Final Report

Sacramento River Settlement Contractors Environmental Impact Statement

Prepared for

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Title of Proposed Action:	Sacramento River Settlement Contractors Environmental Impact Statement
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Legal Mandate:	National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.
Location of Proposed Action:	Sacramento Valley, California

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ACRONYMS AND ABBREVIATIONS

ACID	Anderson-Cottonwood Irrigation District
BWMP	Basinwide Water Management Plan
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DWR	Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
KAFY	thousand acre-feet per year
MAF	million acre-feet
NEPA	National Environmental Policy Act
NOAA-Fisheries	National Oceanic and Atmospheric Administration - Fisheries
OCAP	Operations Criteria and Plan
PEIS	Programmatic Environmental Impact Statement
Reclamation	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
Settlement Contracts	Sacramento River Settlement Contracts
SMWC	Sutter Mutual Water Company
SRSC	Sacramento River Settlement Contractor
ESA	Endangered Species Act
NCMWC	Natomas Central Mutual Water Company
GCID	Glenn-Colusa Irrigation District
MTCR	M&T Chico Ranch
Pelger	Pelger Mutual Water Company
PID	Provident Irrigation District
PCGID	Princeton-Codora-Glenn Irrigation District
RD 108	Reclamation District No. 108
RD 1004	Reclamation District No. 1004

CHAPTER 1
INTRODUCTION

The Final Environmental Impact Statement (EIS) represents the environmental analysis to be used by the U.S. Bureau of Reclamation (Reclamation) in making subsequent federal decisions necessary to renew the Sacramento River Settlement Contracts (Settlement Contracts). In accordance with the National Environmental Policy Act (NEPA), this Final EIS has identified five alternatives that, on the basis of public input, scientific information, and professional judgment, are considered feasible and satisfy the stated purpose and need of the proposed action. This Final EIS amends the Draft EIS in response to public comment and incorporates additional information, corrections, and changes. Chapter 4 presents the Draft EIS with changes and clarifications (new text is underlined, and deleted text is stricken [i.e., ~~deleted~~]). This Final EIS is organized as follows:

Chapter 1 – Introduction: Identifies the function of the Final EIS, presents a summary of alternatives and impacts, and describes related projects and activities.

Chapter 2 – Thematic Responses to Draft EIS Comments: Discusses process for responding to comments and presents eight thematic responses to common issues raised by commentors.

Chapter 3 – Specific Comments and Responses to Comments on the Draft EIS: Presents copies of original comment letters received on the Draft EIS and provides responses to those comments.

Chapter 4 – Revised Draft EIS: Presents the Draft EIS showing deletions (text is lined through) and additions (text is underlined) made to the text on the basis of received comments.

Appendix A – U.S. Fish and Wildlife Service Biological Opinion on the CVP-OCAP

Appendix B – NOAA – Fisheries Biological Opinion on the CVP-OCAP

Appendix C – U.S. Bureau of Reclamation Project Description for CVP-OCAP

This Final EIS examines the affected environment and the environmental consequences for the following six alternatives:

- No Action Alternative
- Alternative 1 – Preferred Alternative/Negotiated Contract
- Alternative 2 – Reclamation’s Initial Contract Proposal
- Alternative 3 – Sacramento River Settlement Contractors’ Initial Counter Proposal
- Alternative 4 – Shortage Provisions Based on Shasta Inflow Sliding Scale
- Alternative 5 – Shortage Provisions Based on 40-30-30 Sacramento River Flow Index

All alternatives are compared to the No Action Alternative, as is required by NEPA. A brief summary of each alternative, along with a description of associated environmental impacts, follows.

BACKGROUND AND PROPOSED ACTION

The Settlement Contracts have a unique history and nature. The Sacramento River Settlement Contractors (SRSC) hold water rights to Sacramento River water that are senior to the Central Valley Project (CVP) and, cumulatively, claim senior water rights that entitle them to use a significant portion of the water available for appropriation in the Sacramento River. If the SRSCs were to fully use their senior water rights, Reclamation's current ability to operate the CVP would be compromised. It was in recognition of this fact that members of Congress directed Reclamation to negotiate with the SRSCs and enter into the existing Settlement Contracts.

Together, 146 SRSCs have rights to divert approximately 2.2 million acre-feet (MAF) per year from the Sacramento River (except during critical years as defined under the Settlement Contracts). The Colusa Drain Mutual Water Company has a contract entitlement that requires Reclamation to release up to an additional 70,000 acre-feet per year into the Sacramento River as part of a negotiated water rights settlement. A complete list of these contractors appears in Appendix A to the Draft EIS.

The contract quantities range from 4 to 825,000 acre-feet per year. The 20 largest SRSCs account for approximately 95 percent of the total contracted quantity, and span the Sacramento Valley from Redding to Sacramento. With the exception of Sutter Mutual Water Company (SMWC) and Anderson-Cottonwood Irrigation District (ACID), the renewed contracts would provide for the continued diversions and delivery of the same quantities of water as the existing Settlement Contracts. For SMWC and ACID, the renewed contracts include reduced contract quantities.

The contract renewals also provide for continued diversions and delivery of water to the same lands and for the same purposes, with one exception. Natomas Central Mutual Water Company (NCMWC) has requested a change in authorized use from agricultural to municipal and industrial in the Metro Air Park portion of its service area.

When originally executed, the term of these Settlement Contracts was not to exceed 40 years, and these contracts were scheduled to expire on March 31, 2004. However, on December 1, 2003, Congress passed Public Law 108-37. Section 218 of that Act states,

> "The Secretary of the Interior shall extend the term of the Sacramento River Settlement Contracts, long- and short-form, entered into by the United States with various districts and individuals, under section 14 of the Reclamation Project Act of 1939 (53 Stat. 1197), for a period of 2 additional years after the date on which each of the contracts, respectively, would expire but for this section, or until renewal contracts are executed, whichever occurs earlier."

Pursuant to this Congressional mandate, Reclamation has issued written notices to the SRSCs confirming that all terms and conditions of their existing Settlement Contracts will remain in full force and effect during the extension period.

The action proposed here is renewal of the Settlement Contracts for an additional 40 years. This EIS considers the impacts of renewal, including potential impacts from five alternatives, relative to the No Action Alternative. The Preferred Alternative is renewal of the Settlement Contracts as mutually negotiated by Reclamation and the SRSCs.

SUMMARY OF ALTERNATIVES AND IMPACTS

The project alternatives evaluated in this EIS represent a broad range of possible alternatives; however, because of the unique nature of the Preferred Alternative, as the result of a negotiated settlement, this EIS focuses additional attention on Alternative 1 – Preferred Alternative/Negotiated Contract.

No Action Alternative

The No Action Alternative is defined by NEPA as the most likely future that could be expected to occur in the absence of the project. It is intended to represent a projection of current conditions to the most reasonable future responses or conditions that could occur during the life of the project without any action alternatives being implemented.

The No Action Alternative for the SRSC contract renewals has been determined to be the Preferred Alternative for the Central Valley Project Improvement Act (CVPIA) Programmatic Environmental Impact Statement (PEIS). The rationale for this decision is that with the passage of the CVPIA in 1992, and the completion of the environmental documentation for the CVPIA (PEIS) in 1999, the operations of the CVP, including the diversions of Sacramento River water by the SRSCs, are guided by the adopted PEIS Preferred Alternative. Therefore, the CVPIA PEIS Preferred Alternative is considered the existing conditions for this EIS, and the ongoing implementation of the CVPIA is the most likely future scenario. The Preferred Alternative for the CVPIA PEIS assumed renewal of the Settlement Contracts at existing, full contract amounts.

The rationale for definition of the No Action Alternative also considered that the majority of the SRSCs and Reclamation have shown their willingness to renew the contracts, and Congress has approved interim contract extensions. Therefore, the possibility of a future without contract renewals was not anticipated as an alternative in this EIS.

The use of the PEIS Preferred Alternative as the No Action Alternative is consistent with the definition of the No Action Alternative for several other ongoing contract renewal environmental documents, including Westside Canals (i.e., Tehama-Colusa Canal), Shasta-Trinity, San Felipe, San Luis Unit, Friant, Cross-Valley, Contra Costa Water District, and Delta-Mendota.

The No Action Alternative forms the basis for comparison against other alternatives.

ALTERNATIVE 1: PREFERRED ALTERNATIVE – NEGOTIATED CONTRACT

The Preferred Alternative of this EIS is the renewal of all proposed Settlement Contracts in the Sacramento Valley. Specific terms are outlined in Table 1. Two contract amounts have been reduced based on Reclamation's Water Needs Assessment. The result is that the contracts better reflect actual use for these districts. Thus, physical conditions under this alternative are exactly the same as under the No Action Alternative; therefore, no incremental impact is associated with this alternative.

Alternative 2: Reclamation's Initial Contract Proposal

Alternative 2 is Reclamation's initial contract proposal to the SRSCs, which was the impetus for a counter proposal by the SRSCs. Specific terms are outlined in Table 1. Physical conditions under this alternative are similar to the No Action Alternative, with the primary change being an increase in the frequency of drought years under this alternative.

Alternative 3: Sacramento River Settlement Contractors' Initial Counter Proposal

Alternative 3 represents the contract provisions contained in the SRSCs' response to Reclamation's initial proposal for terms of the renewed contract. Specific terms are outlined in Table 1. Physical conditions under this alternative are exactly the same as under the No Action Alternative, and the primary change is that the SRSCs would receive payment in exchange for using quantities of water below their contracted amounts.

Alternative 4: Shortage Provisions Based on Shasta Inflow Sliding Scale

Alternative 4 is similar to Alternative 1, except that it considers a variation in the shortage provision that was not considered in the contract negotiations between Reclamation and the SRSCs, and would result in more frequent reductions. Specific terms are outlined in Table 1. Under Alternative 4, shortage provisions are similar to those under Alternative 2, and would be implemented on a 10-20-25 percent sliding scale that is tied to Shasta inflow deficiencies.

Alternative 5: Shortage Provisions Based on 40-30-30 Sacramento River Index

Alternative 5 introduces a 25-year contract term and another variation of the shortage provision that is based on the 40-30-30 Sacramento River index. Specific terms are outlined in Table 1. Under Alternative 5, shortage provisions are similar to those under Alternative 2, and would be implemented on a 10-20-25 percent sliding scale that is tied to the 40-30-30 Sacramento River index rather than Shasta inflows.

TABLE 1

PROJECT ALTERNATIVES SUMMARY

Alternative	No Action	Alternative 1: Preferred Alternative – Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Initial Counter Proposal	Alternative 4: Shortage Provisions Based on Shasta Inflow	Alternative 5: Shortage Provisions Based on 40-30-30 Sacramento River Index
Total Annual Contract Amount (KAFY)[a]	2,316	2,227	2,316	2,316	2,227	2,227
Contract Period	40 years	40 years	40 years	40 years	40 years	25 years
Shortage Provision	Specifies reductions in critical years[b] only; reductions of 25%	Specifies reductions in critical years only; reductions of 25%	Specifies delivery reductions based on Shasta inflow deficiencies varying from 10 to 25% (sliding scale)	Same as Alternative 2, and SRSCs are compensated for water reductions	Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full contract amount is reset at 4 MAF in Shasta Lake	Sliding-scale cutback (10-20-25%) based on Sacramento River Index[c] water years; no reset requirement at 4 MAF in Shasta Lake
Number of Years Shortage Provision Is Activated (based on historical period of record)	9 years	9 years	16 years	9 years	17 years	43 years
Total Amount Reduced over 4-year Drought Sequence Based on Shortage Provision (KAFY)	2,127	2,127	2,021	2,127	2,127	2,021
Base Supply Rescheduling Provisions	No fees for rescheduling	Requires rescheduling fee for water rescheduled into January through October from any month of the diversion season	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract	No fees for rescheduling	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract
Costing Mechanism	Take or Pay: Requires SRSC to pay for Project Water at established rates with adjustments by Contracting Officer if water used other than for agricultural purposes; SRSC pays for 100% of Project Water	Take or Pay: Requires SRSC to pay for 75% of the amount of Project Water each year and to pay for Project Water actually diverted in excess of 75%; Contracting Officer can adjust rates to applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use	Take or Pay: Requires SRSC to pay for Project Water at established rates with adjustments by Contracting Officer if water used other than for agricultural purposes; SRSC pays for 100% of Project Water	Take or Pay: Limits payment to Project Water actually diverted by the SRSC; does not specifically include adjustment for water used other than for agricultural purposes	Same as Alternative 1	Take or Pay: Requires SRSC to pay for 75% of the amount of Project Water each year and to pay for Project Water actually diverted in excess of 75%; Contracting Officer can adjust rates to applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use

TABLE 1

PROJECT ALTERNATIVES SUMMARY

Alternative	No Action	Alternative 1: Preferred Alternative – Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Initial Counter Proposal	Alternative 4: Shortage Provisions Based on Shasta Inflow	Alternative 5: Shortage Provisions Based on 40-30-30 Sacramento River Index
Conservation Measures		Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law; which allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a)	Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law	Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law	Same as Alternative 1	Reclamation's standard criteria would apply, including measurement at each farm delivery, volumetric pricing of water, and implementation of Best Management Practices

[a]Includes contract amounts for 145 SRSCs and Colusa Drain Mutual Water Company. Total annual amounts vary according to shortage provisions.

[b]Shasta critical years defined by the contract between Reclamation and the SRSCs (see Appendix C to the Draft EIS for complete contract). This shortage provision was the mechanism used in the original contracts and, thus, represents the No Action Alternative, in addition to Alternatives 1 and 3.

[c]The 40-30-30 Sacramento River Index is computed as a weighted average of the current water year's April through July unimpaired runoff forecast (40 percent), the current water year's October through March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff (calculated in the 40-30-30 Sacramento River Index as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom) is the river production unaltered by water diversions, storage, exports, or imports. A water year with a 40-30-30 Sacramento River Index equal to or greater than 9.2 MAF is classified as "wet." A water year with an index equal to or less than 5.4 MAF is classified as "critical."

Notes:

BWMP = Basinwide Water Management Plan
KAFY = thousand acre-feet per year

RELATIONSHIP TO OTHER PROJECTS AND ACTIVITIES

The proposed project is related to several other projects and activities. These are outlined on pages 1-9 through 1-12 of the Draft EIS. Related projects include the following:

- Long-term Contract Renewal of Existing CVP Water Service Contracts –Reclamation
- Implementation of CVPIA –Reclamation and U.S. Fish and Wildlife Service (USFWS)
- CALFED Bay-Delta Program – CALFED
- Trinity River Mainstem Fishery Restoration EIS/Environmental Impact Report (EIR) – Reclamation, USFWS, Hoopa Valley Tribe, and Trinity County

Related activities include the following:

- CVPIA PEIS –Reclamation
- Operations Criteria and Plan (OCAP) Biological Assessment – Reclamation
- Sacramento River BWMP and Regional Criteria – selected SRSCs
- Sacramento Valley Water Management Program – selected SRSCs, Reclamation, and California Department of Water Resources (DWR)

As noted above, these projects and activities are described in the Draft EIS. However, in response to the Reclamation CVP-OCAP Biological Assessment, National Oceanic and Atmospheric Administration-Fisheries (NOAA-Fisheries) has issued a Biological Opinion outlining the effects of operating the CVP on threatened and endangered fish. This NOAA-Fisheries Biological Opinion is included, in its entirety, as Appendix B to this Final EIS. Additionally, the USFWS Biological Opinion is included as Appendix A to this Final EIS. The NOAA-Fisheries Biological Opinion on the CVP-OCAP is of special concern because it directly addresses operations of Shasta Reservoir and releases to the Sacramento River, two issues of particular relevance to the SRSCs. Additional explanation of the relationship between this Final EIS and the NOAA-Fisheries Biological Opinion on the CVP-OCAP is presented in Thematic Response No. 7. Additionally, Reclamation has undertaken project-specific Endangered Species Act (ESA) consultation for this action with both NOAA-Fisheries and USFWS. The ESA consultation has included informal consultation on the potential effects to listed species, formal consultation and analysis, and a determination by Reclamation that the proposed action will not have a significant impact to listed species and/or critical habitat. Formal Biological Assessments were prepared by Reclamation and transmitted to NOAA-Fisheries on April 28, 2004 and USFWS on April 13, 2004. The ESA consultation will be completed prior to the signing of the Record of Decision. The results of both consultation processes will be available to the public when they are complete.

CHAPTER 2
THEMATIC RESPONSES TO DRAFT EIS COMMENTS

SUMMARY OF COMMENT PROCESS AND APPROACH

The Draft EIS was available for public review between October 1, 2004 and November 15, 2004. A public hearing on the document was held October 27, 2004, in Willows, California. Comments received on the Draft EIS have been carefully documented and considered for relevance to the EIS. In cases where commentors have identified shortcomings of the Draft EIS, corrections to the draft have been made and are detailed in Chapter 4. Responses have been provided for all comments on the EIS. Comment letters and the transcript from the public hearing have been reproduced in Chapter 3.

Several commentors raised issues or concerns that were shared, in part, by other commentors. Eight thematic responses have been prepared to provide comprehensive responses that allow for a more complete explanation of the rationale or process behind explanations. In most cases, individual responses were prepared for comments in addition to the more general response given by the thematic responses.

THEMATIC RESPONSES TO COMMON ISSUES

Eight thematic responses are presented below to provide comprehensive responses to common issues raised by commentors. These thematic responses allow for more complete responses to individual comments. Thematic responses were prepared for the following areas:

1. History of Settlement Contracts
    - Nature of Original Dispute between Reclamation and Contractors
    - Brief Overview of Senior Status of Contractors
    - Benefits of Settlement Contracts with Regard to River Operations
2. Relationship of Settlement Contracts to CVPIA and CALFED
    - CVPIA (CVPIA language regarding 25-year terms, tiered pricing)
    - CALFED
3. Water Needs Assessments
    - Water Needs Assessment
    - Historical Use
    - Water Conservation
4. Administrative Process
    - Ability-To-Pay
    - Rationale for not Extending Comment Period

5. Summary of Incremental Impacts
   - Comparison of No Action Alternative and Alternative 1: Preferred Alternative – Negotiated Contract
   - Alternative Impact Determination
6. Water Transfers
   - General Overview of Water Transfers
   - Water Transfers and CVPIA
7. Relationship between NOAA-Fisheries Biological Opinion on the CVP-OCAP and the Settlement Contracts
8. SRSC Efforts to Promote Fish Passage and Survivability

1. History of Settlement Contracts

Nature of Original Dispute between Reclamation and Contractors

In the 1930s, before the CVP was constructed, it was anticipated there would be water rights disputes regarding the operation of Shasta Dam between Reclamation and those holding direct diversion rights on the Sacramento River. This proved to be true and led to over 20 years of negotiations, protracted technical studies, and hearings by the State of California and Congress, and eventually required the intervention of representatives of the Secretary of the Interior to resolve.

Prior to construction of Shasta Dam in 1944, the Sacramento River had no significant storage on the system. Those water users diverting water from the Sacramento River before construction of Shasta Dam had to rely on the natural, uncontrolled flow of the river. The water rights held by the water users who diverted from the Sacramento River included pre-1914 appropriative water rights, post-1914 appropriative rights, and riparian rights. In addition, 34 water users diverted from the Sacramento River under other claimed water rights. The water rights held by many users on the Sacramento River are generally rights that are senior to those of Reclamation for the CVP. However, some of these rights are junior to Reclamation's rights in terms of actual date of priority (1927 and 1938) and even junior to the date of Shasta Dam completion (1944). These rights provide for the direct diversion of water from the Sacramento River; they are not rights to store water. Thus, those water users were dependent on the natural flow in the river and had to share that water according to the priority of their water right. At certain times of the year (primarily the summer months), water was generally not available to meet all of the needs of the water right holders along the Sacramento River.

Since 1944, the Sacramento River has been regulated by the operation of Shasta Dam and Reservoir. The diversions along the river increased dramatically over the 20-year period between the initial operation of Shasta Dam and Settlement Contract execution. A portion of the water diverted was released from CVP storage. In 1944, negotiations were initiated to require diverters to pay for CVP benefits. Within 2 years, the negotiations failed because of the numerous water users involved and the complex nature of the alleged water rights of those users. Thereupon, Reclamation undertook comprehensive studies to catalog and evaluate the claimed water rights. These studies involved cooperative arrangements with the state and were considered essential in the event that the complex water right questions were settled by litigation or agreement.

The operation and management problems of the CVP were being brought with increasing frequency to the attention of Congress, who responded in 1951 by convening a special Congressional subcommittee on Irrigation and Reclamation. This subcommittee recommended that a "monstrous lawsuit should be avoided, and a practical operating agreement (between Reclamation and the water users) should be obtained." In response to this report, Reclamation and the Sacramento River and Delta Water Association, in cooperation with the State of California, entered into an agreement in 1952, to establish a procedure to determine the rights of the users and of the CVP. The process of determining these rights became known as the 1956 Cooperative Studies.

The 1956 Cooperative Studies quantified the amounts of water each SRSC diverted in each year between 1924 and 1954. These studies determined the average monthly water supply available for the satisfaction of each water right entitlement and were used in determining Base Supply and Project Water in the Sacramento River contracting program. Each SRSC's average deficiency (the difference between the SRSC's full demand and the amount available under their rights from natural flow) was established. In dry years, a SRSC would have less water available under its rights than in wet years. Correspondingly, in dry years, the SRSC would need more Project Water than in wet years. The contract quantities are an average of the Base Supply and Project Water for all the years covered by the 1956 Cooperative Studies.

Negotiations with the Sacramento River diverters resumed in 1960, and most contracts were executed during 1964. These contracts met many of the needs of both parties. Although the SRSCs were unable to receive the full amount of their claimed water rights, they did receive the benefit of the certainty and reliability of flow provided by the operation of the CVP. Reclamation obtained a greater certainty as to operation of the CVP, particularly during critically dry years.

Brief Overview of Senior Status of Contractors

A water right does not have to be adjudicated to be valid. The major contractors have riparian rights, pre-1914 appropriative rights, or permits or licenses for appropriation issued by the State Water Resources Control Board.

These contracts were negotiated over a period of more than 20 years with the premise that a negotiated settlement was preferable to a general stream adjudication. The CVP is operated on the basis that the SRSCs do not use all of their contract supplies in some years and that water is used to meet other CVP-authorized purposes. Key provisions of the existing contracts, such as requiring the Contracting Officer's approval before water is transferred or before the contractor changes its service area, have been retained. These provisions will assure that other users are not negatively impacted.

Some press reports have claimed that Reclamation is delivering water for "free" to certain users. Reclamation does not deliver water for "free." Reclamation charges for the stored water that it makes available under its water right, but cannot, and does not, charge for the water to which it has no right. Simply put, Reclamation cannot charge for water that was not developed by the CVP or made available as a result of the CVP. Under the settlement agreements, cities, districts, companies, and individuals divert water out of the Sacramento River or its tributaries under their own state water rights, which in many instances predate the CVP, without charge, but pay Reclamation for the stored water that they divert.

Benefits of Settlement Contracts with Regard to River Operations

In most respects, a CVP water service contractor's rights to water derive from Reclamation's water rights obtained from the state. Conversely, the SRSCs' rights to water arise out of their state-perfected water rights that exist independent of Reclamation. In some respects, Reclamation's rights are therefore based on the SRSCs' underlying water rights and the SRSCs' willingness, under the terms of the Settlement Contracts, to settle or compromise those underlying rights to resolve water rights protests and thereby enhance the viability of the CVP.

The Settlement Contracts have not only facilitated agricultural practices in the Sacramento Valley, important to the preservation of fish and wildlife habitat, but also have allowed the transfer of water to urban communities. The renewal of these Settlement Contracts, on substantially the same terms that have existed since 1964, provides Reclamation with an extraordinary opportunity to pursue and achieve its stated goals in a manner consistent with the congressional mandates.

2. Relationship of Settlement Contracts to CVPIA and CALFED

Some concerns have been raised regarding provisions of the CVPIA and CALFED in relation to renewal of the Settlement Contracts. In some cases, there is confusion about the various types of water supply arrangements accommodated by Reclamation, and the ways in which CVPIA and CALFED apply to those arrangements. Following is an explanation of the relationship between renewal of the Settlement Contracts and CVPIA and CALFED.

CVPIA

The CVPIA affected the operations of the CVP by adding considerations that had been previously omitted or marginalized. Reclamation's narrative history of the CVP (http://www.usbr.gov/history/projhist.htm) states:

> President George Bush signed the bill as part of the Reclamation Projects Authorization and Adjustment Act of 1992, over the objections of California Governor Pete Wilson and Central Valley legislators. Environmentalists considered the act a victory, while California agricultural leaders considered it a disaster. The CVPIA reallocated 800,000 acre-feet of CVP water (600,000 in dry years) from Valley farmers toward the restoration of Central Valley fisheries. CVPIA limited renewed agricultural water contracts to twenty-five years with no long-term renewals.

In effect, the CVPIA added requirements to CVP operations on top of existing operations for flood control, water quality operations, water deliveries, and power production. This created a complex set of rules and requirements for the water system that is documented in the CVP-

OCAP; see Appendix C to this Final EIS. Many of the operational details that resulted from the CVPIA are still being negotiated and litigated.

Of particular relevance to this EIS are the terms within CVPIA relating to contract renewal. The CVPIA expressly distinguishes Settlement Contracts from “CVP water service contracts” or “repayment contracts.” The CVPIA provides definitions for both water service contracts and repayment contracts. The CVPIA also includes a definition for the phrase “Central Valley Project water,” which means:

> All water that is developed, diverted, stored or delivered by the Secretary in accordance with the statutes authorizing the Central Valley Project and in accordance with the terms and conditions of water rights acquired pursuant to California Law. CVPIA § 3403(f).

This definition includes all water to which Reclamation holds a legal right, pursuant to its applications, permits, and licenses for the operation of the CVP. This does not include the water rights of the SRSCs, most of which are senior to those of the CVP. Contractors that are supplied with CVP water are addressed in Section 3404(c) of the CVPIA, which deals specifically with the renewal of existing long-term “repayment or water service contracts.”

Additional provisions of the CVPIA relate to conservation mandates for water contractors. The proposed Settlement Contracts include detailed conservation language, consistent with the applicable provisions in the CVPIA. Specifically, under the Water Conservation provision of the contracts:

> Prior to the diversion of Project Water, the Contractor shall be implementing an effective water conservation and efficiency program based on the Basin-Wide Water Management Plan and/or Contractor’s water conservation plan that has been determined by the Contracting Officer to meet the conservation and efficiency criteria for evaluating water conservation plans established under Federal law. The water conservation and efficiency program shall contain definite water conservation objectives, appropriate economically feasible water conservation measures, and time schedules for meeting those objectives. Continued diversion of Project Water pursuant to this Settlement Contract shall be contingent upon the Contractor’s continued implementation of such water conservation program.

Renewal of the Settlement Contracts is consistent with the terms and provisions outlined under the CVPIA. However, it is common for commentors to mistake CVPIA provisions relating to other types of contracts (i.e., water service contracts or repayment contracts, sometimes referred to as 9(e) contracts) as relating to all types of CVP water contracts. This is not the case. The CVPIA specifically recognizes the different classifications of water contracts and outlines requirements and provisions that relate to specific types of water contracts.

The existing Settlement Contracts provide for a 40-year term of contract, and for renewals thereof in addition to conversion to a 9(d) repayment-type contract pursuant to the 1939 Act. The renewal contracts retain a term of 40 years, with the ability to convert to a 9(d) repayment contract at some point. This term is consistent with current Reclamation policy because the Settlement Contracts were negotiated pursuant to Section 14 of the 1939 Act. Therefore, the provision in Section 3404(c) limiting the term of repayment and water service contracts to a period not to exceed 25 years does not apply to the Settlement Contracts.

Congress' specific intent to exempt the Settlement Contracts from various portions of the CVPIA was clearly expressed on the floor of Congress by former Representative Vic Fazio, a participant in the development of the CVPIA. Mr. Fazio noted that "the bill [CVPIA] specifically exempts all [Sacramento River] settlement . . . contract water. These contractors have a prior right to the water they receive. They were entitled to this water before the project was constructed, or have developed water rights independent of the project. They are held harmless from the imposition of any new requirements, and that is appropriate given the seniority of their water rights" (Congressional Record-House October 5, 1992 at 11515-11516).

The Secretary of the Interior has the authority to enter into contracts, such as these, under Section 14 of the 1939 Act to settle water rights disputes. These contracts were the result of a protracted water rights dispute. The fact that water furnished under them is used for irrigation purposes, and that the SRSCs pay for the Project Water portion of their contract quantities, does not make them water service or repayment contracts.

It was suggested that the CVPIA's tiered pricing mechanism be applied to the Settlement Contracts. However, these provisions only apply to repayment contracts or water service contracts and not to Settlement Contracts. CVPIA Section 3405(d), which sets forth the tiered pricing requirements, is specifically limited to "Central Valley Project water service or repayment contracts for a term longer than three years . . . ."

The SRSCs pay for Project Water at CVP rates. Under the take-or-pay provisions of the new proposed Settlement Contracts, they will pay for 75 percent of CVP water regardless of whether they take that water or not. Thus, some SRSCs may actually overpay for Project Water in any given year. Moreover, SRSCs will have to pay for past operation and maintenance deficits by the year 2030 as mandated by federal law.

Reclamation and the contractors have also agreed that "take-or-pay" (a concept no longer imposed at all on CVP water service contractors) will only apply to the first 75 percent of their Project Water. This figure is in line with the contractor's historical use of their Project Water. Amounts over 75 percent will be paid for on an as-delivered basis. Finally, the contract contains a provision that will allow a contractor to elect to reduce the amount of Project Water it will take in any year. These measures provide significant incentives for water conservation. Tiered pricing and the requirement that the contractors be charged for water actually delivered applies only to water or repayment service contracts. Reclamation disagrees with the assertion that the Settlement Contracts are water service or repayment contracts.

CALFED

Commentors have expressed concern that commitments included in the Settlement Contracts will upset the balance achieved in the CALFED Record of Decision. This is not the case. It is important to note that the CALFED Record of Decision is a comprehensive document that includes consideration of a number of ongoing projects and processes, including the following:

- American River Water Resource Investigation
- American River Watershed Project
- CVPIA (Ecosystem Restoration, Water Transfer, Water Use Efficiency, and Water Quality Programs)
- Contra Costa Water District Multi-Purpose Pipeline Project
- Delta Wetlands Project (Ecosystem Restoration Program)
- Hamilton City Pumping Plant Fish Screen Improvement Project (Ecosystem Restoration Program)
- Interim South Delta Plan (Conveyance Element)
- Montezuma Wetlands Project (Ecosystem Restoration Program)
- Pardee Reservoir Enlargement Project
- Red Bluff Diversion Dam Fish Passage Program (Ecosystem Restoration Program)
- Sacramento River Flood Control System Evaluation (partial)
- Sacramento Water Forum Process (Ecosystem Restoration Program)
- Trinity River Restoration Program (proposed flows are included in modeling assumptions for the Preferred Alternative)
- East Bay Municipal Utility District Supplemental Water Supply Project
- Sacramento County Municipal and Industrial Water Supply Contracts
- Urbanization (future population growth is included in modeling assumptions for the Preferred Alternative)
- West Delta Water Management Program (Ecosystem Restoration Program)
- Sacramento River Conservation Area Program (Ecosystem Restoration Program)

Clearly, CALFED has included consideration of a wide range of efforts including many interests across many geographic reaches. It is notable that renewal of the Settlement Contracts is consistent with the CVPIA, which is specifically included in the projects considered under CALFED.

3. Water Needs Assessment

Water Needs Assessments

Water Needs Assessments conducted in support of the SRSC contract renewal process served to evaluate past beneficial use of contract water supplies; provided water demand and supply information under current and future conditions; and provided an estimate of contractor-specific needs for the contract water supplies by the year 2020.

Water Needs Assessments were prepared for the20 contractors that had more than 2,000 irrigable acres (agricultural) or allocated more than 2,000 acre-feet of water (municipal and industrial). Those 20 contractors account for approximately 94 percent of the total water diverted by the SRSCs. Eighteen of twenty Water Needs Assessments showed that the contractors had a future need for their existing contract supply.

If a contractor's supply exceeded demand, but was within 10 percent for contracts in excess of 15,000 acre-feet or 25 percent for contracts equal to or less than 15,000 acre-feet, then the test of full future need of the water supplies was deemed to be met. The contract amounts for ACID and SWMC were reduced based upon Reclamation's Water Needs Assessments for these contractors.

Projections of irrigated acreage in the year 2020 are estimates. Individual contractors have the best insight into the factors affecting future land uses that are required to estimate these quantities. Cropping patterns do and will continue to change, and it is presumptuous to believe the contractors should not plan to irrigate the land in their service areas when the economic opportunities arise. Reclamation accepts the contractor's estimates so long as the contractor's projections of irrigation demand is consistent with total irrigated acreage (accounting for potential areas of double cropping).

Reclamation did consider other water sources during the preparation of Water Needs Assessments for water service contractors. However, as explained in Thematic Response No. 1, the Settlement Contracts are different from water service contracts. Reclamation does not have the authority to require the contractors to pump groundwater instead of using their full contract quantities. These contracts were negotiated to settle disputes over the respective rights of the contractors and the United States. The contractors' use of water during the contract period is not to be used as a reference to how the contractors would have used the water under their water right(s). It should be assumed that the contractors would have exercised due diligence to fully protect or prove their water rights. Existing language in the Settlement Contracts provides that the contractors' water use during the term of the contract cannot be construed as an admission that such water use was not water it would have been entitled to under their water rights.

The Water Needs Assessments take into account the variations in water quality of the irrigation water. Water use efficiency is estimated as 80 percent if water quality is a concern (i.e., applied water is of lower quality) and 85 percent for other, higher quality sources.

Historical Use

Several commentors have focused on diversions by certain SRSCs during the 1997 to 2001 period as a basis for alleging that the SRSCs' might not reasonably and beneficially use the proposed contract totals in future years. Reclamation has reviewed these comments and concludes that use of the average recent diversions is inaccurate and inappropriate for the purposes of conducting Water Needs Assessments for long-term contract renewals. Focusing on recent average diversions, particularly during the 1997 to 2001 period, is inappropriate for at least the following reasons:

1. Use of an average diversion is inconsistent with the development of water right quantities by the State Water Resources Control Board, Division of Water Rights.
2. Recent diversions from the Sacramento River have been reduced because of fishery protection. As improvements to diversion facilities have taken place since 2001, such as fish screens on the GCID diversion facility, increased diversions have occurred and likely will continue.
3. Using recent reduced diversions, to establish a contract quantity, might result in impacts to other areas that have relied on the tailwater from upstream irrigation, or result in forced and unmanaged groundwater use.
4. The use of recent diversions incorporates the past conservation, including reuse, shorter varieties of rice, laser leveling of fields, and other technological advances. These advances are recognized as conservation measures, and the conserved water is recognized as beneficial use under a water right.
5. The sum of the individual maximum year of diversions for each of the larger SRSCs exceeds the sum of the proposed contract quantities by approximately 4 percent.
6. The use of the average recent diversions is inappropriate because of the inability for agricultural water users to operate to a precise number because of numerous variables, including weather and other factors outside of their control.
7. Most of the larger SRSCs are irrigation districts or mutual water companies. These contractors do not have the ability or authority to dictate cropping patterns within their service areas. Cropping patterns are influenced by commodity prices and world markets beyond the control of the contractors. Because of these influences, water needs in any year may be higher or lower than some average period.
8. The SRSCs have implemented measures, such as the reuse of water, and other tools that have allowed them to reduce diversions from the Sacramento River; which is a benefit to the overall system. However, it is important to note that historically, the SRSCs have used their full contract amount, and retain the ability to divert full contract amount even with the implemented system improvements. Periodic use of full contract amounts may be necessary because of crop rotation, unusual weather patterns, or other occurrences typical to agricultural operations.
9. Many SRSCs are only recently dealing with the increased need for water to decompose rice straw. This is a new need for water that has generally occurred after the 1997 to 2001 period used by the commentors.

Water Conservation

The Settlement Contracts require that a contractor implement an effective water conservation and efficiency program based on the Basinwide Water Management Plan or the contractor's water conservation plan and meet the conservation and efficiency criteria established under federal law. The contractor's water conservation and efficiency program must contain definite conservation objectives and time schedules for meeting those objectives. The contract requires the contractor to report the status of its implementation of its plan, and at 5-year intervals, the plans must be revised to meet then-current conservation and efficiency criteria.

The argument for water conservation is valid, but it needs to be recognized that the SRSCs are facing significant increases in the cost of CVP water under the renewal contracts. Pricing is the driving force to achieve water conservation. No longer will the SRSCs have a fixed rate at $2.00 per acre-foot. They will now have to pay an annually adjusted cost-of-service rate that is 7 to 8 times higher, on average. In addition, they have to pay an annually adjusted Restoration Fund charge (pursuant to the CVPIA) of approximately $8.00 for each acre-foot of CVP water diverted. Also, Reclamation and the SRSCs have agreed that the SRSCs will pay a fee equal to 50 percent of the storage operation and maintenance and capital cost components to reschedule Base Supply water into the months of June, July, August, September, or October.

Reclamation and the contractors have also agreed that take-or-pay will only apply to the first 75 percent of their Project Water. This figure is in line with the contractor's historical use of their Project Water. Amounts over 75 percent will be paid for on an as-delivered basis. Finally, the contract contains a provision that will allow a contractor to elect to reduce the amount of Project Water they will take in any year. These measures provide significant incentives for water conservation. Tiered pricing and the requirement that the contractors be charged for water actually delivered applies only to 9(e) contracts. Reclamation disagrees with the assertion that the Settlement Contracts are 9(e) contracts.

Generally, many water conservation measures that could be taken on the Sacramento River have only limited economic practicality. Many SRSCs have indicated that they cannot implement additional conservation without substantial (or perhaps total) outside funding. In addition, because most of the "losses" return back to the system, downstream users are not necessarily adversely affected if the SRSCs do not reduce those losses. However, it is acknowledged that reducing losses, or increasing efficiency, can result in lower diversions from the river, and there are certain benefits associated with lower diversions.

4. Administrative Process

Ability-To-Pay

The Settlement Contracts provide for cost-of-service water rates for CVP water that are adjusted annually and are calculated to provide for repayment by 2030, of those plant-in-service costs that existed at the end of fiscal year 1980. On average, the rates for CVP water will increase from $2.00 per acre-foot under the existing Settlement Contracts to $18.00 per acre-foot under the renewal Settlement Contracts, plus an additional charge for the Restoration Fund, currently approximately $8.00 per acre-foot.

Interest-free capital and ability-to-pay relief were not appropriate points of negotiation in the renewal CVP water service contracts or Settlement Contracts. These two concepts have been basic tenets of Reclamation law since its inception. Specifically, since the original 1902 Reclamation Project Act, Congress has mandated that costs associated with irrigation water be repaid without interest. Congress has reaffirmed this principle in many major bills addressing the Reclamation program up through and including the Reclamation Reform Act of 1982 and the CVPIA.

Recognizing the need to balance the repayment obligations for a project equitably among the various users of services provided by the project, the concept of "ability-to-pay" has been embedded in Reclamation law for at least 80 years[1]. Section 3407(d)(2)(A) of the CVPIA further extends the ability-to-pay relief to CVP irrigators' Restoration Fund charges if the Secretary of the Interior finds that such relief is necessary to reduce the charge "to an amount within the probable ability of the water users to pay." This direct application of ability-to-pay concepts to a charge unique to the CVP is consistent with the original Congressional authorization of the project in the Rivers and Harbor Act of 1940 (54 Stat. 1198). Congress declared, among other things, that the generation and sale of electric energy would be a means of financially aiding and assisting the other undertakings of the CVP, including flood control, navigation, and storage and delivery of water.

Consistent with the CVPIA, other Reclamation law, and Reclamation policy, Reclamation has completed ability-to-pay analyses. In addition, Reclamation updates those analyses every 5 years. It should be noted that under provisions of the Reclamation Reform Act requiring that rates at least equal to the operation and maintenance costs of the project be charged, an ability-to-pay analysis cannot result in the delivery of water for less than those operation an maintenance costs. Ability-to-pay adjustments can apply only to capital charges, and, in the case of the CVP, to Restoration Fund charges. As stated in the congressional authorization of the CVP, the generation and sale of electric energy provides the funds to pay charges from which irrigators are relieved. Therefore, although some water contractors receive ability-to-pay relief, all existing CVP capital costs allocated to water supply functions will be recovered during the Congressionally mandated CVP repayment period, and all Restoration Fund charges are collected under a similar time frame.

Rationale for not Extending Comment Period

Section 9 of the Reclamation Project Act of 1939 (43 U.S.C. 485h) was amended by Section 226 of the Reclamation Reform Act of 1982 (43 U.S.C. 390aa) that requires a 60-day public review and comment period before entering into any new or amended contract for the delivery of irrigation water.

Letters were received requesting the public comment period be extended and public workshops be conducted pending receipt of the NOAA-Fisheries Biological Opinion on the CVP-OCAP, so the public would have an opportunity to concurrently review the environmental documents and the proposed contracts. Reclamation declined to extend the comment period because the Biological Assessments for the operation of the CVP as a whole, and renewal of the Settlement Contracts in particular, and the Draft EIS were all available during the public review period of the Draft EIS. In addition, the overall CVP-OCAP Biological Assessments were available via Reclamation's Central Valley operations office for some months before the Draft EIS was released. Thus, there has been ample time to review the environmental

1 ". . . the Secretary is authorized to fix different construction charges against different classes of land under the same project for the purpose of equitably apportioning the total construction costs so that all lands may as far as practicable bear the burden of such costs according to their productive value" (43 USC Sec. 462). Similar references to ability-to-pay appear in 43 USC Sec. 485b-1; 43 USC Sec. 485h; and 43 USC 485h-1.

analyses that will be considered by decisionmakers. Should a Biological Opinion differ from the analyses and conclusions set forth in Reclamation's documents, the effect can be expected to constrain rather than expand the options. Thus, Reclamation's analyses represent the maximum environmental change to be expected, and therefore, the public has been fully informed of what changes might be. Actual changes will be equal to or less than those predicted, and the Biological Opinion is therefore not required to obtain a sense of what the implications of the proposed action would be.

Moreover, Reclamation is committed to an open and full process for public input; and consistent with that approach, contract negotiations have been held in public and have included an opportunity for public comment at each session. To date, more than 190 such sessions/workshops have been open to the public. Reclamation has also maintained an extensive web site to inform the public of the status and content of contract negotiations, located at www.usbr.gov/mp/cvpia/3404c/index.html, and has posted the relevant environmental documents.

5. Summary of Incremental Impacts

Concerns have been raised regarding the descriptions of impacts under the Preferred Alternative. This thematic response summarizes the differences (and similarities) between the No Action Alternative and Preferred Alternative as well as the assumptions inherent in determining potential impacts from implementing the Preferred Alternative.

Comparison of No Action Alternative and Alternative 1: Preferred Alternative – Negotiated Contract

Table 2 summarizes the No Action Alternative and Alternative 1: Preferred Alternative – Negotiated Contract. Table 2 consists of five discussion rows, including Total Contract Amount, Shortage Provisions, Contract Period, Rescheduling of Base Supply and Project Water, and Water Conservation. This table outlines the two alternatives for comparison purposes.

TABLE 2

PROVISIONS INCLUDED IN NO ACTION (EXISTING SETTLEMENT CONTRACT) AND PREFERRED ALTERNATIVE (NEGOTIATED CONTRACT)

Provision	No Action – Existing Settlement Contract	Alternative 1: Preferred Alternative – Negotiated Contract
Total Contract Amount	2,316 KAFY	2,227 KAFY
Shortage Provisions	Reductions of 25 percent in deliveries during critical years only	Reductions of 25 percent in deliveries during critical years only
Contract Period	40 years	40 years
Rescheduling of Base Supply	Permitted without cost within critical months or into non-critical months	Fee for the rescheduling of Base Supply during critical months or into non-critical months, except April and May, in excess of the monthly quantity shown in Exhibit A of each SRSC's contract
Water Conservation	Cost-effective Best Management Practices that are economical and appropriate, including measurement	Program based on the Best Water Management Practices and/or the SRSC's water conservation plan that

TABLE 2

PROVISIONS INCLUDED IN NO ACTION (EXISTING SETTLEMENT CONTRACT) AND PREFERRED ALTERNATIVE (NEGOTIATED CONTRACT)

Provision	No Action – Existing Settlement Contract	Alternative 1: Preferred Alternative – Negotiated Contract
	devices, pricing structures, demand management, public information, and financial incentives	has been determined by the Contracting Officer to meet requirements under federal law, which allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a) Settlement Contract

Alternative Impact Determination

In determining the environmental impacts of the No Action Alternative and the Preferred Alternative, it was necessary to make basic assumptions regarding secondary effects. The following assumptions are outlined to provide a clear explanation for the finding of no environmental impacts associated with either the No Action Alternative or the Preferred Alternative.

In all but two cases (ACID and SMWC), contract amounts remain unchanged; therefore, typical water use among the districts would also remain unchanged. Contract reductions for ACID and SMWC were based on Reclamation’s needs analyses, whereby water needs were evaluated according to irrigated acreage and crop patterns that represent typical district operations. Reclamation has determined that because these analyses are based on historical data of actual use, it is reasonable to assume that operations would be unchanged under reduced contract totals, given that contract reductions for ACID and SMWC result in matching water needs with actual use. Therefore, there is no assumed on-field change between current and revised contract totals. Some SRSCs disagree with the assumptions used in the needs analysis; however, all parties have agreed on the final contract amounts.

The second assumption necessary to assess impacts is how SRSCs would respond to drought conditions. Under the existing contract (i.e., the no action condition), SRSCs are subject to a 25 percent reduction in critical years. On the basis of input from the SRSC representatives, it was determined that in critical years, districts and member farmers turn to short-term supplies for water; typically increased use of groundwater and drainwater. Using this information, there are no anticipated impacts for Alternative 1 during drought conditions because the definition of critical years and the application of a shortage provision are the same as under the No Action Alternative.

Assessing impacts outside the SRSCs also requires basic assumptions about drought operations. As noted previously, Alternative 1 is identical to the No Action Alternative in terms of drought-year frequency; therefore, operations would remain unchanged and no impacts would occur.

In summary, the No Action Alternative is identical to the existing conditions and therefore would not affect resources associated with the SRSCs. Additionally, because Alternative 1, the Preferred Alternative, is essentially a continuation of existing conditions, no environmental effects are associated with the Preferred Alternative and, therefore, can be considered to be environmentally superior to the other action alternatives.

6. Water Transfers

Several commentors expressed concern regarding the potential transfer of SRSC water to other entities. Specifically, commentors suggested that SRSCs stood to receive monetary gains through the sale or lease of water and that such gains were inconsistent with the public interest. To the contrary, water transfers are generally considered a mechanism to facilitate the efficient use of water. If SRSCs were unable to derive an economic benefit from water transfers, there would be no incentive for them to facilitate water transfers. In fact, important language in the CVPIA attempted to facilitate water transfers, recognizing the potential environmental and social benefits of water transfers. The CVPIA transfer provisions build on California law that similarly states the desirability of water transfers. Moreover, because of the complex nature of water transfers, there are misperceptions about the actual monetary gains that may be obtained through water transfers.

General Overview of Water Transfers

Water rights are governed by state law, which in California, includes many complex provisions regarding seniority, use, and transfer. Under this system, ownership of water is separate from the ability to use water. Under state law, water is owned by the citizens of the state, but the right to divert and use water is the property of water rights holders. Technically, it is the ability to use water in a particular location that is transferred for use in another discrete location. Water transfers typically involve the temporary lease of the right to use water in exchange for a fee. In simple terms, the increased use of water by the “buyer” is offset by the reduction in use by a water rights holder, the “seller.”

In practice, water transfers are complex. First, water rights holders must establish that they are using water beneficially. Beneficial use includes application as irrigation, provision of municipal or industrial water, recreational use, and wildlife habitat, among other uses. In the case of SRSCs, water use is variable, driven by climatic, market, and seasonal factors. For example, water demand for agriculture increases in drought years because drought years are generally hotter than wet years, thus requiring more water for crop production. Furthermore, market prices for various farm commodities affect cropping decisions by various farmers and can change the amount and timing of water demand.

Once the beneficial use of the water right holder is established, potential water transfers are subject to review for impacts to third parties and the environment. This review can also be complex because of the numerous water right holders in California (potential “third parties”) and the environmental sensitivity of water itself. SRSC contract provisions regarding water transfers are consistent with both state and federal law. Transfers of CVP water must be approved by Reclamation in accordance with statutes and Reclamation’s transfer guidelines. This provides review of transfers to assure that impacts to the environment and third parties are taken into account.

In recent years, water transfers have attracted increasing interest, usually for transactions directly between agricultural and municipal water users. Sometimes the transactions are proposed by private firms looking to capitalize on the potential market for water. In basic terms, the interest in water marketing is directly related to typical costs for water use in agricultural settings versus municipal settings. Agricultural water is less expensive than municipal water, which, when coupled with challenging economic conditions for farmers, provides the incentive for agricultural users to transfer water to municipal users. However, because of the complicated and unpredictable nature of water transfers, the transaction costs of regulatory approval, analysis, and monitoring can also be very high

More specific information regarding water transfers can be found on the State Water Resources Control Board web site at http://www.waterrights.ca.gov/watertransfer/.

Water Transfers and CVPIA

Prior to the CVPIA, there was no authority for the transfer of CVP water. Under the CVPIA, transfers outside of the basin are limited to historical use [Section 3405(a)(1)(A)] and consumptive use [Section 3405(a)(1)(I)]. Under CVPIA Section 3407(d)(2)(A), transfers to non-CVP contractors carry an extra $25.00 per acre-foot assessment for the Restoration Fund. Parties involved in transfers are free to negotiate prices at market rates.

The aforementioned CVPIA provisions were highly praised by the authors of the legislation and a variety of business, environmental, urban media, and municipal water organizations. Both state and federal law strongly encourage water transfers. Transferors are protected by state and federal law from after-the-fact assertions that transfers are evidence of a lack of need for the water transferred. Transfers of Base Supply must be accomplished in accordance with state law. All potential transfers would be subject to the requirements of both the California Environmental Quality Act and NEPA and undergo separate environmental review.

7. Relationship between NOAA-Fisheries Biological Opinion on the CVP-OCAP and the Settlement Contracts

Several commentors provided comments on the relationship between the NOAA-Fisheries Biological Opinion on the CVP-OCAP consultation under the Endangered Species Act, which specifically addresses winter- and spring-run Chinook salmon, and the renewal of the Settlement Contracts. Specifically, several commentors associated aspects of the CVP-OCAP process with the Settlement Contract renewals that are not related to the Settlement Contracts. Examples include proposed operations of Red Bluff Diversion Dam, flow releases on the Trinity River, and changes in pumping capacity at state and federal pumping facilities in the Bay-Delta, among others.

It is important to recognize the administrative relationship between the overall CVP-OCAP consultation process and the Settlement Contract renewals. The CVP-OCAP consultation process included preparation of four primary documents:

1. Long-Term CVP-OCAP Project Description, outlining the operations of the state and federal water projects. This document is included as Appendix C to this Final EIS.

2. Reclamation Long-Term CVP-OCAP Biological Assessment, outlining Reclamation's assessment of the biological implications of operating the state and federal water projects. This document is not reproduced as an appendix to this Final EIS.

3. USFWS Biological Opinion on the CVP-OCAP, outlining USFWS's conclusion regarding impacts to threatened and endangered species from operation of the state and federal water projects. This document is included as Appendix A to this Final EIS.

4. NOAA-Fisheries Biological Opinion on the CVP-OCAP, outlining NOAA-Fisheries' conclusion regarding impacts to threatened and endangered species from operation of the state and federal water projects. This document is included as Appendix B to this Final EIS.

In basic terms, the description of operations in the CVP-OCAP Project Description (Document 1, above) forms the basis for Reclamation's CVP-OCAP Biological Assessment (Document 2, above), which outlines Reclamation's analyses regarding likely impacts to threatened and endangered species. The USFWS Biological Opinion on the CVP-OCAP (Document 3, above) and the NOAA-Fisheries Biological Opinion on the CVP-OCAP (Document 4, above) essentially respond to Reclamation's CVP-OCAP Biological Assessment, finalizing the impacts and outlining required conditions for operating the system. Both Biological Opinions conclude that operation of the system as proposed by Reclamation will not jeopardize the continued existence of threatened or endangered species.

Delivery of water to the SRSCs is a part of the overall operations of the CVP system. The CVP-OCAP Project Description notes its purpose as follows:

- [CVP-OCAP Project Description] identifies the many factors influencing the physical and institutional conditions and decisionmaking process under which the project currently operates. Regulatory and legal requirements are explained; alternative operating models and strategies are described.

- [CVP-OCAP Project Description] notes that current total water demand for CVP water is about 3.5 MAF for the Delta export service area, and 3.3 MAF for the Sacramento Basin. Of this demand, approximately 2.2 MAF must be made available to SRSCs, unless Shasta inflow is considered "critical," in which case supplies are reduced by 25 percent.

- As outlined on page 5-6 of the [CVP-OCAP Project Description], Settlement Contract water is given a relatively high priority for delivery. For example, Settlement Contract water is allocated before other water service contract water. However, delivery of water to SRSCs does not preclude use of the water for other purposes.

A primary example of the multiple use of water involves temperature control for winter-run Chinook salmon in the Sacramento River. As noted in the NOAA-Fisheries Biological Opinion on the CVP-OCAP (page 219), temperature standards are determined by carryover storage (the amount of water in Shasta Reservoir on September 30) and by the amount of cold water available in Shasta Reservoir on May 30. The combination of these factors determines how far downstream to set the temperature compliance points, which determines the amount of suitable habitat for endangered winter-run Chinook salmon. Management of the temperature compliance point is consistent with provision of water for SRSCs because the majority of SRSCs are downstream of the compliance points. Thus, after the water is used to provide habitat for salmon, it is available for use by SRSCs.

Other CVP operations are unrelated to the SRSCs. These include operations on the Trinity and American Rivers, and operation of Red Bluff Diversion Dam. Changes to these facilities are subject to separate processes, considered elsewhere. However, for the purpose of the overall ESA compliance effort, the CVP-OCAP system, which includes all of the water facilities in the CVP, was considered in its entirety.

Separate ESA consultation was undertaken for the project-specific actions considered as part of contract renewal. Both the USFWS and NOAA-Fisheries concluded that renewal of the Settlement Contracts is not likely to jeopardize continued existence of threatened or endangered species.

8. SRSC Efforts to Promote Fish Passage and Survivability

Several comments received on the Draft EIS address concerns regarding the potential impacts of renewal of the Settlement Contracts on fisheries. As discussed in Chapter 3 of the Draft EIS, Biological Environment, renewal of the Settlement Contracts under the Preferred Alternative will not result in any adverse impacts on fisheries. In addition, many of the larger SRSCs have undertaken programs to promote fish passage and survivability on the Sacramento River. Some of these projects are as follows:

Glenn-Colusa Irrigation District (GCID): GCID operates a state-of-the-art fish screening facility – the largest of its kind in the world. GCID diverts a maximum of 3,000 cubic feet per second from the Sacramento River, with the peak demand occurring during spring months at the same time as the peak outmigration of juvenile salmon. Key components of GCID’s fish screen facility include a 600-foot extension to GCID’s pre-existing fish screen and a stabilizing gradient facility in the mainstem of the Sacramento River. This project is designed and operated to minimize losses of all fish in the vicinity of the pumping plant diversion, including endangered winter-run Chinook salmon, while maximizing GCID’s capability to divert the full quantity of water it is entitled to use to meet its water supply delivery obligations. The total capital cost of GCID’s fish screening project is estimated to be approximately $76 million.

M&T Chico Ranch (MTCR): MTCR environmental restoration activities included relocating the MTCR Pumping Station from the mouth of Big Chico Creek to the Sacramento River and screening the new diversion. MTCR intends to complete this project by installing a remaining pump behind the screens. This project ensures a guaranteed water supply to over 8,000 acres of permanent wetlands and over 1,500 acres of seasonal wetlands. Additionally, it also protects habitat for migrating spring-run Chinook salmon. One other important benefit of this project is MTCR’s agreement to provide fish flows in the amount of 40 cubic feet per second in Butte Creek, one of the most important and last remaining spawning areas for spring-run salmon.

Maxwell Irrigation District (MID): MID now operates a state-of-the-art positive-barrier fish screen, one of the first of its kind installed on the Sacramento River. Completed in 1994, the new pumping plant and screen facility protects threatened steelhead and spring-run

Chinook salmon, and endangered winter-run Chinook salmon. In 2002, MID incorporated a neighboring diversion into the existing project, thereby eliminating another unscreened diversion on the Sacramento River.

NCMWC: NCMWC has completed the feasibility, preliminary design, and environmental evaluation work associated with consolidation of five Sacramento River diversions into two screened facilities. The project will remove pumping from an area (Natomas Cross Canal Channel) that can be preserved for fish passage and provide new protections for terrestrial species by preserving and enhancing important habitat. The consolidation of diversions and upgrading of associated infrastructure will allow the NCMWC project to also help neighboring communities achieve regional water management improvements by connecting the Sacramento and American Rivers for the first time, thus making regional groundwater recharge and banking possible while reducing diversion impacts on the American River.

Pelger Mutual Water Company (Pelger): In 1994, Pelger completed construction of its new pumping station and positive-barrier fish screen in the Sacramento River near Knight's Landing. This facility includes pumps with a discharge capacity of 60 cubic feet per second. The screen protects spring and winter runs of Chinook salmon as well as steelhead trout.

Princeton-Codora-Glenn Irrigation District (PCGID) and Provident Irrigation District (PID): Recently completed the fourth largest fish screen on the Sacramento River. The completed facility replaces three major diversions on the Sacramento River with a consolidated, screened pumping plant. In addition to the fishery benefits, the project also provides reliable water supplies for nearly 30,000 acres of farmland and thousands of acres of seasonal wetlands for migrating waterfowl in PCGID and PID. The districts conducted a dedication ceremony for the screen on November 8, 2001.

Reclamation District No. 108 (RD 108): In 2000, RD 108 completed construction of a positive-barrier fish screen on the Sacramento River. The project, located at the district's Wilkins Slough diversion, protects migrating endangered winter-run Chinook salmon, as well as the spring-run Chinook and steelhead trout. The design for the new screen facility was chosen after several years were spent examining the performance of alternate screen technologies.

RD 108 is currently developing a new fish screen project that will consolidate its three largest unscreened river diversions into one pumping plant with a new fish protection screen facility. This project is scheduled to enter its construction phase in 2005, if it receives adequate funding.

Reclamation District No. 1004 (RD 1004): RD 1004 completed construction on its screen in 1998. In addition to construction of a positive-barrier fish screen, this project relocated the Princeton Pumping Plant and necessary conveyance facilities to a more stable location along the Sacramento River. This project eliminates significant adverse impacts to fish inhabiting the Sacramento River, including juvenile winter-run Chinook salmon and steelhead.

Richter Brothers: The Richter Brothers diversion on the Sacramento River near Knight's Landing is located along a reach of the river that hosts several species of salmon, steelhead trout, and the Sacramento splittail minnow. Richter Brothers have received CALFED funding for feasibility studies and preliminary design for an improved diversion that will provide an important protective role for fish in this critical stretch of the river.

SMWC: SMWC has completed the design work on the fish screen project for its diversion on the Sacramento River just downstream from the Tisdale Weir. The Tisdale Pumping Plant is the largest remaining unscreened diversion on the Sacramento River. SMWC is scheduled to begin construction on the screen in 2005, if adequate funding is secured.

CHAPTER 3
SPECIFIC COMMENTS AND RESPONSES TO COMMENTS ON THE DRAFT EIS

The following pages present comments received on the Draft EIS for the SRSCs and responses to those comments. Comments were received from the following individuals and public agencies:

- Tim Lasko
- David Simpson
- Dan Bacher
- Jonathan McClelland
- Lindsey Pernell
- Friends of the River
- Butte Environmental Council
- United States Environmental Protection Agency
- Natural Resources Defense Council
- Tom Rider
- Megan Ahlstrom
- Tyana Maddock
- Julie Sullivan
- Victor Scoggin
- Morisset, Schlosser, Jozwiak & McGaw
- The Bay Institute Natural Resources Defense Council
- Kelley Breen
- Elyce Judith
- Mitchell Solovay
- Dan
- Jean Hegland
- Kirk Lumpkin
- Bruce Smith
- Kevin Wolf
- Wanda Mathews-Woods
- Jeanette Alosi
- Doug Perske
- David Enevoldsen
- Scott Chamberlain
- William Divens
- Elizabeth Berteaux
- Barbara Williams
- Gordon Becker
- Lamar Pittman
- Milan Cole

Go to Comments...

