Chapter 3
Alternatives Description

3.1 Introduction

The State Water Resources Control Board (State Water Board) is considering amendments to the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary* (2006 Bay-Delta Plan). The Porter-Cologne Water Quality Control Act requires water quality control plans (WQCP) to designate or establish the beneficial uses of water to be protected, water quality objectives that will ensure the reasonable protection of the beneficial uses, and a program of implementation designed to achieve the objectives. (Wat. Code, §§ 13050(j), 13241.)

The plan amendments[1] would include new February–June Lower San Joaquin River (LSJR) flow objectives for the protection of fish and wildlife beneficial uses and an associated program of implementation. The plan amendments would also modify the existing southern Delta water quality (SDWQ) objectives for the protection of agricultural beneficial uses and the associated program of implementation for those objectives.[2] Potential changes to the program of implementation (Appendix K, *Revised Water Quality Control Plan*) that would not result in significant or potentially significant adverse environmental effects are not discussed in detail in this recirculated substitute environmental document (SED).

The California Environmental Quality Act (CEQA) requires an environmental document such as an SED to describe a range of reasonable alternatives to a project that "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, and evaluate the comparative merits of the alternatives." (State CEQA Guidelines § 15126.6, subd. (a); Cal. Code Regs., tit. 23, § 3777, subd. (b).) An SED need not consider every conceivable alternative to a project, but instead, it "must consider a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation." (State CEQA Guidelines § 15126.6, subd. (a).) An SED is not required to consider alternatives that are infeasible. (*Ibid.*)

This chapter describes: the purposes and goals[3] of the plan amendments; the LSJR and SDWQ alternatives evaluated in this SED; the No Project Alternative; and the alternatives considered but eliminated from consideration in this SED.

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

[2] This SED may refer to the proposed amendments to the southern Delta salinity objectives in the singular or plural. The use of singular or plural is immaterial to the description of the southern Delta salinity alternatives.

[3] State CEQA Guidelines Section 15124, subdivision (b), requires the lead agency to include a statement of the objectives sought by the proposed project. To avoid confusion with the term "objective" as it is used in reference to flow and water quality objectives, this document will refer to the "objectives" mentioned in Section 15124 instead as "goals."

3.2 Purposes and Goals

The 2006 Bay-Delta Plan designates beneficial uses of water, establishes water quality objectives for the reasonable protection of those beneficial uses, outlines a program of implementation for achieving the water quality objectives, and includes monitoring and special studies. It also provides recommended actions for other entities to take that will contribute to achieving the objectives. The underlying fundamental purpose and goal of the plan amendments is twofold.

- To establish flow water quality objectives during the February–June period and a program of implementation for the reasonable protection of fish and wildlife beneficial uses in the LSJR Watershed, including the three eastside, salmon-bearing tributaries.[4]
- To establish SDWQ objectives for the reasonable protection of southern Delta agricultural beneficial uses and a program of implementation to achieve the objectives.

As described in Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, scientific information indicates that higher flows of a more natural pattern are needed from the three eastside, salmon-bearing tributaries to the LSJR during the spring (February–June) to protect fish and wildlife beneficial uses (including San Joaquin River [SJR] Basin fall-run Chinook salmon). Therefore, in addition to the fundamental purpose and goal of the plan amendments, the purposes and goals related to the LSJR flow objectives and associated program of implementation are as follows.

1. Maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta.
2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries—the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted.
3. Provide flows in a quantity necessary to achieve functions essential to native fishes such as increased floodplain inundation, improved temperature conditions, improved migratory conditions, and promote other conditions that favor native fishes over nonnative fishes.
4. Allow adaptive implementation of flows that will afford maximum flexibility in establishing beneficial habitat conditions for native fishes, addressing scientific uncertainty and changing conditions, developing scientific information that will inform future management of flows, and meeting biological goals, while still reasonably protecting the fish and wildlife beneficial uses.
5. Promote transparency in decision-making and provide certainty to the regulated community by expressing flow requirements for the protection of fish and wildlife as a share of the total quantity of water available for all beneficial uses.
6. In establishing flow water quality objectives to reasonably protect fish and wildlife, take into consideration all of the demands being made and to be made on waters in the LSJR and the three eastside, salmon-bearing tributaries and the factors to be considered for establishing water quality objectives in Water Code Section 13241, including, but not limited to, past, present and probable future beneficial uses and economic considerations.

[4] In this document, the term *three eastside tributaries* refers to the Stanislaus, Tuolumne, and Merced Rivers.

7. Provide for the development and implementation of an appropriate monitoring and evaluation program to inform adaptive implementation of LSJR flows and future changes to the Bay-Delta Plan.
8. Provide for, and encourage, collaboration, coordination, and integration of regulatory, scientific, and management processes related to LSJR flows.

As described in Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, salt stress can damage crops in several different ways, including stunting growth, diminishing seedling success, and causing foliar damage, thus reducing yield of crops. 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. Salinity conditions are also affected by the capacity of the southern Delta water bodies to assimilate these salinity inputs. This assimilative capacity is potentially affected by hydrodynamic conditions, such as water levels and the direction and magnitude of flow in the various channels of the southern Delta. The purposes and goals related to the SDWQ objective and associated program of implementation are as follows.

1. Provide salinity conditions that reasonably protect agricultural beneficial uses of surface waters in the southern Delta.
2. In establishing salinity water quality objectives to reasonably protect agricultural beneficial uses, take into consideration all of the demands being made and to be made on waters in the southern Delta, the LSJR and the three eastside, salmon-bearing tributaries and the factors to be considered for establishing water quality objectives in Water Code Section 13241, including, but not limited to, past, present and probable future beneficial uses and economic considerations.
3. Establish a salinity objective, supported by existing scientific information, that is not lower than necessary to reasonably protect the most salt sensitive crops currently grown or suitable to be grown on saline- and drainage-impaired soils in the southern Delta.
4. Maintain or improve salinity conditions in the southern Delta to comply with state and federal antidegradation policies.
5. Provide for development and implementation of monitoring and modeling studies needed to better understand the characteristics of salinity conditions in the southern Delta and the dynamics of factors controlling or contributing to those conditions.

3.3 Lower San Joaquin River (LSJR) Alternatives

The development of alternatives requires an understanding of the attributes of alternatives that could feasibly attain most of the basic objectives of the plan amendments but would avoid or substantially lessen any of the significant environmental effects. Attributes of flow objective alternatives may be described or constrained by geography, method, season and averaging period, magnitude, and other aspects of a flow regime. A regulatory program may also consider non-flow measures and adaptive management. Attributes of salinity objective alternatives may be described or constrained by geographic scope, season and averaging period, and the level of protection. The attributes of flow and salinity objectives can then be used to assess the potential for alternatives to achieve the plan amendment goals and to have potential effects, in order to determine which

alternatives are feasible, and should be evaluated, and which are infeasible, and may eliminated from further consideration.

In evaluating potential amendments to the 2006 Bay-Delta Plan, the State Water Board identified key elements that would reasonably protect fish and wildlife beneficial uses in the LSJR Watershed. These key elements form the foundation of the fundamental purpose of the plan amendments:

> "To establish flow water quality objectives during the February–June period and a program of implementation for the reasonable protection of fish and wildlife beneficial uses in the LSJR watershed, including the three eastside, salmon-bearing tributaries (the Stanislaus, Tuolumne, and Merced Rivers)."

First, the State Water Board, which is the State agency responsible for protecting the State's water resources, focused on establishing flow water quality objectives because the best available science identifies flow as a major factor affecting fisheries and other instream uses of water in the Delta. The State Water Board, which is the State agency responsible for protecting the State's water resources, is best suited to using its regulatory authority to address the flow regime. Second, the State Water Board focused on SJR basin fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*Oncorhynchus mykiss*), because these anadromous species are among the most sensitive to inflows from the SJR basin to the Bay-Delta. Flows that benefit these species will also generally benefit other species in the SJR Watershed. Third, the State Water Board identified the geographic scope of the plan amendments to protect the existing fishery in the LSJR Watershed—the three eastside salmon-bearing tributaries—because that portion of the watershed supports an existing fishery that can be maintained and improved. The State Water Board will consider additional measures in future Bay-Delta Plan updates to protect beneficial uses in other areas, such as the Upper SJR, when those areas are restored and can support a fishery. Finally, the State Water Board identified the February-June period as the period in which flows are most critical to support ecosystem functions such as migration.

3.3.1 Attributes of LSJR Flow Objectives

Attributes of flow objective that inform the feasibility of the LSJR alternatives and the ability of the alternatives to avoid or substantially lessen any of the significant environmental effects are: geography; method; season and averaging period; and magnitude. In addition, other considerations, such as non-flow measures and adaptive management, inform the selection of the LSJR alternatives.

Geography

The current flow objective applies only to the SJR at Vernalis. In developing the alternatives, the State Water Board considered whether alternative flow objectives would apply only to Vernalis, just as the current objective, or be extended upstream to some other location. Goals 1 and 2 of the of the plan amendments are as follows.

1. Maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta.
2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries —the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted.

These goals support the selection of a flow alternative that includes the Stanislaus, Tuolumne, and Merced Rivers, not just Vernalis, because the expanded geographic area supports a variety of critical life history stages. For example, flows that support juvenile rearing in the tributary streams and migration through the Delta are needed to maintain the natural production of SJR fall-run Chinook salmon. Though these goals do not explicitly preclude consideration of alternative flow objectives upstream of the Merced River confluence, that area does not currently support viable native fish populations, and such alternatives would not reduce or avoid impacts. For example, such an alternative would not reduce the quantity of water needed from the Stanislaus, Tuolumne, and Merced Rivers to achieve the goals. Inclusion of the flow alternatives for the SJR upstream of the Merced River confluence would increase the adverse environmental effects of the LSJR alternatives in a larger geographic area by reducing the quantity of water available for other uses in areas that rely upon water supplies in the SJR upstream of Merced River confluence. For this reason, alternatives that considered establishing flow objectives in geographic areas other than the LSJR Watershed and the Stanislaus, Tuolumne, and Merced Rivers, were eliminated from further consideration.

Method

There are two principal methods that can be used to develop a flow objective, and that could be considered as an alternative: (1) fixed monthly flows or blocks of water that vary by water year type or other variables, or (2) a percent of unimpaired flow. Unimpaired flow is the flow that would accumulate in surface waters in response to rainfall and snowmelt, and flow downstream if there were no reservoirs or diversions to change the quantity, timing, and magnitude of flows.

The current flow objective at Vernalis is comprised of fixed monthly flows that vary by water year type--higher fixed flows in wet years, and lower fixed flows in dry years. There are five water year types. The relative quantities of water required vary by month and year, and are intended to provide more flow when needed to achieve certain functions such as the outmigration of salmon during an April/May pulse flow. Fixed monthly flows could, alternatively, be established that are not linked to hydrology. These would be purely functional flows that are needed to benefit fish and wildlife but are not tied to the available water supply that is determined by precipitation. LSJR alternatives that are not tied to hydrology were eliminated from any further consideration because they do not mimic natural hydrographic conditions or consider other beneficial uses of water and would, therefore, be in conflict with goals 2, 5, and 6.

2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries—the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted.

5. Promote transparency in decision-making and provide certainty to the regulated community by expressing flow requirements for the protection of fish and wildlife as a share of the total quantity of water available for all beneficial uses.

6. In establishing flow water quality objectives to reasonably protect fish and wildlife, take into consideration all of the demands being made and to be made on waters in the LSJR and the three eastside, salmon-bearing tributaries and the factors to be considered for establishing water quality objectives in Water Code Section 13241, including, but not limited to, past, present and probable future beneficial uses and economic considerations.

Alternatively, flows can be tied directly to unimpaired flow by establishing a flow objective based on a percentage of unimpaired flow. LSJR alternatives tied directly to unimpaired flow achieve goals 2 and 3, among others.

2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries—the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted.

3. Provide flows in a quantity necessary to achieve functions essential to native fishes such as increased floodplain inundation, improved temperature conditions, improved migratory conditions, and promote other conditions that favor native fishes over nonnative fishes.

Fixed monthly flows that vary by month and water year type (similar in method to current flow objectives), or blocks of water that vary by year type, could also be used to achieve these goals instead of flows tied directly to unimpaired flow. Many of the LSJR alternatives suggested by commenters are monthly flows that vary by month and water year type. All of these other LSJR alternatives, however, can be represented by a percent of unimpaired flow quantity, so long as the quantity of water represented by a percent of unimpaired flow is large enough to apportion and shape as needed to achieve fish and wildlife protection goals. These other fixed monthly flow alternatives are discussed in Section 3.3.9, *LSJR Alternatives Considered but Eliminated from Further Evaluation*, and the total volumes of water are compared with the alternatives considered in this SED. In general, however, varying the methodology does not reduce or avoid potentially significant environmental effects, which is the relevant consideration in evaluating the LSJR alternatives.

Season and Averaging Period

The current flow objective is applicable only at Vernalis, and varies by month and year type for the February–June period. There is also an October flow objective. The flow objectives are established as monthly average flows, meaning that flows can vary within the month so long as the average monthly flow rate achieves the flow objective. New flow objectives could be established for specific months, seasons, or every month of the year. Averaging periods could be monthly, or longer or shorter duration. Goal 2 informs both the seasonality and averaging period for LSJR alternatives.

2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries—the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted

Although the State Water Board identified the February-June period as the period in which flows are most critical to support ecosystem functions such as migration, other time periods are also important for other life stages. These other time periods include the fall, which is important for providing a migration cue for returning salmon, and summer, which is important for steelhead.

Magnitude

Goal 2 also directly informs the development of alternatives with regard to the magnitude of flows. Magnitude and total quantity of flow are the principal considerations in the development and selection of alternatives because the total quantity of water provided for the protection of fish and wildlife must be considered in relation to goals 5 and 6, in addition to the other goals.

5. Promote transparency in decision-making and provide certainty to the regulated community by expressing flow requirements for the protection of fish and wildlife as a share of the total quantity of water available for all beneficial uses.

6. In establishing flow water quality objectives to reasonably protect fish and wildlife, take into consideration all of the demands being made and to be made on waters in the LSJR and the three eastside, salmon-bearing tributaries and the factors to be considered for establishing water quality objectives in Water Code Section 13241, including, but not limited to, past, present and probable future beneficial uses and economic considerations.

Alternatives should therefore include quantities of water that are big enough to achieve the fish and wildlife protection goal, but are not so big such that they would have an unreasonable effect on other beneficial uses of water. These constraints allow for the determination of: (1) a lower bound (representing a relatively small quantity of water), below which there could be no reasonable expectation that fish and wildlife protection goals will be achieved; and (2) an upper bound (representing a relatively large quantity of water) beyond which an alternative would have an unreasonable effect on other beneficial uses of water.

Other Considerations

Flow objectives are intended to provide the conditions needed to reasonably protect the fish and wildlife beneficial uses. Goals 1, 2, and 3, explicitly identify flows as a necessary element of alternatives.

1. Maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta.

2. Provide flows that more closely mimic the natural hydrographic conditions (including frequency, timing, magnitude, and duration of natural flows) in the LSJR and three eastside, salmon-bearing tributaries—the Stanislaus, Tuolumne, and Merced Rivers—to which these migratory native fish species are adapted.

3. Provide flows in a quantity necessary to achieve functions essential to native fishes such as increased floodplain inundation, improved temperature conditions, improved migratory conditions, and promote other conditions that favor native fishes over nonnative fishes.

It may be possible to achieve the ecosystem functions identified in goal 3, in part, through the application of non-flow measures such as temperature control and increased floodplain habitat. Temperature and floodplain improvements could occur without the need for as much water, and could directly improve conditions for fish and wildlife without relying entirely on flow. Nonetheless, flow is an essential element for protecting fish and wildlife beneficial uses.

Another consideration in developing alternatives is whether or not to allow adaptive implementation. A flow objective with no adaptive implementation would have to be met exactly as prescribed, without adjustment. Adaptive implementation, in contrast, allows a flow objective to be adjusted based on other information, thus allowing flexibility. LSJR alternatives with adaptive implementation achieve goal 4.

4. Allow adaptive implementation of flows that will afford maximum flexibility in establishing beneficial habitat conditions for native fishes, addressing scientific uncertainty and changing

conditions, developing scientific information that will inform future management of flows, and meeting biological goals, while still reasonably protecting the fish and wildlife beneficial uses.

Alternatives that do not include adaptive implementation were not considered because they would require rigid adherence with flows that may not be optimal based on new information or changed conditions. Alternatives with no adaptive implementation would therefore also conflict with goal 6 because more water than is needed to reasonably protect fish and wildlife would have to be provided even in light of new information or changed conditions.

