Chapter 4
Introduction to Analysis

4.1 Introduction

The 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) that would establish new Lower San Joaquin River (LSJR) flow objectives for the protection of fish and wildlife beneficial uses, revise southern Delta water quality objectives (SDWQ) for salinity for the protection of agricultural beneficial uses, and establish a program of implementation to achieve those objectives. This chapter describes how this Substitute Environmental Document (SED), which is necessary for evaluating the plan amendments, is organized to satisfy the State Water Resources Control Board's (State Water Board's) certified regulatory program consistent with the California Environmental Quality Act (CEQA). This SED also satisfies Public Resources Code Section 21159 and various other requirements, such as requirements of the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) and the federal Clean Water Act (CWA) (33 U.S.C., § 1251 et seq.).

This SED evaluates a range of LSJR alternatives that vary in volume of flow and SDWQ alternatives that vary in concentration of salinity in the southern Delta to implement the narrative objectives that would be established in the amended Bay-Delta Plan. The possible effects of LSJR Alternatives 2, 3, and 4 and SDWQ 2 and 3 on specific resource topics are examined in the resource chapters (Chapters 5–17) and in the appendices. The information on the environmental consequences of the alternatives presented in the resource chapter impact analyses was prepared by a team of resource specialists using and building upon information provided by various models and technical data. Chapter 17, *Summary of Impacts and Comparison of Alternatives*, summarizes the environmental consequences as a result of the LSJR and SDWQ alternatives and compares the environmental outcomes of the various alternatives. Chapter 16, *Cumulative Impact Summary, Growth-Inducing Effects, and Irreversible Commitment of Resources*, summarizes cumulative and growth-inducing impacts.

4.2 Analytical Framework

As required by Cal. Code Regs., tit. 23, Section 3777 (consistent with State CEQA Guidelines, §15126), and Water Code Section 13241, this SED evaluates the potential significant direct and indirect environmental impacts and potentially feasible mitigation measures, where appropriate, related to physical changes associated with approving the LSJR and SDWQ alternatives. The evaluation of the impacts of the LSJR and SDWQ alternatives is contained in Chapters 5–17 and Appendix B, *State Water Board's Environmental Checklist*. Appendix B is based on the template contained in Appendix A of the State Water Board's CEQA regulations (Cal. Code. Regs., tit. 23, §§ 3720–3781). If the initial analysis in Appendix B found potentially significant impacts on a particular environmental resource, then a more detailed impact analysis was performed for that resource.

As required by Public Resources Code Section 21159, this SED evaluates the environmental impacts related to reasonably foreseeable methods of compliance with the regulatory requirements of the alternatives. These impacts are evaluated in Appendix H, *Evaluation of Methods of Compliance.* Although CEQA does not consider economic or social effects as significant impacts on the environment (see State CEQA Guidelines, § 15131), Water Code Section 13241 requires economic considerations be addressed when establishing objectives in a water quality control plan (WQCP). Also, Public Resources Code Section 21159(c) requires a reasonable range of economic factors be considered for reasonably foreseeable methods of compliance with regulations containing performance or treatment standards. In addition, Water Code Section13141 requires an estimate of total costs when implementing an agricultural water quality control program. These analyses are generally focused on capital and operating costs of compliance. Because the State Water Board wishes to understand the water supply effects associated with the alternatives, this SED also evaluates the related indirect and induced impacts on the regional economy. Appendix H provides the analysis needed to satisfy Public Resources Code Section 21159(c). Appendix G, *Agricultural Economic Effects of LSJR Flow Alternatives*, satisfies the requirements of Water Code Section13141 and provides an evaluation of the agriculture-related impacts of reduced surface water diversions. Chapter 18, *Economic Analyses*, provides a summary of all economic impacts of the LSJR and SDWQ alternatives and methods of compliance.

The environmental impacts of an alternative on a particular environmental resource are those associated with a significant physical change relative to baseline conditions. In addition, impacts of an alternative can affect the local or regional economy. Impacts can be direct or indirect. Direct impacts are those associated with an actual physical change caused by an alternative, such as a change in river flows associated with the LSJR alternatives or a change in water quality associated with the SDWQ alternatives. Indirect impacts are those occurring later in time or farther removed in distance and are associated with physical changes to secondary facilities or operations in likely response to an alternative. The LSJR and SDWQ alternatives also have the potential to have impacts associated with reasonably foreseeable methods of compliance.

