by buyers and sellers. These results represent reasonably foreseeable conditions for the 2015-2024 period and are used for comparison with results from each of the project alternatives.

B.6.2 Alternative 2: Full Range of Transfer Measures

Alternative 2 would involve transfers from potential sellers upstream from the Delta to buyers in the Central Valley and Bay Area. Alternative 2 includes transfers under all potential transfer measures: groundwater substitution, reservoir release, conserved water, and crop idling. The order in which transfer measures are prioritized and simulated to occur is described in previous sections. The following section summarizes the results of Alternative 2 with comparisons to and changes from the No Project Alternative.

Figure B-11 is a summary of the quantity of transfer water made available (Transfer Supply) under Alternative 2 on an annual basis and illustrates where the water is diverted or used (Transfer Use). A percentage of water to be transferred through the Delta becomes carriage water to maintain Delta water quality. Unused transfer water is from two different sources/transfer measures. In some years there can be unused crop idling water during May and June because there is no ability to store it upstream or available capacity at the export pumps. A second source is reservoir release transfers from Placer County Water Agency that are held in Folsom but spill prior to being delivered to East Bay MUD. Results are summarized by water year and show small amounts of water in wetter years such as 1978, 1982, 1993, etc. These are transfers from Placer County Water Agency to East Bay MUD that extend past September of the year when the transfer begins. East Bay MUD may begin taking delivery of transfer water from Placer County Water Agency as early as March and extend into February of the following year.

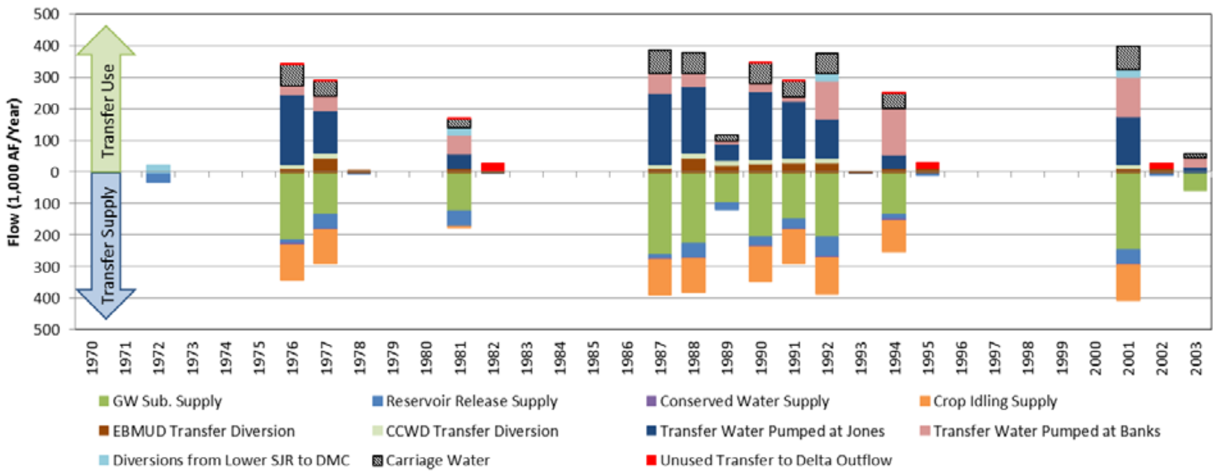

Figure B-11. Annual Transfer Summary for Alternative 2

TOM simulates transfer water made available and moved through the system and produces results under each Project alternative for comparison with baseline, without transfers, results. TOM simulates the effects of transfers on reservoir storage, river flows, Delta outflow and exports, and diversions by Contra Costa WD and East Bay MUD. The following sections describe and illustrate these effects for Alternative 2.

B.6.2.1 Storage

Figure B-12 illustrates the change in operations at Shasta with the Project. Under Alternative 2 release from Shasta can increase or decrease. Decreased releases occur when transfer water is stored in Shasta during the April through June period and create higher storage conditions than under Alternative 1 (Baseline). Releases increase during the July through September period when stored transfer water is released for delivery. These releases bring storage back to Baseline levels. Releases also increase because groundwater substitution transfers reduce stream flow on the Sacramento River, and during times of low-flow, stored water must be released from the reservoir to meet minimum flow requirements at Wilkins Slough.

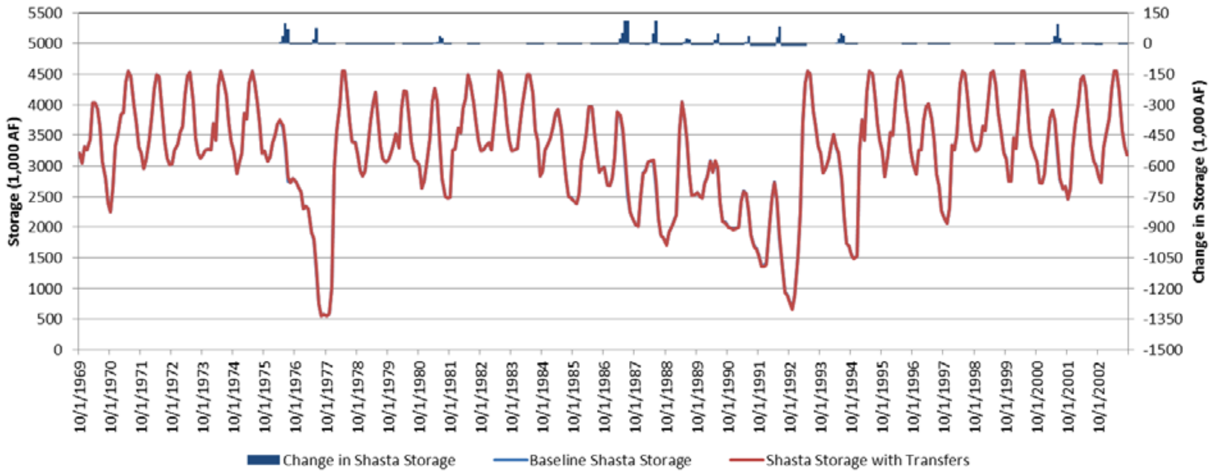

Figure B-12. Shasta Operations with and without Alternative 2 Transfers

Operations at Folsom are illustrated below in Figure B-13. Transfer water can be temporarily stored in Folsom for release and delivery in subsequent months. This includes transfers from groundwater substitution in the American River Basin, crop idling in the Sacramento Valley, and reservoir release from upstream Placer County Water Agency reservoirs. Releases from Folsom can increase to maintain minimum flow requirements downstream on the American River at H Street.

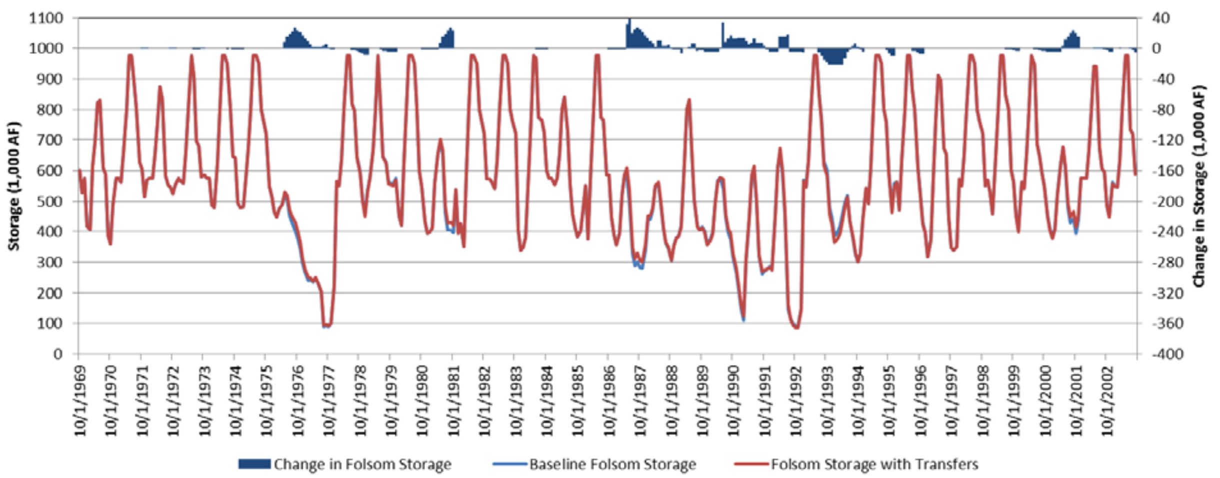

Figure B-13. Folsom Operations with and without Alternative 2 Transfers

Figure B-14 illustrates changes in Oroville storage with and without the Project. Larger changes in Oroville storage result from shifting the timing of delivery of SWP water to accommodate transfers. There are also decreases in storage when additional water is released to maintain minimum flow requirements on the Lower Feather River. These additional releases from Oroville are made to account for reductions in Feather River flows due to groundwater substitution transfers.

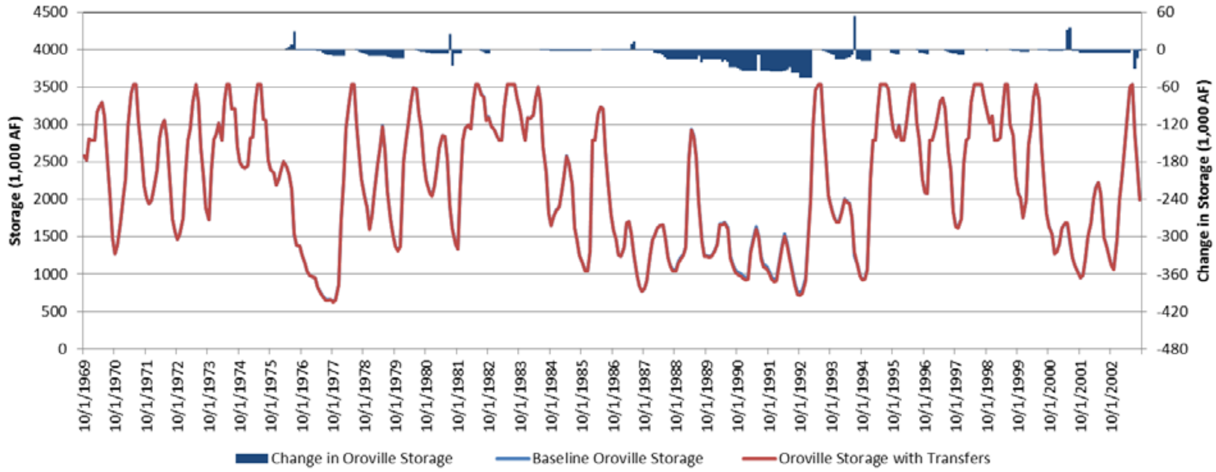

Figure B-14. Oroville Operations with and without Project

South Sutter WD releases water from Camp Far West Reservoir to participate in reservoir release transfers. Figure B-15 illustrates the only change in reservoir storage from baseline conditions as the quantity released for transfer, a volume of five or 15 thousand acre-feet (TAF). Camp Far West Reservoir storage returns to baseline levels when the reservoir refills.

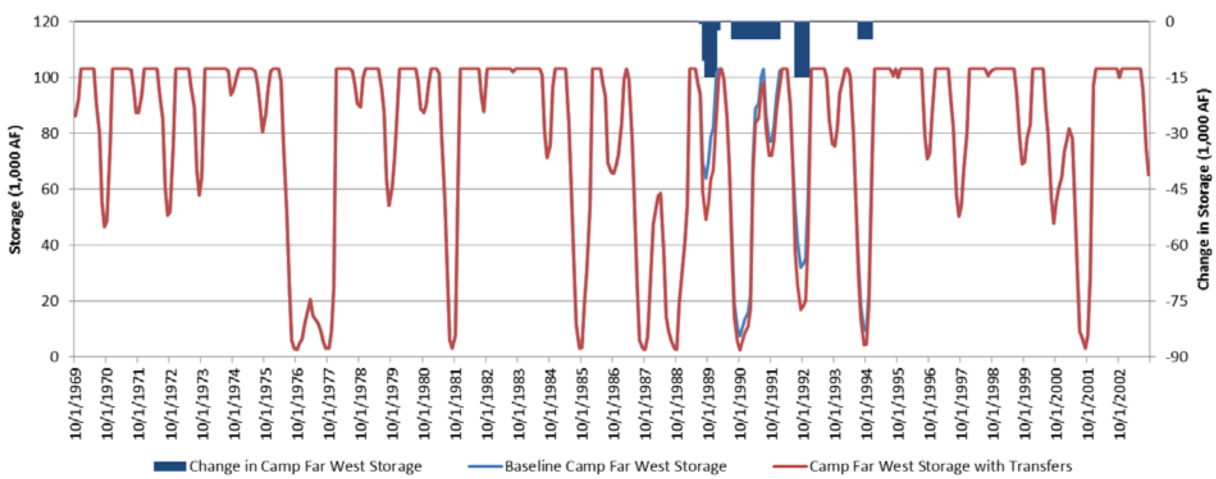

Figure B-15. Camp Far West Operations with and without Alternative 2 Transfers

Browns Valley ID releases water from Merle Collins Reservoir to participate in reservoir release transfers. Figure B-16 illustrates the only change in reservoir storage from baseline conditions as the quantity released for transfer, up to five

TAF in any year. Merle Collins Reservoir storage returns to baseline levels when the reservoir refills.