3.3.2 LSJR Alternatives Considered

The State Water Board considered a range of reasonable alternatives that would feasibly attain most of the basic goals of the plan amendments, discussed in Section 3.2, *Purposes and Goals*, but would avoid or substantially lessen any of the significant environmental effects of the plan amendments. Because the indirect effects of the plan amendment are primarily associated with increased instream flows or reductions in water supply available for diversion, this SED focuses on alternatives that evaluate a range of flows, based on unimpaired flow, with a lower and upper bound. The lower bound represents the minimum quantity of water at which there is a reasonable expectation that fish and wildlife protection goals will be achieved, although at this level, it may require other actions, such as non-flow measures. The upper bound represents the maximum quantity of water beyond which an alternative would have an unreasonable effect on other beneficial uses of water, and would therefore not be feasible. Each LSJR alternative also includes an adaptive range that has the effect of lessening the impact of the alternatives.

This SED evaluates four alternatives for LSJR flow requirements during the February–June time frame, including the LSJR Alternative 1 (No Project Alternative) and three other LSJR alternatives (LSJR Alternatives 2, 3, and 4).

LSJR Alternatives 2, 3, and 4 are comprised of narrative and numeric flow objectives and an associated program of implementation. The objectives will require flows below the rim dams[5] on the Stanislaus, Tuolumne, and Merced Rivers, and the mainstem of the LSJR between its confluence with the Merced River and downstream to Vernalis. The narrative objective calls for the following:

> "Maintain inflow conditions from the San Joaquin River Watershed to the Delta at Vernalis, sufficient to support and maintain the natural production of viable native San Joaquin River Watershed fish populations migrating through the Delta. Inflow conditions that reasonably contribute toward maintaining viable native migratory San Joaquin River fish populations include, but may not be limited to, flows 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 viability include population abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity."

In addition to the narrative objective, there are numeric flow objectives from February–June. This is the element of the flow objective where LSJR Alternatives 2, 3, and 4 have different lower and upper bounds of the adaptive range:

> "A percent of unimpaired flow between a lower and upper limit from each of the Merced, Tuolumne, and Stanislaus Rivers shall be maintained from February through June."

[5] In this document, the term *rim dams* is used when referencing the three major dams and reservoirs on each of the eastside tributaries: New Melones Dam and Reservoir on the Stanislaus River; New Don Pedro Dam and Reservoir on the Tuolumne River; and New Exchequer Dam and Lake McClure on the Merced River.

The final element of the flow objective requires, the same for all alternatives, requires a base flow at Vernalis:

> "Notwithstanding the above unimpaired flow requirement, a minimum base flow value between 800-1,200 cfs [cubic feet per second], inclusive, at Vernalis, shall be maintained at all times."

Each LSJR alternative evaluates a different range of flows.

- LSJR Alternative 2 evaluates a range between 20 and 30 percent, with 20 percent as the starting percentage of unimpaired flow in the program of implementation.
- LSJR Alternative 3 evaluates a range between 30 and 50 percent, with 40 percent as the starting percentage of unimpaired flow in the program of implementation.
- LSJR Alternative 4 evaluates a range between 50 and 60 percent, with 60 percent as the starting percentage of unimpaired flow in the program of implementation.

Ultimately, however, the State Water Board, in exercising its authority and responsibilities, may select a range within the LSJR alternatives analyzed that is consistent with the requirements of applicable law, including CEQA and the Porter-Cologne Water Quality Control Act. In other words, the Board may select a percent of unimpaired flow anywhere between the 20 and 60 percent range evaluated in this SED. Likewise, the Board may implement the range with a different starting percentage of unimpaired flow in the program of implementation.

The program of implementation includes specific flow requirements and other measures to implement the objectives. Specifically, LSJR Alternatives 2, 3, and 4 implement the numeric flow objective by requiring 20 percent, 40 percent, and 60 percent, respectively, of unimpaired flow, based on a minimum 7-day average, from each of the Stanislaus, Tuolumne and Merced Rivers and allow for adaptive adjustments within the numeric water quality objective range for each alternative. The program of implementation provides that the State Water Board will fully implement the February–June LSJR flow objectives by 2022 through water right actions and water quality actions, including Federal Energy Regulatory Commission (FERC) hydropower licensing processes. These actions are necessary because the amendments to the 2006 Bay-Delta Plan are not self-implementing.

These unimpaired flow percentages, 20, 40, and 60 percent, were selected as alternatives to capture a range of potential flow alternatives that the State Water Board may implement, thus allowing an examination of alternatives that would feasibly obtain most of the goals of the plan amendments while avoiding or substantially lessening any significant impacts. The alternative with the lowest flow, LSJR Alternative 2 is 20 to 30 percent unimpaired flow, and was selected to bracket the low end of flows under current conditions because it potentially could have fewer impacts on the environment than higher flows.[6] LSJR Alternative 3 is 30 to 50 percent of unimpaired flow, which represents a mid-point for the analysis, and would be more likely to both meet most of the goals of the plan amendments while potentially having fewer impacts on the environment. LSJR Alternative 4 has the highest level of flow, with 50 to 60 percent of unimpaired flow. The State Water Board's 2010 report, *Development of Flow Criteria for the Sacramento–San Joaquin Delta Ecosystem*, determined that approximately 60 percent of unimpaired flow at Vernalis from February–June would be fully protective of fish and wildlife beneficial uses in the three eastside tributaries and LSJR when considering flow alone. This level of unimpaired flow, however, also represents the

[6] Flows in the Stanislaus, Tuolumne, and Merced Rivers and the SJR at Vernalis had median values of 40, 21, 26, and 29 percent of February–June unimpaired flow, respectively, for water years 1986–2009.

upper bound above which there would be unacceptably high adverse effects on water supply and temperature control.

3.3.3 Adaptive Implementation

The unimpaired flow objective does not have to be implemented in a way that requires rigid adherence with a fixed percent of unimpaired flow. LSJR Alternatives 2, 3, and 4 include an adaptive implementation element. This adaptive implementation element allows for flows under each alternative to be "shaped" or shifted in time to provide more functionally useful flows and to respond to changing information and conditions. Functionally useful flows achieve a specific function such as increased habitat, more optimal temperatures, or a migration cue. The unimpaired flow requirement also does not need to remain at one fixed percent, but may be adaptively implemented within a range of unimpaired flow in response to changing information, and changing conditions. Each of the three LSJR alternatives is intended to provide the flexibility to be achieved through adaptive implementation. Each of the three tributaries may be managed differently, with respect to the percent of unimpaired flow and the specific adaptive implementation, so long as the adaptive implementation in the three rivers is coordinated.

The adaptive implementation element of the flow proposal consists of a defined adaptive implementation process that allows the magnitude and timing of flows to be adjusted in a number of ways, within a prescribed range of flows, if scientific information supports that such changes would continue to support and maintain the natural production of the viable native fish LSJR fish populations migrating through the Delta. Adaptive implementation achieves one of the principal goals for flow objectives.

4. Allow adaptive implementation of flows that will afford maximum flexibility in establishing beneficial habitat conditions for native fishes, addressing scientific uncertainty and changing conditions, developing scientific information that will inform future management of flows, and meeting biological goals, while still reasonably protecting the fish and wildlife beneficial uses.

Adaptive Implementation also achieves these related goals.

- Quickly respond to changing information and changing conditions, including changes in flow patterns as a result of climate change.
- Minimize adverse water temperature effects.
- Allow for adaptive management and conducting of scientific experiments.

Adaptive implementation could also be used to optimize flows to achieve the objectives while allowing for consideration of other beneficial uses, such as agricultural, municipal, and recreational uses, provided that these other considerations do not reduce intended benefits to fish and wildlife and that requirements are met. Adaptive implementation allows for flows to be reduced to the low end of the range as long as these reductions do not reduce benefits to fish and wildlife and, thus, could have the effect of lessening the environmental impacts associated with higher flow alternatives. The State Water Board may approve adaptive adjustments to the flow requirements as forth in (1)–(4) below if information produced through the monitoring and review processes in the program of implementation, or other best available scientific information, indicates that the change for the period at issue will: (a) be sufficient to support and maintain the natural production of viable native SJR Watershed fish populations migrating through the Delta, and (b) meet any existing biological goals approved by the State Water Board. The Stanislaus, Tuolumne, and Merced Working

Group (STM Working Group) will assist with implementation, monitoring, and assessment activities for the flow objectives and with developing biological goals to help evaluate the effectiveness of the flow requirements and adaptive implementation actions. The STM Working Group may recommend adjusting the flow requirements through adaptive implementation if scientific information supports such changes to reasonably protect fish and wildlife beneficial uses. Scientific research may also be conducted within the adaptive range to improve scientific understanding of measures needed to protect fish and wildlife and reduce scientific uncertainty through monitoring and evaluation. Further details describing the methods, the STM Working Group, and the approval process are included in Appendix K, *Revised Water Quality Control Plan*.

Without adaptive implementation, flow must be managed such that it tracks the daily unimpaired flow percentage based on a running average of no more than 7 days. The four methods of adaptive implementation are generally described below; they are described in Sections 3.3.5 through 3.3.7 as they relate to each LSJR alternatives.

1. Based on best available scientific information indicating that more flow is needed or less flow is adequate to reasonably protect fish and wildlife beneficial uses, the specified annual February–June minimum unimpaired flow requirement may be increased or decreased to a percentage within the ranges listed below. For LSJR Alternative 2 (20 percent unimpaired flow), the percent of unimpaired flow may be increased to a maximum of 30 percent. For LSJR Alternative 3 (40 percent unimpaired flow), the percent of unimpaired flow may be decreased to a minimum of 30 percent or increased to a maximum of 50 percent. For LSJR Alternative 4 (60 percent unimpaired flow), the percent of unimpaired flow may be decreased to a minimum of 50 percent.

2. Based on best available scientific information indicating a flow pattern different from that which would occur by tracking the unimpaired flow percentage would better protect fish and wildlife beneficial uses, water may be released at varying rates during February–June. The total volume of water released under this adaptive method must be at least equal to the volume of water that would be released by tracking the unimpaired flow percentage from February–June.

3. Based on best available scientific information, release of a portion of the February–June unimpaired flow may be delayed until after June to prevent adverse effects to fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements. The ability to delay release of flow until after June is only allowed when the unimpaired flow requirement is greater than 30 percent. If the requirement is greater than 30 percent but less than 40 percent, the amount of flow that may be released after June is limited to the portion of the unimpaired flow requirement over 30 percent. For example, if the flow requirement is 35 percent, 5 percent may be released after June. If the requirement is 40 percent or greater, then 25 percent of the total volume of the flow requirement may be released after June. As an example, if the requirement is 50 percent, at least 37.5 percent unimpaired flow must be released in February–June and up to 12.5 percent unimpaired flow may be released after June. If after June the STM Working Group determines that conditions have changed such that water held for release after June should not be released by the fall of that year, the water may be held until the following year. See Appendix K, for further details.

4. Based on best available scientific information indicating that more flow is needed or less flow is adequate to reasonably protect fish and wildlife beneficial uses, the February–June Vernalis base flow requirement of 1,000 cfs may be modified to a rate between 800 and 1,200 cfs.

Any of the adjustments in (1)–(4) above may be made independently of each other or combined. The adjustments in (1), (2), and (3) may also be made independently on each of the Stanislaus, Tuolumne, and Merced Rivers, so long as the flows are coordinated to achieve beneficial results in the LSJR related to the protection of fish and wildlife beneficial uses. Experiments may also be conducted within the adaptive adjustments in (1)–(4), subject to the approvals provided therein, in order to improve scientific understanding of needed measures for the protection of fish and wildlife beneficial uses, such as the optimal timing of required flows. Any experiment shall be coordinated with the San Joaquin River Monitoring and Evaluation Program (SJRMEP), described below, and identify the scientific uncertainties to be addressed and the actions that will be taken to reduce those uncertainties, including monitoring and evaluation.

Although framed as February– June flow objectives, the range of alternatives captures the entire feasible quantity of water that could be used to reasonably protect fish and wildlife in the LSJR year round. As shown in Table 3-1, approximately 80 percent of the annual volume of unimpaired flow occurs in February–June (based on 1984–2009 unimpaired flow data from Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*). This means that LSJR Alternative 4 evaluates the effects of directing approximately 48 percent of mean annual flows towards the protection of fish and wildlife (60 percent multiplied by 80 percent). The impacts assessment of LSJR Alternative 4 shows that redirecting this quantity of water at the current level of water development would cause large adverse effects on water supply and temperature control. The adaptive element of the LSJR alternatives means that up to 25 percent of the February–June flows can be shifted to time periods after June, thus assuring that there will be no adverse effects on fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements. The combination of an alternative that requires 60 percent of February –June unimpaired flows, in combination with adaptive implementation, which allows shifting of up to 25 percent of this flow volume means that this SED has evaluated all feasible alternatives with regard to the quantity of water consistent with the goal to "take into consideration all of the demands being made and to be made on waters in the LSJR" (goal 6).

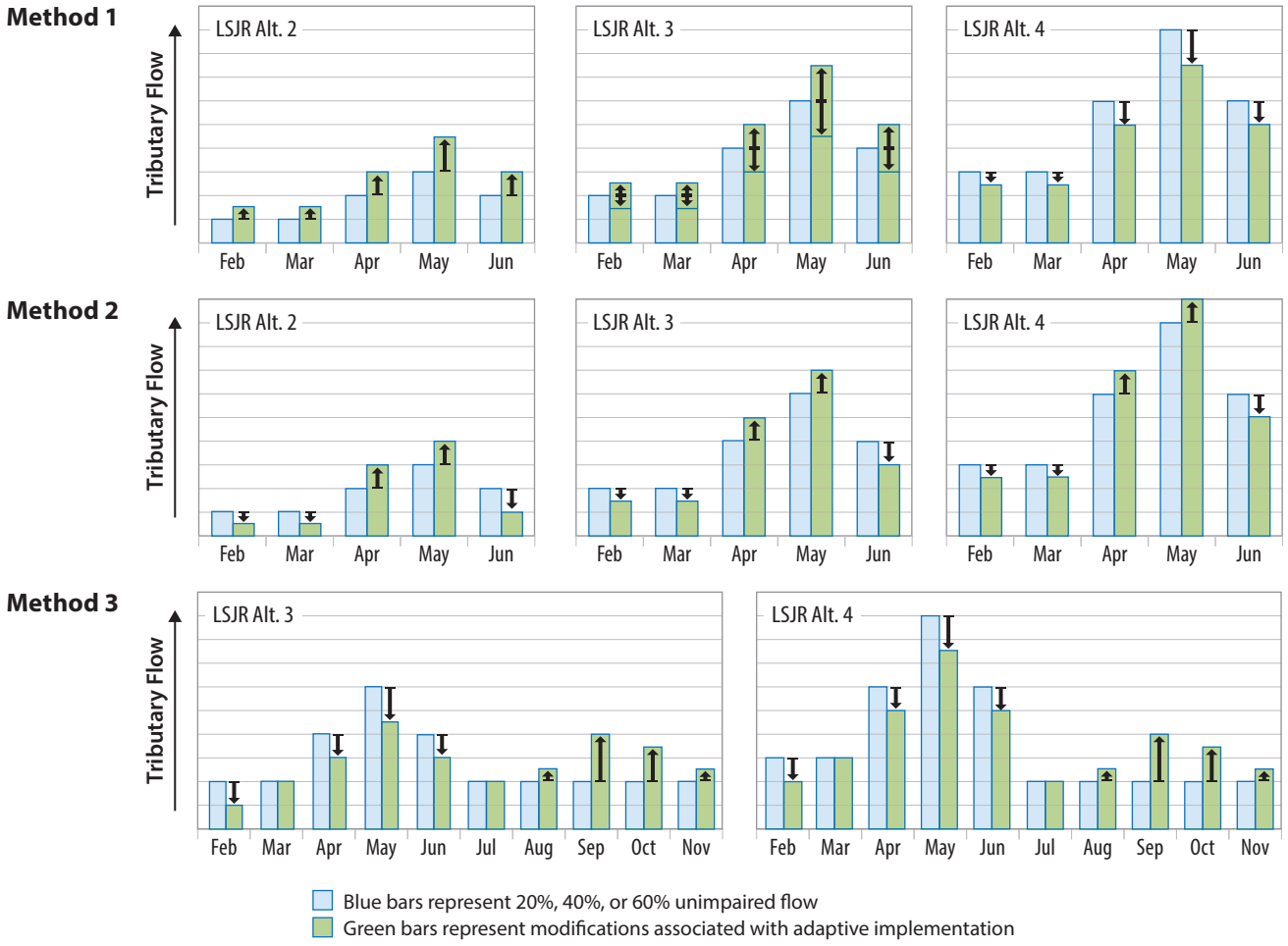
Table 3-1. February–June Unimpaired Flow as a Percent of Annual Unimpaired Flow on the Three Eastside Tributaries

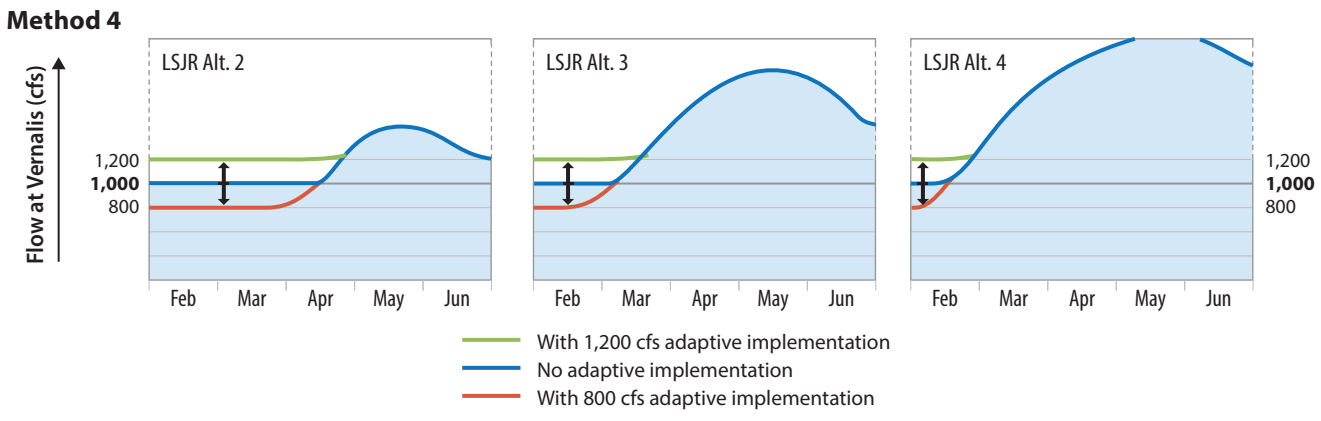
	Feb–June Unimpaired Flow as a % of the Annual Unimpaired Flow		
Averaged for:	Stanislaus	Tuolumne	Merced
All Years	80	79	80
Wet	73	71	72
Above Normal	83	82	85
Below Normal	82	80	80
Dry	84	84	85
Critical	85	85	85

The specific constraints on the use of adaptive implementation vary between LSJR Alternatives 2, 3, and 4 because the alternatives have different starting percentages and ranges. These differences are identified in the description of alternatives below. Also, see Figure 3-1 which provides conceptual illustrations of the adaptive implementation methods for each of the LSJR alternatives.

