Chapter 23
Antidegradation Analysis

23.1 Overview of Antidegradation Policies

The State Water Board and the United States Environmental Protection Agency (USEPA) have adopted antidegradation policies intended to protect existing high quality waters. Both the state and federal antidegradation policies, which are independently enforceable, require the high quality of these waters to be maintained unless otherwise provided by the policies.[1]

In 1968 the State Water Board adopted California's antidegradation policy by Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." The state policy applies to surface water and groundwater whose quality meets or exceeds water quality objectives and establishes the intent to maintain high quality waters of the State to the maximum extent possible.

Whenever existing water quality is better than the quality established in applicable policies or plans, Resolution 68-16 provides that the high water quality must be maintained unless it can be demonstrated that any change in water quality will have the following results.

1. Will be consistent with the maximum benefit to the people of the State.
2. Will not unreasonably affect present and anticipated beneficial uses of such water.
3. Will not result in water quality less than that prescribed in applicable water quality control policies or plans.

Further, any activity that results in a discharge to high quality waters must use the best practicable treatment or control necessary to avoid a pollution or nuisance and to maintain the highest water quality consistent with the maximum benefit to the people of the state.

The federal antidegradation policy was included USEPA's first water quality standards regulation in 1975[2] (See 40 Fed. Reg. 55340-41, November 28, 1975). The federal antidegradation policy applies to surface water, regardless of the quality of the water. (40 C.F.R. § 131.12) Under the federal policy, "existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." (40 C.F.R. § 131.12, subd. (a)(1)) In addition, where the quality of waters exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality of water must be maintained and protected unless the state finds that

1. allowing lower quality is necessary to accommodate important economic or social development in the area in which the waters are located;

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[1] While the consideration of state and federal antidegradation policies is included as a chapter in this recirculated substitute environmental document (SED), it is not a requirement under CEQA.

[2] The federal antidegradation policy was originally based on the Clean Water Act's objectives, including the objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (33 U.S.C. § 1251(a)) In 1987, the Clean Water Act was amended to expressly require satisfaction of antidegradation requirements for revisions of certain effluent limitations. (33 U.S.C. § 1313(d)(4)(B))

2. water quality is adequate to protect existing beneficial uses fully; and
3. the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control are achieved. (40 C.F.R. § 131.12, subd. (a)(2))

The federal regulations further require that if a state determines it is necessary to lower the water quality of high quality waters, this determination will be based on both an analysis of alternatives that would lessen or prevent degradation and an analysis related to economic or social development in the area in which the waters are located. (40 C.F.R. § 131.12, subd. (a)(2)(ii); 80 Fed. Reg. 51032 (August 21, 2015)) However, the federal policy applies to reductions in water quality after the policy was adopted in November, 1975 (State Water Board 1994). The federal regulations also require that state water quality standards[3] include an antidegradation policy consistent with the federal policy. (40 C.F.R. § 131.12, subd. (a)) The State Water Board has interpreted Resolution 68-16 to incorporate the federal policy where the federal policy applies under federal law[4] (State Water Board 1986; State Water Board 1994).

The proposed amendments to the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (2006 Bay-Delta Plan) will fully protect existing beneficial uses and will not result in a lowering of water quality. Instead, the analysis of the proposed plan amendments[5] indicates it will likely result in water quality improvements in the San Joaquin River (SJR) Watershed and the southern Delta. As such, a complete antidegradation analysis is not required. (See, e.g., State Water Board, Administrative Procedures Update, Antidegradation Policy Implementation for NPDES Permitting, 90-004 (State Water Board 1990) Nonetheless, by raising the salinity water quality objective in the Southern Delta, the proposed plan amendments may appear to relax the objective and authorize a lowering of water quality. Accordingly, the State Water Board provides the analysis in this chapter, with respect to salinity, to show how existing uses will be fully protected and how water quality will be maintained or improved, consistent with the principles contained in the state and federal antidegradation policies, under the proposed Bay-Delta Plan amendments. In addition, the following analysis demonstrates how there will not be a lowering of water quality with respect to other affected parameters. The analyses are based on available water quality data, modeling, and other analyses contained elsewhere in the recirculated substitute environmental document (SED).

23.2 The 2006 Bay-Delta Plan

The 2006 Bay-Delta Plan defines beneficial uses of water and establishes water quality objectives to reasonably protect these beneficial uses. The plan also includes a program of implementation to achieve the objectives. The requirements of the 2006 Bay-Delta Plan are primarily implemented

[3] Together, the beneficial uses and the water quality objectives established to reasonably protect the beneficial uses are called water quality standards under the terminology of the federal Clean Water Act.

[4] The State Water Board continues to reserve its arguments regarding the USEPA's authority to adopt standards for flow and operations, including standards for salinity intrusion. (See Bay-Delta Water Quality Control Plan, footnote 3.) To the extent the proposed flow and salinity water quality objectives are state-only standards, the federal antidegradation policy would not apply.

[5] These plan amendments are the *project* as defined in State CEQA Guidelines, Section 15378.

through water right actions and other measures, such as Clean Water Act hydropower water quality certifications. The beneficial uses protected by the 2006 Bay-Delta Plan include the following.

- Agricultural supply (AGR)
- Cold freshwater habitat (COLD)
- Commercial and sport fishing (COMM)
- Contact water recreation (REC-1)
- Estuarine habitat (EST)
- Groundwater recharge (GWR)
- Industrial process supply (PRO)
- Industrial service supply (IND)
- Migration of aquatic organisms (MIGR)
- Municipal and domestic supply (MUN)
- Navigation (NAV)
- Non-contact water recreation (REC-2)
- Rare, threatened, or endangered species (RARE)
- Shellfish harvesting (SHELL)
- Spawning, reproduction, and/or early development (SPWN)
- Warm freshwater habitat (WARM)
- Wildlife habitat (WILD)

23.3 San Joaquin River Water Quality Objectives for Fish and Wildlife Beneficial Uses

23.3.1 Current San Joaquin River Flow Objectives

The State Water Board first established the SJR flow objectives at Vernalis to protect fish and wildlife beneficial uses in the 1995 Bay-Delta Plan. The State Water Board set different flow objectives for three time periods: February through June, excluding April 15 through May 15 (spring flows); April 15 through May 15 (pulse flows); and October (fall flows). The flow objectives vary depending on the water year type, with higher flows required in wetter years. The spring flow objective was intended to provide minimum freshwater flows in the SJR to address habitat concerns caused by reduced tributary inflows and poor water quality. The pulse flows were principally developed to aid in cueing fall-run Chinook salmon juvenile out-migration in the spring from the SJR. The fall flows were developed to provide attraction flows for fall-run adult salmon returning to the watershed to spawn. The objectives were based on the limited scientific information available at the time. To obtain additional scientific information, the State Water Board in Revised Decision 1641 (2000) approved conducting the Vernalis Adaptive Management Plan (VAMP) experiment proposed in the San Joaquin River Agreement (SJRA) until 2012, in lieu of meeting the pulse flow objectives included in the 1995

Bay-Delta Plan. In 2006, the Bay-Delta Plan was amended to allow the VAMP experiment to be conducted in lieu of the pulse flows.

23.3.2 Proposed Lower SJR Flow Objectives

The proposed Lower San Joaquin River (LSJR) flow objectives would replace the existing water quality objectives for fish and wildlife beneficial uses at Vernalis during the February–June time frame. The proposed objectives call for inflow conditions from the SJR Watershed to the Delta at Vernalis sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta. Inflow conditions include those that more closely mimic the natural hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of flows as they would naturally occur. Indicators of fish population viability include abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity. In addition to the narrative objective, the flow objectives will require from each of the three eastside tributaries to the LSJR, the Merced, Tuolumne, and Stanislaus Rivers, to release a percent of unimpaired flow[6] to the LSJR. The flow objectives evaluated in this SED and this chapter range from 20 percent to 60 percent of the unimpaired flow on each tributary. In addition, a minimum base flow value between 800–1,200 cubic feet per second (cfs), based on a maximum 7-day running average, will be required at Vernalis from February–June.

As described in Appendix K, *Revised Water Quality Control Plan*, the program of implementation will allow the unimpaired flow objective to be adjusted, or adaptively implemented. Specifically, the flow objectives may be adjusted if information produced through the monitoring and review processes, as described in Appendix K, or other best available scientific information indicates that such changes will be sufficient to support and maintain the natural production of viable native SJR Watershed fish populations migrating through the Delta and meet any existing biological goals approved by the State Water Board. Adaptive implementation options include: (1) adjusting the percentage of unimpaired flow within an adaptive range (30 to 50 percent for LSJR Alternative 3), (2) managing the required percentage of unimpaired flow as a total volume that may be released on an adaptive schedule during the February–June period, and (3) shifting flow from the February–June period for release later in the year to prevent adverse impacts on coldwater pool and related fisheries impacts. These measures would be implemented based on real-time circumstances and available scientific information to achieve the narrative objective for the protection of LSJR fish and wildlife. The Vernalis base flow objective may also be adaptively implemented within the allowed range of 800–1200 cfs.

Appendix K describes the coordination actions and approvals needed to manage the flows from the tributaries to the LSJR. This includes the creation of a Stanislaus, Tuolumne, and Merced Working Group (STM Working Group) whose purpose is to assist with implementation, monitoring and effectiveness assessment activities for the LSJR flow objectives. The State Water Board will seek recommendations from the STM Working Group on biological goals to inform adaptive implementation actions and the effectiveness of the program of implementation, among others.

[6] *Unimpaired flow* represents the water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds. It differs from natural flow because unimpaired flow is the flow that occurs at a specific location under the current configuration of channels, levees, floodplain, wetlands, deforestation and urbanization.

23.4 Southern Delta Salinity Water Quality Objectives to Protect Agricultural Beneficial Uses

23.4.1 Current Southern Delta Salinity Objectives

The current salinity objectives for agricultural beneficial uses in the southern Delta are found in Table 2 of the 2006 Bay-Delta Plan (and shown below in Table 23-1). The salinity objectives apply in all water year types and compliance is determined at the following four locations: (1) SJR at Airport Way Bridge, Vernalis (Station C-10); (2) SJR at Brandt Bridge (Station C-6); (3) Old River near Middle River (Station C-8); and (4) Old River at Tracy Road Bridge (Station P-12)[7]. While the salinity objectives for the southern Delta apply to all locations in the general area, these specific locations are used to determine compliance with the objectives.

Table 23-1. Current South Delta EC[8] Standards

EC Objective (30-day running average)	Time Period
0.7 dS/m EC (mmhos/cm)[9]	April 1–August 31
1.0 dS/m EC (mmhos/cm)	September 1–March 31

dS/m = deciSiemens per meter
mmhos/cm = millimhos per centimeter

Agricultural beneficial use is the most sensitive use requiring protection for the range of salinity conditions encountered in the southern Delta. The current salinity standards for the southern Delta were originally adopted in the 1978 *Water Quality Control Plan for the Sacramento-San Joaquin Delta* (1978 Bay-Delta Plan) to protect agricultural beneficial uses. These standards were based on the water quality needs of the different crops grown, predominant soil types, and irrigation practices in the southern Delta. The salinity objectives did not take immediate effect, but instead were to become effective on completion of suitable circulation and water supply facilities. In addition, a year-round total dissolved solids (TDS)[10] standard of 500 milligrams per liter (mg/L) (equivalent to approximately 0.83 dS/m EC) at Vernalis was also included in the 1978 Delta Plan, which became effective in 1980 when New Melones Dam was completed. Prior to adoption of the 1978 Bay-Delta Plan, the Central Valley Regional Water Quality Control Board adopted in its June 1971 *Interim Water Quality Control Plan, San Joaquin River Basin 5C*, a TDS standard of 500 mg/L as a maximum 30-day running average at Vernalis. Water Right Decision 1422 adopted by the State Water Board in 1973, which addressed the U.S. Bureau of Reclamation's (USBR) application to appropriate water from the

[7] Although the 2006 Bay-Delta plan identifies this compliance station as Tracy Road Bridge, the actual location is Tracy Boulevard Bridge, consequently Tracy Blvd. will be used here for accuracy.