- Tammy Mebane
- Office of Congressman George Miller
- Associated Students/Community Legal Information Center

Copies of the original letters of comment are presented on the left side of each of the following pages, with individual comments numerically identified. Responses to individual comments are provided to the right of each letter.

Go to Comments...

CHAPTER 4
REVISED DRAFT EIS

This chapter presents the Draft EIS in its original format. The Draft EIS has been amended in response to public comment and incorporates additional information, corrections, and changes. Changes are detailed in the text that follows (new text is underlined, and deleted text is stricken [i.e., ~~deleted~~]). Note that the page numbers follow the same convention as in the Draft EIS. That is, page numbering begins in the Table of Contents with iii and continues through page 1-1, 2-1, 3-1, and so on. No changes were made to Draft EIS figures and, thus, have not been included in the text that follows (however, a figure identification sheet is provided for each figure referenced).

DRAFT REPORT

Sacramento River Settlement Contractors Environmental Impact Statement

Prepared for

U.S. Bureau of Reclamation

September 2004

CH2MHILL

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Appendices

Tables

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ACRONYMS AND ABBREVIATIONS

µg/m3	micrograms per cubic meter
°F	degrees Fahrenheit
Accord	Bay-Delta Accord
ACID	Anderson-Cottonwood Irrigation District
AF	acre-feet
AFY	acre-feet per year
BLM	Bureau of Land Management
BWMP	Basinwide Water Management Plan
CAAQS	California Ambient Air Quality Standards
CDFG	California Department of Fish and Game
CDMWC	Colusa Drain Mutual Water Company
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
COE	Corps of Engineers
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
D	Decision
~~Department~~	~~California Department of Water Resources~~
DPR	Department of Parks and Recreation
Department	California Department of Water Resources
EDD	Employment Development Department
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Agency
GCID	Glenn-Colusa Irrigation District
gpd	gallons per day
KAFY	thousand acre-feet per year
M&I	municipal and industrial
MAF	million acre-feet
MFWC	Meridian Farms Water Company
MID	Maxwell Irrigation District
NAAQS	National Ambient Air Quality Standards
NCMWC	Natomas Central Mutual Water Company
NEPA	National Environmental Policy Act
NOAA-Fisheries	National Oceanic and Atmospheric Administration - Fisheries
NPS	National Park Service
OCAP	Operations Criteria and Plan
PCGID	Princeton-Codora-Glenn Irrigation District
PEIS	Programmatic Environmental Impact Statement
PID	Provident Irrigation District
RD 1004	Reclamation District No. 1004
Plan	Bay-Delta Water Quality Control Plan

PM_{10}	particulate matter less than 10 (respirable) microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 (fine) microns in diameter
PMWC	Pelger Mutual Water Company
ppm	parts per million
ppm	parts per million
RD 108	Reclamation District No. 108
Reclamation	U.S. Bureau of Reclamation
Regional Criteria	Regional Criteria for Evaluating Water Management Plans for the Sacramento River Contractors
Regional Plan	Regional Water Management Plan
Service	U.S. Fish and Wildlife Service
SMWC	Sutter Mutual Water Company
SRSC	Sacramento River Settlement Contractor
State Board	State Water Resources Control Board
SVAB	Sacramento Valley Air Basin
SWP	State Water Project
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
~~WMA~~WA	Wildlife ~~Management~~ Area
WQCP	Water Quality Control Plan

CHAPTER 1
PURPOSE AND NEED

INTRODUCTION

This Environmental Impact Statement (EIS) evaluates the potential impacts and benefits for the U.S. Bureau of Reclamation (Reclamation), as lead agency, to renew the long-term Sacramento River Settlement Contracts (Settlement Contracts) between Reclamation and the Sacramento River Settlement Contractors (SRSC). The Settlement Contracts provide for an agreement regarding the SRSCs' diversions of natural flow from the Sacramento River and tributaries thereto, and Reclamation's delivery of Central Valley Project (CVP) water for agricultural and municipal and industrial (M&I) uses.

The SRSCs consist of 145 contractors that can be categorized into the following three groups:

- Irrigation Districts/Water Districts/Mutual Water Companies/Municipalities
- Individuals – Standard-form Contract
- Individuals – Short-form Contract

As part of this action, Reclamation also proposes to renew its contract with the CDMW~~M~~C. CDMWC's contract provides for payment of water diverted from the Colusa Basin Drain that would otherwise flow into the Sacramento River to satisfy the rights of senior water right holders. Water in the drain stems from return flows resulting from ~~diverions~~diversions by upstream SRSC~~'~~s; therefore, Reclamation determined that the EIS should also evaluate the effects of renewing the CDMWC contract.

Together, 145 SRSCs may ~~have rights to~~ divert approximately 2.2 million acre-feet (MAF) per year from the Sacramento River (except during critical years as defined under the Settlement Contracts). The CDMWC has a contract entitlement that requires Reclamation to release up to an additional 100,000 acre-feet per year (AFY) into the Sacramento River, to replace the water diverted from the Colusa Basin Drain that would otherwise return to the Sacramento River~~as part of a negotiated water rights settlement~~. All of these contractors are listed in Appendix A.

The ~~contract amounts~~ contract quantities range from 4 to 825,000 AFY. The 20 largest SRSCs listed in Table 1-1 account for approximately 95 percent of the total contracted amount.

With the exception of Sutter Mutual Water Company (SMWC) and Anderson-Cottonwood Irrigation District (ACID), the renewed contracts would provide for the continued diversions and delivery of the same quantities of water as the existing Settlement Contracts. For SMWC and ACID, the renewed contracts include slightly reduced contract amounts. In addition, the renewed contract for Colusa Drain Mutual Water Company would require a reduced "release" by Reclamation; whereas, the current contract allows for up to 100,000 afy to be released into the Sacramento River as part of a negotiated water rights settlement, the renewed contract would allow only up to a maximum of 70,000 afy to be released, and releases will be calculated according to a formula that accounts for the actual amount of acreage being irrigated. Table 1-1 shows the contract amounts under the existing contracts for 20 of the largest SRSCs.

The contract renewals also provide for continued diversions and delivery of water to the same lands and for the same purposes, with one exception. Natomas Central Mutual Water Company (NCMWC) has requested a change in authorized use from agricultural to M&I in the Metro Air Park portion of its service area.

The term of the~~se~~ existing Settlement Contracts was not to exceed 40 years, and these contracts were scheduled to expire on March 31, 2004. On December 1, 2003, however, Congress passed Public Law 108-37. Section 218 of that Act states,

> "The Secretary of the Interior shall extend the term of the Sacramento River Settlement Contracts, long- and short-form, entered into by the United States with various districts and individuals, pursuant to section 14 of the Reclamation Project Act of 1939 (53 Stat. 1197), for a period of 2 additional years after the date on which each of the contracts, respectively, would expire but for this section, or until renewal contracts are executed, whichever occurs earlier."

Pursuant to this congressional mandate, Reclamation has issued written notices to the SRSCs confirming that all terms and conditions of their existing Settlement Contracts will remain in full force and effect during the extension period.

TABLE 1-1

TWENTY LARGEST (AF) EXISTING SRSC CONTRACT TOTALS

Contractors[a]	CVP Project Water		Base Supply	TOTAL
	Agricultural	M&I	Water Rights	
ACID	10,000		165,000	175,000
GCID	105,000		720,000	825,000
MID	6,000		11,980	17,980
MFWC	12,000		23,000	35,000
NCMWC	22,000		98,200	120,200
PMWC	1,750		7,110	8,860
Pleasant Grove-Verona	2,500		23,790	26,290
PCGID	15,000		52,810	67,810
PID	5,000		49,730	54,730
RD 1004	15,000		56,400	71,400
RD 108	33,000		199,000	232,000
City of Redding		3,150	17,850	21,000
SMWC	95,000		172,900	267,900
Tisdale Irrigation Company	2,000		7,900	9,900
Conaway Conservancy Group	672		50,190	50,862
Davis Ranch	9,800		22,000	31,800
Lomo Cold Storage	700~~6,410~~		6,410~~700~~	7,110

TABLE 1-1

TWENTY LARGEST (AF) EXISTING SRSC CONTRACT TOTALS

	CVP Project Water		Base Supply	
Contractors[a]	**Agricultural**	**M&I**	**Water Rights**	**TOTAL**
M & T Chico Ranch, Inc.	976~~16,980~~		16,980~~976~~	17,956
Reynen	2,000		8,070	10,070
River Garden Farms	500		29,300	29,800
Subtotal[b]	**338,898 ~~360,612~~**	**3,150**	**1,738,620 ~~1,716,906~~**	**2,080,668**
Miscellaneous Users (125 users)	**40,858**		**94,825**	**135,683**
145 SRSCs Subtotal	379,756 ~~401,470~~	3,150	1,833,445 ~~1,811,731~~	2,216,351
CDMWC	~~10~~70,000			~~10~~70,000
Totals	479,756 ~~501,470~~	3,150	1,833,445~~1,811,731~~	2,316,351
20 Largest SRSC Contractors – Percent of Total				**93.9%**
All Other Miscellaneous SRSC Users – Percent of Total				**6.1%**

[a]A complete list of SRSCs is provided in Table 3-7.

[b]This subtotal represents water diverted by the 20 contractors for which Reclamation prepared needs analyses. The threshold for needs analyses was 2,000 irrigable acres or more for irrigation use or 2,000 AFY for M&I use. These 20 contractors represent 94 percent of the total water diverted by the SRSCs. The remaining 125 contractors divert the remaining 6 percent.

Notes:

GCID = Glenn-Colusa Irrigation District

MID = Maxwell Irrigation District
MFWC = Meridian Farms Water Company
PMWC = Pelger Mutual Water Company
PCGID = Princeton-Codora-Glenn Irrigation District
PID = Provident Irrigation District
RD 1004 = Reclamation District No. 1004
RD 108 = Reclamation District No. 108

PURPOSE OF AND NEED FOR THE ACTION

The purpose of this project is to renew the Settlement Contracts, consistent with the applicable provisions of federal Reclamation law and state law.

Long-term contract renewal of the SRSCs is needed for the following reasons:

- To ensure SRSCs of the use of both the regulated and unregulated flow of the Sacramento River and its tributaries, and to provide for the efficient and economical operation of the CVP by, and the reimbursement to, the United States for expenditures made for the CVP.

- To continue beneficial use of water, developed and managed as part of the CVP, with a reasonable balance among competing demands, including the needs of irrigation and domestic uses; fish and wildlife protection, restoration, and mitigation; fish and wildlife enhancement; power generation; recreation; and other water uses consistent with requirements imposed by the State Water Resources Control Board (State Board) and by the Central Valley Project Improvement Act (CVPIA).
- To incorporate certain administrative conditions into the renewed contracts to ensure the CVP's continued compliance with current federal Reclamation law and other applicable statutes.

BASIS FOR SETTLEMENT CONTRACT RENEWALS

Reclamation has authority, under several statutes dating from 1902 to 1992[1], to enter into agreements with the SRSCs to settle disputes over the respective rights of the parties to divert and use water from the Sacramento River. These disputes were settled by an agreement that specifies the quantity of water that can be diverted free of charge (Base Supply), and the quantity that would be paid for by the SRSCs (Project Water). This agreement resulted in the Settlement Contracts. The conditions associated with the delivery of CVP water include, but are not limited to, the following:

- The terms and conditions included within Reclamation's applicable state water right permits/licenses
- The amounts of water each contractor can put to reasonable and beneficial use
- For irrigation water, the number of acres of irrigable and eligible lands within the contractor's boundaries that are also within the authorized CVP service area and the places of use designated in the applicable CVP water right permits/licenses

These conditions do not allow Reclamation to limit or regulate Base Supply water except as provided in the Settlement Contracts.

The Settlement Contracts are distinct from the water service contracts that the United States has executed with other CVP contractors. Unlike the CVP water service contractors, the SRSCs hold senior vested water rights that allow them to divert significant quantities of natural flow from the Sacramento River, regardless of whether they have a contract for CVP supplies.

DECISION TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT

In determining whether to prepare an EIS, Reclamation noted that public comments and input from public meetings, among other factors, suggested that the relatively complex history and

[1] Renewal of the Settlement Contracts is being undertaken pursuant to the following authorities: the Act of June 17, 1902 (32 Stat. 388), and acts amendatory or supplementary thereto, including, but not limited to, the Acts of August 26, 1937 (50 Stat. 844), as amended and supplemented, August 4, 1939 (53 Stat. 1187), as amended and supplemented, including, but not limited to, Sections 9 and 14 thereto, July 2, 1956 (70 Stat. 483), or June 21, 1963 (77 Stat. 68), October 12, 1982 (96 Stat. 1262), October 27, 1986 (100 Stat. 3050), as amended, and Title XXXIV of the Act of October 30, 1992 (106 Stat. 4706).

unique attributes of the Settlement Contracts including their integral role in the operation of the CVP are not widely understood. As a result, the proposal to renew the Settlement Contracts was determined to potentially involve substantial public uncertainty and controversy regarding the nature of the proposal itself and its potential effects on the quality of the human and natural environment. Although initial analysis indicated that renewal of the contracts under the Preferred Alternative would not result in any appreciable changes to the environment, Reclamation determined that it was appropriate to prepare an EIS given the potential for controversy. This EIS provides a detailed explanation of the proposal and any potential for changes in the physical environment, therefore minimizing uncertainty and maximizing the role of public information and environmental considerations in Reclamation's decision-making process consistent with the goals of the National Environmental Policy Act (NEPA).

HISTORY OF THE SACRAMENTO RIVER SETTLEMENT CONTRACTORS

The CVP was first authorized as a federal project in 1935, and includes facilities on the Trinity, Sacramento, and American Rivers; Sacramento-San Joaquin Delta; San Joaquin and Stanislaus Rivers; and offstream storage and conveyance facilities associated with the San Luis Reservoir and Delta-Mendota Canal. Construction of dams on the Sacramento and Trinity Rivers substantially modified the flows of the Sacramento River. Prior to construction of the CVP, individuals and entities along the Sacramento River were diverting water for irrigation and M&I use under various claims of right. To settle the controversy over assertions of water rights, the United States, acting through Reclamation, negotiated contracts that provided for agreement on diversion of natural flows and CVP water service.

The SRSCs include various irrigation districts, reclamation districts, mutual water companies, and partnerships located in the Sacramento River Basin in Northern California. ~~All~~ Most of the majority of the SRSCs have senior vested water rights under California law to divert surface water from the Sacramento River. Without these contracts it would have been difficult, if not impossible, for the United States to develop the balance of the CVP. As a result, these contracts have become known as the Sacramento River ~~Water Rights~~ Settlement Contracts or Settlement Contracts.

Most SRSCs have claims to water rights that pre-exist the CVP. For example, GCID water rights date back to at least 1883, and include pre-1914 water rights and post-1914 appropriative water rights licenses[2]. These collective water rights include adjudicated decreed rights on Stony Creek and pre- and post-1914 water rights on the Sacramento River. Because of the nature of the rights GCID holds, the exact magnitude of these rights has never been fully quantified. However, the claimed rights exceed 1 MAF annually. GCID, ACID and City of Redding are the only SRSCs with claims to pre-1914 water rights. The other SRSCs have

[2] With respect to appropriative water rights in California, the year of 1914 was a significant turning point. In that year, the Water Commission Act became effective, establishing for the first time statutory procedures for appropriating water (those procedures do not apply to riparian water uses). Because that act was not effective until December 19, 1914, water rights obtained prior to that date were not governed by those statutory procedures. Such rights are known as "pre-1914" rights. Thus, pre-1914 rights are rights to appropriate water that were acquired prior to 1914. The key to acquiring and maintaining a pre-1914 right was beneficial use.

claims to post-1914 water rights on the Sacramento River or its tributaries, with relatively small amounts of riparian rights. As discussed above, when the CVP was authorized, the prior water rights of the SRSCs were recognized. It was acknowledged that for the CVP to be constructed and operated, and water rights confirmed, the SRSCs' protests to the granting of CVP water rights must be resolved.

Ultimately, in 1964, GCID and Reclamation entered into the first of the Settlement Contracts, and others followed shortly thereafter using the same basic form of agreement. Using jointly conducted studies and negotiations, the SRSCs and Reclamation arrived at mutually agreeable quantities of Base Supply and Project Water. For each SRSC, a large portion of the water quantities addressed in each contract is referred to as Base Supply, which is diverted without charge. In addition, ~~and in consideration of SRSCs' willingness to settle on a Base Supply quantity,~~ Reclamation agreed to provide the SRSCs with certain designated monthly quantities of CVP water, referred to as "Project Water," primarily in the months of July, August and September. This Project Water is provided to the SRSCs and is subject to all of the pricing and other requirements of federal Reclamation law.

The Settlement Contracts were negotiated documents. The Settlement Contracts recognize the ~~prior~~ direct diversion rights of the SRSCs. However, as an outgrowth of the negotiations, it was agreed that the SRSCs would take an average yield of their water rights from the flow of the Sacramento River and its tributaries thereto, in return for the benefit of the certainty of flow provided by the operation of the CVP. Conversely, the United States received, among other things, certainty as to its operation of the CVP, and avoided litigation, including the potential for a lengthy and expensive adjudication of CVP and other water rights in the Sacramento River watershed. The original contracts, entered into in 1964 for a period of 40 years, were scheduled to expire on March 31, 2004. As discussed above, Congress extended the terms of the contracts for 2 years pursuant to Public Law 108-37.

On October 30, 1992, the CVPIA was signed into law. This act modifies the authorized purposes of the CVP and requires a wide range of environmental improvements and potential changes in how the CVP is operated. It also specifically addresses contract renewals by setting new contract lengths for repayment and water service contracts, and allowed interim renewals until a Programmatic Environmental Impact Statement, prepared pursuant to ~~the compliance with~~ NEPA, was completed with a Record of Decision in January 2001. The CVPIA distinguishes between Settlement Contracts and other types of CVP contracts such as repayment or water service contracts.

STUDY AREA

The study area boundaries for this EIS are presented on Figure 1-1. This area includes the service areas of each of the SRSCs, as listed in Appendix A. Each lies wholly within the CVP service area.

STUDY PERIOD

The analysis for this EIS was conducted for projected conditions in the year 2044, which will extend through the first period of renewal for the 40-year Settlement Contracts. No interim

Figure
1-1 Large Irrigation Diverters in the SRSC Service Area
8X11 COLOR

back side of figure

time conditions were considered or evaluated with respect to build-out conditions or changes in the Settlement Contract.

PUBLIC INVOLVEMENT PROCESS

Reclamation began preparing this EIS during the scoping phase of the NEPA environmental impact study process. Scoping activities began on July 19, 2001, when Reclamation issued a Notice of Intent for the preparation of a NEPA document for the renewal of the ~~SRSCs~~Settlement Contracts. Reclamation then held three scoping meetings and prepared a scoping report, which is included as Appendix B. Scoping served as a fact-finding process that helped identify public concerns and recommendations about the NEPA process, issues that would be addressed in this EIS, and the scope and level of detail for analysis.

RELATED PROJECTS

Several activities are being implemented by Reclamation as part of the obligation to manage and operate the CVP or are directly related to the contract renewals. The following discussion identifies these activities and describes their relationship to the renewal of the Settlement Contracts. Table 1-2 summarizes additional related studies and projects that have been conducted recently or are currently being completed.

TABLE 1-2

RELATED PROJECTS

Project or Study and Lead Agency	Summary
Long-term Contract Renewal of Existing CVP Water Service Contracts – Reclamation	Reclamation is negotiating with other CVP water contractors for renewal of long-term contracts, including contractors for the American River Division, Feather Water District, Shasta-Trinity Divisions, Sacramento Canals Unit, San Luis Unit, Contra Costa Unit, San Felipe Unit, Delta-Mendota Canal Unit, San Joaquin National Veterans' Cemetery, City of Lindsay, City of Fresno, Cross Valley, and Mercy Spring Water District.
Implementation of CVPIA –	Reclamation and the U.S. Fish and Wildlife Service (Service) are proceeding with implementation of other provisions of the CVPIA, including stream restoration, refuge water supplies, and further analysis of yield replacement.
CALFED Bay-Delta Program – CALFED	Established in May 1995, the consortium of federal and state agencies is charged with the development of a long-term solution to the Delta water concerns. CALFED completed an Environmental Impact Report (EIR) and EIS as part of this process. Renewal of long-term CVP contracts is assumed within the CALFED EIR/EIS and Record of Decision.
Trinity River Mainstem Fishery Restoration EIS/EIR – Reclamation, Service, Hoopa Valley Tribe and Trinity County	The Service completed a Final EIS/EIR and Record of Decision. Because of subsequent litigation, the Service is preparing responses to the court's comments. The Service and Reclamation also are implementing a portion of the recommendations for restoration activities along the Trinity River.

RELATED ACTIVITIES

Following are descriptions of long-term activities related to long-term contract renewal.

Central Valley Project Improvement Act Programmatic Environmental Impact Statement

The CVPIA Programmatic Environmental Impact Statement (PEIS) provided a functional evaluation of the impacts of implementing the CVPIA. Four alternatives, 17 supplemental analyses, a Preferred Alternative, and a No Action Alternative were evaluated in the PEIS. The impact analysis in the PEIS was completed at a subregional level but presented within the PEIS on a regional basis for the Sacramento Valley, San Joaquin Valley, and Tulare Lake regions. The PEIS No Action Alternative assumed that existing water service contracts, exchange contracts, and Settlement Contracts would be renewed under the same terms as expiring contracts. The Final PEIS included a Preferred Alternative that addressed the regional impacts and benefits of the general method that Reclamation anticipated for implementation of the CVPIA, including long-term contract renewal.

The PEIS evaluated the impacts and benefits of long-term contract renewals under the CVPIA, including the Settlement Contracts. Following completion of the PEIS, more specific information related to contract renewal proposals has been developed by Reclamation and the SRSCs. This EIS for the renewal of the Settlement Contracts includes the Preferred Alternative of the Final PEIS as the No Action Alternative and evaluates the impacts and benefits of differences among the contract assumptions in the No Action Alternative, the Preferred Alternative (Alternative 1) and additional project alternatives, as described in Chapter 2.

Operations Criteria and Plan Biological Assessment

Reclamation and the California Department of Water Resources (~~Department~~DWR) propose operations of the CVP and State Water Project (SWP) to divert, store, and convey CVP and SWP water consistent with applicable law. These operations are summarized and evaluated in a Biological Assessment, and described in further detail in the CVP Operations Criteria and Plan (OCAP). The Biological Assessment addresses continued operation of the CVP and SWP in a coordinated manner. In addition to current-day operations, the following future actions are included in this consultation:

- Increased flows in the Trinity River
- Increased pumping at Banks Pumping Plant (referred to as 8,500 Banks)
- Permanent barriers operated in the South Delta
- An intertie between the California Aqueduct and the Delta-Mendota Canal
- A long-term Environmental Water Account
- Freeport Regional Water Project
- Various other operational changes described in detail in the Biological Assessment

The current and ongoing effects of diversions by the SRSCs as part of CVP operations are included in this Biological Assessment. The consultation addresses impacts to listed species that could be caused by hydrological and water quality conditions resulting from operation of the CVP and SWP facilities. With respect to long-term contract renewals with the SRSCs, the consultation evaluates the impact to listed species that could result from operating the CVP and SWP to deliver CVP water to the points of diversion of the SRSCs in combination with other operational and regulatory requirements. The analyses for the OCAP consultation assume the SRSCs divert their total contract quantity with deficiencies in critically dry years in accordance with the existing and renewed contracts. Because maximum contract deliveries are assumed for the SRSCs, the OCAP opinion fully addresses any in-river effects to listed species that could result from long-term contract renewal. The consultation does not evaluate impacts that could result during diversion of water by the contractors or use of diverted water. It is anticipated that formal consultation on long-term OCAP will be completed by the end of 2004.

Sacramento River Basinwide Water Management Plan and Regional Criteria

In 1996, eight of the larger SRSCs commenced litigation against the United States and others to establish that Section 3404(c)(3) of the CVPIA did not apply to Settlement Contracts. Litigation reached settlement in January 1997 through a Stipulated Agreement, wherein the federal defendants agreed that Section 3404(c)(3) of the CVPIA did not apply to the Settlement Contracts.

As part of that settlement, the SRSCs and Reclamation entered into a "Memorandum of Understanding between Named Sacramento River Settlement Contractors and the United States of America for the Preparation of Data in Aid of the Renewal of Settlement Contracts" (Contract Renewal MOU).

SRSC participants that were signatories to the Contract Renewal MOU are as follows:

- Anderson-Cottonwood Irrigation District (ACID)
- Glenn-Colusa Irrigation District (GCID)
- Provident Irrigation District (PID)
- Princeton-Codora-Glenn Irrigation District (PCGID)
- Reclamation District No. 108 (RD 108)
- Reclamation District No. 1004 (RD 1004)
- Meridian Farms Water Company (MFWC)
- Sutter Mutual Water Company (SMWC)
- Pelger Mutual Water Company (PMWC)
- Natomas Central Mutual Water Company (NCMWC)

These SRSCs account for more than 80 percent of the total 2.2 MAF of Sacramento River water currently under Settlement Contracts with Reclamation. Reclamation was also a signatory to the Contract Renewal MOU. The Contract Renewal MOU identified the following four major types of data or documents that were to be prepared to aid in contract renewal negotiations:

- Update and extension of the 1956 Cooperative Study
- A Basinwide Water Management Plan (BWMP) for the Sacramento River
- Contracting principles
- Discussions of obligations, if any, of the SRSCs to meet water quality, endangered species, and other environmental needs, including the needs of the San Francisco Bay/

Sacramento-San Joaquin Delta and alternative means, if any, by which these obligations can be met

The basic objective of the BWMP was to provide the participating SRSCs with a comprehensive basis upon which to manage water resources to meet their existing and future water needs. These needs would be met in a manner that could also serve other water needs in the Sacramento Valley, including, but not limited to, needs for the use of water for the environment. The basic objectives were more specifically defined as follows:

- Maintaining a permanent, reliable, adequate, and economical water supply to meet the existing and future needs of the SRSCs, including long-term soil salinity control and nonpoint discharge requirements
- Identifying the opportunities to enhance the water supplies for wildlife refuges and other uses of water for the environment
- Incorporating other water management considerations in the Sacramento River Basin, such as other water quality goals, agricultural economics, flood control, power operations, and recreation, to ensure a comprehensive and successful approach to meet the basic objectives of the BWMP
- Allowing for the potential use with the updated and extended 1956 Cooperative Study (subsequently mutually agreed would not to be used) and other existing, past, or ongoing studies to provide a common set of data on which negotiations for renewal of ~~water~~ Settlement Contracts could be based

Sacramento Valley Water Management Program

Management of water quality in the Bay-Delta has been the topic of many programs and processes over the years. Water quality in the Bay-Delta is affected by freshwater inflows, which are influenced by upstream diversions. Possible changes to upstream diversion rights as part of water quality management in the Bay-Delta has been an extremely complicated and controversial issue. Certain water users and agencies throughout California, including Sacramento River water users (many of them SRSCs), the DWR~~epartment~~, Reclamation, and CVP and SWP water contractors signed the “Agreement Regarding Resolution of Phase 8 Issues, Development and Management of Water Supplies, and Binding Commitment to Proceed Pursuant of Specified Terms” (April 3, 2001, ~~and~~ known as the Stay Agreement). The Stay Agreement proposed goals and principles to resolve issues of the flow-related standards that would have been argued during the eighth phase (commonly referred to as “Phase 8”) of the impending State Board hearings. On April 26, 2001, the State Board issued Order WR 2001-05, which postponed Phase 8 and allowed for automatic dismissal of the Phase 8 hearing after 18 months in October 2002 (unless Reclamation or the ~~Department~~DWR had requested the State Board resume Phase 8 because of a breakdown in the settlement process). Under the State Board order and as agreed to in the Stay Agreement, Reclamation and the ~~Department~~DWR remained committed to meeting the flow-related objectives described in SWRCB D-1641 (the formal decision governing water quality in the Bay-Delta) during the term of the Stay Agreement.

One outcome of this process has been the Short-Term Program, which will develop projects that can provide water to the Bay-Delta. This water will be made available by conjunctively reducing surface diversions and using groundwater pumping or by re-operation of district or water agency reservoirs.

CHAPTER 2
DESCRIPTION OF ALTERNATIVES

INTRODUCTION

The Settlement Contracts have a unique history and nature. Most~~The~~ SRSCs hold water rights to Sacramento River water that are senior to the CVP and, cumulatively, claim senior water rights that entitle them to use a significant portion of the water available for appropriation in the Sacramento River. If the SRSCs were to fully utilize their senior water rights, Reclamation's current ability to operate the CVP would be compromised. It was in recognition of this fact that members of Congress directed Reclamation to negotiate with the SRSCs and enter into the Settlement Contracts.

The CVPIA states that no contract renewals shall be authorized until appropriate environmental review, including the CVPIA Programmatic Environmental Impact Statement (PEIS), has been completed. The PEIS identifies the need for site-specific environmental documents for the long-term contract renewal process, including the Settlement Contract renewal process. This Chapter describes the methodology used to develop alternatives to be evaluated in this EIS for renewal of the Settlement Contracts, the selected alternatives, and alternatives considered for further evaluation but eliminated from this EIS.

DEVELOPMENT OF ALTERNATIVES

To develop the project Alternatives for this EIS, in 2001, Reclamation initiated public scoping activities and, with the SRSCs, initiated the process to negotiate the renewal of the ~~SRSC~~ Settlement ~~c~~Contracts. Reclamation offered its initial proposed contract on May 15, 2002. Many of the larger SRSCs responded with their initial counter-proposal on May 31, 2002. A series of publicly noticed negotiation sessions between Reclamation and the larger SRSCs were held throughout 2002 and early 2003. The results of the negotiations are reflected in the March 11, 2003 draft form of the contract that has been tentatively approved by both Reclamation and many of the larger SRSCs. (Copies of the May 15, 2002, May 31, 2002, and March 11, 2003 draft contracts are included in Appendix C.)

Through contract negotiations and scoping activities, five reasonable and feasible alternatives have been identified for the renewal of the Settlement Contracts between Reclamation and the SRSCs. These five alternatives represent a range of agreement provisions that could be implemented for contract renewals. In addition to these five alternatives, the No Action Alternative was defined to consist of renewing long-term contracts as described by the adopted and implemented Preferred Alternative of the PEIS.

The negotiated contract is represented by Alternative 1 – the Preferred Alternative; Reclamation's initial proposal is represented by Alternative 2, and the SRSCs' initial counter proposal is represented by Alternative 3. This approach to developing alternatives based on various stages in the contract negotiation process is consistent with the approach taken for the environmental documentation of several other contract renewals, including long-term contract renewal documents for Sacramento~~Westside~~ Canals Unit (i.e., Tehama-Colusa

Canal), Shasta-Trinity, San Felipe, San Luis Unit, Friant, Cross-Valley, Contra Costa Water District, and Delta-Mendota.

Two additional alternatives, 4 and 5, were developed in response to specific comments received during scoping and in extensive discussions between Reclamation and the SRSCs. Alternatives 4 and 5 evaluate different approaches to applying cutbacks of surface water diversions during years when total water supplies are below normal. These approaches were not considered in the contract negotiations.

Various contractual provisions define the differences among alternatives, as shown in Table 2-1. These provisions are addressed differently under the No Action Alternative and each of the project alternatives, and could result in changes in environmental impacts or benefits. These provisions include the following: total contract amount, contract period, Base Supply rescheduling provisions, water costs including Project Water costing mechanisms, conservation measurement, and shortage provisions.

The No Action, Preferred Alternative, and project alternatives are described below.

No Action Alternative

Selection of the No Action Alternative for Contract Renewals

The No Action Alternative is defined by NEPA as the most likely future that could be expected to occur in the absence of the project. It is intended to represent a projection of current conditions to the most reasonable future responses or conditions that could occur during the life of the project without any action alternatives being implemented.

The No Action Alternative for the SRSC contract renewals has been determined to be the Preferred Alternative for the CVPIA PEIS. The rationale for this decision is that with the passage of the CVPIA in 1992 and the completion of the environmental documentation for the CVPIA (PEIS), in 1999, the operations of the CVP, including the delivery of Sacramento River water to the SRSCs are guided by the adopted PEIS Preferred Alternative. The CVPIA Preferred Alternative is therefore the existing conditions for this EIS and the ongoing implementation of the CVPIA is the most likely future scenario. The Preferred Alternative for the CVPIA assumed renewal of the Settlement Contracts at existing full contract amounts. Additional details of the existing contract provisions are provided below.

The rationale for definition of the No Action Alternative also considered that the majority of the SRSCs and Reclamation have indicated their willingness to renew the contracts and Congress has approved a 2-year interim contract extension~~s~~. Therefore, the possibility of a future without contract renewals was not anticipated. The concept of non-contract renewal, rather then being addressed as part of the no action, was considered as a Project Alternative, but eliminated from full analysis for several reasons, as discussed later in this Chapter.

The use of the PEIS Preferred Alternative as the No Action is consistent with the definition of the No Action for several other ongoing contract renewal environmental documents, including the Sacramento ~~Westside~~ Canals Unit (i.e., Tehama-Colusa Canal), Shasta-Trinity, San Felipe, San Luis Unit, Friant, Cross-Valley, Contra Costa Water District, and Delta-Mendota.

TABLE 2-1

PROJECT ALTERNATIVES SUMMARY

Alternative	No Action	Alternative 1:Preferred Alternative–Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Initial Counter Proposal	Alternative 4: Cutback Provisions Based on Shasta Inflow	Alternative 5: Cutback Provisions Based on 40-30-30 Sacramento River Index
Total Annual Contract Amount (KAFY)[a]	2,316	2,227	2,316	2,316	2,227	2,227
Contract Period	40 years	40 years	40 years	40 years	40 years	25 years
Shortage Provision	Specifies reductions in critical years[b] only; reductions of 25%	Specifies reductions in critical years only; reductions of 25%	Specifies delivery reductions based on Shasta inflow deficiencies varying from 10 to 25% (sliding scale)	Same as Alternative 2, and SRSCs are compensated for water reductions	Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF in Shasta Lake	Sliding-scale cutback (10-20-25%) based on Sacramento River Index[c] water years; no reset requirement at 4 MAF in Shasta Lake
Number of Years Shortage Provision Is Activated (based on historical period of record)	9 years	9 years	16 years	9 years	17 years	43 years
Total Amount Reduced over 4-year Drought Sequence Based on Shortage Provision (KAFY)	2,127	2,127	2,021	2,127	2,127	2,021
Base Supply Rescheduling Provisions	No fees for rescheduling	Requires rescheduling fee for water rescheduled ~~for diversion in April or May that is diverted in July, August, September, or October~~ into June through October from any month of the diversion season.	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract	No fees for rescheduling	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract	Requires rescheduling fee to divert in excess of monthly quantities contained in Settlement Contract

TABLE 2-1

PROJECT ALTERNATIVES SUMMARY

Alternative	No Action	Alternative 1:Preferred Alternative–Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Initial Counter Proposal	Alternative 4: Cutback Provisions Based on Shasta Inflow	Alternative 5: Cutback Provisions Based on 40-30-30 Sacramento River Index
Costing Mechanism	Take or Pay: Requires SRSC to pay for Project Water at established rates with adjustments by Contracting Officer if water used other than for agricultural purposes; SRSC pays for 100% of Project Water	Take or Pay: Requires SRSC to pay for 75% of the amount of Project Water each year and to pay for Project Water actually diverted in excess of 75%; Contracting Officer can adjust rates to applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use	Take or Pay: Requires SRSC to pay for Project Water at established rates with adjustments by Contracting Officer if water used other than for agricultural purposes; SRSC pays for 100% of Project Water	Take or Pay: Limits payment to Project Water actually diverted by the SRSC; does not specifically include adjustment for water used other than for agricultural purposes	Same as Alternative 1	Take or Pay: Requires SRSC to pay for 75% of the amount of Project Water each year and to pay for Project Water actually diverted in excess of 75%; Contracting Officer can adjust rates to applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use
Conservation Measures	Not included	Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law, which allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a)	Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law~~, which allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a)~~	Prior to diversion of Project Water, requires SRSC to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law~~, which allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a)~~	Same as Alternative 1	Reclamation's standard criteria would apply, including measurement at each farm delivery, volumetric pricing of water, and implementation of Best Management Practices

TABLE 2-1

PROJECT ALTERNATIVES SUMMARY

Alternative	No Action	Alternative 1:Preferred Alternative–Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Initial Counter Proposal	Alternative 4: Cutback Provisions Based on Shasta Inflow	Alternative 5: Cutback Provisions Based on 40-30-30 Sacramento River Index

[a]Includes contract ~~amounts~~ quantities for 145 SRSCs and CDMWC. Total annual amounts vary according to shortage provisions.

[b]Shasta critical years defined by the contract between Reclamation and the SRSCs (see Appendix C for complete contract). This shortage provision was the mechanism used in the original contracts and, thus, represents the No Action, in addition to Alternatives 1 and 3.

[c]The 40-30-30 Sacramento River Index is computed as a weighted average of the current water year's April through July unimpaired runoff forecast (40 percent), the current water year's October through March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff (calculated in the 40-30-30 Sacramento River Index as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom) is the river production unaltered by water diversions, storage, exports, or imports. A water year with a 40-30-30 Sacramento River Index equal to or greater than 9.2 MAF is classified as "wet." A water year with an index equal to or less than 5.4 MAF is classified as "critical."

Note:

KAFY = thousand acre-feet per year

Similarities of the No Action to the Affected Environment/Existing Conditions

For Projects where the No Action future is different from the existing conditions, NEPA Guidelines instruct that the differences should be clearly defined. The No Action Alternative should not automatically be considered to be the same as the existing condition of the affected environment because reasonably foreseeable future actions may be taken regardless of whether any of the project action alternatives are chosen.

For the resources that may be affected by this Project, the existing conditions and the No Action are essentially identical. The existing condition consists of effects of the exercising of the SRSC contracts and the No Action assumes ongoing implementation of those contracts under identical contract provisions.

The analysis in Chapter 3 compares the reasonable action alternatives to the No Action Alternative to determine the net effect or impact of each of the action alternatives. This allows the analysis to focus upon the impacts that would be the result of the action under consideration, distinguishing the different impacts associated with each of the Alternatives. Because in this case, the No Action is the same as the existing conditions, this comparison of the project alternatives to the No Action is essentially the same as a comparison of the project alternatives to existing conditions.

Total Contract Amount

The total ~~contract amount~~ contract quantity for each alternative includes both Base Supply and Project Water ~~supply~~ to be diverted by the SRSCs in years when shortage provisions are not in effect. The contract defines Base Supply as the quantity of water that the United States agrees may be diverted by the SRSCs from the Sacramento River each month from April through October without charge. This Base Supply reflects the negotiated quantity of surface water agreed to by both the SRSCs and Reclamation, derived from jointly conducted studies. The Base Supply represents the larger portion of the water quantities addressed in each contract and is diverted by the contractor free of any payment to Reclamation.

In addition, and in consideration of the SRSCs' willingness to settle on a Base Supply quantity during the term of the Settlement Contract, Reclamation agreed to provide the SRSCs with designated monthly quantities of CVP water, referred to as "Project Water." Project Water is used to satisfy calculated average deficiencies in the year of the claimed rights. In the contracts, Project Water refers to all water diverted or scheduled for diversion by the SRSCs from the Sacramento River each month from April through October of each year that is in excess of the Base Supply. This CVP Project Water is provided to the SRSCs subject to all of the pricing and other requirements of federal Reclamation law.

As shown in Table 2-2, the total ~~contract amount~~ contract quantity for the No Action Alternative is 2,316 KAFY. This alternative assumes renewal of all contracts at the existing contract amounts. This is the aggregated total amount provided for in all 145 contracts and the contract with CDMWC. Table 2-2 also shows the Base Supply and Project Water ~~supply~~ for each of the 20 largest SRSCs for each alternative. These are total contracted amounts, which may be reduced during years when shortage provisions are ~~activated~~ implemented, as described below.

TABLE 2-2

CONTRACT QUANTITIES~~AMOUNTS~~ BY PROJECT ALTERNATIVE

Contractor	No Action (Renewal of Existing Contracts)			1 – Preferred Alternative (Negotiated Contract)			2 – Reclamation's Initial Contract Proposal	3 – SRSCs' Initial Counter Proposal	4 – Cutback Provisions Based on Shasta Inflow	5 – Cutback Provisions Based on 40-30-30 Sacramento River Index
	CVP Water	Base Supply	TOTAL	CVP Water	Base Supply	TOTAL				
ACID	10,000	165,000	**175,000**	7~~6~~,000	121~~2~~,000	**128,000**[a]	Same as No Action		Contract ~~amounts~~ quantities same as Preferred Alternative[b]	
GCID	105,000	720,000	**825,000**	105,000	720,000	**825,000**				
MID	6,000	11,980	**17,980**	6,000	11,980	**17,980**				
MFWC	12,000	23,000	**35,000**	12,000	23,000	**35,000**				
NCMWC	22,000	98,200	**120,200**	22,000	98,200	**120,200**				
PMWC	1,750	7,110	**8,860**	1,750	7,110	**8,860**				
Pleasant Grove-Verona	2,500	23,790	**26,290**	2,500	23,790	**26,290**				
PCGID	15,000	52,810	**67,810**	15,000	52,810	**67,810**				
PID	5,000	49,730	**54,730**	5,000	49,730	**54,730**				
RD 1004	15,000	56,400	**71,400**	15,000	56,400	**71,400**				
RD 108	33,000	199,000	**232,000**	33,000	199,000	**232,000**				
City of Redding[c]	3,150	17,850	**21,000**	3,150	17,850	**21,000**				
SMWC	95,000	172,900	**267,900**	56,500	169,500	**226,000**[2]				
Tisdale Irrigation Company	2,000	7,900	**9,900**	2,000	7,900	**9,900**				
Conaway Conservancy Group	672	50,190	**50,862**	672	50,190	**50,862**				
Davis Ranch	9,800	22,000	**31,800**	9,800	22,000	**31,800**				
Lomo Cold Storage	700~~6410~~	6,410~~700~~	**7,110**	700~~6,410~~	6,410~~700~~	**7,110**				
M & T Chico Ranch, Inc.	976~~16980~~	16,980~~976~~	**17,956**	976~~16,980~~	16,980~~976~~	**17,956**				
Reynen	2,000	8,070	**10,070**	2,000	8,070	**10,070**				
River Garden Farms	500	29,300	**29,800**	500	29,300	**29,800**				
Subtotal	**363,762**	**1,716,906**	**2,080,668**	**363,762**	**1,716,906**	**2,080,668**				
Other 125 Users	40,858	94,825	**135,683**	40,858	94,825	**135,683**				
CDMWC	100,000		**100,000**	100,000		**100,000**				
TOTAL	**404,620**	**1,811,731**	**2,316,351**	**362,120**	**1,765,331**	**2,227,451**				

[a]Needs analyses resulted in reduction from 175 to 128 KAFY for ACID and from 267,900 to 226 KAFY for SMWC.

[b]Total contract quantities ~~amount~~s under Alternatives 4 and 5 are the same; however, during dry years, shortage provisions may result in varying quantities of reductions in water delivered as detailed in Table 2-3.

[c]All CVP ~~Project Water supply~~Project Water is denoted for agricultural use with the exception of the City of Redding supply, which is for M&I use.

Contract Period

The existing Settlement Contracts were originally executed in 1964, with a term not to exceed 40 years. Those contracts specified the following: "That under terms and conditions mutually agreeable to the parties hereto, renewals may be made for successive periods not to exceed forty (40) years each." In addition, Section 3404(c) of the CVPIA, which limits the renewal of existing long-term repayment or~~f~~ water service contracts to a period of 25 years, does not apply to the Settlement Contracts. Under the No Action Alternative, the contract period for the renewed contracts would ~~extend for~~ be40 years.

Base Supply Rescheduling

The Base Supply and the Project Water ~~supply~~ for each contractor is allocated on a monthly basis as specified under Exhibit A of each contract. Base Supply is scheduled during the months of April through October for all SRSCs, with the exception of the City of Redding, whose Base Supply water is scheduled year round for M&I use.

Critical months are defined in all of the contracts as July, August, and September, with the exception of GCID, ACID, and the City of Redding. Critical months for these three contractors, because of their claims to senior water rights, are July and August only.

Under the existing contracts (No Action), an SRSC cannot move Base Supply from non-critical months into critical months, but can move Base Supply within critical months or from critical months into non-critical months. However, after the Base Supply for critical months is exhausted, contractors can purchase Project Water up to their full contract amount. Rescheduling of Base Supply within critical months or into non-critical months is permitted without cost in the No Action Alternative.

Water Costs and Costing Mechanisms

As stated previously, SRSCs divert the Base Supply portion of their contract free of any payment to Reclamation. No payment is required if Base Supply is rescheduled as described in the previous section.

The cost for Project Water under the No Action Alternative is as set by the CVPIA and would apply to 100 percent of the Project Water, whether diverted or not.

Conservation Measures

The water conservation assumptions under the No Action Alternative include water conservation actions for municipal and on-farm uses assumed in ~~Department~~DWR Bulletin 160-93 and conservation plans completed under the 1982 Reclamation Reform Act consistent with the criteria and requirements of the CVPIA. Such criteria address cost-effective Best Management Practices that are economical and appropriate, including measurement devices, pricing structures, demand management, public information, and financial incentives.

Shortage Provisions

Under the No Action Alternative, the shortage provisions of the existing Settlement Contracts would apply. That contract specifies cutbacks of 25 percent in total Base Supply and Project

Water quantities~~deliveries~~ during critical years only. Critical years are defined by the contract as any year during which either of the following eventualities exists:

(1) The forecasted full natural inflow to Shasta Lake for the current Water Year, is equal to or less than three million two hundred thousand (3,200,000) AF; or

(2) The total accumulated actual deficiencies below four million (4,000,000) AF in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than four million (4,000,000) AF, together with the forecasted deficiency for the current Water Year, exceed eight hundred thousand (800,000) acre-feet.

Under these shortage provisions, as shown in Table 2-3, cutbacks would be projected to occur under the No Action Alternative in 9 years out of 80. This projection is based on the period of record from 1921 to 2001. Information from this period of record, such as frequency of various levels of dry years, periods of sequential dry years resulting in long-term droughts, and wet years, is typically used by Reclamation as a reliable predictor of the pattern of hydrology that can be expected in the future. During a 4-year drought sequence, such as that which occurred during the period 1930 through 1934, total cutbacks to SRSCs would allow for diversion of approximately 2,127 KAFY. Because the contract period is 40 years, and the period of record is 80 years, a reasonable assumption can be made that during the contract period, these shortage provisions would occur 4.5 years out of 40.

Alternative 1: Preferred Alternative – Negotiated Contract

Total Contract Amount

As shown in Table 2-2, the total ~~contract amount~~ contract quantity for the Preferred Alternative is 2,227 KAFY. This total contract quantity of water is less than the No Action Alternative by 89 KAFY in response to the needs analyses prepared by Reclamation, which resulted in a proposed reduction in total supplies (Base and Project water) to two SRSCs (SMWC and ACID).

To determine contract quantities~~amounts~~ for the renewed contracts, and assist in demonstrating beneficial use, Reclamation developed a needs analysis methodology to evaluate the use of CVP water supplies. The water rights granted to the United States for the CVP require that the water be used in accordance with California law and in the interest of the public welfare to prevent waste and unreasonable use.

The needs analysis for the SRSCs used a multi-step approach to identify existing and projected water demands and support the ~~assignment of~~ contract quantities~~amounts~~ in the contract negotiations and the Preferred Alternative and alternatives. As discussed previously, the Settlement Contracts were negotiated to settle disputes over claims of water rights and resulted in agreement of the quantities of water that could be diverted free of charge (Base Supply) and that would be paid for by the SRSCs (Project Water). There was no requirement that the SRSCs had to use other sources of water supply, if available, in lieu of diverting Base Supply and Project Water, a fact that was taken into account in completing the water needs analysis. Beneficial and efficient future water demands were also identified for each district and then compared to each SRSC's Base Supply and Project Water.

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1921-1922	4.6	100%	100%	100%	100%
1922-1923	3.6	100%	90%	90%	90%
1923-1924	2.5	75%	75%	75%	75%
1924-1925	5.1	100%	100%	100%	80%
1925-1926	3.7	100%	90%	90%	80%
1926-1927	7.0	100%	100%	100%	100%
1927-1928	5.1	100%	100%	100%	100%
1928-1929	3.2	100%	75%	75%	75%
1929-1930	4.2	100%	100%	100%	80%
1930-1931	2.5	75%	75%	75%	75%
1931-1932	3.7	75%	80%	75%	80%
1932-1933	3.5	75%	75%	75%	75%
1933-1934	3.3	75%	75%	75%	75%
1934-1935	4.9	100%	100%	100%	90%
1935-1936	4.7	100%	100%	100%	90%

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1936-1937	4.1	100%	100%	100%	90%
1937-1938	9.5	100%	100%	100%	100%
1938-1939	3.5	100%	75%	80%	80%
1939-1940	7.0	100%	100%	100%	100%
1940-1941	8.7	100%	100%	100%	100%
1941-1942	7.6	100%	100%	100%	100%
1942-1943	5.9	100%	100%	100%	100%
1943-1944	3.7	100%	80%	90%	80%
1944-1945	4.9	100%	100%	100%	90%
1945-1946	5.9	100%	100%	100%	90%
1946-1947	3.9	100%	100%	90%	80%
1947-1948	5.4	100%	100%	100%	90%
1948-1949	4.3	100%	100%	100%	80%
1049-1950	4.1	100%	100%	100%	90%
1950-1951	6.3	100%	100%	100%	100%

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1951-1952	7.8	100%	100%	100%	100%
1952-1953	6.5	100%	100%	100%	100%
1953-1954	6.5	100%	100%	100%	100%
1954-1955	4.1	100%	100%	100%	80%
1955-1956	8.8	100%	100%	100%	100%
1956-1957	5.4	100%	100%	100%	100%
1957-1958	9.7	100%	100%	100%	100%
1958-1959	5.1	100%	100%	100%	90%
1959-1960	4.7	100%	100%	100%	80%
1960-1961	5.1	100%	100%	100%	80%
1961-1962	5.3	100%	100%	100%	90%
1962-1963	7.0	100%	100%	100%	100%
1963-1964	3.9	100%	100%	100%	80%
1964-1965	7.0	100%	100%	100%	100%
1965-1966	5.3	100%	100%	100%	90%

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1966-1967	7.4	100%	100%	100%	100%
1967-1968	4.8	100%	100%	100%	90%
1968-1969	7.7	100%	100%	100%	100%
1969-1970	7.9	100%	100%	100%	100%
1970-1971	7.3	100%	100%	100%	100%
1971-1972	5.1	100%	100%	100%	90%
1972-1973	6.2	100%	100%	100%	100%
1973-1974	10.8	100%	100%	100%	100%
1974-1975	6.4	100%	100%	100%	100%
1975-1976	3.6	100%	80%	80%	75%
1976-1977	2.6	75%	75%	75%	75%
1977-1978	7.8	100%	100%	100%	100%
1978-1979	4.0	100%	100%	100%	90%
1079-1980	6.4	100%	100%	100%	100%
1980-1981	4.1	100%	100%	100%	80%

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1981-1982	9.0	100%	100%	100%	100%
1982-1983	10.8	100%	100%	100%	100%
1983-1984	6.7	100%	100%	100%	100%
1984-1985	4.0	100%	100%	100%	80%
1985-1986	7.5	100%	100%	100%	100%
1986-1987	3.9	100%	100%	100%	80%
1987-1988	3.9	100%	100%	100%	75%
1988-1989	4.7	100%	100%	100%	80%
1989-1990	3.6	100%	80%	80%	75%
1990-1991	3.1	75%	75%	75%	75%
1991-1992	3.6	75%	90%	75%	75%
1992-1993	6.8	100%	100%	100%	100%
1993-1994	3.1	75%	75%	75%	75%
1994-1995	9.6	100%	100%	100%	100%
1995-1996	6.8	100%	100%	100%	100%

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			
1996-1997	7.4	100%	100%	100%	100%
1997-1998	10.3	100%	100%	100%	100%
1998-1999	7.2	100%	100%	100%	100%
1999-2000	6.8	100%	100%	100%	100%
2000-2001	4.1	100%	100%	100%	80%
Number of years with cutbacks during period of record		9 years	16 years	17 years	43 years
Cumulative (4 years) cutback during 4–year drought of 1931-1934		2,127,451	2,021,078	2,127,451	2,021,078

TABLE 2-3

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Inflow to Shasta Reservoir in MAF	Percentage Cutback	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Using Shasta Inflow, Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Using 40-30-30 Sacramento River Index, Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]			

Notes:

[a]Shasta critical years defined by the contract between Reclamation and the SRSCs (see Appendix C for complete contract). This shortage provision was the mechanism used in the original contracts and thus represents the No Action, in addition to Alternatives 1 and 3.

[b]The 40-30-30 Sacramento River Index is computed as a weighted average of the current water year's April through July unimpaired runoff forecast (40 percent), the current water year's October through March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff (calculated in the 40-30-30 Sacramento River Index as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom) is the river production unaltered by water diversions, storage, exports, or imports. A water year with a Sacramento Valley 40-30-30 Index equal to or greater than 9.2 MAF is classified as "wet." A water year with an index equal to or less than 5.4 MAF is classified as "critical."

In only two cases, the projected water needs were less than the contract amount, and the amount of Base Supply Project Water was reduced. Because the renewed CVP ~~contract amount~~ contract quantity is limited by the existing contract quantity, an increase in the total ~~contract amount~~ contract quantity was not considered in the needs analysis.

Reclamation's threshold for conducting needs analysis for contractors is the irrigation of 2,000 or more acres. Twenty of the SRSCs meet this threshold and together these 20 SRSCs divert 94 percent of the total water diverted. Because of their small size, needs analyses were not conducted for 125 of the SRSCs.

The results of the completed needs analyses are summarized in Table 2-2 and are provided in more detail in Appendix D.

Under Alternative 1, the proposed contracts also provide for continued delivery of CVP water to the same lands and for the same purposes of irrigation and M&I use as the No Action, with the exception of NCMWC, which has requested a change in authorized use from agricultural to M&I for use in the Metro Air Park portion of its service area. This action is being processed along with the renewal of the Settlement Contracts. Water deliveries would be made through existing CVP facilities, with no new construction required. The water would be beneficially used within CVP-authorized places of use (within the SRSCs' service areas).

Contract Period

The existing Settlement Contracts were originally executed in 1964, with a term not to exceed 40 years. Those contracts specified the following: "That under terms and conditions mutually agreeable to the parties hereto, renewals may be made for successive periods not to exceed forty (40) years each." Consistent with the existing contract language, and the CVPIA PEIS, the Preferred Alternative includes a 40-year contract term.

Base Supply Rescheduling

Under the Preferred Alternative, the negotiated contract introduces a fee for the rescheduling of Base Supply into June, July, August, September, or October. There is no fee for rescheduling Base Supply into April or May. ~~during critical months or into non-critical months (except April and May), in excess of the monthly quantity shown in Exhibit A of each SRSC's contract.~~ The fee is equal to 50 percent of the sum of the storage operations and maintenance component ~~rate~~ and the storage capital ~~rate~~ component~~s~~ of the Project rate setting policy. Rescheduling water from non-critical months into critical months would not be permitted.

Water Costs and Costing Mechanisms

As stated previously, SRSCs divert the Base Supply portion of their contract supply free of charge. The only costs related to Base Supply are in the event that Base Supply is rescheduled as described in the previous section.

Payment for Project Water under the Preferred Alternative would include a costing mechanism that requires the contractor to pay for 75 percent of the amount of allocated Project Water each year at the applicable rate, whether or not the contractor diverted the water, and to pay the applicable rate for Project Water actually diverted in excess of 75 percent. The Contractor would also pay a Restoration Charge for each acre-foot actually diverted. The Contracting Officer could adjust applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use.

Conservation Measures

Prior to diversion of Project Water, Alternative 1 requires SRSCs to be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law. This alternative also allows any of the SRSCs to reduce the amount of Project Water for which payment is required under Article 8(a) of the Settlement Contract.

Shortage Provisions

In the existing Settlement Contract and No Action Alternative, ~~cutbacks~~ reductions in ~~deliveries~~ total Base Supply and Project Water quantities of 25 percent are required during critical years only. Critical years are defined by the contract as any year in which either of the following eventualities exists:

> (1) The forecasted full natural inflow to Shasta Lake for the current Water Year, is equal to or less than three million two hundred thousand (3,200,000) AF; or
>
> (2) The total accumulated actual deficiencies below four million (4,000,000) AF in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than four million (4,000,000) AF, together with the forecasted deficiency for the current Water Year, exceed eight hundred thousand (800,000) AF.

The Preferred Alternative includes these same shortage provisions. Under these shortage provisions, as shown in Table 2-3, and based on the period of record, ~~cutbacks~~ reductions would occur in 9 years within the 80-year period of record or 4.5 years during the 40-year contract period. During a 4-year drought sequence, such as that which occurred during the period 1930 through 1934, total ~~cutbacks~~ reductions to contractors would allow for diversions of approximately 2,127 KAFY, the same as No Action.

Alternative 2: Reclamation's Initial Contract Proposal

Alternative 2 represents the initial offer presented by Reclamation to the SRSCs during the initial phase of contract renewal negotiations.

Total Contract Amount

As shown in Table 2-2, the total ~~contract amount~~ contract quantity for Alternative 2 is 2,316 KAFY. This is the aggregated total amount provided for in all 145 contracts and the contract with the CDMWC. Table 2-2 also shows the Base Supply and Project Water ~~supply~~ for each of the 20 largest SRSCs for each alternative. Note that these are total contracted amounts, which may be reduced during years when shortage provisions are implemented activated, as described below.

This amount is the same as under the No Action Alternative because, at the time that contract negotiations were initiated, the needs analyses of a few SRSCs had not been completed by Reclamation, and no reductions in contract quantities~~amounts~~ had been identified.

Contract Period

Alternative 2 includes a 40-year contract term, which is the same as the No Action and Preferred Alternatives.

Base Supply Rescheduling

Alternative 2 includes the same Base Supply rescheduling fee provision as in the Preferred Alternative. Water to be diverted in April, May, or June may be diverted in September or October or vise versa; the contractor shall be charged a fee based on appropriate components of water rate setting policy (see Article 3(b)(2) of Reclamation Ex1).

Water Cost and Costing Mechanism

Payment for Project Water under Alternative 2 is a costing mechanism that requires the contractor to pay for 100 percent of the amount of allocated Project Water each year, whether or not the contractor diverted the water. The contractor would also pay a Restoration Charge for each acre-foot of water actually diverted. The Contracting Officer can adjust ~~rates to~~ the applicable rates and charges if the SRSC desires to use Project Water for other than agricultural use.

Conservation Measures

Prior to diversion of Project Water, Alternative 2 requires that SRSCs already be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law.~~, and allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a) of the Settlement Contract.~~ Each SRSC is responsible for preparing a individual conservation plan to comply with this contract term.

Shortage Provisions

Under Alternative 2, shortage provisions would be implemented on a 10-20-25 percent sliding scale that is tied to Shasta Lake inflow deficiencies. A 10 percent reduction is applied if inflows to Shasta Lake are between 3.6 and 3.8 MAF. A 20 percent reduction occurs if inflows are between 3.4 and 3.59 MAF, and 25 percent reduction occurs if inflows are below 3.4 MAF.

Under this shortage provision, as shown in Table 2-3, and based on the period of record, cutbacks would occur in 16 years during the 80-year period of record or 8 years during the 40-year contract period. During a 4-year drought sequence, such as that which occurred during the period 1930 through 1934, ~~total cutbacks to SRSCs~~ reductions in total contract supply would allow for diversions of approximately 2,021 KAFY. This projection assumes reductions ~~cutbacks~~ in 7 additional years (20 percent of years) over the 80-year period of record, versus 11 percent of years under the No Action Alternative.