4.2.1 Impacts Associated with LSJR Alternatives

LSJR Alternatives

The existing LSJR flow objectives identified in the 2006 Bay-Delta Plan would be amended to protect the beneficial uses of fish and wildlife. The alternatives evaluated in this SED include a narrative objective to establish flow sufficient to support and maintain the natural production of fish populations in the plan area that mimic the natural hydrograph with respect to relative magnitude, duration, timing, and spatial extent of flows. As part of the program of implementation, the narrative flow objectives would be applied as percentages of unimpaired flow in order to achieve protection of beneficial uses. The alternatives include the following.

- LSJR Alternative 1, the No Project Alternative, would implement the flow requirements as described by the 2006 Bay-Delta Plan and implemented through D-1641.
- LSJR Alternative 2 would establish 20 percent unimpaired flow equally on the Stanislaus, Tuolumne, and Merced Rivers (the three eastside tributaries).
- LSJR Alternative 3 would establish 40 percent of the unimpaired flow equally on the three eastside tributaries.

- LSJR Alternative 4 would establish 60 percent unimpaired flow equally on the three eastside tributaries.

The program of implementation for all LSJR alternatives also includes: water rights actions; modification to the Federal Energy Regulatory Commission (FERC) hydropower licensing process; adaptive management of flows February–June; and special studies, reporting, and monitoring. As noted in Chapter 1, *Introduction*, the State Water Board's Phase III would specifically identify the water rights that could be modified as a result of adopting and applying the program of implementation for the LSJR flow objectives analyzed in this SED as part of Phase I. Details of these four LSJR alternatives are provided in Chapter 3, *Alternatives Description*, and the language of the amended WQCP is included in Appendix K, *Revised Water Quality Control Plan.*

Mechanisms Causing Potential Direct and Indirect Impacts

The following list summarizes the physical changes that could result from the LSJR alternatives and have the potential for quantifiable direct and indirect impacts on environmental resources.

- River Flows—Changes in river flows associated with the LSJR alternatives could result in direct impacts (e.g., reduction in aquatic resource habitat).
- Surface Water Diversions—Changes to surface water diversions from implementation of the LSJR alternatives could result in direct impacts (e.g., reduction of irrigated agricultural land).
- Reservoir Operations—Changes to reservoir operations from implementation of the LSJR alternatives could result in direct and indirect impacts.
- Groundwater Pumping Rates—Changes to surface water diversions from implementation of the LSJR alternatives could result in increased groundwater pumping.

The potential resource impacts of these physical changes are evaluated further in Chapters 5–17 of this SED. The agricultural economic impact of surface water diversion reductions are summarized, along with all other economic impacts, in Chapter 18, *Economic Analyses*, and are evaluated in detail in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*.

Methods of Compliance

The following list summarizes the methods of compliance that could be implemented by irrigation districts, water districts, and farmers to comply with potential changes in surface water diversions needed to meet the required flows under the LSJR alternatives. A site-specific, project-level analysis of these potential methods of compliance is not possible due to uncertainty about timing, duration, and magnitude of the actions. Therefore, a conceptual environmental evaluation of these methods of compliance and a cost evaluation are provided in Appendix H, *Evaluation of Methods of Compliance*. Economic impacts associated with these methods of compliance are summarized with all other economic impacts in Chapter 18, *Economic Analyses*.

- Substitution of Surface Water with Groundwater (New or Expansion of Groundwater Supplies)—Construction and operation of new groundwater wells or increased utilization of existing wells.
- Aquifer Storage and Recovery—Increased conjunctive groundwater use by agricultural and municipal and industrial water suppliers.

- Recycled Wastewater Sources—Construction and operation of new recycled wastewater facilities or increased utilization of existing facilities.

4.2.2 Impacts Associated with SDWQ Alternatives

SDWQ Alternatives

The SQWQ alternatives would amend the existing SDWQ objectives for salinity identified in the 2006 Bay-Delta Plan to protect agricultural beneficial uses in the southern Delta. The alternatives evaluated in this SED are listed below.

- SDWQ Alternative 1, the No Project Alternative, would continue the existing salinity objectives as 1.0 dS/m September–March and 0.7 deciSiemens per meter (dS/m) April–August in the southern Delta; include continued conditioning of the U.S. Bureau of Reclamation (USBR) water rights at New Melones Dam to meet the water quality objective for salinity (EC) at Vernalis (current salinity D-1641 compliance requirement at Vernalis of 0.7 dS/m); and include continued use of the temporary agricultural barriers in the southern Delta.
- SDWQ Alternative 2 would establish an annual 1.0 dS/m salinity objective for the southern Delta; include continued conditioning of USBR water rights to meet its current salinity D-1641 compliance requirement at Vernalis; and include continued use of the temporary agricultural barriers; and various study, planning, and monitoring requirements.
- SDWQ Alternative 3 would establish an annual 1.4 dS/m salinity objective for the southern Delta and include continued conditioning of USBR water rights to meet its current salinity D-1641 compliance requirement at Vernalis; continued use of the temporary agricultural barriers; and various study, planning, and monitoring requirements.