[8] In this document, EC is *electrical conductivity,* which is generally expressed in deciSiemens per meter (dS/m). Measurement of EC is a widely accepted indirect method to determine the salinity of water, which is the concentration of dissolved salts (often expressed in parts per thousand or parts per million). EC and salinity are therefore used interchangeably in this document.

[9] The text in this chapter and elsewhere in this SED primarily describes salinity using deciSiemens per meter (dS/m), while the units of millimhos/cm (mmhos /cm) are used in the 2006 Bay-Delta Plan. These units are interchangeable in that EC equivalent to 1.0 mmhos/cm is the same as an EC of 1.0 dS/m.

[10] Total dissolved solids is another way to measure dissolved salts in water that has been replaced by electrical conductivity (EC) due to the relative ease in measuring EC.

Stanislaus River, assigned responsibility to USBR for meeting the 500 mg/L TDS salinity standard at Vernalis.

Updates to the Bay-Delta Plan in 1991 and 1995 did not substantively change the southern Delta salinity objectives, except for removal of the 500 mg/L TDS standard at Vernalis beginning with the 1991 plan. Both plans again provided for the staged implementation of the EC water quality objectives. The 1991 Bay-Delta Plan required implementation of the Vernalis and Brandt Bridge salinity standards by 1994, while the Old River near Middle River and Old River at Tracy Boulevard were to be implemented by 1996. Water Right Order 95-6, adopted by the State Water Board in 1995, assigned to USBR the responsibility for meeting the April–August 0.7 dS/m and the September–March 1.0 dS/m EC salinity objectives at Vernalis, which replaced USBR's previous requirement to meet the 500 mg/L TDS standard at Vernalis. Water Right Order 95-6 did not assign responsibility to meet the salinity standards at the other three compliance stations. The 1995 Bay-Delta Plan delayed the compliance date of the agricultural salinity objectives at Old River near Middle River and Old River at Tracy Boulevard from 1996 to December 31, 1997.

In 2000, the State Water Board adopted a water right decision (Revised Decision 1641) that assigned responsibility for meeting the southern Delta salinity objectives by amending the California Department of Water Resources' (DWR) State Water Project (SWP) water rights and the USBR's Central Valley Project (CVP) water rights to require compliance with the 1995 Bay-Delta Plan salinity objectives. In Revised Decision 1641, the State Water Board, however, further delayed the effectiveness of the 0.7 dS/m EC water quality objective set forth in the 1995 Bay-Delta Plan at the Brandt Bridge and the two Old River compliance locations until April 2005. It also allowed for the 0.7 dS/m EC objective to be replaced by the 1.0 dS/m EC objective after April 1, 2005, if permanent barriers were constructed, or equivalent measures were implemented, in the southern Delta and an operations plan that reasonably protected Delta agriculture was prepared by USBR and DWR and approved by the State Water Board Executive Director. In 2006, the Court of Appeals held that the State Water Board did not adequately implement the 1995 Bay-Delta Plan because the plan did not allow further delay in the implementation of the 0.7 dS/m EC water quality objective at the three compliance locations or replace the 0.7 EC objective with the 1.0 EC objective. (State Water Board Cases (2006) 136 Cal.App.4th 674–735 (39 Cal. Rptr. 3d 189)) Currently, SWP and CVP water rights are conditioned on implementation of the EC objectives at the three southern Delta stations downstream of Vernalis and the CVP permits under which USBR delivers water to the SJR Basin are conditioned on meeting the salinity objectives in the SJR at Vernalis.

23.4.2 Proposed Southern Delta Salinity Objectives

The proposed amendments to the Bay-Delta Plan will establish a year-round salinity objective to protect agricultural beneficial uses in the southern Delta of 1.0 dS/m as a maximum 30-day running average of mean daily EC to replace the current seasonal objective of 0.7 dS/m from April–August. The September–March 1.0 dS/m water quality objective will remain unchanged. The compliance locations will include (1) the SJR at Airport Way Bridge, Vernalis; (2) the SJR from Vernalis to Brandt Bridge: (3) Middle River from Old River to Victoria Canal; and (4) Old River/Grant Line Canal from the Head of Old River to West Canal. The program of implementation requires the development of a monitoring plan to assess compliance with the proposed salinity objective, which may lead to changes in the specific locations where compliance is determined. Until the plan is developed, compliance will be assessed at the four locations contained in the 2006 Bay-Delta Plan.

The proposed change to the salinity objective to protect agricultural beneficial uses is based on scientific information and analysis described in Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, and contained in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*. Appendix E examines current agricultural practices, soil characteristics, and crop patterns in the southern Delta to perform its analysis. The analysis in Appendix E concludes that the proposed 1.0 dS/cm EC objective provides for 100 percent yields under most hydrological conditions, and 95 percent yields for the most salt-sensitive crop grown in the region (i.e., dry beans) under dry year conditions and, therefore, adequately protects agricultural beneficial use in the southern Delta. Consequently, the existing April – August water quality objective of 0.7 dS/m, which has never been consistently achieved at all of the required locations, is over protective.

To meet the revised salinity objective downstream of Vernalis, the proposed program of implementation will require the continued conditioning of USBR's water rights pursuant to Revised Water Right Decision 1641. Specifically, USBR's water rights will continue to require the USBR to meet salinity levels of 0.7 dS/m at Vernalis from April 1–to August 31 and 1.0 dS/m from September 1–March 31, as has been the condition since State Water Board adoption of Water Right Order 95-6 in 1995. This will provide assimilative capacity for salinity inputs downstream of Vernalis and help maintain salinity levels that meet the revised objective and reasonably protect agricultural beneficial uses in the southern Delta. Continuation of this requirement will assure that the proposed change to the salinity objective will not result in the lowering of water quality at and downstream of Vernalis in the southern Delta.

The proposed program of implementation requires that DWR and USBR develop and implement a comprehensive operations plan to address the impacts of SWP and CVP export operations on flow and salinity conditions in the southern Delta, including the availability of assimilative capacity for local sources of salinity. DWR's and USBR's water rights will be conditioned to required continued operations of the agricultural barriers at Grant Line Canal, Middle River, and Old River at Tracy Boulevard, or other reasonable measures, to address the impacts of the export operations. In addition, DWR's and USBR's water rights would be conditioned to require monitoring, modeling, special studies, and reporting activities, in coordination with other monitoring programs, to ensure that the salinity objectives are effectively implemented. The proposed program of implementation also includes recommendations to other agencies that would assist in meeting the southern Delta salinity objective (Appendix K, *Revised Water Quality Control Plan*).

23.5 Antidegradation Analysis

The proposed changes to the LSJR flow objectives and southern Delta salinity objective in the Bay-Delta Plan would not result in a lowering of water quality in the Stanislaus, Tuolumne, and Merced Rivers, the LSJR, and the southern Delta. As such, a complete antidegradation analysis is not required (State Water Board 1990). The State Water Board, nevertheless, provides one for salinity because raising the April–August 0.7 dS/m salinity water quality objective to 1.0 dS/m may appear to allow water quality degradation. In addition, the analysis below explains why there will not be a lowering of water quality with respect to other parameters. The analysis evaluates the State Water Board's preferred alternatives: Southern Delta Water Quality (SDWQ) Alternative 2 (1.0 dS/m EC as a running 30-day average year-round) and LSJR Alternative 3 (40 percent unimpaired flow with adaptive implementation); however, this analysis also considers unimpaired flows ranging from 20 percent to

60 percent in order to evaluate a broad range of the LSJR flow objectives alternatives on water quality.

23.5.1 Salinity

Although many factors influence water quality, the new LSJR flow objectives proposed as part of the updated Bay-Delta Plan could affect salinity concentrations in the southern Delta. Salinity, therefore, is evaluated under varying flow objectives (the LSJR alternatives) proposed to revise the Bay Delta Plan. This analysis uses modeling results from the Water Supply Effects (WSE) model to examine whether the proposed changes to the southern Delta salinity and flow objectives for the LSJR would result in a lowering of water quality. Appendix F1, *Hydrologic and Water Quality Modeling*, and Chapter 5, *Surface Hydrology and Water Quality*, of this SED provide explanation and details regarding the analyses and models used to assess the impacts of the proposed plan amendments on water quality. Chapter 5 also evaluates whether the LSJR and SDWQ alternatives would degrade water quality by increasing salinity concentrations at Vernalis or elsewhere in the southern Delta, such that agricultural beneficial uses are impaired. The analysis in Chapter 5 concludes that all LSJR alternatives would reduce average EC values at Vernalis and in the southern Delta channels from April–September and maintain agricultural beneficial uses.

Historical Conditions and Factors Affecting Salinity

Salinity patterns in the southern Delta began to change from their natural state early in the Twentieth Century as a result of increasing agricultural diversions in and around the Delta. Salinity conditions were further altered by the completion of the state, federal, and local water projects, which together have reduced flow entering the Delta at Vernalis. Historical water quality in the southern Delta is discussed in Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta*. Appendix F.2 also describes the high annual and seasonal variability of southern Delta salinity and the strong correlation between salinity and streamflow at Vernalis.

Salinity levels in the southern Delta are affected primarily by the salinity of water flowing into the southern Delta from the SJR near Vernalis and evapoconcentration of salt in water that is diverted from and discharged back into southern Delta channels for agricultural purposes. Point sources of salt in the southern Delta have a small overall salinity effect. High Vernalis flows generally reduce the salinity of water entering the southern Delta from the SJR by diluting salt loads from upstream areas. Municipal treated wastewater discharges[11] have a relatively small effect on the southern Delta salinity. Higher CVP and SWP pumping also has an effect on southern Delta salinity by bringing more low-salinity Sacramento River water across the Delta to the export pumps. In addition, periods of low Delta outflow (in the fall months) can cause increased seawater intrusion and higher EC at the southern Delta export facility and Contra Costa Water District intakes.

In the early 1970s, salinity conditions at Vernalis did not always meet water quality standards for salinity, as evident in the discussion provided in Water Right Decision 1422, issued in 1973. Water Right Decision 1422 states that the water quality objective of 500 mg/L TDS (~0.83 dS/m EC) was

[11] Municipal dischargers in the southern Delta are currently not subject to the existing numeric salinity water quality objectives in the 2006 Bay-Delta Plan as a result of a superior court decision in *City of Tracy v. California State Water Resources Control Board*, Sacramento Superior Court, Case No. 34-2009-80000392. In order for municipal dischargers to be subject to salinity standards, the decision requires the consideration of Water Code section 13241 factors for any new salinity standards and a program of implementation.

exceeded 38 percent of the time during the irrigation season. After adoption of the first salinity objectives at Vernalis in the June 1971 Interim Water Quality Control Plan, San Joaquin River Basin 5C, the LSJR was identified as impaired due to salinity in 1975 (1975 303[d] list). Implementation of the April–August 0.7 dS/m salinity objective for the southern Delta, first adopted in the 1978 Bay-Delta Plan, was delayed repeatedly under the assumption that infrastructure would be built to better meet the objective; however, these actions never occurred. Salinity conditions did not improve in the 1980s or early 1990s, as indicated by historical water quality data presented in the final environmental impact report to support implementation of the 1995 Bay-Delta Plan, which shows that the April–August 0.7 dS/m salinity objective at Vernalis was exceeded 62 percent of the time between 1986 and 1995 (State Water Board 1999).