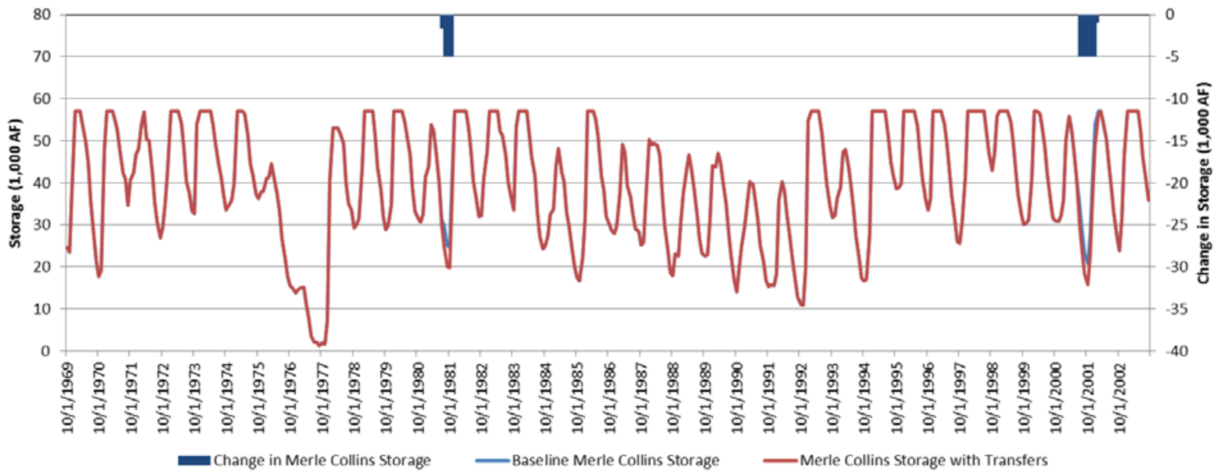

Figure B-16. Merle Collins Reservoir Operations with and without Alternative 2 Transfers

Placer County Water Agency releases water from MFP reservoirs of French Meadows and Hell Hole to participate in reservoir release transfers. Figure B-17 illustrates the combined storage in these two reservoirs under both baseline and with Project operations. MFP reservoir storage returns to baseline levels when the reservoirs refill.

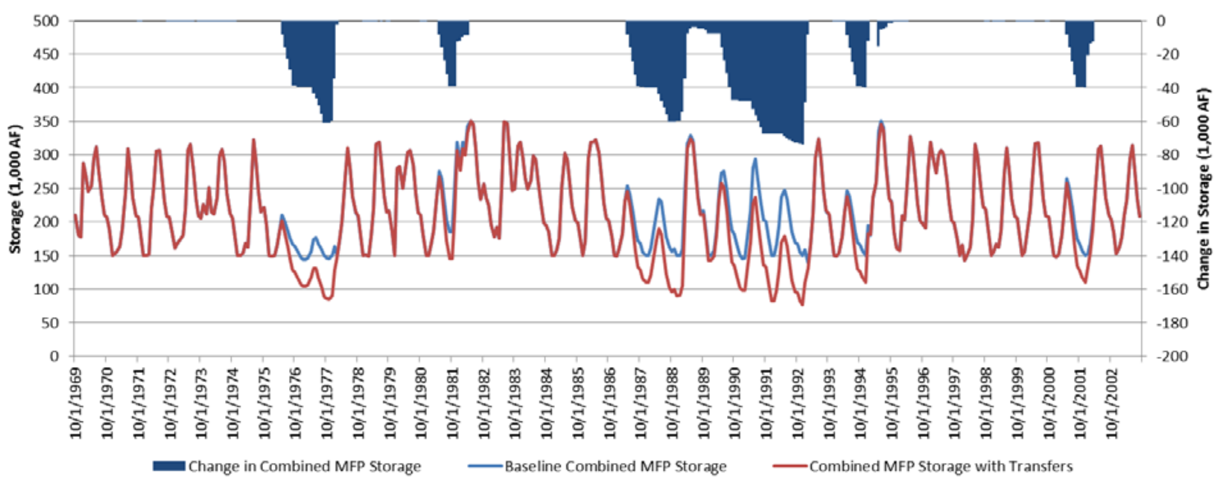

Figure B-17. MFP Operations with and without Alternative 2 Transfers

Figure B-18 illustrates Merced ID operations of Lake McClure with and without reservoir release transfers. Reservoir release transfers of up to 30 TAF reduce reservoir storage until the reservoir refills in subsequent wet years.

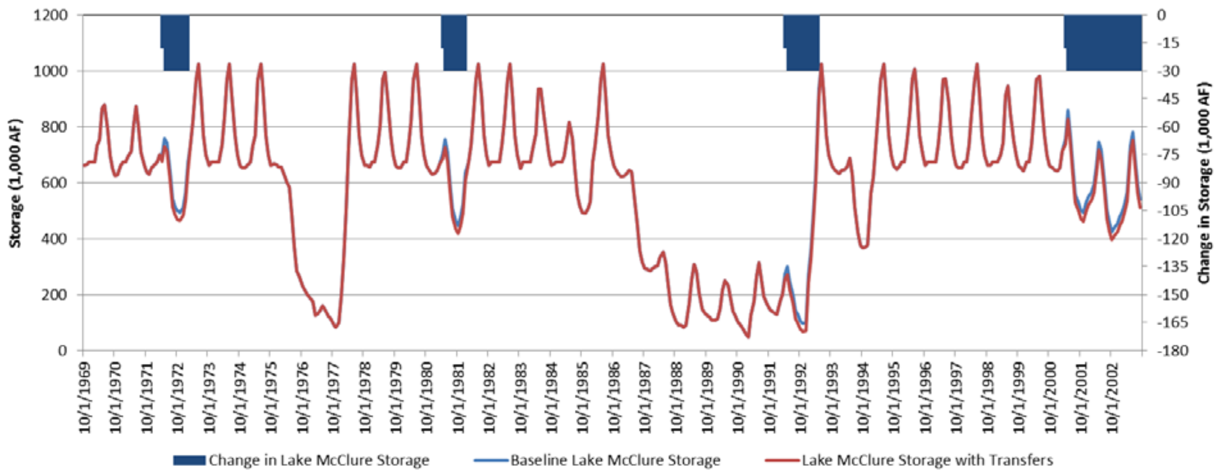

Figure B-18. Lake McClure Operations with and without Alternative 2 Transfers

Conserved water is stored in Yuba County Water Agency's New Bullards Bar Reservoir and released for transfer in years with demand and capacity. The effect of these releases is illustrated below in Figure B-19. New Bullards Bar Reservoir storage returns to baseline levels when the reservoir refills.

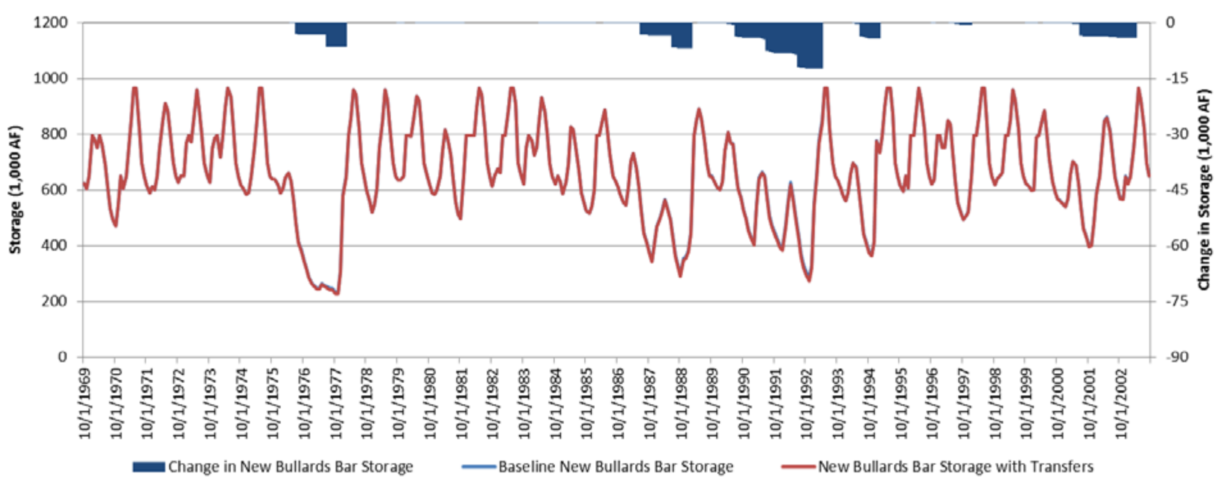

Figure B-19. New Bullards Bar Operations with and without Alternative 2 Transfers

B.6.2.2 Stream Flow

Releases from Keswick Dam, as illustrated below in Figure B-20, reflect the changes in Shasta storage seen in Figure B-12. A reduction in release corresponds to an increase in Shasta storage. Reduced releases typically occur in the April through June period when it may be possible to store transfer water made available downstream in Shasta. Months of reduced releases are followed by increased releases as transfer water is released to be moved through the Delta during the July through September period.

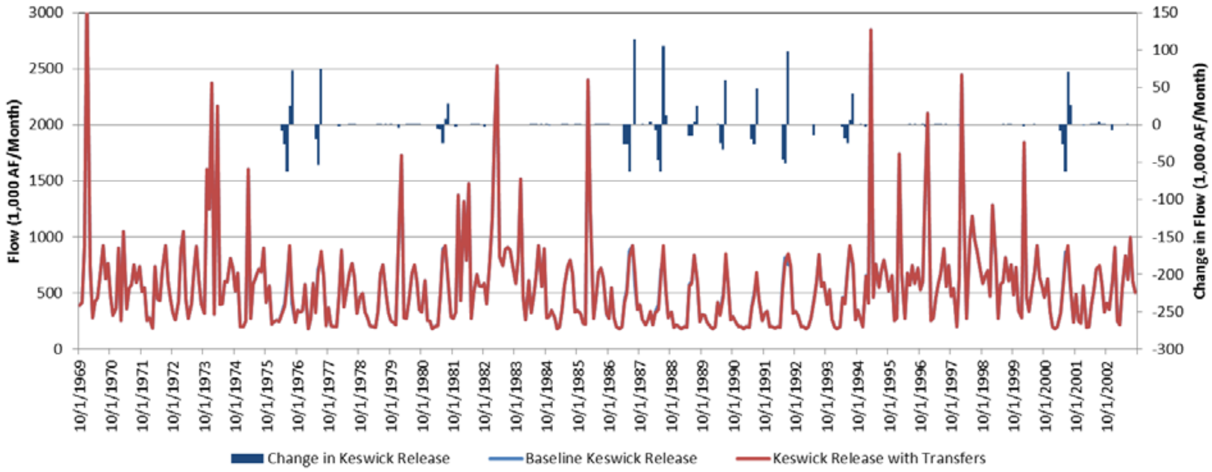

Figure B-20. Keswick Dam Release with and without Alternative 2 Transfers

Figure B-21 illustrates the effect of Alternative 2 transfers to the Sacramento River at Wilkins Slough. Increased flows result from changes in Keswick release, plus water made available by groundwater substitution and crop idling transfers upstream of Wilkins Slough. Decreases occur when transfer water is stored upstream in Shasta.