Details of these three SDWQ alternatives are provided in Chapter 3, *Alternatives Description*, and the language of the amended WQCP is included in Appendix K, *Revised Water Quality Control Plan.*

Mechanisms Causing Potential Direct and Indirect Impacts

The following summarizes the physical changes that could result from the SDWQ alternatives and have the potential for direct and indirect impacts on environmental resources and the economy.

- EC/Salinity Concentrations—Changes in surface water salinity (electrical conductivity [EC]) resulting from the LSJR and SDWQ alternatives could result in direct impacts.

The potential resource impacts of these physical changes are evaluated further in Chapters 5–17 of this SED. The associated economic impacts were evaluated and summarized together with all other economic impacts in Chapter 18, *Economic Analyses.*

Methods of Compliance

The following summarizes the potential methods of compliance that could be implemented by municipalities, agricultural producers, and the Central Valley Project (CVP) and State Water Project (SWP) to comply with the water quality requirements of the SDWQ alternatives. A site-specific, project-level analysis of these potential methods of compliance is not possible due to uncertainty about timing, duration, and magnitude of the actions. Therefore, a conceptual environmental evaluation of these methods of compliance and a cost evaluation are provided in Appendix H,

Evaluation of Methods of Compliance. Economic impacts associated with these methods of compliance are summarized with all other economic impacts in Chapter 18, *Economic Analyses*.

Municipal Wastewater Treatment Plants

Although other actions could be undertaken, it is reasonably foreseeable that municipalities would take one or more of the following actions to comply with National Pollutant Discharge Elimination System (NPDES) effluent limits established by the Central Valley Regional Water Quality Control Board (Central Valley Water Board), which would use the numeric salinity objectives in the SDWQ alternatives.

- New Source Water Supplies—Develop and utilize alternate low-salinity municipal water supplies.
- Salinity Pretreatment Programs—Implement industrial and residential salinity source controls.
- Desalination—Construct and operate salinity removal facilities at municipal wastewater treatment plants.

Agricultural Producers

Although other actions could be undertaken, it is reasonably foreseeable that drainage districts and/or farmers would take one or more of the following actions to control salinity loads in agricultural return flows to comply with salinity load allocations. These allocations might result from a total maximum daily load based on the SDWQ alternatives established by the Central Valley Water Board.

- Real-Time Management—Shift the agricultural discharge timing such that the timing of the agricultural return flow released from agricultural lands would occur during times of high assimilative capacity for the receiving waters. This would require the construction and operation of detention ponds.
- Salinity Removal using Evaporation Ponds—Construct and operate evaporation ponds to allow a portion of the discharged water to evaporate and leave behind suspended and dissolved solids.

CVP and SWP

Although they could undertake other actions, it is reasonably foreseeable that the Department of Water Resources (DWR) for SWP operations and USBR for CVP operations would take the following action to comply with the water level and flow conditions of the SDWQ alternatives in the event that future modeling (as required in the program of implementation requirements for SDWQ Alternatives 2 and 3) finds that such modifications are warranted.

- Low-Lift Pumping Stations—Construct and operate either temporary pumping system(s) or permanent pumping system(s) near the Middle River, Grant Line Canal, and/or Old River at Tracy Temporary Barriers Project in the southern Delta.

4.3 Organization of Resource Chapters

The discussion of each resource in Chapters 5–14 is divided into several parts, including an introduction, a description of the environmental and regulatory setting, and analysis of

environmental impacts. Growth-inducing impacts are discussed in a separate chapter (Chapter 16, *Cumulative Impact Summary, Growth-Inducing Effects, and Irreversible Commitment of Resources*) and the No Project Alternative is analyzed in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)* and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*.

4.3.1 Introduction

The introduction provides an overview of the existing environmental setting and impacts evaluated for the resource. A summary of the impacts on the resource is presented in a table at the end of the introduction. These tables provide each impact statement for the resource, summarize the impacts and their levels of significance in relation to each of the LSJR or SDWQ alternatives, and identify the significance determination after implementation of all feasible mitigation. This information is also provided in Tables 17-1 and 17-2.

4.3.2 Environmental Setting

The environmental setting section provides a historical perspective and a detailed description of the current conditions for the resource. This section also presents specific baseline information, including information obtained from published environmental documentation, books, websites, research and journal articles, and personal communications with field experts.