Applicability of Methods for Each LSJR Alternative

	LSJR Alt. 1	LSJR Alt. 2	LSJR Alt. 3	LSJR Alt. 4
Method 1	N/A	✓	✓	✓
Method 2	N/A	✓	✓	✓
Method 3	N/A	N/A	✓	✓
Method 4	N/A	✓	✓	✓





Graphics...00427.11 (4-26-2016)

Figure 3-1
Conceptual Illustrations of Adaptive Implementation Methods for each LSJR Alternative

3.3.4 LSJR Alternative 1: No Project Alternative

California Code of Regulations, Title 14, Section 15126.6, Subdivision (e), requires evaluation of a no project alternative and its impacts. The purpose of a no project alternative is to compare the impacts of approving a project with the impacts of not approving a project. When a project is the amendment of a regulatory plan, such as the 2006 Bay-Delta Plan, the no project alternative will be the continuation of the existing plan into the future. In evaluating the impacts of a no project alternative, a lead agency should consider what is reasonably expected to occur in the foreseeable future.

LSJR Alternative 1 is the No Project Alternative (see Section 3.4.3, *SDWQ Alternative 1: No Project Alternative*). The No Project Alternative assumes continued implementation of, and full compliance with, the 2006 Bay-Delta Plan, as implemented through State Water Board's Water Right Decision 1641 (D-1641). The No Project Alternative focuses on efforts related to the implementation of Vernalis flow objectives and a southern Delta salinity objective because these objectives are the ones proposed to be amended. The Vernalis flow objectives were first established in the 1995 Bay-Delta Plan to protect fish and wildlife beneficial uses. These objectives include the minimum monthly flow rates for fish and wildlife beneficial uses during specific times of the year, as presented in Table 3 of the 2006 Bay-Delta Plan and implemented through D-1641. In D-1641, the State Water Board assigned compliance with these minimum flows on the SJR at Vernalis to the U.S. Bureau of Reclamation (USBR). When the State Water Board subsequently amended the Bay-Delta Plan in 2006, it approved an interim flow regime through the Vernalis Adaptive Management Program (VAMP) experiment, as proposed in the San Joaquin River Agreement (SJRA), in lieu of meeting the April–May pulse flow objective (as presented in Table 3 of the 2006 Bay Delta Plan).

No Project Alternative conditions differ from the baseline because the Vernalis flow objectives in Table 3 of the 2006 Bay-Delta Plan have not been fully implemented and are not part of the baseline because of implementation of the SJRA and VAMP. The VAMP flows, which are generally lower than the Table 3 flows in the 2006 Bay-Delta Plan, are thus included in the baseline. During VAMP, a portion of the flows needed to comply with VAMP came from the three eastside tributaries (Stanislaus, Tuolumne, and Merced Rivers), even though the 2006 Bay-Delta Plan and D 1641 do not contain numeric or narrative flow requirements specific to these rivers. However, the No Project Alternative does not include VAMP flows because that experimental flow regime concluded in 2011. The No Project Alternative and the baseline both include the 2009 National Marine Fisheries Service (NMFS) Biological Opinion (BO) flow requirements on the Stanislaus River, FERC requirements on the Tuolumne and Merced Rivers, and the Davis Grunsky requirements on the Merced River.

The No Project Alternative assumes that the flows would continue to be the responsibility of USBR and that the objectives would be met with additional releases from New Melones Reservoir on the Stanislaus River. There are other possible ways that compliance with the objectives could be achieved, but it is speculative to identify which other measures, or combination of measures, would be used. For example, the flow objective could be achieved by a combination of releases from New Melones Reservoir and other actions (e.g., water purchases and transfers among different water users and other upstream SJR actions [such as SJR Restoration Program[7] flows]). However, these other actions are difficult to predict or quantify. The analytical approach used here evaluates increased releases from New Melones Reservoir to meet the objectives because such releases could be the primary method by which the Vernalis flow objectives and southern Delta salinity objective

[7] Implementation of the settlement and the Friant Dam release flows required by the San Joaquin River Restoration Program are expected to increase the existing SJR flows at Stevinson in the near future.

would be achieved. Focusing the evaluation on New Melones Reservoir releases affords an evaluation of maximum potential water supply impacts compared to assuming that increases in Vernalis flow would be distributed among the tributaries.

The No Project Alternative also assumes the continuation of the southern Delta salinity objective for agricultural beneficial uses, as identified in Table 2 of the 2006 Bay-Delta Plan, and full compliance with these objectives as implemented through D-1641 (see Section 3.4.3, *SDWQ Alternative 1: No Project Alternative*). Under D-1641, compliance with the numeric salinity objective on the SJR at Vernalis (station C-10) is the obligation of USBR. Compliance with the numeric salinity objective at the three interior southern Delta compliance stations—SJR at Brandt Bridge (station C-6), Old River near Middle River (station C-8), and Old River at Tracy Road Bridge (station P-12)—is the combined obligation of USBR and the California Department of Water Resources (DWR).

Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1)*, evaluate the potential impacts of the No Project Alternative. Appendix D provides the modeling assumptions and technical analysis considered in Chapter 15. LSJR Alternative 1 and SDWQ Alternative 1 are evaluated together as the No Project Alternative because continuation of the 2006 Bay-Delta Plan would require compliance with the Vernalis flow objectives and southern Delta salinity objective. Appendix D quantifies the amount of water needed to meet both objectives in the 2006 Bay-Delta Plan.

3.3.5 LSJR Alternative 2

LSJR Alternative 2 implements the 20–30 percent numeric flow water quality objective range by initially requiring maintenance of 20 percent of unimpaired flows at the confluences of each of the Stanislaus, Tuolumne, and Merced Rivers with the SJR from February–June based on a minimum 7-day running average. As described above in Section 3.3.3, *Adaptive Implementation*, the flow requirements could be adaptively adjusted in the same manner for LSJR Alternatives 2, 3, and 4. The following discussion describes aspects of adaptive implementation as specifically applied to LSJR Alternative 2.

1. Adjust the unimpaired flow objective within a range of 20 percent to 30 percent, inclusive.
2. Manage the February–June percent of unimpaired flow as a total volume of water and release the water on an adaptive schedule during that period where scientific information indicates a flow pattern different from that which would occur by tracking the unimpaired flow percentage, would better protect fish and wildlife beneficial uses. Applying this method, the total volume of water released would be the same as LSJR Alternative 2 without adaptive implementation; however the rate could vary from the actual (7-day running average) unimpaired flow rate and the volume for each month could vary.
3. Unlike LSJR Alternatives 3 and 4, a portion of the total February–June unimpaired flow volume may not be held and released after June in order to prevent adverse effects to fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements.
4. The minimum required LSJR base flow objective for February–June of 1,000 cfs, based on a minimum 7-day running average, at Vernalis may be adjusted to a value between 800 and 1,200 cfs.

3.3.6 LSJR Alternative 3

LSJR Alternative 3 implements the 30–50 percent numeric flow water quality objective range by initially requiring maintenance of 40 percent of unimpaired flows at the confluences of each of the Stanislaus, Tuolumne, and Merced Rivers with the SJR from February–June based on a 7-day minimum running average. As described above in Section 3.3.3, *Adaptive Implementation*, the flow requirements could be adaptively adjusted in the same manner for LSJR Alternatives 2, 3, and 4. The following discussion describes aspects of adaptive implementation as specifically applied to LSJR Alternative 3.

1. Adjust the minimum unimpaired flow objective within a range of 30 percent to 50 percent.
2. Implementing this method would allow an increase or decrease of up to 10 percent in the February–June 40 percent minimum unimpaired flow requirement (with a minimum of 30 percent and maximum of 50 percent).
3. Manage the February–June percent of unimpaired flow as a total volume of water and release the water on an adaptive schedule during that period where scientific information indicates a flow pattern different from that which would occur by tracking the unimpaired flow percentage, would better protect fish and wildlife beneficial uses. Applying this method, the total volume of water released would be the same as LSJR Alternative 3 without adaptive implementation; however the rate could vary from the actual (7-day running average) unimpaired flow rate and the volume for each month could vary.
4. Allow a portion of the total February–June unimpaired flow volume to be held and released after June in order to prevent adverse effects to fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements. If the requirement is greater than 30 percent but less than 40 percent, the amount of flow that may be released after June is limited to the portion of the unimpaired flow requirement over 30 percent. If the requirement is 40 percent or greater, then 25 percent of the total volume of the flow requirement may be released after June.
5. The minimum required LSJR base flow objective for February–June of 1,000 cfs, based on a minimum 7-day running average, at Vernalis may be adjusted to a value between 800 and 1,200 cfs.

3.3.7 LSJR Alternative 4

LSJR Alternative 4 implements the 50–60 percent numeric flow water quality objective range by initially requiring maintenance of 60 percent of unimpaired flows at the confluences of each of the Stanislaus, Tuolumne, and Merced Rivers with the SJR from February–June based on minimum a 7-day running average. As described above in Section 3.3.3, *Adaptive Implementation*, the flow requirements could be adaptively adjusted in the same manner for LSJR Alternatives 2, 3, and 4. The following discussion describes aspects of adaptive implementation as specifically applied to LSJR Alternative 4.

1. Adjust the minimum unimpaired flow objective within a range of 50 percent to 60 percent.
2. Manage the February–June percent of unimpaired flow as a total volume of water and release the water on an adaptive schedule during that period where scientific information indicates a flow pattern different from that which would occur by tracking the unimpaired flow percentage, would better protect fish and wildlife beneficial uses. Applying this method, the total volume of

water released would be the same as LSJR Alternative 4 without adaptive implementation; however the rate could vary from the actual (7-day running average) unimpaired flow rate and the volume for each month could vary.

3. Allowing a portion of the total February–June unimpaired flow volume to be held and released after June in order to prevent adverse effects to fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements. If the requirement is 50 percent or greater, then 25 percent of the total volume of the flow requirement may be released after June.
4. The minimum required LSJR base flow objective for February–June of 1,000 cfs, based on a minimum 7-day running average, at Vernalis may be adjusted to a value between 800 and 1,200 cfs.

3.3.8 Common Elements of LSJR Alternatives

The following elements of the LSJR alternatives are the same for LSJR Alternatives 2, 3, and 4.

- Implementing entity and biological goals.
- Planning, monitoring, and reporting.
- State of emergency provisions.
- Non-flow measures.

Implementing Entity and Biological Goals

The State Water Board will establish the STM Working Group to assist with implementation, monitoring and assessment activities for the LSJR flow objectives. The STM Working Group will be comprised of representatives from the State Water Board; California Department of Fish and Wildlife (CDFW); NMFS; United States Fish and Wildlife Service (USFWS); water users on the Stanislaus, Tuolumne, and Merced Rivers; and any other representatives deemed appropriate by the Executive Director. The STM Working Group or State Water Board staff as necessary, will, in consultation with the Delta Science Program, develop specific measures necessary to implement the February–June LSJR flow requirements and assess their effectiveness. The STM Working Group, or State Water Board staff as necessary, will also, in consultation with the Delta Science Program, develop proposed procedures for allowing the adaptive adjustments to the February–June flow requirements.

The program of implementation requires the development of biological goals that can be used to demonstrate the reasonable protection of LSJR fish and wildlife beneficial uses, evaluate the effectiveness of the program of implementation, and to inform adaptive implementation. These biological goals will be developed by the STM Working Group or State Water Board staff, as necessary. Based on the STM's recommendations and input from other interested persons, the State Water Board will make a final determination regarding the biological goals that will be used to evaluate the effectiveness of the program of implementation. Once developed, those biological goals may be modified by the State Water Board based on new information developed through the monitoring and evaluation activities described below or other new sources of scientific information. Biological goals will be developed specifically for LSJR salmonids for abundance; productivity as measured by population growth rate; genetic and life history diversity; and population spatial extent, distribution, and structure. It is expected that the biological goals for the LSJR will be

incorporated into the water rights implementation of the flow objectives. In this way, the biological goals will be one of the tools that will guide the specific flow percent that is required within the adaptive range.

Planning, Monitoring, and Reporting

A comprehensive monitoring, special studies, evaluation, and reporting program is necessary to determine compliance with the LSJR flow objectives, inform adaptive implementation, investigate the technical factors involved in water quality control, and identify potential needed future changes to the LSJR flow objectives, including flows for other times of the year. The State Water Board will require annual and comprehensive monitoring, evaluation, and reporting, as part of the SJRMEP, including:

1. Monitoring, special studies, and evaluations of the effects of flow and other factors on the viability of native LSJR Watershed fish populations throughout the year, including assessment of abundance, spatial extent (or distribution), diversity (both genetic and life history), and productivity.
2. Consideration of recommendations from entities with relevant Central Valley monitoring plans to improve standardization of methods, including the quantification of bias and precision of population estimates.
3. Regular external scientific review of monitoring, evaluation, and reporting.

Monitoring under this program would be integrated and coordinated with new and ongoing monitoring and special studies programs in the LSJR, including federal BO requirements, FERC licensing proceedings for the Merced and Tuolumne Rivers, Central Valley Regional Water Board requirements, and the Delta Science Program. The SJRMEP consists of annual and comprehensive monitoring and reporting.

To inform the next year's operations and other activities, the State Water Board will require preparation and submittal of an annual report to the State Water Board by December 31 of each year. The annual report shall describe implementation of flows, including any flow shifting done pursuant to the annual adaptive operations plan, monitoring and special studies activities, and implementation of other measures to protect fish and wildlife during the previous water year, including the actions by other entities identified in this program of implementation. The annual report shall also identify any deviations from the annual adaptive operations plan and describe future special studies. The State Water Board may hold public meetings to receive and discuss the annual report.

Additionally, every 3 to 5 years following implementation of this update to the Bay-Delta Plan, the State Water Board will require preparation and submittal of a comprehensive report that, in addition to the requirements of annual reporting, reviews the progress toward meeting the biological goals and identifies any recommended changes to the implementation of the flow objectives. The comprehensive report and any recommendations shall be peer-reviewed by an appropriate independent science panel, which will make its own conclusions and recommendations. The State Water Board will hold public meetings to consider the comprehensive report, technical information, and conclusions or recommendations developed through the peer review process. This information will be used to inform potential adaptive changes to the implementation of the flow objectives and, as appropriate, future potential changes to the Bay-Delta Plan.

In summary, the program of implementation for LSJR flow objectives identifies the following information, plans, and reports that must prepared and submitted to the State Water Board or its Executive Director for approval.

- Biological goals—one time preparation, but can be modified thereafter; to be considered for approval within 180 days after Office of Administrative Law (OAL) approval of the amendments to Bay-Delta Plan.
- Measures to achieve, monitor, and evaluate compliance with the flow objectives—one time preparation and submittal; to be considered for approval within 180 days after OAL approval of the amendments to the Bay-Delta Plan.
- Adaptive Methods Procedures—one time preparation and submittal, to be considered for approval within 1 year after OAL approval of the amendments to the Bay-Delta Plan.
- Annual Adaptive Operations Plan—due January 10 each year.
- Annual Report on Implementation Activities—due December 31 each year.
- Comprehensive Review of Implementation Actions—due every 3 to 5 years.