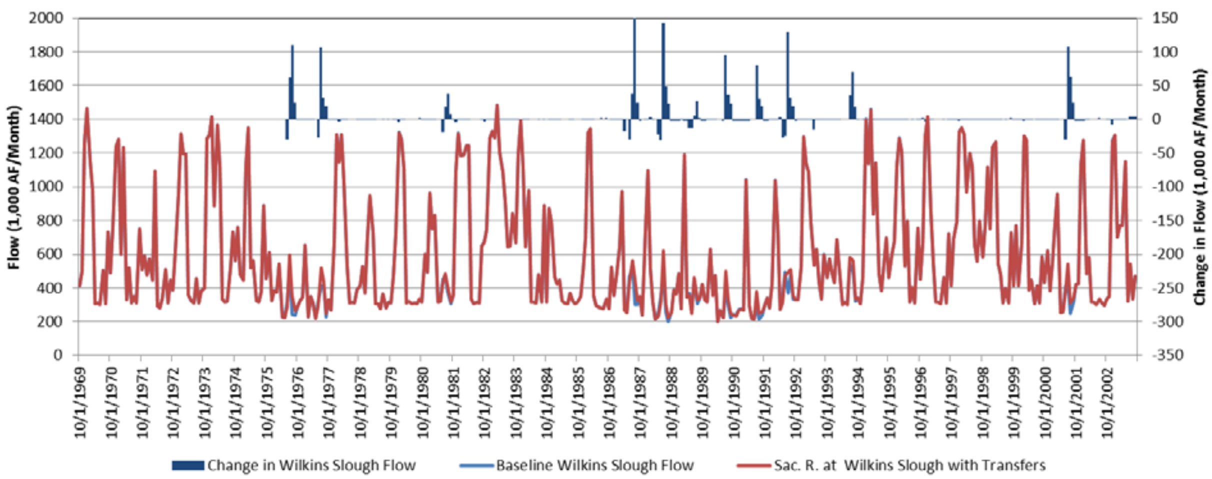

Figure B-21. Sacramento River at Wilkins Slough with and without Alternative 2 Transfers

Figure B-22 illustrates Nimbus Dam releases. Nimbus releases reflect CVP operations of Folsom Reservoir. Increases in release of approximately five TAF are water made available by Placer County Water Agency being released for re-diversion by East Bay MUD. Larger increases are typically preceded by decreases as transfer water made available downstream is stored in Folsom. Large releases occur when stored transfer water is release to be conveyed through the Delta. Decreases also occur when Placer County Water Agency's upstream reservoirs refill, typically during times when Folsom is also spilling water to maintain flood space requirements.

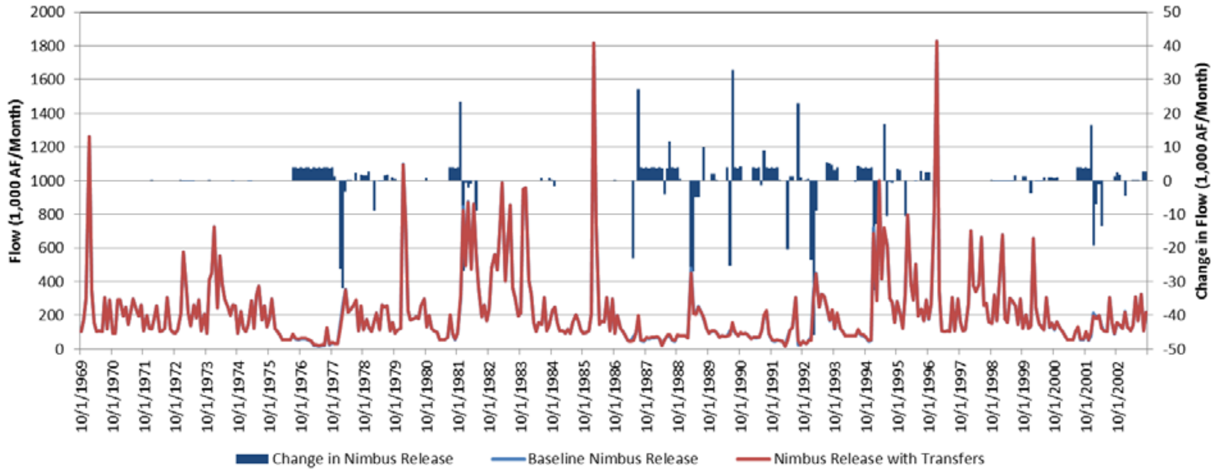

Figure B-22. Nimbus Dam Release with and without Alternative 2 Transfers

Flows on the American River at H Street, illustrated in Figure B-23, show similar changes as flows at Nimbus. Flow at H Street also increases from water made available by groundwater substitution transfers by Sacramento Suburban WD and the City of Sacramento.

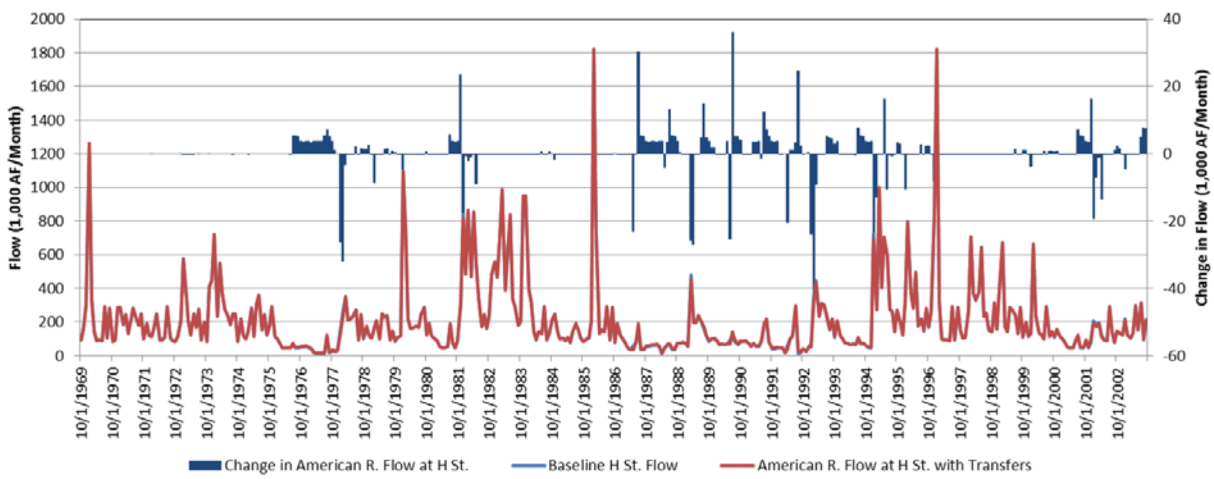

Figure B-23. American River at H Street with and without Alternative 2 Transfers

Figure B-24 illustrates change in Feather River flow below Thermalito. Flow in the Feather River below Thermalito changes due to changes in the operation of Oroville. Transfer water made available on the Feather River downstream from Thermalito can be temporarily stored in Oroville for release and transfer during the July through September period. Water stored prior to July reduces Feather River flow. Increases and decreases in flow on the Feather River below

Thermalito also occur from shifts in timing of SWP water to accommodate transfers. The magnitude of some of these differences is affected by model nuances within CalSim II that can create variations from month-to-month in release of SWP water from Oroville for movement through the Delta.

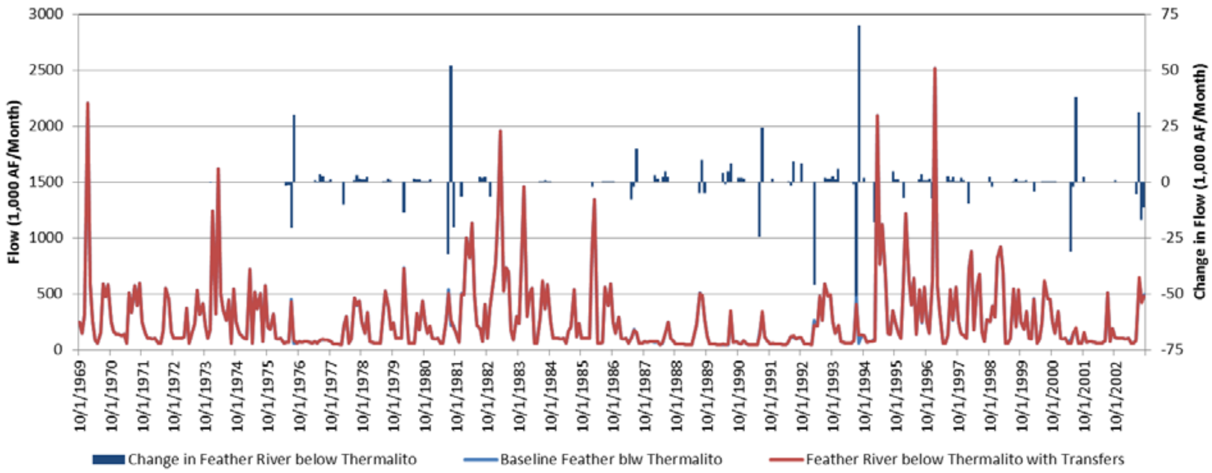

Figure B-24. Feather River below Thermalito with and without Alternative 2 Transfers

Figure B-25 illustrates changes in flow on the Yuba River at Marysville as a result of Browns Valley ID's transfers of conserved water from New Bullards Bar Reservoir and reservoir release from Merle Collins Reservoir. Increases indicate transfer water moving downstream for re-diversion and decreases indicate upstream reservoir refill.

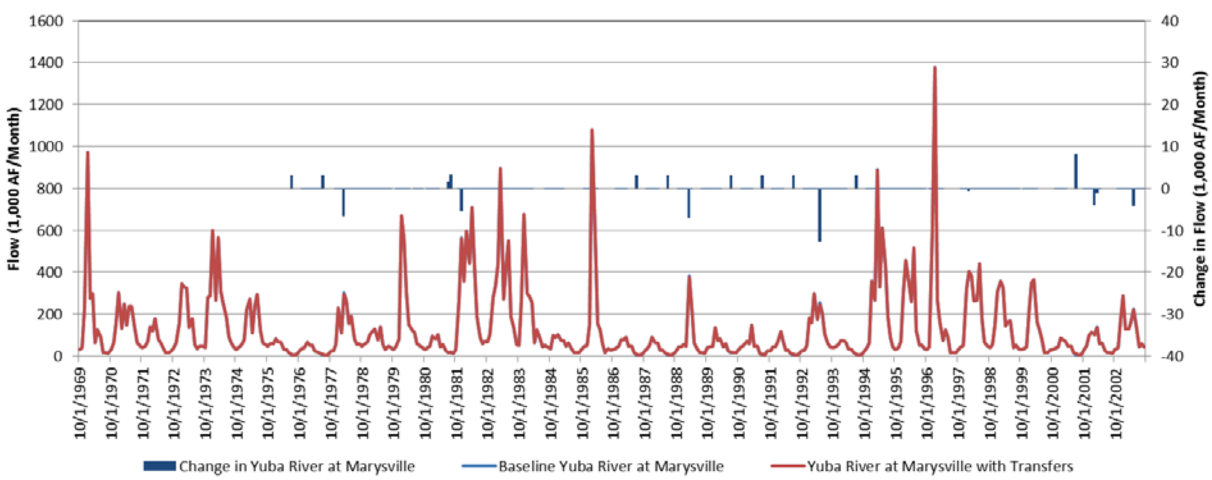

Figure B-25. Yuba River at Marysville with and without Alternative 2 Transfers

Figure B-26 illustrates the response of Bear River flows into the Feather River as a result of South Sutter WD reservoir release transfers from Camp Far West

Reservoir. Flows increase when water is released for transfer and decrease when Camp Far West refills.

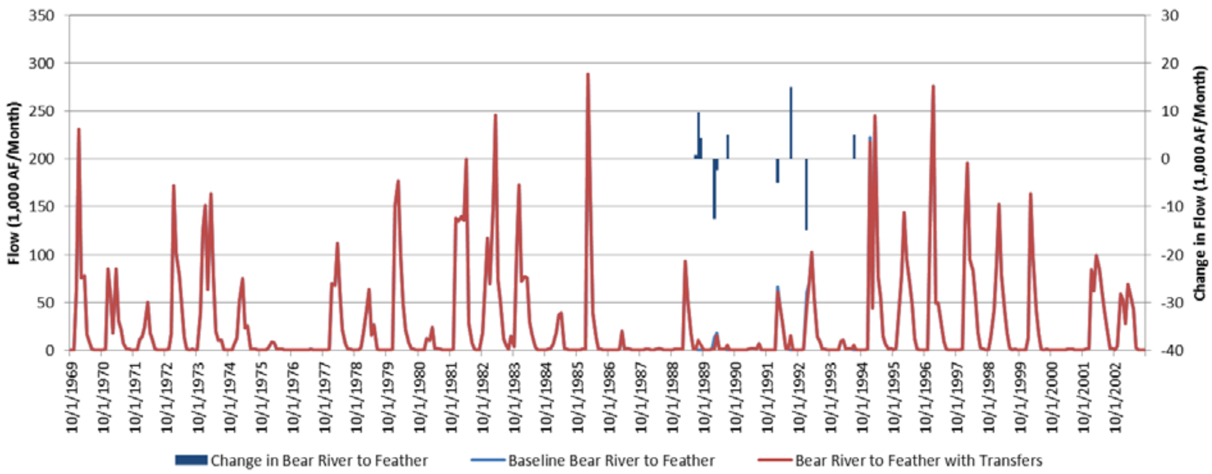

Figure B-26. Bear River to the Feather River with and without Alternative 2 Transfers

The flow on the Lower Feather River represents an aggregation of flows on the Yuba River, Bear River, and upper portions of the Feather River. There are also increases due to water made available by groundwater substitution transfers along the Feather River between Thermalito and the confluence with the Sacramento. Figure B-27 illustrates the effect to the Feather River.