4.3.3 Regulatory Setting

The regulatory setting section lists and describes laws, regulations, and policies that are relevant to the State Water Board's action, the assessment of impacts, or development of mitigation. Often, as in aquatic or terrestrial biological resources, the regulatory framework is the basis for the conclusion of the level of significance and, therefore, plays a role in impact assessment.

4.3.4 Environmental Impacts

Thresholds

The thresholds section describes thresholds of significance used for the resource to determine the significance of impacts as required in an SED. The thresholds for determining the significance of impacts for this analysis are based on the State Water Board's Environmental Checklist in Appendix A of the Board's CEQA regulations (Cal. Code Regs., tit. 23, §§ 3720–3781) and the Environmental Checklist in Appendix G of the State CEQA Guidelines. The thresholds derived from the checklist have been modified as appropriate to meet the circumstances of the alternatives. (Cal. Code Regs., tit. 23, § 3777, subd. (a)(2).).

Methods and Approach

The methods and approach section in Chapters 5–14 describes the resource-specific assessment methods, approach, and analytical models used to identify and evaluate the environmental impacts for the resource. It also describes any specific significance criteria used in the assessments to determine the level of significance of an impact.

LSJR and SDWQ Alternatives

State Water Board regulations for the SED require that a reasonable range of alternatives to the project be identified that will avoid or substantially lessen one or more of the significant effects. The alternatives for both the LSJR and SDWQ objectives were developed for this purpose, as well as to show differences in environmental consequences of the alternatives. The alternatives are feasible and satisfy the objectives and goals of amending the 2006 Bay-Delta Plan. This SED fully analyzes all alternatives identified in Chapter 3, *Alternatives Description*. Chapter 3 also includes a discussion of those alternatives considered but eliminated from detailed evaluation in this SED.

- Analysis of the LSJR alternatives not only determines the impacts for specific amounts of flow (i.e., 20 percent, 40 percent, 60 percent unimpaired), but also serves to evaluate the significance of impacts bounded by the upper and lower percentages. The results of the impact analysis may lead to selection of a flow alternative bounded by those specifically analyzed (e.g., 35 percent unimpaired flow).
- Analysis of the SDWQ alternatives determines the impacts for specific EC requirements (i.e., 1.0 dS/m or 1.4 dS/m year-round) at the interior southern Delta compliance stations but maintains the existing Vernalis EC objective.

Mitigation Measures and State Water Board Authorities

An SED must identify feasible mitigation measures for each significant environmental impact identified in the SED. (Cal. Code Regs., tit. 23, § 3777 (b)(d).). Feasible mitigation measures are intended to avoid, reduce, or compensate for adverse impacts on a resource and can include actions such as implementation of plans to minimize impacts. For each impact identified as significant, a mitigation measure to reduce that impact to a less-than-significant level is described, if appropriate, or the infeasibility of mitigation is discussed. One legal factor that may render a mitigation measure infeasible is the limited authority of the lead agency. CEQA does not grant agencies new, discretionary powers independent of the powers granted to the agencies by other laws. (Pub. Resources Code, § 21004; Cal. Code Regs., tit. 14, § 15040.) Accordingly, a mitigation measure may be legally infeasible if the lead agency does not have the discretionary authority to implement it. In addition, economic considerations may render mitigation measures infeasible. (Pub. Resources Code, § 21004; Cal. Code Regs., tit. 14, §§ 15040; 15041; 150126.4; 15364.) Several authorities granted to the State Water Board may be applicable to implementing mitigation and are discussed in the various resource chapters. These authorities include: Constitution Article X, Section 2 and Water Code Section 100, which prohibit the waste, unreasonable use, unreasonable method of use, and unreasonable method of diversion of water; Water Code Section 275, which directs the State Water Board to take appropriate proceedings or actions to prevent waste or violations of the unreasonable use standard; Cal Code Regs., tit. 23, Sections 735 and 862; and court rulings (e.g., *National Audubon Society v. Superior Court* [1983] 33 Cal.3d 419; People ex rel. *State Water Resources Control Board v. Forni* [1976] 54 Cal.App.3d 743 [Forni]), which allows the State Water Board to address waste, unreasonable use, unreasonable methods of use, and unreasonable methods of diversion of water through quasi-legislative action.

Cumulative Impacts

Cumulative environmental impacts must be addressed in SEDs. The definition of cumulative impacts for the purposes of this document is consistent with the definition under the State CEQA Guidelines (Cal. Code Regs., tit. 14, § 15355(b)):

> Cumulative impacts refer to two or more individual impacts that, when considered together, are considerable or that compound or increase other environmental impacts. The cumulative impact of several projects is the change in the environment that results from the incremental impact of the project when added to other, closely related past, present, or reasonably foreseeable, probable future projects.