Salinity conditions improved after 1995 when Water Right Order 95-6 assigned USBR responsibility to meet the Vernalis salinity objectives of 0.7 dS/m EC from April–August and 1.0 dS/m EC from September–March. In addition, regulatory requirements for discharge of agricultural drainage upstream of Vernalis were put in place in 1996, in particular for the Grasslands drainage area, which have helped reduce the salinity load and improved water quality in the LSJR. As of 2015, the salinity discharges from the Grasslands drainage area have been reduced by 83 percent between 1995 and 2015 (SLDMWA 2015).

There is a strong relationship between EC values at Vernalis and EC at downstream monitoring locations under most flow regimes. Therefore, as conditions at Vernalis have improved since 1995, so have conditions at the other southern Delta salinity compliance stations. However, despite the improvement, compliance with the interior southern Delta salinity objectives has not always been achieved. The standards at the interior south Delta stations are more difficult to achieve because of high salinity runoff from agricultural land downstream of Vernalis. There are also additional sources of salinity between Vernalis and the other locations, as well as diversions and other hydrodynamic factors that may increase salinity concentrations at the interior locations compared to Vernalis.

Figure 23-1 is an exceedance chart of observed monthly average EC values collected for April–August from 1995–2015 at the four southern Delta compliance locations (Old River at Tracy Boulevard Bridge, Old River near Middle River, SJR at Vernalis, and SJR at Brandt Bridge). Figure 23-1 shows the percent of months during the irrigation season that the monthly average EC values exceeded the 0.7 dS/m EC standard for each of the southern Delta stations. From 1995 to 2015, the monthly average EC at Vernalis exceeded 0.7 dS/m EC only once during April–August, just barely in July of 2015. However, for the other three locations, the average monthly EC exceeded 0.7 dS/m more frequently over the last 2 decades. For the SJR at Brandt Bridge and the Old River near Middle River locations, the average monthly EC remained below 0.7 dS/m approximately 85 percent and 83 percent of months, respectively. Conditions for Old River at Tracy Boulevard Bridge are often worse than the other stations, and the average monthly EC remained below 0.7 dS/m only about 55 percent of the time (DWR 2016a, 2016b).

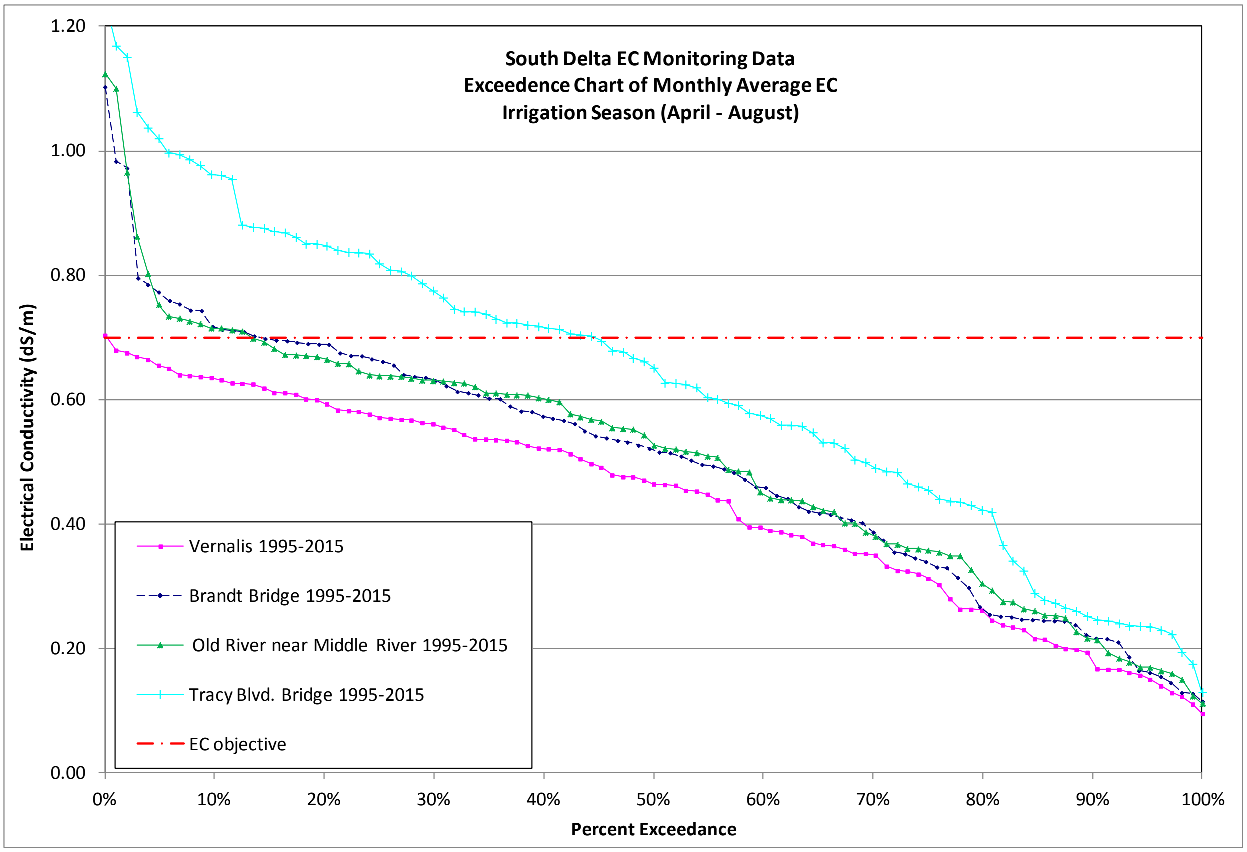

Figure 23-1. Exceedance Chart of Monthly Average EC (dS/m = deciSiemens per meter) Values at South Delta Monitoring Locations for Irrigation Months from 1995–2015

Figure 23-2 shows an exceedance chart for observed monthly average EC values collected for September–March from 1995–2015 at the four southern Delta compliance locations. Similar to Figure 23-1, this chart indicates the percent of months outside of the irrigation season that the monthly average EC values exceeded the 1.0 dS/m EC standard for each of the southern Delta stations. From 1995–2015 the monthly average EC at Vernalis never exceeded 1.0 dS/m from September–March. For the SJR at Brandt Bridge and the Old River near Middle River locations, the average monthly EC remained below 1.0 dS/m approximately 97 percent and 95 percent of months, respectively. Finally, The EC for Old River at Tracy Boulevard Bridge is less than 1.0 dS/m about 85 percent of the time.

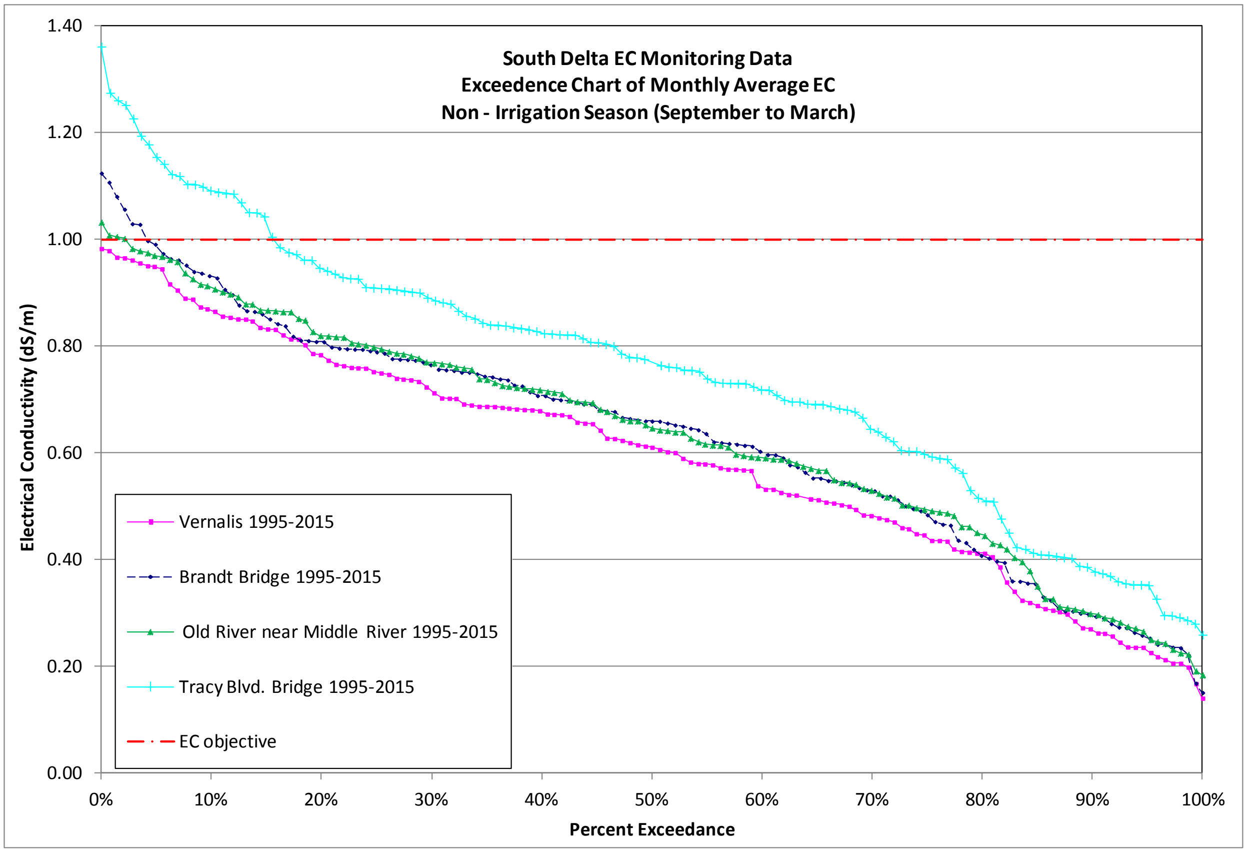

Figure 23-2. Exceedance Chart of Monthly Average EC (dS/m = deciSiemens per meter) Values at South Delta Monitoring Locations for Non-Irrigation Months from 1995–2015

Baseline Water Quality

Establishing the baseline receiving water quality for salinity determines the level of water quality protection. Baseline water quality for the purposes of the antidegradation analysis is the best quality of water measured since 1968, considering the state antidegradation policy, or 1975, considering the federal antidegradation policy, unless a subsequent lowering of water quality was allowed consistent with state and federal antidegradation policies. Under the state antidegradation policy, where a water quality objective for a particular constituent was adopted after 1968, the baseline for that constituent is the highest water quality achieved since the adoption of objective (Resolution 68-16, Resolve 1). If the baseline water quality is equal or less than the water quality objective, it must be maintained at the objective or improved to a level that achieves the objective (State Water Board 1990). If the baseline water quality is better than the water quality objective, it must be maintained unless poorer water quality is necessary to accommodate important economic or social development and is considered to be the maximum benefit to the people of the State (State Water Board 1990).Based on information and salinity data described above, 1995–2015 represents the period of highest water quality, with respect to salinity, since adoption of the state and federal antidegradation policies and establishment of the first salinity objectives. Therefore, this period represents the baseline water quality for salinity.

Salinity concentrations in the southern Delta vary widely over months and years, driven largely by changes in hydrology. The baseline water quality that is representative of salinity conditions must therefore be assessed based on a sufficiently long time frame that takes into consideration this variability. The historical variation in salinity and its relation to hydrological conditions is illustrated in Figure 23-3, which compares the monthly averages of EC and flow at Vernalis from 1995–2015 (DWR 2016b). This time period represents water quality conditions for a range of wet and dry water years. Using a 20-year baseline period is consistent with State Water Board guidance that baseline water quality should be representative of the water body, accounting for temporal and spatial variability (State Water Board 1990). Therefore, the 1995–2015 time period is appropriate for this antidegradation analysis.