Alternative 3: SRSCs' Initial Counter Proposal

Alternative 3 represents the contract provisions contained in the SRSCs' response to Reclamation's initial proposal for terms of the renew~~ed~~al contract.

Total Contract ~~Amount~~Quantity

As shown in Table 2-2, the total ~~amount~~ contract quantity for Alternative 3 is 2,316 KAFY. This is the aggregated total ~~amount~~ quantity provided for in all 145 contracts and the contract with the CDMWC. Table 2-2 also shows the Base Supply and Project Water ~~supply~~ for each of the 20 largest SRSCs for each alternative. These are total contracted ~~amounts~~ quantities that may be reduced during years when shortage provisions are ~~activated~~ implemented, as described below.

This ~~amount~~ quantity is the same as under the No Action Alternative and Alternative 2 because, at the time that contract negotiations were initiated, the needs analyses of a few SRSCs had not been completed by Reclamation, and no reductions in contract ~~amounts~~ quantities had been identified.

Contract Period

Alternative 3 includes a 40-year contract term, which is the same as the No Action and Preferred Alternatives.

Base Supply Rescheduling

~~Alternative 3 includes the same Base Supply rescheduling provision as provided in the Preferred Alternative.~~ The SRSCs did not offer rescheduling.

Water Cost and Costing Mechanism

Under Alternative 3, there is no provision to pay for CVP Project water not diverted. SRSC payments are limited to Project Water actually diverted by the SRSC. Additionally, there is no adjustment of cost for water used other than for agricultural purposes. These costs and mechanisms are the same as for the No Action Alternative.

Conservation Measures

Prior to diversion of Project Water, Alternative 3 requires that SRSCs be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC's water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law~~, and allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a) of the Settlement Contracts~~.

Shortage Provisions

Under Alternative 3, the mechanism for the shortage provision is the same as Alternative 2. However, the SRSCs would receive payment in exchange for using quantities of water below their contracted amounts. Such payment would be based on mutually acceptable terms between Reclamation and the SRSCs.

Alternative 4: ~~Cutback~~ Shortage Provisions Based on Shasta Inflow Sliding Scale

Alternative 4 is similar to Alternative 1, except that it considers a variation in the shortage provision that was not considered in the contract negotiations between Reclamation and the SRSCs, and would result in more frequent reductions.

Total Contract ~~Amount~~Quantity

As shown in Table 2-2, the total contract ~~amount~~ quantity for Alternative 4 is 2,227 KAFY. This is the aggregated total ~~amount~~ quantity provided for in all 145 contracts and the contract with the CDMWC. Table 2-2 also shows the Base Supply and Project Water ~~supply~~ for each of the 20 largest SRSCs for each alternative. These are total contracted ~~amounts~~ quantities that may be reduced during years when shortage provisions are ~~activated~~ implemented, as described below.

Total contract ~~amount~~ quantity for Alternative 4 is the same as the Preferred Alternative because it includes adjustments made for ACID and SMWC total contracted ~~amount~~ quantity on the basis of Reclamation’s needs analyses conducted for those contractors and subsequent negotiations. It also includes adjustments for NCMWC’s requested change in authorized use from agricultural to M&I in the Metro Air Park portion of its service area. Water deliveries would be made through existing CVP facilities, with no new construction required. The water would be placed to beneficial use within CVP-authorized places of use (within the SRSCs’ service areas).

Contract Period

Alternative 4 includes a 40-year contract term, which is the same as the No Action and Preferred Alternatives.

Base Supply Rescheduling

Alternative 4 includes the same Base Supply rescheduling provision as provided under the Preferred Alternative.

Water Cost and Costing Mechanism

Under Alternative 4, there is no provision to pay for CVP ~~Project~~ water not diverted. Contractor payments are limited to Project Water actually diverted by the SRSC. The contractor would also pay a Restoration Charge for each acre-foot of Project Water actually diverted. Additionally, there is no adjustment of cost for water used other than for agricultural purposes. These costs and mechanisms are the same as for the No Action Alternative.

Conservation Measures

Prior to diversion of Project Water, Alternative 4 requires that SRSCs be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC~~’~~s’ water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law, and allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a) of the Settlement Contract.

Shortage Provisions

Under Alternative 4, shortage provisions are similar to those under Alternative 2, and would be implemented on a 10-20-25 percent sliding-scale basis that is tied to Shasta inflow deficiencies. A 10 percent reduction is applied if inflows to Shasta Lake are between 3.6 and 3.8 MAF. A 20 percent reduction occurs if inflows are between 3.4 and 3.59 MAF, and a 25 percent reduction occurs if inflows are below 3.4 MAF. However, under Alternative 4, as reductions are applied, they are sustained at their greatest level until inflows to Shasta Lake return to 4.0 MAF.

Under this shortage provision, as shown in Table 2-3, and based upon the 80-year period of record, ~~cutbacks~~ shortages would be projected to occur in 17 years or 8.5 years during the 40 year contract period. During a 4-year drought sequence, such as that which occurred during the period 1930 through 1934, total ~~cutbacks~~ shortages to SRSCs would allow for diversions of approximately 2,127 KAFY. This projection assumes ~~cutbacks~~ shortages in 8 additional years (21 percent of years) over the 80-year period of record versus 11 percent of years for the No Action Alternative.

Alternative 5: ~~Cutback~~ Shortage Provisions Based on 40-30-30 Sacramento River Index

Alternative 5 introduces a 25-year contract term and another variation of the shortage provision that is based on the 40-30-30 Sacramento River Index, as described below.

Total Contract ~~Amount~~Quantity

As shown in Table 2-2, the total contract ~~amount~~ quantity for Alternative 5 is 2,227 KAFY. This is the aggregated total ~~amount~~ quantity provided for in all 145 contracts and the contract with the CDMWC. Table 2-2 also shows the Base Supply and Project Water ~~supply~~ for each of the 20 largest SRSCs for each alternative. Note that these are total contracted ~~amounts~~ quantities that may be reduced during years when shortage provisions are ~~activated~~ implemented, as described below.

This ~~amount~~ quantity is the same as the Preferred Alternative because it includes adjustments made for ACID and SMWC total contracted ~~amounts~~ quantities on the basis of Reclamation's needs analyses conducted for those contractors and subsequent negotiations. It also includes adjustments for NCMWC's requested change in authorized use from agricultural to M&I in the Metro Air Park portion of its service area. Water deliveries would be made through existing CVP facilities, with no new construction required. The water would be placed to beneficial use within CVP-authorized places of use (within the SRSCs' service areas).

Contract Period

The contract period for Alternative 5 is 25 years. The CVPIA authorizes renewal of long-term repayment or water service contracts for 25 years. Settlement Contracts are distinct from these types of contracts; however, a 25-year period is considered in this alternative to evaluate the potential for lessening any potential impacts with a shorter contract term, as suggested by comments received during scoping.

Base Supply Rescheduling

Alternative 5 includes the same Base Supply rescheduling provision as Alternative 1.

Water Cost and Costing Mechanism

Under Alternative 5, there is no provision to pay for CVP Project water not diverted. Contractor payments are limited to Project Water actually diverted by the SRSC. The contractor would also pay a Restoration Charge for each acre-foot of Project Water actually diverted. Additionally, there is no adjustment of cost for water used ~~for~~ other than for agricultural purposes.

Conservation Measures

Prior to diversion of Project Water, Alternative 5 requires that SRSCs be implementing a water conservation and efficiency program based on the BWMP and/or the SRSC~~'~~s' water conservation plan that has been determined by the Contracting Officer to meet requirements under federal law, and allows the SRSC to reduce the amount of Project Water for which payment is required under Article 8(a) of the Settlement Contract.

Shortage Provisions

Under Alternative 5, shortage provisions are similar to those under Alternative 2, and would be implemented on a 10-20-25 percent sliding-scale basis that is tied to the 40-30-30 Sacramento River Index rather than Shasta inflows.

The 40-30-30 Sacramento River Index is computed as a weighted average of the current water year's April through July unimpaired runoff forecast (40 percent), the current water year's October through March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff calculated in the 40-30-30 Sacramento River Index is the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom. The result is the river production unaltered by water diversions, storage, exports, or imports. A water year with a 40-30-30 Sacramento River Index equal to or greater than 9.2 MAF is classified as "wet." Indexed water years are classified as follows:

- A water year with an index greater than 7.8 and less than 9.2 MAF is classified as "above normal."
- A water year with an index greater than 6.5 and equal to or less than 7.8 MAF is classified as "below normal."
- A water year with an index greater than 5.4 and equal to or less than 6.5 MAF is classified as "dry."
- A water year with an index equal to or less than 5.4 MAF is classified as "critical."

A 10 percent reduction is applied in years identified as below normal by the index. A 20 percent reduction occurs in dry years and a 25 percent reduction occurs in critical years.

Under this shortage provision, as shown in Table 2-3, and based on the period of record, ~~cutbacks would occur~~ shortages would be imposed in 43 years out of 80 or 10.5 years of the 25-year contract period. During a 4-year drought sequence, such as that which occurred during the period 1930 through 1934, total ~~cutbacks~~ reductions to the SRSCs would allow for diversions of approximately 2,021 KAFY. This projection assumes ~~cutbacks~~ reductions in 34 additional years (42 percent of years) during the 80-year period of record, versus 11 percent of years under the No Action Alternative.

ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED DISCUSSION

Several alternatives were identified by Reclamation and the SRSCs during preliminary planning efforts and scoping activities for this EIS. The following discussion identifies two alternatives that were considered, but eliminated from further discussion in this document. Each of these alternatives was eliminated from detailed discussion in this EIS for one or more of the following reasons: (1) it fails to meet the requirements of the purpose of and need for the action, or (2) the alternative is prohibitively greater in cost or in environmental impacts than the other alternatives, or (3) it cannot be reasonably implemented.

No Contract Renewal Alternative

This alternative was suggested by comments received during the scoping process for the EIS and would assume that the Settlement Contracts between the SRSCs and Reclamation were not renewed.

This alternative was eliminated from further consideration in this EIS because it would not meet the objectives of both Reclamation and the SRSCs to provide water supplies to the various M&I and agricultural water users within the contractors' service areas, and would not meet the purpose of the proposed action. It is difficult to speculate how both Reclamation and the SRSCs may respond in a scenario where the Settlement Contracts were not renewed. However, at least two possible scenarios are imagined. In the first, the status quo could prevail. Operations of the CVP would continue as they have in the recent past under existing contracts, and the SRSCs would continue to divert ~~Base and Project Water supplies~~ water in the quantities and during the months that they have historically., until someone protests and it throws the Sacramento River into a general stream adjudication. This scenario is not a feasible alternative as it does not meet the purpose for and need of the project to ensure the use ~~of the Sacramento River to~~ and payment for CVP stored water by the SRSCs. Without a contract in place there would be no legally binding document to support both Reclamation and the SRSCs in the event of a dispute. Continuing water deliveries and diversions in the absence of a contract is not considered to be a reasonable alternative by either Reclamation or the SRSCs.

A second and possibly more probable scenario of a no contract renewal alternative would result in the inability of the SRSCs to divert water during the critical irrigation months. The existing contracts and the CVP provide the SRSCs with the ability to divert water during the hot summer, peak irrigation months. Without contracts in place and in the absence of current CVP operations, the SRSCs could possibly revert to their original water rights. Those rights would enable them to divert water in accordance with the natural hydrograph of the River; greater flows in the winter and spring months and lesser or none during the peak irrigation months. The existing diversion facilities are currently limited as to diversion capacity and the SRSCs do not have the capability to divert greater amounts of water during non-peak periods and store it onsite for use during periods of peak demand. This scenario would likely result in a greater reliance on local groundwater supplies to fulfill summer irrigation demands of the SRSCs. Consistent increased use of local groundwater supplies could lead to depletion of groundwater resources, and impacts to local streams and the biological resources reliant on those streams such as wildlife and vegetation of riparian habitats. In addition to environmental effects of groundwater use, the cost of pumping groundwater could become burdensome on the SRSCs, resulting in economic hardship, which could lead to fallowing and potentially the indirect effects associated with fallowing, such as air quality or soil erosion. These impacts would be greater than those projected under both the No Action Alternative and the Preferred Alternative. Therefore this alternative was eliminated from further consideration.

Additionally, Public Law 88-44 (77 Stat. 68) provides that the Secretary of the Interior shall, upon request of the other party to any long-term contract for municipal, domestic, or industrial water supply hereafter entered into under the Reclamation Project Act of 1939 (53 Stat. 1195, 43 U.S.C. 485h), include provision for contract renewal subject to renegotiation. Thus, nonrenewal of the contracts for M&I purposes is also legally infeasible.

Reduction in Contract ~~Amounts~~Quantities

Alternatives that included a significant reduction of contract ~~amounts~~ quantities for all contractors were considered but eliminated from further consideration for two major reasons. First, water needs analyses have been completed for all contractors with more than 2,000 irrigable acres, or 2,000 AF of CVP water, accounting for over 95 percent of the ~~contract water supply provided to the SRSCs~~ water under contract. In all but two cases, the needs exceed or equal the current total contract ~~amount~~ quantity. Reduced contract ~~amounts~~ quantities would therefore not meet the purpose and need of the project to ensure the SRSCs the use of the ~~Sacramento River~~ stored CVP water. Additionally, reduced contract ~~amounts~~ quantities could have a similar effect as the no contract renewal alternative described ~~above~~ previously by forcing the SRSCs to rely on local groundwater supplies. Ongoing, increased use of local groundwater supplies could lead to depletion of groundwater resources, and impacts to local streams and the biological resources reliant on those streams such as wildlife and vegetation of riparian habitats. In addition to environmental effects of groundwater use, the cost of pumping groundwater could become burdensome on the SRSCs, resulting in economic hardship, which could lead to fallowing and potentially the indirect effects associated with fallowing, such as air quality or soil erosion. For these reasons, an alternative that would include reduced contract ~~amounts~~ quantities, beyond those included in the Preferred Alternative, was considered but eliminated from further analysis.

SELECTION OF THE PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 1, renewal of the SRSC contracts under the contract terms negotiated by Reclamation and the SRSCs. These terms were determined to be agreeable by both parties and such make this Alternative the most feasible to implement. Additionally, because this Alternative is essentially a continuation of existing conditions, there are no environmental effects of the Preferred Alternative and thus it can be considered to be environmentally superior.

SUMMARY OF IMPACT ASSESSMENT

The alternatives considered in this EIS were analyzed to determine the potential for adverse and beneficial impacts associated with their implementation as compared to continuation of existing conditions, which are reflected in the No Action Alternative. The results of this analysis are summarized in Table 3-1 and presented in Chapter 3 of this EIS.

CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the affected environment and the environmental consequences associated with renewing the Settlement Contracts under all alternatives described in Chapter 2 as compared to renewing the ~~contracts~~ Settlement Contracts under the No Action Alternative. This chapter also describes potential mitigation measures that could be used to avoid, reduce, or otherwise minimize potential adverse impacts to the environment resulting from an alternative. Cumulative effects are presented in Chapter 4.

The resources and issues included in this chapter were identified through a review of NEPA guidance documents and through the scoping process. The resources and issues described in this chapter are as follows:

- Physical Environment
  - Air Quality
  - Geology and Soils
  - Surface Water
  - Groundwater
- Biological Environment
  - Terrestrial Biological Resources
  - Aquatic Biological Resources
- Economics
  - Land Use and Agricultural Production
  - M&I Land Use and Water Costs
  - Power Supply and Demands
  - Regional Economics
- Sociocultural Environment
  - Demographics Description
  - Cultural Resources
  - Indian Trust Assets
  - Environmental Justice
  - Recreation

The descriptions of the affected environment are first organized by issue and, then, further discussed by county, city, irrigation district, or province. The analyses for these areas include summaries of evaluations completed by cities, counties, irrigation districts, and federal and state agencies.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Section 102(C)(v) requires federal agencies to consider to the fullest extent possible irreversible and irretrievable commitments of resources that would be involved if the Preferred Alternative were implemented. The Preferred Alternative is the renewal of existing ~~contracts~~ Settlement Contracts and does not involve construction or use of resources except water. There is no commitment of nonrenewable resources, and the Preferred Alternative would not commit future generations to permanent use of natural resources.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA Section 102(C)(iv) requires all federal agencies to disclose the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. The~~se~~ ~~water delivery~~ Settlement ~~c~~Contracts are temporary (40 years), yet result in long-term benefits to the sustainability and reliability of agricultural production and economic growth. Long-term productivity would be enhanced through the water supply that sustains agricultural economics, social benefits, and the long-term productivity of urban and rural populations by continuing to provide CVP water.

IMPACT ASSUMPTIONS

In conducting analyses of environmental impacts, it is necessary to make basic assumptions regarding secondary effects. For the analyses conducted in the following sections, basic assumptions were required regarding the use of water under the various alternatives. This was particularly relevant for Alternatives 4 and 5, which make water available for other uses through increased frequency of contract reductions. Following is a basic discussion of the assumptions guiding impact analysis.

Assumptions within Sacramento River Settlement Contractor ~~Districts~~Service Areas

In all but two cases (ACID and SMWC~~D~~), contract ~~amounts~~ quantities remain unchanged; therefore, typical water use among the SRSCs ~~districts~~ would also remain unchanged. Contract reductions for ACID and SMWC~~D~~ were based on Reclamation's needs analyses, whereby water needs were evaluated according to irrigated acreage and crop patterns that represent typical SRSC ~~district~~ operations. Reclamation has determined that because these analyses are based on historical data of actual use, it is reasonable to assume that operations would be unchanged under reduced contract totals, given the contract reductions for ACID and SMWC~~D~~ result in matching water needs with actual use. Therefore, there is no assumed on-field change between current and revised contract totals. However, some SRSCs disagree with the assumptions used in the needs analysis, particularly with regard to irrigated acreage. Regardless, all parties have agreed upon the final contract quantities ~~amounts~~.

The second assumption necessary to assess impacts is how SRSCs would respond to drought conditions. Under the existing Settlement ~~c~~Contracts (i.e., the No Action condition), SRSCs are subject to a 25 percent reduction in critical years. Reviewing input from the SRSC representatives, it was determined that in critical years, ~~districts~~ SRSCs and member farmers turn to short-term supplies for water; typically increased use of groundwater and drainwater.

Using this information, there are no anticipated impacts under Alternatives 1 and 3 during drought conditions because the definition of critical years and the application of a shortage provision are the same as under No Action. Over the period of record (1922 through 2001), there were 9 critical years, and future responses are likely to be identical to past drought operations; thus, no change would occur. Under Alternatives 2, 4, and 5, the frequency of drought conditions is effectively increased because the definition of ~~cutback~~ years where shortages are imposed has been expanded. For Alternatives 2 and 4, there would be 16 years with drought shortage conditions (varying between 10 and 25 percent of full contract supply). Under Alternative 5, there would be 43 years with drought shortage conditions. It was expected that an increase in drought frequency would result in a change in cropping pattern; however, the agricultural impact analysis noted that cropping patterns would not change.

Potential increases in groundwater pumping under Alternatives 2, 4, and 5 are anticipated to have less than significant effects on groundwater supplies, even under very conservative modeling conditions. Although seasonal depth to groundwater may increase in some areas in the range of 20 to 40 feet, it is not anticipated to substantially change the economics of pumping groundwater during drought years, nor would new wells be required because drought-year supplies are currently being met. Also, the increased pumping would not lead to long-term declines in groundwater levels. Alternatives 3, 4, and 5 also include provisions stating that additional terms would be added to ensure that the additional drought years included compensation to offset additional costs, meaning that the additional cost of pumping would be offset by Reclamation. Therefore, drought operations, although occurring more frequently, would not result in substantial land use or cropping changes; thus, no significant secondary impacts would occur.

Assumptions outside Sacramento River Settlement Contractor ~~Districts~~Service Areas

Assessing impacts outside the SRSCs also requires basic assumptions about drought operations. As noted above, Alternatives 1 and 3 are identical to No Action in terms of drought-year frequency; therefore, operations would remain unchanged and no impacts would occur. The overall decrease in SRSC diversion associated with the reduction of ACID and SMWC contract ~~amounts~~ quantities would provide Reclamation with additional flexibility in meeting other contract and environmental water needs. Under Alternatives 2, 4, and 5, frequencies of drought years would increase, meaning that deliveries to SRSCs would decrease, potentially allowing water to be re-allocated from SRSCs to other contract and environmental uses. However, it is speculative to predict specifically where the water would be allocated.

Many resources are potential recipients of the water not ~~delivered to~~ diverted by SRSCs. Water could be allocated for water quality in the Sacramento River or Bay Delta, for use by other agricultural or M&I~~municipal~~ water contractors, for habitat enhancement, as a benefit to recreational use, or simply as carryover supply for the subsequent water year. In some cases, these uses may be complementary. To assess impacts, or benefits, in these areas, it is necessary that the additional water be potentially available for various uses. Actual use would be determined at a future date, and could change on the basis of administrative policy, hydrology, demographics, or other considerations.

Table 3-1 provides a basic overview of the general impact direction for all the resource categories under each of the alternatives.

TABLE 3-1

SUMMARY OF IMPACTS FOR ALL RESOURCE CATEGORIES

Alternative	Alternative 1: Preferred Alternative - Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Counter Proposal	Alternative 4: Cutback Provisions Based on Sliding Scale	Alternative 5: Cutback Provisions Based on Sacramento Index
Physical Environment					
Air Quality	No impact	No impact	No impact	Significant impact	Significant impact
Geology and Soils	No impact	No impact	No impact	No impact	No impact
Surface Water	No impact	Small potential benefit - increased flow in the Sacramento River/small potential impact – decreased flow in tributaries	No impact	Small potential benefit - increased flow in the Sacramento River/small potential impact – decreased flow in tributaries	Small potential benefit - increased flow in the Sacramento River/small potential impact – decreased flow in tributaries
Groundwater					
Sacramento Valley Groundwater Basin	No impact	No impact	No impact	Less than significant	Less than significant
Redding Groundwater Basin	No impact	No impact	No impact	Less than significant	Less than significant
Biological Environment					
Terrestrial Biological Resources	No impact	Less than significant	No impact	Less than significant	Less than significant

TABLE 3-1

SUMMARY OF IMPACTS FOR ALL RESOURCE CATEGORIES

Alternative	Alternative 1: Preferred Alternative - Negotiated Contract	Alternative 2: Reclamation's Initial Contract Proposal	Alternative 3: SRSCs' Counter Proposal	Alternative 4: Cutback Provisions Based on Sliding Scale	Alternative 5: Cutback Provisions Based on Sacramento Index
Aquatic Biological Resources	No impact	Potential benefit	No impact	Potential benefit	Potential benefit
Economics					
Agricultural Land Use and Production	No impact	Less than significant	No impact	Less than significant	Less than significant
M&I Land Use and Water Costs	No impact	Potential benefit	No impact	Potential benefit	Potential benefit
Power Supply and Demands	No impact	Potential benefit	No impact	Potential benefit	Potential benefit
Regional Economics	No impact	No impact	No impact	No impact	No impact
Socioculture Environment					
Demographics Description	No impact	No impact	No impact	No impact	No impact
Cultural Resources	No impact	No impact	No impact	No impact	No impact
Indian Trust Assets	No impact	No impact	No impact	No impact	No impact
Environmental Justice	No impact	No impact	No impact	No impact	No impact
Recreation	No impact	Potential benefit	No impact	Potential benefit	Potential benefit

PHYSICAL ENVIRONMENT

Air Quality

Affected Environment

The Preferred Alternative is located entirely within the Sacramento Valley Air Basin (SVAB), which is composed of Shasta, Tehama, Butte, Glenn, Colusa, Sutter, Yolo, and Sacramento Counties and portions of Placer and Solano Counties.

Air Quality Standards. Air quality in the SRSCs' service area is regulated at the federal, state, and local levels. At the federal level, the U.S. Environmental Protection

Agency (EPA) is responsible for overseeing implementation of the federal Clean Air Act amendments. Pursuant to this act, EPA established National Ambient Air Quality Standards (NAAQS) for the following air pollutants (termed “criteria” pollutants): carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 (respirable) and 2.5 (fine) microns in diameter (PM_{10} and $PM_{2.5}$, respectively), and lead. ~~i~~In 1977, the federal Clean Air Act was amended to require each state to maintain a State Implementation Plan for achieving compliance with NAAQS. In 1990, the federal Clean Air Act was again amended to strengthen regulation of both stationary and mobile emission sources.

The California Air Resources Board oversees California’s air quality policies. California Ambient Air Quality Standards (CAAQS) were established starting in 1969, pursuant to the Mulford-Carrell Act. These standards are generally more stringent and include more pollutants than the NAAQS. The California Clean Air Act was approved in 1988, and requires each local air district in the state to prepare an Air Quality Plan to achieve compliance with CAAQS. Table 3-2 summarizes NAAQS and CAAQS and represents safe levels to avoid specific adverse health effects associated with each pollutant.

Several air districts are located within the SVAB. The local air districts with jurisdiction within the project study area include the following:

- Shasta County Air Quality Management District
- Glenn County Air Pollution Control District
- Tehama County Air Pollution Control District
- Colusa County Air Pollution Control District
- Butte County Air Quality Management District
- Feather River Air Quality Management District (mainly Sutter County)
- Placer County Air Pollution Control District
- Yolo/Solano Air Quality Management District

Pursuant to the 1990 federal Clean Air Act amendments, EPA has classified air basins (or portions thereof) as either “attainment” or “nonattainment” for each criteria air pollutant, according to whether NAAQS have been achieved. Similar designations are assigned for attainment and nonattainment of CAAQS. The “nonattainment” designation means that the air quality standards for the criteria pollutants are not consistently met. Table 3-3 shows the attainment classification for each county represented in the SVAB.

Regional Climate and Weather. The climate in the SVAB is considered Mediterranean, with average maximum and minimum temperatures of 97 degrees Fahrenheit (°F) and 58°F, respectively. Annual sunshine is approximately 75 percent of daytime hours, and annual precipitation ranges from approximately 15 inches in the northwest to 60 inches in the northeast. Prevailing winds within the SVAB originate offshore of the San Francisco Bay Area and flow through the Carquinez Strait and then north through the Sacramento Valley. Elevations within the Sacramento Valley Floor range from 60 to 500 feet above mean sea level. The Sacramento Valley is bordered to the north by the Sierra Cascade Mountains, to the east by the Sierra Nevada Mountains, and to the west by the Coast Range.

TABLE 3-2
NATIONAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	California Standards[a]	National Standards[b]	
			Primary[c]	Secondary[d]
Ozone	8-hour	--	0.08 ppm	0.08 ppm
	1-hour	0.09 ppm	0.12 ppm	0.12 ppm
Carbon Monoxide	8-hour	9.0 ppm	9 ppm	--
	1-hour	20 ppm	35 ppm	--
Nitrogen Dioxide	Annual arithmetic mean	--	0.053 ppm	0.053 ppm
	1-hour	0.25 ppm	--	--
Sulfur Dioxide	Annual arithmetic mean	--	0.030 ppm	--
	24-hour	0.04 ppm	0.14 ppm	--
	3-hour	--	--	0.5 ppm
	1-hour	0.25 ppm	--	--
PM_{10}	Annual arithmetic mean	20 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
$PM_{2.5}$	Annual arithmetic mean	12 $\mu g/m^3$	15 $\mu g/m^3$	15 $\mu g/m^3$
	24-hour	--	65 $\mu g/m^3$	65 $\mu g/m^3$
Sulfates	24-hour	25 $\mu g/m^3$	--	--
Lead	30-day average	1.5 $\mu g/m^3$	--	--
	Calendar quarter	--	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Hydrogen Sulfide	1-hour	0.03 ppm	--	--
Vinyl Chloride	24-hour	0.01 ppm	--	--
Visibility-reducing Particles	8-hour	See note[e]	--	--

[a]California standards for ozone, carbon monoxide, sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter (PM_{10}, $PM_{2.5}$,and visibility-reducing particles) are values that are not to be exceeded. All others are not to be equaled or exceeded.
[b]National standards, other than ozone, particulate matter, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard.
[c]National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect human health.
[d]National Secondary Standards: The levels of air quality necessary to protect human welfare from any known or anticipated adverse effects of a pollutant.
[e]Insufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent.

Notes:

$\mu g/m^3$ = micrograms per cubic meter.
ppm = parts per million (by volume).

Source: California Air Resources Board, 2003.

The topography and climate in the SVAB create a high potential for air inversions. Air inversions occur when air of one temperature is contained beneath a layer of air of another temperature, and air circulation is impeded. Inversions occur frequently within the SVAB during all seasons. The most stable of these inversions occurs in the late summer and early fall, when cool coastal air is trapped beneath a warm air mass. During late fall and winter, air inversions occurring at ground level often result in low-lying fog when valley air becomes trapped and does not mix with coastal air. Under these conditions, the SVAB experiences the highest concentrations of carbon monoxide, nitrogen oxide (NO_x), and airborne particulate matter.

Factors contributing to the existing air quality within the SVAB, and especially within the SRSCs' service area, are rural-type pollution and pollution transported from urban areas. Local emissions stem from the region's predominantly agricultural economy, which necessitates land cultivation and produces agricultural byproducts. Overall, SVAB emissions are a result of industries, automobiles, and land disturbances from urban areas, such as metropolitan Sacramento and surrounding communities including Yuba City, Marysville, Woodland, Davis, Chico, and, to a lesser extent, the San Francisco Bay Area. In addition, local, regional, and interstate automobile and truck traffic is a continually increasing, predominant air pollutant emission source within the basin (Navigant Consulting, Inc., 2000).

Environmental Consequences. The effects of Alternatives 1 through 5 on air quality in the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would be 40 years.

Alternative 1. Air quality in the SRSCs' service area under Alternative 1 would be similar to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC. However, these reductions would not result in increased pumping activities by these districts; therefore, the reductions would not result in impacts to air quality.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 2. Air quality in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

TABLE 3-3

ATTAINMENT STATUS FOR COUNTIES WITHIN THE SACRAMENTO VALLEY AIR BASIN

Pollutant	Shasta	Tehama	Glenn	Colusa	Solano	Sutter	Butte	Yolo	Sacramento
State									
Ozone	Nonattainment	Nonattainment	Nonattainment – Transitional	Nonattainment	Nonattainment	Nonattainment	Nonattainment – Transitional	Nonattainment	Nonattainment
PM_{10}	Nonattainment	Nonattainment	Nonattainment	Nonattainment	Nonattainment	Nonattainment	Nonattainment	Nonattainment	Nonattainment
Carbon Monoxide	Unclassified	Unclassified	Unclassified	Unclassified	Attainment	Attainment	Attainment	Attainment	Attainment
Federal									
Ozone (1-hour Standard)	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Nonattainment (severe)	Nonattainment (southern portion – severe; northern portion – Section 185A)	Nonattainment	Nonattainment (severe)	Nonattainment (severe)
Ozone (8-hour Standard)	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Nonattainment (portions – serious)	Nonattainment (southern portion – serious; northern portion – basic)		Nonattainment (serious)	Nonattainment (serious)
PM_{10}	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Unclassified/ Attainment	Nonattainment (moderate) (request for attainment redesignation has been filed)
Carbon Monoxide	Unclassified	Unclassified	Unclassified	Unclassified	Unclassified	Unclassified	Unclassified	Unclassified	Unclassified

Note: Attainment or Unclassified = sufficient data were not available to make a designation.

Source: California Air Resources Board, 2002.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 3. Air quality in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.
It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 4. It is assumed that use of the ~~assigned~~ CVMP water by SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative. Air quality in the SRSCs' service area under Alternative 4 would be potentially decreased in comparison to the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC, and sliding-scale reduced diversions to all contractors in dry years. Increased frequency of dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts, but are still within the range of reductions for critical years as defined under No Action. Therefore, the amount of irrigated acreage would be within the normal range associated with the No Action condition, and no additional fallowing would be required, although some additional crop acreage reductions would occur in lands served by short-form contractors. Possible results of these reductions are discussed in the Agricultural Land Use and Production section.

Alternatively, farmers may supplement surface water with groundwater, which would cause increased diesel emissions from pumping activities, particularly PM_{10} and NOx. The quantity of pumping that would occur as a result of this alternative is outlined in the Groundwater section. However, all project-related emissions would be produced in nonattainment areas; thus, the project could potentially contribute to an existing air quality violation, which would be considered a significant impact.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

Alternative 5. It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative. Air quality in the SRSCs' service area under Alternative 5 would be potentially decreased in comparison to the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC, and Shasta Inflow Index-reduced diversions to contractors in dry years. Increased frequency of dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts, but are still within the range of reductions for critical years as defined under No Action. Therefore, the amount of irrigated acreage would be within the normal range associated with the No Action condition, and no additional fallowing would be required, although some additional crop acreage reductions would occur in lands served by short-form contractors. Possible results of these reductions are discussed in Agricultural Land Use and Production section.

Alternatively, farmers may supplement surface water with groundwater, which would cause increased diesel emissions from pumping activities, particularly PM_{10} and NOx. The quantity of pumping that would occur as a result of this alternative is outlined in the Groundwater section. However, all project-related emissions would be produced in nonattainment areas; thus, the project could potentially contribute to an existing air quality violation, which would be considered a significant impact.

It is assumed that use of the assigned CVP water by the SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

Geology and Soils

Geology Affected Environment. The SRSCs' service area includes portions of two major physiographic provinces, the Sacramento Valley Province and the Klamath Mountains Province. The following sections provide a brief description of these provinces.

Sacramento Valley Province. The majority of the SRSCs' service area, which includes Butte, Colusa, Glenn, ~~Placer,~~ Sutter, Tehama, Sacramento, and Yolo Counties, overlies the Sacramento Valley Province. The Sacramento Valley Province is a 400-mile-long by 60-mile-wide sedimentary basin positioned among the Sierra Nevada, Klamath Mountains, Cascade Range, and Coast Range Provinces. Rocks of the Sacramento Valley Province include Upper Jurassic to Cretaceous marine sedimentary rocks, fluvial deposits, and recent alluvium (CALFED, 2000).

Klamath Mountains Province. The Klamath Mountains Province occurs at the northern end of the Sacramento Valley Province. Within the SRSCs' service area, Shasta and Tehama Counties fall within the boundaries of this province. Klamath Mountains Province is approximately 70 miles wide and extends northward into Oregon. Rocks of this province range in age from Paleozoic to Jurassic. The province consists of several well-defined mountain ranges, including the Trinity, Marble, Scott, and Salmon Mountains (CALFED, 2000).

Soils

Affected Environment. The SRSCs' service area includes the following five types of landforms that are associated with distinct characteristic soil compositions (CALFED, 1998):

- **Floodplain –** Composed of nearly level, recent alluvium with deposits of silt, sand, and gravel that were deposited by streams from the hills and mountains. These recent deposits consist mainly of reddish, sandy clay and black humus topsoil overlying unconsolidated sand, silt, clay, and gravel. The valley alluvium deposits increase in thickness toward the center of the valley, ranging from only a few inches near the foothills to over 200 feet near the Sacramento River (Butte County, 1977). Floodplain soils support highly productive agricultural land (CALFED, 1998).

- **Basin Rim/Basin Floor –** Consists of poorly drained soil, and saline and alkali soils in the valley trough and on the basin rim. This soil is typically used for pasture, rice, and cotton (CALFED, 1998).
- **Terraces –** Terraces consist of deposits of poorly consolidated, deeply red-stained gravel, sand, silt, and clay. These deposits typically are found near the eastern edge of the Sacramento Valley. The terraces were apparently formed as ancient floodplains during glacial periods (County of Sacramento, 1993). These soils are typically used for grazing and timberland (CALFED, 1998).
- **Delta –** Delta soils are primarily fertile peat composed of slow-to-decay organic material (County of Sacramento, 1993).
- **Foothills and Mountains –** This type of soil is formed in place through the decomposition and disintegration of underlying parent material. These soils are typically used for grazing and timberland (CALFED, 1998). A list of the most common soil groups in this category follows:
  - Soils with a deep depth (greater than 40 inches) to bedrock, which typically occur in high-rainfall zones at higher elevations
  - Soils with a shallow depth (less than 20 inches) to bedrock, which typically occur in the medium- to low-rainfall zones at lower elevations
  - Soils with a very shallow depth (less than 12 inches) to bedrock, which typically occur on steep slopes at high elevations

Environmental Consequences. The effects of Alternatives 1 through 5 on geology and soils of the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Geology and soils in the SRSCs' service area under Alternative 1 would be similar to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSC, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC. However, these reductions would not result in activities that would cause disturbance to soils; therefore, the reductions would result in no impacts.

It is assumed that use of the ~~assigned~~ CVP water by the SRSC would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 2. Geology and soils in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 3. Geology and soils in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSC.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 4. Geology and soils in the SRSCs' service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSC, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC and sliding-scale reduced diversions to all contractors in dry years. Increased frequency of dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts, but are still within the range of reductions for critical years as defined under No Action. Therefore, the amount of irrigated acreage would be within the normal range associated with the No Action condition, and no additional erosion or loss of soil would occur.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

No significant adverse impacts are associated with this alternative.

Alternative 5. Geology and soils in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC, and Shasta Inflow Index-reduced diversions in dry years. Increased frequency of dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts, but are still within the range of reductions for critical years as defined under No Action.

Therefore, the amount of irrigated acreage would be within the normal range associated with the No Action condition, and no additional erosion or loss of soil would occur.

No significant adverse impacts are associated with this alternative.

Water Quality

Affected Environment. Shasta Dam is a major influence on Sacramento River water quality and, consequently, on the Bay-Delta. Operation of the Trinity River Division (TRD) also affects water quality in the Sacramento River through the timing, magnitude, and temperature of imports to the Sacramento Valley, and the coordination with Shasta releases. Sacramento River water quality from Keswick Dam to the Red Bluff Diversion Dam is primarily influenced by Shasta Division releases and imports from the Trinity River. Downstream of the Red Bluff Diversion Dam, tributary inflow lessens the influence of the Shasta Division and imports from the TRD. During warm weather, Sacramento River water temperatures tend to increase downstream from Keswick Dam. This effect is magnified during dry water years with lower in-stream flows.

Following adoption of Water Right Orders 90-05 and 91-01 by SWRCB and implementation of the 1993 Winter-run Chinook Biological Opinion (BO), temperature requirements became a much more important constraint in the operation of the Shasta Division, which includes Shasta Dam and the Trinity River Division. Water Right Orders 90-05 and 91-01 implement the year-round 56°F Sacramento River temperature objective contained in the Sacramento River Basin Plan (Basin Plan) for the protection of all Sacramento River Chinook runs (winter, spring, fall, and late fall). The BO, which was recently updated, requires a minimum Shasta Reservoir carryover storage of 1.9 MAF on September 30. The BO also set temperature compliance standards at downstream measuring points at Balls Ferry, Jellys Ferry, and Bend Bridge (see the OCAP BO for a discussion of how the temperature compliance points will be collaboratively managed in the future). Table 3-3A outlines the projected temperature compliance points based on the amount of cold water in Shasta Reservoir on May 1 of each year. Before the BO and Water Right Orders 90-05 and 91-01, Shasta Dam was operated to maximize water deliveries, power generation, and flood control.

TABLE 3-3A

PROJECTED TEMPERATURE COMPLIANCE POINTS BASED ON THE AMOUNT OF COLD WATER IN SHASTA RESERVOIR ON MAY 1 OF EACH YEAR

May 1, Shasta coldwater volume below 52°F	Compliance Target
< 3.3 MAF	Balls Ferry (farthest upstream)
> 3.3 MAF but < 3.6 MAF	Jellys Ferry
> 3.6 MAF	Bend Bridge (farthest downstream)

The Shasta Division imports Trinity water in the spring and summer to conserve the coldwater pool in Shasta Reservoir for release later in the year. An important aspect of this coordination is to move Trinity water through Whiskeytown Reservoir at a rate sufficient to prevent warming. Water moving too slowly can result in warming, requiring additional coldwater releases from Shasta Dam to meet downstream temperature standards, which can reduce the amount of cold water available to meet standards later in the year and also affect water quality and deliveries in the Bay-Delta. Reclamation recently added a temperature control device (TCD) to the upstream (reservoir side) face of Shasta Dam. The TCD allows dam operators to pull cold water from lower depths throughout the year, increasing the ability to generate power while helping meet temperature objectives in the Sacramento River.

The majority of SRSCs are located downstream of the temperature compliance points outlined in Table 3-3A. Therefore, temperature compliance decisions are not affected by delivery of water to SRSCs.

Dilution of Iron Mountain Mine runoff is also an important Sacramento River water quality consideration. Runoff from the mine, an Environmental Protection Agency (EPA) Superfund site near Redding, can be highly acidic and contain toxic metals. Runoff is held at Spring Creek Debris Dam, located upstream from the tailrace of Spring Creek Powerplant.

The debris dam allows mine runoff to be released into Keswick Reservoir on a controlled schedule so that it can be diluted to safe levels. During wet periods when the debris dam fills and spills, runoff flows directly into Keswick Reservoir, and metal concentrations occasionally exceed desirable levels in the Sacramento River.

Releases of water from Whiskeytown Reservoir to the Spring Creek Powerplant are typically maintained at a minimum level of 200 cfs to help dilute the polluted water prior to entry into Keswick Reservoir. In the future, minimum releases may be lowered. This number should be considered very conservative given the ongoing construction of metal effluent control systems associated with Iron Mountain Mine.

The Colusa Basin Drain is located on the west side of the Sacramento Valley and provides drainage for agricultural fields as well as a source of water for farms located adjacent to it. Several efforts are underway to characterize and improve the quality of agricultural return flows discharged to the Colusa Basin Drain and the basin. These include the programs developed by the California Rice Commission (CRC) and Sacramento Valley Water Quality Coalition (SVWQC) to comply with the Central Valley Regional Water Quality Control Board "Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands." Both the CRC and the SVWQC have submitted Watershed Evaluation Reports and Monitoring and Reporting Programs that will serve as the foundation for a phased water quality management program. Both Coalition groups, in coordination with local County Agricultural Commissioners, water districts, other agricultural representatives, and farmers, will be implementing sediment and water quality monitoring programs and efforts to implement and track water quality management practices as determined appropriate on the basis of the monitoring results. Additionally, Colusa Basin Drain water quality is currently being evaluated in coordination with downstream water users to assess the potential for alternative Colusa Basin Drain operation scenarios to improve the water quality of the Sacramento River.

Water quality in the Bay-Delta is primarily affected by the way water moves through the region. Freshwater inflows are continuously influenced by the tidal cycle, which moves into and out of the Bay-Delta approximately twice a day. This tidal interaction is important because it moves the saltwater/freshwater interface back and forth, which influences water quality at specific locations throughout the Bay-Delta, both daily and seasonally. Water exports from the Bay-Delta are impacted by these changing water quality characteristics.

Currently, a combination of agreements and directives are used to maintain water quality in the Bay-Delta, including the following:

- Bay-Delta Accord
- SWRCB D-1485, as amended by Water Right Orders 95-1, 95-6, and 98-9
- Coordinated Operations Agreement

These agreements and directives outline standards and operating procedures that, when used in conjunction with upstream water quality plans and BOs for endangered species, determine water quality in the Bay-Delta.

The Bay-Delta Accord, formulated by CALFED and representatives of several urban, agricultural, and environmental groups, is effective until the adoption of final Delta water quality standards. Originally intended to be valid for 3 years, the Bay-Delta Accord has been extended twice. The Bay-Delta Accord established new outflow standards, modified BOs for winter-run Chinook salmon and Delta smelt to increase water project flexibility, and established a funding mechanism for non-flow-related measures.

SWRCB Bay-Delta water quality standards are conditioned by water-year class and, in general, become less stringent in critically dry years. The SWRCB May 1995 Water Quality Control Plan, as amended by Water Right Orders R 95-1, 95-6, and 98-9, outlines standards for salinity, chloride, and habitat protection (X2 criteria for example). X2 criteria refer to the management of upstream movement of water with 2 parts-per-thousand (ppt) concentration of salt. X2 is measured as kilometers (km) from the Golden Gate Bridge. Higher X2 values indicate saltwater intrusion into the Delta. X2 is sometimes used as a measure of Delta smelt habitat.

Water quality standards are much more difficult to meet in critically dry years because there is less water supply to meet them, and multi-objective CVP purposes must be made on a tradeoff basis with limited resources. Water quality standards become more protective (or enhanced) as conditions become wetter, and there are generally more water resources and project flexibility to meet these competing multi-objective needs. Because of their ability to significantly alter flows, and therefore water quality in the Bay-Delta, the major export pumps are also regulated. Exports from the pumps are restricted according to Delta inflow and San Joaquin River flow. These limits are intended to be monitored in real time to detect fish in the areas adjacent to the pumps. Currently, exports are limited to 35 percent of Delta inflow from February through June and 65 percent of inflow for the remainder of the year. In 1995, the export/inflow ratio averaged 18.4 percent, with a low of 6.2 and a daily maximum of 64.3. Exports are also limited between April 15 and May 15 to 1,500 cfs or 100 percent of San Joaquin River flow at Vernalis, whichever is greater. The San Joaquin export limit is only used if it is more restrictive than the 35 percent limit.

Diversions from the Delta provide drinking water for about 20 million people, making water quality and the ability to adequately treat Delta water, a major concern. Fresh water that is not used in the Delta, or not exported from the Delta flows, to the Pacific Ocean through San Francisco Bay, helps prevent saline water from encroaching into the Delta and degrading water quality. Managing the balance between water taken from the Delta for drinking water and water left in the Delta to protect water quality is a key concern.

The Safe Drinking Water Act (SDWA) was enacted and signed into law in 1974. Through the SDWA, the EPA was given the authority to set standards for contaminants in drinking water supplies. The EPA was required to establish primary regulations for the control of contaminants that affect public health, and secondary regulations for compounds that affect the taste or aesthetics of drinking water. Under the SDWA, Department of Health Services has the primary enforcement responsibility (referred to as “primacy”). The Health and Safety Code and Title 22 of the California Code of Regulations establishes Department of Health Services authority and stipulates drinking water quality and monitoring standards. To maintain primacy, a state’s drinking water regulations can be no less stringent than the federal standards. Water in the Delta generally meets public water supply water quality standards identified by EPA and the Department of Health Services. However, stricter federal standards have been promulgated and are significantly more difficult and costly to meet. The standards of concern relate to disinfection by-products and the potential requirements for more rigorous disinfection. Since 1914, chlorine has been the preferred disinfectant in most United States public surface water systems. It is relatively easy to use, inexpensive, and it persists in water, continuing to kill bacteria throughout the distribution system. In the mid-1970s, concern arose over newly discovered compounds that form when chlorine combines with naturally occurring organic, carbon-based materials, such as decaying vegetation or some salts. Known as disinfection by-products (DBP), these synthetic organic compounds are suspected carcinogens.

For drinking water, DBPs have only been consistently measured since the early 1980s, because EPA first adopted a maximum contaminant level for trihalomethanes (THM) in 1981. Constituents that can cause DBPs include the halogens fluorine, bromine, chlorine, and iodine , all relatively abundant in seawater, and organic carbon. Tidal currents created by the rise and fall of sea levels modify stream flow, particularly when outflows are low or when tides are high. Intruded seawater is a major source of halogens, particularly in the western Delta. Intrusion profoundly affects Delta water withdrawn at the CCWD, SWP, and CVP intakes. The presence of halogens, particularly bromine, in a drinking water source complicates the disinfection process because bromine is heavier than chlorine and the THM standard is based on weight. Hence, it takes fewer molecules of brominated THMs to exceed the drinking water standard. Another method of disinfection, ozone treatment, is also complicated by the presence of bromide because it forms bromate, which is also a DBP.

Of the agricultural land acreage in the Delta, 80 percent contain peat soils. The organic carbon content of peat soil is 50 to 80 percent, and intermediate organic-type soils have 30 to 50 percent organic matter. High organic content makes peat soil highly productive for agriculture, but prone to wind erosion and subsidence. Subsidence is the result of exposure of peat to oxygen, which converts the organic carbon solids to carbon dioxide gas.

Environmental Consequences. The effects of Alternatives 1 through 5 on water quality within the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Water quality in the SRSCs' service area under Alternative 1 would be similar to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage, or release patterns from CVP facilities, or the maximum quantity of water delivered to the SRSCs. Although contract amounts to ACID and SMWC would be reduced, these reductions are the result of needs analyses and are reflective of past water use by these SRSCs. Therefore, these reductions in contract amounts would not result in activities or conditions that would result in impacts to water quality. It is assumed that use of the CVP water by the SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 2. Water quality in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage, or release patterns from CVP facilities, or the maximum quantity of water delivered to the SRSCs.

It is assumed that use of the CVP water by the SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 3. Water quality in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage, or release patterns from CVP facilities, or the maximum quantity of water delivered to the SRSCs.

It is assumed that use of the CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 4. Water quality in the SRSCs' service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage, or release patterns from CVP facilities, or the maximum quantity of water delivered to the SRSCs, with the exception of reduced contract amounts to ACID and SMWC and sliding-scale reduced diversions to all contractors in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water shortages during dry years when the irrigation district would have otherwise maintained full contract amounts. However, total irrigated acreage would be the same; therefore, runoff from agriculture would also be the same. Increased pumping activities associated with these cutbacks would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Over time, increased pumping activities could result in a reduction in local streamflow in limited portions of the service areas. (Much of the area served by Settlement Contracts has no natural inflows during the summer other than that in the Sacramento River.) As outlined in the groundwater analysis, reductions associated with this alternative are very small, even under conservative assumptions.

It is assumed that use of the CVP water by the SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

No significant adverse impacts are associated with this alternative.

Alternative 5. Water quality in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage, or release patterns from CVP facilities, or the maximum quantity of water delivered to the SRSCs, with the exception of reduced contract amounts to ACID and SMWC, and Shasta Inflow Index-reduced diversions in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water shortages during dry years when the irrigation district would have otherwise maintained full contract amounts. However, total irrigated acreage would be the same; therefore, runoff from agriculture would also be the same. Increased pumping activities associated with these shortages would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Over time, increased pumping activities could result in a reduction in local streamflow in limited portions of the service areas. (Much of the area served by Settlement Contracts has no natural inflows during the summer other than that in the Sacramento River). As outlined in the groundwater analysis, reductions associated with this alternative are very small, even under conservative assumptions.

It is assumed that use of the CVP water by the SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

No significant adverse impacts are associated with this alternative.

Surface Water

Affected Environment

The CVP is the largest surface water storage and delivery system in California, covering 35 of the state's 58 counties. The project includes 20 reservoirs, with a combined storage capacity of approximately 11 MAF, and 9 power plants and 2 pump-generating plants, with a combined generation capacity of approximately 2 million kilowatts. Operations of the CVP are quite complex given the multiple demands that must be met. Key Shasta Division operational issues include the following:

- Flood control
- Storage and release of water for agricultural, M&I, fish and wildlife, refuges, and other needs

- Navigation flows
- Temperature control as specified by the 1993 Biological Opinion for Sacramento Winter-run Chinook Salmon
- Bay-Delta water requirements
- Generation of hydroelectric energy

Historically, the vast majority of CVP water has been delivered to agricultural users. However, continued urban growth is resulting in greater demand from CVP M&I customers.

The CVP operations are guided by a series of documents, including the 1992 CVP-OCAP (currently undergoing revisions), various Biological Opinions for endangered species, the Coordinated Operating Agreement (COA) between the CVP and SWP, and Regional Water Resources Control Board water quality plans.

Flows in the upper Sacramento River are primarily regulated by Shasta Dam and are re-regulated 15 miles downstream at Keswick Dam. The watershed above Shasta Dam drains approximately 6,650 square miles with an average annual runoff of 5.7 MAF. With a capacity of 4.6 MAF, Shasta Dam has the largest capacity of any reservoir in the state. Annual releases range from 9 MAF in wet years to 3 MAF in dry years. From 1964-1996, Keswick releases averaged 7.3 MAF annually. In more recent years (1986 to 1996), Keswick annual releases averaged 5.9 MAF.

The 1993 Winter-run Biological Opinion is one of the most influential factors governing Shasta releases, both in terms of quantity and timing. The Biological Opinion sets temperature requirements below Keswick Dam for April through October, and established an end-of-September minimum carryover storage for Shasta Lake of 1.9 MAF. In years when CVP facilities cannot be operated to meet required temperature and storage objectives, Reclamation re-initiates consultation with National Oceanic and Atmospheric Administration-Fisheries (NOAA-Fisheries).

Aside from making water available for downstream uses, exports for the remainder of the water year are managed to maximize the following:

- Movement of water through Whiskeytown Reservoir to minimize warming
- Conservation of Shasta coldwater reserves
- Production of high-value summer and early fall power generation

The agricultural contractors account for the vast majority of consumptive uses of water along the Sacramento River. Of the total amount that is diverted for agricultural use, the portion of the water that is applied to fields but is not actually used by crops is assumed to return to the Sacramento River either through surface water or groundwater. This water is then available for other downstream uses, including CVP contractors within the Bay Area (e.g., Contra Costa Water District) or those served through Delta exports (e.g., the San Joaquin Exchange contractors, or agricultural and M&I water service contractors located south of the Delta).

The CVP annually supplies up to approximately 6.2 MAF to water contractors in the Central and Santa Clara Valleys and Contra Costa County. The CVP is required by contract~~s~~ to make deliveries up to the contract amount, if requested, except in periods of water shortage. During periods of reduced supply, water deliveries are decreased according to terms in the contracts. Contractors are grouped into the following three general categories:

1. **Sacramento River ~~Water Rights~~ Settlement Contractors.** These contractors claimed water rights in the Sacramento River Basin prior to construction of Shasta Dam. Contract provisions allow for reductions of up to 25 percent of contracted amounts during dry conditions (as determined by the Shasta Inflow Index).

2. **San Joaquin River Exchange Contractors.** These contractors claimed water rights in the San Joaquin River and agreed to forgo these rights in exchange for CVP water diverted from the Bay-Delta and delivered to the Mendota Pool. Contract provisions allow for reductions of up to 25 percent of contracted amounts under dry conditions (as determined by the Shasta Inflow Index).

3. **CVP Water Service Contractors.** These agricultural and M&I water service contractors entered into agreements with Reclamation for delivery of CVP water as a supplemental or full supply. Water deliveries to agricultural water service contractors can be reduced up to 100 percent in particularly dry years. Maximum curtailment levels are not specified for most M&I water service contractors. Historically, Reclamation has limited maximum curtailments to M&I contractors to 25 percent; future system demands are assumed to potentially require curtailments of up to 50 percent. Water availability for delivery to CVP water service contractors during periods of insufficient supply is determined using a combination of operational objectives, hydrologic conditions, and reservoir storage conditions.

Environmental Consequences. The effects of Alternatives 1 through 5 on surface water within the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Surface water in the SRSCs' service area under Alternative 1 would be similar to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC. However, these reductions are the result of needs analyses and are reflective of past water use by these SRSCs. Therefore, these reductions in contract ~~amounts~~ quantities would not result in activities or conditions that would result in impacts to surface water. It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 2. Surface water in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 3. Surface water in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 4. Surface water in the SRSCs' service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC and sliding-scale reduced diversions to all contractors in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water cutbacks during dry years when the irrigation district would have otherwise maintained full contract amounts. Increased pumping activities associated with these cutbacks would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Over time, increased pumping activities could result in a reduction in local streamflow by (1) increasing infiltration of surface water through the streambed, (2) intercepting groundwater that would have recharged surface waterbodies, or (3) a combination of 1 and 2.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

No significant adverse impacts are associated with this alternative.

Alternative 5. Surface water in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract ~~amounts~~ quantities to ACID and SMWC, and Shasta Inflow Index-reduced diversions in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water cutbacks during dry years when the irrigation district would have otherwise maintained full contract amounts. Increased pumping activities associated with these cutbacks would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Over time, increased pumping activities could result in a reduction in local streamflow by (1) increasing infiltration of surface water through the streambed, (2) intercepting groundwater that would have recharged surface waterbodies, or (3) a combination of 1 and 2.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

No significant adverse impacts are associated with this alternative.

Groundwater

Affected Environment

Sacramento River Hydrologic Region. The project area is located within the Sacramento River Hydrologic Region. The Sacramento River Hydrologic Region covers approximately 17.4 million acres and extends south from the Modoc Plateau and Cascade Range at the Oregon border to the Sacramento-San Joaquin Delta. The hydrologic region contains both the Redding and Sacramento Valley Groundwater Basins. Collectively, the Redding and Sacramento Valley Groundwater Basins extend from Redding in the northern portion of the Sacramento Valley to the Sacramento metropolitan area in the southern portion of the Sacramento Valley. This discussion focuses on the land within the Sacramento Valley Groundwater Basin.

The Sacramento River Hydrologic Region is the main water supply source for much of California's urban and agricultural areas. Annual runoff in the hydrologic region averages approximately 22.4 MAF, which is nearly one-third of the state's total natural runoff. Major water supplies in the region are provided through surface storage reservoirs. The two largest surface reservoirs are Reclamation's Shasta Lake (CVP) on the upper Sacramento River and DWR's Lake Oroville (~~the Department's~~ SWP) on the Feather River. M&I and agricultural demands in the region are approximately 8 MAF, with groundwater providing approximately 2.5 MAF of that total. This 2.5 MAF represents approximately 11 percent of the total annual runoff, as shown on Figure 3-1 (all figures are located at the end of this chapter). Much of the remainder of the runoff goes to dedicated natural flows, which support various environmental requirements, including in-stream fishery flows and flushing flows in the Delta. (~~Department~~DWR, 2003a).

Climatic Influence on Groundwater Levels. Since 1980, California has experienced a variety of climate conditions, including a 5-year drought from approximately 1987 through 1992. During this drought, decreasing groundwater levels were experienced across much of the region; however, after the drought ceased, groundwater levels generally recovered. This suggests that the variability in the seasonal recovery of groundwater levels in the Sacramento Valley through time has been largely due to climate conditions (i.e., precipitation).

Sacramento Valley Groundwater Basin

The Sacramento Valley Groundwater Basin extends from the southern edge of the Redding Groundwater Basin to the San Joaquin Valley and includes portions of Tehama, Glenn, Butte, Yuba, Sutter, Colusa, Placer, Solano, Sacramento, and Yolo Counties. It is bordered by the Red Bluff Arch to the north, the Coast Range to the west, the Sierra Nevada to the east, and the San Joaquin Valley to the south. ~~Department~~DWR Bulletin 118 further divides the Sacramento Valley Groundwater Basin into sub-basins (~~Department~~DWR, 2003a). Figure 3-2 shows the areal extent of the Sacramento Valley Groundwater Basin and defined sub-basins within the area of analysis.

Geology, Hydrogeology, and Hydrology

The Sacramento Valley Groundwater Basin is a north-northwestern-trending asymmetrical trough filled with as much as 10 miles of both marine and continental rocks and sediment (Page, 1986). On the eastern side, the basin overlies basement bedrock that rises relatively gently to form the Sierra Nevada, and on the western side, the underlying basement bedrock rises more steeply to form the Coast Ranges. Overlying the basement bedrock are marine sandstone, shale, and conglomerate rocks, which generally contain brackish or saline water (DWR~~epartment~~, 2001). The more recent continental deposits, overlying the marine sediments, contain freshwater. These continental deposits are generally 2,000 to 3,000 feet thick (Page, 1986). The depth (below ground surface) to the base of freshwater typically ranges from 1,000 to 3,000 feet (Bertoldi, 1991). Along the eastern and northeastern portion of the basin are the Tuscan and Mehrten Formations, derived from the Cascades and Sierra Nevada. The Tehama Formation in the western portion of the basin is derived from Coast Range sediments. In most of the Sacramento Valley Groundwater Basin, the Tuscan, Mehrten, and Tehama Formations are overlain with relatively thin alluvial deposits.

Groundwater is recharged by deep percolation of applied water and rainfall, infiltration from streambeds, and lateral inflow along the basin boundaries. Average annual precipitation in the Sacramento Valley Groundwater Basin ranges from 13 to 26 inches, with the higher precipitation quantities occurring along the eastern and northern edges of the basin. Typically, 80 to 90 percent of the basin’s precipitation occurs from November to April. Farther east in the Sierra Nevada, precipitation ranges from 40 to 90 inches, much in the form of snow (Bertoldi, 1991).