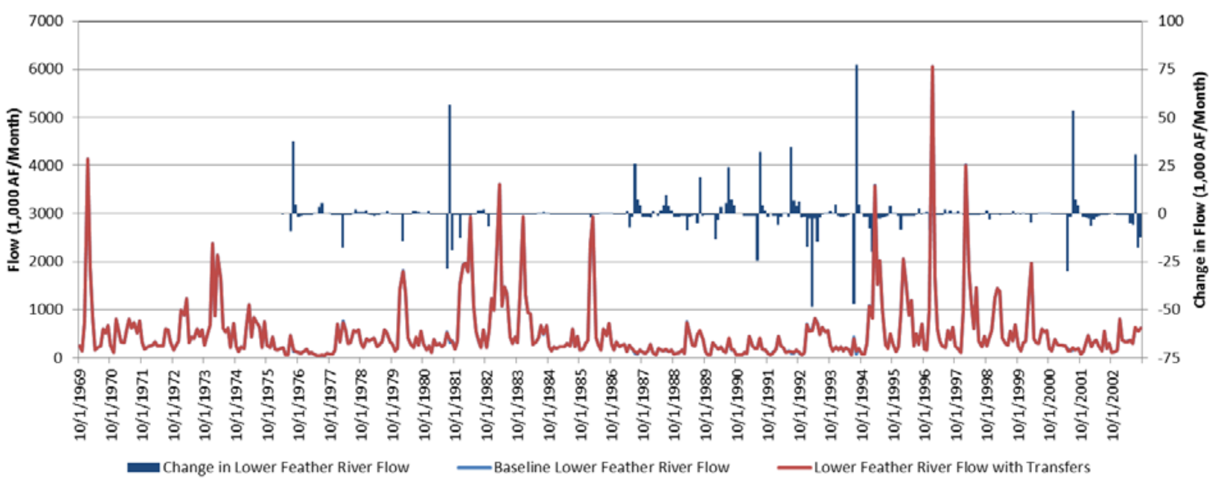

Figure B-27. Lower Feather River with and without Alternative 2 Transfers

Figure B-28 illustrates the flow of the Sacramento River at Freeport. This location is an aggregation of all changes on the Sacramento River at Wilkins Slough, the Lower Feather River, the American River at H Street, and changes between those locations and Freeport. Changes between those locations and Freeport include increases in flow due to water made available through groundwater substitution and crop idling transfers and decreases due to stream-aquifer interaction. Reductions in flow of approximately 50 TAF or more are a result of changes in stream and flood bypass flows during surplus conditions after one or more years of groundwater substation transfers. These changes are also illustrated above in Figure B-6.

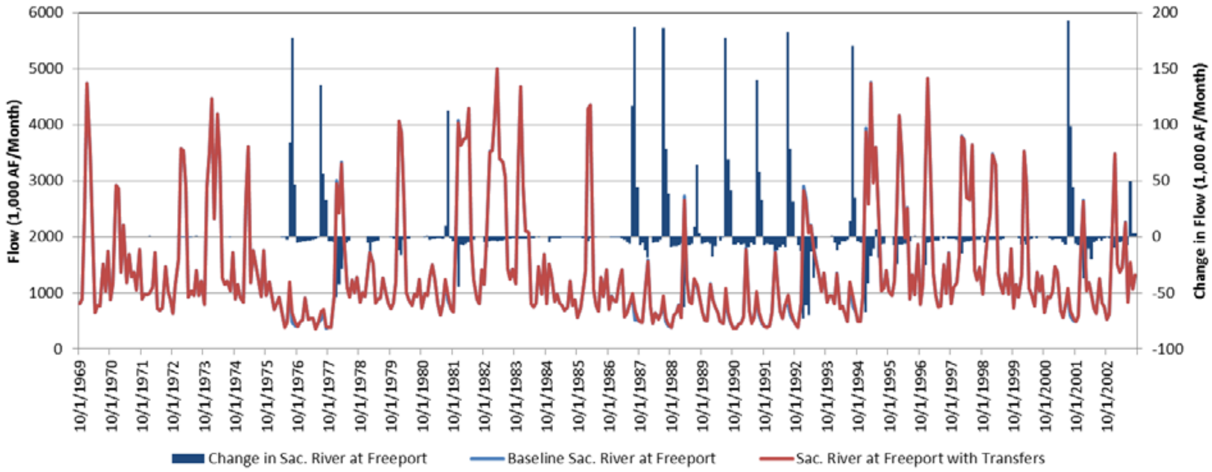

Figure B-28. Sacramento River at Freeport with and without Alternative 2 Transfers

Figure B-29 illustrates the changes on the Merced River at the confluence with the San Joaquin River. Increases in Merced River flow represent transfer water made available by reservoir releases at Lake McClure; decreases occur when Lake McClure refills.

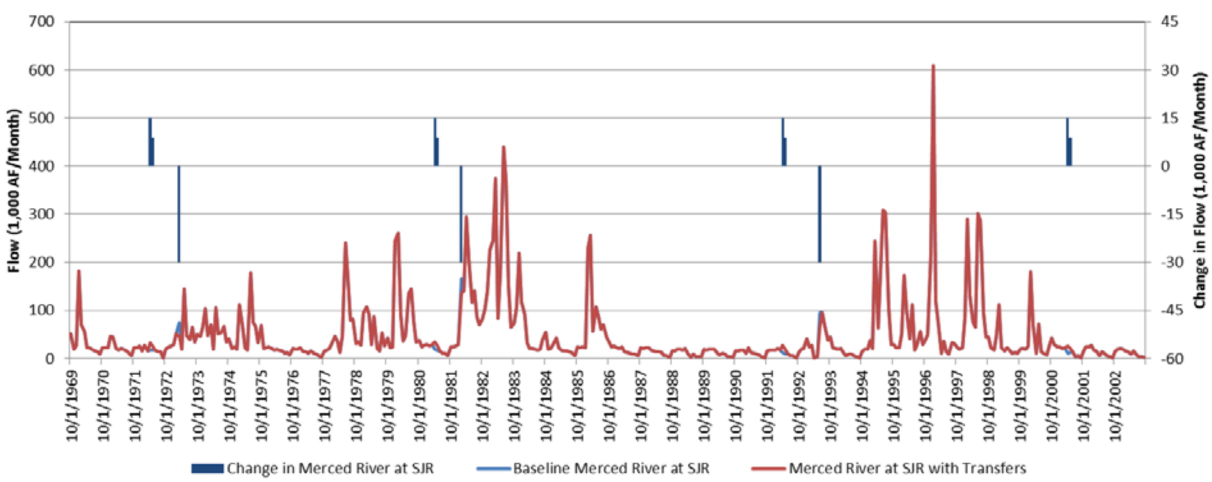

Figure B-29. Merced River at the San Joaquin River with and without Alternative 2 Transfers

Figure B-30 illustrates San Joaquin River flows at Vernalis. Increases in flow are Merced ID transfer water to be diverted at Banta Carbona ID and conveyed to the DMC. Decreases in flow occur when Lake McClure refills space vacated during reservoir release transfers.

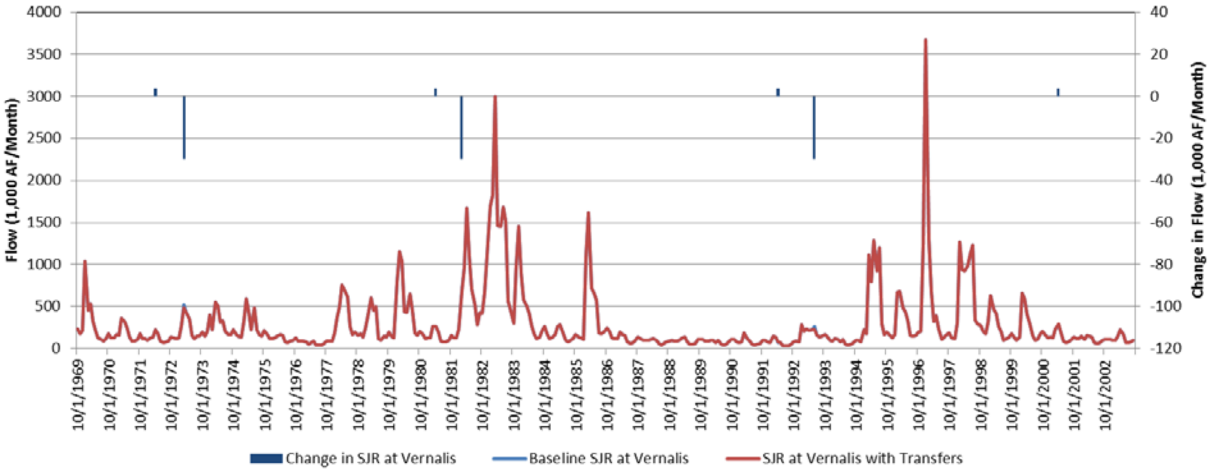

Figure B-30. San Joaquin River at Vernalis with and without Alternative 2 Transfers

Changes to Delta outflow are illustrated below in Figure B-31. Increases in Delta outflow are primarily due to carriage water to facilitate transfers through the Delta. Decreases in Delta outflow are attributed to reservoir refill upstream and changes in stream-aquifer interaction.

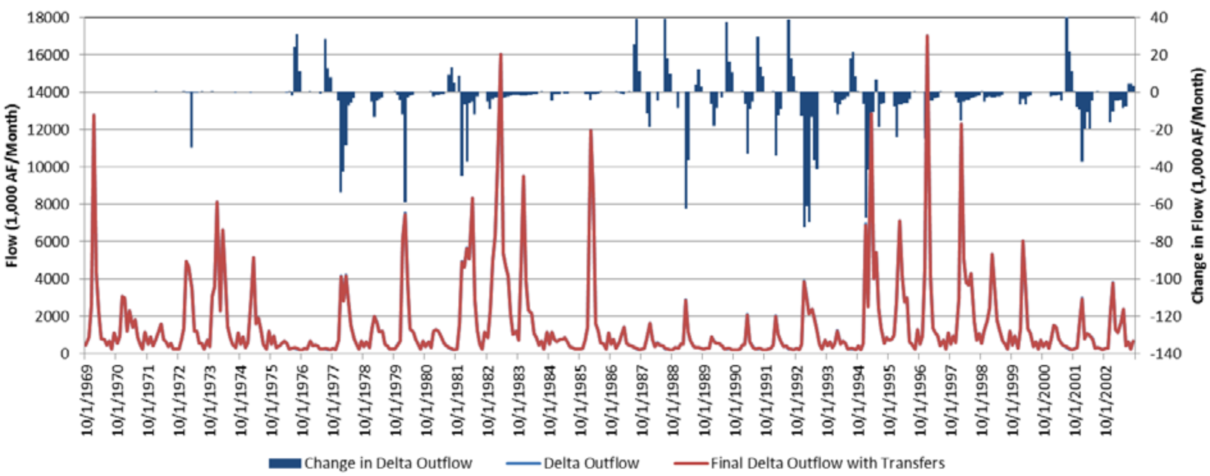

Figure B-31. Delta Outflow with and without Alternative 2 Transfers

Table B-1 summarizes changes in Delta outflow on an average monthly basis. Average annual Delta outflow is decreased by approximately 31 TAF with decreases November through June and increases June through September.

Table B-1. Average Monthly Delta Outflow (TAF) for Alternative 2

Delta Outflow	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Baseline	393	867	1,490	3,260	3,312	3,278	1,753	1,381	816	546	297	638	18,031
With Transfers	393	867	1,485	3,250	3,300	3,268	1,748	1,378	813	554	303	641	18,000
Change	0	-1	-5	-10	-12	-10	-5	-3	-3	8	6	3	-31

B.6.2.3 Exports and Diversions

Figure B-32 illustrates the change in exports at Jones Pumping Plant. Increases are generally due to export of transfer water for SLDMWA. Decreases in Jones exports are due to changes in Sacramento Valley stream-aquifer interaction that reduce Delta inflows.