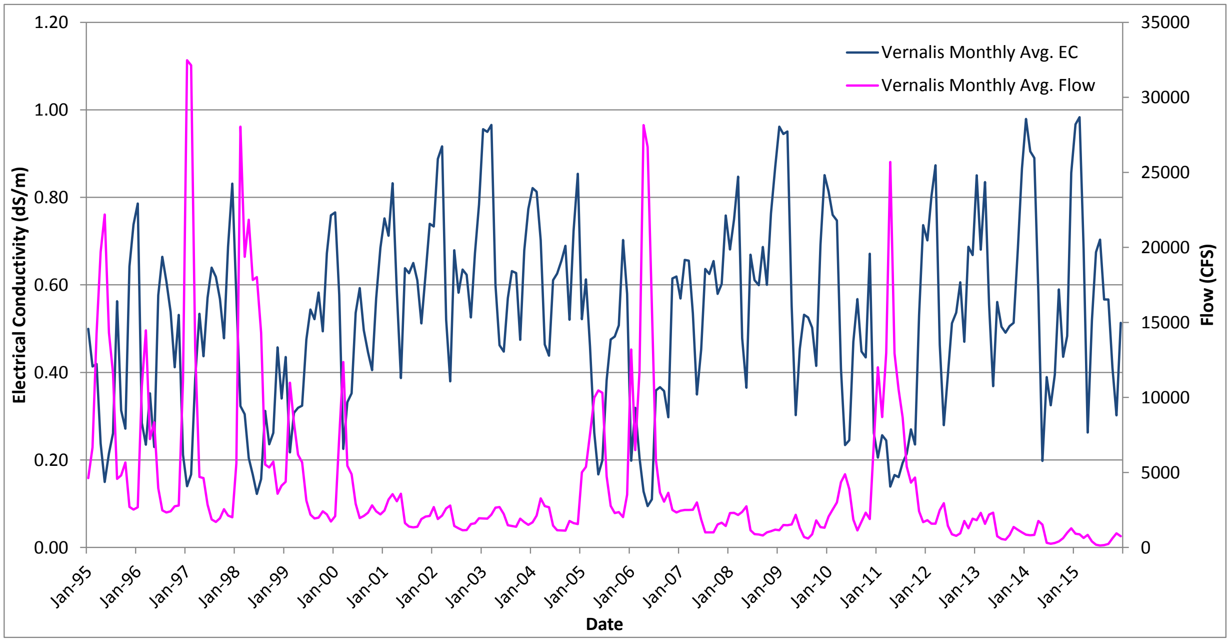

Figure 23-3. Monthly Average EC (dS/m = deciSiemens per meter) Observed at Vernalis Compared to Monthly Average Flow (cfs = cubic feet per second) Observed at Vernalis from 1995– 2015

Comparing the receiving water quality during the 1995–2015 baseline period to the existing water quality objectives (Figures 23-1 and 23-2) indicates that at Vernalis, the baseline water quality is equal to or better than the objective; at the other southern Delta locations, the baseline water quality is equal to or less than the existing objective. Where the baseline water quality is equal or less than the water quality objective, the water quality must be maintained or improved to a level that achieves the objective (State Water Board 1990). Where the baseline water quality is better than the water quality objective, the baseline water quality must be maintained unless poorer water quality is necessary to accommodate important economic or social development and is considered to be the maximum benefit to the people of the State. (State Water Board 1990) The analysis below explains why the baseline water quality will be maintained or improved under the proposed salinity objectives.

Analytic Approach

The WSE model results must be compared to the baseline water quality conditions before they can be used to make determinations about potential changes in salinity conditions. Though the WSE model simulates water operations using historical hydrology, operations are based on current infrastructure development and regulations. WSE model results, therefore, may be different than historical conditions. In addition, the modeling period used in the WSE model does not match the period observed to have the best water quality (i.e., the baseline water quality period). The WSE model uses the same modeling period as the CALSIM II model, water years from 1922–2003, which provides a robust representation of the varying conditions that have occurred in the SJR Watershed. There is only a relatively short period of time overlapping between the period of highest baseline water quality and the modeling results, 1995–2003, and this period is too short to adequately represent long-term variations in water quality.

To determine if modeled results for the LSJR alternatives show degradation in water quality, they must be compared to the model baseline. The *model baseline* represents the water infrastructure and regulatory conditions as of 2010. Due to operations to meet only the Vernalis salinity objective, periodic exceedances of interior southern Delta salinity objectives occur in the historical record and likewise remain in the modeled baseline conditions. A comparison of EC results for the LSJR alternatives and the model baseline will, therefore, show if the proposed flow objectives could cause an increase or decrease in EC at Vernalis and the interior southern Delta compliance locations. This analysis focuses on conditions in the southern Delta since salinity standards upstream are not changing. These results can then be qualitatively applied to the 1995–2015 baseline water quality; if there is an increase in EC compared to the model baseline, it is likely EC would increase compared to baseline water quality conditions as well, and there would be degradation.

As described in Appendix F.1, *Hydrologic and Water Quality Modeling*, the WSE model estimates of monthly EC are based on the Vernalis EC results extracted from a version of the CALSIM II SJR Module. Since EC is highly dependent on flow volume, the WSE model calculated EC at Vernalis is the CALSIM II estimate adjusted by the ratio of flow at Vernalis in CALSIM II compared to the WSE model. EC values predicted in the WSE model for Brandt Bridge, Old River near Middle River and Old River at Tracy Boulevard Bridge are based on the empirical relationship between flow conditions and the observed incremental increase in EC between Vernalis and these downstream locations. The relationship between flow and the incremental increase in EC was found to be the same for both the Brandt Bridge and Old River near Middle River compliance locations (see Appendix F.1 for more details). Consequently, the distribution of EC values predicted under the LSJR alternatives is the same for Brandt Bridge and Old River near Middle River.

CALSIM II EC values were used as a starting point for the WSE model because the CALSIM II results include a suitably long time period to account for long term variation in salinity (82-year period) and because CALSIM II closely matches recent historical salinity at Vernalis. Figure 23-4 compares the monthly average time series of observed EC data (from CDEC) at Vernalis with the CALSIM II estimates of EC at Vernalis from January 1995– September 2003. Figure 23-4 shows that CALSIM II calculated EC is very similar to the historical EC from 1995–2003.

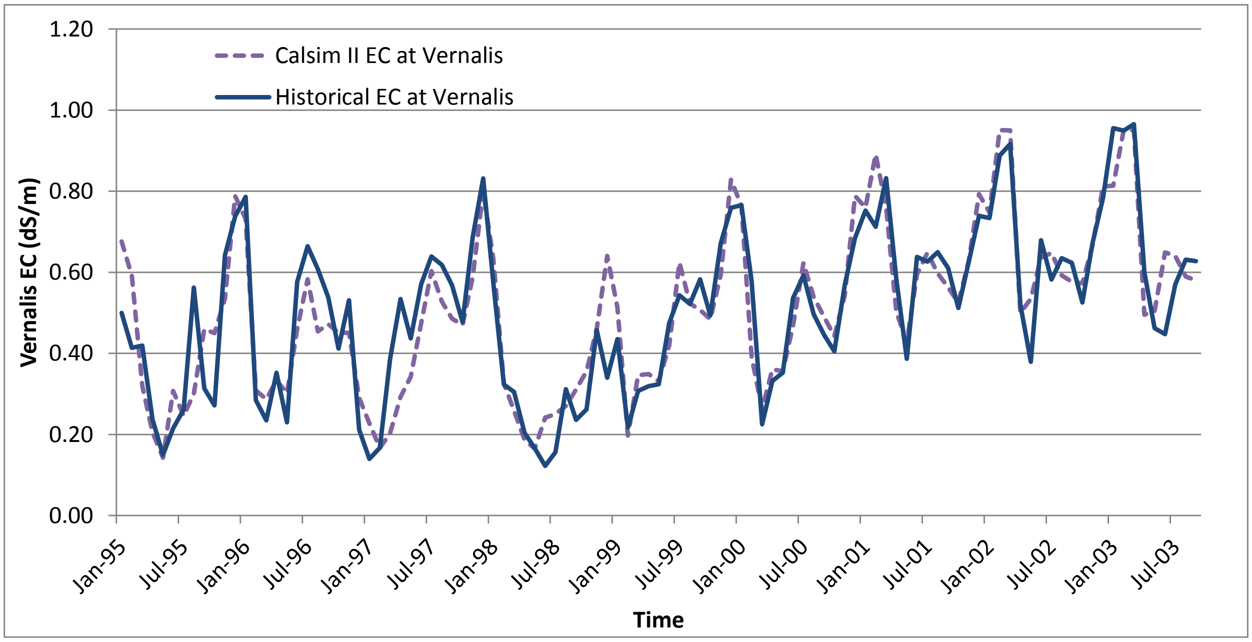

Figure 23-4. Monthly Average EC (dS/m = deciSiemens per meter) Observed at Vernalis Compared to CALSIM II Monthly Estimate of EC at Vernalis from 1995–2003

Effects of the Proposed LSJR Flow and SDWQ Objectives on Salinity

The EC results of the modeled LSJR alternatives are compared with the modeled baseline results for EC to assess whether a reduction in water quality is expected due to implementation of the proposed LSJR flow and EC water quality objectives. The modeled impacts on water quality can then be qualitatively applied to the baseline water quality, 1995–2015, to determine if there could be a degradation of water quality. The analysis shows that, overall, the baseline salinity in the southern Delta would not only be maintained under the proposed plan amendments, consistent with antidegradation requirements, but would generally improve during the irrigation season.

Table 23-2 presents the average annual EC values for each of the southern Delta compliance locations under the modeled baseline conditions and the change in those values for the LSJR flow objectives ranging from 20 to 60 percent unimpaired flow. Model results are provided for 30 and 50 percent unimpaired flow because adaptive implementation may, at times, result in a percentage of unimpaired flow that falls between proposed LSJR Alternatives 2, 3, and 4. As described above, the EC conditions as modeled in WSE are the same for the SJR at Brandt Bridge and for Old River near Middle River. All four stations experience an overall decrease in EC under each of the alternatives, with the least decrease under 20 percent unimpaired flow and the largest decrease under 60 percent unimpaired flow. The compliance location on Old River at Tracy Boulevard Bridge has the greatest reduction in EC for all alternatives but still has the highest modeled EC overall.

Table 23-2. Annual Average EC at Southern Delta Compliance Locations under Modeled Baseline Conditions and the Change in Value based on Percent of Unimpaired Flow

	Annual Average EC (dS/m)					
		Change from Baseline EC				
	Baseline	20% UF	30% UF	40% UF	50% UF	60% UF
SJR at Vernalis	0.57	-0.01	-0.02	-0.04	-0.06	-0.07
SJR at Brandt Bridge	0.61	-0.01	-0.02	-0.05	-0.06	-0.08
Old River near Middle River	0.61	-0.01	-0.02	-0.05	-0.06	-0.08
Old River at Tracy Boulevard Bridge	0.70	-0.01	-0.03	-0.06	-0.07	-0.09

EC (dS/m) = electrical conductivity (salinity) as measured in deciSiemens per meter
UF = unimpaired flow

Although there are individual months in some years when EC increases, in other months EC decreases much more substantially, particularly during the irrigation season. EC increases in the LSJR alternatives correspond to times when flow at Vernalis is lower than under modeled baseline. When the flow at Vernalis decreases it can usually be attributed to a change in the timing and magnitude of flood control releases (there are a few times when it is also caused by the elimination of VAMP and D1641 flow releases or by changes in the New Melones Index, which partially determines instream flow objectives on the Stanislaus River). The increases in EC merely represent shifts in salinity concentrations as water is moved from one period to another. Figures 23-5 through 23-7 show the exceedance plots for the change in monthly EC values under the LSJR flow objectives ranging from 20 to 60 percent unimpaired flow, relative to modeled baseline, at each of the southern Delta compliance locations. Depending on the alternative, about 10–20 percent of months show an increase in EC as water is moved around, while between 25 and 50 percent of months show a much more substantial decrease in EC. Overall, salinity concentrations would improve under the LSJR alternatives. Figures 23-8 through 23-10, discussed below, further illustrate the extent to which the predicted EC values under the LSJR alternatives would be substantially lower than the modeled baseline for the April–August irrigation season.