The quantity and timing of snowpack melt are the predominant factors affecting the surface water and groundwater hydrology;~~,~~ and peak runoff in the basin typically lags peak precipitation by 1 to 2 months (Bertoldi, 1991). The main surface water feature in the Sacramento Valley Groundwater Basin is the Sacramento River, which has several major tributaries draining the Sierra Nevada, including the Feather, Yuba, and American Rivers. Stony, Cache, and Putah Creeks, draining the Coast Range, are the main western tributaries of the Sacramento River. Surface water and groundwater interact on a regional basis, and, thus, gains and losses to groundwater vary significantly geographically and temporally. In areas where groundwater levels have declined, such as in Sacramento County, streams that formerly gained flow by groundwater discharge now lose water to the groundwater system through seepage.

The exact quantity of groundwater that is pumped in the valley is not known. However, estimates by the ~~Department~~DWR and others, based on land use and crop requirements, suggest that approximately 2.5 MAF of water is pumped annually from M&I and agricultural production wells in the Sacramento River Hydrologic Region[3]. This magnitude of pumping

[3] http://www.groundwater.water.ca.gov/bulletin118/update2003/index.cfm

represents approximately 11 percent of the average annual runoff into the Sacramento Valley Groundwater Basin. As described above, groundwater levels have historically recovered during the wet season within a given annual cycle.

To further evaluate the nature of groundwater production from the Sacramento Valley Groundwater Basin, information contained in ~~Department~~DWR records is summarized in Table 3-4. These data suggest that the approximate 2.5 MAF of groundwater production from the Sacramento Valley Groundwater Basin occurs from a combination of about 5,800 irrigation and municipal wells along with 18,000 domestic wells. Municipal and irrigation wells appear to be screened slightly deeper within the aquifer (200 to 400 feet bgs) than the domestic wells in the basin (screened 100 to 250 feet bgs).

TABLE 3-4

TYPICAL WELL CONSTRUCTION IN THE SACRAMENTO VALLEY GROUNDWATER BASIN

Sub-basin	Number of Domestic Wells	Average Depth[a] (feet bgs)	Number of Irrigation Wells	Average Depth[a] (feet bgs)
Red Bluff	3,293[a]	197[a]	18[a]	207[b]
Bend	No Data	No Data	No Data	No Data
Antelope	702[a]	104[a]	92[a]	176[b]
Dye Creek	432[a]	94[a]	56[a]	188[b]
Los Molinos	311[a]	92[a]	42[a]	327[a]
Corning	1,667[a]	135[a]	822[a]	246[b]
Vina	2,215[a]	139[a]	715[a]	330[b]
Colusa	2,599[a]	155[a]	1,515[a]	368[b]
West Butte	1,469[a]	136[a]	1,038[a]	321[a]
East Butte	1,477[a]	101[a]	699[a]	285[a]
Sutter	510[c]	127[c]	106[c]	195[c]
North Yuba	262[c]	131[c]	61[c]	251[c]
South Yuba	275[c]	186[c]	92[c]	343[c]
Yolo	380[c]	243[c]	189[c]	395[c]
North American	665[c]	190[c]	105[c]	396[c]
South American	422[c]	247[c]	78[c]	372[c]
Solano	954[c]	235[c]	111[c]	422[c]
TOTALS	17,663		5,739	

[a]Based on well completion reports (~~Department~~DWR, 2003a).

[b]Includes both municipal and irrigation wells.

[c]Niblack (2004), Well Completion Reports received from 1979-2002.

Groundwater Production, Levels, and Storage

Irrigated agriculture in the Sacramento Valley Groundwater Basin increased steadily from less than 500,000 acres in the 1940s to more than 1.5 million acres by 1980 (Reclamation, 1997). Correspondingly, groundwater production to support agriculture rose from less than

500,000 AF annually to more than 2.5 MAF annually by the mid-1990s (~~Department~~DWR, 2003c).

In general, groundwater flows inward from the edges of the basin and south parallel to flow in the Sacramento River. Depth to groundwater throughout most of the valley averages about 30 feet, with shallower depths along the Sacramento River and greater depths along the basin margins. Additionally, several local groundwater depressions are associated with areas of groundwater extraction.

The information presented in Table 3-4 suggests that, with the exception of the extreme northern end of the valley, most irrigation wells in the valley are at least 300 feet deep. Where construction data are not available, it is assumed that the "typical" irrigation well is screened over the bottom half of the total depth of the well. This fact, along with the depth-to-water measurements, implies that the top of a typical irrigation well screen lies at least 100 feet below the water table, and seasonal fluctuations on the order of tens of feet should not substantially impact well productivity.

Redding Groundwater Basin

The Redding Groundwater Basin is in the northernmost portion of the Sacramento Valley. Underlying Tehama and Shasta Counties, it is bordered by the Klamath Mountains to the north, the Coast Range to the west, and the Cascade Mountains to the east. The Red Bluff Arch, between Cottonwood and Red Bluff, separates the Redding Groundwater Basin from the Sacramento Valley Groundwater Basin to the south. DWR~~epartment~~ Bulletin 118 subdivides the Redding Groundwater Basin into six sub-basins: Anderson, Enterprise, Millville, Rosewood, Bowman, and South Battle Creek (DWR~~epartment~~, 2003a). Figure 3-3 shows the areal extent of the Redding Groundwater Basin.

Geology, Hydrogeology, and Hydrology

The Redding Groundwater Basin consists of a sediment-filled, southward-plunging symmetrical trough (DWR~~epartment~~, 2001). Simultaneous deposition of material from the Coast Range and the Cascade Range resulted in two different formations, which are the principal freshwater-bearing formations in the basin. The Tuscan Formation in the east is derived from Cascade Range volcanic sediments, and the Tehama Formation in the western and northwest portion of the basin is derived from Coast Range sediments. These formations are up to 2,000 feet thick near the confluence of the Sacramento River and Cottonwood Creek, and the Tuscan Formation is generally more permeable and productive than the Tehama Formation (DWR~~epartment~~, 2001). Groundwater recharge occurs in the higher elevations by stream seepage and direct infiltration of precipitation. Rivers and streams transition to gaining streams at lower elevations and receive direct groundwater discharge. Areas of riparian vegetation occur along surface water features throughout the basin.

The water budget of the Redding Groundwater Basin is dominated by a large annual influx of water falling as precipitation on the surrounding mountains and on the valley floor. A large portion of recharge to the Redding Groundwater Basin is from precipitation and snowmelt from higher elevations. Average annual precipitation in the Redding Groundwater Basin ranges from 22 inches to as much as 40 inches in the higher elevations. As is typical throughout the Central Valley, 80 to 90 percent of the area's precipitation occurs from November to April. In the surrounding mountain ranges, precipitation ranges from 40 to 75 inches, much of it in the form of snow. A portion of this water is consumed by evapotranspiration by native vegetation, and the remainder occurs as runoff and groundwater recharge.

It has been estimated that the Redding Groundwater Basin yields an average of 850,000 AF of annual runoff (CH2M HILL, 2003). Much of this water is potentially available to recharge the Redding Groundwater Basin and replenish water levels that have been depressed because of groundwater pumping. Applied water totals approximately 270,000 AF in the Redding Groundwater Basin (CH2M HILL, 1997). The exact quantity of groundwater that is pumped from the basin is not known; however, it has been estimated that approximately 55,000 AF of water is pumped annually from M&I and agricultural production wells (CH2M HILL, 2003). This magnitude of pumping represents approximately 6 percent of the average annual runoff into the basin.

To further evaluate the nature of groundwater production from the Redding Groundwater Basin, Table 3-5 summarizes information contained in ~~Department~~DWR records. These data suggest that the approximately 55,000 AF of groundwater production from the Redding Groundwater Basin occur from a combination of about 170 irrigation and municipal wells and approximately 6,000 domestic wells. Municipal and irrigation wells appear to be screened slightly deeper within the aquifer (200 to 300 feet bgs) than the domestic wells in the basin (screened 140 to 250 feet bgs).

TABLE 3-5

TYPICAL WELL CONSTRUCTION IN THE REDDING GROUNDWATER BASIN

Sub-basin	Number of Domestic Wells	Average Depth (feet bgs)[a]	Number of Municipal and Irrigation Wells	Average Depth (feet bgs)[a]
Anderson	2,239	140	48	302
Bowman	804	257	27	312
Enterprise	1,970	139	65	180
Millville	487	156	8	265
Rosewood	447	181	15	311
South Battle Creek	18	189	5	227
Totals	5,965		168	

[a]Based on well completion reports (DWR, 2003c).

Seasonal groundwater fluctuations range from 2 to 3 feet in shallow unconfined aquifers and 2 to 5 feet in semi-confined to confined aquifers in normal years. During drought years, unconfined aquifer levels could fluctuate by as much as 10 feet, and semi-confined and confined aquifer levels could fluctuate as much as 16 feet. The principal surface water features in the Redding Groundwater Basin are the Sacramento River and its tributaries

Battle, Cow, Little Cow, Clear, Dry, and Cottonwood Creeks. Surface water and groundwater interact in many areas in the Redding Groundwater Basin.

In general, groundwater flows southeasterly on the west side of the basin and southwesterly on the east side, toward the Sacramento River. The Sacramento River is the main drain for the basin (DWR~~epartment~~, 2003a).

Groundwater Production, Levels, and Storage

Total annual groundwater pumping for the Redding Groundwater Basin is approximately 40,000 AF (CH2M HILL, 2003). This quantity represents less than 10 percent of the basin’s average (during years of normal precipitation) groundwater discharge to surface water, estimated at approximately 670,000 AF (CH2M HILL, 2003). The majority of the groundwater discharge to surface water in the basin occurs to the Sacramento River in the lower portions of the basin.

Groundwater levels typically range from greater than 460 feet above mean sea level (msl) around the fringes of the basin, to less than 390 feet msl near the confluence of Cottonwood Creek and the Sacramento River. Historically, groundwater levels have remained stable, with no long-term trend of declining or increasing. However, groundwater levels are affected by changes in precipitation, falling during droughts but rising quickly when normal or above-normal precipitation occurs. For example, some short-term declines were noticeable during the droughts of 1976 through 1977 and in 1987 through 1992. These declines were followed by recovery to pre-drought levels after several successive normal or above-normal precipitation events occurred.

ASSESSMENT APPROACH

To evaluate the potential impacts associated with each of the proposed contract alternatives, some method of assessing the potential impacts that may occur to surface water flows and groundwater levels under various contract options was required. It was recognized early in the project planning process that sufficient time and resources were not available to develop a comprehensive water-budget based numerical model of the entire Sacramento Valley. This type of model would require simulation of spatial and temporally varying hydrologic processes including the recharge of precipitation, surface water/groundwater interactions, cropping patterns, and the recharge of applied irrigation water. As an alternative, a superposition approach was taken to estimating project impacts. A superposition model simulates the incremental impacts that would occur solely due to the changes in water contracting strategies, and these impacts would be superimposed on existing baseline groundwater conditions in the valley.

Impacts associated with changes to the current contracting strategy are simulated by the model, and model output provides estimates of impacts on surrounding groundwater levels and changes in streamflow due to changes in groundwater pumping in the basin. Model estimates represent the incremental impacts that would occur solely due to changes in groundwater pumping that would occur as a result of modifications to the current contracting approach. Simulations were performed to evaluate potential impacts projected during the

April through October pumping period. In addition, potential impacts that would occur in the November through December time frame were also simulated because it was assumed that significant winter recharge would not yet occur. Finally, it was assumed that winter recharge would replenish groundwater levels over the winter months (January through March), eliminating any residual impacts; therefore, this period was not explicitly modeled.

The assumption of seasonal basin refilling is based on a comprehensive review of historical water-budget components and water-level trends in the Sacramento River Hydrologic Region. Under current conditions, the Sacramento Valley and Redding Groundwater Basins are full and spill excess recharge to streams. In general, as pumping increases, the amount of discharge to streams decreases, but the groundwater basin would remain virtually full unless pumping rates exceed the water available for groundwater recharge. Existing data indicate that a large amount of water is available to replenish the groundwater basin after pumping. Furthermore, evaluation of water-level hydrographs from wells across the valley indicate that in almost all areas groundwater levels have been stable over the past 25 years, and water levels recover to pre-pumping conditions over the winter recharge period.

The impacts that may occur due to implementation of various contracting alternatives were evaluated by comparing the magnitude of cutbacks to surface water deliveries that would occur under current contracting practices, versus the magnitude of cutback that would occur under the proposed contracting alternatives. It was assumed that any decrease in surface water deliveries would immediately be replaced by groundwater pumping. In other words, during a period of reduced surface water deliveries, ~~water~~ irrigation districts would use the same quantity of irrigation water with the same timing simply by replacing surface water supplies with groundwater production. The estimated percentage of contract ~~amounts~~ quantities that would be delivered under each alternative during the 1921-2001 hydrology period is shown in Table 3-6. Using this information, it was possible to compare the difference in surface water deliveries predicted under current contracting methodology, and under each of the proposed contracting alternatives. These data suggest that the greatest difference in surface water deliveries would occur during the early stages of drought periods, where the current contracting approach would result in full delivery of contracted amounts, whereas several alternative approaches would result in a 25 percent cutback in deliveries, and therefore a switch to groundwater pumping to meet irrigation needs. The impacts of this additional pumping on groundwater levels and streamflows were evaluated using the groundwater flow model as described below.

Several major assumptions were made in preparing the groundwater modeling simulations. These assumptions are summarized as follows:

- The quantity and timing of the contracted surface water deliveries for the contractors were used as a basis for assigning the additional groundwater pumping rates to the model. This was done on a monthly time step. If a contractor has a 25 percent cutback in deliveries for the year, it was assumed that the cutback occurs uniformly to the contracted delivery each month, and groundwater pumping would occur during that same time period to make up the difference in irrigation water supplies. A list of SRSCs included in the modeling effort, as well as monthly contract supplies, can be found in Table 3-7.

TABLE 3-6

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Flow in Shasta in MAF	Percentage Cutback No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
1921-1922	4.6	100%	100%	100%	100%
1922-1923	3.6	100%	90%	90%	90%
1923-1924	2.5	75%	75%	75%	75%
1924-1925	5.1	100%	100%	100%	80%
1925-1926	3.7	100%	90%	90%	80%
1926-1927	7.0	100%	100%	100%	100%
1927-1928	5.1	100%	100%	100%	100%
1928-1929	3.2	100%	75%	75%	75%
1929-1930	4.2	100%	100%	100%	80%
1930-1931	2.5	75%	75%	75%	75%
1931-1932	3.7	75%	80%	75%	80%
1932-1933	3.5	75%	75%	75%	75%
1933-1934	3.3	75%	75%	75%	75%
1934-1935	4.9	100%	100%	100%	90%
1935-1936	4.7	100%	100%	100%	90%
1936-1937	4.1	100%	100%	100%	90%
1937-1938	9.5	100%	100%	100%	100%
1938-1939	3.5	100%	75%	80%	80%

TABLE 3-6

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Flow in Shasta in MAF	Percentage Cutback			
		No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
1939-1940	7.0	100%	100%	100%	100%
1940-1941	8.7	100%	100%	100%	100%
1941-1942	7.6	100%	100%	100%	100%
1942-1943	5.9	100%	100%	100%	100%
1943-1944	3.7	100%	80%	90%	80%
1944-1945	4.9	100%	100%	100%	90%
1945-1946	5.9	100%	100%	100%	90%
1946-1947	3.9	100%	100%	90%	80%
1947-1948	5.4	100%	100%	100%	90%
1948-1949	4.3	100%	100%	100%	80%
1049-1950	4.1	100%	100%	100%	90%
1950-1951	6.3	100%	100%	100%	100%
1951-1952	7.8	100%	100%	100%	100%
1952-1953	6.5	100%	100%	100%	100%
1953-1954	6.5	100%	100%	100%	100%
1954-1955	4.1	100%	100%	100%	80%
1955-1956	8.8	100%	100%	100%	100%
1956-1957	5.4	100%	100%	100%	100%
1957-1958	9.7	100%	100%	100%	100%
1958-1959	5.1	100%	100%	100%	90%

TABLE 3-6

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

		Percentage Cutback			
Water Year – Period of Record	**Flow in Shasta in MAF**	**No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]**	**Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF**	**Alternative 4 – Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF**	**Alternative 5 – Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF**
1959-1960	4.7	100%	100%	100%	80%
1960-1961	5.1	100%	100%	100%	80%
1961-1962	5.3	100%	100%	100%	90%
1962-1963	7.0	100%	100%	100%	100%
1963-1964	3.9	100%	100%	100%	80%
1964-1965	7.0	100%	100%	100%	100%
1965-1966	5.3	100%	100%	100%	90%
1966-1967	7.4	100%	100%	100%	100%
1967-1968	4.8	100%	100%	100%	90%
1968-1969	7.7	100%	100%	100%	100%
1969-1970	7.9	100%	100%	100%	100%
1970-1971	7.3	100%	100%	100%	100%
1971-1972	5.1	100%	100%	100%	90%
1972-1973	6.2	100%	100%	100%	100%
1973-1974	10.8	100%	100%	100%	100%
1974-1975	6.4	100%	100%	100%	100%
1975-1976	3.6	100%	80%	80%	75%
1976-1977	2.6	75%	75%	75%	75%
1977-1978	7.8	100%	100%	100%	100%
1978-1979	4.0	100%	100%	100%	90%

TABLE 3-6

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Flow in Shasta in MAF	Percentage Cutback: No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
1079-1980	6.4	100%	100%	100%	100%
1980-1981	4.1	100%	100%	100%	80%
1981-1982	9.0	100%	100%	100%	100%
1982-1983	10.8	100%	100%	100%	100%
1983-1984	6.7	100%	100%	100%	100%
1984-1985	4.0	100%	100%	100%	80%
1985-1986	7.5	100%	100%	100%	100%
1986-1987	3.9	100%	100%	100%	80%
1987-1988	3.9	100%	100%	100%	75%
1988-1989	4.7	100%	100%	100%	80%
1989-1990	3.6	100%	80%	80%	75%
1990-1991	3.1	75%	75%	75%	75%
1991-1992	3.6	75%	90%	75%	75%
1992-1993	6.8	100%	100%	100%	100%
1993-1994	3.1	75%	75%	75%	75%
1994-1995	9.6	100%	100%	100%	100%
1995-1996	6.8	100%	100%	100%	100%
1996-1997	7.4	100%	100%	100%	100%
1997-1998	10.3	100%	100%	100%	100%
1998-1999	7.2	100%	100%	100%	100%

TABLE 3-6

SAMPLE OF IMPLEMENTATION OF SHORTAGE PROVISIONS BASED ON HISTORICAL PERIOD OF RECORD

Water Year – Period of Record	Flow in Shasta in MAF	Percentage Cutback No Action, Alternative 1 (Preferred Alternative), and Alternative 3 – 25% cutback in Shasta critical years only[a]	Alternative 2 – Sliding-scale cutback (10-20-25%) based on stepped decrease; no cutback if previous water year greater than 4.0, and no reset requirement at 4 MAF	Alternative 4 – Sliding-scale cutback (10-20-25%) based on stepped decrease; cutback remains at lowest level until full ~~contract amount~~ contract quantity reset at 4 MAF	Alternative 5 – Sliding-scale cutback (10-20-25%) based on Sacramento River Index[b] water years; no reset requirement at 4 MAF
1999-2000	6.8	100%	100%	100%	100%
2000-2001	4.1	100%	100%	100%	80%
Number of years with cutbacks during period of record		9 years	16 years	17 years	43 years
Cumulative (4 years) cutback during 4–year drought of 1931-1934		2,127,451	2,021,078	2,127,451	2,021,078

[a]Shasta critical years defined by the contract between Reclamation and the SRSCs (see Appendix C for complete contract). This shortage provision was the mechanism used in the original contracts and thus represents the No Action, in addition to Alternatives 1 and 3.

[b]The Sacramento Valley 40-30-30 Index is computed as a weighted average of the current water year's April through July unimpaired runoff forecast (40 percent), the current water year's October through March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff (calculated in the Sacramento Valley 40-30-30 Index as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom) is the river production unaltered by water diversions, storage, exports, or imports. A water year with a Sacramento Valley 40-30-30 Index equal to or greater than 9.2 MAF is classified as "wet." A water year with an index equal to or less than 5.4 MAF is classified as "critical."

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
~~City of West Sacramento~~	~~0-07-20-W0187~~	~~23,600~~	~~0~~	~~0~~	~~0~~	~~2,776~~	~~4,533~~	~~4,628~~	~~4,864~~	~~3,796~~	~~2,089~~	~~891~~	~~0~~	~~0~~
Howald Farms, Inc.	14-06-200-1042A	2,760	0	0	0	170	440	510	590	650	390	10	0	0
A & F Boeger Corp. and Boeger Land Company (Eastside MWC)	14-06-200-1053A	2,804	0	0	0	390	540	460	506	478	260	170	0	0
King, ~~Barbara~~ Ben and Laura	14-06-200-1086Y	19	0	0	0	1	4	4	5	3	2	0	0	0
~~Dommer, Elizabeth~~ ~~(~~King, Laura~~)~~	14-06-200-1086Z	26	0	0	0	2	4	4	8	5	3	0	0	0
Reische, Laverne C., et ux	14-06-200-1150A	450	0	0	0	0	50	108	142	108	25	17	0	0
Reische, Eric	14-06-200-1150X	90	0	0	0	0	10	22	28	22	5	3	0	0
Furlan, Emile, et ux	14-06-200-1175A	920	0	0	0	50	180	165	180	200	140	5	0	0
Heidrick, Joe, Family Trust	14-06-200-1176A	560	0	0	0	20	120	120	120	120	60	0	0	0
Reynen, John; Bardis, Christo (Broomside Farms)	14-06-200-1286A	10,070	0	0	0	1,320	2,260	1,550	2,160	2,030	670	80	0	0
Lauppe, Burton	14-06-200-1289A	950	0	0	0	0	10	250	230	240	90	130	0	0
Driver, John A. and Clare M., Family Revocable Trust	14-06-200-1314A	230	0	0	0	10	40	50	50	40	30	10	0	0
~~ELH Sutter Properties~~ ~~(~~Natomas Basin Conservancy~~)~~	14-06-200-1364A	490	0	0	0	28	50	96	120	131	65	0	0	0
Lauppe, B & K	14-06-200-1364X	350	0	0	0	20	36	69	85	94	46	0	0	0
ELH Sutter Properties, Inc. ~~& Lauppe, B.~~	14-06-200-1364Y	40	0	0	0	2	4	8	10	11	5	0	0	0
Wakida, ~~Masaru~~Tomio, et ux	14-06-200-1415A	325	0	0	0	0	25	45	115	110	30	0	0	0
~~Ritchey, E.J (~~Jansen, Pete and Sandy~~)~~	14-06-200-1426A	190	0	0	0	20	50	30	40	40	10	0	0	0
~~Furlan Joint Venture~~ ~~(~~Byrd/Osborne~~)~~	14-06-200-1595A	1,700	0	0	0	160	360	340	350	360	110	20	0	0
Baber, Jack, et al	14-06-200-1604A	6,260	0	0	0	0	1,160	1,703	1,188	1,520	649	40	0	0
Heidrick, Emmett & Mildred, Trust	14-06-200-1616A	120	0	0	0	6	19	24	27	24	15	5	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
Hale & Marks	14-06-200-1638A	75	0	0	0	6	21	17	17	13	1	0	0	0
Odysseus Farms	14-06-200-1664A	2,070	0	0	0								0	0
Anderson, Ray Properties, L.P.~~E., et ux~~ (1) & (2)	14-06-200-1726A	190	0	0	0	15	25	35	50	40	15	10	0	0
~~Amen, Henry, Estate~~ ~~(~~RD 900&1000~~)~~	14-06-200-1779A	404	0	0	0	12	55	92	104	74	55	12	0	0
Zelmar Ranch	14-06-200-1827A	164	0	0	0	16	32	40	40	12	12	12	0	0
~~Martin, Andrew~~ ~~(~~Gomes, Judith~~)~~	14-06-200-1827X	246	0	0	0	24	48	60	60	18	18	18	0	0
Davis, Grover L., et ux	14-06-200-1851A	85	0	0	0	7	17	21	25	14	1	0	0	0
Andreotti, Arnold~~rthur~~, et al	14-06-200-1898A	3,620	0	0	0	380	610	600	790	920	320	0	0	0
Locvich, ~~Paul~~Loyd	14-06-200-1945A	150	0	0	0	0	30	50	40	10	10	10	0	0
Tarke, ~~James~~Stephen, et ux	14-06-200-1949A	2,700	0	0	0	230	650	500	550	550	210	10	0	0
Nelson, Thomas L., et ux	14-06-200-1954A	136	0	0	0	0	18	36	38	40	4	0	0	0
Butte Creek Farms (Mayfair Farms)	14-06-200-1976A	204	0	0	0	18	47	55	51	0	0	33	0	0
Howard, Theodore & Linda	14-06-200-1976X	76	0	0	0	7	18	20	19	0	0	12	0	0
Carter MWC (Colusa Properties, Inc.)	14-06-200-2042A	940	0	0	0	40	230	200	220	180	30	40	0	0
Windswept Land & Livestock	14-06-200-2045A	4,040	0	0	0	220	690	720	730	740	880	60	0	0
~~Chilton, Barbara~~ ~~(~~Siddiqui~~)~~, Javed, et ux	14-06-200-2065A	130	0	0	0	0	20	30	40	30	10	0	0	0
Pelger Mutual Water Company	14-06-200-2073A	8,860	0	0	0	1,210	3,250	1,670	1,010	990	670	60	0	0
~~Swinford Tract Irrigation Company~~ ~~(~~Montgomery/Mehrhof~~/ McPherson)~~	14-06-200-2145A	181	0	0	0	16	36	56	44	20	4	4	0	0
Davis, ~~Olive P., et al~~Ranches	14-06-200-2146A	31,800	0	0	0	3,200	6,900	6,400	7,200	6,100	1,900	100	0	0
Knaggs Walnut Ranches Co., L.P.	14-06-200-2148A	630	0	0	0	40	110	180	110	70	120	0	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
~~Deseret Farms of California (~~Sacramento River Ranch~~)~~	14-06-200-2149A	4,000	0	0	0	500	1,000	1,100	600	200	500	100	0	0
Quad H Ranches	14-06-200-2153A	500	0	0	0	40	100	100	100	90	70	0	0	0
Freeman, Vola ~~Frank, et ux~~	14-06-200-2212A	30	0	0	0	2	4	6	6	6	4	2	0	0
Drew, Jerry	14-06-200-2250A	36	0	0	0	2	6	7	8	7	4	2	0	0
Butler, Leslie, et ux	14-06-200-2365A	460	0	0	0	30	70	110	110	80	40	20	0	0
~~Elliot, Marlene, and Hradecky, Denton, Co-Tenancy (~~Rubio, Exequiel, et ux~~)~~	14-06-200-2368A	16	0	0	0	1	2	2	3	3	3	2	0	0
Driver, John A., et ux	14-06-200-2398A	16	0	0	0	1	3	3	4	3	2	0	0	0
Carter MWC (Sartain Mutual Water Company) ~~(Carter MWC)~~	14-06-200-2401A	7,122	0	0	0	560	1,950	1,610	1,154	818	810	210	0	0
Sacramento, County of	14-06-200-2404A	750	0	0	0	20	100	180	220	130	100	0	0	0
Oji, Mitsue, Family Partnership	14-06-200-2427A	4,740	0	0	0	590	920	910	910	730	680	0	0	0
Wirth~~Davis~~, Marilyn ~~(Lamb/Wirth)~~	14-06-200-2486A	520	0	0	0	10	110	110	120	120	50	0	0	0
McLaughlin, Jack	14-06-200-2514A	650	0	0	0	70	110	110	140	160	60	0	0	0
J.B. Unlimited, Inc.	14-06-200-2519A	510	0	0	0	10	60	110	110	110	60	50	0	0
Kary, Carol	14-06-200-2520A	1,000	0	0	0	0	190	220	270	210	110	0	0	0
Young, Russell L., et al	14-06-200-2552A	10	0	0	0	0	1	2	3	3	1	0	0	0
Tisdale Irrigation and Drainage Company	14-06-200-2781A	9,900	0	0	0	1,200	2,000	1,900	1,800	1,700	1,100	200	0	0
Butte Creek Farms (Y)	14-06-200-2851A	36	0	0	0	3	13	8	10	2	0	0	0	0
Redding, City of	14-06-200-2871A	21,000	900	800	1,100	1,400	1,925	2,700	3,000	3,000	2,175	1,800	1,150	1,050
Griffin, Joseph, et al	14-06-200-2895A	2,760	0	0	0	20	400	668	652	548	462	10	0	0
~~Wells, Joyce M (~~Otterson, Mike~~/Azevedo)~~	14-06-200-2896A	1,815	0	0	0	120	580	360	160	465	120	10	0	0
Fedora, Sib, et al	14-06-200-2916A	210	0	0	0	10	30	40	50	40	30	10	0	0
Hollins, Mariette B.	14-06-200-2993A	1,560	0	0	0	30	620	340	150	280	130	10	0	0
Seaver, Charles	14-06-200-3296A	480	0	0	0	40	80	100	130	50	50	30	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
Anderson-Cottonwood Irrigation District	14-06-200-3346A	128,000	0	0	0	15,360	18,286	19,749	20,846	20,114	19,017	14,629	0	0
Willey, Edwin, et ux	14-06-200-3556A	95	0	0	0	5	15	20	25	20	10	0	0	0
Anderson, Arthur et al~~Westfall, Ralph D.~~	14-06-200-3591A	490	0	0	0	20	80	100	110	100	60	20	0	0
Oji Brothers Farm, Inc.	14-06-200-3753A	3,200	0	0	0	240	550	600	760	710	340	0	0	0
~~Chicago Almond Products Co. and American Almond Products Co., Inc.~~ ~~(~~Exchange Bank/The Nature Conservancy~~)~~	14-06-200-3774A	780	0	0	0	40	90	130	190	180	140	10	0	0
Gjermann, Hal	14-06-200-4010A	12	0	0	0	0	2	2	2	4	2	0	0	0
Giusti, Richard, et al	14-06-200-4076A	1,610	0	0	0	130	310	310	340	290	230	0	0	0
Lockett, William P. & Jean B. 1998 Family Revocable Trust	14-06-200-4105A	417	0	0	0	10	60	110	110	100	27	0	0	0
O'Brien, Janice	14-06-200-4105X	839	0	0	0	75	90	179	175	190	90	40	0	0
Leiser, Dorothy L.	14-06-200-4178A	60	0	0	0	1	13	13	13	13	7	0	0	0
Daniell, Harry	14-06-200-4348A	20	0	0	0	1	3	3	4	3	4	2	0	0
Richter Brothers, et al	14-06-200-4362A	2,780	0	0	0	155	550	490	530	600	435	20	0	0
McLane, Robert	14-06-200-4446A	40	0	0	0	3	6	7	9	6	5	4	0	0
Wilson Ranch Partnership	14-06-200-4520A	370	0	0	0	30	60	150	40	10	70	10	0	0
Wallace Trust ~~Construction~~ (Tenhumfeld)	14-06-200-4604A	3,640	0	0	0	210	640	1,088	674	438	570	20	0	0
Carter MWC (Carter, Jane Foster)	14-06-200-4617A	1,470	0	0	0	140	620	440	140	100	20	10	0	0
Driscoll Strawberry Associates, Incorporated	14-06-200-4736A	820	0	0	0	80	130	130	170	150	110	50	0	0
Spence, Ruth Ann	14-06-200-4829A	730	0	0	0	120	100	180	210	10	0	110	0	0
Lake California Property Owners Association	14-06-200-4961A	780	0	0	0	60	100	150	170	140	110	50	0	0
Wilson, Dennis ~~M & L Farms~~	14-06-200-5200A	355	0	0	0	0	10	85	135	110	15	0	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
Wakida, Tomid~~Masaru~~, et ux	14-06-200-5200X	160	0	0	0	0	10	25	55	55	15	0	0	0
Butte Creek Farms (A)	14-06-200-5206A	95	0	0	0	0	25	30	30	10	0	0	0	0
~~Cannell, Fred (~~Green Valley Corp~~)~~	14-06-200-5210A	890	0	0	0	60	110	160	245	180	120	15	0	0
~~Stegeman Station Ranch (~~Green Valley Corp~~)~~	14-06-200-5211A	880	0	0	0	70	130	195	245	170	55	15	0	0
Wisler, Jack, et ux~~Cribari, Emile (Wisler)~~	14-06-200-5215A	35	0	0	0	1	2	11	18	3	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	14-06-200-5520A	26,290	0	0	0	2,360	5,250	6,690	3,680	3,690	3,100	1,520	0	0
Morehead, Joseph A., et ux	14-06-200-5789A	255	0	0	0	20	45	50	50	50	30	10	0	0
Maxwell Irrigation District	14-06-200-6078A	17,980	0	0	0	1,990	3,520	2,410	2,220	2,030	2,710	3,100	0	0
Munson, James T., et ux	14-06-200-7049A	155	0	0	0	0	10	45	60	40	0	0	0	0
Cachil Dehe Band of Wintun Indians ~~Lee Farms~~	14-06-200-7206A	180	0	0	0	20	30	40	40	40	10	0	0	0
Churkin, Michael, et al	14-06-200-7227A	130	0	0	0	10	20	25	30	25	15	5	0	0
Tuttle, Charles	14-06-200-7296A	390	0	0	0	20	30	75	95	90	50	30	0	0
Leviathan, Inc.	14-06-200-7308A	700	0	0	0	55	65	135	155	120	110	60	0	0
Eggleston, Ronald H., et ux	14-06-200-7339A	65	0	0	0	6	18	15	14	11	1	0	0	0
Conaway Conservancy Group	14-06-200-7422A	50,862	0	0	0	6,890	13,970	14,690	5,374	1,268	6,810	1,860	0	0
Mirbach-Harff Antonius	14-06-200-7556A	170	0	0	0	0	10	60	60	40	0	0	0	0
Hale & Marks	14-06-200-7572A	130	0	0	0	11	36	29	29	22	3	0	0	0
Forry, Laurie	14-06-200-7691A	2,285	0	0	0	80	570	500	500	420	195	20	0	0
Pires, Lawrence J., et ux	14-06-200-7744A	280	0	0	0	10	75	85	55	45	5	5	0	0
Butte Creek Farms (P)	14-06-200-7744X	640	0	0	0	30	105	130	140	130	80	25	0	0
Alexander, Thomas, et ux	14-06-200-7754A	22	0	0	0	2	3	4	5	3	3	2	0	0
MCM Properties, Inc.	14-06-200-7827A	1,470	0	0	0	50	320	320	320	320	140	0	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
Siddiqui, Javed & Amna	14-06-200-7941A	1,060	0	0	0	90	120	190	220	220	170	50	0	0
Hershey Land Company	14-06-200-7972A	3,020	0	0	0	400	570	560	530	520	330	110	0	0
Micke, Daniel	14-06-200-7995A	100	0	0	0	11	13	20	32	13	10	1	0	0
Gillaspy, William~~Fay~~	14-06-200-8117A	210	0	0	0	30	45	45	45	35	10	0	0	0
Beckley, Ralph, et ux	14-06-200-8118A	300	0	0	0	45	60	65	65	50	15	0	0	0
Sutter Mutual Water Company	14-06-200-815A	226,000	0	0	0	20,000	42,500	48,000	53,500	44,000	12,500	5,500	0	0
Riverview Golf & Country Club	14-06-200-8286A	280	0	0	0	30	35	45	55	55	35	25	0	0
Heidrick, Emmett & Mildred, Trust	14-06-200-8322A	430	0	0	0	5	30	120	145	80	35	15	0	0
Ehrke, Allen A., et ux	14-06-200-8330A	380	0	0	0	20	60	75	85	80	45	15	0	0
Meridian Farms Water Company	14-06-200-838A	35,000	0	0	0	4,400	6,200	5,900	7,000	6,100	5,400	0	0	0
Princeton-Codora-Glenn Irrigation District~~Company~~	14-06-200-849A	67,810	0	0	0	10,800	13,500	13,190	12,740	11,180	5,000	1,400	0	0
Glenn-Colusa Irrigation District	14-06-200-855A	825,000	0	0	0	100,000	140,000	150,000	185,000	140,000	65,000	45,000	0	0
Provident Irrigation District	14-06-200-856A	54,730	0	0	0	7,210	10,830	12,920	10,000	3,500	7,900	2,570	0	0
Odysseus Farms Partnership	14-06-200-8574A	630	0	0	0	0	70	140	135	170	100	15	0	0
Driver, Gary, et al	14-06-200-8585A	30	0	0	0	1	2	6	8	7	4	2	0	0
Lonon, Michael, et al	14-06-200-8658A	1,155	0	0	0	120	190	220	260	240	110	15	0	0
Steidlmayer, Francis J., et al	14-06-200-874A	1,310	0	0	0	230	210	160	360	140	130	80	0	0
Reclamation District #108	14-06-200-876A	232,000	0	0	0	34,000	50,500	49,000	47,500	31,500	18,000	1,500	0	0
River Garden Farms	14-06-200-878A	29,800	0	0	0	4,300	6,500	5,800	5,800	4,700	2,200	500	0	0
Hiatt, Family Trust ~~Glenwood J., et al~~	14-06-200-880A	1,486	0	0	0	75	258	244	420	377	115	0	0	0
Hiatt and Illerich~~,~~ ~~Thomas et al~~	14-06-200-880X	584	0	0	0	28	102	96	165	148	45	0	0	0
Natomas Central Mutual Water Company	14-06-200-885A	120,200	0	0	0	14,000	27,700	23,000	18,700	18,700	16,100	2,000	0	0

TABLE 3-7

CONTRACT SUPPLY AND SCHEDULED MONTHLY DELIVERIES

Contractor Name	Contract Number	Total Contract Supply (AF)	January Delivery (AF)	February Delivery (AF)	March Delivery (AF)	April Delivery (AF)	May Delivery (AF)	June Delivery (AF)	July Delivery (AF)	August Delivery (AF)	September Delivery (AF)	October Delivery (AF)	November Delivery (AF)	December Delivery (AF)
Schreiner, Joe & Cleo	14-06-200-889A	200	0	0	0	0	10	40	100	30	20	0	0	0
Reclamation District #1004	14-06-200-890A	71,400	0	0	0	6,300	14,700	12,200	12,100	12,000	8,800	5,300	0	0
~~Wilson, Neil (~~Edson, W&M~~)~~	14-06-200-906A	104	0	0	0	8	16	24	16	16	16	8	0	0
Chesney, R & A, Bypass Trust et al	14-06-200-930A	700	0	0	0	60	170	140	170	140	20	0	0	0
Lomo Cold Storage	14-06-200-931A	7,110	0	0	0	1,400	2,900	1,670	450	360	330	0	0	0
Henle Family Limited Partnership	14-06-200-932A	935	0	0	0	120	300	210	120	100	55	30	0	0
Riverby Limited	14-06-200-934A	500	0	0	0	30	60	130	110	110	50	10	0	0
Robert's Ditch Irrigation Company, Inc.	14-06-200-935A	4,440	0	0	0	660	670	950	600	550	610	400	0	0
Driver, William, et al	14-06-200-939A-1	160	0	0	0	0	18	45	44	45	8	0	0	0
Driver, Gregory E.	14-06-200-939A-2	20	0	0	0	0	2	5	6	5	2	0	0	0
M & T Chico Ranch (Pacific Realty)	14-06-200-940A	17,956	0	0	0	1,200	1,640	3,002	4,330	4,564	2,460	760	0	0
Penner, Roger~~H.H.~~, et ux	14-06-200-960A	180	0	0	0	9	24	37	38	36	23	13	0	0
Giovannetti, B.E.~~ & Mary~~	14-06-200-991A	520	0	0	0	60	80	90	120	120	50	0	0	0
Sekhon, Arjinderpal & Daljit	7-07-20-W0001	820	0	0	0	60	170	150	165	150	85	40	0	0
Jaeger, William, et al	7-07-20-W0002	870	0	0	0	90	145	185	205	190	55	0	0	0
High-Low Nursery, Inc.	7-07-20-W0006	205	0	0	0	10	30	45	50	45	20	5	0	0
Cummings, William ~~Verona Farming Partnership~~	7-07-20-W0054	300	0	0	0	20	55	50	75	65	35	0	0	0
Rauf, Aboul, et ux~~t~~ ~~Forster, Rosemary Trust & Jerome~~	8-07-20-W0117	3,160	0	0	0	250	710	540	670	600	380	10	0	0

- The timing of irrigation deliveries, and therefore groundwater pumping, for the districts where monthly contract delivery data were not available was estimated by calculating the percentage of contract delivery that occurs during each month of the irrigation season based on the all other districts, and applying those monthly percentages to the remaining contracts.
- Groundwater pumping was assumed to occur at a uniform rate over the entire water district service area.
- Groundwater pumping was assumed to occur from the regional aquifer beneath each SRSC~~district~~. The regional aquifer is defined as the aquifer from which the majority of existing irrigation wells draw water in a given area.
- Groundwater production rates are assumed to be constant in a given month with groundwater production occurring 24 hours per day, 7 days a week.

The superposition approach was used to simulate two pumping scenarios. The first simulation represents a single year where all of the contract supplies are decreased by 25 percent. The second simulation represents a hypothetical 4-year drought. During this simulation, all contractor supplies are decreased by 25 percent for 4 consecutive years. It was assumed that there is a seasonal recovery of 40 to 50 percent (for the Sacramento Valley and Redding Groundwater Basins, respectively) during each winter. The recovery factor is based on the average seasonal recovery observed during the 1976-1977 drought in the Sacramento Valley and Redding Groundwater Basins (DWR~~epartment~~, 2003a).

Sacramento Valley Groundwater Basin Modeling Tool

The Sacramento Valley Groundwater Basin modeling tool covers the Sacramento Valley extending south from the Red Bluff Arch in Tehama County to the Sacramento-San Joaquin Delta. It includes specific information on the thickness and properties of the aquifers and the relationships between the streams and underlying aquifers. The extent of the groundwater modeling tool is presented on Figure 3-2. The total thickness and lateral extent of the model represent the freshwater aquifer defined by Berkstresser (1973). Thickness was divided into six model layers based on assumed construction of typical irrigation wells in the Sacramento Valley Groundwater Basin. A no-flow boundary was assumed along the margins of the model domain to simulate the lateral extent of freshwater-bearing sediments in the Sacramento Valley Groundwater Basin. A head-dependent boundary condition was used to simulate 40 individual streams throughout the model domain. The distribution of aquifer properties, such as transmissivity and specific yield, were derived from those reported by Bloyd (1978).

Redding Groundwater Basin Modeling Tool

To evaluate the impacts of the project on groundwater conditions and streamflows in the Redding Groundwater Basin, a superposition groundwater model was used similar to that constructed for the Sacramento Valley Groundwater Basin (referred to as the "Redding Basin Groundwater Model [RBGM]). Initial conditions for the modeling simulations assume a flat water table and with streams in direct hydraulic connection with the groundwater aquifer.

The boundary of the RBGM generally coincides with the boundary of the Redding Groundwater Basin and is shown on Figure 3-3. The RBGM boundary was extended slightly beyond the boundary in the following areas:

- North of the Redding Groundwater Basin boundary and south of Shasta Lake
- West of the Redding Groundwater Basin boundary and east of Clear Creek below Whiskeytown Lake

The RBGM boundaries were extended in these areas to fully encompass local water purveyor service areas for future simulations involving potential water transfers and impacts. The total aquifer thickness in the RBGM was estimated by subtracting the depth to bedrock (i.e., Chico Formation) (DWR~~epartment~~, 1968) from average groundwater levels. The total aquifer thickness was subdivided into four model layers based on typical screened intervals of wells in the Redding Groundwater Basin. A no-flow boundary was used along the margins of the model domain to simulate the lateral extent of freshwater-bearing sediments in the basin. A head-dependent boundary condition was used to simulate 31 individual streams throughout the model domain. The distribution of aquifer properties that resulted from the calibration process, such as transmissivity, were originally derived from specific capacity data obtained from M&I and, where available, domestic water supply wells. An additional head-dependent boundary was applied to the surface of the RBGM to simulate the loss of shallow groundwater to evapotranspiration.

Due to the contracted surface water deliveries to the City of Redding water service area, pumping scenarios simulated with the RBGM were run using monthly time steps from April through March. Additionally, because well locations were known for the three largest contractors in the Redding Groundwater Basin, pumping was assigned to these discrete locations as opposed to being distributed over the district area.

Sacramento Valley Groundwater Basin Analysis

The following sections describe the modeling results for the Sacramento Valley Groundwater Basin.

Groundwater Levels

Under a 25 percent cutback scenario, annual SRSC pumping within the Sacramento Valley Groundwater Basin would total approximately 495,000 AF. A decrease in surface water supplies to SRSCs, and subsequent increase in groundwater pumping, would result in temporary additional drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Model forecast drawdown was evaluated in both the shallow and regional aquifers. The shallow aquifer is defined as the unconfined aquifer that exists in the upper 50 feet of saturated sediments. The regional aquifer is defined as the deeper portions of the aquifer that are typically tapped by irrigation wells in the basin. Figures 3-4 and 3-5 are maps of maximum incremental drawdown due to increased SRSC pumping in both the shallow aquifer and the deeper regional aquifer at the end of an average pumping season. Drawdown in the shallow aquifer could influence streams and riparian vegetation. Drawdown in the deeper aquifer could affect pumping water levels in nearby wells and potentially induce subsidence. The degree of anticipated impact and relative potential for significance is discussed below.

Shallow aquifer drawdown, shown on Figure 3-4, refers to changes in water levels within the upper 50 feet of the unconfined aquifer. This figure is based on the maximum computed drawdown that would occur at the end of the April through October pumping season. The model indicates that shallow aquifer drawdown resulting from increased SRSC pumping generally ranges from 0 to 22 feet, with drawdown not exceeding 10 feet in most areas (Table 3-8). The maximum projected drawdown of 22 feet occurs in the GCID area.

Regional aquifer drawdown, shown on Figure 3-5, is the maximum incremental drawdown, attributable to increased pumping, in groundwater levels in the aquifer where most irrigation pumping occurs. Model results suggest that drawdown of groundwater levels would range from 0 to 22 feet (Table 3-8). This maximum drawdown is forecast to occur in the GCID area. However, predicted drawdown in all other areas of the Sacramento Valley Groundwater Basin would generally be less than 10 to 15 feet. The areal extent of regional aquifer drawdown is similar to that of shallow aquifer drawdown, but of slightly greater magnitude.

TABLE 3-8

SUMMARY OF DRAWDOWN IMPACTS AT THE END OF THE PUMPING SEASON

Sub-basin	Maximum Incremental Drawdown – Shallow Aquifer (feet)	Maximum Incremental Drawdown - Regional Aquifer (feet)
North Colusa	22	22
South Colusa	10	9
West Butte	6	6
East Butte	5	5
North Yuba	<1	<1
South Yuba	<1	<1
Sutter	15	15
Yolo	5	5
North American	10	9

Surface Water/Groundwater Interaction. Implementation of any cutback of SRSC surface water supply, and resultant increase in groundwater pumping, would result in a reduction in local streamflow by: (1) increasing infiltration of surface water through the streambed, (2) intercepting groundwater that would have recharged surface waterbodies, or (3) a combination of 1 and 2.

Impacts to Sacramento River flows are anticipated to result in a peak instantaneous streamflow reduction rate shortly before the end of the 214-day pumping period of 148 cfs, and an average streamflow reduction of 103 cfs between April and December. Peak impacts to flows in the Feather River are predicted to be 16 cfs, with an average reduction of 11 cfs. For comparison, the historical mean monthly flow in the Sacramento River ranges from 12,390 (October) to 41,060 (February) cfs at the Freeport gauge. The historical mean monthly flow in the Feather River, as measured at the Nicolaus gauge, ranges from 2,630 (August) to 15,520 (February) cfs. Table 3-9 summarizes the predicted streamflow depletion rates, along with average measured streamflows during the month of peak depletion, where available. Streamflow impacts on several outlying streams are predicted to continue to increase once pumping has stopped. However, the influence of winter recharge, assumed to begin January 1, would cause these impacts to decline over the winter, and cease altogether once groundwater levels return to pre-pumping conditions. Therefore, the impacts on these streams are assumed to peak on December 31. The spatial variation in streamflow depletion rates across the Sacramento Valley Groundwater Basin, at the end of the 214-day stress period, is shown on Figure 3-6.

Table 3-9 lists the average and peak stream impacts estimated for streams in the Sacramento Valley, along with the percentage of streamflow that each impact represents. The simulated peak stream depletion rate for each stream was compared to the corresponding measured historical streamflow for each stream (where data were available) to quantify the peak reduction in average streamflow. Results suggest that forecast changes in streamflow in the Sacramento Valley Groundwater Basin would be insignificant and likely unmeasureable.

TABLE 3-9

SUMMARY OF SIMULATED AVERAGE AND PEAK STREAM DEPLETION RATES IN THE SACRAMENTO VALLEY GROUNDWATER BASIN

Stream	Average April through December Stream Depletion Rate (cfs)	Peak Stream Depletion Rate (cfs)	Month of Peak Stream Depletion Rate	Historical Mean Measured Streamflow (cfs) for Month of Simulated Peak Impact – Gauge Location	Predicted Peak Reduction in Average Flows (%)
Sacramento River	102.8	147.8	September	14,850 – Freeport	1%
Feather River	10.5	16.1	October	3,375 – Nicolaus	0.5%
GCID Canal	9.5	13.8	October	N/A	N/A
Colusa Basin Drain	5.6	8.0	September	N/A	N/A
Stone Corral Creek[a]	4.3	6.3	October	0 – Sites	
Butte Creek	2.9	4.3	October	138 – Chico	3%
Funks Creek	2.5	3.6	October	N/A	N/A
Willow Creek	1.6	2.4	October	N/A	N/A
Stony Creek	1.0	1.5	September	136 – Orland	1%
Salt Creek	0.8	1.2	October	N/A	N/A
American River	0.6	0.9	October	1,160 – Fair Oaks	0.1%
Cache Creek	0.3	0.5	October	14 – Yolo	3%
Big Chico Creek	0.3	0.5	September	24 – Chico	2%
Angel Slough	0.2	0.3	December[b]	N/A	N/A
Walker Creek	0.1	0.3	December[b]	27 – Artois	1%
Little Chico Creek	0.1	0.2	September	N/A	N/A
Wilson Creek	0.1	0.2	December[b]	N/A	N/A
South Fork Willow Creek	0.1	0.2	December[b]	2 - Fruto	12%
TOTALS	**143.4**	**208.0**			

TABLE 3-9

SUMMARY OF SIMULATED AVERAGE AND PEAK STREAM DEPLETION RATES IN THE SACRAMENTO VALLEY GROUNDWATER BASIN

Stream	Average April through December Stream Depletion Rate (cfs)	Peak Stream Depletion Rate (cfs)	Month of Peak Stream Depletion Rate	Historical Mean Measured Streamflow (cfs) for Month of Simulated Peak Impact – Gauge Location	Predicted Peak Reduction in Average Flows (%)

[a]The assumption that Stone Corral Creek flows year-round is conservative. Drawdown impacts are not underestimated as the total depletion from this stream (410 AF) represents only 0.30% of the total program supply (155,000 AF).

[b]It is assumed that the influence of winter recharge, beginning January 1, would cause stream impacts to decline over the winter, and cease altogether once groundwater levels return to pre-pumping conditions. Therefore, the impacts on these streams are assumed to peak on December 31.

Multi-year Drought Periods

The analysis of impacts presented above assumes that groundwater levels in the Sacramento Valley return to pre-pumping levels each spring due to recharge of precipitation and streamflow during the winter months. However, during periods of extreme drought conditions occurring over multiple years, it is likely that groundwater levels would not recover completely each spring, and some residual drawdown would persist into the subsequent irrigation season.

The groundwater flow model that was developed to estimate the SRSC groundwater and streamflow impact is a superposition model, which means that is does not explicitly simulate the recharge of applied water and precipitation that occurs over the course of the year. This modeling approach simply assumes that no groundwater recharge occurs during the pumping season (April through October) or the 2 months following, and that recharge during the winter months (January through March) is sufficient for full recovery of groundwater levels prior to the subsequent pumping season. Thus, it is not possible to use the existing model to simulate specific climatic trends such as the 1976-1977 drought or the 1928-1934 drought.

As an alternative, the approach taken to evaluate the impacts of decreases in SRSC surface water deliveries during multiple dry years is much more simplistic. This hypothetical 4-year drought scenario assumes that surface water deliveries are decreased by 25 percent each year, and that there is a seasonal recovery in groundwater levels of 40 percent (based on a review of historical hydrographs of water levels measured during the 1976-1977 drought). It was assumed that even in these extreme conditions, seepage from the Sacramento and Feather Rivers continued to occur, as these streams would continue to be fed by reservoir releases.

Groundwater Levels. The simulated maximum incremental drawdown in the shallow and regional aquifers after 4 consecutive dry years is presented as Figures 3-7 and 3-8, respectively. These results suggest that drawdown after 4 dry years would be greater than the single-year scenario (up to 15 to 20 feet of drawdown in most areas, but up to 37 feet in the GCID area, Table 3-10), but still supportable by the basin with current well construction (depth to screen). In other words, after a series of critically dry years, the basin would still be capable of producing the 495,000 AF of water associated with a cutback of 25 percent in SRSC supplies. It should be noted that the estimated drawdown is due to the SRSC pumping only, and does not include the influence of the other 2.5 MAF of pumping in the Sacramento Valley, which is assumed to occur under No Action. Figures 3-9 and 3-10 show the simulated drawdown over time by sub-basin in the model for the 4-year drought scenario in the shallow and regional aquifers, respectively. These figures demonstrate that under the multiple dry-year condition, a dynamic equilibrium is slowly established under which the groundwater removed from storage by pumping is replenished by seepage from surface water sources.

TABLE 3-10

SUMMARY OF DRAWDOWN IMPACTS AT THE END OF THE PUMPING SEASON – DROUGHT YEAR 4

Sub-basin	Maximum Incremental Drawdown - Shallow Aquifer (feet)	Maximum Incremental Drawdown – Regional Aquifer (feet)
North Colusa	36	37
South Colusa	16	15
West Butte	10	10
East Butte	8	8
North Yuba	<1	<1
South Yuba	1	1
Sutter	24	24
Yolo	8	8
North American	15	14

Groundwater/Surface Water Interaction. From a streamflow perspective, the model predicts a peak streamflow impact of about 352 cfs from all streams in the model after 4 drought years, 241 cfs of that coming from the Sacramento River (Table 3-11). These figures are shown graphically on Figure 3-11. To put this number into perspective, the minimum mean monthly flow in the Sacramento River during the 1976-1977 drought, as measured at the Freeport gauge, was 4,494 cfs in October 1977. Streamflow at this gauge increased to over 45,000 cfs by January 1978.

Figure 3-12 is a time series plot of stream seepage rates over the drought for several major streams. This figure shows that near the end of the drought, the magnitude of increase in-stream seepage rates begin to level off, illustrating the equilibrium that is reached between groundwater pumping and stream leakage.

TABLE 3-11

SUMMARY OF STREAM IMPACTS IN SACRAMENTO GROUNDWATER BASIN AFTER 4 CRITICALLY DRY YEARS

Stream	Peak Instantaneous Stream Depletion Rate (cfs)	Month of Peak Stream Depletion Rate	Measured Streamflow during Month of Peak Stream Depletion (cfs)	Percent Instantaneous Depletion of Measured Streamflow
Sacramento River	240.7	August	8,718[a]	3%
Feather River	29.7	October	1,120[b]	3%
GCID Canal	25.2	September	N/A	N/A
Colusa Basin Drain	15.0	September	N/A	N/A
Stone Corral Creek	10.9	September	0	
Butte Creek	7.6	October	114[a]	7%
Funks Creek	6.3	September	N/A	N/A
Willow Creek	4.6	October	N/A	N/A
Stony Creek	2.7	August	N/A	N/A
Salt Creek	2.4	October	N/A	N/A
American River	1.6	September	857[a]	0.2%
Cache Creek	0.9	October	0[a]	
Walker Creek	0.9	March	0[b]	
South Fork Willow Creek	0.7	March	0[b]	
Big Chico Creek	0.7	August	16[b]	4%
Wilson Creek	0.6	March	N/A	N/A
Angel Slough	0.6	December	N/A	N/A
Little Chico Creek	0.3	September	N/A	N/A
Bear River	0.2	March	487[a]	0.04%
Sand Creek	0.2	March	N/A	N/A
French Creek	0.2	March	N/A	N/A
Putah Creek	0.1	March	42.9[a]	0.2%
Yuba River	0.1	March	804[a]	0.01%
Totals:	**352.1**			

[a]1992

[b]1977

Table 3-11 lists the peak stream impacts estimated for streams in the Sacramento Valley, along with the percentage of streamflow that each impact represents. The simulated peak stream depletion rate for each stream was compared to the corresponding measured historical streamflow for each stream, during a drought period (where data were available) to quantify the peak reduction in average streamflow.

Redding Groundwater Basin

Groundwater Levels. Under a 25 percent cutback scenario, annual SRSC pumping within the Redding Groundwater Basin would total approximately 38,000 AF. A decrease in surface water supplies to SRSCs, and subsequent increase in groundwater pumping, would result in temporary additional drawdown of groundwater levels in the aquifer system underlying the Redding Groundwater Basin. Model forecast drawdown was evaluated in both the shallow and regional aquifers. The shallow aquifer is defined as the unconfined aquifer that exists in the upper 50 feet of saturated sediments. The regional aquifer is defined as the deeper portions of the aquifer that are typically tapped by irrigation wells in the basin. Figures 3-13 and 3-14 are maps of maximum incremental drawdown due to increased SRSC pumping in both the shallow aquifer and the deeper regional aquifer at the end of an average pumping season. Drawdown in the shallow aquifer could influence streams and riparian vegetation. Drawdown in the deeper aquifer could affect pumping water levels in nearby wells and potentially induce subsidence. The degree of anticipated impact and relative potential for significance is discussed below.

Shallow aquifer drawdown, shown on Figure 3-13, refers to changes in water levels within the upper 50 feet of the unconfined aquifer. This figure is based on the maximum computed drawdown that would occur at the end of the April through October pumping season. The model indicates that shallow aquifer drawdown resulting from increased SRSC pumping generally ranges from 0 to 15 feet, with drawdown not exceeding 5 to 10 feet in most areas (Table 3-12). The maximum projected drawdown of 15 feet occurs in the ACID area.

Regional aquifer drawdown, shown on Figure 3-14, is the maximum incremental drawdown, attributable to increased pumping, in groundwater levels in the aquifer where most irrigation pumping occurs. Model results suggest that drawdown of groundwater levels would range from 0 to 21 feet (Table 3-12). This maximum drawdown is forecast to occur in the ACID area. However, predicted drawdown in all other areas of the Redding Groundwater Basin would generally be less than 5 to 10 feet. The areal extent of regional aquifer drawdown is similar to that of shallow aquifer drawdown, but of slightly greater magnitude.

TABLE 3-12

SUMMARY OF DRAWDOWN IMPACTS AT THE END OF THE PUMPING SEASON

Sub-basin	Maximum Incremental Drawdown – Shallow Aquifer (feet)	Maximum Incremental Drawdown – Regional Aquifer (feet)
Anderson	15	21
Bowman	5	6
Enterprise	4	4
Millville	2	3
Rosewood	1	2
South Battle Creek	1	1

Surface Water/Groundwater Interaction. Implementation of any cutback of SRSC surface water supply, and resultant increase in groundwater pumping, would result in a reduction in local streamflow by: (1) increasing infiltration of surface water through the streambed, (2) intercepting groundwater that would have recharged surface waterbodies, or (3) a combination of 1 and 2.

Impacts to Sacramento River flows are anticipated to result in a peak instantaneous streamflow reduction rate at the end of the 214-day pumping period of 27 cfs, and an average streamflow reduction of 16 cfs between April and December. Peak impacts to flows in Cottonwood Creek are predicted to be 3 cfs, with an average reduction of 2 cfs. For comparison, the historical mean monthly flow in the Sacramento River ranges from 5,866 (October) to 13,200 (February) cfs at the Keswick gauge. The historical mean monthly flow in Cottonwood, as measured at the Olinda gauge, ranges from 20 (September) to 1,444 (March) cfs. Table 3-13 summarizes the predicted streamflow depletion rates, along with average measured streamflows during the month of peak depletion, where available. Streamflow impacts on several outlying streams are predicted to continue to increase once pumping has stopped. However, the influence of winter recharge, assumed to begin January 1, would cause these impacts to decline over the winter, and cease altogether once groundwater levels return to pre-pumping conditions. Therefore, the impacts on these streams are assumed to peak on December 31. The spatial variation in streamflow depletion rates across the Redding Groundwater Basin, at the end of the 214-day stress period, are shown on Figure 3-15.