State of Emergency Change Provision

The current drought has highlighted the need to adjust requirements in water rights that implement the current Bay-Delta standards during emergencies. The flow proposal therefore includes a provision to adjust flows for a state of emergency, such as the current drought emergency. Under this emergency element of the flow proposal, the State Water Board, at its discretion or at the request of any affected responsible agency or person, may authorize a temporary change to the implementation of the LSJR flow objectives if the State Water Board determines that either: (1) there is an emergency as defined by CEQA (Pub. Resources Code, § 21060.3), or (2) the Governor of the State of California or a local governing body has declared a state or local emergency pursuant to the California Emergency Services Act. (Gov. Code, § 8550 et seq.) Before authorizing any temporary change, the State Water Board must find that measures will be taken to reasonably protect the beneficial use in light of the circumstances of the emergency.

Non-Flow Measures

The program of implementation for the flow proposal recommends and encourages the development of non-flow measures to assist in further improving protections for fish and wildlife beneficial uses. This is intended to provide guidance to the entities that will be responsible for attainment of flow objectives, and other entities, as regarding non-flow that are complementary to the LSJR flow objectives and that may help to achieve the overarching goal of supporting and maintaining the natural production of viable native LSJR Watershed fish populations. Increased flows, however, remain the principal means of compliance with the LSJR flow objectives. As discussed above, adaptive adjustments to the range of flows may be made if certain requirements are met, which allows for consideration of benefits associated with the non-flow measures, but the lower number of the adaptive range still represents the minimum required flow. In other words, some level of flow is always required.

The following actions are non-flow measures that can be used to improve conditions for fish and wildlife in a manner that may support a change in the flows within the adaptive range, thus lessening the significant effects of the alternatives that occur as a result of reduced water availability

for diversions. These recommended actions, together with the coordinated monitoring and adaptive implementation described above, are expected to improve habitat conditions that benefit native fish and wildlife, or are expected to improve related science and management within the LSJR Watershed. The following actions are recommended for evaluation and subsequent implementation.

- Restore, enhance, and protect floodplain and riparian habitat.
- Reduce vegetation disturbing activities in floodplains and floodways, where safe and appropriate.
- Provide and maintain coarse sediment for salmonid spawning and rearing.
- Enhance in-channel complexity.
- Improve reservoir operations and/or physical structures to maintain adequate water temperature conditions.
- Expand fish screening.
- Improve fish passage above dams.
- Improve fish and water barrier programs.
- Reduce predation and competition by nonnative fish.
- Reduce invasive species.

Allowance for and implementation of these non-flow measures achieve the goal of taking "into consideration all of the demands being made and to be made on waters in the LSJR and the three eastside, salmon-bearing tributaries" (goal 6) by allowing measures other than flow to help achieve the overarching goal of supporting and maintaining the natural production of viable native LSJR Watershed fish populations.

3.3.9 LSJR Alternatives Considered but Eliminated from Further Evaluation

CEQA requires identification of any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process with a brief explanation of the reasons underlying the lead agency's determination. (State CEQA Guidelines, § 15126.6, subd. (c).) Among the factors that may be used to eliminate alternatives from detailed consideration are: "(i) failure to meet most of the basic project objectives, (ii) infeasibility, or (iii) inability to avoid significant environmental impacts." (*Ibid.*)

This section summarizes alternatives that were considered by the State Water Board and eliminated from detailed consideration. It includes a discussion of suggestions that were received from the public during the comment periods associated with the February 13, 2009 notice of preparation and the April 1, 2011 revised notice of preparation. This section also includes discussion of flow recommendations received during the process of preparing the August 2010 State Water Board staff report entitled *Development of Flow Criteria for the Sacramento–San Joaquin Delta Ecosystem* (State Water Board 2010). These potential alternatives were evaluated for their ability to meet most of the underlying fundamental purposes and goals of the plan amendments, feasibility, and ability to avoid significant effects on the environment.

3.3.10 LSJR Flow Objectives and Program of Implementation

Fixed Monthly Flow-Based Programs of Implementation

Several commenters suggested the State Water Board consider fixed monthly flow objectives similar to the current flow objectives, that vary by water year type and month instead of using an unimpaired flow approach.

As detailed in Appendix C, *Technical Report on the Scientific Basis Alternative for San Joaquin River Flow and Southern Delta Salinity Objectives*, retaining the spatial and temporal attributes of the natural flow regime is important in protecting a wide variety of ecosystem processes. The historical practice of developing fixed monthly flow objectives to be met from limited sources has been shown to be less than optimal in protecting fish and wildlife beneficial uses in the SJR Basin. Accordingly, to preserve the attributes of the flow regime to which native SJR Basin fish and wildlife have adapted and that are believed to be generally protective of the current beneficial uses, the flow requirements in the program of implementation are expressed as a percentage of unimpaired flow (e.g., 40 percent of unimpaired flow). However, if specific information indicates that more fixed flows would be more protective of fish and wildlife, the adaptive management provisions of LSJR Alternatives 2, 3, and 4 could allow for such an approach to be implemented, provided that the required amount of flow is less than or equal to that of the LSJR alternatives. To assess whether this would be possible for the specific flow recommendations that the State Water Board received, an analysis was conducted to compare the flow exceedance curves for LSJR Alternatives 2, 3, and 4 with the different recommended flow schedules. If flow exceedance curves for the recommended flows are less than or equal to the flow exceedance curves for the LSJR alternatives, and if it is determined that the recommended flow schedule is more protective than the percent of unimpaired flow pursuant to the LSJR alternatives, then adequate water would generally be available to meet the recommended flows. Accordingly, this category of recommendation is effectively included within the LSJR alternatives analyzed in this SED. Moreover, there is no information to support a conclusion that a fixed monthly flow objective would reduce or avoid potentially significant effects on the environment any more than the current alternatives.

Contra Costa County Department of Conservation and Development

The Contra Costa County Department of Conservation and Development (CCCDCD) submitted scoping comments on the *Southern Delta Agriculture and San Joaquin River Flows Revised Notice of Preparation* (CCCDCD 2011). The CCCDCD scoping comments included recommendations on setting quantitative LSJR flow objectives that would have percentages of unimpaired flow that vary by month yet ensure additional reduced-flow impacts are not created outside of the February–June period. Presented in Table 3-2 are the flow schedule-based recommendations submitted by CCCDCD.

Table 3-2. Contra Costa County Department of Conservation and Development Flow Schedule-Based Recommendations

	Minimum Monthly Average Flow as a Percentage of Monthly Unimpaired Flow				
Month	Vernalis	Stanislaus River upstream of the confluence with the SJR	Tuolumne River upstream of the confluence with the SJR	Merced River upstream of the confluence with the SJR	Upper SJR upstream of the confluence with the Merced
Jan[a]	20	20 with an upper cap[b]	20 with an upper cap	20 with an upper cap	20 with an upper cap
Feb	50	30	30	30	30
Mar	50	30	30	30	30
Apr	40	20	20	20	20
May	30	20	20	20	20
Jun	30	20	20	20	20
Jul–Dec[a]	20	20 with an upper cap	20 with an upper cap	20 with an upper cap	20 with an upper cap

[a] Minimum flows are also needed outside the February–June period of greatest concern for fish and wildlife to ensure flow impacts are not redirected to the July–January period.

[b] The upper cap should be based on the 70th percentile of the unimpaired flows for each tributary and month. In other words, the minimum flow requirement of 20% of unimpaired flow would generally apply in critical, dry, and normal years but would be capped at 20% of the 70th-percentile unimpaired flow in wet years. This cap would only apply from July–January (i.e., outside of the period of greatest concern for fish).

Comparison of the exceedance plots for flow at Vernalis in Figure 3-2 indicates that LSJR Alternatives 2, 3, and 4 encompass the CCCDCD flow recommendations for all water year types. The CCCDCD flow recommendations are less than LSJR Alternative 4 in all years. The CCCDCD flow recommendations are generally greater than LSJR Alternative 2 in all years and would not avoid or substantially lessen potentially significant effects.

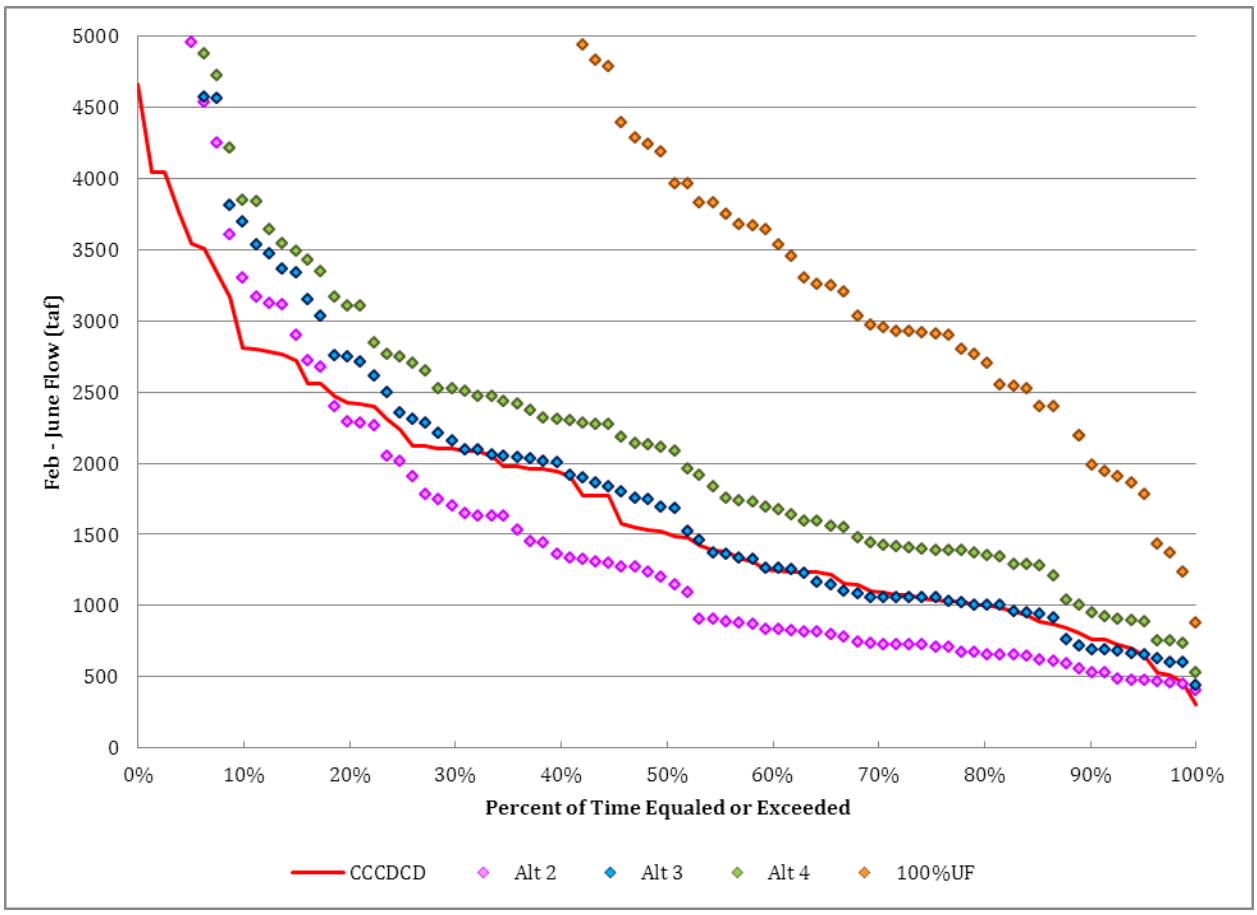


Figure 3-2. Flow Exceedance Plot of Contra Costa County Department of Conservation and Development's (CCCDCD's) Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

California Department of Fish and Wildlife

CDFW (formerly the California Department of Fish and Game) provided written testimony and closing comments as part of the State Water Board Proceeding to Develop Flow Criteria for the Delta (CDFG 2010a, 2010b). CDFG testimony and comments included flow recommendations for the SJR at Vernalis that would double Chipps Island SJR fall-run Chinook salmon smolt production from 78,210 to more than 156,420 (derived from SJR Salmon Model V.1.6 output). Table 3-3 presents the flow schedule-based recommendations from CDFG.

Table 3-3. California Department of Fish and Game Flow Schedule-Based Recommendations, 2010 (cubic feet per second)

Water Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
C			1500 (Base)	5500 (Pulse) (4/15-5/15) (Total 7000)								
D			2125 (Base)	4875 (Pulse) (4/11-5/20) (Total 7000)								
BN			2258 (Base)	6242 (Pulse) (4/6-5/25) (Total 8500)								
AN			4339 (Base)	5661 (Pulse) (4/1-5/30) (Total 10000)								
W			6315 (Base)	8685 (Pulse) (3/27-6/4) (Total 15000)								

C = critical
D = dry
BN = below normal
AN = above normal
W = wet

A comparison of the exceedance plots for flow at Vernalis in Figure 3-3 indicates that LSJR Alternatives 2, 3, and 4 generally encompass the CDFG flow recommendations. The CDFG flow recommendations are generally greater than LSJR Alternative 2 in all years, and would not avoid or substantially lessen potentially significant effects.

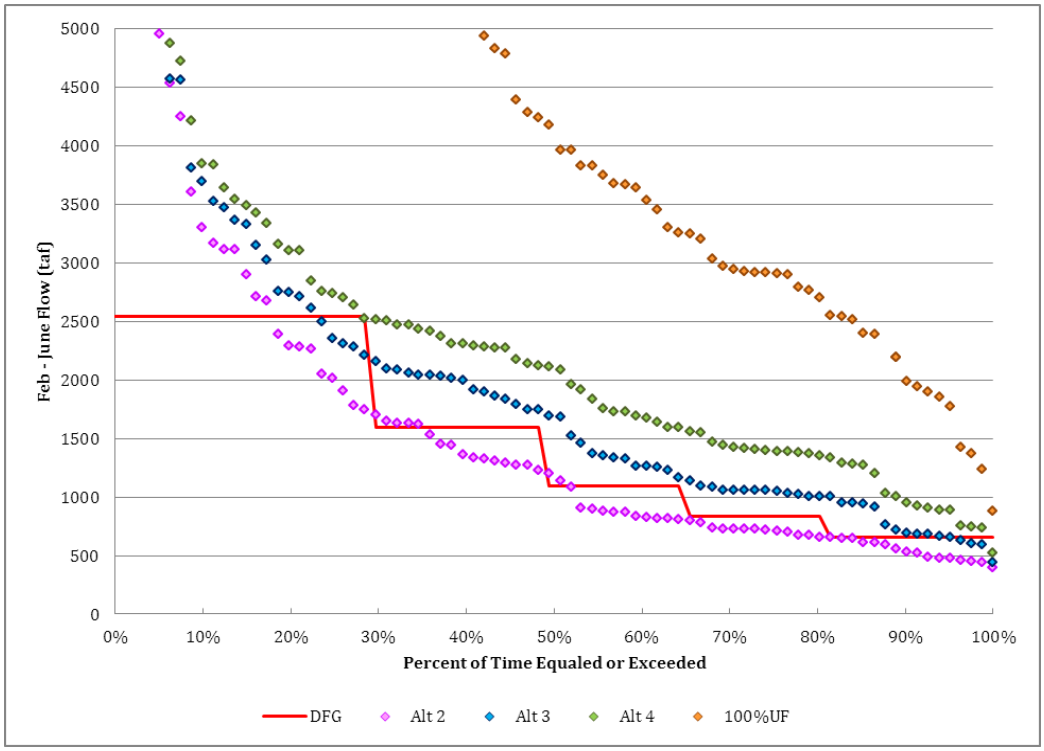


Figure 3-3. Flow Exceedance Plot of California Department of Fish and Game's (CDFG's) Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

California Water Impact Network and California Sportfishing Protection Alliance

California Water Impact Network and California Sportfishing Protection Alliance (C-WIN/CSPA) provided closing comments as part of the State Water Board Proceeding to Develop Flow Criteria for the Delta (C-WIN 2010; CSPA 2010). The C-WIN/CSPA comments included flow recommendations based on pulse flows considered to match and facilitate the early life stages of salmonid larvae, juvenile rearing, and smoltification. Table 3-4 presents the flow schedule-based recommendations by C-WIN/CSPA.

Table 3-4. California Water Impact Network and California Sportfishing Protection Alliance Flow Schedule-Based Recommendations (cubic feet per second)

Water Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
C		13400	4500	6700 8900	1200					5400		
D		13400 (2 days)	4500	6700 8900	1200					5400		
BN		13400 (16 days), 26800 (2 days)	4500	6700 8900	11200	1200				5400		
AN		13400 (13 days), 26800 (5 days)	4500	6700 8900	11200	1200				5400		
W		13400 (17 days), 26800 (5 days)	13400			14900				5400		

Note: Critically dry is 13,400 for 2 days.
C = critical
D = dry
BN = below normal
AN = above normal
W = wet

Comparison of the exceedance plots for flow at Vernalis in Figure 3-4 indicates that LSJR Alternatives 2, 3, and 4 largely encompass the C-WIN/CSPA flow recommendations and entirely encompasses them for above-normal and dry water year types. The C-WIN/CSPA flow recommendations are generally greater than LSJR Alternative 2 in all years, and would not avoid or substantially lessen potentially significant effects.