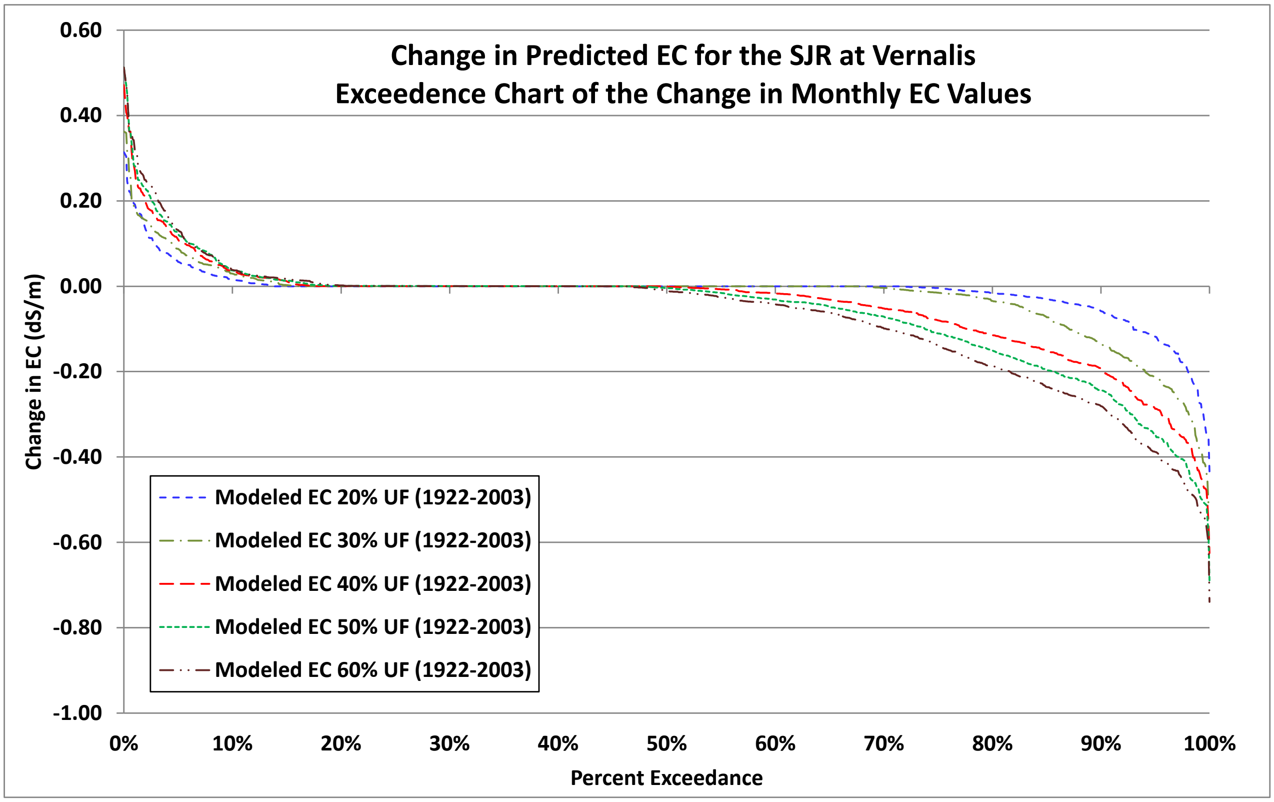

Figure 23-5. Exceedance Chart of the Change in Monthly EC Values for the SJR at Vernalis Based on Percent of Unimpaired Flow, Relative to Modeled Baseline

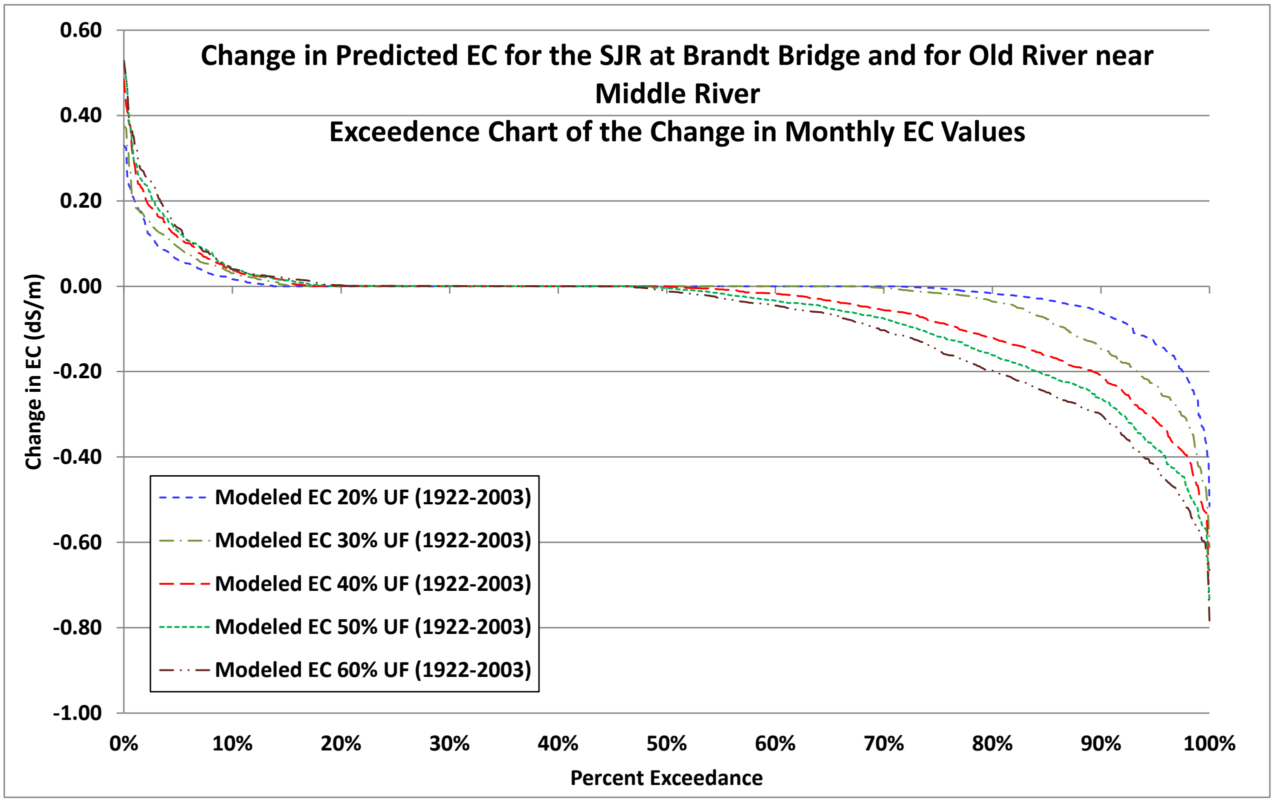

Figure 23-6. Exceedance Chart of the Change in Monthly EC Values, for the SJR at Brandt Bridge and for Old River near Middle River Based on Percent of Unimpaired Flow, Relative to Modeled Baseline

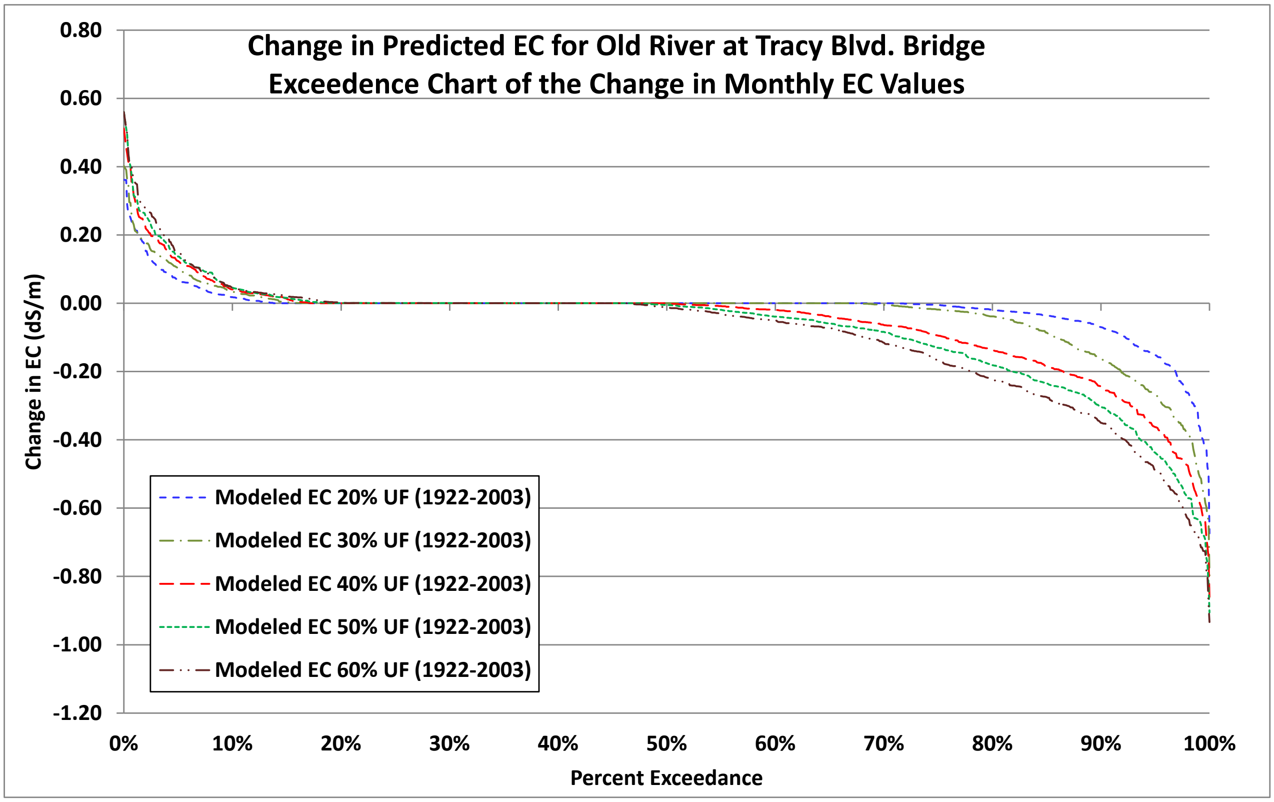

Figure 23-7. Exceedance Chart of the Change in Monthly EC Values for Old River at Tracy Boulevard Bridge Based on Percent of Unimpaired Flow, Relative to Modeled Baseline

Seasonal exceedance distributions are also analyzed to see if EC values might impair beneficial uses, particularly during the irrigation season. Figures 23-8 through 23-10 below compare the predicted average monthly EC results during the April – August irrigation season for each of the southern Delta compliance locations under the modeled baseline conditions and LSJR flow objectives ranging from 20 to 60 percent unimpaired flow. The LSJR alternatives would lead to lower EC values compared to baseline at all locations during the April – August period, with each subsequently higher unimpaired flow objective lowering the EC further.