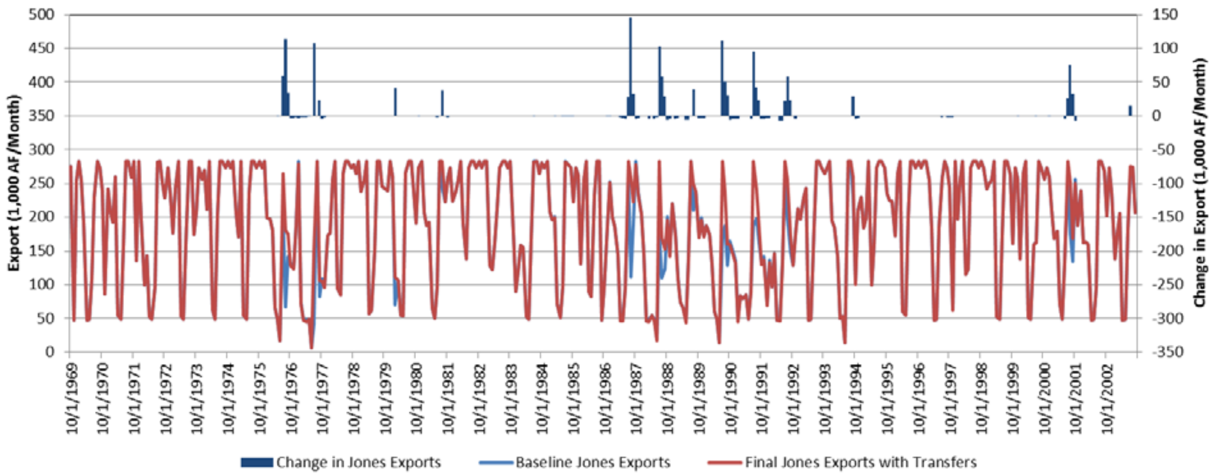

Figure B-32. Exports at Jones Pumping Plant with and without Alternative 2 Transfers

Table B-2 summarizes the average monthly exports at Jones Pumping Plant for the baseline and with Project alternatives and the change. Increases occur during the transfer months of July, August, and September, with an average annual increase of 39 TAF.

Table B-2. Average Monthly Exports at Jones Pumping Plant (TAF) for Alternative 2

Jones Exports	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Baseline	222	212	235	197	186	198	69	65	153	256	252	223	2,268
With Transfers	221	211	235	197	187	198	69	65	152	272	270	231	2,306
Change	-1	-1	0	0	1	0	0	-1	-1	17	18	8	39

Transfer water can also be exported at Banks Pumping Plant. Banks exports also can be reduced when changes in stream-aquifer interaction affect the SWP. This is illustrated below in Figure B-33.

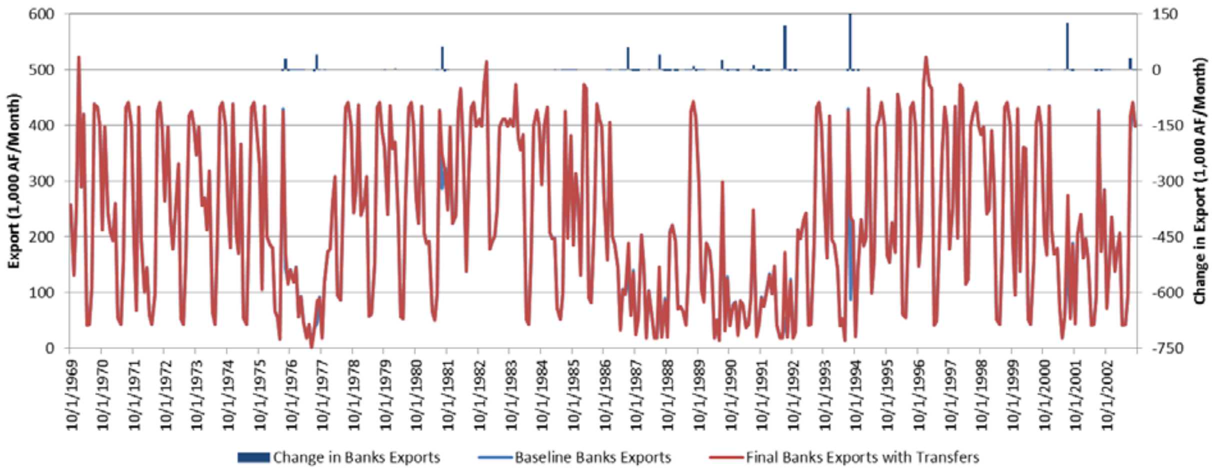

Figure B-33. Exports at Banks Pumping Plant with and without Alternative 2 Transfers

Table B-3 summarizes the average monthly exports at Banks Pumping Plant for the baseline and with Project alternatives and the change. The average annual change is an increase of approximately 15 TAF.

Table B-3. Average Monthly Exports at Banks Pumping Plant (TAF) for Alternative 2

Banks Exports	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Baseline	202	212	307	222	239	261	70	62	156	363	316	320	2,731
With Transfers	201	211	307	221	239	261	70	62	156	375	324	319	2,746
Change	-1	-1	0	0	0	0	0	0	0	11	8	-1	15

Total CVP/SWP exports, the sum of exports at Jones and Banks Pumping Plants, are illustrated in Figure B-34.

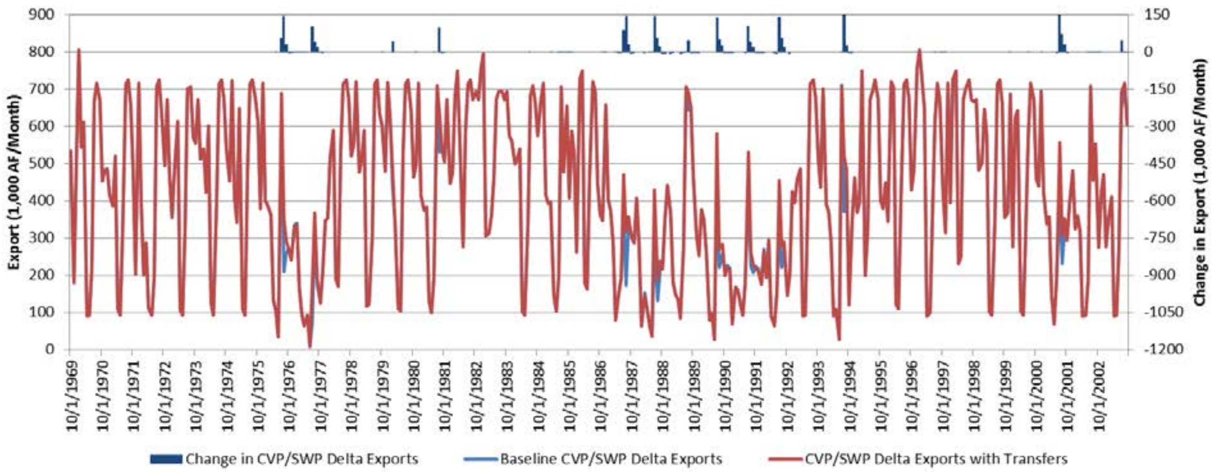

Figure B-34. Total CVP/SWP Exports from the Delta with and without Alternative 2 Transfers

Table B-4 summarizes the average monthly combined CVP/SWP exports. The average annual change under Alternative 2 is approximately 54 TAF.

Table B-4. Average Monthly Combined CVP/SWP Exports (TAF) for Alternative 2

CVP/SWP Exports	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Baseline	424	424	543	419	425	459	138	128	309	619	568	543	4,998
With Transfers	422	422	542	418	426	459	138	127	308	647	594	549	5,052
Change	-2	-2	-1	-1	1	0	0	-1	-1	28	26	6	54

Transfer water is also diverted by East Bay MUD at the Freeport Regional Water Project (Freeport) and by Contra Costa WD at their diversion facilities on Rock Slough, Old River, and Victoria Canal. Figure B-35 illustrates changes in diversions by East Bay MUD at Freeport. Baseline East Bay MUD diversions represent diversion of CVP project water under East Bay MUD's existing contract. Diversion of transfer water occurs during months when East Bay MUD is also diverting CVP project water and increases the total East Bay MUD Freeport diversion up to the available capacity.

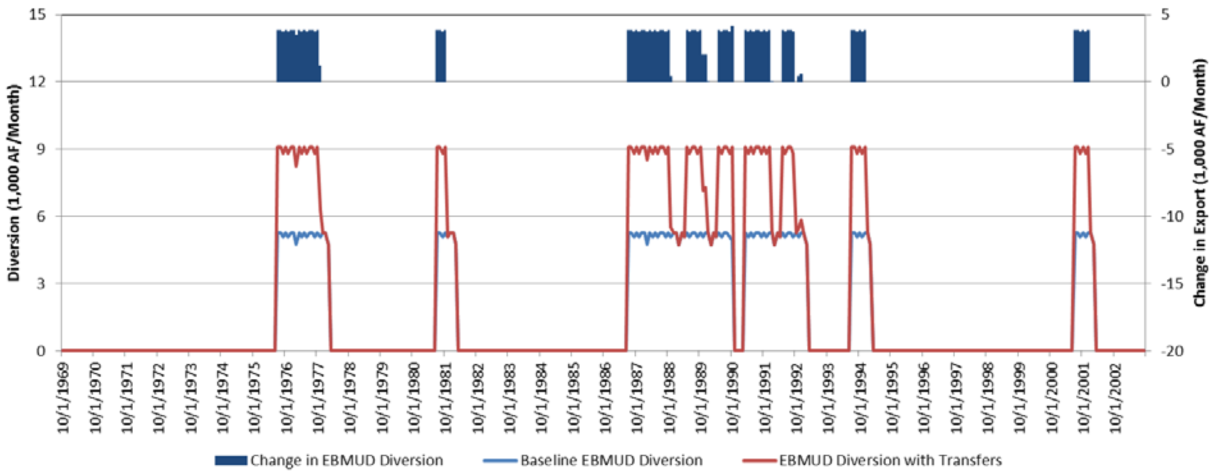

Figure B-35. East Bay MUD Diversions with and without Alternative 2 Transfers

Contra Costa WD diversions increase to take delivery of transfer water as illustrated below in Figure B-36. Contra Costa WD identified an annual transfer demand of up to 15 TAF and this volume of water diverted at a rate of five TAF per month during the July through September period. Contra Costa WD diversions of transfer water are assumed to occur at the point of diversion with the best water quality and available capacity.

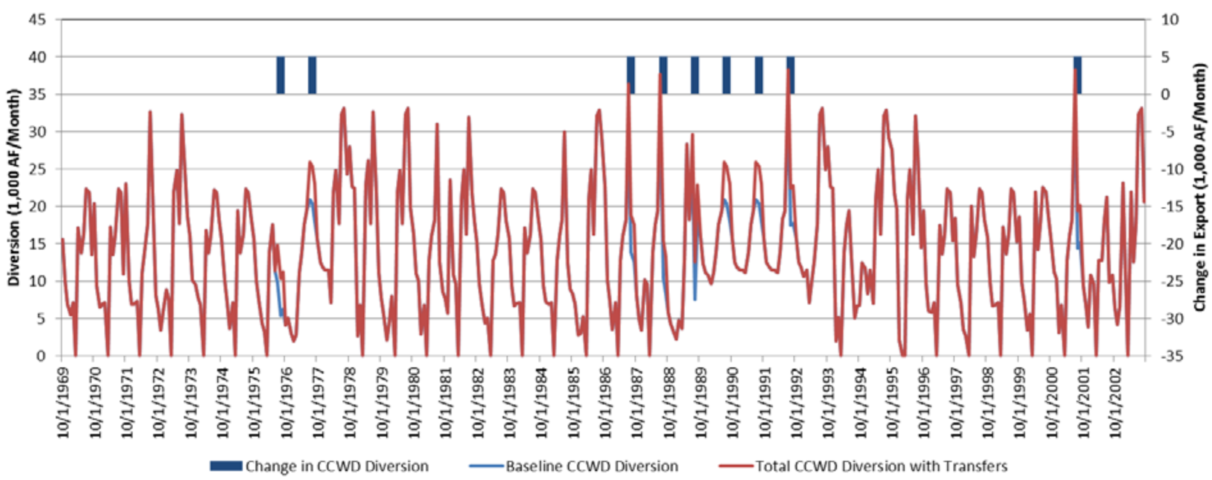

Figure B-36. Contra Costa WD Diversions with and without Alternative 2 Transfers

B.6.3 Alternative 3: No Cropland Modifications

Alternative 3 would include transfers through groundwater substitution, stored reservoir release, and conservation. It would not include any cropland idling transfers.

Figure B-37 summarizes the quantity of transfer water made available (Transfer Supply) under Alternative 3 on an annual basis, and illustrates where the water is diverted (Transfer Use). As in Alternative 2, a percentage of water to be transferred through the Delta becomes carriage water to maintain Delta water quality. Alternative 3 does not include crop idling transfer so there are no transfer supplies from that measure. Unused transfer water under this alternative is from the spill of Placer County Water Agency reservoir release water from Folsom before it can be released and re-diverted by East Bay MUD.