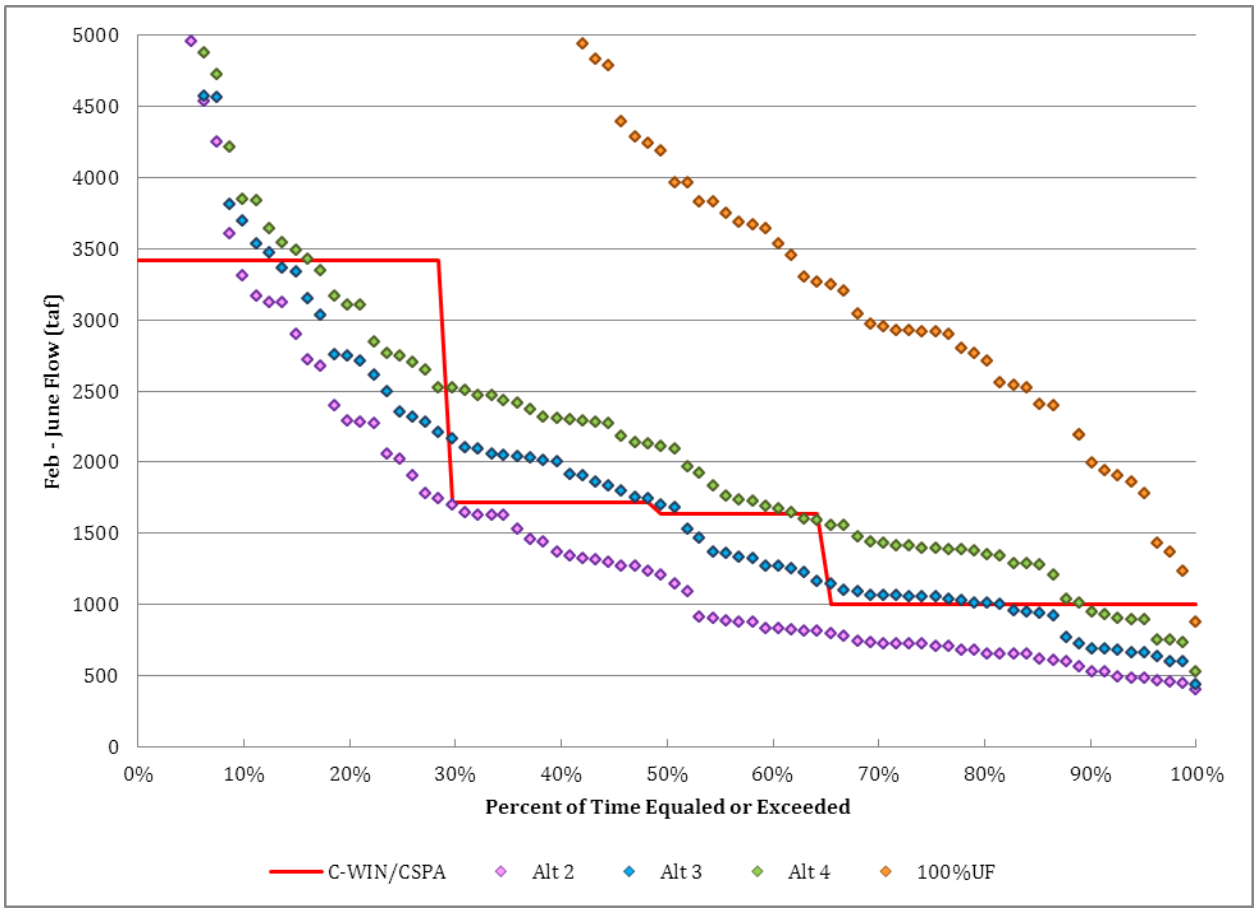


Figure 3-4. Flow Exceedance Plot of California Water Impact Network and California Sportfishing Protection Alliance's (C-WIN/CSPA) Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

The Bay Institute and Natural Resources Defense Council

The Bay Institute and Natural Resources Defense Council (TBI/NRDC) provided testimony and closing comments as part of the State Water Board Proceeding to Develop Flow Criteria for the Delta (TBI/NRDC 2010a, 2010b, 2010c). The TBI/NRDC testimony and comments included flow recommendations developed by analyzing the relationship between LSJR flows with abundance, productivity, and life history diversity of SJR fall-run Chinook salmon. Table 3-5 presents the TBI/NRDC flow schedule-based recommendations.

Table 3-5. The Bay Institute and Natural Defense Council Flow Schedule-Based Recommendations (cubic feet per second)

Water Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
100% of years (all yrs)		2000		5000					2000			
80% (D yrs)		2000		5000	10000	7000	5000		2000			
60% (BN yrs)		2000		20000	10000	7000	5000		2000			
40% (AN yrs)		2000	5000	20000		7000			2000			
20% (W yrs)		2000	5000	20000		7000			2000			

D = dry
BN = below normal
AN = above normal
W = wet

Comparison of the exceedance curves shown in Figure 3-5 indicates that the State Water Board's flow resulting at Vernalis from the range of LSJR alternatives generally encompasses the TBI/NRDC flow recommendations and entirely encompasses them for above-normal and dry water year types. The TBI/NRDC flow recommendations are generally greater than LSJR Alternative 2 in all years, and would not avoid or substantially lessen potentially significant effects.

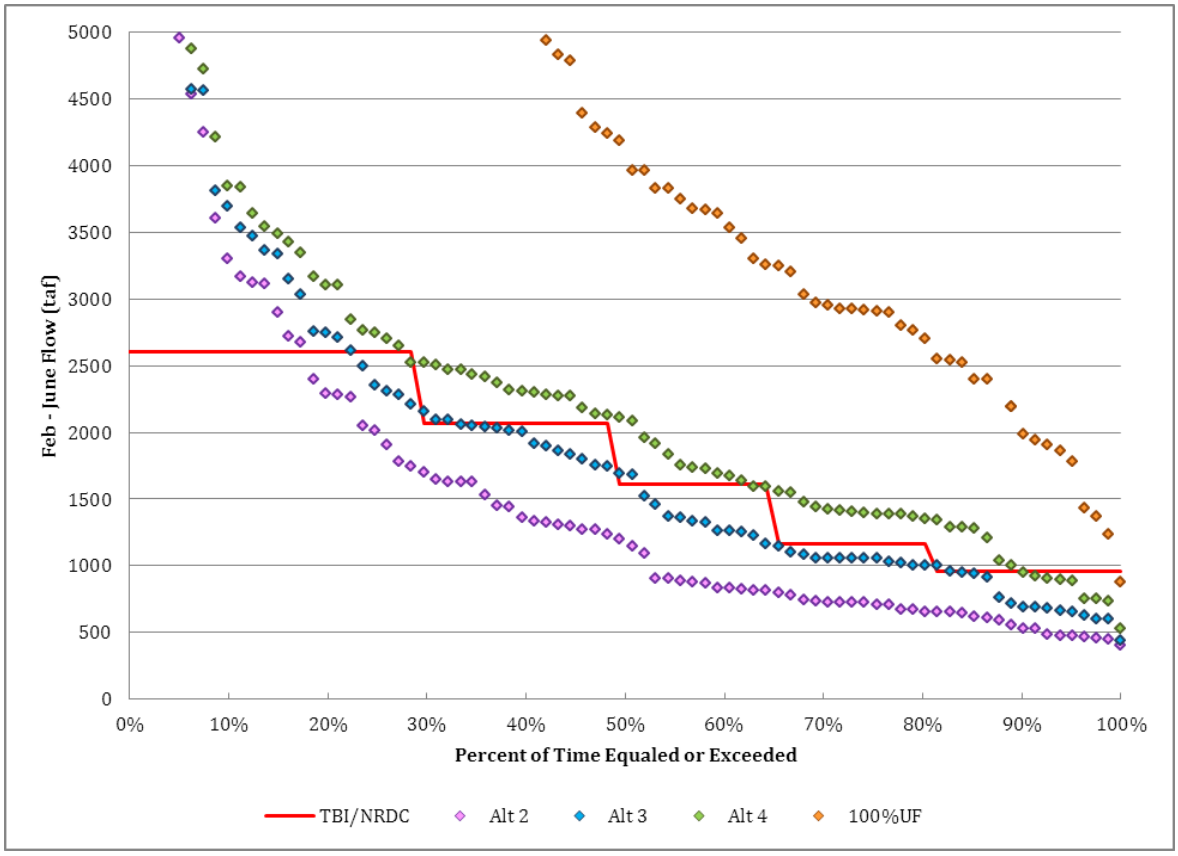


Figure 3-5. Flow Exceedance Plot of The Bay Institute and Natural Defense Council's (TBI/NRDC) Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

American Rivers and Natural Heritage Institute

The American Rivers and Natural Heritage Institute (AR/NHI) provided testimony and closing comments as part of the State Water Board Proceeding to Develop Flow Criteria for the Delta (AR/NHI 2010a, 2010b). Included in the testimony and closing comments were recommendations for LSJR flows that would benefit salmon rearing habitat and smolt outmigration (i.e., increased flow velocities and turbidity), with focus on temperature (i.e., maintaining temperature at or below 65°F). These flow recommendations are to be in addition to those stipulated in D-1641. Table 3-6 presents the flow schedule-based recommendations provided in the AR/NHI testimony and closing comments.

Table 3-6. American Rivers and Natural Heritage Institute Flow Schedule-Based Recommendations

Water Year	Jan	Feb	Mar		Apr		May	Jun		Jul	Aug	Sept	Oct	Nov	Dec
100% of years (all yrs)			3000	4000	5000			2000							
80% (D yrs)			3000	4000	5000	10000	7000	5000	2000						
60% (BN yrs)			3000	5000	20000	10000	7000	5000	2000						
40% (AN yrs)			3000	5000	20000		7000		2000						
20% (W yrs)			3000	5000	20000			7000	2000						
All			Flows of approx. 10000 cfs should occur at Vernalis for ≥5 days. There should be at least 2 such events in dry years, and more in wetter years.												

D = dry
BN= below normal
AN= above normal
W = wet

Comparison of the exceedance plots for flow at Vernalis in Figure 3-6 indicates that LSJR Alternatives 2, 3, and 4 generally encompass the AR/NHI flow recommendations and entirely encompass them for above-normal and dry water year types. The AR/NHI flow recommendations are generally greater than LSJR Alternative 2 in all years, and would not avoid or substantially lessen potentially significant effects.

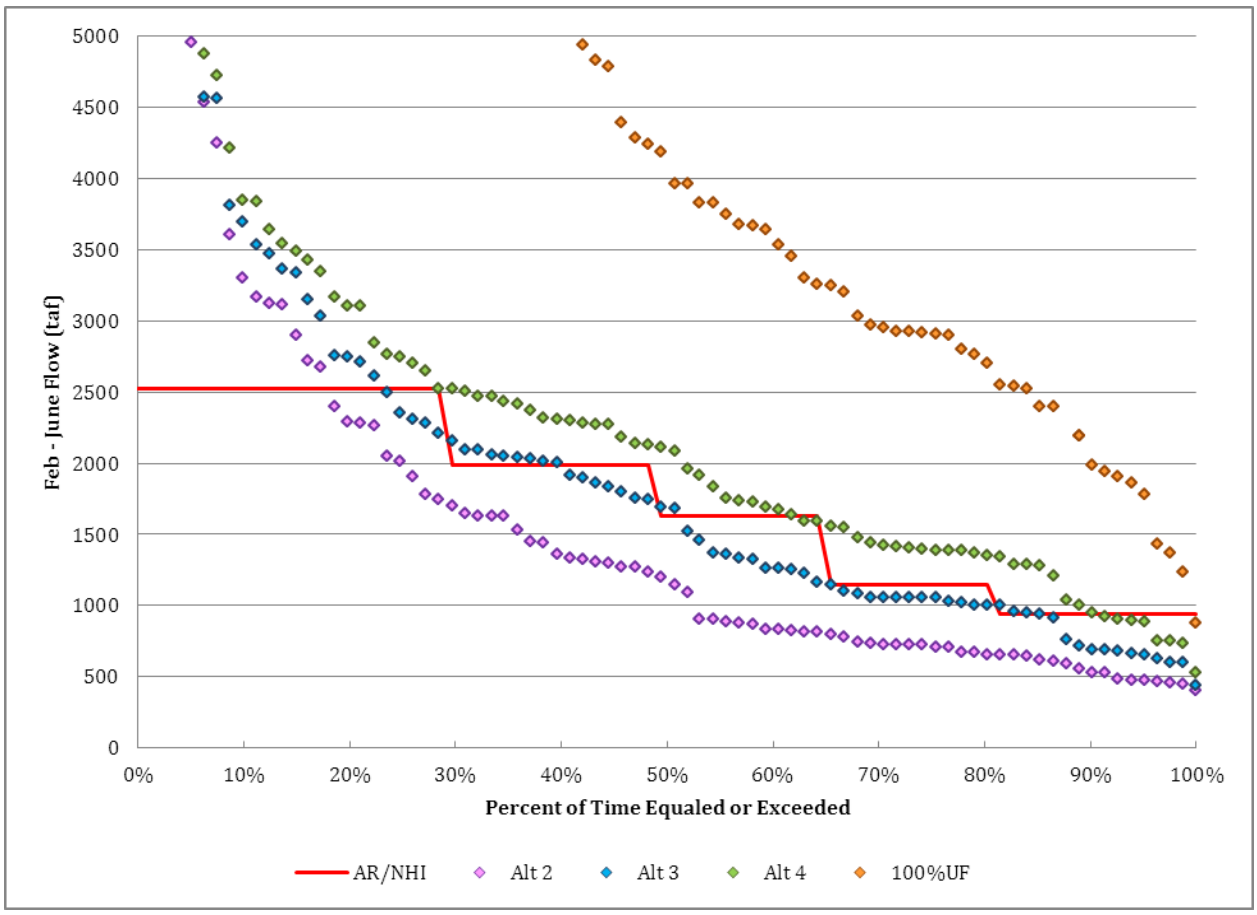


Figure 3-6. Flow Exceedance Plot of American Rivers and Natural Heritage Institute's (AR/NHI) Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

U.S. Department of the Interior

Pursuant to the Central Valley Project Improvement Act (CVPIA), the U.S. Department of the Interior (DOI) is required to develop and implement measures to at least double the natural production of anadromous fish in Central Valley streams; the program to achieve this is known as the Anadromous Fish Restoration Program (AFRP). DOI submitted a written summary and witness testimony on behalf of both USFWS and USBR as part of the State Water Board Proceeding to Develop Flow Criteria for the Delta (DOI 2010). DOI recommended evaluation of the flow recommendations contained within the CVPIA's 2005 AFRP Report (USFWS 2005) for salmon population doubling and increasing salmon population by 53 percent. Table 3-7 presents USFWS/USBR flow recommendations, as stated in the CVPIA's 2005 AFRP Report, for salmon population doubling and increasing salmon population by 53 percent.

Table 3-7. Central Valley Project Improvement Act's 2005 Anadromous Fish Restoration Program Report Flow Schedule-Based Recommendations (cubic feet per second)

	Water Year Type	Flow			
		Feb	Mar	Apr	May
Doubling Salmon Population	C	1744	2832	4912	5665
	D	1784	3146	5883	7787
	BN	1809	3481	6721	9912
	AN	2581	5162	8151	13732
	W	4433	8866	10487	17369
53% Increase in Salmon Population	C	1250	1665	2888	3331
	D	1350	1850	3459	4579
	BN	1450	1933	3733	5505
	AN	1638	2703	4266	7194
	W	2333	4667	5520	9142

C = critical
D = dry
BN = below normal
AN = above normal
W = wet

Comparison of the exceedance plots for flow at Vernalis in Figure 3-7 indicates that LSJR Alternatives 2, 3, and 4 encompass the USFWS/USBR salmon population doubling flow recommendations for above-normal, below-normal, and dry water year types. The USFWS/USBR salmon population doubling flow recommendations are generally greater than LSJR Alternative 2 in all years.

Comparison of the exceedance plots for flow at Vernalis in Figure 3-7 indicates that LSJR Alternatives 2, 3, and 4 generally encompass the USFWS/USBR flows. With the exception of critical years, the LSJR alternatives entirely encompass both sets of flows. The USFWS/USBR salmon population 53 percent increase flow recommendations are generally lower than LSJR Alternative 2 in most years. These recommendations would not avoid or substantially lessen potentially significant effects, and in years with lower flows, would not meet the plan amendment purpose and goals of protecting the fish and wildlife beneficial uses, including by maintaining inflow conditions sufficient to support and maintain the natural production of viable migratory fish populations.