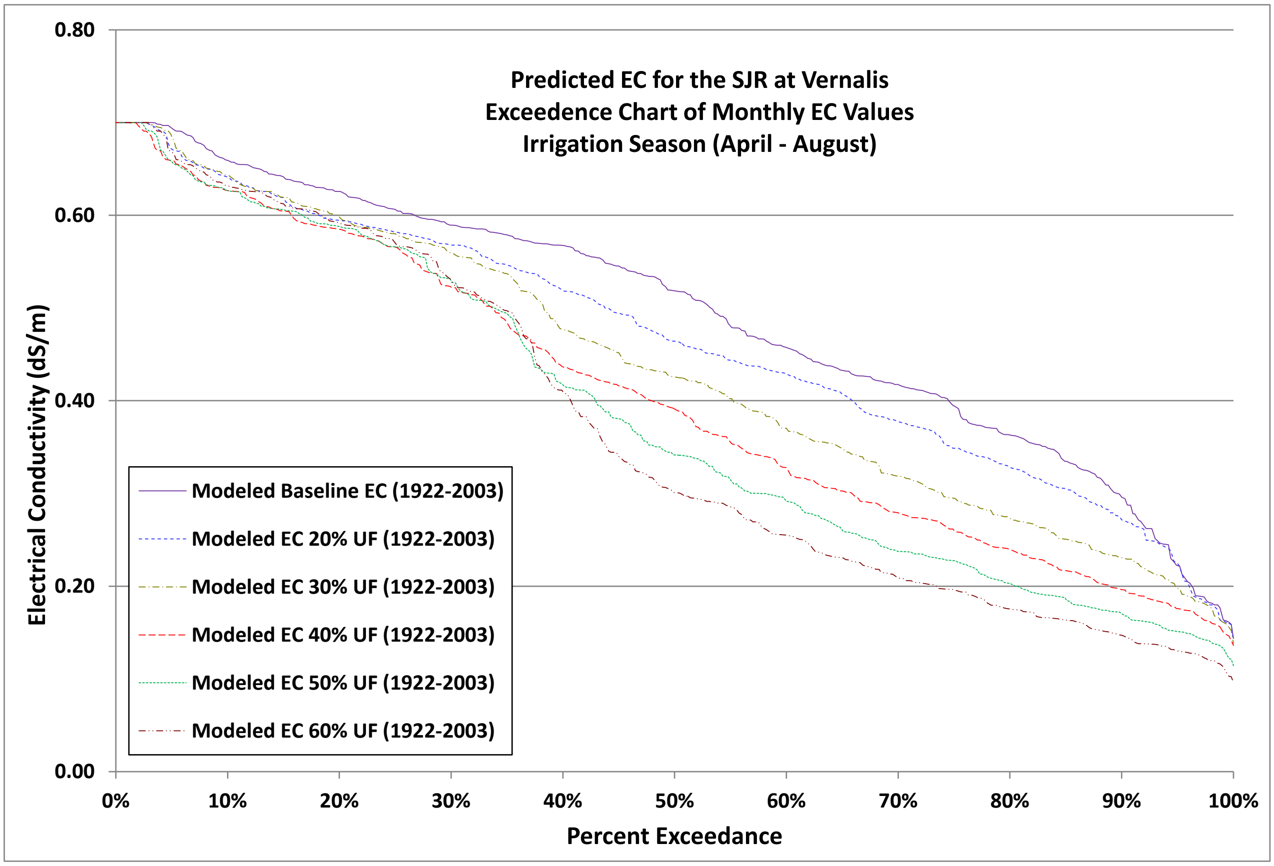

Figure 23-8. Exceedance Chart of Monthly EC Values at Vernalis during April–August under Modeled Baseline and Percent of Unimpaired Flow

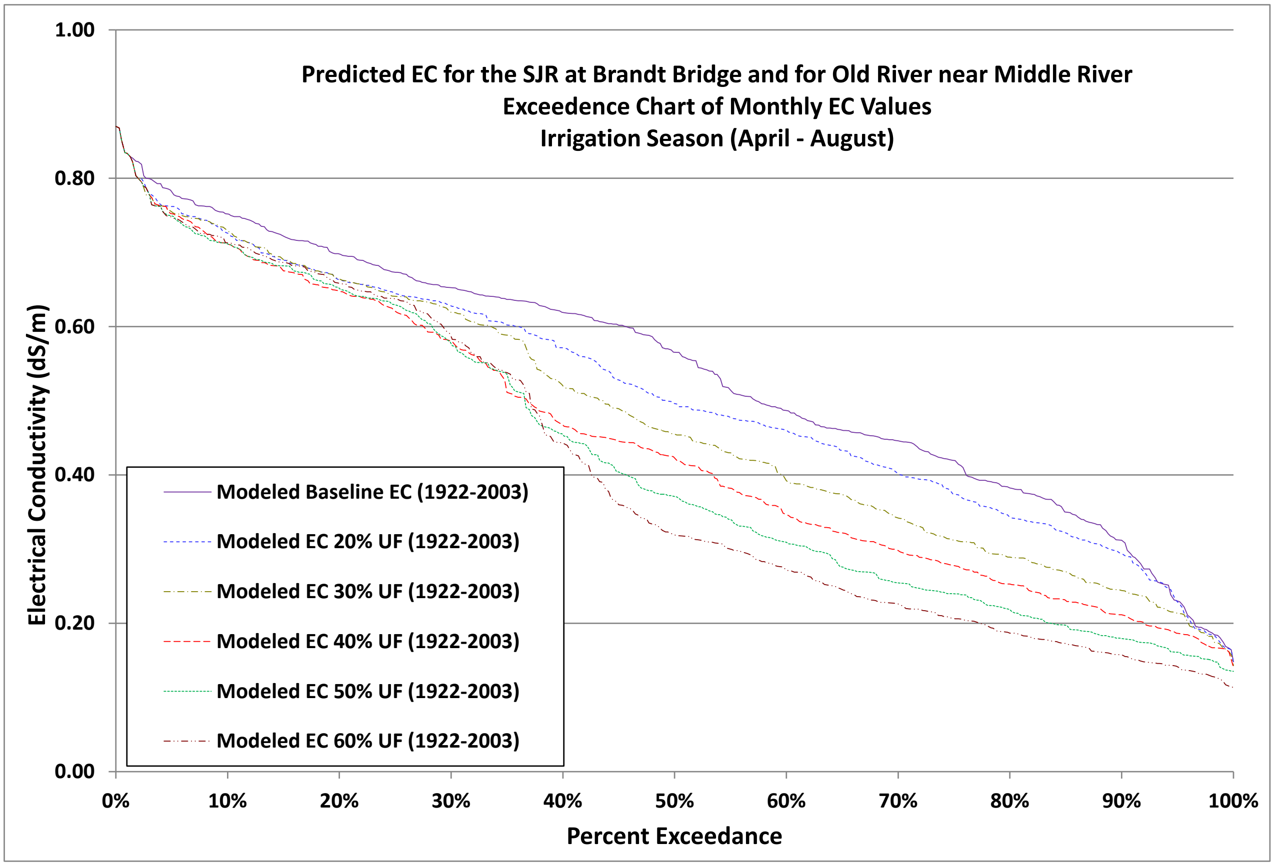

Figure 23-9. Exceedance Chart of Monthly EC Values for the SJR at Brandt Bridge and for Old River near Middle River during April–August under Modeled Baseline and Percent of Unimpaired Flow

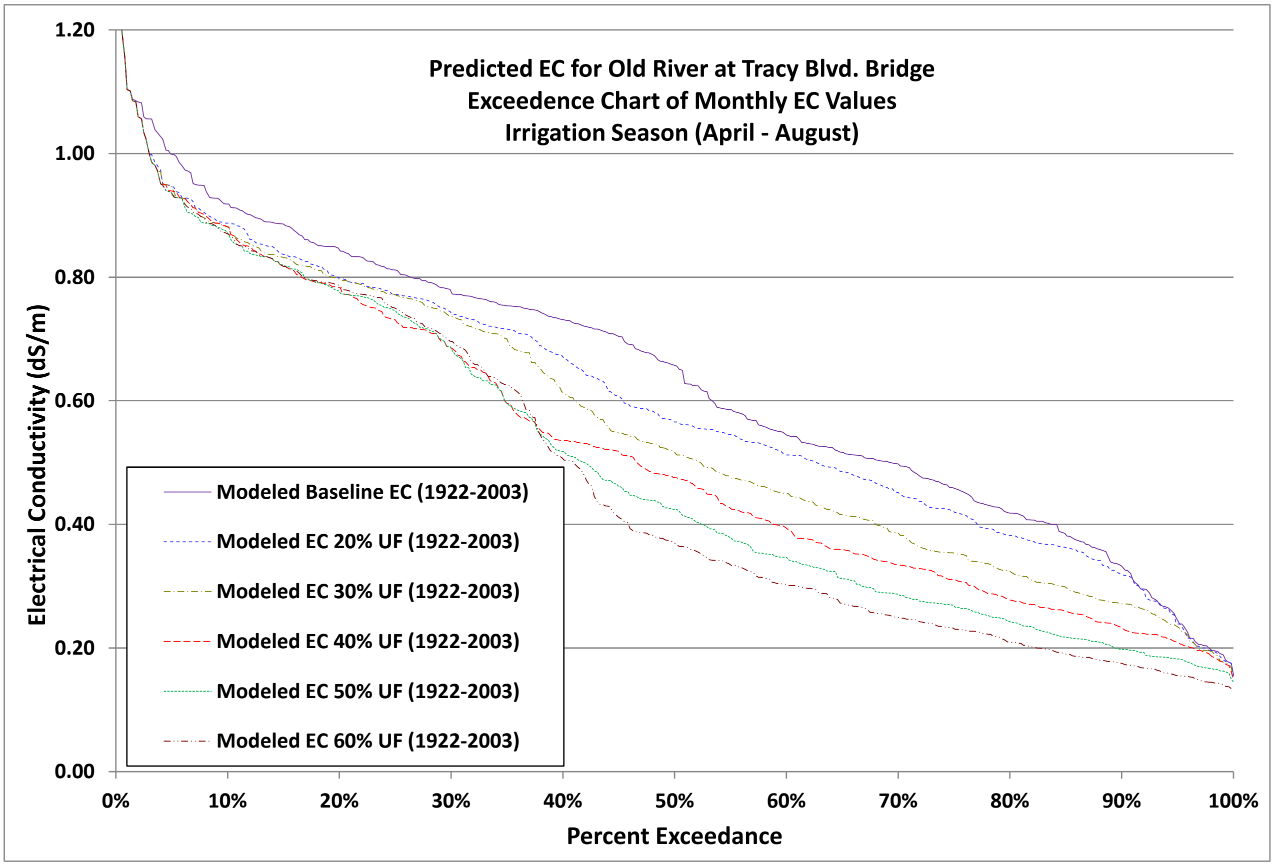

Figure 23-10. Exceedance Chart of Monthly EC Values for Old River at Tracy Boulevard Bridge during April–August under Modeled Baseline and Percent of Unimpaired Flow

Figures 23-11 through 23-13 compare the predicted average monthly EC results during the September–March non-irrigation season for each of the south Delta compliance locations under the modeled baseline conditions and LSJR flow objectives ranging from 20 to 60 percent unimpaired flow. The exceedance distribution of EC values does increase slightly over baseline conditions for some of the LSJR alternatives. These increases usually occur in the months of January and December when agricultural beneficial uses are not likely to be impacted. As described above, these occasional increases do not indicate a degradation of water quality, but rather only a shift in variable salinity as the timing and magnitude of flood control releases change.