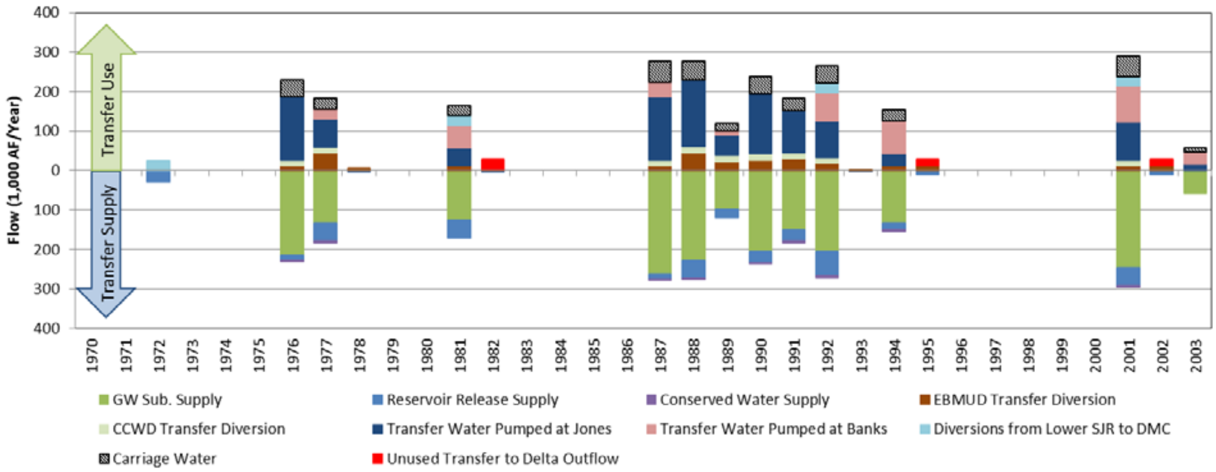

Figure B-37. Annual Transfer Summary for Alternative 3

B.6.3.1 Storage

Changes in the operation of Shasta under Alternative 3 are similar to changes under Alternative 2 (see Figure B-38). Increases in storage under Alternative 3 occur when groundwater substitution transfers start prior to July and transfer water is stored upstream. There are also small reductions in storage when additional releases are made to account for changes in Sacramento River flow as a result of groundwater substitution transfers.

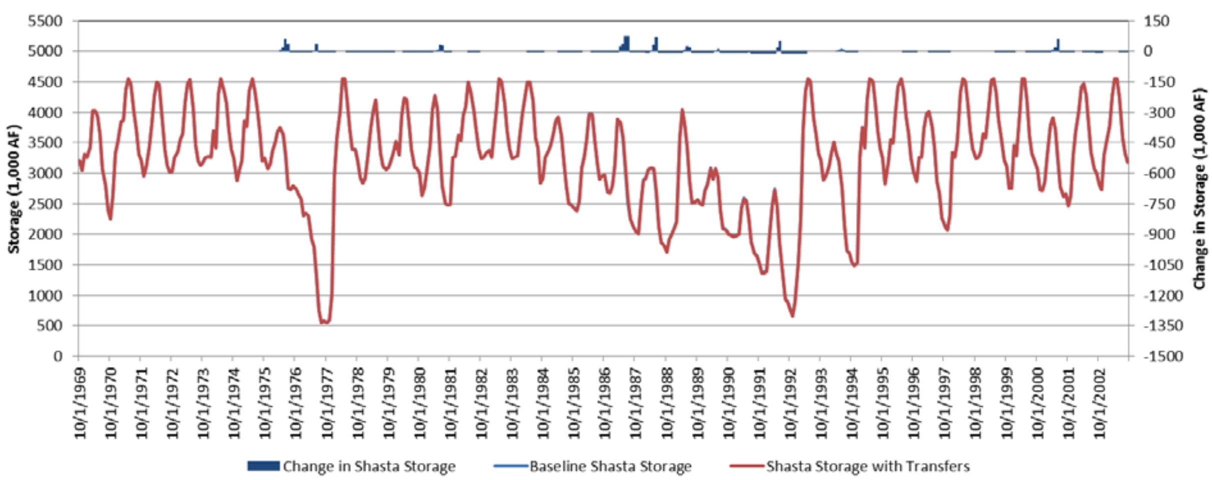

Figure B-38. Shasta Operations with and without Alternative 3 Transfers

Folsom is used to regulate reservoir release transfers from Placer County Water Agency's upstream reservoirs before delivery to East Bay MUD. This operation can result in temporary changes in storage, as illustrated in Figure B-39. Additional releases are also made out of Folsom to account for changes in river flows as a result of groundwater substitution transfers.

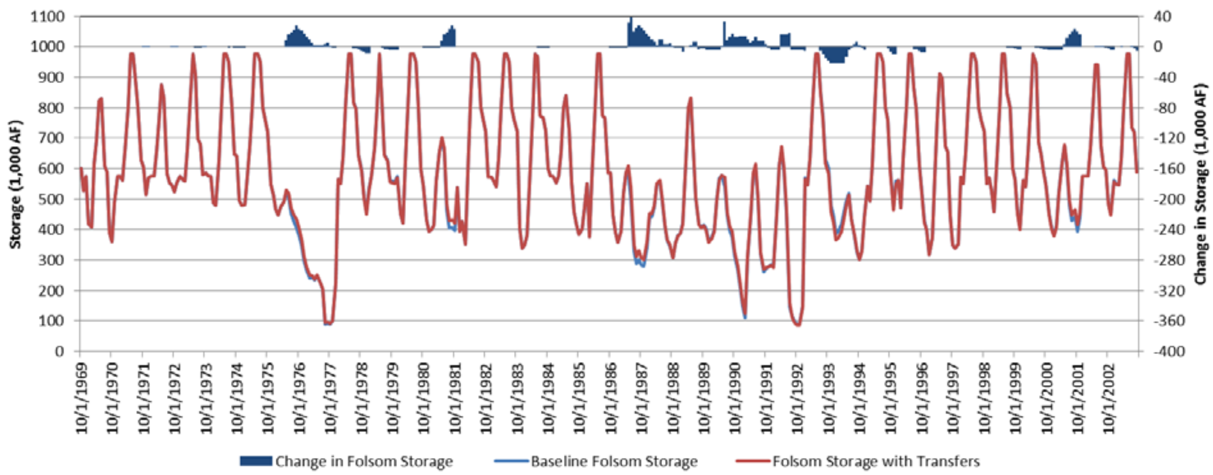

Figure B-39. Folsom Operations with and without Alternative 3 Transfers

Figure B-40 illustrates the change in operations at Oroville. Changes in Oroville operations result from shifting the timing of delivery of SWP water to accommodate transfers. There are also decreases in storage when additional water is released to maintain minimum flow requirements on the Lower Feather River. These additional releases from Oroville are made to account for reductions in Feather River flows due to groundwater substitution transfers.

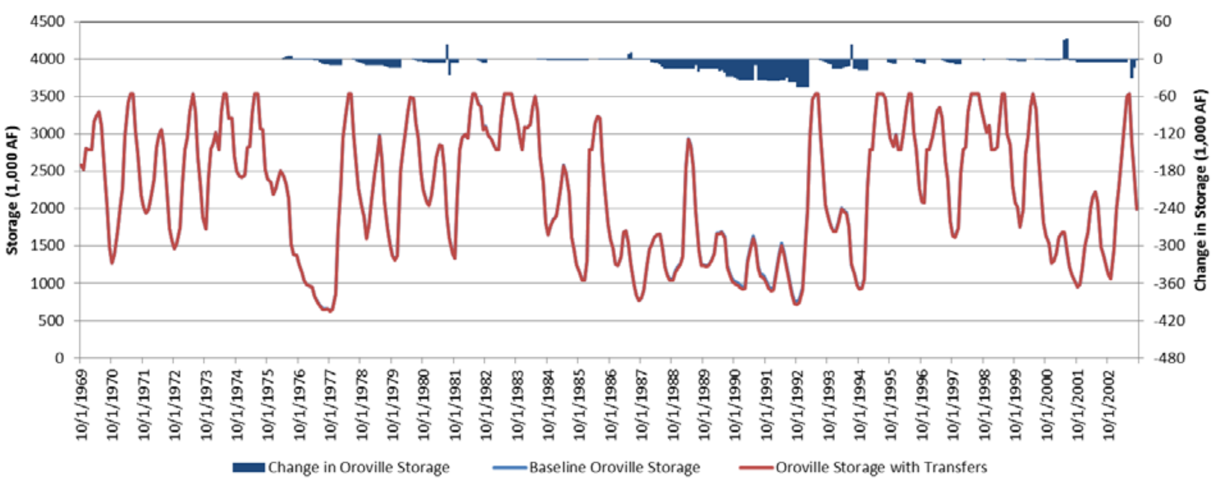

Figure B-40. Oroville Operations with and without Alternative 3 Transfers

South Sutter WD releases water from Camp Far West Reservoir to participate in reservoir release transfers. Figure B-41 illustrates the only change in reservoir storage from baseline conditions as the quantity released for transfer. Camp Far West Reservoir storage returns to baseline levels when the reservoir refills.

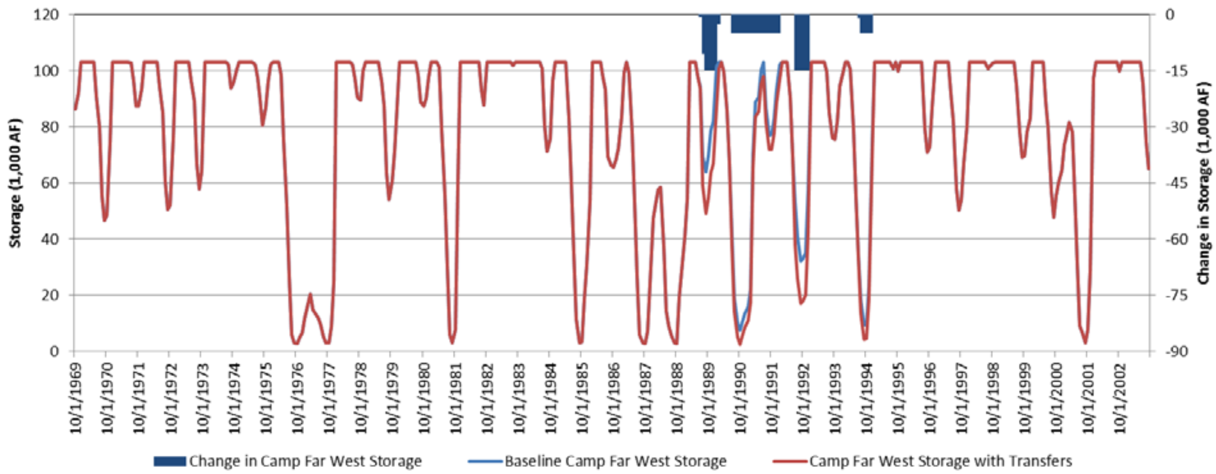

Figure B-41. Camp Far West Operations with and without Alternative 3 Transfers

Browns Valley ID releases water from Merle Collins Reservoir to participate in reservoir release transfers. Figure B-42 illustrates the only change in reservoir storage from baseline conditions as the quantity released for transfer, up to five TAF in any year. Merle Collins Reservoir storage returns to baseline levels when the reservoir refills.

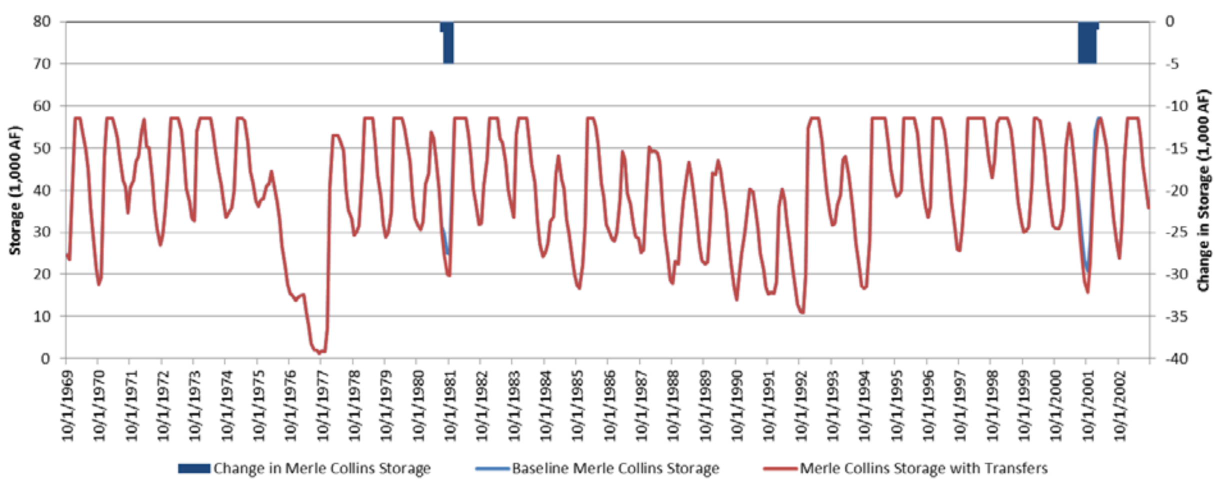

Figure B-42. Merle Collins Operations with and without Alternative 3 Transfers

Placer County Water Agency releases water from MFP reservoirs of French Meadows and Hell Hole to participate in reservoir release transfers. Figure B-

43 illustrates the combined storage in these two reservoirs under both baseline and with Project operations. MFP reservoir storage returns to baseline levels when the reservoirs refill.