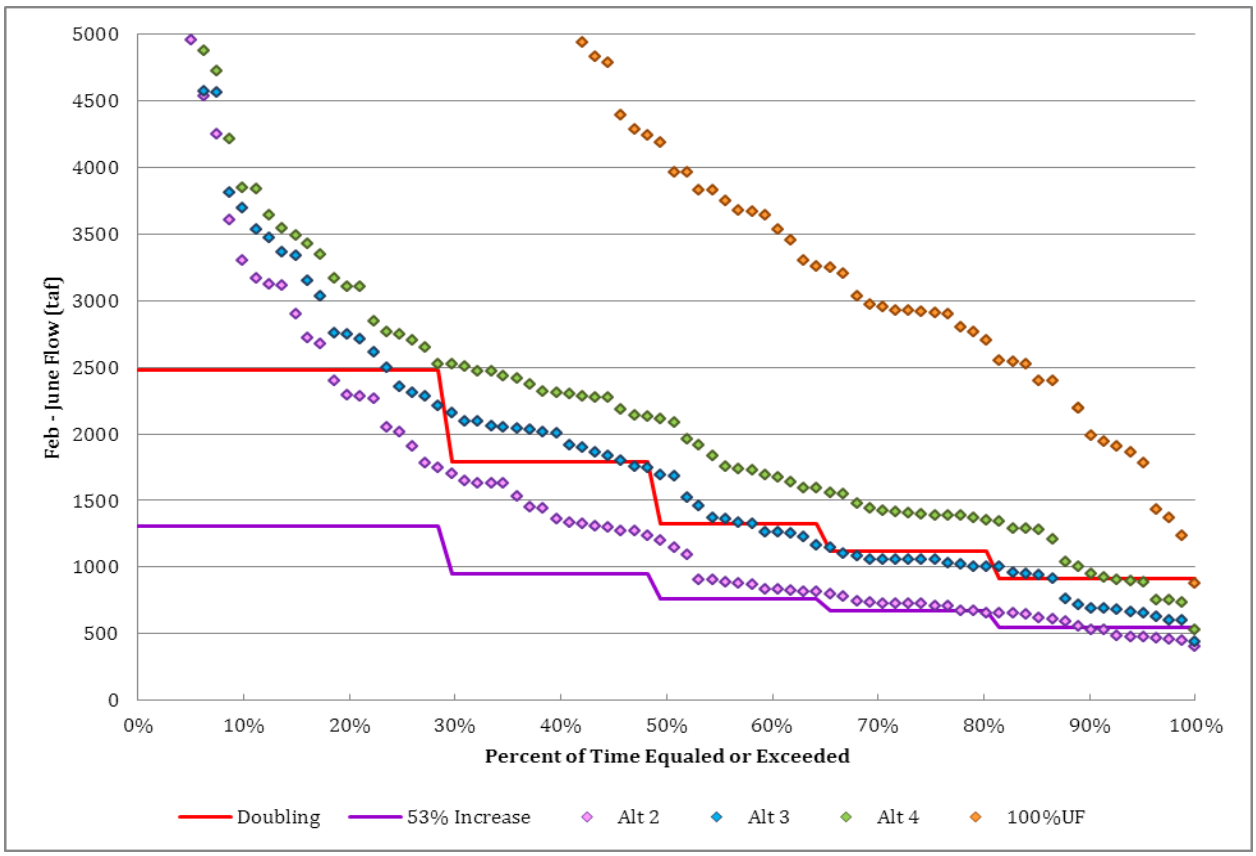


Figure 3-7. Flow Exceedance Plot of Central Valley Project Improvement Act's 2005 Anadromous Fish Restoration Program's Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

Delta Solution Group

During the development of flow criteria for the Sacramento–San Joaquin Delta, the State Water Board invited a group of experts to participate in and provide scientific information relevant to the Delta Flow Criteria Informational Proceeding. This led to the formation of the Delta Environmental Flows Group. A subset of this group was the U.C. Davis Delta Solutions Group (DSG), who prepared three papers to inform the Delta Flow Criteria Informational Proceeding. Of the three papers, Fleenor et al. (2010) explored several approaches for establishing freshwater flow prescriptions. Detailed in the Fleenor et al. (2010) paper are functional flow prescriptions to support and promote habitat conditions for desirable estuarine fishes. In Table 3-8 are the LSJR flow schedule-based recommendations presented in the Fleenor et al. (2010) paper by the DSG.

Table 3-8. Delta Solution Group LSJR Flow Schedule-Based Recommendations (cubic feet per second)

Water Year Type	Flow											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
C	2000	2000	2000	5000	2000	2000	2000	2000	2000	2000	2000	2000
D	2000	2000	2000	7000[a]	2000[b]	2000	2000	2000	2000	2000	2000	2000
BN	2000	2000	2000	10000	2000	200	2000	2000	2000	2000	2000	2000
AN	2000	2000	2000	15000	15000[c]	2000[d]	2000	2000	2000	2000	2000	2000
W	2000	2000	2000	20000	20000	20000	2000	2000	2000	2000	2000	2000

C = critical
D = dry
BN = below normal
AN = above normal
W = wet

[a] 7000 cubic feet per second (cfs) from April 1–May 15.
[b] 2000 cfs from May 16–December 31.
[c] 15000 cfs from May 1–June 15th.
[d] 2000 cfs from June 16–December 31.

Comparison of the exceedance plots for flow at Vernalis in Figure 3-8 indicates that LSJR Alternatives 2, 3, and 4 generally encompass the DSG flow recommendations with the exception of wetter years when flows are often uncontrolled and may incidentally meet the proposed levels. The DSG flow recommendations are generally greater than LSJR Alternative 2 in all years and would not avoid or substantially lessen potentially significant effects.

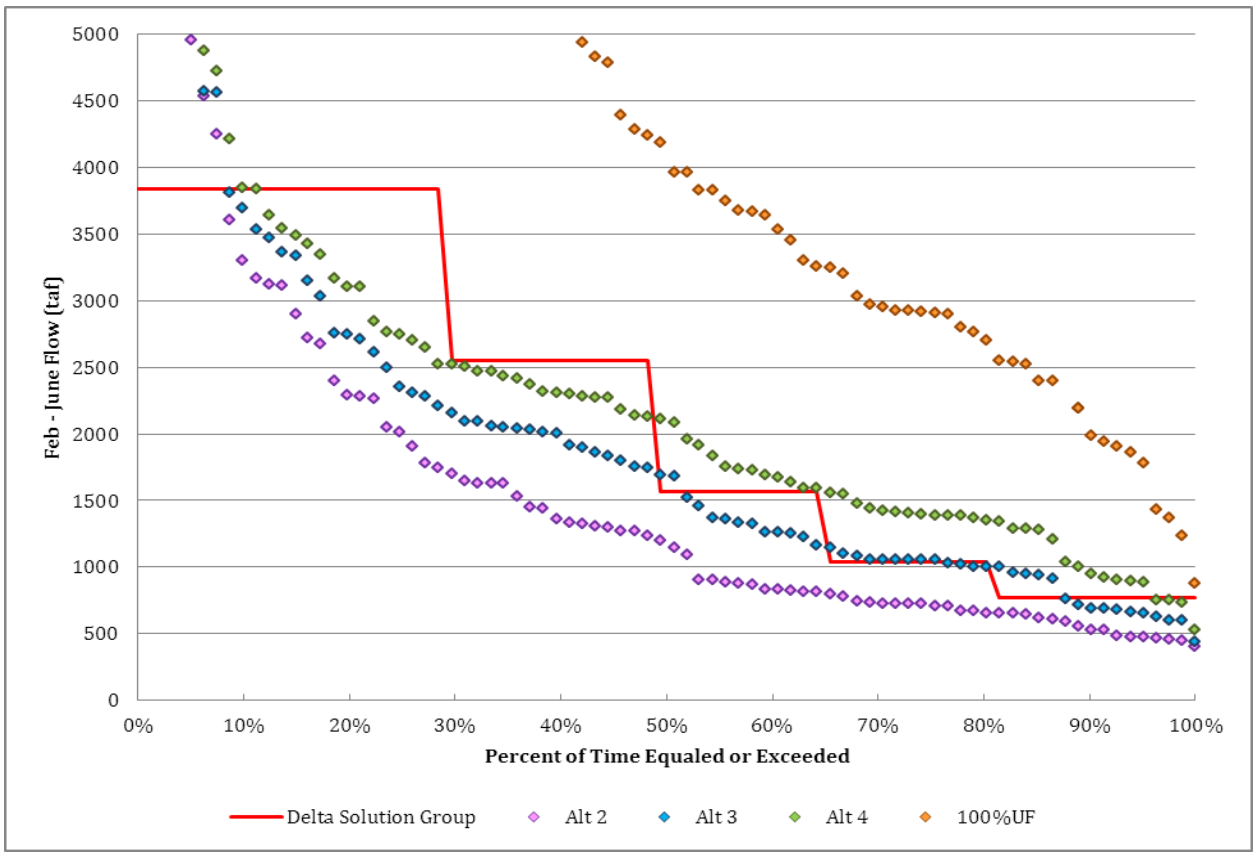


Figure 3-8. Flow Exceedance Plot of Delta Solution Group's Flow Recommendations and State Water Board's LSJR Alternatives (TAF = thousand acre-feet; UF = unimpaired flow)

The LSJR alternatives considerably bracket the flow schedule-based recommendations submitted by commenters. There are, however, periods of time when the flow recommendations are outside of this bracket, and the LSJR alternatives provide more or less flow than the recommendations. Table 3-9 presents the number of years out of 82 that the February–June flow schedule-based recommendations exceed LSJR Alternative 4 flows.

Table 3-9. Number of Years February– June Flow Schedule-Based Recommendations Exceed LSJR Alternative 4 at Vernalis by Water Year Type

Water Year Type	Total Number of Years (1922–2003) per Water Year Type	Recommendation							
							USFWS/USBR		
		CCCDCD	CDFG	C-WIN/ CSPA	TBI/ NRDC	AR/ NHI	Doubling	53% Incr.	DSG
W	24	0	4	10	4	4	4	0	15
AN	16	0	0	0	0	0	0	0	13
BN	13	0	0	2	2	2	0	0	1
D	13	0	0	0	0	0	0	0	0
C	16	0	1	9	9	8	7	1	4
Total	82	0	5	21	15	14	11	1	33

USFWS = U.S. Fish and Wildlife Service
USBR = U.S. Bureau of Reclamation
CCCDCD = Contra Costa County Department of Conservation and Development
CDFG = Department of Fish and Game
C-WIN/CSPA = California Water Impact Network and California Sportfishing Protection Alliance
TBI/NRDC = The Bay Institute and Natural Resources Defense Council
AR/NHI = The American Rivers and Natural Heritage Institute
DSG = Delta Solutions Group
W = wet
AN = above normal
BN = below normal
D = dry
C = critical

With the exception of the C-WIN/CSPA and DSG, LSJR Alternative 4 provides more flow than the recommendations for 80–100 percent of the 24 wet water years evaluated. For critically-dry years, LSJR Alternative 4 provides more flow than CCCDCD (all critically-dry years), CDFG/USBR 53 percent salmon increase recommendations (15 out of 16 critically-dry years), and DSG (12 out of 16 years), but less flow than C-WIN/CSPA, TBI/NRDC, AR/NHI, and USBR Doubling recommendations in 9, 9, 8, and 7 years out of 16 critically-dry years, respectively.

For the time periods when the aforementioned flow recommendations are within the LSJR alternatives' brackets, the LSJR alternatives exceed the recommendations. The result is a balance in which the time the LSJR alternatives are not satisfying the recommendations is offset by the time the alternatives exceed the recommendations. The LSJR alternatives may not satisfy each of the flow recommendations all the time, but the flow schedule-based recommendations are satisfied the majority of the time. Further, adaptive management of flows would increase the amount of time that the flow recommendations are achieved if information indicates that achieving these schedules is more protective of fish and wildlife. In general, these recommendations would not avoid or substantially lessen potentially significant effects. To the extent lower flows are proposed, they would not meet the plan amendment purpose and goals of protecting the fish and wildlife beneficial uses, To the extent that higher flows are proposed, they would not meet the plan amendment purpose and goal to consider all of the demands being made and to be made on waters in the LSJR and the three eastside, salmon-bearing tributaries.

Other Suggested Program of Implementation Elements

Additional program of implementation suggestions for the LSJR flow objectives involve water rights. These suggestions are described below.

Commenters suggested that this SED should evaluate a "No Action Implementation Alternative," with a program of implementation under which the 2006 Bay-Delta Plan narrative objective for LSJR flows would not be amended, D-1641 would remain in place, and USBR would be responsible for meeting D-1641. The No Project Alternative evaluated in this SED consists of these elements.

One commenter suggested an "Upstream Inclusion Alternative" that was to include flow contributions and implementation measures from throughout the entire historical SJR Watershed, including flow contributions upstream of the Merced River. The purpose of the plan amendments is to establish flow objectives and a program of implementation for the LSJR, including the three eastside salmon-bearing tributaries. This flow proposal applies to the entire migration pathway of salmon from the rim dams on the three salmon bearing tributaries of the SJR to the SJR near Vernalis. Currently, the SJR does not support salmon runs upstream of the Merced River confluence (Upper SJR). However, pursuant to the San Joaquin River Restoration Program (SJRRP), spring-run Chinook salmon are planned to be reintroduced to the Upper SJR no later than December 31, 2012. Flows needed to support this reintroduction are being determined and provided through the SJRRP. During the next review of the Bay-Delta Plan, the State Water Board will consider information made available through the SJRRP process, and any other pertinent sources of information, in evaluating the need for any additional flows from the Upper SJR Basin to contribute to the narrative LSJR flow objective. At this time, however, an alternative that would require flow contributions upstream of the Merced River would not meet the plan amendment goals of providing more flows on the three east-side salmon-bearing tributaries, unless it were in addition to flows on the Merced, Tuolumne, and Stanislaus Rivers. Additional flows from upstream of the Merced would increase, rather than reduce or substantially lessen, potentially significant environmental effects.

A "South Delta and Lower San Joaquin Alternative" was a commenter suggestion that would restrict water diverters in the southern Delta and LSJR from diverting water that was released upstream to meet the narrative objective. The alternative would include a mechanism to assure flows released pursuant to the narrative objective are not rediverted downstream for purposes other than meeting the narrative objective. The program of implementation in Appendix K, *Revised Water Quality Control Plan*, addresses this alternative with the following language:

> "The State Water Board will exercise its water right and water quality authority to help ensure that the flows required to meet the LSJR flow objectives are used for their intended purpose and are not diverted for other purposes."

This alternative would not reduce or substantially lessen potentially significant environmental effects.

3.4 Southern Delta Water Quality (SDWQ) Alternatives

The development of alternatives requires an understanding of the attributes of alternatives that could feasibly attain most of the basic objectives of the plan amendments but would avoid or substantially lessen any of the significant environmental effects. Attributes of salinity objective

alternatives may be described or constrained by geographic scope, season and averaging period, and the level of protection. These attributes of salinity objectives can then be used to assess the potential for alternatives to achieve plan amendment goals and to have potential effects, in order to determine which alternatives are feasible, and should be evaluated, and which are infeasible, and may eliminated from further consideration.

In evaluating potential amendments to the Bay-Delta Plan, the State Water Board identified the fundamental purpose of the plan amendments:

> "To establish southern Delta water quality objectives for the reasonable protection of southern Delta agricultural beneficial uses and a program of implementation to achieve the objectives."

As discussed in Section 3.2, *Purposes and Goals*, the purpose of the plan amendments is to establish southern Delta water quality objectives for the reasonable protection of southern Delta agricultural beneficial uses. 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 the evapoconcentration of salts in water diverted and discharged back into the channels. Point sources of salt in the southern Delta have a small overall salinity effect (Appendix C, *Technical Report on the Scientific Basis for Alternatives*, and Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*). Accordingly, the State Water Board identified a numeric range of alternatives that would be met through flow as the means of protecting agricultural beneficial uses. Additional information related to southern Delta salinity is provided in Appendix C.

3.4.1 Attributes of the SDWQ Objectives

Attributes of salinity alternatives that inform the feasibility of alternatives and the ability of alternatives to avoid or substantially lessen any of the significant effects of the project are: magnitude/level of protection, seasonality and averaging period, geographic scope, and other measure, such as improved circulation.

Magnitude/Level of Protection

The magnitude of salinity alternatives could vary over a wide range because different crops have a wide range of sensitivities to salinity. Salt sensitivity is affected by a number of variables including soil characteristics, irrigation and management techniques, and rainfall. Salt sensitive crops of significance in the southern Delta include almond, apricot, dry bean, and walnut, with dry bean being the most sensitive. Analyses and modeling summarized in Appendix C, *Technical Report on the Scientific Basis for Alternatives*, show that water quality objectives could be 0.9–1.1 deciSiemens per meter (dS/m) and be protective of all crops normally grown in the southern Delta under current irrigation practices, although during low rainfall years, this might lead to yield loss of approximately 5 percent under certain conditions. Additional information summarized in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta*, shows that crops such as alfalfa, although somewhat more salt tolerant, is frequently grown on low permeability soils with low leaching fractions. The report shows that alfalfa grown on low permeability soils (with a very low leaching fraction of 0.10) with irrigation water of 1.4 dS/m might lead to yield loss of approximately 5 percent under certain conditions (Appendix E, Figure 5.13).