Cumulative impacts are analyzed in this SED at the end of each resource chapter; in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)* for the No Project Alternative*;* and, are summarized in Chapter 16, *Cumulative Impact Summary, Growth-Inducing Effects, and Irreversible Commitment of Resources*. The analysis considers long-term environmental impacts of the alternatives, in conjunction with past, present, and reasonably foreseeable future projects, on the respective resource, to determine if the alternatives would have a considerable contribution to a significant cumulative impact. Impacts of the alternatives are analyzed even if those impacts are minimal and would be less than significant in isolation of the cumulative impact.

In general, the analysis of cumulative impacts is qualitative. Cumulative impacts were identified based on: (1) information extracted from existing environmental documents or studies for the resource categories; (2) investigation of other state, federal, and privately funded project plans in the plan area; and (3) knowledge of expected effects of similar projects.

4.3.5 Growth-Inducing Impacts

Growth-inducing impacts are those that "foster economic or population growth," "remove obstacles to growth," or "may encourage and facilitate other activities that could significantly affect the environment" (State CEQA Guidelines, § 15126.2[d]). Chapter 16, *Cumulative Impact Summary, Growth-Inducing Effects, and Irreversible Commitment of Resources*, discusses the growth-inducing impacts that may result from implementation of the LSJR or SDWQ alternatives.

4.3.6 No Project Alternative Impacts

The resource chapters refer to Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)* and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for a discussion of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1). As State CEQA Guidelines Section 15126.6(e)(3)(A) states, "when the project is revision of an existing regulatory plan ... the 'no project' alternative will be the continuation of the existing plan ... into the future." The No Project Alternative represents the likely future conditions without implementation of the flow or salinity amendments to the 2006 Bay-Delta Plan. The No Project Alternative assumes implementation of the current 2006 Bay-Delta Plan, which includes flow objectives implemented through Water Rights Decision 1641 (D-1641) and flow objectives to comply with the salinity objectives for the San Joaquin River (SJR) at Vernalis and the three interior compliance stations (Brandt Bridge on the SJR, Old River near Middle River, and Old River at Tracy Road Bridge). Chapter 15 describes LSJR Alternative 1 and SDWQ Alternative 1, summarizes technical results, and describes the environmental impacts of LSJR Alternative 1 and SDWQ Alternative 1. Appendix D presents the technical assumptions for the No Project Alternative.

Because the No Project Alternative is discussed in Chapter 15 and Appendix D, any reference to LSJR alternatives or SDWQ alternatives in the resource chapters (Chapters 5—14) refers to LSJR Alternatives 2, 3, or 4 or SDWQ Alternatives 2 and 3, respectively.

4.4 Terminology

The following terms are used in the discussion of each impact.

- No impact: A designation of no impact is given when no adversechanges in the environment are expected.
- Less than significant: The alternatives would cause no substantial adverse change in the environment (i.e., the impact would not reach the threshold of significance).
- Significant: The alternatives would cause a substantial or potentially substantial adverse change in the environment. Such an impact would exceed the applicable significance threshold established by the lead agency. Depending on the availability of feasible mitigation, a significant impact may be mitigable or avoidable and reduced to a less-than-significant level by application of one or more mitigation measures.
- Significant and unavoidable: The alternatives would cause a substantial adverse change in the environment, and no feasible mitigation measure(s) could reduce the impact to a less-than-significant level.
- Mitigation. Mitigation refers to measures that would be implemented to avoid or lessen potentially significant impacts. Mitigation measures would be proposed as a condition of plan approval and would be monitored to ensure compliance and implementation. Mitigation includes actions that have the following effects on an impact.
    - Avoiding the impact altogether by not taking a certain action or parts of an action.
    - Minimizing the impact by limiting the degree or magnitude of the action and its implementation.
    - Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
    - Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
    - Compensating for the impact by replacing or providing substitute resources or environments.

4.5 Scope of Analysis

In developing this SED, the State Water Board considered the nature of the 2006 Bay-Delta Plan amendment(s), comments received in response to the notice of preparation (NOP) and during public consultation, other public comments and information, and the environmental issues identified in Appendix A of the State Water Board's CEQA regulations (Cal. Code Regs., tit. 23, §§ 3720–3781) and Appendix G of the State CEQA Guidelines. The State Water Board's determinations regarding other impacts that are not potentially significant and not addressed in this SED are explained in Appendix B, *State Water Board's Environmental Checklist*. The State Water Board determined that potentially significant impacts on the following resources could result from the LSJR alternatives or SDWQ alternatives. These effects are further evaluated in the following chapters.