Table 3-13 lists the average and peak stream impacts estimated for streams in the Redding Groundwater Basin, along with the percentage of streamflow that each impact represents. The simulated peak stream depletion rate for each stream was compared to the corresponding measured historical streamflow for each stream (where data were available) to quantify the peak reduction in average streamflow. Results suggest that forecast changes in streamflow in the Redding Groundwater Basin would be insignificant and likely unmeasureable.

Multi-year Drought Periods

The analysis of impacts presented above assumes that groundwater levels in the Redding Groundwater Basin return to pre-pumping levels each spring due to recharge of precipitation and streamflow during the winter months. However, during periods of extreme drought conditions occurring over multiple years, it is likely that groundwater levels would not recover completely each spring, and some residual drawdown would persist into the subsequent irrigation season.

The groundwater flow model that was developed to estimate the SRSC groundwater and streamflow impact is a superposition model, which means that is does not explicitly simulate the recharge of applied water and precipitation that occurs over the course of the year. This modeling approach simply assumes that no groundwater recharge occurs during the pumping season (April through October) or the 2 months following, and that recharge during the winter months (January through March) is sufficient for full recovery of groundwater levels prior to the subsequent pumping season. Thus, it is not possible to use the existing model to simulate specific climatic trends such as the 1976-1977 drought or the 1928-1934 drought.

TABLE 3-13

SUMMARY OF SIMULATED AVERAGE AND PEAK STREAM DEPLETION RATES IN THE REDDING GROUNDWATER BASIN

Stream	Average April through December Stream Depletion Rate (cfs)	Peak Stream Depletion Rate (cfs)	Month of Peak Stream Depletion Rate	Historical Mean Measured Streamflow (cfs) for Month of Simulated Peak Impact – Gauge Location	Predicted Peak Reduction in Average Flows
Sacramento River	15.8	26.5	October	5,866 - Keswick	0.5%
Cottonwood Creek	1.9	3.0	October	42.2 - Olinda	7%
Anderson Creek	0.9	1.2	October	N/A	N/A
Stillwater Creek	0.9	1.4	October	N/A	N/A
Cow Creek	0.6	1.0	October	125	1%
Clover Creek	0.4	0.6	October	N/A	N/A
Battle Creek	0.3	0.5	October	298 - Coleman Hatchery	0.2%
Churn Creek	0.3	0.4	October	N/A	N/A
Bear Creek	0.2	0.4	October	21.2 - Millville	2%
Ash Creek	0.1	0.2	December	N/A	N/A
Dry Creek	0.1	0.1	December[a]	N/A	N/A
TOTALS	**21.5**	**35.4**			

[a] It is assumed that the influence of winter recharge, beginning January 1, would cause stream impacts to decline over the winter, and cease altogether once groundwater levels return to pre-pumping conditions. Therefore, the impacts on these streams are assumed to peak on December 31.

As an alternative, the approach taken to evaluate the impacts of decreases in SRSC surface water deliveries during multiple dry years is much more simplistic. This hypothetical 4-year drought scenario assumes that surface water deliveries are decreased by 25 percent each year, and that there is a seasonal recovery in groundwater levels of 50 percent (based on a review of historical hydrographs of water levels measured during the 1976-77 drought). It was assumed that even in these extreme conditions, seepage from the Sacramento River continued to occur, as this stream would continue to be fed by reservoir releases.

Groundwater Levels. The simulated maximum incremental drawdown in the shallow and regional aquifers after 4 consecutive dry years is presented as Figures 3-16 and 3-17, respectively. These results suggest that drawdown after 4 dry years would be greater than the single-year scenario (up to 5 to 10 feet of drawdown in most areas, but up to 23 feet in the ACID area, Table 3-14), but still supportable by the basin with current well construction (depth to screen). In other words, after a series of critically dry years, the basin would still be capable of producing the 38,000 AF of water associated with a cutback of 25 percent in SRSC supplies. It should be noted that the estimated drawdown is due to the SRSC pumping only, and does not include the influence of the other 55,000 AF of pumping in the Redding Groundwater Basin, which is assumed to occur under No Action.

TABLE 3-14

SUMMARY OF DRAWDOWN IMPACTS AT THE END OF THE PUMPING SEASON – DROUGHT YEAR 4

Sub-basin	Maximum Incremental Drawdown – Shallow Aquifer (feet)	Maximum Incremental Drawdown – Regional Aquifer (feet)
Anderson	18	23
Bowman	7	8
Enterprise	5	5
Millville	5	3
Rosewood	2	3
South Battle Creek	1	2

Groundwater/Surface Water Interaction. From a streamflow perspective, the model predicts a peak streamflow impact of about 41 cfs from all streams in the model after 4 drought years, 34 cfs of that coming from the Sacramento River (Table 3-15). These figures are shown graphically on Figure 3-18. To put this number into perspective, the minimum mean monthly flow in the Sacramento River during the 1976-1977 drought, as measured at the Keswick gauge, was 3,431cfs in October 1977 (USGS, 2004). Streamflow at this gauge increased to over 6,200 cfs by January 1978.

Figure 3-19 is a time series plot of stream seepage rates over the drought for several major streams. This figure shows that near the end of the drought, the magnitude of increase in stream seepage rates begin to level off, illustrating the equilibrium that is reached between groundwater pumping and stream leakage.

Table 3-15 lists the peak stream impacts estimated for streams in the Redding Groundwater Basin portion of the Sacramento Valley, along with the percentage of streamflow that each impact represents. The simulated peak stream depletion rate for each stream was compared to the corresponding measured historical streamflow for each stream, during a drought period (where data were available) to quantify the peak reduction in average streamflow.

TABLE 3-15

SUMMARY OF STREAM IMPACTS IN THE REDDING GROUNDWATER BASIN AFTER 4 CRITICALLY DRY YEARS

Stream	Simulated Peak Stream Seepage Rate (cfs)	Month of Simulated Peak Stream Seepage Rate	Measured Streamflow during Month of Peak Stream Depletion (cfs)	Percent Instantaneous Depletion of Measured Streamflow
Sacramento River	34.2	October	3,741[b]	1%
Cottonwood Creek	3.6	October	17.4[c]	21%
Stillwater Creek	1.5	October	N/A[d]	N/A
Cow Creek	1.4	October	90.9[b]	2%
Anderson Creek	1.3	October	N/A[d]	N/A
Battle Creek	0.8	October	139[b]	1%
Clover Creek	0.7	October	N/A[d]	N/A
Churn Creek	0.4	November	N/A[d]	N/A
Bear Creek	0.4	November	N/A[d]	N/A
Ash Creek	0.2	December	N/A[d]	N/A
Hooker Creek	0.1	December[a]	N/A[d]	N/A
Dry Creek	0.1	December[a]	N/A[d]	N/A
Inks Creek	0.1	December[a]	N/A[d]	N/A
South Fork Cottonwood Creek	0.1	December[a]	521[c]	0.01%
Clough Creek	0.1	December[a]	N/A[d]	N/A

[a] It is assumed that the influence of winter recharge, beginning January 1, would cause stream impacts to decline over the winter, and cease altogether once groundwater levels return to pre-pumping conditions. Therefore, the impacts on these streams are assumed to peak on December 31.

[b]1992

[c]1977

[d]No data for either the 1976-1977 or 1989-1992 drought

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year shortages ~~reductions~~ would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Groundwater recharge and groundwater use by the SRSCs under Alternative 1 would be similar, if not identical to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs with the exception of reduced contract quantities amounts to ACID and SMWC. These reductions in contract quantities ~~amounts~~ are based on needs analyses and historical use and are not expected to result in less water use by these contractors. Therefore, groundwater pumping is not expected to increase as a result of this alternative.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

Therefore, there are no environmental impacts of this alternative as compared to the No Action Alternative.

Alternative 2. Groundwater recharge and groundwater use by the SRSCs under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs as compared to the No Action Alternative.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

Therefore, there are no environmental impacts of this alternative as compared to the No Action Alternative.

Alternative 3. Groundwater recharge and groundwater use by the SRSCs under Alternative 3 would be similar to conditions under the No Action Alternative. Alternative 3 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs as compared to the No Action Alternative.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

Therefore, there are no environmental impacts of this alternative as compared to the No Action Alternative.

Alternative 4.

Groundwater Levels. Increased frequency of pumping within the Sacramento Valley Groundwater Basin could occur during dry years within the Sacramento Valley Groundwater Basin. This increased frequency would result from sliding-scale cutbacks in water deliveries during years where cutbacks would otherwise not have occurred. Assuming pumping were equal to reduced diversions, the increased pumping would total approximately 212,745 AF during Shasta inflow deficits of 200,000 to 400,000 AF, and 425,490 AF during inflow deficits of 400,000 to 600,000 AF. When deficits are greater than 600,000 AF, pumping would be the same as under No Action critical years.

Increased pumping activities associated with these reductions ~~cutbacks~~ would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Drawdown in the deeper aquifer could affect pumping water levels in nearby wells and potentially induce subsidence. However, as stated above, even under the multi-year drought analysis, the overall impact to the Sacramento Valley and Redding Groundwater Basins is less than significant.

Land Subsidence. Groundwater extraction under this alternative may decrease groundwater levels, increasing the potential for localized land subsidence. Typically, permanent subsidence only occurs when groundwater levels are lowered for many years. Implementation of this alternative would not cause a permanent lowering of groundwater levels because it is expected that the basin would refill except during extreme drought conditions. Therefore, the potential for permanent subsidence of the land surface as a result of Alternative 4 is expected to be less than significant, even under the worst-case analysis considered here.

Groundwater Quality. *Migration of Reduced-quality Groundwater.* Although groundwater in this area is generally of good quality, elevated levels of TDS and nitrates have been detected in some localized areas of the basin. Areas of naturally occurring high TDS are west of the Sacramento River between Putah Creek and the confluence of the Sacramento and San Joaquin Rivers, and in the area south of the Sutter Buttes, in the vicinity of the confluence of the Sacramento and Yuba Rivers. Elevated nitrate levels occur in two areas within the Sacramento Valley Groundwater Basin: one in northern Yuba and southern Butte Counties, east of Sutter Buttes, and another in northern Butte and southern Tehama Counties (Reclamation, 1997). Any movement or migration of reduced-quality water under each of the contract alternatives would be similar to the No Action Alternative because the distribution of pumping across the valley would not change. However, the increase in the frequency of pumping may result in a slight increase in groundwater migration rates. This impact is considered less than significant.

Alternative 5.

Groundwater Levels. Increased pumping within the Sacramento Valley Groundwater Basin could occur during dry years within the Sacramento Valley Groundwater Basin. This increase would result from sliding-scale cutbacks in water deliveries during years where cutbacks would otherwise not have occurred under the No Action Alternative. The increased pumping would total approximately 212,745 AF during Sacramento Index below normal years, and 425,490 AF during Sacramento Index dry years. Pumping under Sacramento Index critically dry years would be equivalent to critical years under the No

Action.

Increased pumping activities associated with these cutbacks would result in temporary drawdown of groundwater levels in the aquifer system underlying the Sacramento Valley Groundwater Basin. Drawdown in the deeper aquifer could affect pumping water levels in nearby wells and potentially induce subsidence. However, as stated above, even under the multi-year drought analysis, the overall impact to the Sacramento Valley and Redding Groundwater Basins is less than significant.

Land Subsidence. Groundwater extraction under this alternative could decrease groundwater levels, increasing the potential for localized land subsidence. Typically, permanent subsidence only occurs when groundwater levels are lowered for many years. Implementation of this alternative would not cause a permanent lowering of groundwater levels, because it is expected that the basin would refill except during extreme drought conditions. Therefore, the potential for permanent subsidence of the land surface as a result of Alternative 5 is expected to be less than significant, even under the worst-case analysis considered here.

Groundwater Quality. *Migration of Reduced-quality Groundwater.* Although groundwater in this area is generally of good quality, elevated levels of TDS and nitrate have been detected in some localized areas of the basin. Areas of naturally occurring high TDS are west of the Sacramento River between Putah Creek and the confluence of the Sacramento and San Joaquin Rivers, and in the area south of the Sutter Buttes, in the vicinity of the confluence of the Sacramento and Yuba Rivers. Elevated nitrate levels occur in two areas within the Sacramento Valley Groundwater Basin: one in northern Yuba and southern Butte Counties, east of Sutter Buttes, and another in northern Butte and southern Tehama Counties (Reclamation, 1997). Any movement or migration of reduced-quality water under each of the contract alternatives would be similar to the No Action Alternative because the distribution of pumping across the valley would not change. However, the increase in the frequency of pumping may result in a slight increase in groundwater migration rates. This impact is considered less than significant.

BIOLOGICAL ENVIRONMENT

Terrestrial Biological Resources

Affected Environment.

This section describes the wildlife habitats that occur in the SRSCs' service area and the wildlife species typically found in each habitat. Special-status wildlife and plant species with the potential to occur in the SRSCs' service area are identified, and their general habitat associations are summarized.

Wildlife and Wildlife Habitat. Historically, the Sacramento Valley contained a mosaic of riverine, wetlands, and riparian habitat along rivers and streams with surrounding terrestrial habitats consisting of perennial grassland and oak woodland. With settlement of the Sacramento Valley, agricultural and urban development converted land from native habitats to cultivated fields, pastures, residences, water impoundments, flood-control structures, and other developments. As a result, native habitats generally are restricted in their distribution and size and are highly fragmented. Agricultural land comprises most of the SRSCs' service area and includes row and field crops, rice, pasture, and orchards. The following discussion describes the various terrestrial habitats that are present in or near the service areas of the SRSC and CDMWC.

The types, amounts, and distribution of habitats in the service areas were derived from the California GAP Analysis Project (California Department of Fish and Game [CDFG], 1998a). In the California GAP Analysis, habitats were typed using the California Wildlife Habitats Relationship System (CWHR) (Mayer and Laudenslayer, 1988). This project focused on mapping habitats at a landscape scale and has a resolution of 274 acres (100 hectares) for upland habitats and 98.8 acres (40 hectares) for wetlands habitat. The database identifies general habitat types throughout the service area but does not distinguish small habitat patches, such as stringers of riparian habitat or small wetlands, which can have high wildlife value. Where available, additional information is provided on the occurrence of important habitat types not distinguished in the California GAP Analysis.

Wetlands Habitat. California supports a wide variety of wetland habitats. The plants and wildlife species supported in wetlands vary depending on the hydrologic regime, substrate, water source, and water quality of the site. Types of wetlands in the SRSCs' service area are freshwater emergent wetlands and vernal pools.

Freshwater Emergent Wetlands. Freshwater emergent wetlands occur in areas that are seasonally or perennially inundated. They form a transitional habitat between open water and upland habitats and occur in backwater areas of rivers, streams, and lakes, and in the floodplains of rivers and streams. Emergent wetlands are characterized by erect, rooted, herbaceous vegetation that emerges above the water surface. Water depths are shallow, up to about 1 to 2 feet. Common plant species include cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), and rushes (*Juncus* spp.).

Urban and agricultural development, as well as hydrologic changes from flood control and water supply development, have substantially reduced the amount of wetlands habitat in the Central Valley. In the 1940s, freshwater emergent wetlands occupied about 554,000 acres of the Central Valley (Frayer et al., 1989; Central Valley Habitat Joint Venture, 1990). By 1990, only 86,704 acres remained (CDFG, 1998a). Regional reductions in freshwater emergent wetlands have been estimated at 88.7 percent in the Sacramento Valley Groundwater Basin, 96.2 percent in the San Joaquin Basin, 99.2 percent in the Tulare Basin, 98.3 percent in the Delta, and 97.2 percent in the San Francisco Bay Area.

Freshwater wetlands are among the most important habitats for wildlife. In winter, waterfowl rely on wetlands in the Central Valley as a stopover during their migration or as habitat throughout the winter. Raptors such as golden eagles (*Aquila chrysaetos*) and northern harriers (*Circus cyaneus*) frequent wetlands while foraging. Birds such as marsh wrens (*Cistothorus palustris*), tricolored blackbirds (*Agelaius tricolor*), red-winged blackbirds (*Agelaius phoeniceus*), American bitterns (*Botaurus lentiginosus*), great egrets (*Ardea alba*), great blue herons (*Ardea herodias*), black-crowned night herons (*Nycticorax nycticorax*), and green herons (*Butorides virescens*) are common in wetland habitats in the SRSCs' service area and depend on this habitat. Numerous amphibians and mammals also depend on wetlands and ~~or~~ frequent this habitat because of its high productivity and diversity. Because much of the wetlands habitat in California has been lost, a number of species that require wetlands have been listed as threatened or endangered, or are species of concern to the U.S. Fish and Wildlife Service (Service) or CDFG. Special-status species associated with wetlands in the SRSCs' service area include giant garter snake (*Thamnophis gigas*), tricolored blackbird, white-faced ibis (*Plegadis chihi*), and western pond turtle (*Clemmys marmorata*).

Vernal Pool. Vernal pools are typically found in association with annual grassland habitat, and constitute a unique habitat type. Vernal pools form in shallow depressions that are underlain by hardpan or volcanic rock. The hardpan or volcanic rock impedes drainage such that, in winter, the depressions fill with water and retain moist soil into late spring. The pools are then dry during the summer and fall until the rains commence the following winter. The soils and moist microhabitat of these pools provide a unique habitat within a general matrix of annual grassland habitat. Plant species of vernal pools differ from those of the surrounding annual grassland habitat, and many animals associated with annual grassland habitat depend on the occurrence of vernal pools to persist in the annual grassland landscape. Common plant species found in vernal pools include popcorn flower (*Plagiobothrys stipitata*), navarretia (*Navarretia leucocephala*), toad rush (*Juncus bufonius*), goldfields (*Lathenia chrysostoma*), yellow carpet (*Blennosperma nanum*), coyote thistle (*Eryngium vaseyi*), tidy tips (*Layia* spp.), water buttercup (*Ranunculus* spp.), and hairgrass (*Deschampsia danthonioides*).

The number and distribution of vernal pools in the Central Valley has been greatly reduced as a result of agricultural practices and conversion to urban land uses. Holland (1978) estimated that 5 to 30 percent of California's vernal pools are intact today, and 5 percent of the Central Valley's vernal pools remain. The reduction in vernal pool habitat has resulted in several plant and animal species being listed under the federal Endangered Species Act. Listed species associated with vernal pools in the SRSCs' service area include Bogg's Lake hedge hyssop (*Gratiola heterosepala*), Hoover's spurge (*Chamaesyce hooveri*), hairy orcutt grass (*Orcuttia pilosa*), Greene's tuctoria (*Tuctoria greenei*), vernal pool fairy shrimp (*Branchinecta lynchi*), and vernal pool tadpole shrimp (*Lepidurus packardi*). In addition to the listed species, the California tiger salamander (*Ambystoma californiense*) breeds in vernal pools. The Central California Distinct Population Segment (DPS) of this species is currently proposed for federal threatened listing.

Valley Foothill Riparian Habitat. Valley foothill riparian habitat develops in the floodplains of low-gradient rivers and streams. Riparian habitats form a transitional community between the aquatic, riverine environment and dry upland habitats. Dominant tree species of valley foothill riparian habitat are cottonwood (*Populus fremontii*), California sycamore (*Plantanus racemosa*), and valley oaks (*Quercus lobata*). Typical shrub species include willows (*Salix* sp.), elderberry (*Sambucus* sp.), and wild grape (*Vitis californica*).

The composition of riparian plant communities is shaped by the timing, intensity, and duration of flooding. Willows predominate in areas subject to regular inundation and quickly colonize newly deposited gravel bars or recently scoured areas. Cottonwoods occur farther from the river channel in areas subject to less frequent and intense flooding. Still, the persistence of cottonwoods is linked to the natural seasonal pattern of flows. Cottonwoods evolved to release seeds at the same time that high spring flows deposit nutrient-rich sediment to enhance germination and seedling survival. Thus, the timing and intensity of flows is critical to the persistence of riparian vegetation. Flood-control and water supply projects have resulted in hydrologic alterations that have changed the species composition, structure, and extent of riparian habitats. In addition, most rivers have been channelized and confined by levees, which limits the area available to support riparian habitat. These changes have resulted in the reduction of widespread riparian habitat in the Central Valley.

The structural and compositional diversity, abundant food resources, and availability of water in valley foothill riparian habitat make this habitat particularly valuable to wildlife. Wildlife species diversity is often higher in riparian habitats than in adjacent habitats. Many resident birds, amphibians, reptiles, and mammals breed in riparian habitats, and other species frequent this habitat in winter or during migration (Sanders et al., 1985). Special-status species associated with riparian habitats in the SRSCs' service area include the valley elderberry longhorn beetle (*Desmocercus californicus dimorphus*), Swainson's hawk (*Buteo swainsoni)*, and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

Annual Grassland. Annual grassland is a common habitat type in the SRSCs' service area. Historically, grasslands in the Central Valley were dominated by native perennial grasses such as needlegrass. Currently, most grasslands in the area are dominated by introduced annual grasses of Mediterranean origin and a mixture of native and introduced forbs. Introduced annual grasses are the dominant plant species and include wild oats (*Arena* sp.), soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus rigidus*), red brome (*Bromus rubens*), barley (*Hordeum* sp.), and foxtail (*Hordeum murinum*). Annual native forbs also occur in annual grassland habitat and include filaree (*Erodium* sp.), California poppy (*Eschscholtzia californica*), owl's clover (*Gilia* spp.), tarweed (*Holocarpha virgata*) and various lupines (*Lupinus* spp.). Yellow star-thistle (*Centaurea solstitialis*), a noxious weed, has invaded many annual grassland habitats and degraded their quality for wildlife and as livestock pasture. Annual grassland habitat merges with valley oak and blue oak woodlands, occurring where soil moisture is insufficient to support tree growth or is suppressed because of grazing.

Many species of birds, mammals, reptiles, and amphibians use annual grasslands. Raptors, such as ferruginous hawks (*Buteo regalis*), red-tailed hawks (*Buteo jamaicensis*), white-tailed kites (*Elanus leucurus*), American kestrels (*Falco sparverius*), and northern harriers (*Circus cyaneus*) commonly forage in annual grasslands. Short-eared owls (*Asio flammeus*) and burrowing owls (*Athene cunicularia*) forage and breed in this habitat. Horned larks (*Eremophila alpestris*), western meadowlarks (*Sturnella neglecta*), and savannah sparrows (*Passerculus sandwichensis*) are other common bird species. Characteristic reptiles and amphibians include western fence lizards (*Sceloporus occidentalis*), common garter snakes (*Thamnophis sirtalis*), and western rattlesnakes (*Rotalus viridis*). Common mammals include black-tailed jackrabbits (*Lepus californicus*), California ground squirrels (*Spermophilus beecheyi*), California voles (*Microtus californicus*), badgers (*Taxidea taxus*), coyotes (*Canis latrans*), and Botta's pocket gophers (*Thomomys bottae*). A number of special-status species use annual grassland habitat, including white-tailed kite, burrowing owl, and prairie falcon (*Falco mexicanus*).

Valley Oak Woodland. Valley oak woodland can occur throughout much of the Central Valley and into the Sierra Nevada foothills up to an elevation of about 2,000 feet. The overstory canopy of this habitat type is almost exclusively valley oak. California sycamore, black walnut (*Juglans californica*), interior live oak (*Quercus wislizenii*), boxelder (*Acer negundo*) and blue oak occur sporadically. Shrubs such as poison-oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), and coffeeberry (*Rhamnus californica*) can occur in the understory; although, typically, the understory is composed of annuals such as wild oats, bromegrass (*Bromus* sp.), barley (*Hordeum* sp.), and ryegrass (*Lolium* sp.) (Mayer and Laudenslayer, 1988). Valley oak woodland merges with annual grasslands and often borders agricultural fields. This habitat also occurs adjacent to valley foothill riparian habitats. As distance from the watercourse increases, tree density declines, thus transitioning from a forest-like structure, to savanna-like, to grassland.

Like other habitats containing oaks, valley oak woodland is used by a variety of wildlife species that exploit the acorn food resource. Cavities formed in oaks are also an important habitat feature for cavity-nesting birds and mammals. Common species inhabiting valley oak woodland include California quail (*Callipepla californica*), red-shouldered hawk (*Buteo lineatus*), acorn woodpecker (*Melanerpes formicivorus*), scrub jay (*Aphelocoma californica*), bushtit (*Psaltriparus minimus*), gray squirrel (*Sciurus griseus*), mule deer (*Odocoileus hemionus*), red-tailed hawk, and white-tailed kite. Special-status species associated with oak woodland habitats include oak titmouse (*Baeolophus inornatus*), Lawrence’s goldfish (*Carduelis lawrenci*), and Nuttall’s woodpecker (*Picoides nuttallii*).

Blue Oak Woodland. Blue oak woodland occurs in foothill regions of the SRSCs’ service area at elevations of 250 to 3,000 feet (Mayer and Laudenslayer, 1988). Blue oak (*Quercus douglasii*) is the dominant overstory species of this habitat, although at the higher elevations of this habitat’s distribution, gray pine (*Pinus sabiniana*) becomes an important overstory species. Where gray pine or other conifers comprise 25 to 49 percent of the overstory and blue oak comprises at least 50 percent of the overstory canopy, the CWHR classifies this habitat as Blue Oak - Foothill Pine Woodland. Both CWHR habitat types (Blue Oak - Foothill Pine Woodland and Blue Oak Woodland) are considered collectively in this document as “blue oak woodland.” Typical shrub species in blue oak woodland are poison-oak, coffeeberry, redbud (*Cercis occidentalis*), ceanothus (*Ceanothus* spp.), and manzanita (*Arctostaphylos* spp.) with groundcover consisting of annuals such as bromegrass, wild oats, foxtail, and filaree (Mayer and Laudenslayer, 1988).

Blue oak woodlands provide habitat for a diversity of wildlife species, although no species appear to be completely dependent on this habitat type. Verner and Boss (1980) state that 29 species of amphibians and reptiles, 57 species of birds, and 10 species of mammals find optimal breeding habitat conditions in mature stages of blue oak woodlands. Acorns produced by blue oaks are an important food resource for a diversity of bird and mammal species. Typical species inhabiting blue oak woodlands in the SRSCs’ service area include scrub jays, yellow-billed magpies (*Pica nuttalli*), gray squirrels, and California ground squirrels (*Spermophilus beecheyi*). Special-status species associated with oak woodland habitats include oak titmouse, Lawrence’s goldfish, and Nuttall’s woodpecker.

Agricultural Habitat. Native habitats in the Sacramento Valley have been largely replaced by agricultural habitats. The following two primary agricultural types are used to characterize agricultural habitat in the SRSCs' service area: (1) cropland and (2) orchard.

Cropland. Cropland in the SRSCs' service area consists of row and field crops, and grain crops. Row crops in the SRSCs' service area are predominantly tomatoes, beans, and vineseeds~~sugar beets, and melons~~. Grain crops include rice, wheat, and corn. Rice is the predominant crop in the SRSCs' service area.

Agricultural fields have replaced native habitats consisting of grasslands, wetlands, and oak woodlands. However, some wildlife species have adapted to using agricultural fields. Pheasants (*Phasianus colchicus*) and other game birds use tall crops for cover and grain crops for foraging. Waterfowl and sandhill cranes (*Grus canadensis*) also forage on waste grains after harvest. Small mammals such as black-tailed jackrabbit and several species of mice are often abundant in agricultural fields and attract foraging raptors such as red-tailed hawks, Swainson's hawks, northern harriers, and white-tailed kites. Special-status species that often use agricultural fields include Swainson's hawk, white-tailed kites, burrowing owl, and mountain plover (*Charadrius montanus*).

Riceland in the Central Valley provides some of the attributes found in seasonal wetlands and is used by some wetlands-associated species. However, the intensive management of rice reduces its value relative to natural wetlands. Irrigation ditches used to flood rice fields often contain dense cattail vegetation and provide habitat for some wetlands-associated species. Notably, rice fields and the associated water conveyance facilities are important habitat for the state- and federal-listed giant garter snake.

Orchard. Orchard habitat consists of cultivated fruit- or nut-bearing trees. Typically, they are open, tree-dominated habitats consisting of a single tree species. This habitat is planted in a uniform pattern and intensively managed. Understory vegetation is usually sparse; however, in some areas, grasses or forbs are grown between orchard rows to reduce erosion. Walnuts and olives are the primary orchard crops in the SRSCs' service area. Wildlife use of orchards is typically limited. Ground squirrels and other small mammals can inhabit understory areas, and birds such as scrub jays may be seasonally attracted to fruit orchards. No special-status species rely on orchards or regularly use this habitat type.

Habitat in the Service Areas of the Sacramento River Settlement Contractors. All of the habitats described above are found within the SRSCs' service area. Blue oak woodland habitat is found primarily within the northern portion of the SRSCs' service area, with large blocks located adjacent to urban and agricultural habitats (Figure 3-20). The central portion of the SRSCs' service area is largely agricultural, dominated by cropland with a few areas of orchard and vineyard. This portion of the SRSCs' service area also contains some large areas of freshwater emergent wetlands at the federal wildlife refuges and smaller areas of valley-foothill riparian and annual grassland habitats (Figure 3-21). The southern portion of the SRSCs' service area is almost entirely agricultural, dominated by cropland with a few small patches of orchard and vineyard. A few small patches of annual grassland and valley-foothill riparian habitats also are found in the southern portion of the SRSCs’ service area (Figure 3-22). Acres of each habitat type within selected SRSC service areas are identified in Table 3-16.

TABLE 3-16

ACRES OF EACH HABITAT TYPE WITHIN SELECTED SRSC SERVICE AREAS

	Habitat Type								
Contractor	**AGS**	**BAR**	**BOP/BOW**	**CRP/IRF**	**FEW**	**OVN**	**URB**	**VOW**	**VRI**
ACID			19,493	3,630			9,539		24
GCID	1,909	198		147,307	19,085	4,347	335		39
MID				5,642	1,196				
MFWC				10,342		323			118
NCMWC				39,765	53		144		
PMWC				2,963					
Pleasant Grove-Verona				7,429					
PCGID				11,803		269			<1
PID				16,205	84				
RD 1004	942			21,805	1,097	47			344
RD 108	189			58,467		163			
City of Redding			21,294	538			16,162	770	
SMWC				51,118					
Tisdale Irrigation and Drainage Co.				2,409					

Notes:

AGS = Annual Grassland
BAR = Barren
BOP/BOW = Blue Oak-Foothill Pine/Blue Oak Woodland
CRP/IRF = Cropland/Irrigated Row and Field Crops
FEW = Freshwater Emergent Wetland
OVN = Orchard and Vineyard
URB = Urban
VOW = Valley Oak Woodland
VRI = Valley-Foothill Riparian

Special-status Wildlife Species. Many special-status wildlife species potentially use habitats in the SRSCs’ service area. The Service provided a list of species that are federally listed or are considered species of concern with the potential to occur in the SRSCs’ service area. This list was reviewed to identify species that use one or more habitats in the SRSCs’ service area. Species associated with habitats that do not occur in the service areas of the SRSCs and CDMWC would not be affected by the Preferred Alternative and alternatives and were not further considered. In addition to the federal-listed species and species of concern, state-listed species and California Species of Special Concern with the potential to occur in the SRSCs’ service area were identified. Table 3-17 lists the special-status wildlife species with the potential to occur in the SRSCs’ service area, each species’ state and federal status, and the general habitat types used by each species. The biological effects of project alternatives on federally designated critical habitat for wildlife and plants are very minor because there are no major changes anticipated in on-farm practices or cropping pattern. Simply put, the modest changes to system operations were not deemed to result in significant changes to aquatic habitat; therefore, potential effects on endangered species were also deemed minimal.

TABLE 3-17

SPECIAL-STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Association
LISTED AND PROPOSED SPECIES		
BIRDS		
bald eagle *Haliaeetus leucocephalus*	Federal – T State – E; FP	Open-water habitats, lakes, rivers, and marshes
bank swallow *Riparia riparia*	Federal – none State – T	Riparian areas, nest in friable soils of vertical streambanks
greater sandhill crane *Grus canadensis tabida*	Federal – none State – T	Freshwater wetlands and irrigated fields
little willow flycatcher *Empidonax traillii brewsteri*	Federal – none State – E	Montane riparian areas and wet meadows, in dense willows
mountain plover *Charadrius montanus*	Federal – PT State – CSC	Agricultural fields
Peregrine falcon *Falco peregrinus anatum*	Federal – D State – E	Wetlands, lakes, rivers, grasslands, and agricultural fields
Swainson's hawk *Bueto swainsoni*	Federal – none State – T	Mature riparian forests, oak groves, agricultural fields, and grasslands
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Federal – C State – E	Riparian forests with abundant canopy cover of willow and cottonwood
REPTILES		
giant garter snake *Thamnophis gigas*	Federal – T State – T	Wetlands, sloughs, irrigation ditches, rice fields
AMPHIBIANS		
California red-legged frog *Rana aurora draytonii*	Federal – T State – CSC	Streams, ponds, marshes, and stock ponds
INVERTEBRATES		
conservancy fairy shrimp *Branchinecta conservatio*	Federal – E State – none	Vernal pools
valley elderberry longhorn beetle *Desmocercus californicus dimorphus*	Federal – T State – none	Elderberry shrubs in riparian areas, savannas, and woodlands
vernal pool fairy shrimp *Branchinecta lynchi*	Federal – T State – none	Vernal pools
vernal pool tadpole shrimp *Lepidurus packardi*	Federal – E State – none	Vernal pools

TABLE 3-17

SPECIAL-STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Association
OTHER SPECIAL-STATUS SPECIES		
BIRDS		
Aleutian Canada goose *Branta canadensis leucopareia*	Federal – D State – none	Freshwater wetlands and agricultural fields
black swift *Cypseloides niger*	Federal – SC State – CSC	Coastal bluffs and mountain canyons
California horned lark *Eremophila alpestris actia*	Federal – none State – CSC	Grasslands and open woodlands
California thrasher *Toxostoma redivivum*	Federal – SC State – none	Chaparral, riparian forest, and scrub
Cooper's hawk *Accipiter cooperii*	Federal – none State – CSC	Woodlands, riparian forests, and agricultural fields
ferruginous hawk *Buteo regalis*	Federal – SC State – CSC	Grasslands and agricultural fields
golden eagle *Aquila chrysaetos*	Federal – none State – CSC; FP	Grasslands, open woodlands, chaparral, wetlands, and agricultural areas
Lawrence's goldfinch *Carduelis lawrencei*	Federal – SC State – none	Oak woodlands
Lewis' woodpecker *Melanerpes lewis*	Federal – SC State – none	Open woodlands, savannas, and riparian areas
loggerhead shrike *Lanius ludovicianus*	Federal – SC State – CSC	Grasslands, savannas, and chaparral
long-billed curlew *Numenius americanus*	Federal – SC State – CSC	Wetlands and irrigated agricultural fields
northern harrier *Circus cyaneus*	Federal – none State – CSC	Marshes, grasslands, and agricultural fields
Nuttall's woodpecker *Picoides nuttallii*	Federal – SLC State – none	Riparian forest and oak woodland
oak titmouse *Baeolophus inornatus*	Federal – SLC State – none	Riparian forest and oak woodland
osprey *Pandion haliaetus*	Federal – none State – CSC	Open water habitats, lakes, and rivers
prairie falcon *Falco mexicanus*	Federal – none State – CSC	Grasslands, agricultural fields, river embankment, and open savannas
purple martin *Progne subis*	Federal – none State – CSC	Grasslands, wet meadows, wetlands, woodlands, and riparian areas
rufus hummingbird *Selasphorus rutus*	Federal – SC State – none	Riparian areas, open woodlands, chaparral, orchards, and gardens
sharp-shinned hawk *Accipiter striatus*	Federal – none State – CSC	Woodlands, riparian forests, and shrub thickets
short-eared owl *Asio flammeus*	Federal – none State – CSC	Annual grasslands and wetlands
tri-colored blackbird	Federal – SC	Wetlands in dense emergent vegetation

TABLE 3-17

SPECIAL-STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Association
Agelaius tricolor	State – CSC	
Vaux's swift *Chaetura vauxi*	Federal – SC State – CSC	Mixed oak and conifer woodlands, forage over grasslands, lakes, and streams
western burrowing owl *Athene cunicularia hypougea*	Federal – SC State – CSC	Grasslands, pastures, agricultural fields, road embankments, and near open urban areas
white-faced Ibis *Plegadis chihi*	Federal – SC State – CSC	Freshwater wetlands and irrigated fields
white-tailed kite *Elanus leucurus*	Federal – SC State – FP	Grasslands, oak savannas, and woodlands, and open riparian areas and agricultural fields
yellow-breasted chat *Icteria virens*	Federal – none State – CSC	Riparian areas
yellow warbler *Dendroica petechia*	Federal – none State – CSC	Riparian areas
REPTILES		
California horned lizard *Phrynosoma coronatum frontale*	Federal – SC State – CSC	Grasslands, chaparral, and riparian areas
San Joaquin coachwhip *Masticophis flagellum ruddocki*	Federal – SC State – CSC	Grasslands, chaparral habitat
western pond turtle *Emys* (*Clemmys*) *marmorata*	Federal – SC State – CSC	Wetlands, ponds, irrigation ditches, rivers, and streams
AMPHIBIANS		
California tiger salamander *Ambystoma californiense* Central California DPS[a]	Federal – PT State – CSC	Vernal pools and associated grasslands
foothill yellow-legged frog *Rana boylii*	Federal – SC State – CSC	Large streams with open gravel bars and rocks
western spadefoot toad *Spea* (*Scaphiopus*) *hammondii*	Federal – SC State – CSC	Quiet streams and pools in grasslands and woodlands
INVERTEBRATES		
Antioch Dunes anthicid beetle *Anthicus antiochensis*	Federal – SC State –none	Sandbars and sandy riparian areas
California linderiella fairy shrimp *Linderiella occidentalis*	Federal – SC State – none	Vernal pools
midvalley fairy shrimp *Branchinecta mesovallensis*	Federal – SC State – none	Vernal pools
Sacramento anthicid beetle *Anthicus sacramento*	Federal – SC State – none	Sandbars and sandy riparian areas
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	Federal – SC State – none	Sandy soils along rivers, streams, and lakes
MAMMALS		
fringed myotis *Myotis thysanodes*	Federal – SC State – none	Foothill woodlands and mixed conifer-hardwood forests

TABLE 3-17

SPECIAL-STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Association
greater western mastiff bat *Eumops perotis californicus*	Federal – SC State – CSC	Grasslands, chaparral, woodlands and conifer forests
long-eared myotis *Myotis evotis*	Federal – SC State – none	Chaparral, woodlands, and conifer forests
long-legged myotis *Myotis volans*	Federal – SC State – none	Chaparral, woodlands, and conifer forests
Marysville Heerman's kangaroo rat *Dipodomys californicus eximus*	Federal – SC State – CSC	Grasslands
pale big-eared bat *Corynorhinus townsendii pallescens*	Federal – SC State – CSC	Grasslands, chaparral, woodlands, and conifer forests
San Joaquin pocket mouse *Perognathus inornatus inornatus*	Federal – SC State – none	Grasslands and oak savannas
small-footed myotis *Myotis ciliolabrum*	Federal – SC State – none	Open forests, woodlands, and chaparral
spotted bat *Euderma maculatum*	Federal – SC State – CSC	Grasslands and mixed conifer forests
Townsend's western big-eared bat *Corynorhinus townsendii townsendii*	Federal – SC State – CSC	Grasslands, chaparral, woodlands, and conifer forests
Yuma myotis *Myotis yumanensis*	Federal – SC State – none	Open forests and woodlands, and open waters

[a]DPS = Distinct Population Segment

Notes:

Federal: E = Endangered
T = Threatened
PT = Proposed Threatened
SC = Species of Concern
SLC = Species of Concern
D = Delisted
C = Candidate for Federal Listing
State: E = Endangered
T = Threatened
CSC = California Species of Concern
FP = California Fully Protected

Special-status Plant Species. Many special-status plant species have the potential to occur in the SRSCs' service area. The Service provided a list of species that are federally listed or are considered species of concern with the potential to occur in the SRSCs' service area. This list was reviewed to identify species that occur in one or more habitats in the SRSCs' service area. Species associated with habitats or environmental conditions that do not occur in the service areas of the SRSCs and CDMWC would not be affected by the Preferred Alternative and alternatives and were not further considered. In addition to the federal-listed species and species of concern, state-listed species with the potential to occur in the SRSCs’ service area were identified. Table 3-18 lists the special-status plant species with the potential to occur in the SRSCs’ service area, each species’ state and federal status, and the general habitats and conditions each species prefers.

TABLE 3-18

SPECIAL-STATUS PLANTS WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Associations
LISTED AND PROPOSED SPECIES		
Bogg’s Lake hedge hyssop *Gratiola heterosepala*	Federal – none State – E CNPS – 1B	Vernal pools
Butte County meadowfoam *Limnathes floccosa* ssp. *californica*	Federal – E State – E CNPS – 1B	Vernal pools
Greene’s tuctoria *Tuctoria greenei*	Federal – E State – R CNPS – 1B	Vernal pools
hairy Orcutt grass *Orcuttia pilosa*	Federal – E State – E CNPS – 1B	Vernal pools
Indian Valley brodiaea *Brodiaea coronaria* ssp. *rosea*	Federal – none State – E CNPS – 1B	Chaparral, woodlands, and conifer forests/serpentine
palmate bracted bird’s-beak *Cordylanthus palmatus*	Federal – E State – E CNPS – 1B	Grassland and scrub habitats
slender Orcutt grass *Orcuttia tenuis*	Federal – T State – E CNPS – 1B	Vernal pools
OTHER SPECIAL-STATUS SPECIES		
Stony Creek spurge *Chamaesyce ocellata* ssp. *rattanii*	Federal – SLC State – none CNPS – 1B	Chaparral and grassland
silky cryptantha *Cryptantha crinita*	Federal – SC State – none CNPS – 1B	Riparian areas and gravelly streambeds
Henderson’s bent grass *Agrostis hendersonii*	Federal – SC State – none CNPS – 3	Vernal pools and grasslands
woolly meadowfoam *Limnanthes floccosa* ssp. *floccosa*	Federal – none State – none CNPS – 4	Vernal pools and wet meadows
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	Federal – SC State – none CNPS – 1B	Vernal pools and wet meadows, riparian areas, chaparral, and woodlands
Colusa layia *Layia septentrionalis*	Federal – SLC State – none CNPS – 1B	Serpentine soils in chaparral, woodlands, and grasslands

TABLE 3-18

SPECIAL-STATUS PLANTS WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Associations
adobe lily *Fritillaria pluriflora*	Federal – SC State – none CNPS – 1B	Grasslands, chaparral, and woodlands
Hoover's spurge *Chamaesyce hooveri*	Federal – T State – none CNPS – 1B	Vernal pools
legenere *Legenere limosa*	Federal – SC State – none CNPS – 1B	Vernal pools
red-flowered lotus *Lotus rubriflorus*	Federal – SC State – none CNPS – 1B	Woodlands and grasslands
Ahart's paronychia *Paronychia ahartii*	Federal – SC State – none CNPS – 1B	Woodlands, grasslands, and vernal pools
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	Federal – SLC State – none CNPS – 1B	Grasslands
San Joaquin spearscale *Atriplex joaquiniana*	Federal – SC State – none CNPS – 1B	Scrub habitat, grasslands, and meadows
brittlescale *Atriplex depressa*	Federal – SC State – none CNPS – 1B	Vernal pools, grasslands, and scrub habitat
lesser saltscale *Atriplex minuscula*	Federal – SC State – none CNPS – 1B	Alkaline sandy soils in scrub and grassland habitats
heartscale *Atriplex cordulata*	Federal – SC State – none CNPS – 1B	Alkaline sandy soils in scrub and grassland habitats
subtle orache *Atriplex subtilis*	Federal – SLC State – none CNPS – 1B	Grasslands
vernal pool saltbush *Atriplex persistens*	Federal – SC State – none CNPS – 1B	Vernal pools
alkali milk-vetch *Astragalus tener* var. *tener*	Federal – SC State – none CNPS – 1B	Vernal pools and grasslands
Ferris' milkvetch *Astragalus tener* var. *ferrisiae*	Federal – SC State – none CNPS – 1B	Grasslands
pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	Federal – SLC State – none CNPS – 1B	Serpentine soils in chaparral, grassland, and woodland habitats
little mousetail *Myosurus minimus* ssp. *apus*	Federal – SC State – none CNPS – 3	Grasslands and vernal pools

TABLE 3-18

SPECIAL-STATUS PLANTS WITH THE POTENTIAL TO OCCUR IN THE SRSC SERVICE AREAS

Species	Status	General Habitat Associations
valley sagittaria *Sagittaria sanfordii*	Federal – SC State – none CNPS – 1B	Wetlands
Baker’s navarretia *Navarretia leucocephala* ssp. *bakeri*	Federal – SC State – none CNPS – 1B	Woodlands, open conifer forests, grasslands, and vernal pools

Notes:

CNPS = California Native Plant Society
Federal: E = Endangered
T = Threatened
SC = Species of Concern (Former Category 2 Candidates)
SLC = Species of Local Concern
State: E = Endangered
T = Threatened
R = Rare
CNPS: 1B = Rare or Endangered in California and elsewhere
2 = Rare or Endangered in California, more common elsewhere
3 = Additional information needed to determine status
4= Plants of Limited distribution

Environmental Consequences. The effects of Alternatives 1 through 5 on terrestrial biological resources of the SRSCs’ service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative involves renewal of delivery contracts to SRSCs and the CDMWC with no changes in contract provisions, including total contract amounts, relative to those included in the original Settlement Agreements.

Alternative 1. Alternative 1 would not significantly affect terrestrial biological resources of the SRSCs’ service area~~,~~ when compared to the No Action Alternative.

The total volume of delivered water (Base Supply and Project Water) would decrease from 2,316 to 2,227 KAFY (4 percent reduction total). Such a reduction would be realized with reductions in contract totals to ACID and SMWC. It is assumed that use of the contracted CVP water by the SRSC would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

Reductions in water use by ACID and SMWC could negatively impact terrestrial resources associated with drain and canal habitat, and with agricultural crops. Such impacts assume substantial changes in the nature and character of these habitats with less water delivered. Water needs analyses conducted by Reclamation, however, showed that both ACID and SMWC have not “…diverted the increments of water [they are entitled to] in recent years.” (CH2M HILL, 2003). In fact, historical diverted volumes are similar to those volumes proposed after contract reductions (CH2M HILL, 2003, Appendix D). If implemented, reductions in contract ~~volumes~~ quantities to these contractors would not pose adverse effects to terrestrial resources of the service area because in-district operations would be essentially the same as under current conditions.

Alternative 2. Terrestrial biological resources in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract ~~cutbacks~~ reductions would occur, less water would be diverted from the Sacramento River than under No Action, although total irrigated crop acreage would remain unchanged; therefore, on-farm habitat and in-drain habitat would be effectively the same as under No Action. Terrestrial habitat may be incrementally reduced between diversion points and on-farm application, but this reduction would be *de-minimis*, because canals would be operated with the same water surface elevations as No Action. Therefore, even if the volume of diversion were less, the amount of habitat in canals would be the same because the canals would still convey water to the fields throughout the normal irrigation season. Additional water available for re-allocation during the additional drought years could be available for habitat improvements, at refuges or other locations, thus providing a potential benefit. However, any re-allocation would be evaluated on a case-by-case basis during yearly operational planning activities.

There are no adverse impacts associated with this alternative, although benefits are feasible if water is re-allocated for terrestrial habitat.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping could occur during dry years within the Sacramento Valley Groundwater Basin. Increased pumping activities would occur in association with ~~cutbacks~~ shortages and could result in temporary drawdown of groundwater levels, which could ultimately result in a reduction in local streamflow, affecting associated riparian vegetation.

The Sacramento River Riparian Vegetation GIS showed a total of 9,064 acres of vegetation along the Sacramento River in the project area. Of this acreage, 4,980 acres are Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley riparian scrub. If pumping were to increase as a result of this alternative, it is likely that most of the riparian vegetation would experience minor reductions in groundwater elevations, but not enough to negatively affect acreage. An estimated 4,741 acres of riparian vegetation would experience a reduction in groundwater elevations at the end of the pumping season, again, not enough to affect acreage. The small change in extent of altered groundwater levels is not likely to cause an adverse impact to riparian vegetation.

Alternative 3. Terrestrial biological resources in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum ~~volume~~ quantity of water diverted by ~~delivered to~~ the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

There are no adverse impacts associated with this alternative.

Alternative 4. Terrestrial biological resources in the SRSCs' service area under Alternative 4 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract ~~cutbacks~~ reductions would occur, less water would be diverted from the Sacramento River than under No Action, although total irrigated crop acreage would remain unchanged; therefore, on-farm habitat and in-drain habitat would be effectively the same as under No Action. Terrestrial habitat might be incrementally reduced between diversion points and on-farm application, but this reduction would be *de-minimis*, because canals would be operated with the same water surface elevations as No Action. Therefore, even if the volume of diversion were less, the amount of habitat in canals would be the same because the canals would still convey water to the fields throughout the normal irrigation season. Additional water available for re-allocation during the additional drought years could be available for habitat improvements, at refuges or other locations, thus providing a potential benefit. However, any theoretical re-allocation would be evaluated on a case-by-case basis during yearly operational planning activities.

There are no adverse impacts associated with this alternative, although benefits are feasible if water is re-allocated for terrestrial habitat.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping could occur during dry years within the Sacramento Valley Groundwater Basin. Increased pumping activities associated with these reductions ~~cutbacks~~ would result in temporary drawdown of groundwater levels, which would ultimately result in a reduction in local streamflow, affecting associated riparian vegetation.

The Sacramento River Riparian Vegetation GIS showed a total of 9,064 acres of vegetation along the Sacramento River in the project area. Of this acreage, 4,980 acres are Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley riparian scrub. If pumping were to increase as a result of this alternative, it is likely that most of the riparian vegetation would experience minor reductions in groundwater elevations. An estimated 4,741 acres of riparian vegetation would experience a reduction in groundwater elevations at the end of the pumping season. In neither case would the additional pumping affect habitat acreage. The small change in groundwater levels is not likely to cause an adverse impact to riparian vegetation.

Alternative 5. Terrestrial biological resources in the SRSCs' service area under Alternative 5 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract reductions ~~cutbacks~~ would occur, less water would be diverted from the Sacramento River than under No Action, although total irrigated crop acreage would remain unchanged; therefore, on-farm habitat and in-drain habitat would be effectively the same as under No Action. Terrestrial habitat may be incrementally reduced between diversion points and on-farm application, but this reduction would be *de-minimis*, because canals would be operated with the same water surface elevations as No Action. Therefore, even if the volume of diversion were less, the amount of habitat in canals would be the same because the canals would still convey water to the fields throughout the normal irrigation season. Additional water available for re-allocation during the additional drought years could be available for habitat improvements, at refuges or other locations, thus providing a potential benefit. However, any theoretical re-allocation would be evaluated on a case-by-case basis during yearly operational planning activities.

There are no adverse impacts associated with this alternative, although benefits are feasible if water is re-allocated for terrestrial habitat.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping within the Sacramento Valley Groundwater Basin could occur during dry years within the Sacramento Valley Groundwater Basin. Increased pumping activities associated with these cutbacks would result in temporary drawdown of groundwater levels, which would ultimately result in a reduction in local streamflow, affecting associated riparian vegetation.

The Sacramento River Riparian Vegetation GIS showed a total of 9,064 acres of vegetation along the Sacramento River in the project area. Of this acreage, 4,980 acres are Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley riparian scrub. If pumping were to increase as a result of this alternative, it is likely that most of the riparian vegetation would experience minor reductions in groundwater elevations. An estimated 4,741 acres of riparian vegetation would experience a reduction in groundwater elevations at the end of the pumping season. In neither case would pumping affect habitat. The small change in groundwater levels is not likely to cause an adverse impact to riparian vegetation.

Aquatic Biological Resources

Affected Environment.

This section describes the various types and characteristics of aquatic habitats in the SRSCs’ service area, the fish species inhabiting the SRSCs’ service area, and the distribution and habitat requirements of special-status fish species that occur in the SRSCs’ service area.

Aquatic Habitats. Aquatic habitats in the SRSCs’ service area fall into two broad types: riverine and lacustrine.

Riverine Habitat. Riverine habitat is aquatic habitat characterized by moving water. The nature and characteristics of riverine habitat can vary considerably. Depending on the size of the drainage basin and topography, riverine habitats can range from large, slow-moving water to small, fast-moving streams found in higher elevation drainages.

Historically, in the Central Valley, smaller creeks and rivers typically were dry in the late summer. Only the largest rivers were consistently perennial. With construction of reservoirs on most of the larger streams and rivers in the Central Valley, flows have been regulated, resulting in more consistent availability of aquatic habitat within and among years. Aquatic and emergent vegetation is typically sparse in riverine habitats and limited to the margins and backwaters of the river in areas of shallow, slow-moving water.

In the SRSCs’ service area, riverine habitat occurs as large, perennial rivers; small, perennial streams; and small, intermittent streams. The Sacramento River is the dominant riverine habitat in the SRSCs’ service area. Other perennial rivers and streams in or near the SRSCs’ service area include Clear, Cottonwood, Cow, Butte, Battle, and Bear Creeks, and the Feather

River. Intermittent streams include Stony and Thomes, among others. These intermittent and perennial streams are tributaries to the Sacramento River.

In addition to the natural watercourses, the SRSCs’ service area contains an extensive network of canals and ditches. These canals and ditches were created and are maintained to convey water to agricultural users and to collect and carry drainwater from the agricultural fields after application. Canals and drains provide aquatic habitat of widely varying characteristics within and among years. Depending on the frequency and intensity of maintenance activities and the consistency of water availability, some canals and drains can support emergent vegetation or bank vegetation. Water depth, velocity, and water quality also vary dramatically depending on the channel’s size and use.

Lacustrine Habitat. Lacustrine habitats are inland depressions containing standing water. They vary in size and characteristics and include natural lakes, reservoirs, dammed river channels, and ponds. This aquatic habitat type can be associated with rivers and freshwater emergent wetlands. Shallow, temporary habitats may support rooted plants, whereas deep permanent waterbodies are primarily open water. Permanent open waters can support emergent and aquatic plants in shallow areas along the margins of the waterbody.

Lacustrine habitat is uncommon in the SRSCs’ service area. Lacustrine habitat has been created behind diversion dams on the Sacramento River and behind several dams on tributaries to the Sacramento River. The large CVP and State Water Project reservoirs also provide lacustrine habitat, but these features occur outside of the SRSCs’ service area.

Essential Fish Habitat. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) mandates federal action agencies that fund, permit, or carry out activities that may adversely impact the Essential Fish Habitat (EFH) of federally managed fish species to consult with National Oceanic and Atmospheric Association-Fisheries (NOAA-Fisheries) regarding the potential adverse effects of their actions on EFH (Section 305 (b)(2)). Section 600.920(a)(1) of the EFH regulations states that consultations are required of federal action agencies for renewals, reviews, or substantial revisions of actions if the renewal, review, or revision may adversely affect EFH. The EFH regulations require that federal action agencies obligated to consult on EFH provide NOAA-Fisheries with a written assessment of the effects of their action on EFH (50 CFR 600.920). The statute also requires federal action agencies receiving EFH Conservation Recommendations from NOAA-Fisheries to provide a detailed written response to NOAA-Fisheries within 30 days upon receipt detailing how they intend to avoid, mitigate, or offset the impact of the activity on EFH (Section 305(b)(4)(B)). NOAA-Fisheries may also include recommendations for other species.

EFH is the aquatic habitat (water and substrate) necessary to fish for spawning, breeding, feeding, or growth to maturity that would allow a level of production needed to support a long-term, sustainable commercial fishery and contribute to a healthy ecosystem. “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and can include areas historically used by fish in addition to areas currently used. “Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities. “Necessary” means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Because of their commercial value, consultation is required with NOAA-Fisheries on all runs of Chinook salmon, including the following:

- Sacramento River winter-run Chinook salmon
- Central Valley spring-run Chinook salmon
- Central Valley fall-/late-fall–run Chinook salmon

Effects of the project on EFH are incorporated into the analysis for the listed and candidate species. A separate analysis to address potential effects on EFH was unnecessary.

Fish Resources. Fish resources of the SRSCs' service area include native and non-native anadromous and resident species. Several native anadromous and resident species have been listed as threatened or endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA) or are candidates for listing.

Listed and Candidate Species. Five fish species or Evolutionarily Significant Units (ESU) listed under the ESA have the potential to occur in watercourses in the SRSCs' service area (see Table 3-19). In addition to these listed species, two species that are candidates for federal listing have the potential to occur in the SRSCs' service area (Table 3-19).

Central Valley Winter-run Chinook Salmon. Chinook salmon are anadromous, spawning in freshwater rivers and streams but spending most their life in the ocean. Adult winter-run Chinook salmon generally spend 1 to 3 years in the ocean before returning to their natal streams to spawn. Upstream migrants appear during December on the upper Sacramento River (Vogel and Marine, 1991). Because there are no fish passage facilities at Keswick Dam, the adults tend to migrate to and hold in deep pools between Red Bluff Diversion Dam (RBDD) and Keswick Dam before initiating spawning activities. The primary spawning grounds in the Sacramento River are above the RBDD.

TABLE 3-19

LISTED AND CANDIDATE FISH SPECIES POTENTIALLY OCCURRING IN THE SRSC SERVICE AREAS

Species	Status
Central Valley winter-run Chinook salmon *Onchorhynchus tshawytscha*	Federal – E State – E
Central Valley spring-run Chinook salmon *Onchorhynchus tshawytscha*	Federal – T State – T
Central Valley fall-/late-fall-run Chinook salmon *Onchorhynchus tshawytscha*	Federal – C State – CSC
Central Valley steelhead *Onchorhynchus mykiss*	Federal – T State – none
delta smelt *Hypomesus transpacificus*	Federal – T State – T

TABLE 3-19

LISTED AND CANDIDATE FISH SPECIES POTENTIALLY OCCURRING IN THE SRSC SERVICE AREAS

Species	Status
green sturgeon *Acipenser medirostris*	Federal – C State – CSC
Sacramento splittail *Pogonichthys macrolepidotus*	Federal – SC State – CSC

Notes:

E – Listed as endangered under the federal or state Endangered Species Acts
T – Listed as threatened under the federal or state Endangered Species Acts
C – Candidate for listing as threatened or endangered under the federal or state Endangered Species Acts
CSC – California Species of Special Concern

Winter-run Chinook salmon lay their eggs in late summer in the gravel of the stream bottom where the eggs incubate for an extended time. Depending on water temperature, they generally hatch within 40 to 60 days of fertilization. After hatching, fry remain in the gravel for another 2 to 4 weeks before emerging. After emergence, Chinook salmon fry seek out shallow, nearshore areas with slow currents and good cover. Rearing Chinook salmon feed on a variety of aquatic and terrestrial insects and other small invertebrates, and newly emerged fry are sometimes prey to older steelhead. As they grow, juvenile Chinook salmon move to deeper, swifter water, but continue to use available cover to minimize the risk of being prey and to reduce energy expenditure. The emigration of juvenile winter-run Chinook salmon from the upper Sacramento River is highly dependent on streamflow conditions and water-year type. Storm events may cause pulses of mass emigration.

Prior to construction of Shasta and Keswick Dams, winter-run Chinook salmon spawned in the upper reaches of the Little Sacramento, McCloud, and lower Pit Rivers (Moyle et al., 1995). Shasta Dam, completed in the 1940s, blocked access to historical winter-run spawning grounds in the McCloud River and other areas upstream. However, cold-water releases from Shasta and Keswick Dams created more favorable spawning and rearing conditions in the mainstem Sacramento River than existed there prior to dam construction (Slater, 1963). Since the construction of Keswick Dam, all spawning of winter-run Chinook salmon has occurred downstream of Keswick Dam.