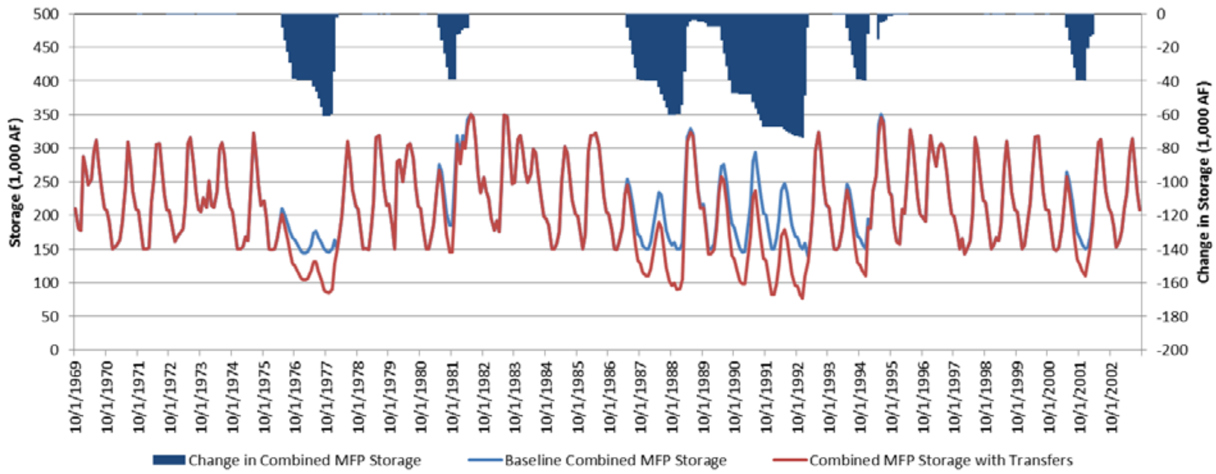

Figure B-43. MFP Operations with and without Alternative 3 Transfers

Figure B-44 illustrates change in storage of Lake McClure due to reservoir release transfers. Storage in Lake McClure can be lower by up to 30 TAF, the volume of reservoir release transfer, and returns to baseline levels when the reservoir refills with water that would otherwise have been released to maintain flood space requirements.

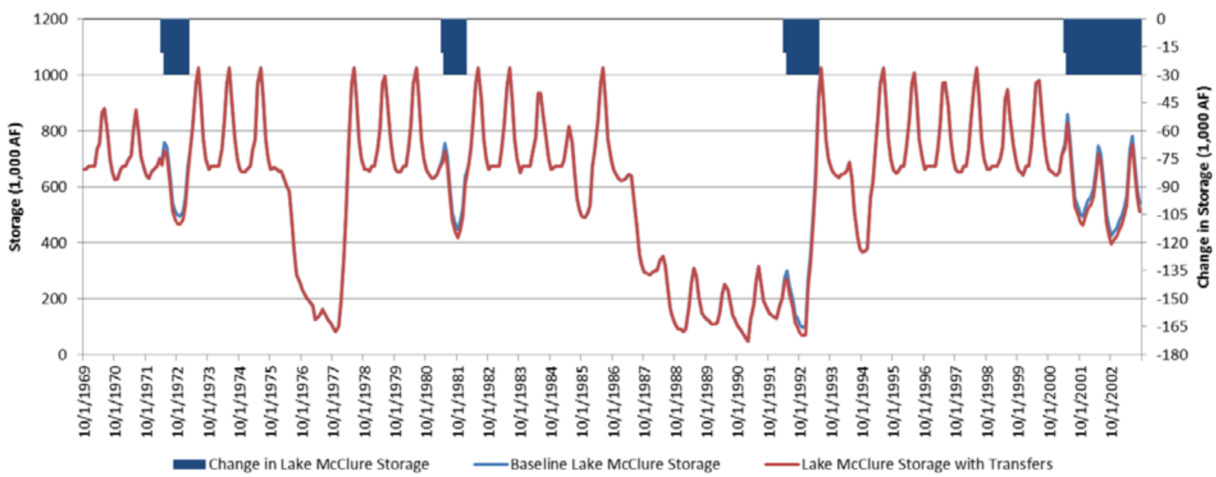

Figure B-44. Lake McClure Operations with and without Alternative 3 Transfers

Conserved water from Browns Valley ID is stored in Yuba County Water Agency's New Bullards Bar Reservoir and released for transfer in years with demand and capacity. These releases of stored water are the primary effect to New Bullards Bar Reservoir as illustrated below in Figure B-45.

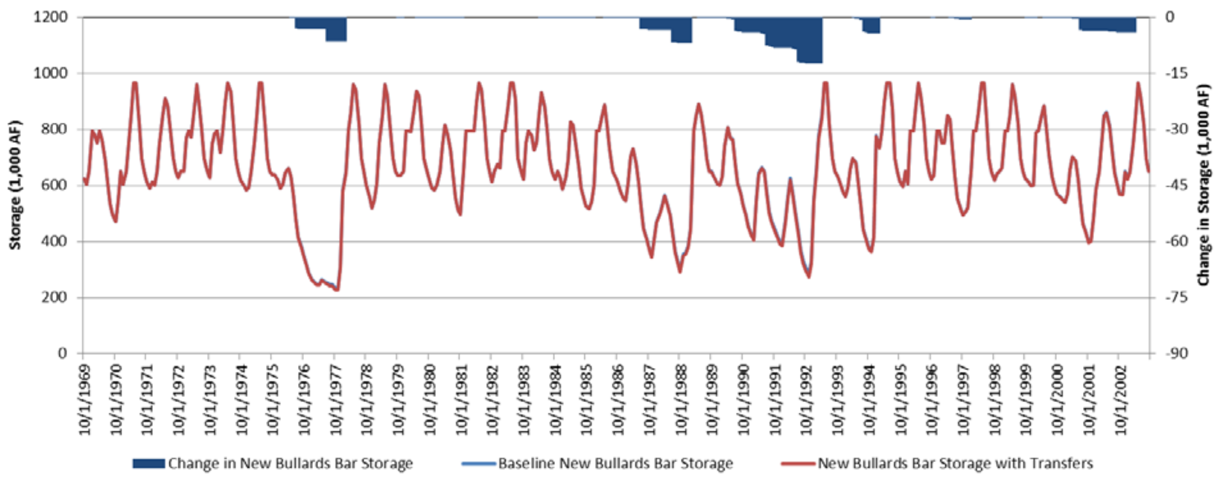

Figure B-45. New Bullards Bar Operations with and without Alternative 3 Transfers

B.6.3.2 Stream Flow

Releases from Keswick Dam, as illustrated below in Figure B-46, reflect changes in Shasta storage seen in Figure B-38. A reduction in release corresponds to an increase in Shasta storage. Reduced releases typically occur in the April through June period when it may be possible to store transfer water made available downstream. Months of reduced releases are followed by increased releases as transfer water is released to be moved through the Delta during the July through September period.

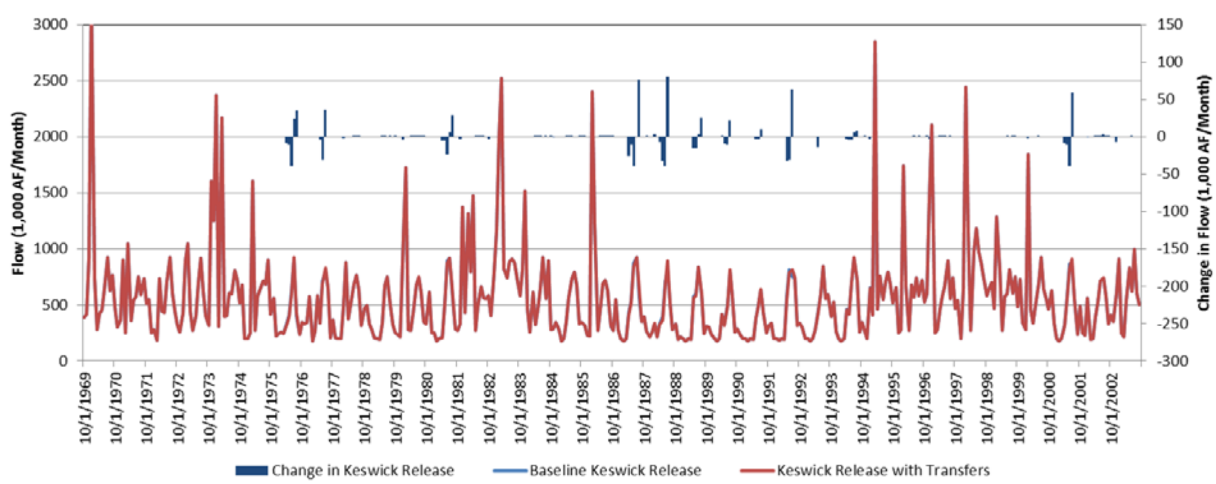

Figure B-46. Keswick Dam Release with and without Alternative 3 Transfers

Figure B-47 illustrates the effect to flows on the Sacramento River at Wilkins Slough. Flows are reduced when groundwater substitution transfers commence prior to July and are simulated as stored upstream in Shasta. Flows are increased in the July through September period when previously stored transfer water is released for delivery through the Delta, and additional groundwater substitution transfers occur upstream of Wilkins Slough.

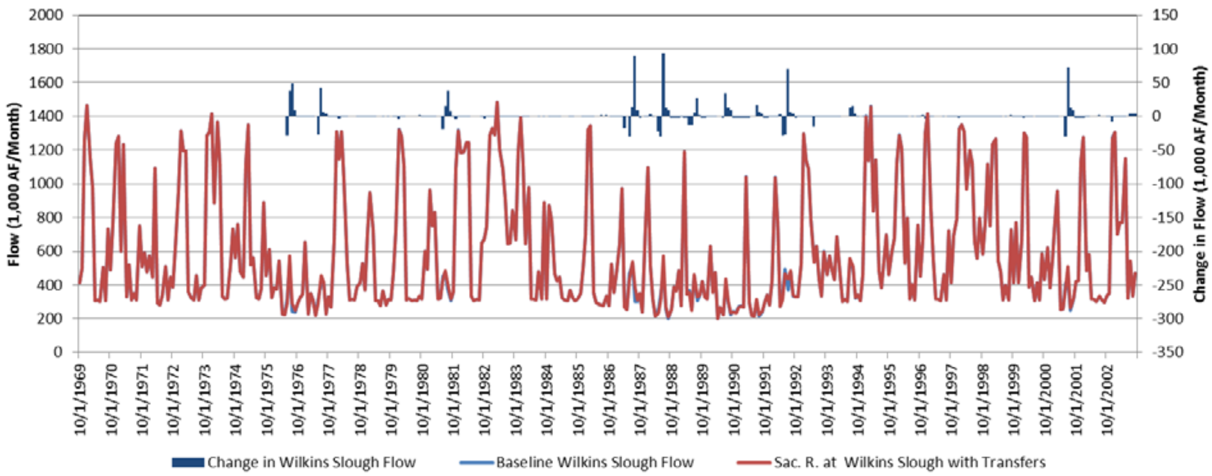

Figure B-47. Sacramento River at Wilkins Slough with and without Alternative 3 Transfers

Figure B-48 illustrates Nimbus Dam releases under baseline and with Alternate 3 transfers. Nimbus releases reflect CVP operations of Folsom Reservoir. Increases in release of approximately five TAF are water made available by Placer County Water Agency and released from Folsom for re-diversion by East Bay MUD. Larger increases are typically preceded by decreases as transfer water made available downstream is stored in Folsom. Large releases occur when stored transfer water is release to be conveyed through the Delta. Decreases also occur when Placer County Water Agency's upstream reservoirs refill, typically during times when Folsom is also spilling water to maintain flood space requirements.