- Chapter 5: *Water Supply, Surface Hydrology, and Water Quality*
- Chapter 6: *Flooding, Sediment, and Erosion*

- Chapter 7: *Aquatic Resources*
- Chapter 8: *Terrestrial Biological Resources*
- Chapter 9: *Groundwater Resources*
- Chapter 10: *Recreational Resources and Visual Quality*
- Chapter 11: *Agricultural Resources*
- Chapter 12: *Cultural Resources*
- Chapter 13: *Service Providers*
- Chapter 14: *Energy Resources and Climate Change*
- Chapter 15: *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*
- Chapter 16: *Cumulative Impact Summary, Growth-Inducing Effects and Irreversible Commitment of Resources*
- Chapter 17: *Summary of Impacts and Comparison of Alternatives*
- Chapter 20: *Preferred LSJR Alternative and SDWQ Alternative*

The content for this SED is primarily based on criteria from the thresholds of significance provided in Appendix A of the State Water Board regulations (Appendix B of this SED, *State Water Board's Environmental Checklist*) for implementation of the State CEQA Guidelines. Some thresholds or criteria have been adapted to the specific circumstances of the alternatives. The impact analysis and significance determinations for each impact and a conclusion of no impact, less than significant, or significant and unavoidable for each resource is included in Chapters 5–15 and Chapter 20.

Chapter 18, *Economic Analyses,* and Chapter 19, *Antidegradation Analysis,* are required by the Porter-Cologne Act or the CWA.

Several technical appendices support the analysis in the SED chapters, including the following.

- Appendix A: *NOP Scoping and Other Public Meetings*
- Appendix B: *State Water Board's Environmental Checklist*
- Appendix C: *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*
- Appendix D: *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*
- Appendix E: *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*
- Appendix F.1: *Hydrologic and Water Quality Modeling*
- Appendix F.2: *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta*
- Appendix G: *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*
- Appendix H: *Evaluation of Methods of Compliance*
- Appendix I: *Cultural Resources Overview*
- Appendix J: *Hydropower and Electric Grid Analysis of Lower San Joaquin River Flow Alternatives*

- Appendix K: *Revised Water Quality Control Plan*
- Appendix L: *Sensitivity Analyses*

Appendix B, *State Water Board's Environmental Checklist*, also identifies and explains why the alternatives would result in either no impacts or less-than-significant impacts on particular resources. As discussed in more detail in Appendix B, the following resources would experience either no impact or a less-than-significant impact. Therefore, they are not analyzed in the SED chapters.

- Aesthetics
- Air Quality
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Transportation/Traffic

4.6 Baseline

CEQA requires a description of the physical environmental conditions in the vicinity of the project as they exist at the time the NOP is published (February 13, 2009), or if no NOP is published, at the time environmental analysis is commenced (Pub. Resources Code, § 15125). The description of the existing environmental conditions is normally the baseline against which the environmental impacts of the alternatives are compared. The baseline pertinent to each of the resource areas is included in the *Environmental Setting* section of each resource chapter. Below is a description of how different resource parameters may vary over time and how they may be incorporated into baseline conditions.

The environmental conditions in the Bay-Delta and SJR Basin are determined by numerous complex interactions and changing conditions. Defining baseline in such a variable environment is problematic as the definition can change depending on the parameter being considered and the range of variability it exhibits. For example, conditions related to salmon populations exhibit variability at multiple temporal and spatial scales, although conditions have changed substantially over time. In many instances, conditions that existed prior to the development of the major rim dams (defined in Chapter 2, *Water Resources*) and other pertinent water development infrastructure are not likely to be repeated; therefore, it is not appropriate to define these prewater supply project development years as representing existing conditions for these parameters.

To take into account natural variability, while still representing shifts that have occurred over time, existing conditions for surface hydrology, and water quality, aquatic resources, and other relevant resources are described based on recent historical conditions. The recent historical period used in the analysis differs for each resource considered, depending on the availability and suitability of

data to represent existing conditions. Since hydrologic conditions vary naturally from year to year, sometimes dramatically, parameters strongly dependent on hydrology, such as water supply, are modeled using CALSIM Water Resources Simulation Model (CALSIM, discussed below in Section 4.7.2) output over the period of record 1922–2003 at the present level of development. Recent monitoring data and reports in combination with CALSIM output are also used to establish baseline conditions for water supply.

Other parameters, such as cultural resources, also change over time but do not exhibit significant annual variability. These types of parameters are defined by the conditions present at the time the NOP was issued. This may be constrained in some instances by data availability; in those instances, the most current readily available information is used. It should be noted that a second NOP was released on April 1, 2011, and this SED discusses the relevance of any changes that may have occurred between the first and second issuance of the NOP, where appropriate.