Critical habitat for Central Valley winter-run Chinook salmon was designated on March 22, 1999. Critical habitat includes the following:

(1) Sacramento River from Keswick Dam in Shasta County (River Mile [RM] 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta

(2) All waters from Chipps Island westward to Carquinez Bridge including Honker Bay, Suisun Bay, and Carquinez Strait

(3) All waters of San Pablo Bay westward of the Carquinez Bridge

(4) All waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge

Central Valley Spring-run Chinook Salmon. Central Valley spring-run Chinook salmon include all naturally spawned spring-run populations from the Sacramento-San Joaquin River mainstem and its tributaries (50 CFR Part 17). Spring-run Chinook salmon are distinguished from the other runs of Central Valley Chinook salmon in the timing of life history events. Spring-run Chinook salmon adults leave the ocean and enter the Sacramento River from March to July (Myers et al., 1998). They move into tributaries where they over-summer in deep, cool pools. They prefer to hold in deep pools with moderate velocities and bedrock substrates.

Gravel beds at the tails of holding pools are used for spawning (Service, 1995). Chinook salmon lay their eggs in the gravel of the stream bottom where the eggs incubate for an extended time, depending on water temperature. The length of time required for eggs to develop and hatch is quite variable, but hatching generally occurs within 40 to 60 days of fertilization (Vogel and Marine, 1991). After hatching, fry remain in the gravel for another 2 to 4 weeks before emerging. Timing of emergence is variable among drainages and is strongly influenced by temperature.

After emergence, Chinook salmon fry seek out shallow, nearshore areas with slow currents and good cover. Rearing Chinook salmon feed on a variety of aquatic and terrestrial insects and other small invertebrates, and newly emerged fry are sometimes prey to older steelhead. As they grow to around 75 millimeters long, juvenile Chinook salmon move to deeper, swifter water, but continue to use available cover to minimize the risk of being preyed upon. Suitable rearing habitat for spring-run Chinook salmon includes areas with in-stream and overhead cover in the form of undercut banks, downed trees, and large, overhanging tree branches. In the Sacramento River, juveniles may begin migrating downstream almost immediately following emergence or may remain in riverine and/or estuarine habitats including their natal tributaries, the Sacramento River, non-natal tributaries, and the Delta for a year or more.

Historically, spring-run Chinook salmon were found throughout the Central Valley, with substantial populations in the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers. Naturally spawning populations of spring-run Chinook salmon in the Central Valley are currently restricted to accessible reaches in the upper Sacramento, Feather, and Yuba Rivers, and Antelope, Battle, Butte, Clear, Deer, and Mill Creeks, and other creeks (CDFG, 1998b). Current surveys indicate that spring-run Chinook in Cottonwood, Battle, Antelope, and Big Chico Creeks are remnant, nonsustaining populations (DWR, 1997).

Critical habitat for spring-run Chinook salmon was designated on February 16, 2000. Critical habitat for Central Valley spring-run Chinook salmon is designated to include all river reaches accessible to listed Chinook salmon in the Sacramento River and its tributaries in California (e.g., Butte and Beegum Creeks). Also included are adjacent riparian zones, as well as river reaches and estuarine areas of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.

Central Valley Steelhead. The life history of steelhead differs from that of Pacific salmon in several ways. First, steelhead do not necessarily die after spawning; a small portion survive to become repeat spawners. Secondly, juvenile steelhead have a longer freshwater rearing requirement (usually from 1 to 3 years). Thirdly, both adults and juveniles show more variability in the length of time they spend in fresh and salt water. Some individuals may remain in a stream, mature, and even spawn without ever going to sea; others migrate to the ocean at less than 1 year in age; and some may return to freshwater after spending less than 1 year in the ocean. Central Valley stocks generally return to spawn after 1 to 2 years (Barnhart, 1986; Busby et al., 1996).

Adult steelhead migrate through the mainstem Sacramento from July through March, with peaks in September and February (Bailey, 1954; Hallock et al., 1961), and spawn primarily from January through March, although spawning can begin as early as late December and can extend through April (Hallock et al., 1961). Similar to other salmonids, steelhead lay their eggs in the gravel of the stream bottom where they incubate for about 3 to 12 weeks. The length of time required for eggs to develop and hatch is quite variable and depends on water temperature. After hatching, pre-emergent fry remain in the gravel for another 4 to 6 weeks, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft, 1954).

Steelhead fry usually emerge from the gravel 2 to 8 weeks after hatching (Barnhart, 1986; Reynolds et al., 1993). Upon emergence, steelhead fry seek out shallow areas along perennial streambanks. Streamside vegetation is essential for foraging, cover, and habitat diversity. Juvenile steelhead are generally associated with the bottom of the stream. The majority of steelhead inhabit riffles during their first year of life, although larger fish will occupy pools and deeper runs. In winter, juvenile steelhead become inactive and hide in available cover, which can include woody debris and the interstices between streambed cobbles. After rearing for 1 to 3 years in freshwater, juvenile steelhead migrate downstream to the ocean. Sacramento River steelhead generally emigrate as 1-year olds (Barnhart, 1986; Reynolds et al., 1993). Although juveniles can emigrate downstream to the ocean from November through May, most Sacramento River steelhead emigrate in the spring and early summer (Reynolds et al., 1993). Additionally, there is a much smaller peak in the fall (Hallock et al., 1961).

Historically, steelhead were found throughout most of the tributaries and headwaters of the Sacramento and San Joaquin Basins. Compared to Chinook salmon, steelhead generally migrated farther into tributaries and headwater streams where suitable conditions were available year-round. Dam construction and water diversions during the nineteenth and twentieth centuries blocked steelhead migration to these preferred spawning and rearing habitats. Currently, wild steelhead stocks are mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill Creeks and the Yuba River (McEwan and

Jackson, 1996). Butte Creek and the upper Sacramento, Feather, American, Mokelumne, and Stanislaus Rivers also contain naturally spawning populations of steelhead (CALFED, 1999).

Critical habitat for the Central Valley steelhead ESU is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are adjacent riparian zones, as well as river reaches and estuarine areas of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence, tribal lands, and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).

Delta Smelt. Delta smelt are small, slender-bodied fish that tolerate a wide salinity range. It spawns in freshwater but has been collected from estuarine waters up to 14 parts per thousand (ppt) salinity (Moyle et al., 1992). For most of its 1-year life span, this species is associated with the freshwater edge of the mixing zone (saltwater-freshwater interface), where the salinity is about 2 ppt.

Shortly before spawning, adult Delta smelt migrate upstream from the brackish-water habitat associated with the mixing zone to disperse widely into river channels and tidally influenced backwater sloughs. Delta smelt spawn in shallow, fresh, or slightly brackish water upstream of the mixing zone (Wang, 1991). Most spawning occurs in tidally influenced backwater sloughs and channel edgewaters (Moyle, 1976; Wang, 1986 and 1991; Moyle et al., 1992). Although Delta smelt spawning behavior has not been observed in the wild (Moyle et al., 1992), the adhesive, demersal eggs are thought to attach to substrates such as cattails, tules, tree roots, and submerged branches. After hatching, larvae are carried downstream where they rear at the saltwater-freshwater interface.

Delta smelt are endemic to the Suisun Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. The Delta smelt is thought to have occurred historically from Suisun Bay upstream to at least the Cities of Sacramento on the Sacramento River and Mossdale on the San Joaquin River.

Designated critical habitat for Delta smelt consists of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; and the existing contiguous waters contained within the Delta, as defined in Section 12220 of the California Water Code (50 CFR Section 17.95).

Sacramento Splittail. Splittail are endemic to the lakes and rivers of the Central Valley (Moyle et al., 1995). Splittail are primarily freshwater fish, but are tolerant of moderate salinity and can live in water with salinities of 10 to 18 ppt. Adults migrate upstream from brackish areas to spawn in freshwater. The onset of spawning seems to be associated with increasing water temperature and day length between early March and May. Spawning begins by late January and early February and continues through July, with most spawning taking place from February through April.

Splittail typically spawn in dead-end sloughs and slow reaches of large rivers and river floodplains over submerged vegetation. Spawning occurs primarily in the lower river reaches and flood bypass of the Sacramento and San Joaquin Rivers. Shallow, weedy areas inundated during seasonal flooding provide habitat for adult spawning and foraging and subsequent egg development and larval and early juvenile rearing.

As flooded habitat disappears, larvae and juveniles use habitat along the margins of the main river and Delta channels. Although splittail use deeper, open water as they grow, much of the population continues to use shallow (less than 10 feet) edge habitat as adults (Meng and Moyle, 1995). Juvenile splittail are commonly found in Delta sloughs in late winter and spring and are particularly abundant in the vicinity of Montezuma Slough. As summer progresses, juvenile splittail occupy the deeper, open-water habitats of Suisun and San Pablo Bays.

Sacramento splittail are found only in California’s Central Valley where they were once widely distributed. Historically, splittail were found as far north as Redding on the Sacramento River and as far south as Friant Dam on the San Joaquin River. Splittail were common in San Pablo Bay and Carquinez Strait following high winter flows until about 1985. In recent times, dams and diversions have increasingly prevented upstream access in large rivers, and splittail are now restricted to a small portion of their former range. Splittail are currently confined largely to the Delta, Suisun Bay, Suisun Marsh, and Napa Marsh, but will use the Sutter, Sacramento, and Yolo bypasses when flooded (Moyle et al., 1995; Natural Heritage Institute, 1992; Jones and Stokes Associates, Inc., 1993). Splittail enter the lower reaches of the Feather and American Rivers on occasion and have been reported as far as Red Bluff on the Sacramento River.

Sacramento splittail is considered a federal and state Species of Concern.

Central Valley Fall-/Late-fall-run Chinook Salmon. Fall-run and late-fall-run Chinook salmon have similar habitat requirements and life history traits to spring-run and winter-run Chinook salmon. They differ from these runs mainly in the timing of life history events. They are anadromous, spending most of their lives in the ocean before returning to their natal streams to spawn. Fall-run Chinook salmon enter the Sacramento River as early as July and continue their upstream migration until about December. Late-fall-run Chinook salmon follow fall-run Chinook salmon, migrating to spawning areas during October through April. Fall-run Chinook salmon typically spawn between October and December, followed by late-fall-run Chinook salmon, which spawn from January to April.

Fall-run and late-fall-run Chinook salmon have similar habitat requirements for spawning and incubation as the other runs of Chinook salmon. As described for spring-run and winter-run Chinook salmon, the length of time required for eggs to hatch and the fry to develop sufficiently to leave the gravel is quite variable depending on environmental conditions. After emergence, fry seek out shallow, nearshore areas with slow currents and good cover. Late-fall-run Chinook salmon typically rear in their natal streams through the summer and emigrate in winter (December through February), and fall-run Chinook salmon typically have left natal streams by June or July depending on environmental conditions.

Fall-run salmon are well distributed in the Central Valley relative to the other runs of Chinook salmon. The Sacramento, Feather, Yuba, and American Rivers support sizable spawning populations of fall-run Chinook salmon. They also occur in smaller tributaries to the Sacramento River as well as in tributaries to the San Joaquin River. Late-fall-run Chinook salmon spawn in the mainstem Sacramento River as well as in Battle, Cottonwood, Clear, and Mill Creeks, and Yuba and Feather Rivers. Fall-run Chinook salmon are the most abundant of the Central Valley Chinook salmon runs, and late-fall-run Chinook salmon are the least abundant (Moyle et al., 1995).

Fall-run/late-fall-run Chinook salmon currently are candidates for listing under the ESA. Because this species is not formally listed, critical habitat has not been designated.

Green Sturgeon. Green sturgeon are anadromous fish migrating into freshwater to spawn, but spending most of their adult life in the ocean or estuaries. They are believed to migrate into the Sacramento River for spawning between late February and late July. Spawning occurs in deep, fast-moving water during March through July (Moyle et al., 1995). Habitat requirements for spawning are poorly understood, but sturgeon are believed to prefer large cobble for spawning, although they spawn over a range of substrates. Sturgeon are broadcast spawners and spawn in areas of deep water with high water velocity. Embryos are planktonic and develop as they drift downstream. Juveniles typically migrate to the ocean before 2 years of age (Moyle et al., 1995).

In California, green sturgeon spawn in the mainstem Sacramento River as far north as Red Bluff and in the Feather River. They are also known to spawn in the Klamath River, and historically used the Eel River on the north coast of California. Green sturgeon are a candidate for federal~~ly~~ listing. No critical habitat has been designated because they are not formally listed under the ESA.

Other Anadromous Fish Species. Several other native and introduced species of anadromous fish occur in the Sacramento River and tributaries in the SRSCs' service area. Native anadromous species include the following:

- river lamprey (*Lampetra ayresi*)
- Pacific lamprey (*Lampetra tridentata*)
- white sturgeon (*Acipenser transmontanus*)

Non-native anadromous species include striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). Both species were introduced into the Central Valley waterways for recreational fishing. The anadromous species share a common life history trait of spawning in freshwater rivers and streams and then migrating to the ocean where they spend most of their adult lives. All of these species use the Sacramento River; the adults use it for upstream migration, and the larvae or juveniles use it for downstream migration.

The ecological requirements and distribution of Pacific and river lampreys in California are poorly understood. They are known to occur in the Sacramento River and have been reported passing the RBDD during their upstream migrations, but where they spawn has not been determined. In other parts of their ranges, these species spawn in small tributaries and, therefore, could spawn in the numerous tributaries to the Sacramento River. Larvae grow and develop in natal streams for several years.

In California, white sturgeon are known to spawn only in the Feather River and the mainstem Sacramento River upstream of the confluence with the Feather River. Embryos are planktonic and carried downstream to rear in the upper reaches of the Sacramento-San Joaquin River and Suisun-San Pablo Bay estuary. Except during spawning runs, adults are primarily found in the lower reaches of the Delta and in Suisun, San Pablo, and San Francisco Bays.

American shad and striped bass are broadcast spawners. American shad spawn in the main channels of major rivers including the Sacramento, American, and Feather Rivers. Juveniles and adult shad have been documented as far upstream in the Sacramento River as the RBDD. The Sacramento River between Sacramento and Colusa is a major spawning area for striped bass. After spawning, adults return to brackish water and saltwater areas. Larvae are carried downstream where they rear in the Sacramento-San Joaquin Delta.

Other Resident Fish Species. Most of the resident fish species in SRSCs' service area waterways are non-native species that have been introduced for recreational fishing (see Table 3-20). Many of these species are well distributed in the Sacramento River and tributaries. Some species such as carp, catfish, and mosquitofish are able to tolerate a wide range of aquatic conditions and are found in water delivery canals and agricultural drains. Other species have more restricted habitat requirements and are only found in portions of the natural watercourses.

TABLE 3-20

RESIDENT FISH SPECIES IN THE SRSC SERVICE AREAS

Common Name	Scientific Name	Status
rainbow trout	*Oncorhynchus mykiss*	Native
hitch	*Lavinia exilicauda*	Native
Hardhead	*Mylopharodon conocephalus*	Native California Species of Special Concern
Sacramento pikeminnow	*Ptychocheilus grandis*	Native
speckled dace	*Rhinichthys osculus*	Native
California roach	*Hesperoleucus symmetricus*	Native
Sacramento sucker	*Catostomus occidentalis*	Native
tule perch	*Hysterocarpus traski*	Native
prickly sculpin	*Cottus asper*	Native
riffle sculpin	*Cottus gulosus*	Native
Sacramento blackfish	*Orthodon microlepidotus*	Native
threespine stickleback	*Gasterosteus aculeatus*	Native

TABLE 3-20

RESIDENT FISH SPECIES IN THE SRSC SERVICE AREAS

Common Name	Scientific Name	Status
brown trout	*Salmo trutta*	Non-native
threadfin shad	*Dorosoma petenense*	Non-native
largemouth bass	*Micropterus salmoides*	Non-native
spotted bass	*Micropterus punctulatus*	Non-native
smallmouth bass	*Micropterus dolomieui*	Non-native
green sunfish	*Lepomis cyanellus*	Non-native
Bluegill	*Lepomis macrochirus*	Non-native
redear sunfish	*Lepomis microlophus*	Non-native
pumpkinseed	*Lepomis gibbosus*	Non-native
black crappie	*Pomoxis nigromaculatus*	Non-native
white crappie	*Pomoxis annularis*	Non-native
channel catfish	*Ictalurus punctatus*	Non-native
white catfish	*Ictalurus catus*	Non-native
black bullhead	*Ictalurus melas*	Non-native
yellow bullhead	*Ictalurus nalalis*	Non-native
Goldfish	*Carassius auratus*	Non-native
Carp	*Cyprinus carpio*	Non-native
Mosquitofish	*Gambusia affinis*	Non-native

Environmental Consequences. The effects of Alternatives 1 through 5 on aquatic biological resources of the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative is described previously in the Terrestrial Biological Resources section. A total volume of 2,316 KAFY would be contracted over a 40-year period, as has been done since 1964.

Alternative 1. Alternative 1 would not significantly affect aquatic resources of the SRSCs' service area.

Aquatic biological resources in the SRSCs' service area under Alternative 1 would be similar to conditions under the No Action Alternative. Alternative 1 would not alter current CVP operations, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC.

As discussed previously in the Terrestrial Biological Resources section, reductions in contracted water ~~volumes~~ quantities to ACID and SMWC would not differ from quantities ~~volumes~~ actually diverted by these water agencies in recent years. Therefore, no impacts due to water quantity reductions are anticipated in association with drain habitat, canal habitat, or agricultural areas.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

There are no adverse impacts associated with this alternative.

Alternative 2. Aquatic biological resources in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract cutbacks would occur, less water would be diverted from the Sacramento River than under No Action. Reduced diversions of water from the Sacramento River may provide a small benefit for in-stream habitat. The potential availability of re-allocation of water from drought reductions ~~cutbacks~~ to fishery benefits is a potential benefit, although there is no assurance that the water would be allocated for fishery enhancement.

There are no adverse impacts associated with this alternative.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping within the Sacramento Valley Groundwater Basin could occur during dry years within the Sacramento Valley Groundwater Basin. Increased pumping activities associated with these reductions ~~cutbacks~~ would result in temporary drawdown of groundwater levels, which would ultimately result in a reduction in local streamflow as groundwater is intercepted before it can flow into the Sacramento River, affecting associated aquatic species. However, this effect is exceptionally small (e.g., not measurable at existing gauges) and is offset by reduced diversions of surface water; therefore, there are no adverse impacts associated with this alternative.

Alternative 3. Aquatic biological resources in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSC.

It is assumed that use of the assigned CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

There are no adverse impacts associated with this alternative.

Alternative 4. Aquatic biological resources in the SRSCs' service area under Alternative 4 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract reductions ~~cutbacks~~ would occur, less water would be diverted from the Sacramento River than under No Action. Reduced diversions of water from the Sacramento River may provide a small benefit for in-stream habitat. The potential availability of re-allocation of water from drought reductions

~~cutbacks~~ to fishery benefits is a potential benefit, although there is no assurance that the water would be allocated for fishery enhancement.

There are no adverse impacts associated with this alternative.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping within the Sacramento Valley Groundwater Basin could occur during dry years ~~within the Sacramento Valley Groundwater Basin~~. Increased pumping activities associated with these reductions ~~cutbacks~~ would result in temporary drawdown of groundwater levels, which would ultimately result in a reduction in local streamflow as groundwater is intercepted before it can flow into the Sacramento River, affecting associated aquatic species. However, this effect is exceptionally small and is offset by reduced diversions of surface water; therefore, there are no adverse impacts associated with this alternative.

Alternative 5. Aquatic biological resources in the SRSCs' service area under Alternative 5 would be identical to conditions under the No Action Alternative during years with full contract delivery. During drought conditions, when contract reductions ~~cutbacks~~ would occur, less water would be diverted from the Sacramento River than under No Action. Additionally, reductions ~~cutbacks~~ would occur with more frequency than in other alternatives. During years when the shortage provisions are implemented~~activated~~, reduced diversions of water from the Sacramento River may provide a small benefit for in-stream habitat. The potential availability of re-allocation of water from drought reductions ~~cutbacks~~ to fishery benefits is a potential benefit, although there is no assurance that the water would be allocated for fishery enhancement.

There are no adverse impacts associated with this alternative.

Seasonal Groundwater Drawdown. As discussed in the Groundwater section, increased pumping within the Sacramento Valley Groundwater Basin could occur during dry years within the Sacramento Valley Groundwater Basin. Increased pumping activities associated with these reductions ~~cutbacks~~ would result in temporary drawdown of groundwater levels, which would ultimately result in a reduction in local streamflow as groundwater is intercepted before it can flow into the Sacramento River, affecting associated aquatic species. However, this effect is exceptionally small and is offset by reduced diversions of surface water; therefore, there are no adverse impacts associated with this alternative.

ECONOMICS

Land Use

Agricultural Land Use and Production.

Affected Environment.

Counties and Districts. The Sacramento Valley is an important agricultural region for both the state of California and the United States. In 1997, the nine Sacramento River Valley counties contributed more than 8 percent, by value, of California's agricultural production. California producers account for about 10 percent of total United States agricultural exports. These exports represent almost 25 percent of the gross farm income of the state. Almost 80 percent of the irrigated land in California is located in the Central Valley. Water deliveries for agriculture average about 22.5 MAF per year, with the CVP providing about 25 percent, the State Water Project about 10 percent, local surface water rights about 30 percent, and groundwater about 35 percent. Most SRSCs ~~districts~~ that receive CVP supplies also use other supplies such as groundwater. Use of non-CVP sources varies annually because of changes in weather and crop market conditions.

Agriculture accounts for the largest land use in each of the counties that are in the SRSCs' service area (see Table 3-21). The region produces a wide variety of crops including rice, grains, tomatoes, field crops, fruits, and nuts. Sacramento Valley crop production reached $1.9 billion in 1997, with rice, tomatoes, and orchard crops providing the highest revenues. Approximately 10 percent of the applied water within the Sacramento Valley is provided through CVP contracts.

The counties within the Sacramento Valley that are within the SRSCs' service area include the following:

- Shasta
- Tehama
- Glenn
- Butte
- Colusa
- Sutter
- Yolo
- Sacramento
- Yuba

Shasta County. Shasta County's General Plan (updated 1998) identifies four major categories of land uses: urban, rural, agricultural, and timber. Urban land is primarily contained in the Cities of Redding, Shasta Lake, and Anderson, with small unincorporated communities throughout the county.

Shasta County has a total area of approximately 2,428,000 acres. Preservation of agricultural lands to support full-time and part-time agricultural operations, and to protect future agricultural operations is a stated objective in the Agricultural Element of the Shasta County General Plan. In 1997, the total land area in farm production was 316,743 acres. Although a large portion of the county's most valuable resources are in timberland, a significant portion of the county's land area is under agricultural production. Shasta County's highest reported crop type in 1997 was hay, accounting for approximately 13,000 acres.

Tehama County. With a total land area of 1,888,640 acres, Tehama County focuses largely on resource conservation and its relationship to urban development. Urban encroachment upon agricultural areas is regarded as a potentially adverse effect. Tehama County's General Plan has established planning strategies specifically for agricultural preservation, such as minimum parcel sizes and agricultural land preserves.

Agricultural preservation is a top priority in the Tehama County General Plan. Agriculture is the dominant land use in the county and comprises approximately 58 percent of the total land area in the county. In 1997, orchards accounted for the majority of the land in agricultural productivity. The second and third highest acreage in agricultural productivity was in hay crops and wheat.

TABLE 3-21

TOTAL ACRES OF FARMLAND AND LAND COMMITTED TO NONAGRICULTURAL USES IN COUNTIES IN THE SRSC SERVICE AREAS, 2000 DATA

County	Shasta		Tehama		Glenn		Butte		Colusa		Sutter		Yolo		Sacramento		Yuba	
Land Use Category	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**	**Total Acres**	**Percent of Total**
Prime Farmland	19,815	2%	73,772	4%	166,549	20%	NA	NA	202,232	27%	169,782	44%	264,452	40%	116,116	18%	44,484	11%
Farmland of Statewide Importance	4,716	0%	19,760	1%	87,784	10%	NA	NA	1,811	0%	111,296	29%	18,072	3%	62,650	10%	10,991	3%
Unique Farmland	405	0%	18,486	1%	11,605	1%	NA	NA	125,497	17%	20,213	5%	54,390	8%	15,609	2%	34,698	8%
Farmland of Local Importance	10,416	1%	132,763	7%	141,965	17%	NA	NA	236,354	32%	0	0%	71,927	11%	39,745	6%	0	0%
Farmland Subtotal	**35,352**	**3%**	**244,781**	**13%**	**407,903**	**48%**	**257,315**[a]	**28%**[a]	**565,894**	**76%**	**301,291**	**77%**	**408,841**	**63%**	**234,120**	**37%**	90,173	22%
Grazing Land	409,477	40%	706,026	38%	176,071	21%	264,982	29%	7,526	1%	50,896	13%	144,695	22%	162,344	26%	144,519	35%
Agricultural Land Subtotal	**444,829**	**44%**	**950,807**	**52%**	**583,974**	**69%**	**522,297**	**57%**	**573,420**	**77%**	**352,187**	**90%**	**553,536**	**85%**	**396,464**	**62%**	234,692	57%
Urban and Built-up Land	32,657	3%	11,459	1%	5,609	1%	40,185	4%	4,257	1%	11,360	3%	25,939	4%	157,157	25%	11,544	3%
Other Land	537,852[b]	53%[a]	871,007	47%	253,785	30%	333,784	36%	160,877	22%	24,044	6%	66,577	10%	64,209	10%	159,292	39%
Water Area	5,875	1%	6,221	0%	5,759	1%	21,643	2%	1,838	0%	1,848	0%	7,399	1%	18,253	3%	6,289	2%
Total Area Inventoried	**1,021,213**		**1,839,494**		**849,127**		**917,909**		**740,392**		**389,439**		**653,451**		**636,083**		411,817	

[a]Includes 249,414 acres of irrigated farmland (27%) and 7,901 acres of nonirrigated farmland (1%).

[b]"Other Land" is defined as land not included in any other mapping category. Common examples include low-density rural developments; brush, timber, wetlands, and riparian areas not suitable for livestock grazing; confined livestock, poultry, or aquaculture facilities; strip mines; borrow pits; and waterbodies smaller than 40 acres. Vacant and nonagricultural land surrounded on all sides by urban development and greater than 40 acres is mapped as "Other Land."

Source: Department of Conservation, 2003.

Glenn County. Glenn County is situated at the northern end of the Colusa Basin and has the second lowest population of the counties in the study area. Of the county's 849,127 acres, approximately two-thirds (583,974 acres) are croplands and pasture, with approximately 48 percent of that land considered Important Farmland. Rice is the primary field crop in the county; rice grows well in the poorly drained alkali soils found in the Colusa Basin. The second and third highest crop types by acreage are orchards and hay, respectively.

Butte County. Butte County is the second most populous county in the study area; however, the majority of the county's 1,068,800 acres are rural. In 1997, 404,166 acres of land were in farm production. The Cities of Chico, Gridley, and Oroville (including East and South Oroville), the Town of Paradise, and the outlying area of Magalia comprise nearly half the population of the county.

Urban encroachment onto agricultural lands presents a challenge to agricultural uses within the county. As development pressures increase in the southern portion of the county, and in the existing urban centers, parcels are being subdivided and converted to nonagricultural land uses. Butte County's General Plan established goals and policies, such as minimum acreage densities, to help minimize the effects of urban development and encroachment into agricultural areas.

Colusa County. The majority of Colusa County's 740,392 acres are used for agricultural production. Approximately 77 percent of the county's land area is in orchards and vineyards, cropland, and undeveloped rangeland. Approximately 4,200 acres in Colusa County account for urban uses.

Similar to Glenn County, Colusa County's main crop is rice. The total land in farm production in 1997 was 430,958 acres, of which ~~and~~ rice accounted for 129,974 acres (30 percent).

Sutter County. Sutter County's 389,439 acres are composed of two major geographic units: the valley area and the Sutter Buttes. Approximately 98 percent of the land in the county is unincorporated, and approximately 98 percent of the unincorporated land is zoned for agricultural use. Agriculture is identified as a dominant industry in Sutter County (EDD, 2003).

Yolo County. Yolo County consists of approximately 647,936 acres, the majority of which is in agricultural production. The Yolo County General Plan identifies policies to prevent division and/or use of land for anything but agricultural uses. These policies prevent urban, residential, commercial, or industrial uses in the rural areas of the county. Nonagricultural land uses are discouraged by the Yolo County General Plan in areas that are presently farmed or contain prime agricultural soils. To preserve agricultural lands, the county participates in the Williamson Act Land Conservation Program and applies Agricultural Preserve Zoning designations where appropriate.

Yuba County. Of Yuba County's 408,960 acres, approximately 57 percent are in agriculture. The Yuba County General Plan states that agriculture is the most extensive land use in Yuba County and the most significant component of the county's economy. Agricultural lands within the county not only contribute to the county's economy and food source, agricultural land preservation provides open space, which in turn contributes benefits for psychological and aesthetic qualities as well as biological resources.

Sacramento County. The unincorporated area of Sacramento County, excluding the Delta area, includes approximately 444,000 acres, 250,000 acres of which are in agriculture. The majority of the land outside of the urban developments within the county are devoted to agriculture.

Irrigation Districts. The 20 irrigation districts listed in Table 3-22 represent approximately 90 percent of the annual allocated water in the SRSCs' service area. Rice is the predominant crop for most of the districts because of the prevalence of clay soils within many of the districts. Water needs for rice are greatest early in the growing season to flood rice fields. In response to increasingly stringent limitations on burning, many of the district's landowners also partially flood their fields in the fall to decompose leftover rice straw. Table 3-22 summarizes the number of acres flooded annually by each irrigation district. This trend is expected to continue or increase unless alternative options for disposing of rice straw (including the sale of stubble for ethanol production) become more economically feasible. This practice provides additional winter habitat for waterfowl.

Other key crops include processing tomatoes, vineseed (e.g., cucumber seeds), corn, orchards, pasture, and alfalfa. Water requirements are typically highest during the summer irrigation season (June, July, and August) because of the area's hot, dry climate.

In most of the irrigation districts, annual crop patterns have remained stable since the mid-1970s. For most of the districts, water needs have been a function of water-year type rather than changes in crop patterns.

Anderson-Cottonwood Irrigation District. ACID's service area encompasses approximately 32,000 acres and extends south from the City of Redding and encompasses the City of Anderson and the Town of Cottonwood. ACID's service area includes portions of Shasta and Tehama Counties. Although ACID overlaps the service area boundaries of a few municipalities, ACID does not currently provide water for municipal or industrial uses. Approximately 90 percent of ACID's customers irrigate pasture for hay or livestock; however, some orchard and other crops are also grown.

Land use within ACID's service area is primarily pasture (approximately 75 percent), in addition to alfalfa and some deciduous orchards (CH2M HILL, 2003). Groundwater pumping is limited in the district, and the small amount of water that is pumped is used for deciduous crops.

Table 3-23 shows 1995 normalized estimates of irrigated acres for the primary crops grown within the ACID service area, as well as projections for the year 2020. The variation around these estimates (+/- percentage) accounts for typical and predicted variation in crop acreage due to year type.

TABLE 3-22

ACRES FLOODED ANNUALLY BY DISTRICT TO DECOMPOSE RICE STRAW

District	Acres Flooded	Notes
ACID	0	Rice is not a significant crop in this district
GCID	30,000	Value from 1999; 50,000 acres flooded estimated for the future
PID		No data listed
PCGID		No data listed
MID	346	
RD 108	6,000	
RD 1004	12,000	
MFWC	0	Policy against flooding of rice fields to decompose rice straw for flood protection
SMWC	4,000	Total acres flooded capped at 5,000 under flood control agreement with Reclamation District 1500
PMWC	1,000	
NCMWC	5,780	
Pleasant Grove-Verona ID		
Tisdale Irrigation Company		
Conaway Conservancy Group		
Davis Ranch		
Lomo Cold Storage		
M&T Chico Ranch		
Reynen		
River Garden Farms		

TABLE 3-23

ACID TOTAL IRRIGATED ACRES BY CROP – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Pasture	10,500 (+/- 5%)[c]	9,900 (+/- 5%)[c]
Other Deciduous	1,600 (+/- 5%)[c]	1,600 (+/- 5%)[c]
Alfalfa	400 (+/- 5%)[c]	200 (+/- 5%)[c]
Almonds and Pistachios	200 (+/- 5%)[c]	200 (+/- 5%)[c]
All Other Crops	1,200 (+/- 5%)[c]	1,200 (+/- 5%)[c]
Total Irrigated Acres	**13,900 (+/- 5%)[c]**	**13,100 (+/- 5%)[c]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from ACID.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively constant in terms of crop mix; however, ACID anticipates an overall decrease in irrigated acres because of urban encroachment.

Glenn-Colusa Irrigation District. GCID is located in the central portion of the Sacramento Valley to the west of the Sacramento River and is the largest irrigation district in the Sacramento Valley, encompassing approximately 170,000 acres. GCID's service area extends from northeastern Glenn County, near Hamilton City, to Colusa County, south of Williams. GCID boundaries also encompass the communities of Willows and Maxwell, but GCID does not supply water to municipal or industrial users. Rice is the predominant crop and accounts for approximately 85 percent of the GCID's irrigated acreage. Other important crops include tomatoes, orchards, vineseed, cotton, alfalfa, and irrigated pasture. Although surface water is the primary source of irrigation water, groundwater is used in drought years by individual growers.

GCID also conveys ~~provides~~ water to three National Wildlife Refuges (NWR) (Sacramento, Delevan, and Colusa) that encompass approximately 22,500 acres. ~~Although surface water is the primary source of irrigation water, groundwater is used in drought years by individual growers.~~

Table 3-24 shows 1995 normalized estimates of irrigated acres and projections for the year 2020 for the primary crops grown within GCID's service area. The variation around the estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-24

GCID TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	99,300 (+/- 10%)[c]	99,100 (+/- 10%)[c]
Grain	5,500 (+/- 10%)[c]	5,000 (+/- 10%)[c]
Alfalfa	4,300 (+/- 50%)[c]	4,500 (+/- 50%)[c]
Pasture	4,100 (+/- 20%)[c]	3,300 (+/- 20%)[c]
Tomatoes	3,800 (+/- 40%)[c]	6,400 (+/- 40%)[c]
All Other Crops	13,200 (+/- 10%)[c]	18,500 (+/- 10%)[c]
Total Irrigated Acres	**130,200 (+/- 10%)[c,d]**	**136,800 (+/- 10%)[c,d]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from GCID.

[d]Includes 200 double-cropped acres for 1995, and 3,700 double-cropped acres for 2020.

Provident Irrigation District. PID lies to the west of the Sacramento River in the Colusa Basin and includes portions of Glenn and Colusa Counties. PID encompasses approximately 15,965 acres (including 800 acres recently annexed) and serves 120 landowners. Rice is the predominant crop and accounts for approximately 98 percent of irrigated acres in PID. Other crops include pasture and grains. Many of PID's operations are coordinated with the PCGID, located directly adjacent and east of PID. PID jointly operates a pumping plant with PCGID, with a capacity of 300 cfs, on the Sacramento River located at Sidd's Landing north of the community of Glenn.

The majority of water needs are met through contracted surface water, although groundwater is used in drought years by individual growers.

Table 3-25 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within PID's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-25

PID TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	14,600 (+/- 10%)[c]	14,600 (+/- 10%)[c]
All Other Crops	200 (+/- 10%)[c]	400 (+/- 10%)[c]
Total Irrigated Acres	**14,800 (+/- 10%)[c]**	**15,000 (+/- 10%)[c]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from PID.

Princeton-Codora-Glenn Irrigation District. PCGID is located in the western Sacramento Valley and is adjacent to the Sacramento River. PCGID covers portions of Glenn and Colusa Counties. The Colusa Basin Drain runs along most of PCGID's western boundary. The community of Princeton lies within PCGID's boundaries, but is not served by the district. PCGID encompasses approximately 11,700 acres and serves 125 landowners. PCGID jointly operates a pumping plant with PID, with a capacity of 300 cfs, on the Sacramento River located at Sidd's Landing north of the community of Glenn.

Rice is the major crop grown within PCGID's service area, in addition to orchard and row crops. Rice accounts for approximately 75 percent of PCGID's irrigated acreage

Although surface water is the primary source of irrigation water, groundwater is used in drought years by individual growers.

Table 3-26 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within PCGID's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

Future irrigation-season cropping patterns and crops would likely shift, but overall water requirements are anticipated to remain relatively the same as current conditions.

TABLE 3-26

PCGID TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	7,700 (+/- 20%)[c]	7,700 (+/- 30%)[c]
Other Deciduous	700 (+/- 20%)[c]	700 (+/- 30%)[c]
Alfalfa	200 (+/- 10%)[c]	500 (+/- 10%)[c]
All Other Crops	1,400 (+/- 10%)[c]	1,400 (+/- 10%)[c]
Total Irrigated Acres	**10,000 (+/- 10%)[c,d]**	**10,300 (+/- 10%)[c,d]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. The source of water for additional acreage is undetermined. Source: CH2M HILL, 2003.

[c]Percentages obtained from PCGID.

[d]Includes 100 double-cropped acres for 1995 and 2020.

Maxwell Irrigation District. MID is located on the west side of the Sacramento River approximately northwest of the Town of Colusa in Colusa County. MID is located directly east of the southern portion of GCID and south of the Delevan NWR. MID's service area encompasses approximately 6,134 acres and includes 28 landowners.

The primary crop in MID's service area is rice, due to the fine-textured and poorly drained soils found in the majority of the district. Rice accounts for over 95 percent of MID's irrigated acres (CH2M HILL, 2003).

Table 3-27 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within MID's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-27

MID TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	4,900 (+/- 10%)[c]	4,900 (+/- 10%)[c]
All Other Crops	100 (+/- 10%)[c]	100 (+/- 10%)[c]
Total Irrigated Acres	**5,000 (+/- 10%)[b]**	**5,000 (+/- 10%)[c]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from MID.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

Reclamation District No. 108. RD 108's 48,000-acre service area is located within southern Colusa County and northern Yolo County along the west side of the Sacramento River, between the towns of Grimes and Knights Landing. The service area is surrounded on three sides by flood-control levees: on the east by the Westerly Levee of the Sacramento River, on the west and southwest by the Colusa Basin Drain (commonly referenced as the "Back Levee"), and on the southeast by the Northerly Levee of Reclamation District No. 787.

Rice is the predominant crop grown within RD 108's service area. Other key crops include tomatoes, safflower, wheat, alfalfa, corn, and vineseed. Rice accounts for approximately 40 to 50 percent of RD 108's irrigated acreage. Water needs are met through the contract surface water supply, although groundwater is used by a few individual growers to supplement the surface supply, particularly in dry years.

Table 3-28 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within RD 108's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-28

RD 108 TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	21,500 (+/- 10%)[c]	21,600 (+/- 10%)[c]
Grain	8,200 (+/- 45%)[c]	8,100 (+/- 45%)[c]
Safflower	5,500 (+/- 35%)[c]	5,100 (+/- 35%)[c]
Tomatoes	5,400 (+/- 70%)[c]	6,600 (+/- 70%)[c]
All Other Crops	10,400 (+/- 30%)[c]	9,300 (+/- 30%)[c]
Total Irrigated Acres	**51,000 (+/- 5%)[c,d]**	**52,500 (+/-5%)[c,d]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: DWR, Northern and Central Districts.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: DWR, Northern and Central Districts.

[c]Percentages obtained from RD 108.

[d]Includes 1,400 double-cropped acres for 1995, and 1,800 double-cropped acres for 2020.

Reclamation District No. 1004. RD 1004 is located on the east side of the Sacramento River east of the Town of Colusa and directly west of the Sutter Buttes. RD 1004 is primarily in Colusa County, with the southeasternmost portion extending into Sutter County. Butte Creek runs along a portion of the eastern edge of RD 1004. RD 1004's service area encompasses approximately 26,000 acres and serves 48 landowners.

The primary crop in RD 1004's service area is rice, due to the fine-textured and poorly drained soils found in the majority of the district. Rice accounts for over 80 percent of RD 1004's irrigated acres (CH2M HILL, 2003). Water needs are met through the contract surface water supply, although groundwater is used by a few individual growers to supplement the surface supply, particularly in dry years as per agreements with RD 1004.

Table 3-29 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within RD 1004's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-29

RD 1004 TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	12,800 (+/- 10%)[c]	11,600 (+/- 10%)[c]
Dry Beans	1,400 (+/- 10%)[c]	1,200 (+/- 15%)[c]
Cotton	500 (+/-10%)[c]	1,500 (+/- 10%)[c]
Tomatoes	300 (+/-5%)[c]	300 (+/- 5%)[c]
Cucurbits	200 (+/-10%)[c]	600 (+/- 10%)[c]
All Other Crops	500 (+/-5%)[c]	500 (+/- 5%)[c]
Total Irrigated Acres	**15,700 (+/-10%)[c]**	**15,700 (+/- 10%)[c]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from RD 1004.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

Meridian Farms Water Company. MFWC is located on the east side of the Sacramento River east of the community of Meridian and directly southwest of the Sutter Buttes. MFWC encompasses approximately 9,900 acres and serves 73 landowners. The main pumping facility is located at River Mile 134 on the Sacramento River.

Rice has typically accounted for less than half of MFWC's irrigated acreage; other key crops include tomatoes, safflower, alfalfa, and walnuts. MFWC uses recycled drainwater and stores water in canals and Long Lake to warm the water, which increases rice production. Several fields in MFWC's service area have recently been certified as organic rice farms. Organically grown rice is a higher value crop that requires additional water to offset herbicides commonly used for weed control. Irrigation water requirements are met through contract surface water supplies, drainwater recycling, and groundwater.

Rice production was increased in the MFWC service area, and tomato production has decreased because of changing market conditions. This increase in rice production has placed additional demands on MFWC's water delivery system, which has limited capacity in the middle of the company due to relatively flat slope and the need to maintain full canals to recirculate drainwater.

Table 3-30 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within MFWC's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-30

MFWC TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	3,500 (+/- 44%)[c]	3,500 (+/- 44%)[c]
Safflower	2,400 (+/- 11%)[c]	2,400 (+/- 11%[c]
Tomatoes	1,300 (+/- 32%)[c]	1,300 (+/- 32%)[c]
Grain	1,000 (+/- 13%)[c]	1,000 (+/- 13%)[c]
Other Deciduous	600 (+/- 8%)[c]	600 (+/- 8%)[c]
All Other Crops	900 (+/- 5%)[c]	11,100 (+/- 5%)[c]
Total Irrigated Acres	**9,700 (+/- 5%)[c,d]**	**9,700 (+/- 5%)[c,d]**

[a]Figures are estimates derived from field data which have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur).

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020.

[c]Percentages obtained from MFWC.

[d]Includes 500 double-cropped acres for 1995 and 2020.

The MFWC Board of Directors issued a policy directive against the use of winter water for rice straw decomposition. During a flood event, the existing drain pumps would not be able to remove flood water and decomposition water. Removal of rice straw has not been an issue in the service area because rice straw is usually disked under after the growing season, and the field is planted with a different crop the following year.

Future irrigation-season cropping patterns and associated water requirements are anticipated to continue the current trend toward increased rice production and a reduction in tomato production, with rotations of beans, wheat, and safflower.

Sutter Mutual Water Company. SMWC is located northwest of Sacramento and is bordered by three levee systems. SMWC encompasses approximately 50,000 acres and serves 150 landowners. The service area encompasses the Town of Robbins.

The two major crops grown within the service area are tomatoes (grown in rotation with wheat, safflower, and beans) and rice (sometimes grown in rotation with wheat, safflower, beans, and melons, or grown 7 or 8 years consecutively without rotation).

Rice is the predominant crop grown within SMWC's service area, accounting for approximately 35 to 40 percent of the irrigated acreage. The majority of irrigation water needs are met through the contract surface water supply, although drainwater is used depending on availability and quality.

Annual cropping patterns have changed over the last few decades as rice acreage has declined substantially. The prevalence of relatively rich, well-drained soils allows for a diversity of crops within the service area. Tomatoes have been the primary crop that has supplanted former rice-growing lands. However, the recent closure of two tomato canneries in the area may lead to a reduction in tomato production in the near future.

Table 3-31 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within SMWC's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-31

SMWC TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Rice	17,400 (+/- 10%)[c]	17,400(+/- 25%)[c]
Tomatoes	12,200 (+/- 10%)[c]	12,200 (+/- 20%)[c]
Grain	8,100 (+/- 15%)[c]	8,000 (+/- 15%)[c]
Dry Beans	5,500 (+/- 15%)[c]	4,900 (+/- 15%)[c]
All Other Crops	8,900 (+/- 15%)[c]	8,500 (+/- 25%)[c]
Total Irrigated Acres	**52,100 (+/- 5%)[c,d]**	**51,000 (+/- 5%)[c,d]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur).

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020.

[c]Percentages obtained from SMWC.

[d]Includes 5,500 double-cropped acres for 1995, and 4,900 double-cropped acres for 2020.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

Pelger Mutual Water Company. PMWC is located approximately northwest of Sacramento and is bordered by SMWC on three sides. PMWC encompasses approximately 2,900 acres and serves 10 landowners.

PMWC has a relatively small service area, but operates similarly to larger districts in terms of cropping patterns and agricultural practices. Rice typically accounts for less than half of the irrigated acreage; other key crops include tomatoes and corn (CH2M HILL, 2003). Irrigation water needs are met through contract surface water supplies, drainwater recycling, and groundwater. There is high variability in crop mix from year to year.

Table 3-32 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within PMWC's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-32

PMWC TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a]	2020[b]
Corn	700 (+/- 10-25%)[c]	700(+/- 10-25%)[c]
Rice	600 (+/- 10-25%)[c]	600 (+/- 10-25%)[bc]
Tomatoes	600 (+/- 10-25%)[c]	600 (+/- 10-25%)[c]
All Other Crops	1,000(+/- 10-25%)[c]	1,000 (+/- 10-25%)[c]
Total Irrigated Acres	**2,900(+/- 10%)[c,d]**	**2,900 (+/- 10%)[c,d]**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: CH2M HILL, 2003.

[b]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: CH2M HILL, 2003.

[c]Percentages obtained from PMWC.

[d]Includes 100 double-cropped acres for 2020.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

Natomas Central Mutual Water Company. NCMWC is located on the east side of the Sacramento River between the Towns of Knight's Landing and the City of Sacramento. The service area includes portions of Sutter and Sacramento Counties and is within the western portion of the American Basin. NCMWC's service area encompasses approximately 55,000 acres, which includes approximately 36,000 irrigated acres. NCMWC serves approximately 238 landowners, and the service area includes the Sacramento Municipal Airport and several proposed residential developments.

Rice is the predominant crop grown in the service area, accounting for approximately 60 percent of NCMWC's irrigated acreage. Other crops include tomatoes and sugar beets, and rotation crops such as wheat and safflower, which are rotated with rice and tomatoes. The expanding Sacramento Metropolitan Area applies increasing urbanization pressure on agricultural properties in the service area along the urban fringe.

Water needs are met through the contract surface water supply, although groundwater is used by a few individual growers to supplement the surface supply, particularly in dry years as per agreements with NCMWC.

Table 3-33 shows 1995 normalized estimates and projections for the year 2020 of irrigated acres for the primary crops grown within NCMWC's service area. The variation around these estimates (+/- percentage) accounts for typical and anticipated variations in crop acreage due to year type.

TABLE 3-33

NCMWC TOTAL IRRIGATED ACRES – 1995 AND 2020 ESTIMATES

Crop	1995[a, b]	2020[c]
Rice	18,000	13,700
Sugar Beets	3,700	1,800
Corn	1,000	700
Tomatoes	600	500
All Other Crops	600	4,600
Total Irrigated Acres	**23,900** [b]	**21,300**

[a]Figures are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur).

[b]Acreages are based on NCMWC's actual deliveries. Potential acreage within Reclamation contract service area is approximately 35,000 acres.

[c]Figures are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

NCMWC has requested a change in authorized use from agricultural to M&I for use in a specified portion of its service area (i.e., Metro Air Park). Water deliveries would be made through existing CVP facilities, with no new construction required. The water would be placed to beneficial use within the CVP authorized places of use (within the SRSCs' service area).

Agricultural Production. Regional economies include the producing, delivering, and trading of goods and services. Agriculture in the area of analysis is an important element of the local economy. Social and economic indicators addressed in this chapter include agricultural net returns, total output, value added, wages and salaries, and employment.

This section describes the social and economic conditions in the area of analysis and the social and economic effects of the No Action Alternative and Alternatives 1 through 5.

The Affected Environment/Existing Conditions section presents recent data related to the social and economic conditions of the subject areas, and provides background data related to other social and economic issues, such as county tax revenue generated by the Williamson Act and agricultural groundwater extraction costs. This section presents most data at the county level because data regarding regional and agricultural economics area descriptions are generally available by county.

Area of Analysis. The area of analysis includes the following counties: Shasta, Tehama, Glenn, Colusa, Yolo, Butte, Sutter, Yuba, and Sacramento. Implementation of the Preferred Alternative would affect primarily the rural, agricultural portion of these counties, including small towns, located within the Sacramento Valley.

Agricultural Economics. The number and size of farms, together with ownership patterns, cropping patterns, production characteristics, and expense characteristics are used to describe the general structure of agriculture in the region. Table 3-34 summarizes data provided by the United States Department of Agriculture (USDA) Census of Agriculture for the number of farms, land in farm production, and area of cropland for counties in the Sacramento Valley.

In 1997, the average farm size in the Sacramento Valley was 349 acres[4], and the region supported approximately 2 million acres of cropland, of which approximately 80 percent (1.6 million acres) were irrigated.

TABLE 3-34

FARMS, LAND IN FARMS, AND CROPLAND PROFILES OF SACRAMENTO VALLEY, 1997

County	Number of Farms	Land in Farms (acres)[a]	Average Size of Farms[b] (acres)	Total Cropland[c]		Harvested Cropland[d]		Irrigated Land[e]	
				Farms[f]	Acres	Farms	Acres	Farms	Acres
Shasta	850	316,743	373	612	59,487	401	22,659	605	38,863
Tehama	1,362	885,426	650	1,063	127,019	831	62,038	1,001	85,571
Glenn	1,189	482,583	406	1,070	255,968	916	212,848	1,025	220,235
Colusa	810	430,958	532	759	316,756	722	287,630	723	276,562
Yolo	923	536,595	581	832	380,700	747	324,291	709	294,021
Butte	1,942	404,166	208	1,750	247,368	1,646	222,209	1,686	223,690
Sutter	1,314	348,349	265	1,259	297,109	1,203	266,399	1,199	242,183
Yuba	706	208,462	295	548	96,989	426	79,586	556	85,241

4 USDA data provided assumes the Census Bureau's most recent definition of a farm, being any place from which $1,000 or more of agricultural products were produced or sold, or normally would have been sold during the census year.

TABLE 3-34

FARMS, LAND IN FARMS, AND CROPLAND PROFILES OF SACRAMENTO VALLEY, 1997

County	Number of Farms	Land in Farms (acres)[a]	Average Size of Farms[b] (acres)	Total Cropland[c]		Harvested Cropland[d]		Irrigated Land[e]	
				Farms[f]	Acres	Farms	Acres	Farms	Acres
Sacramento	1,288	308,035	239	986	159,059	688	120,220	886	122,550
Total	**11,793**	**4,123,686**	**349**	**9,763**	**2,017,833**	**8,150**	**1,627,931**	**9,371**	**1,630,571**

[a]The acreage designated as “land in farms” consists primarily of agricultural land used for crops, pasture, or grazing. All grazing land, except land used under government permits on a per-head basis, was included as “ land in farms,” provided it was part of a farm or ranch.

[b]All farms were classified into selected size groups according to the total land area in the farm. The land area of a farm is an operating unit concept and includes land owned and operated as well as land rented from others.

[c]This category includes land from which crops were harvested or hay was cut; land in orchards, citrus groves, vineyards, nurseries, and greenhouses; cropland used only for pasture or grazing; land in cover crops, legumes, and soil-improvement grasses; land on which all crops failed; land in cultivated summer fallow; and idle cropland.

[d]This category includes land from which crops were harvested or hay was cut, and land in orchards, citrus groves, Christmas trees, vineyards, nurseries, and greenhouses.

[e]This category includes all land watered by any artificial or controlled means, such as sprinklers, flooding, furrows or ditches, and spreader dikes. Included are supplemental, partial, and pre-plant irrigation.

[f]Number of farms with some cropland.

Source: 1997 Census of Agriculture, Volume 1 Geographic Area Series, “Table 1. County Summary Highlights: 1997.”

The U.S. Department of Commerce, Bureau of Economic Analysis definition of agricultural net returns is gross crop revenues plus other income less total farming costs. Although higher costs reduce farm profits, some costs represent farm expenditures in the regional economy. In 1999, total cash receipts for the Sacramento Valley were approximately $1.9 billion, other income was $0.5 billion, and realized agricultural net income for the valley was estimated to be approximately $323 million. Table 3-35 shows agriculture revenue and production costs by county.

TABLE 3-35

AGRICULTURAL REVENUE AND PRODUCTION COSTS ($1,000)

County	Gross Farm Income[a]					Production Expenses[b]	Realized Net Income[c]	Total Farm Labor and Proprietors Income[d]
	Total Cash Receipts			Other Income				
	Livestock Production	Crops	Total	Govt. Payments	Total Other Income			
Shasta	15,417	19,738	35,155	429	4,088	42,374	-3,131	9,669
Tehama	53,611	46,931	100,542	4,775	19,244	123,403	-3,617	20,022
Glenn	50,356	149,606	199,962	48,148	71,885	252,270	19,577	32,451
Colusa	7,412	280,828	288,240	74,895	97,987	307,194	79,033	98,887
Yolo	15,537	330,515	346,052	26,678	57,213	368,957	34,308	99,454
Butte	9,103	234,335	243,438	48,682	75,601	283,349	35,690	58,363
Sutter	6,044	315,158	321,202	54,220	89,966	323,420	87,748	97,658
Yuba	15,434	84,078	99,512	17,639	33,159	115,212	17,459	34,784
Sacramento	78,570	171,819	250,389	43,165	56,828	250,083	57,134	83,510
Total	**271,021**	**1,660,266**	**1,931,287**	**325,930**	**520,264**	**2,128,372**	**323,179**	**541,230**

[a]Gross farm income consists of estimates for the following items: cash receipts from marketing of crops and livestock; income from other farm-related activities, including recreational services and the sale of forest products; government payments to farmers; value of food and fuel produced and consumed on farms; gross rental value of farm dwellings; and the value of the net change in the physical volume of farm inventories of crops and livestock.

[b]Production expenses consist of purchases of feed, livestock, seed, fertilizer and lime, and petroleum products; hired farm labor expenses (including contract labor); and all other production expenses (e.g., depreciation, interest, rent and taxes, and repair and operation of machinery).

[c]Production expenses and gross farm income excluding inventory change are used to calculate realized net income of all farms (gross farm income, excluding inventory change, minus production expenses equals realized net income).

[d]U.S. Department of Commerce, Bureau of Economic Analysis estimate of farm proprietors' income is estimated from modifying realized net income to exclude the income of corporate farms and salaries paid to corporate officers.

Farm production expenses represent income for farm labor, farm supply companies, custom operators, and related businesses. A decrease in farm production expenses results in a decrease in revenues received by farm labor and businesses. In 1999, total production expenses for the region were about $2.1 billion (Table 3-36). Hired farm labor costs were one of the largest components of total expenses at 29.5 percent.

TABLE 3-36

PRODUCTION EXPENSES

County	Feed Purchased	Livestock Purchased	Seed Purchased	Fertilizer and Lime	Petroleum Products Purchased	Hired Farm Labor Expenses[a]	Other Production Expenses[b]
Shasta	2,824	1,309	600	801	1,475	8,806	26,559
Tehama	8,701	8,129	1,248	7,635	3,814	26,550	67,326
Glenn	16,556	6,690	7,276	29,233	8,800	64,369	119,346
Colusa	1,308	1,737	17,989	38,468	12,133	93,877	141,682
Yolo	2,103	3,501	20,370	45,069	14,093	118,942	164,879
Butte	2,634	1,308	8,519	3,379	8,698	96,487	132,324
Sutter	1,702	887	11,412	40,657	12,585	99,412	156,765
Yuba	4,194	1,100	2,335	12,241	3,748	37,814	53,780
Sacramento	43,362	9,805	8,098	17,458	7,268	61,251	102,841
Total	**88,232**	**36,957**	**80,038**	**198,838**	**74,545**	**619,918**	**999,803**

[a]Hired Farm Labor" includes contract labor.
[b]Other production expenses includes depreciation, interest, rent, water, taxes, and repair and operation of machinery.

Environmental Consequences. The No Action Alternative represents future conditions if the Preferred Alternative were not implemented. In general, agricultural production within the Sacramento Valley is not anticipated to substantially change within the 40-year term of the Preferred Alternative. Rice, grains, tomatoes, oilseeds, forage, and orchard crops would dominate agricultural production. Trends reported in the most recent California Water Plan Update (~~Department~~DWR, 1998) indicate little change in total irrigated acreage through 2020, but with some shift in acreage toward permanent crops. These trends are expected to continue. Farmers would continue to temporarily idle some land and would continue to rotate other previously idled land back into production. Fallowing fields is a common land management practice and is done for agronomic purposes as well as in response to market conditions and water supply shortages. These farming practices cause normal variations in total value of output, value added, wages and salaries, and employment. It is anticipated that some lands, primarily those near the urban areas of the Sacramento Metropolitan Area and to a lesser degree Redding, would be converted to nonagricultural use in accordance with local general plans and zoning constraints. The conditions under the No Action Alternative generally reflect the conditions described in the Affected Environment section.

Alternative 1.

Water Delivery: Contract Quantities and Shortage Provisions

This alternative would not result in any operational changes compared to the No Action condition.

Other Contract Provisions

Some savings in cost to SRSCs may occur in years during which they purchase between 75 and 100 percent of their Project Water. The average annual savings are anticipated to be small and would not affect agricultural production.

No other proposed contract provisions are expected to affect agricultural production.

Alternative 2.

Water Delivery: Contract Quantities and Shortage Provisions

This alternative could result in a small increase in groundwater pumping due to increased frequency of shortages under the sliding-scale provision. However, such cutbacks would be infrequent and ~~involove~~involve relatively modest amounts of pumping.

Economic analyses prepared for other recent studies indicate that grains, oilseeds, rice, and forage crops are those likely to be reduced in acreage during years of water shortage (Reclamation, 1998). These SRSCs lacking groundwater represent a very small portion of the total Settlement Contract water delivery. No significant impacts to the regional economy are expected. The incremental changes in frequency of shortage would apply to a very limited area.

Some increase in water delivery could occur for agricultural water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Other Contract Provisions

No other proposed contract provisions are expected to affect agricultural production.

Alternative 3.

Water Delivery: Contract Quantities and Shortage Provisions

Water shortages and frequencies are identical to the No Action Alternative, so there would be no impacts to agricultural production or land use.

Other Contract Provisions

Some savings in cost to SRSCs may occur in years during which they purchase less than 100 percent of their project water. The average annual savings is anticipated to be small and would not be expected to affect agricultural production.

No other proposed contract provisions are expected to affect agricultural production.

Alternative 4.

Water Delivery: Contract Quantities and Shortage Provisions

Under this alternative, any increase in groundwater pumping costs would be compensated by Reclamation; therefore, there would be no net change in agricultural production and net revenues for lands with access to groundwater.

SRSCs with no ability to pump groundwater in shortage years would be compensated for any losses in net revenue from agricultural production. Economic analysis prepared for other recent studies indicates that grains, oilseeds, rice, and forage crops are those likely to be reduced in acreage during years of water shortage (Reclamation, 1998). These SRSCs represent a very small portion of the total Settlement Contract water delivery. No significant impacts to the regional economy are expected. SRSC growers would be compensated, and the incremental changes in frequency of shortage would apply to a very limited area.

Some increase in water delivery could occur for agricultural water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Other Contract Provisions

Some savings in cost to SRSCs may occur in years during which they purchase between 75 and 100 percent of their Project Water. The average annual savings are anticipated to be small and would not be expected to affect agricultural production.

No other proposed contract provisions are expected to affect agricultural production.

Alternative 5.

Water Delivery: Contract Quantities and Shortage Provisions

Under this alternative, any increase in groundwater pumping costs would be compensated by Reclamation; therefore, there would be no net change in agricultural production and net revenues for lands with access to groundwater.

SRSCs with no ability to pump groundwater in shortage years would be compensated for any losses in net revenue from agricultural production. Economic analysis prepared for other recent studies indicates that grains, oilseeds, rice, and forage crops are those likely to be reduced in acreage during years of water shortage (Reclamation, 1998). These SRSCs represent a very small portion of the total Settlement Contract water delivery. No significant impacts to the regional economy are expected. SRSC growers would be compensated, and the incremental changes in frequency of shortage would apply to a very limited area.