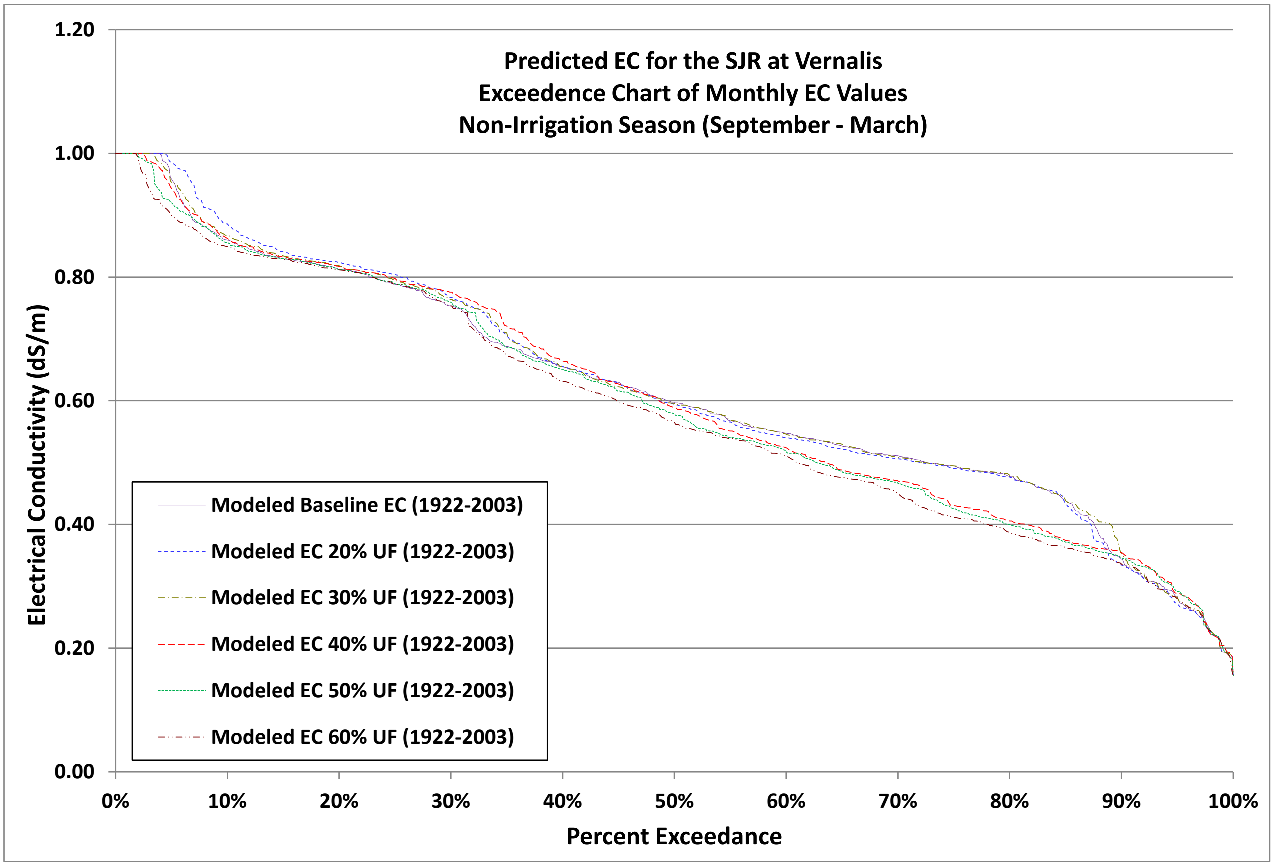

Figure 23-11. Exceedance Chart of Monthly EC Values at Vernalis during September–March under Modeled Baseline and Percent of Unimpaired Flow

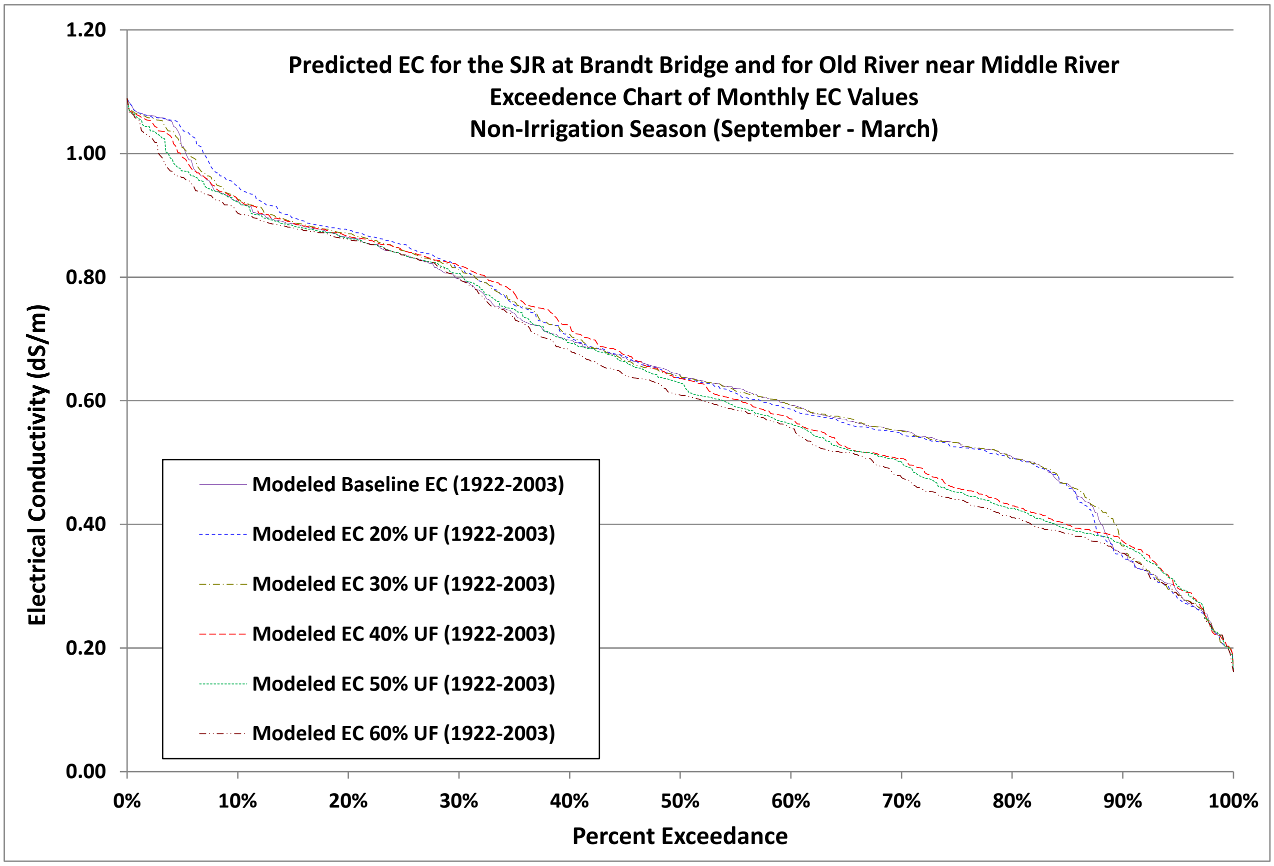

Figure 23-12. Exceedance Chart of Monthly EC Values for the SJR at Brandt Bridge and for Old River near Middle River during September–March under Modeled Baseline and Percent of Unimpaired Flow

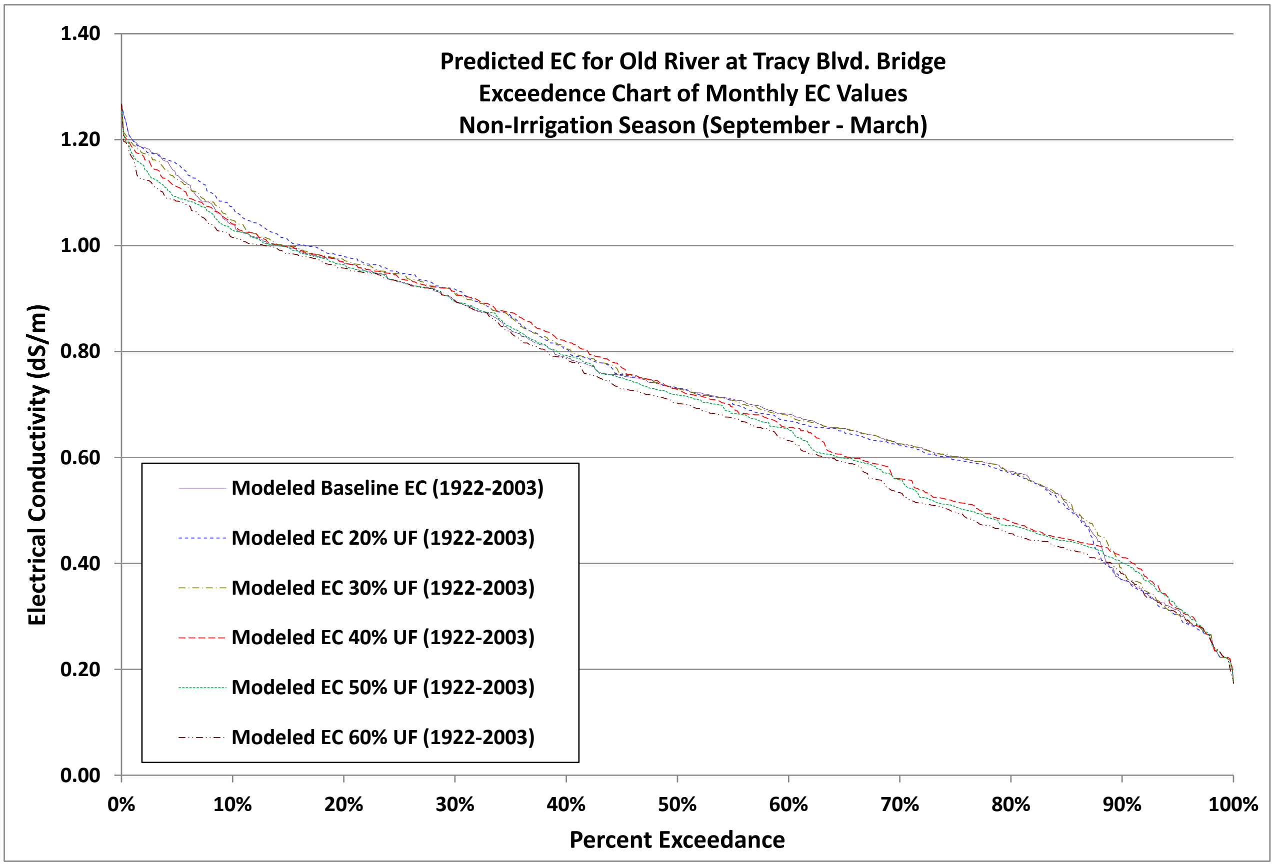

Figure 23-13. Exceedance Chart of Monthly EC Values for Old River at Tracy Boulevard Bridge during September–March under Modeled Baseline and Percent of Unimpaired Flow

Qualitative Discussion

WSE model runs for 1922 to 2003 show that changed flow patterns under the LSJR alternatives would also change salinity conditions, resulting in an overall decrease in salinity, and thus improving water quality with regard to salinity. This 82-year WSE model time period does not fully overlay the 1995 to 2015 period used to represent the baseline period of highest water quality for the purpose of the antidegradation analysis. The 82-year record, however, does include a range of hydrologic conditions that adequately characterizes the shorter, 20-year, 1995–2015 period. As described in Chapter 21, *Drought Evaluation*, WSE model simulations were used to compare drought impacts on water supply over the 1922–2003 analysis period with drought impacts during the more recent period of 2004–2015. The drought analysis showed, among other things, that runoff and water supply effects from 2004–2015 are not more extreme than drought conditions during the 1922–2003 period. Delta EC estimates are likely to be elevated during droughts because there is less water available to dilute salinity concentrations. The drought analysis, therefore, confirms that the modeled hydrologic conditions from 1922–2003 can be used to determine the overall and worst case salinity effects, with regard to antidegradation, for the 1995–2015 period.