Regulatory requirements, which may also affect existing conditions, (e.g., surface water hydrology) also change periodically but show little annual variability, with the exception of the existing federal Endangered Species Act biological opinion (BO) requirements for USBR's operations of relevant facilities. For example, as discussed in Chapter 7, *Aquatic Resources*, the National Marine Fisheries Service (NMFS) in 2009 released a BO on the long-term operations of the CVP and the SWP (NMFS BO) . These BOs identify certain reasonable and prudent alternatives (RPAs) that should be incorporated into USBR's actions to avoid jeopardizing the continued existence of the listed species, including requirements for flow on the Stanislaus River (RPA 3.1.3). However, as a result of litigation, injunctions have been issued, and parts of these BOs have been remanded to NMFS and the U.S. Fish and Wildlife Service for modification. Although, the future of the RPAs identified in the BO is somewhat uncertain, this SED assumes the NMFS BO is in effect in the baseline and will continue into the future.

4.7 Modeling and Technical Analyses

This SED relies on numerous modeling and technical analyses to describe baseline conditions and impacts. Because the LSJR alternatives would be based on the natural (unimpaired) hydrology and would potentially alter the existing water diversions from the tributaries, many of the environmental impacts described in this SED are based on hydrologic modeling and technical analyses of the flow objectives in each of the eastside tributaries. This section provides a brief overview of the types of modeling and technical analyses performed. It identifies the chapters and appendices that describe this information in more detail and the chapters that primarily use the results of the modeling and technical analysis to determine impacts.

4.7.1 Peer-Reviewed Technical Appendix

The scientific basis of any statewide plan, basin plan, plan amendment, guideline, policy, or regulation must undergo external peer review before adoption by the state or regional board (Health and Saf. Code, § 57004). State Water Board staff, in accordance with Health and Safety Code Section 57004, submitted a peer review request for the report titled, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow Objectives for the Protection of Fish and Wildlife Beneficial Uses and Water Quality Objectives for the Protection of Southern Delta Agricultural Beneficial Uses and the Program of Implementation for Those Objectives* (included in this document as

Appendix C, *Technical Report On The Scientific Basis For Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*). Appendix C includes draft changes to the SJR flow and southern Delta salinity objectives in the 2006 Bay-Delta Plan, a program of implementation for those objectives, and discusses the scientific basis for the objectives and their program of implementation. The LSJR alternatives and the SDWQ alternatives are based on this information.

4.7.2 Hydrologic and Water Quality Modeling

The analysis in this SED relies on the modeling output and results of the CALSIM model and the State Water Board's Water Supply Effects (WSE) model. These two models are described below. In addition, a temperature model was used to determine temperature changes as a result of the LSJR alternatives.

CALSIM

CALSIM is a planning model designed to simulate operations of the CVP and SWP reservoirs and water delivery system for current and future facilities, flood control operating criteria, water delivery policies, and instream flow and Delta outflow requirements. CALSIM is a generalized water resources simulation model for evaluating operational alternatives of the CVP/SWP system. CALSIM II is the latest application of the generic CALSIM model CALSIM and CALSIM II are products of joint development between DWR and USBR. This document uses the terms CALSIM and CALSIM II interchangeably. CALSIM is the best available tool for modeling the CVP and SWP and is the only system-wide hydrologic model being used by USBR and DWR to conduct planning and impact analyses of potential projects. CALSIM simulates operation of the CVP and SWP for a set of physical conditions and regulatory requirements that are the same for each year. The model is designed to simulate the effects of various regulatory requirements by running multiple steps. CALSIM steps simulate the operations of the CVP and SWP system under select regulatory requirements and agreements. The model is run for a monthly step for one year. End-of-year conditions from the final step become input for the first step of the next year.

Chapter 5, *Water Supply, Surface Hydrology, and Water Quality,* and Appendix C, *Technical Report On The Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives,* and Appendix F.1, *Hydrologic and Water Quality Modeling*, provide a detailed description of CALSIM and the results from the CALSIM modeling. Chapter 5 uses CALSIM modeling results to establish baseline conditions and analyze the hydrology and water quality impacts of the LSJR alternatives. The other chapters in this SED reference the CALSIM model results and baseline conditions where appropriate.

Water Supply Effects Model

The State Water Board's WSE model is a monthly water balance spreadsheet model that calculates for each tributary reductions in water supply diversions and changes in reservoir operations that could occur based upon user-defined inputs, output from CALSIM, and flood storage rules. The model attempts to maximize diversions and reservoir storage and diversions by setting annual diversions in February of each year based on storage at the end of January in the same year. The model is run using 82 years of monthly hydrology and calculates flows, diversions, and reservoir storage within the three eastside tributaries. To quantify the effects of each LSJR alternative, the output data from the CALSIM baseline conditions are subtracted from the WSE model outputs on a tributary basis and for the entire plan area.