Some increase in water delivery could occur for agricultural water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Other Contract Provisions

Some savings in cost to SRSCs may occur in years during which they purchase between 75 and 100 percent of their Project Water. The average annual savings are anticipated to be small and would not affect agricultural production.

The requirement to install measuring devices on all farm gate deliveries would impose substantial cost obligations on SRSCs. According to estimates prepared for the Independent Panel on Appropriate Measurement of Agricultural Water Use (California Bay-Delta Authority, 2003), most agricultural fields in the SRSCs' service area do not have measuring devices that meet Reclamation's Water Conservation Guidelines for precision. Installation, operation, and data collection for such measuring devices were estimated to cost $1,500 per year per device, or $33 per year per affected acre.

The combination of farm gate measuring devices and volumetric pricing of water to growers would likely result in some reductions in average applied water. The reduction in applied water could be significant if water is priced high enough to induce major changes in irrigation techniques. In turn, this would result in decreases in diversions during all years, both full delivery and shortage years. A portion of the reduced water application would reduce groundwater recharge, and potentially could impair the groundwater basin's ability to recover after drought years when surface water deliveries are cut.

Municipal and Industrial Land Use and Water Costs.

Affected Environment. M&I land uses in the Sacramento Valley are small when compared to agricultural land use. Continued population growth in the Sacramento Valley identified in County General Plans and projected by the Department of Finance would likely cause the conversion of agricultural land uses to M&I uses, particularly near population centers like Sacramento and Yuba City-Marysville (growing commuter populations). The new M&I land uses could increase economic activity in population centers and reach throughout the region by diversifying commercial, industrial, and service industries. The following describes M&I areas that potentially could be affected by the Preferred Alternative. These areas either currently receive, or are anticipated to receive water from irrigation districts for municipal and/or industrial use. Some of these customers would potentially benefit from additional water available, particularly through Alternatives 4 and 5.

City of Redding. The total population of the City of Redding is 80,865, with an anticipated annual growth rate of 2.2 percent. Population is projected to reach 126,548 by the year 2020.

Table 3-37 shows the build-out projections for the City of Redding.

TABLE 3-37

GENERAL PLAN LAND USE PROJECTIONS

Land Use	Acres	Dwelling Units	Population	Commercial/Industrial Square Feet (x 1,000)[2]
Residential	36,817	85,354	201,433	
Commercial	2,658			35,019
Heavy Commercial/Industry	6,556			94,751
Other[a]	25,452			N/A

[a]Other land use designation includes: airports, public facilities/institutional, greenways, parks, and recreation areas.

The City of Redding has two surface water supply contracts with Reclamation, the Sacramento River Contract and the Buckeye Contract. The Sacramento River Contract provides up to 21,000 AFY from the Sacramento River (17,850 AF of Base Supply and 3,150 AF of Project Water);~~,~~ and the Buckeye Contract provides up to 6,140 AF from Whiskeytown Reservoir. The City of Redding Water Master Plan indicates that by the year 2005, the city water system would have an annual demand of approximately 26,100 AF, and by the year 2010, the annual demand would reach approximately 44,200 AF. Table 3-38 shows the City of Redding's demand projections through 2040.

TABLE 3-38

CITY OF REDDING WATER SERVICE AREA – GROWTH AND WATER DEMAND PROJECTIONS

Year	Service Area Population	Average Connections	Annual Demand (AF)	Average-day Demand (mgd)	Maximum-day Demand (mgd)
2000	77,782	24,460	23,900	21.34	46.9
2005	84,956	26,716	26,100	23.30	51.3
2010	92,609	29,122	28,400	25.35	55.8
2015	100,357	31,559	30,800	27.49	60.5
2020	108,326	34,065	33,200	29.64	65.2
2025	117,274	36,879	36,00	32.14	70.7
2030	126,961	39,925	39,00	34.81	76.6
2035	137,448	43,223	42,200	37.67	82.9
2040	144,000	45,283	44,200	39.46	86.8
Source: City of Redding Water Master Plan, 2000.					

Natomas Central Mutual Water Company. NCMWC has requested a change in authorized use from agricultural to M&I for use in a specified portion of its service area (i.e., Metro Air Park). Water deliveries would be made through existing CVP facilities, with no new construction required. The water would be placed to beneficial use within the CVP authorized places of use (within the SRSCs' service area).

City of West Sacramento. Land use in the City of West Sacramento is primarily M&I. The total population of the city is 31,615.

Table 3-39 shows the projected water demand at build-out.

TABLE 3-39

CITY OF WEST SACRAMENTO PROJECTED WATER DEMAND AT BUILD-OUT

Land Use Type	Projected Units	Water Use Factors	Projected Average Day (mgd)
Single-family Residential	14,992 du	560 gpd/du	8.4
Multi-family Residential	14,143 du	290 gpd/du	4.1
Commercial	2,268 acres	2,950 gpd/acre	6.7
Industrial	1,444 acres	2,950 gpd/acre	4.3
Schools	12,027 students	25 gpd/student	0.3
Parks/Other	528 acres	1,800 gpd/acre	0.9
Total			24.7
Notes: gpd = gallons per day du = dwelling unit			

City of Sacramento. Sacramento is bordered on the west by the Sacramento River, and the American River and the Sacramento River converge at the city's west-central border.

The City of Sacramento contains approximately 63,120 acres, and land uses include the following:

- 23,510 acres of residential uses
- 22,360 acres of vacant and agricultural uses
- 7,540 acres of public and quasi-public land uses
- 3,300 acres of industrial
- 3,200 acres of recreation
- 3,210 acres of commercial and office parks

Existing agricultural land in the City of Sacramento is located primarily along the northern and southern perimeters, the western corner of the South Natomas area, and the eastern portion of East Broadway. The City of Sacramento General Plan indicates the following mix of planned land uses (Water Forum, 1999):

- 34,470 acres of residential
- 8,770 acres of industrial
- 5,520 acres of recreation
- 8,570 acres of public and quasi-public land uses
- 5,310 acres of commercial and office park
- 490 acres of vacant land

Water Costs. During periods of cutbacks, the SRSCs would have to turn to other sources of water to make up the difference in CVP deliveries. Agricultural water ~~deliveries~~ allocations are cut back sooner than M&I allocations ~~diversions~~ with the amount of the shortage dependent on the severity of the drought conditions. In the future, as water contracts are converted from agricultural purposes to M&I, more M&I water users may ~~would~~ benefit from these drought delivery prioritizations. This would somewhat reduce the risk to M&I land uses and economic activity. Reclamation is currently working on a new M&I Shortage Policy that would provide a cutback protocol applicable to long-term contract renewals.

Currently only the City of Redding has an M&I contract among the SRSCs. Water withheld from agricultural deliveries could go to M&I contractors outside the SRSCs' service area, including those described earlier, and those contractors would realize some benefit in delayed shortages as well. However, those impacts are beyond the scope of this analysis.

Once the M&I users are shorted CVP water deliveries, they would need to turn to more expensive alternative sources of water through purchases, transfers, storage, or groundwater pumping. Spot market purchases are expensive by the nature of needing to acquire water when supplies are low. They may also create local or regional impacts. For instance, an agricultural producer could decide not to plant a crop because of existing water shortages and sells his or her remaining water to an M&I users on the spot market. The crop is not planted and money is not spent on the process of developing crops (e.g., fertilizer and labor) and is therefore lost to the local and regional economy. Transfer agreements can be costly in time and resources to negotiate. Inter-regional support and approvals are also required to successfully negotiate some transfers. Similarly, storage facilities can require regulatory and local approval and be expensive to build. Groundwater pumping requires infrastructure in the form of wells, pumps, and conveyance if they do not already exist. However, the costs of pumping groundwater under Alternatives 4 and 5 would be compensated by Reclamation under the assumptions of these alternatives.

Environmental Consequences. The effects of Alternatives 1 through 5 on M&I water costs and land use in the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions and the renewal contract period would last 40 years. M&I land uses and economic growth are anticipated to follow trends already identified in county master plans and by the California Department of Finance. The impacts of the No Action Alternative are consistent with existing land use conditions. With the current level of population growth, additional water costs would be incurred to develop new water supplies, but increased water demands due to population growth have been accounted for in county general plans and are integrated into existing conditions.

Alternative 1. Land use and economic growth under Alternative 1 would be identical to conditions under the No Action Alternative. There are no significant changes in project infrastructure or operations. The reduction in contract ~~amounts~~ quantities for ACID and SMWC would have no impact on land use or economic growth because the contract reductions are based on current agricultural development levels. No adverse land use and water cost impacts are associated with this alternative.

Alternative 2. Land use and economic growth under Alternative 2 would be identical to conditions under the No Action Alternative. There are no significant changes in project infrastructure or operations. No adverse land use and water cost impacts are associated with this alternative. Some increase in water delivery could occur for M&I water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Alternative 3. Land use and economic growth under Alternative 3 would be identical to conditions under the No Action Alternative. There are no significant changes in project infrastructure or operations. No adverse land use and water cost impacts are associated with this alternative.

Alternative 4. Land use and economic growth under Alternative 4 would be identical to conditions under the No Action Alternative. There are no significant changes in project infrastructure or operations. The reduction in contract ~~amounts~~ quantities for ACID and SMWC would have no impact on land use or economic growth because contract reductions are based on current agricultural development levels. No adverse land use and water cost impacts are associated with this alternative. Some increase in water delivery could occur for M&I water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Alternative 5. Land use and economic growth under Alternative 5 would be identical to conditions under the No Action Alternative. There are no significant changes in project infrastructure or operations. The reduction in contract ~~amounts~~ quantities for ACID and SMWC would have no impact on land use or economic growth because contract reductions are based on current agricultural development levels. No adverse land use and water cost impacts are associated with this alternative. Some increase in water delivery could occur for M&I water service contractors outside the SRSCs' service area, depending on how the additional years of SRSC shortages affect CVP water management.

Power Supply and Demands

Central Valley Project Hydroelectric Operations and Generation Facilities. Western Area Power Authority (Western) operates, maintains, and upgrades the transmission grid that was constructed by the CVP. Hydroelectric generation facilities were constructed as part of 11 CVP water supply facilities (Figure 3-23). Hydroelectric generation facilities include the turbines, generators, and powerplant substations and switchyards used to generate electricity and deliver it to a transmission system. CVP hydroelectric facilities have an installed generation capability of approximately 2,000 megawatts (MW) (Table 3-40).

TABLE 3-40

HYDROELECTRIC GENERATION FACILITIES

CVP Division	Powerplant	Location	Generating Units	Capability (kW)
Trinity River	Trinity	Trinity Dam/Trinity River	2	139,650
	Lewiston	Lewiston Dam/Trinity River	1	350
	J.F. Carr	Whiskeytown Dam	2	157,000
	Spring Creek	Spring Creek Power Conduit	2	200,000
Shasta	Shasta	Shasta Dam/Sacramento River	7[a]	625,000[b]
	Keswick	Keswick Dam/Sacramento River	3	105,000
American River	Folsom	Folsom Dam/American River	3	215,000
	Nimbus	Nimbus Dam/American River	2	14,900
Delta	San Luis	San Luis Reservoir	8 (total)	202,000 (CVP share) (424,000 total)
	O'Neill	San Luis Canal	6	29,000
East Side	New Melones	New Melones Dam/Stanislaus River	2	383,000
Total Capability				**2,070,900**

[a]Includes two station service units.
[b]Installed capacity after all rewinds were completed in year 2000.

Note:
kW = kilowatt

Western dispatches and markets CVP power to preference power customers. Preference power customers are entities such as municipalities and irrigation districts that are specifically entitled to preference under Reclamation law. Western is also responsible for meeting all project use load, which is the power required to operate CVP facilities. Although developed primarily for irrigation, this multiple-purpose project also provides flood control, improves Sacramento River navigation, supplies domestic and industrial water, generates electric power, conserves fish and wildlife, creates opportunities for recreation, and enhances water supply. Although the generation of power is not the primary operational objective, it is nonetheless a major economic benefit of CVP operations and, accordingly, affects project operations.

Power Generation and Purchase. Power generation from CVP facilities fluctuates with reservoir releases and storage levels. Climatic conditions such as drought or wet conditions are the primary factors affecting releases and storage, and the associated ability to generate power. For example, dry periods reduced the water level in the New Melones Reservoir to below the minimum power-pool levels, resulting in no power being generated at the facility from August through January in 1991 and August through January in 1992. Reservoir releases are also affected by mandated minimum streamflow requirements, flow-fluctuation restrictions, water delivery contracts, and water quality requirements. For example, prior to construction of the Shasta Dam Temperature Control Device (TCD), the Biological Opinion (BO) on Sacramento River Winter-run Chinook Salmon required Reclamation to release cold water from Shasta Dam outlets that bypass the powerplants. The BO has also increased the winter and spring water releases into the Sacramento River, thereby resulting in less water being available for release in the summer, when power needs are highest (the installation of the Shasta TCD in 1997 essentially eliminated the need to bypass the powerplants at Shasta Dam). These factors have resulted in actual generation typically being less than full capability.

Peak power loads typically occur in summer months when water conveyance, groundwater pumping, industrial loads, and air conditioning loads are greatest. In the past, CVP generation has been integrated with other power generation resources operated by Pacific Gas and Electric Company (PG&E) to meet project use load and CVP preference power customer loads. The integration of CVP and PG&E generation is subject to a contract signed by the Department of the Interior (DOI) and PG&E, referred to as Contract 2948-A. In recent years, this integration has also been affected by changes in the power supply industry. Contract 2948-A will expire after 2004 and will not be renewed. Future project power operations will be based on project use loads and CVP preference power customer loads. Currently, project use loads account for about 30 percent of the energy generated by CVP. In Fiscal Year (FY) 2001, CVP net generation was 4,175 gigawatt hours (GWh), and project use was 1,158 GWh (28 percent of net generation). In FY 2002, CVP net generation was 4,280 GWh, and project use was 1,375 GWh (32 percent of net generation). During droughts and other times of low CVP generation, Western has exchanged or banked power with PG&E and purchased power from other entities (particularly those in the Pacific Northwest) to meet demands.

Reclamation, Western, and PG&E work together on a daily basis, comparing hydropower availability, total loads (including PG&E loads), and availability of PG&E resources and transmission capabilities. Daily operations are scheduled 1 day prior to actual use when the

Reclamation dispatch center determines the necessary releases from Keswick, Lewiston, Tulloch, and Nimbus Reservoirs to meet hourly streamflows, water demands, water quality requirements, and power generation needs. Reclamation communicates the dam releases to Western's Folsom dispatch office, which coordinates with the PG&E dispatch center. The three entities confirm and, if necessary, adjust the schedule.

Current Power Marketing. Western sets prices for CVP hydropower according to its costs for delivering power to customers. However, the value of the electricity that Western sells to customers is set by the external markets and can fluctuate according to supply and demand. Although the value and annual project output can fluctuate, Western's costs remain essentially unchanged. This causes Western's per-unit cost of electricity to vary. When long-term average generation decreases, Western's customers receive less electricity and are required to pay a higher per-unit cost. If Western rates are relatively low, Western customers are likely to continue to purchase power from Western as part of their long-term resource mix. For planning purposes, power customers evaluate capacity resources according to dry conditions to ensure reliability.

Western has wide discretion within its statutory guidelines regarding with whom and on what terms it will contract for the sale of federal power. The sale of excess power is conducted so as not to impair the efficiency of CVP irrigation deliveries. Contract 2948-A allows for the sale, interchange, and transmission of electrical power and energy between the federal government and PG&E. The agreement allows PG&E to provide energy and capacity as required to meet project use and preference power customer loads; in return, the CVP generating units provide energy and capacity for integration with other PG&E resources. The agreement also recognizes the federal government's 400-MW entitlement on the Pacific Northwest/Pacific Southwest Intertie.

Under the terms of Contract 2948-A, Western delivers the generation of CVP powerplants to PG&E, along with its wholesale purchases; and PG&E supports firm power deliveries to the preference power customers up to a maximum simultaneous demand of 1,152 MW. Western also purchases additional power to support the CVP marketing program and primarily imports it through use of Western's share of the Pacific Northwest/Pacific Southwest Intertie and the California-Oregon Transmission Project.

Market Trends in Electricity Demand. The California Energy Commission has forecast that electricity usage in California will grow an average of 1.8 percent per year between now and 2010; the growth rate in the PG&E service area is forecast to grow a similar 1.7 percent per year (California Energy Commission, 2000). Peak capacity requirements are forecast to grow at similar rates. Table 3-41 shows the forecast energy use and peak demand for the PG&E service area and the state.

TABLE 3-41

FORECAST ELECTRICITY DEMAND

Year	Energy Use (GWh)		Peak Capacity Demand (MW)	
	PG&E	California	PG&E	California
2000 (estimated)	101,172	262,441	20,320	53,439
2003 (forecast)	103,335	273,063	20,881	57,643
2010 (forecast)	119,968	313,674	24,335	66,095
Change, 2003-2010	16,633	40,611	3,454	8,452
% Change 2003-2010	16.1%	14.9%	16.5%	14.7%
Source: California Energy Commission, 2000. The Commission is in process of preparing the "2003 Integrated Energy Policy Report" that will include updated forecasts.				

Value of Electricity Production. Hydroelectric power generated from existing facilities is one of the lowest-cost sources available and represents about 10 to 20 percent of California's electricity generation, depending on weather. It is often generated during peak demand periods with the ability to rapidly vary output levels, making it more valuable than average. New sources of electricity generation are being developed in California and other western states that will include gas-fired combustion and combined-cycle plants, co-generation plants, and renewable sources such as windmills. The cost of these new sources is expected to be substantially greater than the cost of producing power with existing hydroelectric facilities.

The California Energy Commission has made estimates of what it calls the market-clearing price for new power. This is defined as the price that would be paid for additional power in a day-ahead auction such as California's former energy-trading market, the Power Exchange. The Commission examined a rapid supply development scenario and a cautious development scenario. In the cautious scenario, estimated average costs for increments of purchased power rise from about $25 per megawatt-hour (MWh) in 2003 to over $40 per MWh in 2010. Purchase costs for on-peak power are higher, rising from an estimated $29 per MWh in 2003 to $48 per MWh in 2010 (see Figure 3-24). These estimates were made prior to the very large price spikes observed in 2001. As a comparison, the Energy Commission recently estimated the cost of replacing peak generation on the Klamath Project at $50 per MWh (CEC, 2003).

Power Requirements for Groundwater Pumping. One of the main alternative sources of water when CVP cutbacks are in effect is groundwater. Electric or diesel-driven pumps are used by SRSCs to pump groundwater to supplement CVP water during years of delivery cutbacks. Table 3-42 summarizes the amount of electricity needed to pump groundwater under different cutback scenarios. These estimates assume that the pumps are driven by electric motors – energy required by diesel-driven pumps would be roughly equivalent. For purposes of illustrating potential impacts, total average pumping lift is assumed to be 60 feet and well pumping efficiency is assumed to be 70 percent. Actual lifts and efficiency will vary by location.

TABLE 3-42

POWER REQUIRED TO PUMP GROUNDWATER

Shasta Inflow Deficiency	Water Pumped (AF)	Energy Used (MWh)[a]
200,000 to 400,000 AF	212,745	18,600
400,000 to 600,000 AF	425,490	37,200
Greater than 600,000 AF	531,863	46,500
[a]Assumes 60-foot average total lift and 70 percent pumping efficiency.		

Environmental Consequences. The effects of Alternatives 1 through 5 on hydroelectric power generation and power consumption through changes to groundwater pumping of the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Alternative 1 would not change water operations compared to No Action; therefore, hydroelectric power generation would also remain unchanged.

The demand for electricity to pump groundwater would be exactly the same as under No Action. Implementation of this alternative would not result in any impact compared to No Action.

Alternative 2. Alternative 2 would potentially result in changed water operations compared to No Action, particularly during drought operations when the SRSCs would be subject to more frequent water cutbacks than in the No Action. Any additional water available for hydropower generation would be beneficial for hydropower resources. Notably, if the additional water were allocated for hydropower, it could be reserved to generate power during nonirrigation and peak electrical demand periods, when the value of hydropower generation is highest.

The demand for electricity to pump groundwater during cutbacks would increase in frequency relative to No Action. Expressed as an average over the 80-year hydrologic record, about 32,000 AF of Sacramento River delivery per year would need to be replaced by groundwater pumping. Using the assumptions described above, up to 2,800 MWh of electricity would be consumed by that increased level of pumping. At a price of 9.3 cents per kWh (PG&E, 2004), the annual cost would average up to about $0.3 million. Under assumptions of the alternative, any additional costs to SRSCs and their growers would be compensated by Reclamation, resulting in no net change in cost of agricultural production. The increased demand for electricity to pump groundwater during cutbacks would be less than significant.

Alternative 3. Alternative 3 would not change water operations compared to No Action; therefore, hydroelectric power generation would also remain unchanged. The demand for electricity to pump groundwater would not change relative to No Action.

Alternative 4. Alternative 4 would potentially result in changed water operations compared to No Action, particularly during drought operations when the SRSCs would be subject to more frequent water cutbacks. Any additional water available for hydropower generation would be beneficial for hydropower resources. Notably, if the additional water were allocated for hydropower, it could be reserved to generate power during nonirrigation and peak electrical demand periods, when the value of hydropower generation is highest.

The demand for electricity to pump groundwater during cutbacks would increase in frequency relative to No Action. Expressed as an average over the 80-year hydrologic record, about 121,000 AF of Sacramento River delivery per year would need to be replaced by groundwater pumping. Using the assumptions described above, up to 10,500 MWh of electricity would be consumed by that increased level of pumping. At a price of 9.3 cents per kwh (PG&E, 2004), the annual cost would average up to almost $1 million. Under assumptions of the alternative, any additional costs to SRSCs and their growers would be compensated by Reclamation, resulting in no net change in cost of agricultural production. The increased demand for electricity to pump groundwater during cutbacks would be less than significant.

Alternative 5. Alternative 5 would potentially result in changed water operations compared to No Action, particularly during drought operations when the SRSCs would be subject to more frequent water cutbacks. Any additional water available for hydropower generation would be beneficial for hydropower resources. Notably, if the additional water were allocated for hydropower, it could be reserved to generate power during nonirrigation and peak electrical demand periods, when the value of hydropower generation is highest. The demand for electricity to pump groundwater during cutbacks would increase in frequency relative to No Action. Expressed as an average over the 80-year hydrologic record, about 241,000 AF of Sacramento River delivery per year would need to be replaced by groundwater pumping. Using the assumptions described above, up to 21,000 MWh of electricity would be consumed by that increased level of pumping. At a price of 9.3 cents per kwh (PG&E, 2004), the annual cost would average up to almost $2 million. Under assumptions of the alternative, any additional costs to SRSCs and their growers would be compensated by Reclamation, resulting in no net change in cost of agricultural production. The increased demand for electricity to pump groundwater during cutbacks would be less than significant.

Regional Economics

The total population for the counties in the Sacramento Valley was approximately 2,824,000 in the year 2001. In 2001, the total employment for the area was 1,482,000 jobs, with the most jobs (approximately 22 percent) existing in the government and government enterprises industry. It should be noted that a substantial majority of the Sacramento Valley population is located in the Sacramento metropolitan area and in other urban centers (e.g., Redding and Yuba City/Marysville).

Regional Employment and Income

Table 3-43 shows the total non-farm earnings. The sectors with the largest earnings are Government and Government Enterprises (29 percent), Health Care and Social Assistance (9 percent), Construction (9 percent), Retail Trade (8 percent), and Transportation and Warehousing (8 percent). Table 3-44 shows estimated non-farm industry employment for potentially affected counties in the Sacramento Valley area. As mentioned above, Government and Government Enterprise provide approximately 22 percent of the jobs in the Sacramento Valley, followed by Retail Trade (12 percent), Health Care and Social Assistance (9 percent), Construction (7 percent), and Accommodation and Food Services (7 percent).

Table 3-45 summarizes personal income measures, industry earnings, employment and population. The range of per capita income in 2001 was Sacramento County with the highest at $29,548 and Glenn County with the lowest at $18,031. Non-farm personal income is highest in Sacramento County and lowest in Colusa County. Farm income is highest in Yolo County and lowest in Butte County. Non-farm income represents the majority of the income for the region.

Regional Economic Multipliers

Regional employment and income impacts are often divided into direct, indirect, and induced components. Direct impacts are the initial changes in the economy, such as an increase in expenditure of $1,000 by an agricultural producer for seed. The indirect effect of that increase in expenditure is the new business expenditure on inputs for products or services that it causes. For example, the seed purchase prompts an increased demand for fertilizer by the seed producer to grow more seed stock. The induced effects are the additional spending of wages on goods and services caused by the initial expenditure. For example, the seed grower realizes an increase in income due to the sale and purchases the services of a mechanic with the additional income. The combined economic effect from the $1,000 expenditure rippling through the economy is the total economic effect and it is larger than the initial expenditure. This is known as the multiplier effect.

Taking the nine-county Sacramento Valley study area as one economic region, multipliers were generated using the IMPLAN® regional economic model and 2001 data and are reported in Table 3-46. The economic sectors were aggregated into agricultural and nonagricultural related. The agricultural multipliers are interpreted as for every dollar of agriculture related income generated, the total effect in the economy will be an additional $1.60 of income; for every agricultural job created, an additional 0.78 job is created; and for every $1.00 of output produced, an additional $0.98 of output will result. The nonagricultural multipliers may be interpreted similarly.

TABLE 3-43

TOTAL NON-FARM INDUSTRY EARNINGS, SACRAMENTO VALLEY ($1,000), 2001

Industry	Shasta	Tehama	Glenn	Colusa	Yolo	Butte	Sutter	Yuba	Sacramento	Total
Forestry, Fishing, Related Activities, and Other	N/A	N/A	12,375	14,082	43,346	36,599	32,415	12,932	28,958	215,407
Mining	N/A	N/A	1,924	86	19,275	1,965	2,091	5,633	28,226	96,351
Utilities	51,422	4,571	3,174	846	N/A	26,069	1,480	N/A	68,594	197,041
Construction	264,243	32,009	17,338	8,505	322,247	184,238	111,706	53,272	2,105,739	4,780,420
Manufacturing	140,344	95,856	28,907	56,839	330,415	162,622	84,678	36,178	1,930,604	4,308,211
Wholesale Trade	59,804	6,072	13,114	13,454	N/A	64,833	45,894	N/A	930,622	1,510,067
Retail Trade	270,358	58,162	19,584	17,110	271,715	282,655	119,042	41,554	2,008,555	4,392,565
Transportation and Warehousing	114,320	65,473	16,207	11,047	292,589	72,311	32,129	14,617	498,602	1,285,617
Information	48,388	3,802	2,137	1,456	55,642	57,031	7,363	7,886	1,166,838	1,550,484
Finance and Insurance	82,070	17,044	4,462	4,889	98,410	108,220	25,894	9,368	1,973,899	2,871,024
Real Estate and Rental and Leasing	39,847	5,327	3,286	1,714	58,087	61,534	23,704	5,191	451,690	827,394
Professional and Technical Services	143,094	15,717	10,371	3,408	207,366	155,364	N/A	33,770	2,518,095	3,758,969
Management of Companies and Enterprises	31,737	4,228	0	105	152,356	18,478	N/A	1,094	479,725	957,511
Administrative and Waste Services	76,399	17,920	2,858	1,980	104,090	119,402	30,144	23,053	1,159,264	2,036,543
Educational Services	23,606	2,388	N/A	N/A	12,664	7,088	6,383	872	216,408	356,794
Health Care and Social Assistance	401,893	53,609	N/A	N/A	181,637	411,592	120,854	74,383	2,353,777	4,796,231
Arts, Entertainment, and Recreation	22,985	2,936	604	633	19,894	20,924	4,877	3,437	233,440	436,451
Accommodation and Food Services	103,916	20,098	11,200	8,645	83,055	101,585	36,130	14,243	793,628	1,713,293
Other Services, Except Public Administration	105,739	22,930	10,477	6,447	97,710	141,942	47,210	19,502	955,096	1,873,109
Government and Government Enterprise	545,123	136,787	86,009	64,914	1,287,629	606,759	171,893	456,058	9,810,490	15,676,856
Total	**2,525,288**	**564,929**	**244,027**	**216,160**	**3,638,127**	**2,641,211**	**903,887**	**813,043**	**29,712,250**	

Note: N/A = Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

TABLE 3-44

TOTAL NON-FARM INDUSTRY EMPLOYMENT, SACRAMENTO VALLEY 2001

Industry	Shasta	Tehama	Glenn	Colusa	Yolo	Butte	Sutter	Yuba	Sacramento	Total
Forestry, Fishing, Related Activities, and Other	N/A	N/A	686	553	1,832	1,516	1,510	566	1,588	10,030
Mining	N/A	N/A	53	26	374	117	74	109	577	2,162
Utilities	577	84	67	27	N/A	418	50	N/A	780	2,610
Construction	6,140	1,006	543	212	6,201	5,261	2,552	1,334	46,799	108,243
Manufacturing	3,658	2,576	718	871	6,353	4,585	2,428	1,204	34,365	81,068
Wholesale Trade	1,869	236	383	352	N/A	1,978	1,190	N/A	20,640	35,750
Retail Trade	11,706	2,696	1,136	755	10,035	12,836	5,699	2,000	76,820	173,228
Transportation and Warehousing	3,257	1,941	480	324	7,905	2,407	1,156	489	14,680	36,967
Information	1,297	142	87	41	1,207	1,706	293	244	19,432	28,240
Finance and Insurance	3,140	744	227	199	2,671	3,980	1,370	459	44,643	72,714
Real Estate and Rental and Leasing	3,629	704	275	203	3,020	4,118	1,957	501	24,175	49,914
Professional and Technical Services	4,168	624	327	186	6,272	4,702	N/A	925	48,376	84,581
Management of Companies and Enterprises	709	113	0	27	3,161	446	N/A	52	8,401	18,050
Administrative and Waste Services	4,419	848	221	113	4,489	5,687	1,615	1,075	49,459	89,465
Educational Services	1,231	123	N/A	N/A	985	623	436	77	9,665	17,806
Health Care and Social Assistance	10,944	2,174	N/A	N/A	6,435	13,235	3,571	2,084	59,821	130,900
Arts, Entertainment, and Recreation	1,495	260	83	60	1,770	1,994	643	343	12,049	28,094
Accommodation and Food Services	6,118	1,296	618	613	5,527	6,927	2,247	1,161	44,258	96,748
Other Services, Except Public Administration	5,395	1,230	575	385	4,224	8,011	2,621	1,055	38,173	81,985
Government and Government Enterprise	13,949	3,710	2,173	1,878	28,618	15,662	4,397	10,147	184,119	319,374
Total	**83,701**	**20,507**	**8,652**	**6,825**	**101,079**	**96,209**	**33,809**	**23,825**	**738,820**	

Note: N/A = Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

TABLE 3-45

2001 ECONOMIC ACTIVITY SACRAMENTO VALLEY REGION

County	Personal Income ($1,000)[a]						Total Industry Earnings ($1,000)[c]	Total Employment (jobs)[d]	Total Population (persons)
	Total	Non-farm	% of Total	Farm	% of Total	Per Capita (Dollars)[b]			
Shasta	4,210,746	4,202,674	99.81	8,072	0.0019	25,175	2,577,432	86,655	167,257
Tehama	1,128,994	1,106,902	98.04	22,092	0.0196	19,868	602,520	23,722	56,824
Glenn	475,866	470,418	98.86	5,448	0.0114	18,031	261,165	11,723	26,392
Colusa	413,767	369,297	89.25	44,470	0.1075	21,668	272,062	9,992	19,096
Yolo	4,792,716	4,734,413	98.78	58,303	0.0122	27,332	3,943,138	110,249	175,351
Butte	4,700,738	4,696,386	99.91	4,352	0.0009	22,818	2,645,563	100,379	206,007
Sutter	1,935,941	1,923,530	99.36	12,411	0.0064	24,075	969,872	40.075	80,413
Yuba	1,177,888	1,164,491	98.66	13,397	0.0114	19,236	848,621	26,271	61,232
Sacramento	37,466,330	37,408,287	99.85	58,043	0.0015	29,548	29,770,293	742,414	1,267,969
Total	**79,599,209**	**79,367,614**	**99.71**	**231,595**	**0.0029**	**301,669**	**54,595,887**	**1,482,175**	**2,824,498**

[s]Personal income is the income that is received by persons from participation in production, from both government and business transfer payments, and from government interest.

[b]Per capita personal income is measure of income calculated as the total personal income of the residents of an area divided by the population of the area. Per capita personal income is often used as an indicator of the economic well being of the residents of an area.

[c]Total industry earnings include all farm and non-farm earnings.

[d]Total employment includes all industry sector employment estimates of both full and part-time jobs.

TABLE 3-46

INCOME, EMPLOYMENT, AND OUTPUT MULTIPLIERS FOR THE SACRAMENTO VALLEY

Multiplier	Agricultural Sector	Nonagricultural Sector
Income	2.60	1.93
Employment	1.78	1.94
Output	1.98	1.93
Source: IMPLAN, 2001		

County Settings.

The following sections describe the existing social and economic setting in counties in the project area. Trends from the nine counties in the SRSCs' service area are identified in Table 3-47.

TABLE 3-47

SUMMARY OF AGRICULTURAL ECONOMIC ACTIVITY BY COUNTY

County	Total Land Area of County[a]	Acres in Farm Production[a]	Percent of Total Acres in Farm Production[a]	Agricultural Gross Value (million)	Percent Farm Personal Income of Total from All Sectors	Percent of Labor Force Employed by Agriculture[b]	County Unemploy-ment Rate[b]
Shasta	2,422,400	316,743	13%	52.2	0.2%	1.4%	6.7%
Tehama	1,904,640	885,000	46%	126	1.9%	8.1%	6.4%
Glenn	846,636	482,583	57%	303.9	6.5%	18.6%	12%
Colusa	736,450	430,958	59%	290.2	22.4%	29.5%	17.6%
Yolo	646,500	536,595	83%	299.8	2.1%	4.6%	4.2%
Butte	1,035,897	404,000	39%	288	1.3%	3.8%	7%
Sutter	385,600	248,349	64%	291	5.0%	14.8%	12.3%
Yuba	208,461	108,400	52%	133	3.1%	9%	11.7%
Sacramento	618,240	308,035	50%	276	0.2%	>1%	4.2%
Total	**8,804,824**	**3,720,663**	**42%**	**2,063.1**	**1.0%**		

[a] Source: USDA,1997.
[b] Source: EDD, 2002.

In six out of the nine counties in the SRSCs' service area, agriculture is the largest land use; however, the amount of personal income derived from agriculture as a percentage of personal income from all sectors in each county is significantly less. Agriculture employed a significant percentage of the total labor force in Glenn, Colusa, and Sutter Counties.

Shasta County. Shasta County is the northernmost county in the SRSCs' service area. The City of Redding, located in the southwestern portion of the county on I-5, is the primary trade and commerce center for the far north-central and northeastern portion of California. Historically, Shasta County's economic base relied heavily on the timber industry; however, in recent years, education employment, construction, services, retail trade, and manufacturing industries have all shown an increase (Employment Development Department [EDD], 2002).

Table 3-48 summarizes the value of production of Shasta County's leading commodities.

The EDD labor statistics indicate that the services, retail trade, and government industries were the predominant employers in the county during 2001. These three industries accounted for approximately 73.4 percent of total county employment, and EDD projections estimate that the majority of the non-farm job growth will be in these industries. Agriculture comprised approximately 1.4 percent of total county employment in 2001[5] (EDD, 2002).

TABLE 3-48

SHASTA COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Cattle, Stockers and Feeders	8,700
Nursery, Strawberry Plants	6,193
Hay, Other	4,955
Hay, Alfalfa	3,856
Pasture, Range	3,475
Pasture, Irrigated	3,300
Rice, Wild	2,629
Livestock	2,432
Nursery Products	2,383
Cattle, Beef Cows, Breeding	2,381
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

[5] Agricultural employment includes agricultural workers who are employed by farm labor contractors; employment data do not include unpaid family workers

Tehama County. Because Tehama County has an abundant supply of water, the economic base has been composed primarily of timber, agriculture, and sport and commercial fishing industries. According to the Tehama County 1993 General Plan, agriculture has been and will continue to represent the major focus of the county's economic base. About 10 percent of employed individuals in the county are directly employed by the agricultural industry. Many more provide indirect or secondary service to the agricultural sector. Although government, services, and retail trade are growing industries, agriculture still comprises a significant portion of the county's economic production.

Table 3-49 summarizes the value of production of Tehama County's leading commodities.

TABLE 3-49

TEHAMA COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Walnuts, English	25,109
Plums, Dried	22,281
Milk, Market	11,172
Olives	11,138
Almonds	9,460
Cattle, Stockers and Feeders	7,410
Pasture, Range	6,510
Fruit and Nut Crops	3,390
Cattle, Fed Heifers and Steers	3,150
Cattle, Dairy Replacement Heifers	3,000

Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.

The EDD labor statistics indicate~~s~~ that the retail trade, government, and services industries comprised the majority of employment in the county during 2001. These three industries account for approximately 67.4 percent of total county employment, and EDD projections estimate that the majority of the non-farm job growth will be in these industries. Agriculture comprised approximately 8.1 percent of the total county employment in 2001 (EDD, 2002).

Glenn County. Glenn County is located about 100 miles northwest of Sacramento, along the I-5 corridor. Agriculture, agriculturally dependent industries, and government employment comprise a disproportionately high percentage of employment in the county. Local government was the dominant employer in 2001, and is expected to continue to provide the majority of jobs (EDD, 2002).

Glenn County was the fourth largest producer of rice in California, contributing over 18 percent of the total for the state. The total production value for rice was nearly $100 million. Table 3-50 summarizes the value of production and acreage of Glenn County's leading commodities.

TABLE 3-50

GLENN COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Rice, Paddy	97,829
Almonds	46,728
Dairy Products	38,477
Cattle and Calves	15,099
Hay, Alfalfa	13,309
Walnuts	12,607
Corn	11,517
Olives	11,339
Plums, Dried	10,040
Grapes	5,488
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

Government was the primary job-producing sector in Glenn County in 2001, employing 29.9 percent of the county's labor force compared to 18.6 percent for agriculture (EDD 2002). Non-farm industry projections indicate that the majority of the job growth in the county will be in services, manufacturing, and retail trade (EDD, 2002).

Colusa County. Colusa County is located about 35 miles northwest of Sacramento along the I-5 corridor. The county's economy depends highly on agriculture. The county has a high labor surplus for much of the year because of the seasonal nature of agriculture.

Colusa County ranks as the leading rice-producing county in the United States and is the leading producer of field crops in the region, with a total field crop production of about $170 million in 2002. Colusa County is currently in a transition from row crops to perennial crops (almonds, grapes, and walnuts) and from low-value agronomic crops to higher value vegetables or other row crops". Table 3-51 summarizes the value of production of Colusa County's leading commodities.

TABLE 3-51

COLUSA COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Rice	136,832
Tomatoes, Processing	39,481
Almond Meats	27,197
Rice Seed	9,092
Cotton Lint	8,539
Cattle and Calves	7,685
Walnuts, English	6,530
Beans, Dry	4,717
Wheat	4,676
Cucumber Seed	4,056
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

Colusa County is primarily a rural agricultural county, with a total population of about 18,800 in 2000. Agricultural employment in Colusa County during 2001 was 29.5 percent of total employment, which was the highest percentage of the counties in the Sacramento Valley (EDD, 2002). In comparison, 25.1 percent of the workforce was employed in the government sector and 14.5 percent in retail trade (EDD, 2002). Other major employers in the county include trucking and courier services, amusement and recreation services, oil and gas field services, and groceries and related products.

Yolo County. Yolo County is located immediately west of the Sacramento Metropolitan Area near the southern end of the Sacramento Valley. Although the majority of the county's land area is in agriculture, a large portion of the economy is tied to education facilities and the Sacramento urban economy.

Processing tomatoes were the most valuable crop in Yolo County and were planted on 48,575 acres. Processing tomatoes from Yolo County generated about 13 percent ($76.5 million) of California's tomato processing income in 2000. Gross agricultural production was $299.8 million in 2002. Table 3-52 summarizes the value of production of Yolo County's leading commodities.

TABLE 3-52

YOLO COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Tomatoes, Processing	74,135
Grapes, Wine	44,675
Hay, Alfalfa	32,804
Rice, Milling	27,688
Vegetable Crops	13,704
Walnuts, English	11,465
Wheat, All	8,537
Cattle and Calves	7,695
Safflower	6,697
Almonds	6,694
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

In 2000, agriculture employed 4.6 percent of the civilian workforce, and other major employers in the county included state-local government (32.9 percent), retail trade (16.9 percent), and services (17 percent) (EDD, 2002).

Butte County. Butte County is located about 60 miles north of Sacramento along the Highway 99 corridor. Historically, Butte County has been agriculturally based. ~~, and~~ ~~c~~Commercial agriculture continues to be the county's principal economic base, and ~~which~~ is supplemented by nonagricultural industry located in Chico.

The most valuable crop in Butte County is rice, which is 18.7 percent ($101.2 million) of California's gross production of rice in 2002. Table 3-53 summarizes the value of production of Butte County's leading commodities.

TABLE 3-53

BUTTE COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Rice	101,192
Almonds	65,762
Walnuts, English	45,055
Plums, Dried	18,286
Nursery Stock	7,178
Peaches, Clingstone	7,123
Cattle and Calves	5,227
Field Crops	4,801
Rice Seed	4,740
Kiwifruit	3,206
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

According to EDD labor statistics, the services sector was the largest employer in the county, employing 30 percent of the labor force in 2001. Recent growth within the service industry has been in health services and the social services components. Aircraft and parts, colleges and universities, and amusement and recreation services are some of the other major employers in the county. Government comprised 22.6 percent of the workforce in 2001 compared to 3.8 percent for agriculture.

Sutter County. Sutter County is located about 40 miles north of Sacramento, along the State Highway 99 corridor. Sutter County's main economic base is in agriculture, food processing, lumber and wood products, and government.

In 2000, Sutter County accounted for 19.1 percent of total rice produced in the state. Table 3--54 summarizes the value of production of Sutter County's leading commodities.

TABLE 3-54

SUTTER COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Rice	109,923
Peaches	37,437
Walnuts	29,669
Plums, Dried	19,262
Tomatoes	16,960
Nursery Products	8,929
Melons	8,579
Cattle and Calves	6,963
Almonds	5,375
Hay, Alfalfa	4,789
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

According to the 1996 Sutter County General Plan, agriculture and agriculturally related services and industries have dominated employment in the county. In 2001, 14.8 percent of Sutter County's workforce was employed in agriculture compared with retail trade (21.1 percent) and service industries (21.5 percent) (EDD, 2002).

Yuba County. Yuba County is located east of Sutter County, with the Sacramento River creating the westernmost boundary. Beale Air Force Base, located in Yuba County, provides a large number of federal jobs for the county. The majority of job growth in the county is predicted to be in local government, specifically in local education, city and county government, and Indian tribal government.

Yuba County ranked fifth in the state in overall rice production. Table 3-55 summarizes the value of production of Yuba County's leading commodities.

TABLE 3-55

YUBA COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Rice	35,284
Peaches	20,765
Plums, Dried	19,983
Cattle and Calves	17,129
Walnuts	14,805
Milk	7,652
Pasture, All	3,356
Kiwifruit	3,118
Almonds	1,024
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

Local government has had the highest growth rate in the county, and comprises the majority of the workforce at 39.3 percent (EDD, 2002). Industry projections for non-farm employment indicate that government, services, and retail trade will account for the highest percentage of job growth in the county.

Sacramento County. Sacramento County is situated at the southern portion of the SRSCs' service area and is the most developed of the counties in the SRSCs' service area. The City of Sacramento is the state's capital, and the majority of the workforce is in the government sector.

Grapes were the county's highest crop, in terms of gross value, providing nearly 27 percent of the total gross value of agriculture production. Table 3-56 summarizes the value of production of Sacramento County's leading commodities.

EDD labor statistics indicate that the government and services sectors accounted for over half the total employment in the county at 55.8 percent (EDD, 2002). EDD projections estimate that the majority of the non-farm job growth will be in the government, retail trade, and services industries. Agriculture accounted for less than 1 percent of total county employment in 2001.

TABLE 3-56

SACRAMENTO COUNTY LEADING COMMODITIES

Commodity	Value of Production ($1,000)
Grapes, Wine	73,876
Milk, Market	38,029
Pears, Bartlett	27,352
Nursery Stock	26,378
Cattle and Calves	11,771
Poultry	11,116
Corn, Field	11,022
Hay, Alfalfa	10,544
Rice	9,870
Tomatoes, Processing	9,497
Source: Summary of County Agricultural Commissioners' Reports, 2001-02. California Agricultural Statistics Service.	

Environmental Consequences. The effects of Alternatives 1 through 5 on of the SRSCs' service areas are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative represents future conditions if the Preferred Alternative were not implemented. In general, agricultural economies within the Sacramento Valley are not anticipated to change substantially within the term of the Preferred Alternative. Rice, grains, tomatoes, oilseeds, forage, and orchard crops will dominate agricultural production. Trends reported in the most recent California Water Plan Update (Department, 1998) indicate little change in total irrigated acreage through 2020, but with some shift in acreage toward permanent crops. These trends are expected to continue. It is anticipated that some lands, primarily those near the urban areas of the Sacramento Metropolitan Area and to a lesser degree Redding, will be converted to nonagricultural use in accordance with local general plans and zoning constraints. The conditions under the No Action Alternative generally reflect the conditions described in the Affected Environment section.

Alternative 1. A substantial increase in agricultural production costs would result from the required installation of water measurement devices at farm gates. The installation and operation of these devices would generate additional economic activity in the region, but these gains would be offset by reduced spending by growers on other production items or personal consumption. No significant impacts to agricultural production or other economic activities were identified. Therefore, net changes to the regional economy are judged to be not significant.

Alternative 2. No significant impacts to agricultural production or other economic activities were identified. Therefore, net changes to the regional economy are judged to be not significant.

Alternative 3. No significant impacts to agricultural production or other economic activities were identified. Therefore, net changes to the regional economy are judged to be not significant.

Alternative 4. No significant impacts to agricultural production or other economic activities were identified. Therefore, net changes to the regional economy are judged to be not significant.

Alternative 5. No significant impacts to agricultural production or other economic activities were identified. Therefore, net changes to the regional economy are judged to be not significant.

SOCIOCULTURAL ENVIRONMENT

The following subsections describe settings and potential impacts to sociocultural resources. Sociocultural resources generally refer to resources associated with human communities.

Demographic Descriptions

Affected Environment.

Table 3-57 shows the population projections for counties within the SRSCs' service area. In 2000, the nine counties that comprise the service area accounted for approximately six percent of the total population in the state.

TABLE 3-57

POPULATION PROJECTIONS FOR COUNTIES WITHIN THE CENTRAL VALLEY SRSC SERVICE AREAS[a]

Years	2000[a]	2010	2020	2030	2040
Shasta County	163,000	213,000	241,000	268,000	294,000
City of Redding[b]	81,000	105,000	127,000	--	--
Tehama County	56,000	71,000	94,000	98,000	114,000
Glenn County	26,000	39,000	49,000	61,000	75,000
Butte County	203,000	259,000	307,000	363,000	420,000
Colusa County	19,000	31,000	41,000	54,000	68,000
Sutter County	79,000	100,000	116,000	134,000	152,000
Yolo County	167,000	195,000	225,000	260,000	298,000
Sacramento County	1,223,000	1,436,000	1,652,000	1,884,000	2,123,000
Yuba County	60,219	73,935	94,610	96,563	109,934
Total	**$2,077,219**	**$2,522,935**	**$2,946,610**	**$3,218,563**	**$3,653,934**

[a]U.S. Census Bureau: State and County Quick Facts, 2002.
[b]City of Redding, General Plan, March 2000.

Shasta County. The population of Shasta County has increased from 147,036 in 1990 to 163,256 in 2000. The majority of the county's population (approximately 61 percent) is located in the urban areas of the Cities of Redding, Anderson, and Shasta Lake, all of which are situated along the I-5 corridor.

According to the general plan, the annual growth rate of the county is estimated to be approximately 1.75 percent. The projected population in the year 2020, is 241,000, and 294,000 by the year 2040.

Tehama County. The population of Tehama County in the year 2000 was 56,039, with approximately 23 percent (13,147 people) of the population residing in the City of Red Bluff. The county population increased by approximately 12 percent from 1990 to 2000. The two main urban centers in the county are the Cities of Red Bluff, which contains approximately 23 percent of the county's population (13,147), and Corning, population 6,741.

Tehama County's General Plan zones urban development along the I-5 corridor on lands with relatively low agricultural capability. Thus, the county encourages future growth while maintaining agricultural resources.

Glenn County. The population in Glenn County in the year 2000 was 26,453. The largest urban areas in the county include the City of Orland (population 6,281) and the City of Willows (population 6,220). Both cities are situated near the I-5 corridor. Population increases countywide are estimated at 0.7 percent per year.

Butte County. Butte County's General Plan states an anticipated growth rate of approximately 3 percent. From 1990 to 2000, total county population increased approximately 12 percent from 182,120 to 203,171. The largest urban areas in the county include the City of Chico (population 59,954), City of Oroville (population 13,004), Paradise (population 26,408) and the City of Magalia (population 10,569).

Colusa County. The population of Colusa County in 2000 was 18,804, an approximate 14 percent increase in population since 1990. Communities including the Cities of Williams, Colusa, and Arbuckle contain over 60 percent of the county's population. Growth and urban development is targeted to take place near the existing urban centers of Arbuckle, College City, Colusa, Grimes, Maxwell, Princeton, Stonyford, and Williams. The Colusa County General Plan includes strict policies to preserve agricultural lands.

Sutter County. The two main urban areas within the county include the Cities of Yuba (population 36,758) and Live Oak (population 6,229).

Sutter County's population increased approximately 23 percent from 1990 to 2000. The population in 2000 was 78,930. Nearly half the county's population resides in Yuba City.

Yolo County. From 1990 to 2000, population in the county increased approximately 20 percent, from 141,092 in 1990 to 168,660 in 2000. Residential/urban land uses are primarily located in major urban centers including the Cities of Davis (population 60,308), Winters (population 6,125), Woodland (population 49,151), and the unincorporated area of West Sacramento (population 31,615).

Sacramento County. Urban uses are distributed within a 650-square-mile area of Sacramento County surrounding and including the City of Sacramento. The population of Sacramento County in 2000 was 1,223,499, an approximate increase of 182,000 from 1990. Agricultural and rural residential land uses are primarily located south and east of Elk Grove-Florin Road, south of the Cosumnes River, near Folsom and Rio Linda, and in the northernmost portion of the county along the county line (Water Forum, 1999).

Yuba County From 1990 to 2000, Yuba County's population increased approximately 3 percent from 58,228 to 60,219. The majority of the population in the county resides in the Cities of Linda (13,474), Marysville (12,268), Olivehurst (11,061), and South Yuba City (12,651).

Environmental Consequences. The effects of Alternatives 1 through 5 on land uses of the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years. It is anticipated that growth would continue to occur as described in the county general plans and as projected by the Department of Finance.

It should be noted that the use of CVP water through the Settlement Contracts is not a primary factor driving growth and land use change, and in most areas of urban growth ample groundwater is available to support the predicted growth. Demographic, economic, political, and other factors, independent of the contract renewal process, are causing changes with direct and indirect effects to land use that are beyond the range of Reclamation's responsibilities. Virtually all of the renewal actions are within the range of existing conditions. This includes the area of use, type of use, range of river flows, and reservoir fluctuations. No additional infrastructure would be constructed, deliveries would not increase, and no existing natural habitat would be converted into farmland or other uses.

In some instances, the responsibility to address effects to land uses would be with the local government as part of their California Environmental Quality Act (CEQA) compliance for their actions. For example, Reclamation is not responsible for the development of housing tracts or industrial development in a community. Such actions are approved locally and at the state level. Furthermore, if a farmer changes from one irrigated crop to another because of economic reasons, Reclamation does not control the farmer's decision. On the other hand, Reclamation would need to consider the effects to land uses when Reclamation approves new lands being brought into an irrigation district and when Reclamation approves a change in use.

Alternative 1. Land use in the SRSCs' service area under Alternative 1 would be identical to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC. However, these reductions would not result in activities that would cause any changes to existing land uses in these districts; therefore, there would be no impacts.

It is assumed that use of the ~~assigned~~ CVP water by the SRSC would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

No adverse impacts to land use are associated with this alternative.

Alternative 2. Land use in the SRSCs' service area under Alternative 2 would be identical to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 3. Land use in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 4. Land use in the SRSCs' service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities~~amounts~~ to ACID and SMWC, and sliding-scale reduced diversions to all contractors in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water delivery cutbacks during dry years when the irrigation district would have otherwise maintained full contract amounts.

Alternatively, reduced diversions to the SRSCs could result in increased allocations ~~diversions~~ in dry years to districts that would have otherwise experienced water cutbacks. This would create beneficial impacts to new recipients.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Alternative 5. Land use in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC, and Shasta-Index reduced diversions to all SRSCs in dry years. This reduction could result in increased pumping activities in irrigation districts experiencing water deliveries cutbacks during dry years when the irrigation district would have otherwise maintained full contract amounts.

Alternatively, reduced diversions to the SRSCs could result in increased allocations ~~diversions~~ in dry years to districts that would have otherwise experienced water cutbacks. This would create beneficial impacts to new recipients.

It is assumed that use of the ~~assigned~~ CVP water by the SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

No adverse impacts are associated with this alternative.

Cultural Resources

Affected Environment

The cultural resources analysis focuses on the project study area. Discussion of the project area generally proceeds from north to south from Shasta County to Solano, Yolo, and Sacramento Counties, including the Counties of Butte, Tehama, Glenn, Colusa, Yuba, and Sutter.

Regulatory Setting. Preserving the culture and history of the nation's past are the goals of regulations that include the National Historic Preservation Act, Antiquities Act of 1906, Archaeological Resource Protection Act of 1979, and Historic Sites Act of 1935. The National Historic Preservation Act, Section 106 regulations (36 CFR 800), require that federal agencies seek information, as appropriate, from the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation, Indian tribes (e.g., Tribal Historic Preservation Officer [THPO]), and other individuals and organizations likely to have knowledge of, or concerns with, historic properties in the area of potential effect.

Similar state regulations protect archaeological, paleontological, and historical sites and specifically provide for identification and protection of traditional Native American gathering and ceremonial sites on state land. These regulations include CEQA (Public Resources Code [PRC] Section 21000) and various provisions within PRC Division 5 (Parks and Monuments).

Prehistory/Archaeology. Archaeological evidence of human occupation in the Sacramento Valley and nearby areas extends back several thousand years B.C. Tribal oral histories would place Native American occupation back to "time immemorial."

In the span between about 10,000 B.C. and A.D. 1850, prehistoric societies occupying the greater Sacramento Valley and surrounding areas underwent a series of slow but important changes in subsistence and economic orientation, population densities and distribution, and social organization. The evidence for these changes is found within the known archaeological record. Several models of prehistoric culture history are available for the region and are summarized by Moratto (1984:167-216), Jensen and Reed (1979:90-108), Basgall and Hildebrandt (1989:66-72); and Johnson and Theodoratus (1984a:7-12, 1984b:7-12).

Ethnology/Ethnohistory. The Sacramento Valley includes a broad geographic area that encompassed a great deal of environmental and cultural diversity in prehistoric times and during the contact period when Native Americans encountered Spanish and Euro-American explorers and settlers. The Sacramento Valley was home to several California Native American groups, including the Wintu, Yana, River Nomlaki, Hill Nomlaki, Konkow, Nisenan, Patwin, Bay Miwok, and Plains Miwok.

The Wintu territory covered parts of what are now Trinity, Shasta, Siskiyou, and Tehama counties, including the area north of Cottonwood Creek and west of Little Cow Creek and the Sacramento River. Detailed ethnographic information on the Wintu is available in Du Bois (1935), Lapena (1978:324-340), and Kroeber (1925).

The Yana traditionally occupied the upper Sacramento River valley and foothills east of Little Cow Creek and the Sacramento River (generally east of Redding, Bloody Island, Red Bluff, and Tehama). Detailed ethnographic information on the Yana is available in J.J. Johnson (1978) and Kroeber (1925).

The Nomlaki consisted of two groups; the River Nomlaki lived in the Sacramento River Valley in present Tehama County south of Cottonwood Creek; and the Hill Nomlaki lived in the foothills to the west, extending to the summit of the Coast Range in what is now Tehama and Glenn Counties (Goldschmidt, 1978). Detailed ethnographic information on the Nomlaki is available in Du Bois (1939), Goldschmidt (1951, 1978), and Kroeber (1925).

The Konkow, also known as Northwestern Maidu, occupied territory below the high Sierra in the foothills where the south, middle, north, and west branches of the Feather River converge. Konkow territory included the upper Butte and Chico Creeks and part in the Sacramento Valley along the lower courses of the same streams. Detailed ethnographic information on the Konkow is available in Kroeber (1925, 1932), Hill (1970), and Riddell (1960-1974, 1978).

The Nisenan territory was the drainages of the Yuba, Bear, and American Rivers and the lower drainages of the Feather River southward to a few miles below the confluence of the American River. Their territory in the project area includes Marysville, Sacramento, and the territory between and along the Feather River and Sacramento River.

The Patwin occupied the southern portion of the Sacramento River Valley to the west of the river, from the town of Princeton south to San Pablo and Suisun Bays. Detailed ethnographic information on the Patwin can be found in McKern (1922, 1923), Kroeber (1932), and P.J. Johnson (1978).

The Bay Miwok and Plains Miwok, which lived just south of the Colusa Sub-basin, are part of the Eastern Miwok. The Bay Miwok were located in the inner Coast Ranges in the vicinity of Mount Diablo and extended northeasterly from there into the Sacramento-San Joaquin river delta. Most of the delta and plains along the Cosumnes and Mokelumne rivers were the territory of the Plains Miwok. Detailed ethnographic information on the Eastern Miwok is also available in Kroeber (1925).

Euro-American History. Many areas in the northern Sacramento Valley saw the first major wave of white settlement following the Gold Rush. By the time the local Indians had been forcibly taken to reservations, many small towns and settlements had already been established. White settlement was further stimulated by the 1862 Homestead Act and the arrival of the railroad. White settlement included establishment of farms, ranches, gold mines, and lumber and other extractive industries.

In 1897, copper replaced gold as the main mineral produced in Shasta County. Smoke and fumes from Shasta County smelters killed vegetation, fish, and fruit trees as far south as Anderson and Cottonwood. By 1919, all the smelters were closed by court order.

Through the late nineteenth and twentieth centuries, the spread of riverboat and ferry transportation, and, later railroad and highway transportation, infrastructure increased access to more distant markets. The northern end of the Sacramento Valley developed a growing population sustained by a mix of mineral and timber extraction industries and farm and ranch operations. Large-scale irrigation of farms and ranches was made possible in the mid-twentieth century by completion of Shasta Dam and other large water reservoirs and aqueduct projects. Today, the area enjoys a more diversified economy that is fully integrated with the rest of California and nearby states. In recent decades, recreation and tourism have emerged as important components of the local economy.

The central region of the Sacramento Valley includes Sutter County – named after John Sutter (of Sutter's Fort fame). John Sutter received a grant of 50,000 acres in 1841 from the Mexican government; he named his settlement New Helvetia. He established a farm, the first large-scale agricultural settlement in Northern California, near what is now Yuba City. By 1844, he had nearly completed Sutter's Fort. The United States seized control of California from Mexico in 1846, at the start of the Mexican War. John Marshall, an employee of Sutter, discovered gold on the American River in 1848. In 1856, Yuba City became the permanent County Seat.

Following the Gold Rush, white settlers developed the rich farmland in the region and made use of its abundant water. Several agricultural developments were introduced, including Edward Proper's development in 1868 of a strain of wheat known for its suitability for shipment over long distances; William and George Thompson's development in 1873 of the Thompson seedless grape; and A.F. Abbott and Joseph Phillips' development in the 1880s of a strain of cling peach. Today, this portion of the Sacramento Valley enjoys a diverse population and industry, and vast stretches of rich farmland.