The potential effect of the LSJR alternatives during the 1995–2015 period, with regard to antidegradation, would be to change the timing and magnitude of flows in the Stanislaus, Tuolumne, and Merced Rivers, and in the LSJR downstream of the Merced River confluence. Most of the SJR salt load originates upstream of the Merced River where high salinity agricultural discharges enter the Upper SJR and since the eastside tributaries have relatively low salinity the salt loads on the SJR would not change considerably. With increased flows, and unchanged salt loading, salt concentration would be diluted and EC would decrease. Conversely, with decreased flows and unchanged salt loading, salt concentrations would increase. From February–June, implementation of the proposed LSJR alternatives would generally increase flows, and would, therefore, decrease salinity concentrations. At other times of year, from July–January, EC would be the same as historical conditions during most years, except when flood control releases changed. Overall, salinity conditions would improve or be maintained in most years and annual average EC values would decrease, similar to the results presented in Table 23-2.

In addition, the proposed southern Delta salinity objectives would have no effect on salinity because USBR would still be required to meet a 0.7 dS/m EC objective at Vernalis from April–August as part of its water rights permits under the program of implementation. The September–March 1.0 dS/m EC objective would not change. Therefore, the responsibilities of USBR would not have changed from those in the period of 1995–2015, and New Melones would have been operated in the same way to protect EC conditions at Vernalis. This will assure that assimilative capacity is maintained downstream of Vernalis to meet the 1.0 dS/m EC water quality objective at the three remaining compliance locations in the southern Delta. Based on the crops grown in the southern Delta, an EC value of 1.0 dS/m would protect agricultural beneficial uses in the southern Delta (Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*).

23.5.2 Flow

Antidegradation policies focus on water quality to protect beneficial uses. As part of the LSJR alternatives, flows from the eastside tributaries to the LSJR would increase during the February–June time period compared to the modeled baseline conditions. To the extent that antidegradation policies apply to water volume, increasing the flows is not expected to cause degradation in water quality. On the contrary, increasing the volume of flow would likely improve conditions for fish and wildlife beneficial uses throughout the LSJR Watershed. Annual flow contributions from the tributaries to the SJR are expected to increase by 3 percent under LSJR Alternative 2, 15 percent under LSJR Alternative 3, and 37 percent under LSJR Alternative 4. Adaptive implementation allows some shifting of flows both within and outside the February–June time frame to improve conditions for the protection of fish and wildlife beneficial uses and to preserve coldwater pool resources in the reservoirs. Though there may be instances when flows are lower than under modeled baseline, this would generally occur in wetter years during already high flows due to reduced need for flood control releases.

23.5.3 Other Parameters

This section evaluates whether changes in the LSJR flow objectives, together with the adaptive implementation measures described in Appendix K, *Revised Water Quality Control Plan*, would lower water quality for other parameters, like temperature and Clean Water Act (CWA) Section 303(d)[12] listed pollutants. This section serves as a simplified antidegradation analysis; based on best

[12] Clean Water Act section 303(d) requires states, territories, and authorized tribes to develop a ranked list of water quality limited segments of rivers that do not meet water quality standards.

professional judgment, the proposed alternatives would not be adverse to the intent and purpose of the antidegradation policies (State Water Board 1990). This section employs the analyses and conclusions from elsewhere in this SED to explain why there will not be a lowering of water quality with respect to these other parameters. Chapter 5, *Surface Hydrology and Water Quality*, of this SED examines how the LSJR alternatives could impact water quality, including a discussion of impacts on water temperature and CWA Section 303(d) pollutants. Chapter 5 also investigates the potential water quality impacts of adaptive implementation for the LSJR alternatives by analyzing 30 and 50 percent of unimpaired flow.

Effects of the LSJR alternatives for pollutant concentrations are examined qualitatively based on flow changes in the LSJR and eastside tributaries predicted by the WSE model. Table 5-4 of Chapter 5 provides a list of current CWA Section 303(d) water quality impairments identified in the vicinity of the plan area. As described in more detail below, flow objectives ranging from 20 to 60 percent unimpaired flow on the eastside tributaries are not expected to lower water quality with respect to temperature or CWA Section 303(d) listed pollutants and they are expected to maintain or improve water quality for protection of beneficial uses.

The eastside tributaries are generally considered to be high quality waters. However, the tributaries still face impairment from several different pollutants. Agricultural activity in the lower segments of the Stanislaus, Tuolumne, and Merced Rivers is likely responsible for impairments due to pesticides (303[d] listed since 1998, 2002 and 1996, respectively), while mining activity has likely caused impairments due to mercury (listed since 2002, 2010 and 2006, respectively). All three tributaries were identified as impaired due to water temperature in 2010. The Merced River was identified as impaired due to E. coli in 2010 as well. Additionally, all three tributaries were listed as impaired due to unknown toxicity in 1998 for the Stanislaus River, 2006 for the Tuolumne River, and 2010 for the Merced River. The mainstem of the LSJR between Vernalis and the Merced River is also identified as impaired for a variety of water quality constituents. Segments of the LSJR are listed as impaired for mercury (beginning in 2006), unknown toxicity (beginning in 1994), and for various pesticides (beginning in 1994). The LSJR was first identified as impaired due to water temperature in the 2010 303(d) list. In addition, the small section of the LSJR between the Stanislaus River and Vernalis was also listed as impaired for E.coli in 2010.

In general, adding more streamflow can help dilute many of the above constituents that impair water quality in the LSJR and the tributaries. Inflows to the LSJR from the Stanislaus, Tuolumne, and Merced Rivers, which are characterized by low EC values, help dilute the salt loads entering the SJR from upstream, improving EC values between the Merced River and Vernalis. Elevated water temperature in the LSJR and in the tributaries is also influenced by streamflow, as a larger volume of water will take longer to warm.

In addition to concerns related to salinity, portions of the southern Delta are listed as impaired on the current CWA Section 303(d) list for a variety of constituents, including pesticides (first listed in 1992), and mercury (first listed in 1992). Old River and Middle River were both identified as impaired due to low dissolved oxygen in 2002. As noted in Chapter 5, Table 5-4 of the SED, the entire Delta is identified as impaired due to unknown toxicity. Aquatic toxicity causes mortality or severe negative sublethal effects (e.g., significant impacts on growth, reproductive success) for aquatic organisms. In the case of unknown toxicity, one or more constituents are causing the toxic effects, but they have not been identified.

Water Temperature

Chapter 5, *Surface Hydrology and Water Quality*, and Appendix F.1, *Hydrologic and Water Quality Modeling*, describe the analysis of water temperature impacts resulting from the LSJR alternatives. For this analysis, monthly streamflow results from the WSE model are entered into the HEC-5Q water quality model, developed for the SJR Watershed, to produce daily temperature results for the eastside tributaries and the LSJR. For the impact analysis, the water temperature modeling covers the time period from 197–2003. The average monthly streamflow temperatures for the modeled baseline conditions are compared with the same results for the LSJR alternatives.

As described in Chapter 5 and shown in Tables 5-23a, 5-23b, and 5-23c, the biggest reduction in water temperature is expected to occur during the April–June time period when higher flows are required under the LSJR alternatives. Generally, greater water temperature improvements are expected on the Tuolumne and Merced Rivers than on the Stanislaus River. For the SJR at Vernalis, modeling results indicate either slight improvement or no change in water temperature compared to the modeled baseline conditions. The program of implementation contained in Appendix K, *Revised Water Quality Control Plan*, allows for some flexibility in managing flows outside of the February–June time period. This flow shifting approach was incorporated into the WSE and water temperature modeling, which is why the water temperature model results (shown in Chapter 5, Tables 5-23a-c) show changes outside of the February–June period. Flow shifting may occur under any of the LSJR alternatives above 30 percent unimpaired flow. Water temperatures can also be affected by changes in reservoir storage, which could occur during any month. For a more detailed description of flow shifting and how it is implemented in the WSE model, see Appendix F.1.

Additionally, Chapter 7, *Aquatic Biological Resources*, includes analysis and discussion of how the water temperature modeling results under the LSJR alternatives might affect fisheries resources and why colder streamflow temperatures are more beneficial for them. In general, implementation of the LSJR alternatives would improve streamflow temperatures for developing Chinook salmon and steelhead in the three eastside tributaries. Higher flows and cooler water temperatures in the tributaries are also expected to reduce predation impacts, improve growth opportunities, and reduce temperature-related stress in juvenile Chinook salmon and steelhead.

Clean Water Act Section 303(d) Listed Pollutants

The concentrations of CWA Section 303(d) listed pollutants in the LSJR and the eastside tributaries are more likely to approach or exceed water quality criteria levels when streamflow is low. An increase in flows, which is expected to occur under the proposed LSJR alternatives, would likely dilute pollutant concentrations and, since water quality in the eastside tributaries is generally good, improve water quality overall. The impact assessment for CWA Section 303(d) contaminants in Chapter 5, *Surface Hydrology and Water Quality*, of this SED is more of a qualitative analysis that relates changes in pollutant concentrations to changes in streamflow. The analysis examines changes in the monthly cumulative distributions of flows between modeled baseline and the LSJR alternatives for each tributary and the LSJR.

As described in Chapter 5, water quality is generally poorest under low flow conditions; therefore, changes in the cumulative flow distribution at the low end of the distribution are most likely to affect water quality. The analysis in Chapter 5 concludes that pollutant concentrations are not expected to exceed water quality criteria levels as a result of implementation of the LSJR alternatives. Instead, pollutant concentrations would likely be reduced due to increased dilution from the higher flows associated with the LSJR alternatives. There is potential for flows to decrease compared to the model baseline in wetter periods, as implementation of the LSJR alternatives may result in lower reservoir storage levels and smaller flood control releases. However, higher pollutant concentrations due to lower flows are not likely to occur because adaptive implementation would minimize the frequency of reduced flows. Certain adaptive implementation measures in Appendix K, *Revised Water Quality Control Plan*, would allow some of the February–June flow objective to be retained in storage and released later in the year to maintain or improve current temperature conditions. Therefore, water quality, as indicated by pollutant concentrations in the LSJR and the tributaries, is expected to improve under all LSJR alternatives.

23.6 Conclusion

Water quality conditions in the LSJR Watershed and southern Delta vary both seasonally and annually and are strongly affected by streamflow levels, due to dilution of the salt loads and other constituents in the affected areas. The LSJR and SDWQ alternatives, as well as their implementation, are not expected to reduce water quality; rather, water quality will be maintained and generally improved. More specifically, the proposed southern Delta salinity objective and program of implementation would not lead to a degradation of water quality, with regard to salinity, and would reduce the frequency of exceedance for the EC water quality objective at the interior southern Delta compliance locations. Moreover, USBR's water rights would continue to be conditioned on meeting the 0.7 dS/m EC standard at Vernalis during the irrigation season (April–August); therefore, water quality, with regard to salinity, is not expected to be lowered due to implementation of the proposed amendments to the 2006 Bay-Delta Plan. Modeling results for streamflow used to assess changes in 303(d) contaminant concentrations indicate that they are not expected to increase as a result of the proposed LSJR alternatives either, since baseline flows will either increase or stay the same through adaptive implementation. Water temperatures are expected to improve in the tributaries as well, and to a lesser extent in the SJR at Vernalis, especially during the February–June time period, as higher flows will buffer streamflow temperatures against warmer air temperatures. Since water quality will not be lowered, findings for degradation are not required under state and federal antidegradation policies.

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