Appendix F.1, *Hydrologic and Water Quality Modeling*, provides a detailed description of the WSE model and the results from the modeling. Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, also describes WSE and uses the modeling results to establish baseline conditions and analyze LSJR surface water, surface hydrology and water quality impacts. Additional chapters, such as Chapter 7, *Aquatic Resources*, Chapter 8, *Terrestrial Biological Resources*, Chapter 10, *Recreational Resources and Visual Quality*, Chapter 11, *Agricultural Resources*, and Chapter 13, *Service Providers*, use the WSE-predicted river flows and diversion modifications to evaluate impacts on aquatic resources, agricultural resources, and service providers, respectively.

Temperature Model

To model effects on temperature in the LSJR and three eastside tributaries, the State Water Board modified the SJR Basin-Wide Water Temperature Model (temperature model), a model using the Hydrologic Water Quality Modeling System (HWMS-HEC5Q), a graphical user interface that employs the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) flow and water quality simulation model, HEC-5Q. The SJR temperature model was developed by a group of consultants between 2003 and 2008 through a series of CALFED Bay-Delta Program contracts that included peer review and refinement. Calibration data was used to accurately simulate temperatures for a range of reservoir operations, river flows, and meteorology. To determine effects of the LSJR alternatives, the model was run with CALSIM baseline results and WSE model results, and the resulting temperatures were compared at key locations along each tributary.

Appendix F.1, *Hydrologic and Water Quality Modeling*, provides a detailed description of the temperature model and the modeling results. Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, also provides a description and uses modeling results to establish baseline conditions and analyze the LSJR surface water, surface hydrology and water quality impacts. Other chapters use the temperature model results. For example, Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, describes the results and uses them to document the relative change in temperature under the alternatives compared to baseline conditions, and Chapter 7, *Aquatic Resources*, uses the results to evaluate impacts on aquatic resources.

4.7.3 Agricultural and Economic Modeling

WSE model results predict changes in the amount of surface water diverted. These changes are used in the Statewide Agricultural Production (SWAP) model to estimate agricultural production and revenues for each of the LSJR alternatives. The SWAP model was selected to estimate the agricultural production (crop acreages) and revenues (total production value) associated with the surface water diversions under the LSJR alternatives and baseline conditions. SWAP is an agricultural production model that simulates the decisions of farmers at a regional level based on principles of economic optimization. The model assumes that farmers maximize profit (revenue minus costs) subject to resource, technical, and market constraints. The model selects those crops, water supplies, and irrigation technology that maximize profit subject to these equations and constraints. The model accounts for land and water availability constraints given a set of factors for production prices and calibrates exactly to observed yearly values of land, labor, water, and supplies use for each region.

The results of SWAP were then used as inputs for the Impact Analysis for Planning model (IMPLAN). IMPLAN is an input-output multiplier model and considers interrelationships among sectors and institutions in the regional economy. Production in the different economic sectors is simulated in

IMPLAN by using fixed factors. The model then applies these factors in a matrix that accounts for changes in transactions between producers and intermediate and final consumers in other sectors of the economy. The IMPLAN approach also considers nonmarket transactions, such as unemployment insurance payments and associated changes in tax revenues for government.

Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, provides a detailed description of SWAP and IMPLAN and their results. Chapter 11, *Agricultural Resources*, and Chapter 18, *Economic Analyses*, use the results of SWAP to analyze potential impacts of the LSJR alternatives on agricultural resources and economics, respectively.

4.7.4 Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta

The State Water Board contracted through DWR to have an agricultural water management consultant prepare a report on the *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta* (Appendix E). This report was used to review the existing science regarding irrigation salinity needs in the southern Delta. Information from Appendix E is used to determine potential impacts on agriculture as a result of implementing the SDWQ alternatives in Chapter 11, *Agricultural Resources*.

4.7.5 Energy Modeling

To assess the potential impacts of LSJR alternatives on California's electric grid, the Capacity Reduction Calculation and Power Flow Assessment was used to simulate the operation of the electric grid under peak summer demand conditions. These two technical analyses use the input of the WSE model to determine if hydropower capacity reductions and violations of California's transmission grid would occur. Appendix J, *Hydropower and Electric Grid Analysis of Lower San Joaquin River Flow Alternatives*, describes in detail the methods and results associated with these two analyses. Information from Appendix J is used to determine potential impacts on energy and climate change from implementing the LSJR alternatives in Chapter 14, *Energy and Climate Change*.