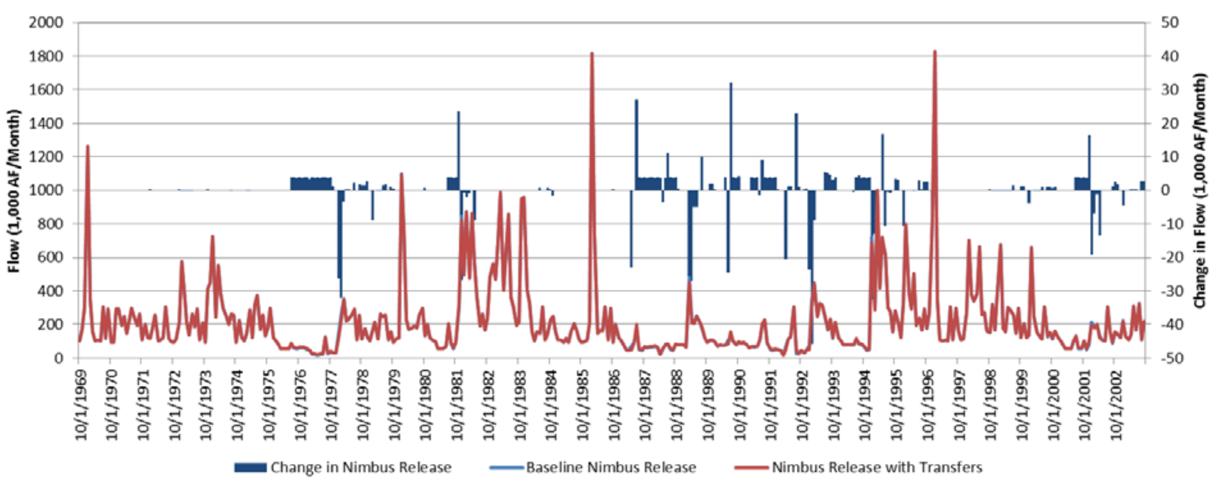

Figure B-48. Nimbus Dam Release with and without Alternative 3 Transfers

The change in flow on the American River at H Street is similar as the change in release from Nimbus. Increases in flow are larger from July through September by the volume of groundwater substitution transfer made available by Sacramento Suburban WD and the City of Sacramento. Figure B-49 is a comparison of flows under baseline and Alternative 3.

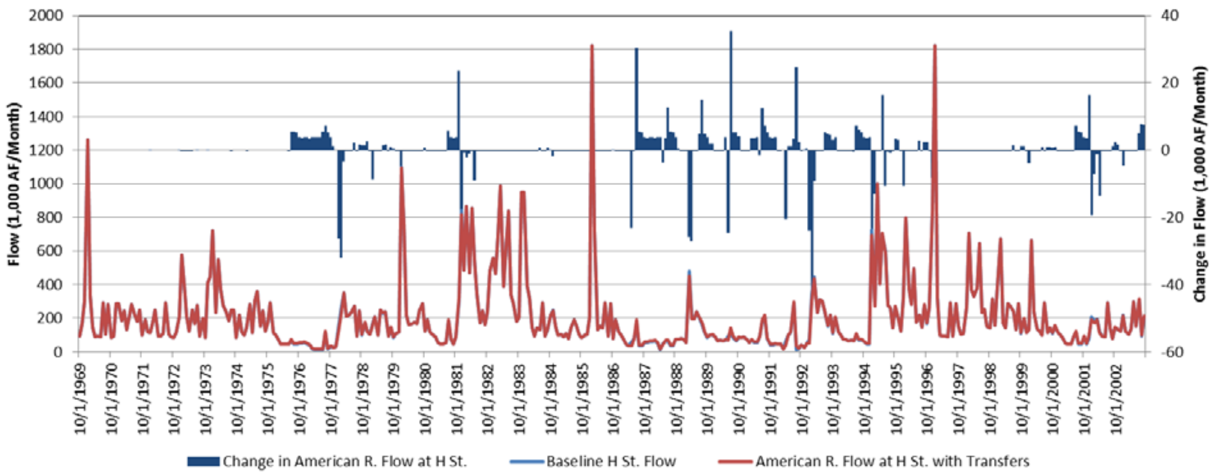

Figure B-49. American River at H Street with and without Alternative 3 Transfers

Figure B-50 illustrates changes in Feather River flow downstream from Thermalito. Flow in the Feather River below Thermalito changes due to changes in the operation of Oroville. Transfer water made available on the Feather River downstream from Thermalito can be temporarily stored in Oroville for release and transfer during the July through September period. Water stored prior to July reduces Feather River flow. Increases and decreases in flow on the Feather River below Thermalito also occur from shifts in timing of SWP water to accommodate transfers. The magnitude of some of these differences is affected by model nuances within CalSim II that can create variations from month-to-month in release of SWP water from Oroville for movement through the Delta.

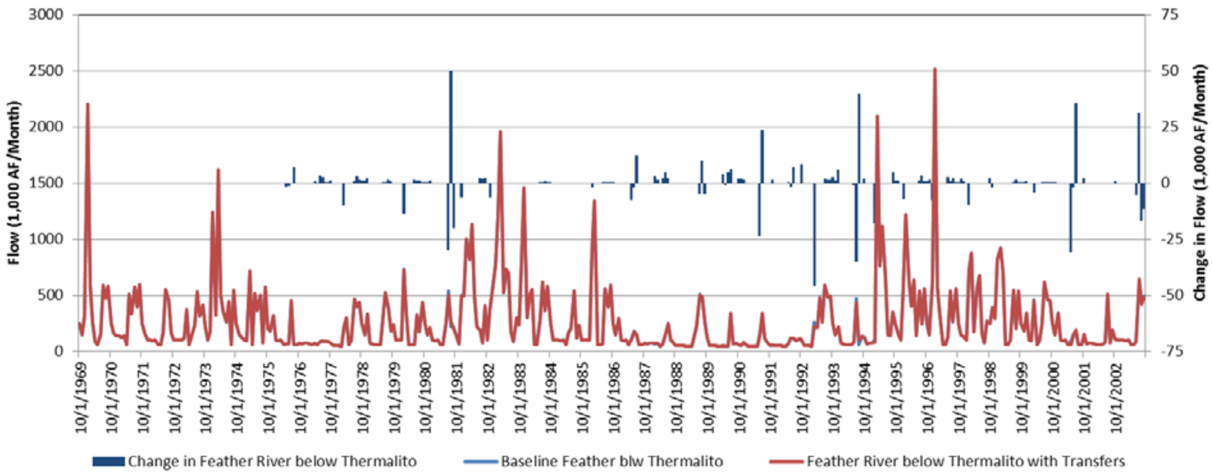

Figure B-50. Feather River below Thermalito with and without Alternative 3 Transfers

Figure B-51 illustrates changes in flow on the Yuba River as a result of New Bullards Bar Reservoir release of Browns Valley ID conserved water (increases) and reservoir refill (decreases).

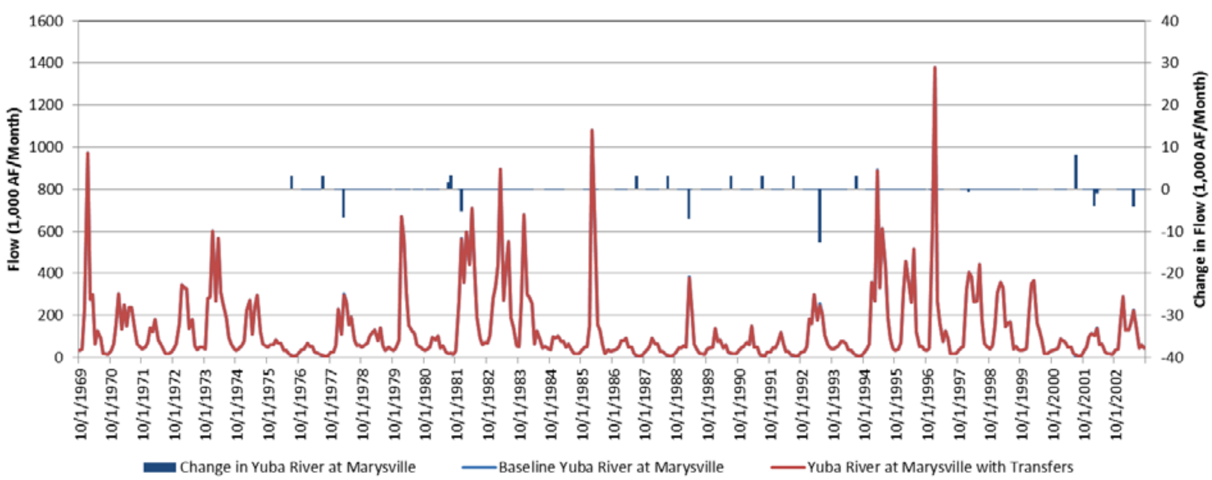

Figure B-51. Yuba River at Marysville with and without Alternative 3 Transfers

Figure B-52 illustrates the monthly flow of the Bear River at the confluence with the Feather River. Bear River flow changes as a result of South Sutter WD reservoir release transfers from Camp Far West Reservoir. Flows increase when water is released for transfer and decrease when Camp Far West refills.

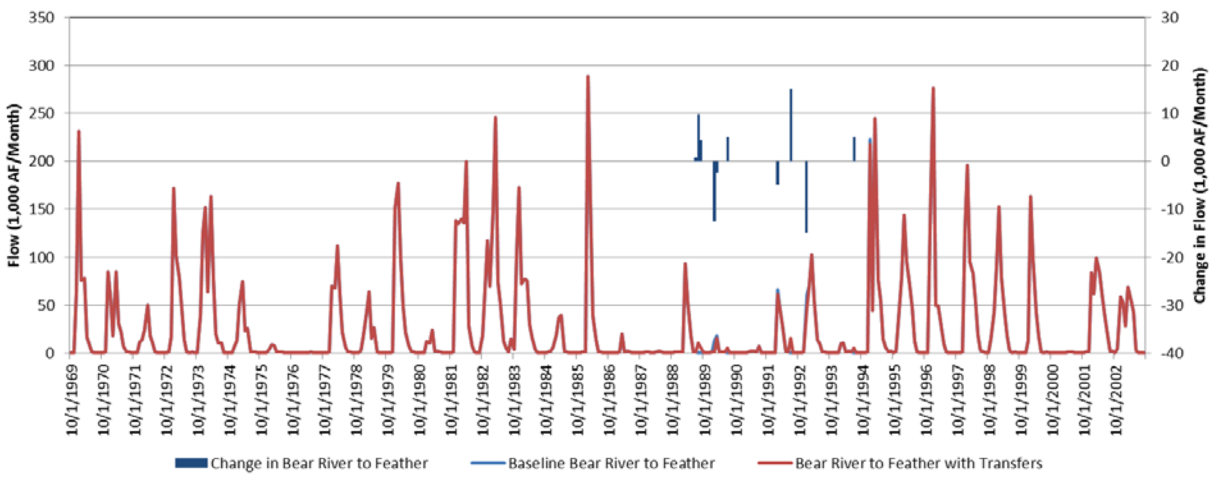

Figure B-52. Bear River to the Feather River with and without Alternative 3 Transfers

The flow on the Lower Feather River represents an aggregation of flows on the Yuba River, Bear River, and upper portions of the Feather River. There are also increases due to water made available by groundwater substitution transfers along the Feather River between Thermalito and the confluence with the Sacramento. Figure B-53 illustrates flows and changes in flows for the baseline and Alternative 3.

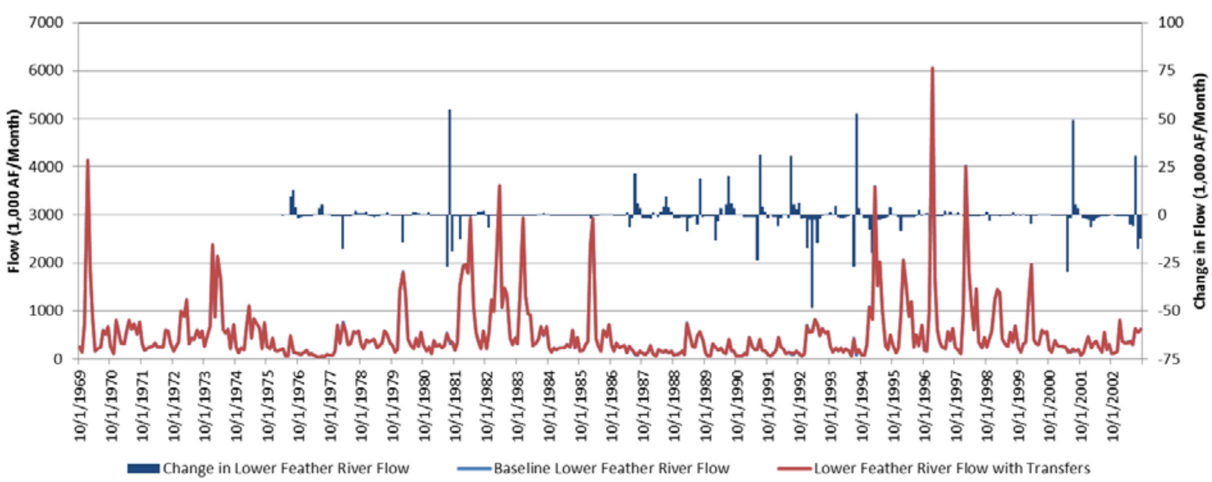

Figure B-53. Lower Feather River with and without Alternative 3 Transfers

Figure B-54 illustrates Sacramento River at Freeport under baseline and Alternative 3 transfers. This location is an aggregation of all changes on the Sacramento River at Wilkins Slough, the Lower Feather River, and the American River at H Street, and changes between those locations and Freeport. Changes between those locations and Freeport include increases in flow due to water made available through groundwater substitution transfers and decreases