Revision of other salinity objectives in the Bay-Delta Plan are not being considered at this time, including the salinity objectives for the protection of agricultural beneficial uses at the intakes of the Central Valley Project (Delta Mendota Canal at Tracy Pumping Plant) and State Water Project (West

Canal at Clifton Court Forebay). The objectives at these locations, which are west, and generally downstream of, the southern Delta salinity stations, are 1.0 dS/m on a monthly average, year-round. The federal Central Valley Project (CVP) and State Water Project (SWP) both also deliver water to cities for drinking water supply.

Drinking water has a Recommended Secondary MCL of 0.9 dS/m, with an Upper MCL of 1.6 dS/m and a Short Term MCL of 2.2 dS/m. Salinities lower than the Secondary MCL are more desirable to a higher degree of consumers, however, it can be exceeded and is deemed acceptable to approach the Upper MCL if it is neither reasonable nor feasible to provide more suitable waters.

For these reasons, water salinity of 1.4 dS/m was selected as the upper limit for SDWQ alternatives, even though this level is higher than other objectives in the immediate area and above the Recommended Secondary MCL. Salinity of 1.4 dS/m is the level at which crops in the southern Delta would have no more than a 5 percent yield loss, and still complies with the 1.6 dS/m drinking water Upper MCl.

This limit achieves goals 1 and 3.

1. Provide salinity conditions that reasonably protect agricultural beneficial uses of surface waters in the southern Delta."

3. Establish a salinity objective, supported by existing scientific information, that is not lower than necessary to reasonably protect the most salt sensitive crops currently grown or suitable to be grown on saline- and drainage-impaired soils in the southern Delta.

Salinity levels in the southern Delta are now maintained at levels generally no higher than approximately 1.0 dS/m because USBR is required, under terms of its water rights, to maintain EC levels of 0.7 dS/m at Vernalis for April– August and 1.0 dS/m for September–March, as a maximum 30-day running average. Salinity generally increases downstream of Vernalis, in the southern Delta, principally as a result of evapoconcentration of salt when the water is used and returned, in smaller quanities, by agriculture in the southern Delta. This evapoconcentation of salts is greatest during peak periods of irrigation and consumptive use of water, which corresponds to the April–August time period. The USBR maintains salinity at Vernalis through the release of low salinity water from New Melones Reservoir. Currently this requires the release of approximately 3 TAF per year (TAF/y) on average to meet the Vernalis salinity requirement. Although there are number of projects that have been developed and are currently under development to reduce salt loading in the SJR, release of stored water by USBR will continue to be the principal means to comply with the salinity objective at Vernalis.

Lowering the objective below the current seasonal requirements of 0.7 and 1.0 dS/m at Vernalis would require the release of even more water for the sole purpose of meeting the lower objective. This means that salinity objectives lower than 0.7 and 1.0 dS/m in the interior southern Delta locations could not be achieved without the release of stored water because salinity generally increases in the southern Delta downstream from Vernalis. Objectives lower than 1.0 were eliminated from consideration because if such low salinities were required in the interior southern Delta this would require much lower salinity at Vernalis to account for the degradation of water quality that occurs downstream, and thus the release of more stored water. Modeling of the No Project Alternative, which includes full compliance with current interior southern Delta salinity objectives, shows that approximately 60 TAF/y, on average, would have to be released from New Melones Reservoir to meet the 0.7 dS/m April–August and 1.0 ds/cm September–March objectives

in the interior southern Delta (see Table D.3 in Appendix D, *Evaluation of No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1)* for estimated New Melones water quality releases for baseline and the No Project Alternative). Water released from storage would not be available for other uses of water. Salinity objectives lower than 0.7 dS/m at Vernalis were eliminated from consideration because of the unreasonably high water costs.

In addition to achieving goals 1 and 3, evaluation of a southern Delta salinity objective no lower than 1.0 dS/m also achieves goals 2 and 4.

2. In establishing salinity water quality objectives to reasonably protect agricultural beneficial uses, take into consideration all of the demands being made and to be made on waters in the southern Delta, the LSJR and the three eastside, salmon-bearing tributaries and the factors to be considered for establishing water quality objectives in Water Code Section 13241, including, but not limited to, past, present and probable future beneficial uses and economic considerations.

4. Maintain or improve salinity conditions in the southern Delta to comply with state and federal antidegradation policies.

Seasonality and Averaging Period

Steady-state modeling presented in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta*, and the results from other transient model studies suggest that the water quality objective could be increased up to 0.9 to 1.1 dS/m and be protective of all crops normally grown in the southern Delta under current irrigation practices. These models calculate the effect of irrigation water quality on soil water salinity, but it is soil water salinity that ultimately affects crop yield, not the salinity of the irrigation water itself. That is why it is possible, in general, to irrigate with higher salinity water on high permeability soils. With the adequate leaching provided by high permeability soils, salts are flushed from the root zone, thus keeping soil water salinities relatively low. The steady state and transient state modeling analysis all assume constant salinity, rather than variable mean annual or variable mean seasonal salinity. The models do, however, consider the effects of additional leaching of salts from the soil profile that occurs as a result of precipitation. Precipitation, unlike most irrigation water, contains no added salt, so has the effect of leaching salts from the soil.

This means that long averaging periods, longer than a 30-day average, have the potential to cause more significant local and seasonal negative effects. Short duration high salinity water supply has the potential to coincide with irrigation of crops, and could therefore have large negative effects because the irrigated crop does not "see" the average salinity. This is particularly the case if high salinity water coincides with irrigation of a salt sensitive crop during emergence and early seedling development, when crops can be most susceptible to damage from high salinity.

Shorter duration averaging periods were deemed infeasible because a short duration average would effectively lower the required salinity objective by reducing the ability to even out high and low salinities. As discussed under magnitude/level of protection above, this would have unreasonable water costs.

Geographic Scope

Different objectives could be considered at different locations to account for different soil types, circulation patterns in back channels of the Delta, and the ability to achieve certain threshold salinity. Variability in soils, including the variable leaching requirement of soils in the southern delta

are discussed in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta.* The irrigation water salinity requirements can vary depending on these and other such characteristics. Although more site-specific irrigation requirements, could be developed based on more detailed soil surveys and models, Appendix E has already taken into account the variability, and the most limiting characteristics of soils and crops grown in the southern delta, to determine, a range in irrigation water salinity that would result in no more than a 5 percent yield reduction for the most sensitive crops. This also means that most crops would not suffer yield reductions at all. Site specific salinity requirements would allow the salinity objective to be higher in some areas, but implementing such a set of variable objectives would be infeasible because of the mixed nature of the water supply.

Different salinity objectives could also be considered based on circulation patterns. Back water areas in the southern Delta, with poor circulation, are currently susceptible to locally higher salinity levels. As for varying soils, implementing a set of variable objectives would be infeasible to account for backwater areas because of the mixed nature of the water supply.

Finally, different salinity objectives could be considered to account for the need to provide assimilative capacity for downstream locations. This would be feasible for the Vernalis location because it is upstream of the interior southern Delta. Although feasible, a different objective in close proximity to other similar locations with the same beneficial use may suggest a different level of protection for the same use, which is not the case. As described below, the SDWQ alternatives rely upon the program of implementation to provide geographic variability by including an implementation provision for the needed assimilative capacity, instead of a different objective. As stated above, a salinity objective at Vernalis lower than 0.7 dS/m is infeasible. An implementation provision lower than 0.7 dS/m would therefore also be infeasible, and was not considered.

Other Measures

Measures other than salinity objectives could be employed to protect agricultural beneficial use. Such measures include improved (raised) water levels and improved flow patterns (circulation) that would have the effect of improving salinity conditions by evening out areas of high and low salinity and moving salts discharged into the southern Delta out of the area. Such measures could be used instead of, or in addition to, salinity objectives. There is a risk, however, that use of such measures without any numeric salinity objective may not protect agricultural beneficial uses. Improved circulation of high salinity water may help to move salts, but the agricultural use would still not be protected if background salinity is still high. Other measures are, therefore, most useful if combined with numeric objectives, unless specific physical measures can be identified and fully relied upon to protect the use.

3.4.2 SDWQ Alternatives Considered

This SED evaluates SDWQ Alternative 1 (No Project Alternative) and two other SDWQ alternatives (SDWQ Alternatives 2 and 3). SDWQ Alternatives 2 and 3 are comprised of a numeric objective and an associated program of implementation. SDWQ Alternatives 2 and 3 have different numeric objectives, which are described in detail below, and the same program of implementation. The different numeric objectives provide a basis for analyzing a range of alternatives that are not lower than necessary to reasonably protect the agricultural beneficial uses. The range of alternatives analyzed in this SED is based on the water quality needs of the most salt-sensitive crops grown in the southern Delta, the predominant soil type, and irrigation practices in the area. The range of

alternatives analyzed help to inform which alternatives meet the purposes and goals of the plan amendments as discussed in Section 3.2, *Purposes and Goals*, while minimizing any potentially significant effects.

Appendix K, *Revised Water Quality Control Plan*, contains the proposed program of implementation for the southern Delta salinity objective. The program of implementation for SDWQ Alternatives 2 and 3 would require the USBR to continue complying with the terms of its water rights that require implementation of EC[8] levels of 0.7 dS/m at Vernalis for April–August and 1.0 dS/m for September–March as a maximum 30-day running average. This is in order to provide assimilative capacity so that the year-round salinity objective 1.0 dS/m can be met in the interior southern Delta after the consumptive use of water and evapoconcentration of salts that occur as a result of agricultural activities in the southern Delta downstream of Vernalis.

DWR and USBR are currently required, as a condition of their water rights, to meet EC levels of 0.7 dS/m from April–August and 1.0 dS/m from September–March at the three compliance stations in the interior southern Delta (Interagency Stations Nos. C-6, C-8, and P-12). As part of implementing the salinity objective for the interior southern Delta, DWR and USBR would be required to instead comply with the 1.0 dS/m objective year-round as a condition of their water rights.

DWR and USBR would also be required to develop a comprehensive operations plan to address the impacts of CVP and SWP export operations on interior southern Delta salinity levels. The operations plan must include detailed information, including describing actions that will address the impacts of SWP and CVP export operations on water levels and flow conditions that may affect salinity conditions in the southern Delta, containing information about the configuration and operations of any facilities relied upon in the plan, and identifying specific performance goals for the facilities.

USBR and DWR's water rights would also be conditioned to require continued operations of the agricultural barriers at specified locations, or other reasonable measures, to address the impacts their export operations. In addition, the program of implementation requires DWR and USBR to develop a long-term Monitoring and Reporting Plan to implement and determine compliance with the salinity objective and to inform the comprehensive operations plan. The agencies will be required to perform monitoring, modeling, special studies, and reporting activities, in coordination with other study and monitoring programs.

The program of implementation also includes recommendations to other agencies that would assist in meeting the SDWQ objective. SDWQ Alternatives 1, 2, and 3 are detailed below. As discussed earlier in this chapter, SDWQ Alternatives 2 and 3 have different numeric objectives but the same programs of implementation.

3.4.3 SDWQ Alternative 1: No Project Alternative

As discussed above in Section 3.3.4, *LSJR Alternative 1: No Project Alternative*, State CEQA Guidelines Section 15126.6, Subdivision (e) requires the evaluation of a no project alternative. When a project is the amendment of a regulatory plan, such as the 2006 Bay-Delta Plan, the no project alternative

[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 chapter.

will be the continuation of the existing plan into the future. In evaluating the impacts of a no project alternative, a lead agency should consider what is reasonably expected to occur in the foreseeable future. SDWQ Alternative 1 (No Project Alternative) assumes full compliance with the water quality objectives in the 2006 Bay-Delta Plan. In addition, the No Project analysis includes flows required by other entities such as the NMFS 2009 BO flow requirements on the Stanislaus River, FERC requirements on the Tuolumne and Merced Rivers, and the Davis Grunsky requirements on the Merced River. SDWQ Alternative 1 is the continuation of the existing water quality objectives for agricultural beneficial uses for the southern Delta contained in the 2006 Bay-Delta Plan as currently implemented by DWR and USBR. The 2006 Bay-Delta Plan states that the maximum 30-day running average of mean daily EC is 0.7 millimhos per centimeter (mmhos/cm)[9] April 1–August 30 and 1.0 mmhos/cm September 1–March 31 for all water year types. This is applicable to the three interior compliance stations (C-6, C-8, and P-12) and the compliance station at Vernalis (C-10). Under baseline, these salinity levels are not always fully met.

Chapter 15, *LSJR No Project Alternative (Alternative 1 and SDWQ Alternative 1),* and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1)*, evaluate the potential impacts of the No Project Alternative. As described in Section 3.3.4, *LSJR Alternative 1: No Project Alternative*, LSJR Alternative 1 and SDWQ Alternative 1 are evaluated together as the No Project Alternative in Chapter 15 and Appendix D because continuation of the 2006 Bay-Delta Plan would require compliance with the Vernalis flow objectives and southern Delta salinity objective. Further, the proposed plan amendments consist of the revised flow and salinity water quality objectives and the LSJR flows are necessary to help achieve the salinity water quality objectives.

3.4.4 SDWQ Alternative 2

SDWQ Alternative 2 would establish a numeric salinity objective of 1.0 dS/m as a maximum 30-day running average of mean daily EC for all months in the SJR between Vernalis and Brandt Bridge, Middle River from Old River to Victoria Canal, and Old River/Grant Line Canal from the Head of Old River to West Canal.

3.4.5 SDWQ Alternative 3

SDWQ Alternative 3 is the same as SDWQ Alternative 2 except the maximum 30-day running average of mean daily EC is 1.4 dS/m for all months. The compliance locations are the same as for SDWQ Alternative 2. The program of implementation for SDWQ Alternatives 2 and 3 is the same. This alternative would lessen the impact on service providers because they would be able to reduce the level of treatment needed to comply with salinity requirements. This would, however, result in slightly higher salinity in some southern Delta channels, which would result in slightly lower yields of salt-sensitive crops.

3.4.6 SDWQ Alternatives Considered but Eliminated from Further Evaluation

The State Water Board is considering modifications to existing SDWQ salinity objectives to protect agricultural beneficial uses in the southern Delta. The range of alternatives examined in this SED

[9] In this SED, electrical conductivity (EC) is generally expressed in deciSiemens per meter (dS/m). The conversion is 1 mmhos/cm = 1 dS/cm).

considers the information and overall conclusions provided in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*, and public comments.

In developing the SDWQ alternatives, the State Water Board considered public comments regarding alternatives to the southern Delta salinity objective and its implementation. Several comment letters suggested the State Water Board analyze salinity objectives within the range of the State Water Board's SDWQ alternatives, and the Board did not analyze those specific recommendations separately because they were already considered in the range of alternative analyzed. There were a few commenters who suggested the State Water Board analyze salinity objectives below 0.7 dS/m, which does not meet the plan amendment goal of establishing a salinity objective that is not lower than necessary to reasonably protect the most salt sensitive crops currently grown or suitable to be grown on saline-and drainage-impaired soils in the southern Delta. It also would not lessen environmental impacts. Other commenters suggested that the State Water Board could further analyze southern Delta salinity issues and water circulation to identify specific actions that could be implemented to improve southern Delta salinity. The program of implementation includes monitoring, special studies, and reporting to identify actions that will fully address the impacts of the SWP and CVP export operations on water level and flow conditions that may affect salinity conditions in the southern Delta. Based on the information contained in Appendix E, the State Water Board believes there is adequate science at this time to refine the numeric salinity objective for the southern Delta. This SED analyzes the environmental impacts of a range of salinity objectives, expressed as a maximum 30-day running average of mean daily EC in dS/m. The State Water Board's SDWQ alternatives are presented in Table 3-10, and a more detailed description of these alternatives was presented earlier in this chapter (Section 3.4, *Southern Delta Water Quality [SDWQ] Alternatives)*.

Table 3-10. State Water Board's Southern Delta Water Quality (SDWQ) Alternatives

Southern Delta Water Quality Alternatives	Electrical Conductivity Values Analyzed in this SED
SDWQ Alternative 1, No Project Alternative	0.7 dS/m April–August 1.0 dS/m September–March
SDWQ Alternative 2	1.0 dS/m all year
SDWQ Alternative 3	1.4 dS/m all year

dS/m = deciSiemens per meter

Following is a description of the salinity objective recommendations submitted by commenters and a discussion of how they were considered in the development of the SDWQ alternatives.

South Delta Water Agency

In its letter dated May 15, 2009, the South Delta Water Agency (SDWA) submitted comments on the proposed SDWQ modeling alternatives (SDWA 2009) and suggested analyzing longer and more restrictive requirements. The SDWA comments include recommendations for the State Water Board to analyze salinity objectives at Vernalis (C-10) and three interior compliance locations (P-12, C-8, and C-6). These SDWA recommendations (Recommendations 1–3) are listed below.

1. 0.65 dS/m April–August.
2. 0.65 dS/m April–October.
3. 0.70 dS/m April–October.

In addition to these analyses, SDWA recommended the State Water Board analyze salinity objectives under dry conditions at Vernalis (C-10) and three interior compliance locations (P-12, C-8, and C-6). The dry condition SDWA recommendations (Recommendations 4–6) are listed below.

4. 0.65 dS/m March–August.
5. 0.65 dS/m March–October.
6. 0.70 dS/m March–October.

It was determined in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*, that existing water quality in the southern Delta was adequate for all agricultural crops. Based on steady-state soil water salinity analysis and published crop salt tolerance information, Appendix E concludes that salinity levels in the range of 0.9 dS/m–1.1 dS/m in irrigation water appear to be reasonably protective of the most salt-sensitive crops grown in the southern Delta. One of the State Water Board's goals for the plan amendments is to develop objectives that are not lower than necessary to reasonably protect the most salt sensitive crops currently grown or suitable to be grown on saline- and drainage-impaired soils in the southern Delta; therefore, this SED does not evaluate alternatives that provide more protection than is needed for the reasonable protection of the beneficial uses. Therefore, no SED alternative evaluates objectives less than the current objectives (i.e., those in the 2006 Bay-Delta Plan).

Contra Costa County Department of Conservation and Development

The CCCDCD submitted scoping comments on the *Southern Delta Agriculture and San Joaquin River Flows Revised Notice of Preparation* (CCCDCD 2011). The CCCDCD scoping comments included recommendations for the State Water Board to analyze two additional salinity objectives.

1. 0.6 dS/m April–August (as 30-day running average of mean daily) and 0.85 dS/m September–March (as 30-day running average of mean daily) at Vernalis (C-10). 0.7 dS/m April–August (as 30-day running average of mean daily) and 1. 0 dS/m September–March (as 30-day running average of mean daily) at interior compliance locations (P-12, C-8, and C-6).
2. 0.6 dS/m April–August (as 30-day running average of mean daily) and 0.85 dS/m September–March (as 30-day running average of mean daily) at Vernalis (C-10) and interior compliance locations (P-12, C-8, and C-6).

The CCCDCD recommendations are also equal to or less than existing objective levels. It was determined in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*, that existing water quality in the southern Delta was adequate for all agricultural crops. One of the State Water Board's goals for the plan amendments is to develop objectives that are not lower than necessary to reasonably protect the most salt sensitive crops currently grown or suitable to be grown on saline- and drainage-impaired soils in the southern Delta. Therefore, this SED does not evaluate alternatives that provide more protection than is needed for the beneficial uses, and no SED alternative evaluates objectives less than the current objectives in the 2006 Bay-Delta Plan.

San Joaquin River Group Authority

O'Laughlin and Paris LLP reviewed the *Peer Review Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives* and prepared comments on behalf of the San Joaquin River Group Authority (SJRGA) (O'Laughlin and Paris LLP 2012). The

SJRGA comments included recommendations for the State Water Board to analyze five additional salinity objectives, which are as follows.

1. 0.7 dS/m March 15–October 31 at interior compliance locations (P-12, C-8, and C-6). Remove the Vernalis (C-10) compliance location.
2. 0.7 dS/m March 15–October 31 at Vernalis (C-10) and interior compliance locations (P-12, C-8, and C-6).
3. 1.0 dS/m March 15–October 31 at Vernalis (C-10). Remove interior compliance locations (P-12, C-8, and C-6).
4. For Recommendations 1–3, modify the salinity objective for April 1–June 31 to be 1.0 dS/cm maximum with a 10-year running average of 0.7 dS/cm at Vernalis (C-10) and interior compliance locations (P-12, C-8, and C-6).
5. For Recommendations 1–3, modify the salinity objective at Vernalis (C-10) for November 1–March 14 to be 1.4 dS/cm maximum with a 10-year running average of 1.2 dS/m. For the same time period, eliminate all salinity objectives at the interior compliance locations (P-12, C-8, and C-6), or set a 1.4 dS/m maximum.

Similar to the State Water Board's SDWQ Alternative 1, the recommendations provided by SJRGA are seasonal water quality objectives. However, unlike the SDWQ alternatives and the other recommendations received, the SJRGA recommendations are only effective for a portion of the year dependent on the recommendation (e.g., SJRGA Recommendations 1, 2, and 3 are only effective March 15–October 31).

SJRGA Recommendations 1, 2, and 3, contain salinity objectives that are encompassed in the SDWQ Alternative 1 objectives. SDWQ Alternatives 1 and 2 encompass the salinity objectives of SJRGA Recommendation 4. SDWQ Alternative 3 encompasses the salinity objectives of SJRGA Recommendation 5. These recommendations do not avoid or lessen any significant impacts and, to the extent they would provide more protection than is needed for the beneficial uses, they do not meet goal 3.

In addition to salinity objectives, SJRGA included specific recommendations pertaining to compliance locations and running averages that were not included in the salinity recommendations received. In SJRGA Recommendation 1, SJRGA recommends the removal of the Vernalis compliance location. Conversely, in SJRGA Recommendations 3 and 5, SJRGA recommends the removal of the interior compliance locations. The Vernalis and the interior compliance locations may not be eliminated because beneficial uses exist there and must be protected. In addition to the elimination of compliance locations, SJRGA Recommendations 4 and 5 included a maximum 10-year running average of 0.7 dS/m and 1.2 dS/m, respectively. The SJRGA recommendations do not provide a technical basis, nor is there one known, for the need to have a 10-year running average. Long averaging periods, longer than a 30-day average, have the potential to cause significant local and seasonal negative effects on crop yields, so does not achieve goal 1 to provide salinity conditions that reasonably protect agricultural beneficial uses of surface waters in the southern Delta.

City of Tracy

In a letter dated May 15, 2009, the City of Tracy recommended that sodium adsorption ratios should be used as the appropriate objective to protect irrigated agriculture instead of EC. The City of Tracy also recommended that experts should be polled as to the constituent(s) of EC that are of concern

for irrigated agriculture, and the 2006 Bay-Delta Plan should be modified to remove EC objectives and include objectives only for those problematic constituents of EC (Downey Brand 2009).

Crop stress associated with salinity is caused by the increase in osmotic pressure across the root membranes, which makes it more difficult for plants to uptake water for evapotranspiration. This increase in osmotic pressure is due to the colligative properties of the soil water in the root zone and is not dependent on the type of solute particles, only their concentration. EC has been the standard way of quantifying this property in soil water as used in nearly all of the supporting literature and appears to be an appropriate measure of the relevant soil water properties. Alternatives based on sodium adsorption ratio, or other problematic constituents, do not address factors affecting crop stress (i.e., increased osmotic pressure). Such alternatives do not meet goal 1 of providing salinity conditions that reasonably protect agricultural beneficial uses of surface waters in the southern Delta, a goal that would include protecting against crop stresses such as increases in osmotic pressure.

U.S. Department of the Interior/U.S. Bureau of Reclamation

In its letter dated May 15, 2009, DOI/USBR suggested that the following recommendations be considered in the development and evaluation of the SED alternatives (USBR 2009).

- Add an alternative that includes no salinity objective at Vernalis, or downstream of Vernalis, during the nonirrigation season months.
- Use the modeling process to help identify carryover storage levels in all of the major SJR Basin reservoirs to meet the needs of all beneficial uses (possibly including dilution flows) in the short and long term.
- Include consideration of the Central Valley Water Board's total maximum daily load implementation program, which is based on the Vernalis salinity standard.
- Examine the system through a loading approach as well as a dilution flow approach. A loading approach could also examine the opportunities that other flow requirements provide for exporting salt loads from the basin and the potential for redirected impacts when salinity loads are sequestered in groundwater basins.
- Evaluate how changes to a southern Delta salinity objective may affect water control systems, which in turn could affect the control of coldwater resources and/or the value of fish habitat using a water temperature model for the SJR Basin.

The first recommendation is not an acceptable alternative for evaluation in the SED as it does not provide for protection of beneficial uses in the months of September–March. It, therefore, does not meet an underlying fundamental goal of the plan amendments to reasonably protect agricultural beneficial uses. The recommendations regarding the quantity of dilution flows needed to meet the salinity objective were considered under the No Project Alternative. Modeling of the No Project Alternative, which includes full compliance with current interior southern Delta salinity objectives, shows that approximately 60 TAF/y, on average, would have to be released from New Melones Reservoir to meet the 0.7 dS/m April–August and 1.0 ds/cm September–March objectives in the interior southern Delta (see Table D.3 in Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1).* The other recommendations described above could not be evaluated as alternatives in the SED, as they are recommendations about issues to consider in the cumulative impacts analysis or to consider during implementation of the SDWQ objective.

Stockton East Water District

In its comments received on May 15, 2009, the Stockton East Water District (SEWD) made the following specific recommendations (SEWD 2009).

- A monthly average salinity objective greater than 1.0 dS/m should be modeled to develop appropriate salinity limitations for evaluation.
- A monthly average EC at Vernalis of 1.5 mmhos/cm in all months and a monthly average EC at Brandt Bridge of 1.5 mmhos/cm and 1.8 mmhos/cm in all months should be modeled.
- Include the water year type in establishing the objectives. Modeling should be conducted to determine the effects that water year types have on the salinity objective. It may be appropriate to have differing salinity objectives based on water year type.

Because 1.4 dS/m was the level above which yield impacts became significant for salt sensitive crops, consideration of higher alternatives were not appropriate as the associated beneficial uses would not be adequately protected (Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*). Also, crop salt tolerance is not a function of water year type; therefore, alternatives and modeling based on water year type are not technically appropriate.

Central Delta Water Agency

In its letter dated May 14, 2009, the Central Delta Water Agency (CDWA) provided four general recommendations regarding the SDWQ alternatives (CDWA 2009).

The first recommendation was that the sufficiency of the existing objectives to protect agricultural beneficial uses should be verified, and the existing objectives should be modeled and compared with all other alternatives. The existing objectives should be among the modeled alternatives to see how meeting the existing objectives compares with the other alternatives. This recommendation was incorporated into SDWQ Alternative 1.

The second recommendation was that an objective lower than the current 0.7/1.0 dS/m EC objective (e.g., 0.6/0.9 dS/m EC), should be modeled in the context of the current regime. Also, the existing objectives should be modeled with 0.7/1.0 dS/m EC substituted with 0.7 dS/m EC year-round. Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*, describes that existing water quality in the southern Delta was adequate for all agricultural crops. The State Water Board determined that a goal would be to provide salinity conditions that reasonably protect agricultural uses, but it would not establish objectives that are lower than necessary to reasonably protect the most salt sensitive crops. Thus, alternatives that provided more protection than necessary did not meet the goals and were not considered.

The third recommendation was to include improvements to the southern Delta barrier program to better improve circulation, eliminate stagnant zones, etc., as well as recirculation of water exported from the Delta. USBR studies show limited benefits and significant environmental and economic impacts associated with recirculation so are not included in the SDWQ alternatives. The program of implementation includes requirements for the CVP and SWP projects to develop a coordinated operations plan to address their impact on assimilative capacity in the southern Delta. This coordination operations plan process can address the issues of improved circulation, elimination of stagnant zones, and recirculation.

Finally, CDWA recommended that alternatives should be designed to ensure that the full water supply needs of the New Melones Reservoir area of origin contractors are met. Placing water supply needs above protection of agricultural beneficial uses, however, is inconsistent with the fundamental purpose and goals of the plan amendments. Water supply effects, however, are inherently considered as part of goals 1, 2, and 3.

County of San Joaquin and the San Joaquin County Flood Control and Water Conservation District

In their letter dated May 15, 2009, the County of San Joaquin and the San Joaquin County Flood Control and Water Conservation District made two general comments (Neumiller & Beardslee 2009).

First, the two entities recommended that at least one of the model alternatives needs to include salinity monitoring objectives at locations within the southern Delta and that it is necessary to have Vernalis monitoring and compliance requirements. They recommended that both the interior Delta monitoring locations and the Vernalis monitoring location must remain. The Vernalis monitoring location will continue as a compliance location under the program of implementation for all alternatives. Specific monitoring locations for the interior Delta compliance locations will be determined under the program of implementation. The program of implementation, under all alternatives, provides flexibility on the specific locations and averaging periods. Second, it was recommended that an annual average could lead to "terrible" irrigation season flows being made up for with significantly better winter flows. The salinity objectives recommendation included meeting a minimum monthly compliance requirement and meeting the salinity objective at even more frequent intervals. It is agreed that an annual average objective could allow for unacceptably high concentrations during the growing season. But no information has been provided suggesting that an averaging period of less than a month is necessary. Soil water salinity levels are affected more by average conditions over the growing season than by short-term changes. The historical variability of daily salinity measurements and crop yields does not suggest that variability within a 30-day averaging period has negative effects on crop yields. Shorter averaging periods would require more water to be released to meet the shorter term requirement, so is inconsistent with the goal of considering other water supply demands.

3.5 References Cited

American Rivers (AR) and Natural Heritage Institute (NHI). 2010a. *Testimony of John Cain, Jeff Opperman, and Mark Tompkins. Sacramento and San Joaquin Flows, Floodplains, Other Stressors, and Adaptive Management.* February. State Water Board Proceeding to Develop Flow Criteria for the Delta. Exhibit AR-1.

———. 2010b. *Closing Comments.* April. State Water Board Proceeding to Develop Flow Criteria for the Delta. Table 2.

California Department of Fish and Game (CDFG). 2010a. *Written Testimony, Exhibit 3. Flows needed in the Delta to restore anadromous salmonid passage from the SJ River at Vernalis to Chipps Island.* State Water Board Proceeding to Develop Flow Criteria for the Delta. Table 10.

———. 2010b. *Closing Comments: Numerical Flow Criteria Necessary to Protect Delta Public Trust Resources*. April. State Water Board Proceeding to Develop Flow Criteria for the Delta.

California Sportfishing Protection Alliance (CSPA). 2010. *Closing Statement.* April. State Water Board Proceeding to Develop Flow Criteria for the Delta. Table 2.

California Water Impact Network (C-WIN). 2010. *Closing Statement*. State Water Board Proceeding to Develop Flow Criteria for the Delta.

Central Delta Water Agency (CDWA). 2009. *Comments on Proposed Modeling Alternatives Regarding Consideration of Potential Amendments to the WQCP for the Bay-Delta Relating to Southern Delta Salinity and Salinity and San Joaquin River Flow Objectives*. May.

Contra Costa County Department of Conservation and Development (CCCDCD). 2011. *Comments on Southern Delta Agriculture and San Joaquin River Flows Revised Notice of Preparation (John Greitzer)*. April.

Downey Brand. 2009. *City of Tracy's Comment Letter on Modeling Alternatives*. May. Southern Delta Salinity/San Joaquin River Flows WQCP Workshop.

Fleenor, W. E., W. A. Bennett, P. B. Moyle, and J. R. Lund. 2010. *On Developing Prescriptions for Freshwater Flows to Sustain Desirable Fishes in the Sacramento-San Joaquin Delta.* Working paper. Delta Solutions, Center for Watershed Sciences, University of California. Davis, CA.

Neumiller & Beardslee. 2009. *Comment Letter*. May. Southern Delta Salinity/San Joaquin River Flow WQCP Workshop.

O'Laughlin and Paris LLP. 2012. *Comment Letter: Program of Implementation Alternatives in the Substitute Environmental Document.* February.

The Bay Institute (TBI) and the Natural Resources Defense Council (NRDC). 2010a. *Summary of Testimony.* February. State Water Board Proceeding to Develop Flow Criteria for the Delta.

———. 2010b. *Testimony of Christina Swanson, John Cain, Jeff Opperman, and Mark Tompkins. Regarding Flow Criteria for the Delta Necessary to Protect Public Trust Resources: Delta Inflows.* February. State Water Board Proceeding to Develop Flow Criteria for the Delta. TBI Exhibit 3, Table 1.

———. 2010c. *Closing Comments of the Bay Institute and Natural Resources Defense Council.* April. State Water Board Proceeding to Develop Flow Criteria for the Delta. Table 3b.

South Delta Water Agency (SDWA). *Comment Letter*. May. Southern Delta Salinity/San Joaquin River Flows WQCP Workshop.

State Water Resources Control Board (State Water Board). 2010. *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*. August.

Stockton East Water District (SEWD). 2009. *Consideration of Potential Amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.* May. Written Comments Relating to the Southern Delta Salinity and San Joaquin River Flow Objectives.

U.S. Bureau of Reclamation (USBR). 2009. *Comments Regarding the California State Water Resources Control Board's Notice of Public Workshops for the San Joaquin River Flow and Salinity Objectives for the San Francisco/Sacramento-San Joaquin Delta Estuary: Proposed Modeling Alternatives.* May.

U.S. Department of the Interior (DOI). 2010. *Comments Regarding the California State Water Resources Control Board's Notice of Public Informational Proceeding To Develop Delta Flow Criteria for the Delta Ecosystem Necessary to Protect Public Trust Resources*. February. Written Testimony. Exhibit 25 and 56–57 pp. State Water Board Proceeding to Develop Flow Criteria for the Delta.

U.S. Fish and Wildlife Services (USFWS). 2005. *Anadromous Fish Restoration Program (ARFP). Recommended Streamflow Schedules to Meet the AFRP Doubling Goal in the San Joaquin River Basin.*