The more southern region of the Sacramento Valley includes portions of Yolo, Glenn, Solano, and Colusa Counties. After the Gold Rush, many disappointed miners became permanent settlers who raised cattle, sheep, wheat, and barley. One of the first pioneering irrigation projects in the region was started on Cache Creek as early as 1865. Initially, the location of towns and settlements was influenced by access to water and water transportation routes. In the late nineteenth century, emphasis shifted from livestock grazing to grain growing and orchard crops.

In the 1870s, the railroad progressed northward, which enabled such towns as Arbuckle, Williams, Maxwell, Willows, and Orland to be established and carried new settlers to the area. Certain areas became known for specific orchard crops: almonds in Arbuckle, oranges in Orland, prunes in Colusa, or olives in Corning. With the advent of large-scale flood control and irrigation projects, the Colusa Sub-basin has become noted for growing rice and tomatoes. Large-scale, diversified farming was introduced as new lands were irrigated and brought into production, and as shipment of local products to domestic and international markets increased by the improved railroad and highway transportation system.

Environmental Consequences. The effects of Alternatives 1 through 5 on cultural resources of the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would be 40 years.

It should be noted that use of CVP water through the Settlement Contracts is not a primary force driving growth and land use change. Demographic, economic, political, and other factors, independent of the contract renewal process, are causing changes with direct and indirect effects to cultural resources that are beyond the range of Reclamation's responsibilities pursuant to Section 106 of the National Historic Preservation Act (NHPA) ~~responsibilities~~. With little exception, virtually all of the contract renewal actions are within the range of existing conditions. This includes the area of use, types of use, range of river flows, and reservoir fluctuations. No additional infrastructure would be constructed, and there would be no increase in deliveries and no conversion of existing natural habitat into farmland or other uses.

Alternative 1. Implementation of the contract renewals would not require the construction of new facilities and thus would not impact cultural resources in the study area. However, this alternative would result in the availability of water for development of the Metro Air Park as a result of the re-assignment of agricultural water for M&I use for NCMWC. ~~However, t~~The Final EIS for the Metro Air Park Project (Service, 2001) stated that "The likelihood of the disturbance of any prehistoric or historic archaeological resource from development of the Metro Air Park project is low as cultural resource surveys of the site found no such resources present …"

Alternative 2. Implementation of the contract renewals would not require the construction of new facilities and thus would not impact cultural resources in the study area.

Alternative 3. Implementation of the contract renewals would not require the construction of new facilities and thus would not impact cultural resources in the study area.

Alternative 4. Implementation of the contract renewals would not require the construction of new facilities and thus would not impact cultural resources in the study area.

Alternative 5. Implementation of the contract renewals would not require the construction of new facilities and thus would not impact cultural resources in the study area.

Indian Trust Assets

Affected Environment. Potential effects on Indian Trust Assets (ITA) stem from actions or activities that would affect federally reserved Indian lands and hunting, fishing, gathering, water rights, or other rights. This section addresses potential ITA~~s~~ that could be affected by the project. The area of analysis is the Sacramento Valley.

Regulatory Setting

ITA~~s~~ are legal interests in property held in trust by the United States for federally recognized Indian tribes or individual Indians. Land assets held in trust for individual Indians are more specifically referred to as "public-domain allotments" (PDA). An Indian trust has the following three components: (1) the trustee, (2) the beneficiary, and ~~9~~(3) the trust asset. ITA~~s~~ can include lands; minerals; federally reserved hunting and fishing rights; federally reserved water rights; and in-stream flows associated with a reservation, rancheria, or PDA. Beneficiaries of the Indian trust relationship are federally recognized Indian tribes and individual Indians with trust land; the United States is the trustee.

By definition, ITA~~s~~ cannot be sold, leased, or otherwise encumbered without approval from the United States government, or one of its executive agencies. The definition and application of the U.S. trust relationship has been defined by case law that supports congressional acts, executive orders, and historical treaty provisions.

Consistent with President Clinton's April 29, 1994~~,~~ Memorandum, agencies assess the effect of programs on tribal trust resources and federally reserved tribal governmental rights and concerns. Agencies must actively engage federally recognized tribal governments and consult with such tribes on a government-to-government level. The DOI's Department Manual Part 512, Chapter 2 (Departmental Responsibilities for Indian Trust Resources) ascribes the responsibility for ensuring protection and preservation of ITA~~s~~ from loss, damage, and unlawful alienation, waste, and depletion to the heads of bureaus and offices.

The DOI's policy is to carry out activities in a manner that protects ITA~~s~~ and avoids adverse effects whenever possible (Reclamation Indian Trust Asset Policy, July 2, 1993).

Project Area Setting

All projects discussed in this section occur in the Sacramento Valley region along the Sacramento River. ITA~~s~~ are described from north to south along this river system.

Sacramento River

The northernmost indigenous California people in the project area were the Achowami, Atsugewi, Ajumawi, Wintun, Pit River, and the Yana. Descendants of these tribes live on the Big Bend, Burney Tract, Montgomery Creek, Redding, and Roaring Creek Rancherias in Shasta County. Shasta County also has 15 PDAs.

Maidu and Wintun people inhabited the downstream Colusa Basin section of the Sacramento River. The Wintun Tribe is composed of three divisions: Patwin, Nomlaki, and Wintu. Present-day descendants of the Wintun live on the Colusa (Cachil Dehe) and Cortina Rancherias in Colusa County and Rumsey Rancheria in Yolo County. Wintun-Wailaki descendants in Glenn County live on the Grindstone Creek Rancheria. The Paskenta Band of

Nomlaki Indians has a large tract of trust land in Glenn County, just northwest of Orland, near I-5. Colusa County has one PDA; there are no PDAs in Glenn and Yolo Counties.

Environmental Consequences. The effects of Alternatives 1 through 5 on ITA~~s~~ of the SRSCs’ service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. There would be no impacts to ITA~~s~~ in the Sacramento Valley region as a result of this alternative.

Alternative 2. There would be no impacts to ITA~~s~~ in the Sacramento Valley region as a result of this alternative.

Alternative 3. There would be no impacts to ITA~~s~~ in the Sacramento Valley region as a result of this alternative.

Alternative 4. There would be no impacts to ITA~~s~~ in the Sacramento Valley region as a result of this alternative.

Alternative 5. There would be no impacts to ITA~~s~~ in the Sacramento Valley region as a result of this alternative.

Environmental Justice

The concept of environmental justice embraces two principles: (1) fair treatment of all people regardless of race, color, nation of origin, or income; and (2) meaningful involvement of people in communities potentially affected by program actions. Executive Order 12898, Section 2-2, signed by President Clinton in 1994, requires all federal agencies to conduct “programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons the benefits of, or subjecting persons to discrimination because of their race, color or national origin.” Section 1-101 requires federal agencies to identify and address, as appropriate, “disproportionately high and adverse human health or environmental effects” of programs on minority and low-income populations.

A total of 81 percent of all farm workers in 1997-98 were foreign-born, 95 percent of which were born in Mexico. In the 1990s, approximately 52 percent of all farm workers were married; however, the majority of these families had incomes below the poverty level. The individual median annual personal income is less than $7,500, with real income having declined over 11 percent in the last decade. Average wages for farm workers are almost 50 percent less than average hourly wages for non-farm private-sector workers. The median level of educational achievement for these farm workers is the sixth grade (U.S. Department of Labor, 2000).

These identifying factors place these workers into a low income, minority group that is considered to represent the environmental justice community – a community that can potentially bear the greatest burden (or share in the benefits) of a given project's effects.

Affected Environment/Existing Conditions.

Area of Analysis. The following discussion provides a general description of the ethnic composition, unemployment, and poverty rates for counties affected by the Preferred Alternative. The counties included in the discussion includes the following:

- Shasta
- Tehama
- Glenn
- Colusa
- Yolo
- Butte
- Sutter
- Yuba
- Sacramento

Regional Setting. Table 3-58 lists the ethnic compositions of each county in the SRSCs' service area.

TABLE 3-58

ETHNICITIES OF COUNTIES IN THE SRSC SERVICE AREAS

County	White Persons	Black or African American Persons	American Indian and Alaska Native Persons	Asian Persons	Native Hawaiian and Other Pacific Islander	Persons of Hispanic or Latino Origin
Shasta	89.3	0.8	2.8	1.9	0.1	5.5
Tehama	84.8	0.6	2.1	0.8	0.1	15.8
Glenn	71.8	0.6	2.1	3.4	0.1	29.6
Colusa	64.3	0.5	2.3	1.2	0.4	46.5
Yolo	67.7	2.0	1.2	9.9	0.3	25.9
Butte	84.5	1.4	1.9	3.3	0.1	10.5
Sutter	67.5	1.9	1.6	11.3	0.2	22.2
Yuba	70.6	3.2	2.6	7.5	0.2	17.4
Sacramento	64.0	10.0	1.1	11.0	0.6	16.0

Note: Values do not equal 100 percent because of multi-race reporting.

Source: Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments.

The data in Table 3-59 underestimates the number of people who live in urbanized areas, because many people live in urban, unincorporated communities surrounding cities. The counties with established metropolitan areas (Yolo and Sacramento) tend to have higher median incomes, and Sacramento County also has a lower percentage of residents living in poverty.

Environmental Consequences. The effects of Alternatives 1 through 5 on environmental justice within the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years. There would be no impacts to environmental justice under the No Action Alternative.

TABLE 3-59

SUMMARY OF PERCENT OF COUNTY POPULATIONS LIVING IN CITIES, MEDIAN INCOME, AND POVERTY

County	Percentage of County Population Living in Cities	Major Cities in the County (Percent of County Population)	Household Median Income	Percentage of County Population Living in Poverty
Shasta	58%	Redding, Shasta Lake, and Anderson	$34,000	15%
Tehama	35%	Red Bluff (23%) and Corning (12%)	$28,000	20%
Glenn	47%	Willows (23%) and Orland (24%)	$32,000	18%
Colusa	49%	Williams (20%) and Colusa (29%)	$35,000	16%
Yolo	84%	Davis, West Sacramento, and Woodland	$41,000	18%
Butte	50%	Chico, Oroville, Town of and Paradise	$32,000	20%
Sutter	45%	Yuba City	$38,000	16%
Yuba	20%	Communities of Linda, Marysville, and Olivehurst	$30,000	21%
Sacramento	54%	Sacramento (33%), Elf Grove (8%), Citrus Heights (7%), Folsom (4%), Galt (2%), and Isleton (0.1%)	$44,000	14%

Alternative 1. Impacts to environmental justice issues in the SRSCs’ service area under Alternative 1 would be identical to conditions under the No Action Alternative. Alternative 1 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC. These reductions would not change actual diversions and thus would not result in changes to job availability within these districts.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

Therefore, there are no impacts to environmental justice under this alternative.

Alternative 2. Impacts to environmental justice issues in the SRSC’s service area under Alternative 2 would be similar to conditions under the No Action Alternative. Alternative 2 would not alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities~~amounts~~ to ACID and SMWC, and sliding-scale reduced diversions to all contractors in dry years. These dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts. It is assumed that these reductions would not result in land fallowing or other reductions in agricultural production. Therefore, no impact to seasonal migrant farmworkers is anticipated due to the loss of jobs. Additionally, water that would have been allocated ~~diverted~~ to the SRSCs may be diverted to other irrigation districts that would have otherwise had water cutbacks in dry years. This could increase the number of jobs available to migrant farmworkers outside of the SRSCs’ service area. Therefore, impacts to environmental justice would be considered less than significant.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 2 as under the No Action Alternative.

Therefore, there are no impacts to environmental justice under this alternative.

Alternative 3. Impacts to environmental justice issues in the SRSCs’ service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water to be delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

Therefore, there are no impacts to environmental justice under this alternative.

Alternative 4. Impacts to environmental justice issues in the SRSCs’ service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC, and sliding-scale reduced diversions to all contractors in dry years. These dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts. It is assumed that these reductions would not result in land fallowing or other reductions in agricultural production due to increased groundwater use. Therefore, no impact to seasonal migrant farmworkers is anticipated due to the loss of jobs. Additionally, water that would have been allocated ~~diverted~~ to the SRSCs may be diverted to other irrigation districts that would have otherwise had water cutbacks in dry years. This would increase the number of jobs available to migrant farmworkers outside of the SRSCs' service area. Therefore, impacts to environmental justice would be considered less than significant.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

Therefore, there are no impacts to environmental justice under this alternative.

Alternative 5. Impacts to environmental justice issues in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water delivered to the SRSCs, with the exception of reduced contract quantities ~~amounts~~ to ACID and SMWC, and Shasta-Index reduced diversions to all contractors in dry years. These dry-year reductions would take place during years when the irrigation district would have otherwise maintained full contract amounts. It is assumed that these reductions would not result in land fallowing or other reductions in agricultural production. Therefore, no impact to seasonal migrant farmworkers is anticipated due to the loss of jobs. Additionally, water that would have been allocated ~~diverted~~ to the SRSCs may be diverted to other irrigation districts that would have otherwise had water cutbacks in dry years. This would increase the number of jobs available to migrant farmworkers outside of the SRSCs' service area. Therefore, impacts to environmental justice would be considered less than significant.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

Therefore, there are no impacts to environmental justice under this alternative.

Recreation

Affected Environment.

The following description includes recreational areas that could be affected by the renewal of the Settlement Contracts. The CVPIA PEIS provides a detailed description of recreation resources within the SRSCs' service area (Reclamation, 1997).

The SRSCs' service area includes several key lakes, reservoirs, rivers, NWRs, Wildlife ~~Management~~ Areas (W~~M~~A), and private hunting clubs. Table 3-60 lists key recreation areas in the SRSCs' service area and summarizes recreation characteristics.

Reservoirs. Construction of reservoirs has provided extensive flatwater recreation opportunities. The following sections describe the major reservoirs located within the SRSCs' service area.

TABLE 3-60

RECREATION CHARACTERISTICS OF AFFECTED RECREATION AREAS IN THE SRSC SERVICE AREAS

Recreation Area	Owner/Recreation Manager	Year Constructed or Established	Use (1,000 visitor days[a])[b]	Number of Key Facilities					Activity Restrictions
				Marinas	Boat Launches	Picnic Areas	Campgrounds	Swimming Areas	
Reservoirs and Lakes									
Shasta	Reclamation/USFS	1945	2,422	13	6	1	22	0	Swimming/boat speed restrictions
Whiskeytown	Reclamation/NPS	1963	279	1	3	0	3	2	Boat speed restrictions in coves
Keswick	Reclamation/Shasta County	1945	0.5	0	1	0	0	0	None
Lake Red Bluff	Reclamation/Reclamation	1964	86	0	1	1	1	0	Reservoir drained in winter
Lake Oroville Complex	DWR/DPR	1968	418	2	3	3	9	1	None
Folsom	Reclamation/DPR	1955	362	1	8	5	4	1	None
Englebright	COE/COE	1941	92	2	4	1	17	0	No skiing in upper portion of lake
New Bullards Bar	YCWA/USFS	1970	52	1	2	1	4	0	No skiing along shore
Camp Far West	SSWD/ Private concessionaire	1963	72	1	2	2	2	2	None
Rivers									
Sacramento	NA/BLM, Reclamation, DPR, counties, private	NA	54	49	40	26	26	1	None
American	NA/DPR, Sacramento County	NA	27	1	16	12	0	0	None
Feather	NA/Private	NA	69	0	3	0	0	0	None
Yuba	NA/Private	NA	2	0	0	0	0	0	Activity restricted on private lands
Clear Creek	NA/NPS, Private	NA	1	0	0	0	0	0	Activity restricted on private lands
Bear	NA/Private	NA	NA	0	0	0	0	0	Dewatered in summer
Wildlife Refuges									
Sacramento NWR	Service/Service	1937	NA	0	3	0	0	0	Limited access during waterfowl season
Delevan NWR	Service/Service	1962	NA	0	0	0	0	0	Limited access during waterfowl season
Sutter NWR	Service/Service	1944	NA	0	3	0	0	0	Limited access during waterfowl season
Colusa NWR	Service/Service	1944	NA	0	0	0	0	0	Limited access during waterfowl season
Gray Lodge NWR	CDFG/CDFG	1931	NA	0	0	0	0	0	Limited access during waterfowl season

[a]Reservoir use reported in 12-hour visitor days, river use reported in 6-hour visitor days, and wildlife refuge use reported in 5-hour visitor days.
[b]Reservoir and river use based on 1992 data.

Source: Reclamation, 1997.

Shasta Lake. Shasta Lake is located approximately 10 miles north of Redding. The surface area of the lake is approximately 30,000 acres, which provides 370 miles of shoreline when the reservoir is full. The Sacramento River, McCloud River, Pit River, and Squaw Creek are tributaries to Shasta Lake and form the main branches of the reservoir.

Approximately 75 percent of the recreational use at Shasta Lake occurs between May and September. Shasta Lake provides a variety of water-dependent recreation activities including the following:

- Power boating
- House boating
- Water skiing
- Fishing
- Camping

Sightseeing, boating, and visiting resorts are most popular recreation activities at Shasta Lake. Fishing is also popular, and rainbow trout, smallmouth bass, and crappie are the most frequently caught species.

Whiskeytown Lake. Whiskeytown Lake is located approximately 8 miles west of Redding. The surface area of the reservoir is approximately 3,250 acres, and the shoreline is 36 miles long when the reservoir is full. The most recreational use occurs between June and August, accounting for approximately 50 percent of the total annual use. The most popular water-dependent activities include swimming/beach use, boating, and fishing. The most popular water-enhanced activities are camping and sightseeing.

Lake Oroville Complex. The Lake Oroville recreational complex consists of Lake Oroville and the Thermalito Forebay and Afterbay. The California Department of Parks and Recreation administers recreation facilities. Peak travel to the area occurs between April and September. Day use and overnight camping account for most of the recreational use. Table 3-60 summarizes the recreation facilities at Lake Oroville.

The Oroville recreation area provides recreation facilities to support the following activities:

- Boating
- Water skiing
- Sailing
- Fishing
- Swimming
- Boat-in camping
- Overnight camping

The reservoir is stocked with game fish, and rainbow trout and smallmouth bass are the most frequently caught species in the reservoir. The surface area of Oroville Lake is approximately 15,800 acres, which provides 167 miles of shoreline when the reservoir is full.

Recreation facilities in the 600-acre Thermalito Forebay include a picnic area, swimming beach, and boat ramp for nonmotorized boats. Recreation activities at the Thermalito Afterbay include fishing and motorized boating. Rainbow trout, catfish, and largemouth and smallmouth bass are the most frequently caught species in the Forebay and Afterbay.

Folsom Lake State Recreation Area. Folsom Lake State Recreation Area (SRA), located east of Sacramento on the America River, includes both Folsom Lake and Lake Natoma. The surface area of the Folsom Lake is approximately 11,450 acres, which provides 75 miles of shoreline when the reservoir is full. Lake Natoma, located 6 miles downstream of Folsom Lake, has a surface area of approximately 500 acres and provides approximately 10 miles of shoreline when full.

Most recreational use occurs between April and September. Water-oriented recreational activities at the Folsom SRA includes the following:

- Boating
- Fishing
- Swimming
- Jet skiing
- Windsurfing
- Sailing

More than 80 percent of the annual recreation use of Folsom Lake includes water-oriented activities. Additionally, water-enhanced activities include camping, picnicking, and hiking.

New Bullards Bar Reservoir. New Bullards Bar Reservoir is located on the Yuba River in Yuba County. The surface area of the reservoir is approximately 4,800 acres, and recreational facilities at the reservoir are administered by the Service. Water-orientated activities include boating, water skiing, fishing, and swimming. Boating activities account for the majority of water-orientated use. The CDFG stocks the reservoir with approximately 220,000 to 250,000 kokanee salmon (landlocked sockeye salmon) annually. The reservoir also provides water-enhanced activities such as picnicking, camping, and hiking.

Englebright Lake. Englebright Lake is located on the Yuba River downstream of New Bullards Bar Reservoir. The surface area of Englebright Lake is approximately 760 acres when the reservoir is full. Most recreational use occurs between April and September. Water-dependent recreation activities include boating, water skiing, fishing, and boat-in camping. Species typically caught on the lake include stocked rainbow trout, kokanee salmon, and warmwater species. The CDFG stocks the lake with approximately 22,000 catchable-sized trout per year.

Lake Red Bluff. Lake Red Bluff is located on the Sacramento River in the City of Red Bluff. The lake consists of backwater from RBDD diversion dam for the Tehama-Colusa Canal, which began operation in 1967. When the diversion structure gates are closed, the lake has a surface area of approximately 530 acres. The diversion structure gates are opened from September 15 to May 15 to provide unimpeded upstream and downstream passage for winter-run Chinook salmon.

Most use of this river segment occurs between May and September when the diversion gates are closed. Annual boat drag races held during the Memorial Day weekend attract approximately 7,500 visitors. Lake Red Bluff provides both water-related and water-enhanced recreation activities when the diversion gates are closed, including fishing, boating, water skiing, camping, and picnicking. When the lake gates are open, flatwater recreation activities are eliminated. Because most recreation activities occur during the summer, opening of the diversion gates does not cause substantial impacts to recreation. Fishing is the primary recreation activity impacted by opening of the diversion gates because of the decrease in water surface area.

Lake Red Bluff is maintained at a constant pool elevation for water diversions when the diversion gates are closed.

Keswick Reservoir. Keswick Reservoir is located on the Sacramento River in a steep canyon approximately one-half mile downstream of Shasta Dam. The reservoir's surface area is approximately 640 acres, which provides about 19 miles of shoreline. The primary recreation activities at the reservoir include fishing, boating, sightseeing, and hunting. Fishing is the most popular activity at the reservoir, and rainbow trout, bass, and crappie are the most frequently caught species. Water-contact recreational activities are limited on the lake because of the cold water released from Shasta Dam.

Camp Far West Reservoir. Camp Far West Reservoir, constructed in 1963, is located on the Bear River at the junction of the Nevada, Placer, and Yuba County lines. The reservoir's surface area is approximately 2,680 acres when full and provides about 32 miles of shoreline. Most use is recorded between April and September. Water-dependent activities include fishing, water skiing, and swimming. Water-enhanced activities include picnicking and camping.

Rivers. Key rivers and streams in the SRSCs' service area include the Sacramento, American, Feather, Bear, and Yuba Rivers and Clear Creek. The Draft PEIS for the CVPIA states that recreational use of these waterways likely has increased with increases in regional population. However, no comprehensive data are available on recreational uses of these rivers and streams.

Sacramento River, Upper Reach. The upper reach of the Sacramento River is defined as the 60-mile portion of the river between Keswick Reservoir and Lake Red Bluff. The reach flows through the foothills of the northern Sacramento Valley, which are largely unpopulated besides the Cities of Redding and Anderson. This reach of the river is characterized by rapid flow and scenic views. The upper reach of the Sacramento River provides more public access opportunities than the lower reaches of the river. Popular public access areas include a 3-mile segment between Keswick Reservoir and Lake Redding, Lake Redding Park, Turtle Bay Recreation Area, Anderson River Park, and a 7-mile segment below Jelly's Ferry.

Fishing is one of the primary water-dependent activities on the reach, with salmon, steelhead, and trout being the most frequently caught species. Although fishing is popular year-round, most fishing occurs in September and October during the fall salmon run. Water-enhanced activities in the upper reach include camping, picnicking, and sightseeing.

Sacramento River, Middle Reach. The middle reach of the Sacramento River is defined as the 160-mile segment of the river between Lake Red Bluff and the confluence with the Feather River. The meandering river channel is characterized by relatively slow-moving water, and the channel is lined with riparian forest and orchards. California DPR and

Tehama, Glenn, Colusa, and Sutter Counties provide public access points along the river. Additionally, private facilities, such as fishing access points, marinas, and resorts, also provide access to the river.

Water-dependent activities include fishing, boating, swimming, and beach use. The middle portion of the Sacramento River provides the widest variety of game fish, including salmon, trout, steelhead, American shad, striped bass, sturgeon, and catfish. The relatively warm water present in this reach makes it a popular location for water-contact activities. Water-enhanced activities include camping, picnicking, and sightseeing.

Sacramento River, Lower Reach. The lower reach of the Sacramento River is defined as the 80-mile segment between the confluence with the Feather River and Courtland. The channel in the upstream portion of the reach meanders across the floodplain. Closer to Sacramento, the channel is confined by levees and commercial development. The downstream portion of this reach flows through agricultural areas.

The City and County of Sacramento provide public access points along the river, such as Discovery Park. In addition, private access points, such as marinas, exist throughout the reach. Water-dependent activities along the lower reach of the Sacramento River include fishing, boating, swimming, and beach use. Game fish present within the lower reach include salmon, steelhead, American shad, striped bass, sturgeon, and catfish. Water-enhanced activities include camping, picnicking, and sightseeing.

Feather River. The lower Feather River is defined as the 40-mile segment of the river between Oroville Dam and the confluence with the Sacramento River. Major recreation areas within this reach include the Oroville Wildlife Areas south of Lake Oroville, Riverfront Park in Marysville, and Lake of the Woods Wildlife Area near the confluence with Bear River. Several other undeveloped public access points also exist within the reach.

The lower Feather River provides both water-enhanced activities (camping, picnicking, and sightseeing) and water-dependent recreation activities (boating, fishing, and swimming). The frequently caught fish within this reach include American shad, salmon, striped bass, and steelhead.

American River. The American River Parkway consists of a 23-mile corridor between Nimbus Dam and the confluence with the Sacramento River. Sacramento County Parks and Recreation Department manages the parkway, which traverses the Sacramento Metropolitan Area and includes a series of 14 parks distributed on publicly owned lands. The parkway provides approximately 6,000 acres of open space, which include 28 automobile access points and 68 access points for pedestrians, equestrians, and bicyclists.

Water-enhanced activities include the following:

- Picnicking
- Hiking
- Jogging
- Nature study
- Bicycling
- Equestrian recreation

Water-dependent recreation activities include the following:

- Rafting
- Boating
- Fishing
- Swimming
- Beach use

The most frequently caught fish within this reach include salmon, trout, striped bass, and steelhead.

Yuba River. The lower Yuba River is defined as the 20-mile reach between Englebright Lake and the confluence with the Feather River at Marysville. No public recreation facilities are located in this reach, and limited public access is available along this reach. Boating is constrained by flows and the presence of a barrier at Daguerre Point Dam, located approximately 10 miles upstream of the confluence with the Feather River. The river provides water-related recreation activities, such as fishing for salmon, steelhead, striped bass, and American shad.

Clear Creek. The Clear Creek reach flows approximately 17 miles from Whiskeytown Lake to the confluence with the Sacramento River, south of Redding. The upstream portion of the creek is characterized by steep terrain with falls and cascades, which transitions to a flatter gradient in the downstream portion of the creek.

The upper 4 miles of the reach flows through the Whiskeytown-Shasta-Trinity National Recreation Area (NRA). Although several miles of stream frontage are now owned by BLM, no formal recreation areas exist along the remaining portion of the creek, which flows through private lands. Public access is provided at the Whiskeytown-Shasta-Trinity NRA and the National Environmental Education Camp, which is primarily used by nearby schools.

Water-dependent recreation activities include fishing, tubing, swimming, and beach use. Water-enhanced recreation activities include relaxing, hiking, and camping.

Bear River. The Bear River reach is defined as the 20-mile segment between Camp Far West Reservoir and the confluence with the Feather River. There are no public recreation facilities or public access points along this reach. However, several informal access sites exist along the reach. Water-dependent recreation activities include fishing for bass, catfish, and other warmwater species. Water-enhanced recreation activities include sightseeing and informal picnicking.

Recreation opportunities provided by Bear River typically are poor because the reach is usually dry during the peak summer recreation season.

Wildlife Refuges. Five key wildlife refuges are located within the SRSCs’ service area: the Sacramento, Delevan, Sutter, and Colusa NWRs and Gray Lodge W~~M~~A. The Sacramento, Delevan, Sutter, and Colusa NWRs are managed as the Sacramento NWR Complex, and Gray Lodge W~~M~~A is managed by CDFG. Most recreation use at the Sacramento NWR Complex and the Gray Lodge W~~M~~A occurs between October and January when migratory birds are present.

Recreation facilities on the refuges include a visitor center, interpretive trails, viewing platforms, and self-guided driving tours, which are designed to enhance wildlife observation opportunities. Nonconsumptive recreation opportunities consist of wildlife viewing, which accounts for most of the recreation use at the refuges. Consumptive recreation opportunities include fishing and hunting. Hunting of ducks, geese, coots, snipes, and pheasants is permitted on all refuges in the Sacramento NWR Complex between October and January. Hunting recreation opportunities are also provided on the Gray Lodge W~~M~~A. Fishing opportunities are provided on ~~the Delevan NWR, which permits fishing for catfish and largemouth bass from February to October, and~~ the Gray Lodge W~~M~~A. The primary goal of the refuges is to provide habitat for waterfowl and other wildlife, and visitor access is restricted in certain areas ~~during specified periods~~ to limit disturbances to wildlife.

Private Hunting Clubs. The SRSCs' service area includes 516 private hunting clubs covering 227,000 acres, and approximately 96,700 acres are flooded annually. Consumptive recreation opportunities include hunting for ducks, geese, snipes, coots, and pheasants.

Economic Value of Recreation The economic value of recreation is commonly measured in dollars per user day. The recreation associated with the CVP in the Sacramento Valley is predominantly reservoir and river based. An estimate of the user day value of reservoir recreation is $12 (Bay-Delta Authority, 2004). This value was updated to 2002 dollars from the CVPIA PEIS. The existing value of recreation at a particular reservoir would be the number of visitors to the reservoir times the number of days in total they spent recreating times $12.

Environmental Consequences. The effects of Alternatives 1 through 5 on recreational activities in the SRSCs' service area are compared to conditions under the No Action Alternative.

No Action Alternative. The No Action Alternative does not include new facilities or construction. The No Action Alternative assumes that dry-year reductions would remain the same as existing conditions, and the renewed contract period would last 40 years.

Alternative 1. Recreation activities and benefits in the SRSCs' service area under Alternative 1 would be identical to conditions under the No Action Alternative. Alternative 1 would not significantly alter current CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water delivered to the SRSCs.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 1 as under the No Action Alternative.

Therefore, there are no impacts to recreation under this alternative.

Alternative 2. Recreation activities and benefits in the SRSCs' service area under Alternative 2 would be similar to conditions under the No Action Alternative. Alternative 2 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water to be delivered to the SRSCs, with the exception of reductions in water deliveries due to sliding-scale cutbacks in dry water years. The cutbacks associated with this alternative could result in additional water in the storage reservoirs, as well as additional surface water flows through the Sacramento River, into the Delta. This could create beneficial impacts to recreational resources in the SRSCs' service area. Impacts could include small increases in visitor-days to CVP reservoirs and streams in the affected area.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

Therefore, there are no impacts to recreation under this alternative.

Alternative 3. Recreation activities and benefits in the SRSCs' service area under Alternative 3 would be identical to conditions under the No Action Alternative. Alternative 3 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water to be delivered to the SRSCs.

It is assumed that use of the assigned CVP water by SRSCs would continue to be managed in the same manner under Alternative 3 as under the No Action Alternative.

Therefore, there are no impacts to recreation under this alternative.

Alternative 4. Recreation activities and benefits in the SRSCs' service area under Alternative 4 would be similar to conditions under the No Action Alternative. Alternative 4 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum quantity ~~volume~~ of water to be delivered to the SRSCs, with the exception of reductions in water deliveries due to sliding-scale cutbacks in dry water years. The cutbacks associated with this alternative could result in additional water in the storage reservoirs, as well as additional surface water flows through the Sacramento River, into the Delta. This could create beneficial impacts to recreational resources in the SRSCs' service area. Impacts could include small increases in visitor-days to CVP reservoirs and streams in the affected area.

It is assumed that use of the ~~assigned~~ CVP water by SRSCs would continue to be managed in the same manner under Alternative 4 as under the No Action Alternative.

Therefore, there are no impacts to recreation under this alternative.

Alternative 5. Recreation activities and benefits in the SRSCs' service area under Alternative 5 would be similar to conditions under the No Action Alternative. Alternative 5 would not alter CVP operations, water storage or release patterns from CVP facilities, or the maximum volume of water to be delivered to the SRSCs, with the exception of reductions in water deliveries due to Sacramento-Index cutbacks in dry water years. The cutbacks associated with this alternative could result in additional water in the storage reservoirs, as well as additional surface water flows through the Sacramento River, into the Delta. This could create beneficial impacts to recreational resources in the SRSCs' service area. Impacts could include small increases in visitor-days to CVP reservoirs and streams in the affected area.

It is assumed that use of the assigned CVP water by SRSCs would continue to be managed in the same manner under Alternative 5 as under the No Action Alternative.

Therefore, there are no impacts to recreation under this alternative.

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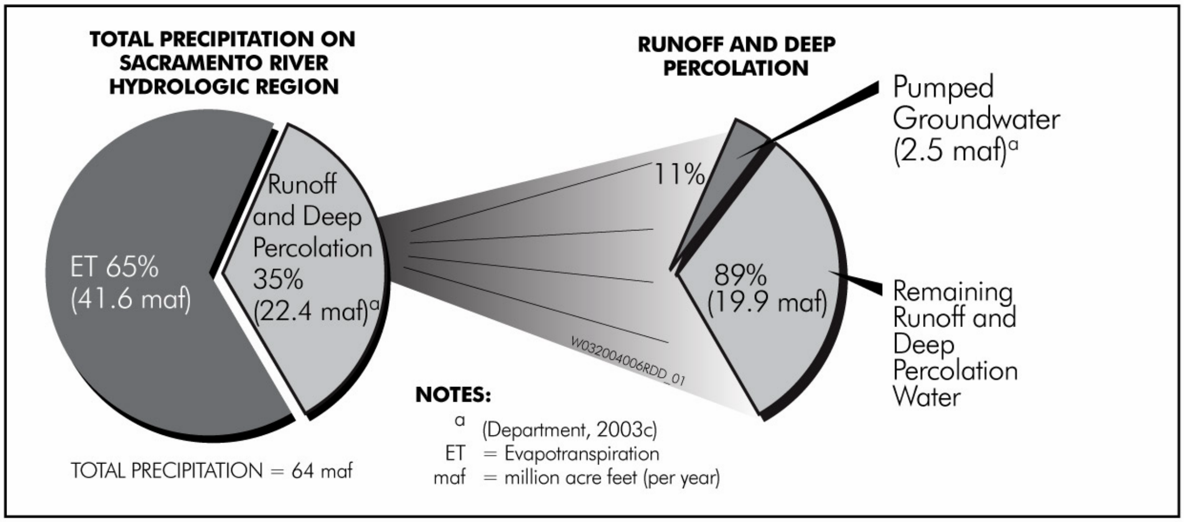

FIGURE 3-1
SACRAMENTO RIVER HYDROLOGIC REGION TOTAL PRECIPITATION BREAKDOWN

Figure 3-1 continued

Figure
3-2 Sacramento Valley Groundwater Sub-basins
11 x 17 color GIS

Figure 3-2 continued

Figure
3-3 Redding Groundwater Basin
8.5x11 color GIS

Figure 3-3 continued

Figure
3-4 Sacramento Valley Groundwater Basin Maximum Incremental Shallow Aquifer Drawdown after One Dry Year
11 x 17 color GIS

Figure 3-4 Continued

Figure
3-5 Sacramento Valley Groundwater Basin Maximum Incremental Regional Aquifer
Drawdown after One Dry Year
11 x 17 color GIS

Figure 3-5 continued

Figure 3-6 Sacramento Valley Groundwater Basin Model Predicted Stream Impacts after One Dry Year

11 x 17 color GIS

Figure 3-6 continued

Figure
3-7 Sacramento Valley Groundwater Basin Maximum Incremental Shallow Aquifer
Drawdown after Four Dry Years
11 x 17 color GIS

Figure 3-7 continued

Figure
3-8 Sacramento Valley Groundwater Basin Maximum Incremental Regional Aquifer Drawdown after Four Dry Years
11 x 17 color GIS

Figure 3-8 continued

Figure
3-9 Sacramento Valley Groundwater Basin Simulated Shallow Aquifer Hydrographs
11 x 17 color Graphics

Figure 3-9 continued

Figure
3-10 Sacramento Valley Groundwater Basin Model Simulated regional Aquifer Hydrographs
11 x 17 color Graphics

Figure 3-10 continued

Figure
3-11 Sacramento Valley Groundwater Basin Model Predicted Stream Impacts after Four Dry Years
11 x 17 color GIS

Figure 3-11 continued

Figure
3-12 Sacramento Valley Groundwater Basin Simulated Stream Leakage over Four Dry Years
11 x 17 color GIS

Figure 3-12 continued

Figure
3-13 Redding Groundwater Basin Maximum Incremental Shallow Aquifer Drawdown after One Dry Year
11 x 17 color GIS

Figure 3-13 continued

Figure
3-14 Redding Groundwater Basin Maximum Incremental Regional Aquifer Drawdown after One Dry Year
11 x 17 color GIS

Figure 3-14 continued

Figure
3-15 Redding Groundwater Basin Model Predicted Stream Impacts after One Dry Year
11 x 17 color GIS

Figure 3-15 continued

Figure
3-16 Redding Groundwater Basin Maximum Incremental Shallow Aquifer Drawdown after Four Dry Years
11 x 17 color GIS

Figure 3-16 continued

Figure
3-17 Redding Groundwater Basin Maximum Incremental Regional Aquifer Drawdown after Four Dry Years
11 x 17 color GIS

Figure 3-17 continued

Figure
3-18 Redding Groundwater Basin Model Predicted Stream Impacts after Four Dry Years
11 x 17 color GIS

Figure 3-18 continued

Figure
3-19 Redding Groundwater Basin Simulated Stream Leakage over Four Dry Years
8.5 x 11 color Graphics

Figure 3-19 continued

Figure
3-20 Vegetation Patterns

Figure 3-20 continued

Figure
3-21 Vegetation Patterns

Figure 3-21 continued

Figure
3-22 Vegetation Patterns

Figure 3-22 continued

Figure
3-23 CVP Power Generation Facilities and Associated Transmission Facilities

Figure 3-23 continued

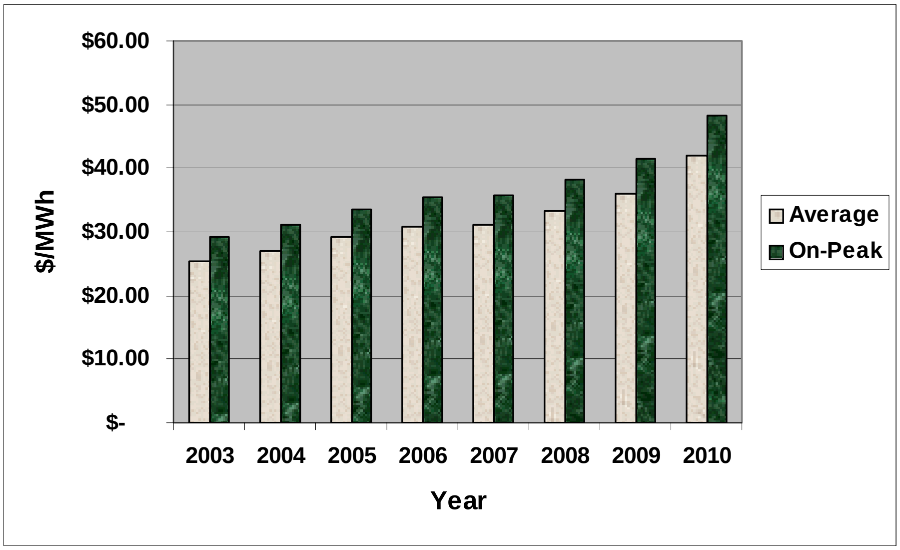

FIGURE 3-24
FORECAST MARKET POWER COSTS (CEC, 2000)

Figure 3-24 continued

CHAPTER 4
CUMULATIVE IMPACTS

INTRODUCTION

As required by NEPA, this section assesses the cumulative impacts of implementing the Preferred Alternative when combined with other projects that could result in impacts to the same environmental resources as the Preferred Alternative. NEPA provides the following guidelines for assessing cumulative impacts.

The CEQ regulations implementing NEPA (40 CFR Section 1508.7) define a "cumulative impact" for purposes of NEPA as follows:

> Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

CUMULATIVE IMPACTS ANALYSIS

The No Action Alternative for this EIS is also the Preferred Alternative for the CVPIA PEIS, which assumed that the Settlement Contracts would be renewed at full contract quantities~~amounts~~. The CVPIA PEIS considered the cumulative effect of future programs including the entirety of the CVPIA with contract renewal of the Settlement Contracts. The cumulative impacts analysis of the CVPIA PEIS is hereby incorporated into this EIS by reference.

The cumulative impact analysis for the CVPIA PEIS is found in Chapter V of that document.

The CVPIA PEIS alternatives (including the PEIS No-Action Alternative) are limited to those actions clearly addressed by the CVPIA and the environmental consequences of closely related actions. However, it is recognized that the provisions of the CVPIA may be implemented in an interactive manner with other concurrent and subsequent projects. The non-CVPIA actions implemented concurrently with CVPIA might affect the overall conditions in the study area and the results of implementation of the CVPIA, and might have impacts different from those associated with implementation of CVPIA in isolation.

Other actions that might contribute to cumulative effects of the CVPIA (including renewal of the Settlement Contracts) include, but are not limited to, the following:

- Implementation of the Bay-Delta Plan Accord
- Conformed Place-of-use EIR for CVP Water Supplies
- Recommendations for increased in-stream flows in the Trinity River
- Implementation of the Sacramento and San Joaquin River Basins Comprehensive Study

- Implementation of the CALFED EIS/EIR
- Implementation of the Sacramento Area Water Forum Proposal (American River)
- Implementation of the Environmental Water Account (EWA) (long term)
- Implementation of the Dry-year Water Purchase Program
- Implementation of the Drought Risk Reduction Program
- Implementation of the Environmental Water Program
- Changes in non-CVPIA water transfer actions
- Changes in federal farm programs
- Changes in demand for agricultural products
- Changes to the commercial and recreational harvest actions for commercial fishing
- Implementation of Yield Increase Plan
- Implementation of the Water Acquisition Program
- Creation of additional wetlands
- Additional listings of special-status species

The CVPIA PEIS includes an in-depth cumulative impact analysis of the effect of the CVPIA Preferred Alternative in combination with the projects listed above and other related projects. That analysis indicated that future projects could potentially improve CVP water supply reliability. These types of programs would modify water supply reliability but not change long-term CVP contract quantities ~~amounts~~ or deliveries from within the historical ranges.

In addition, the PEIS cumulative analysis addressed potential impacts from CVPIA projects that might have occurred during preparation of or following the completion of the PEIS. These actions include early implementation of CVPIA provisions, the Least-cost Yield Increase Plan, development of additional wetlands, and contract renewals. The potential effects of these actions and how they might influence the effects of implementing the alternatives are considered in Chapter V of the PEIS. In addition to these projects, additional recent programs that are being coordinated between Reclamation and the DWR~~epartment~~ or are being wholly managed by the DWR~~epartment~~ are summarized below.

Environmental Water Account (Long Term)

The EWA is a CALFED implementation action, the primary focus of which is to provide environmental benefits while ensuring CVP/SWP operations are not adversely affected. The EWA program makes environmentally beneficial changes in the operations of SWP and CVP, at no uncompensated water loss to the CVP and SWP water users. Protective actions for at-risk native fish species would range from reducing Delta export pumping to augmenting in-stream flows and Delta outflows. Beneficial changes in SWP and CVP operations could include changing the timing of some flow releases from storage and the timing of water exports from the Delta pumping plants to coincide with periods of greater or lesser vulnerability of various fish species to environmental conditions in the Delta. The

CALFED Record of Decision states that an EWA program would replace any regular water supply interrupted by the environmentally beneficial changes to SWP and CVP operations. The timing of the protective actions and operational changes would vary from year to year, depending on many factors such as hydrology and real-time monitoring that indicates fish presence at the pumps.

Dry-year Water Purchase Program and Drought Risk Reduction Investment Program

The Dry-year and Drought Programs would assists water users in dry conditions and compensate willing sellers in coordination with Reclamation and the DWR~~epartment~~. In mid-January 2001, several SWP and CVP contractors requested that Reclamation and the DWR~~epartment~~ initiate planning for a dry-year water acquisition program, based on the dry-year hydrology to date. The DWR~~epartment~~ announced the 2001 Dry-year Water Purchase Program (Dry-year Program) in March 2001. This program represented the first dry-year acquisition program by the DWR~~epartment~~ since the 1991, 1992, and 1994 Drought Bank programs. The Dry-year Program was implemented again in 2002 and 2003, and may be activated in the future to help public agencies throughout California supplement their water supplies in dry years. During dry years, the DWR~~epartment~~ and Reclamation would likely initiate water acquisitions first from reservoirs upstream from the Delta, followed sequentially by groundwater substitution, crop substitution, and crop idling in areas upstream from the Delta. In addition, as part of the implementation of the CALFED Plan, Governor Gray Davis convened a panel to develop plans for California to respond to a future drought. In December 2000, the panel published its report, titled the Critical Water Shortage Contingency Plan, which is now referred to as the Drought Risk Reduction Investment Program (DRRIP). The plan recommended a multi-pronged set of preparations and responses to future water shortages. The water acquisition element of the plan is the Critical Water Shortage Reduction Marketing Program (CWSRMP). CWSRMP is an as-needed water purchasing and allocation program and is activated whenever parts of the state are suffering from critical water shortages.

Environmental Water Program

CALFED agencies created the Environmental Water Program (EWP) to carry out flow-related goals of the Ecological Restoration Program Plan. The EWP will acquire water from sources throughout the Bay-Delta watershed and provide flows to facilitate the following:

- Improvement in habitat conditions for fishery protection and recovery
- Restoration of critical in-stream and channel-forming flows in Bay-Delta tributaries
- Improvement in Delta outflow during critical periods
- Improvement of salmon spawning and juvenile survival in upstream tributaries by purchasing up to 100,000 AF of water per year by the end of Stage 1

The EWP focuses on enhancing in-stream conditions, but program managers would also consider potential benefits to offstream resources. The EWP intends to purchase water from willing sellers in its effort to meet program objectives. CALFED agencies intend to first try the program with pilot water acquisitions. CALFED agencies will then evaluate the results to determine the program effectiveness and to refine the EWP framework (CALFED, 2002). Once the CALFED agencies gather sufficient information, they will prepare an environmental document that covers full implementation of the EWP.

South Delta Improvements Program

The ~~Department~~DWR and Reclamation are currently evaluating the potential benefits and impacts associated with implementing CALFED's South Delta Improvements Program (SDIP). Actions contemplated as part of the SDIP include providing for more reliable long-term export capability by the state and federal water projects, protection of local diversions, and reducing impacts on San Joaquin River salmon. Specifically, the CALFED actions in the South Delta Improvements Program include considering placement of a fish barrier at the head of Old River, up to three hydraulic barriers in south Delta channels, dredging and extending some agricultural diversions, and increasing diversion capability of Clifton Court Forebay to 8,500 cfs.

POTENTIAL FOR SIGNIFICANT CUMULATIVE IMPACTS

The Preferred Alternative for the SRSC Contract Renewals EIS includes slightly reduced contract ~~amounts~~ quantities compared to the Preferred Alternative of the CVPIA PEIS and, therefore, increased CVP flexibility to assist in meeting other contract needs. As discussed above, the CVPIA PEIS Cumulative Impact Analysis is incorporated into this EIS by reference. The potential cumulative effects of future and proposed projects are summarized in Table V-1 of the cumulative effects chapter of the PEIS and is duplicated below for convenience. None of the additional four projects described above would adversely affect the cumulative condition described and evaluated in the PEIS or change the conclusions in that document regarding cumulative impacts of the Preferred Alternative.

TABLE V-1

SUMMARY OF CUMULATIVE EFFECTS

Action	Potential Results	Effects of Cumulative Actions on Results of Impacts of PEIS Alternatives
Implementation of the Bay-Delta Plan Acord	Changes in Delta inflow and associated instream releases.	Changes in instream and Delta flows may influence methodology for reoperation, (b)(2) water, or water acquisition for instream or Delta flows.
	Restoration of habitat in streams and actions to improve water quality.	Programs that could lead to partnerships with CVPIA actions or eliminate need for specific AFRP actions to be implemented under CVPIA.
	Development of new storage and/or Delta conveyance facilities.	Water delivery shortages may not be as severe as identified in PEIS.
	Unknown cumulative effects on CPVIA water requirements.	May lead to partnerships with CVPIA actions or eliminate the need for

TABLE V-1

SUMMARY OF CUMULATIVE EFFECTS

Action	Potential Results	Effects of Cumulative Actions on Results of Impacts of PEIS Alternatives
		specific AFRP actions to be implemented under CVPIA.
Place of Use EIR for CVP Water Supplies	Permitting or cessation of CVP water service areas currently served with CVP water but outside of authorized Place of Use.	No anticipated change.
Trinity River Studies	Changes in instream flow requirements for Trinity River.	Could change (b)(2) water management and CVP water reliability.
Sacramento and San Joaquin River Basins Comprehensive Study	Develop a program to provide offstream storage, channel modifications, and other actions to reduce flood potential and improve habitat.	Could change channel cross-sections; instream flows; and offstream storage. Habitat improvements could be integrated with CVPIA actions.
Sacramento Water Forum Proposal	Changes in water demands and flow requirements on American River.	Could change (b)(2) and (b)(3) water management and CVP water reliability.
Changes in Water Transfer Actions	More extensive non-CVPIA water transfers than assumed in Base Transfer Scenario for alternatives with CVPIA transfers.	Competition for water from water rights holders would reduce available water supplies for transfers under CVPIA water acquisition programs or increase cost of water beyond assumptions for PEIS. Both of these impacts could reduce the amount of water acquired by Interior or increase the price of water purchased by Interior.
Changes in Federal Farm Programs	If lands fallowed or retired due to CVPIA actions continue to accumulate support payments, the net revenue to farmers may increase and the revenue to the Federal Treasury may not increase.	Farmers may decide to increase participation in water transfer programs, including water acquisition programs by Interior. The price of water also may be reduced, which could lead to an opportunity for higher purchases by Interior.
Changes in Demand for Agricultural Products	If changes in demand increase crop value, the price of water would increase and/or farmers would be less willing to sell water. If changes in demand decrease crop value, the price of water could decrease and/or farmers would be more willing to sell water. Changes in demand may cause farmers to change cropping patterns.	Increases in price or reduction in willing sellers would improve the ability of Interior to acquire water. Decreases in price or an increase in willing sellers would improve the ability of Interior to acquire water. Changes in cropping patterns could change the impacts of water shortages, especially if the ratio of permanent to annual crops changes.
Changes in Future Use of Hatcheries	Changes in use of hatcheries could occur based upon future studies. Changes in harvest limitations could occur in the future.	Whether changes in hatchery operations increase fish populations may depend Changes in harvest limitations may increase fish population. However, the upon habitat, hatchery practices, and other factors such as predation. Use of hatcheries also could

TABLE V-1

SUMMARY OF CUMULATIVE EFFECTS

Action	Potential Results	Effects of Cumulative Actions on Results of Impacts of PEIS Alternatives
		reduce natural stock and the overall population through competition or reduction in genetic diversity. impact of domestic harvest may not be noticeable if larger numbers of fish are lost to international harvest, ocean conditions, or predation.
Yield Increase Plan	Development of facilities and programs to increase CVP water supplies could reduce impact of shortages from CVPIA actions.	Associated programs may increase the amount of water available for use by Interior for fish and wildlife purposes or may result in adverse impacts to fish and wildlife habitat due to new storage or conveyance facilities. The programs also may compete for the same sources of water that the PEIS identified as sources for the water acquisition program.
Additional Wetlands	Improve reliability of water supplies to private wetlands and develop new wetlands. A portion of the new wetlands proposal is considered in the PEIS alternatives.	For the new wetlands, water supplies would probably be obtained with the land. Water obtained from other sources could be acquired for multiple purposes or water available for transfers may be reduced.
Future Listings under ESA of Special-Status Species	Initiation of consultation with the Service and NMFS.	Possible additional measures (flow and non-flow) to avoid a jeopardy determination. However, measures being taken under the AFRP, (b)(1) “other” program, and the Conservation Program may suffice to avoid substantial additional requirements.

The potential for cumulative impacts addressed in the PEIS would be slightly reduced given the Preferred Alternative would include a slightly reduced contract quantity from the contract renewals evaluated in the PEIS. Accordingly, implementation of the Preferred Alternative would not result in additional significant cumulative impacts beyond those described in the PEIS.

CHAPTER 5
CONSULTATION AND COORDINATION

INTRODUCTION

Prior to preparation of this EIS, input was solicited and incorporated from a broad range of cooperating and consulting agencies and the public. This chapter summarizes the public involvement program and key issues raised by the public and interest groups.

PUBLIC INVOLVEMENT

Reclamation started the preparation of this EIS with scoping meetings. Public input continued during long-term contract negotiations to define the contract language. Discussions also were held with the SRSCs and their representatives during the preparation of this document. Comments received during this period are summarized below.

Scoping Process

Scoping served as a fact-finding process to identify public concerns and recommendations about the Settlement Contract that would be addressed in this EIS;~~,~~ and the scope and level of detail for analyses. Scoping activities began in July 2001, after a Notice of Intent to prepare environmental documentation for long-term contract renewals was filed in the Federal Register. The scoping period formally ended in August 2001. The Scoping Report was released in December 2001.

At public scoping meetings, Reclamation provided information about the contract renewal process and solicited public comments, questions, and concerns. At these meetings, participants had comments and questions about how important issues would be considered in the EIS. The majority of the comments received during the scoping process addressed the contract terms and negotiations process, the environmental document, and the public involvement process.

CONSULTATION WITH OTHER AGENCIES

This EIS was prepared in accordance with the policies and regulations for the following: ~~issues:~~

- National Environmental Policy Act
- Endangered Species Act
- Fish and Wildlife Coordination Act
- National Historic Preservation Act
- Indian Trust Assets
- Indian Sacred Sites on Federal Land
- Environmental Justice
- State, Areawide, and Local Plan and Program Consistency

National Environmental Policy Act

This EIS was prepared pursuant to regulations implementing NEPA (42 USC 4321 *et seq.*). NEPA provides a commitment that federal agencies will consider the environmental effects of their actions. This EIS provides information regarding the No Action Alternative and alternatives, environmental impacts of the alternatives, potential mitigation measures, and adverse environmental impacts that cannot be avoided.

Endangered Species Act

Reclamation has prepared a Biological Assessment to determine if the Preferred Alternative will affect listed, threatened, and endangered species. The Biological Assessment addresses all species affected by the renewal of the Settlement Contracts. Reclamation is consulting with both the Service and NOAA-Fisheries pursuant to the Endangered Species Act. The terms and conditions, reasonable and prudent measures, and all environmental commitments identified in the Service and NOAA-Fisheries Biological Opinions are hereby incorporated by reference.

Additionally, as described in Chapter 1, Reclamation and ~~the Department~~DWR have proposed to operate the CVP and SWP to divert, store, and convey CVP and SWP ~~(Project)~~ water consistent with applicable law. These operations are summarized and evaluated in a draft Biological Assessment, and described in further detail in the CVP Operations Criteria and Plan (OCAP). The Biological Assessment addresses continued operation of the CVP and SWP in a coordinated manner. In addition to current-day operations, the following future actions are included in this consultation:

- Increased flows in the Trinity River
- Increased pumping at Banks Pumping Plant (referred to as 8500 Banks)
- Permanent barriers operated in the South Delta
- An intertie between the California Aqueduct and the Delta-Mendota Canal
- A long-term EWA
- Freeport Regional Water Project
- Various other operational changes described in detail in the Biological Assessment

The current and ongoing effects of diversions by ~~to~~ the SRSCs as part of CVP operations are included in this Biological Assessment. The consultation addresses impacts to listed species that could be caused by hydrological and water quality conditions resulting from operation of the CVP and SWP facilities. With respect to long-term contract renewals with the SRSCs, the consultation evaluates the impact to listed species that could result from operating the CVP ~~and SWP~~ to deliver CVP water to the points of diversion of the SRSCs in combination with other operational and regulatory requirements. The analyses for the OCAP consultation assume the SRSCs divert their total contract quantity with deficiencies in critically dry years in accordance with the existing and renewal contracts. Because maximum contract deliveries are assumed for the SRSCs, the OCAP opinion fully addresses any in-river effects to listed species that could result from long-term contract renewal. The consultation does not evaluate impacts that could result during diversion of water by the SRSCs or use of diverted water. It is anticipated that formal consultation on long-term OCAP will be completed by the end of 2004.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires that Reclamation consult with fish and wildlife agencies (federal and state) on all water development projects that could affect biological resources. The implementation of the CVPIA, of which this action is a part, has been jointly analyzed by Reclamation and the Service and is being jointly implemented. This continuous consultation and consideration of the views of the Service in addition to their review of this document and consideration of their comments satisfies any applicable requirements of the Fish and Wildlife Coordination Act.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act requires that federal agencies evaluate the effects of federal undertakings on historical, archaeological, and cultural resources and afford the Advisory Council on Historic Preservation opportunities to comment on the proposed undertaking. The first step in the process is to identify cultural resources included on (or eligible for inclusion on) the National Register of Historic Places that are located in or near the project area. The second step is to identify the possible effects of preferred Alternatives. The lead agency must examine whether feasible alternatives exist that would avoid such effects. If an effect cannot reasonably be avoided, measures must be taken to minimize or mitigate potential adverse effects.

During preparation of this EIS, it was determined that renewal of the Settlement Contracts would result in no impacts to cultural resources. The counties within the project study area are required to initiate separate consultations with respect to land use planning activities that would result in effects to cultural resources.

Indian Trust Assets

The United States Government's trust responsibility for Indian resources requires Reclamation and other agencies to take measures to protect and maintain trust resources. These responsibilities include taking reasonable actions to preserve and restore tribal resources. Indian Trust Assets are legal interests in property and rights held in trust by the United States for Indian tribes or individuals. Indian reservations, rancherias, and allotments are common Indian Trust Assets.

In compliance with 36 CFR 800.4(a) (4), Reclamation has sent letters to Indian tribes requesting their input regarding the identification of any properties to which they might attach religious and cultural significance within the area of potential effect. To date, no comments or formal response have been received from the tribes.

~~During preparation of this EIS, it was determined, using the information provided by Reclamation, that no Indian Trust Assets exist within the study area for this EIS.~~

Indian trust assets exist on the trust lands of the following:

- Redding Rancharia in Shasta County
- Paskenta Band of Nomlaki Indians in Tehama County
- Grindstone Rancheria in Glenn County

- Cachil Dehe Band of Wintun Indians of the Colusa Indian Community in Colusa County
- Cortina Band of Wintun Indians of the Cortina Rancheria in Colusa County
- Rumsey Indian Rancheria of Wintun Indians in Yolo County

However, Reclamation concludes that future execution of the SRSCs does not adverseley affect the use, quality, character, or nature of the six tribes' trust assets located in the SRSC study area. Therefore, Reclamation concludes there are no impacts to the Indian Trust Assets of the Redding, Paskenta, Grindstone Colusa, Cortina, or Rumsey Tribes as a result of SRSC execution.

Indian Sacred Sites on Federal Land

Executive Order 13007 provides that in managing federal lands, each federal agency with statutory or administrative responsibility for management of federal lands shall, to the extent practicable and as permitted by law, accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites. No sacred sites were identified during the scoping or planning process and, therefore, were not included in the impact assessment of this EIS.

Environmental Justice

Executive Order 12898 requires each federal agency to achieve environmental justice as part of its mission, by identifying and addressing disproportionately high and adverse human health or environmental effects, including social or economic effects, of programs, policies, and activities on minority populations and low-income populations of the United States. This EIS has evaluated the environmental, social, and economic impacts on minority and low-income populations in the impact assessment of alternatives.

State, Areawide, and Local Plan and Program Consistency

Agencies must consider the consistency of a preferred alternative with approved state and local plans and laws. This EIS was prepared with extensive information from local planning agencies.

CHAPTER 6
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Appendix A
Sacramento River Settlement Contractors

APPENDIX A

Sacramento River Settlement Contractors

Standard-form Contract – Districts, Water Companies, and Municipalities

1) Anderson-Cottonwood Irrigation District
2) Eastside Mutual Water Company
~~2)~~3) Glenn-Colusa Irrigation District
~~3)~~4) Maxwell Irrigation District
~~4)~~5) Meridian Farms Water Company
~~5)~~6) Natomas Central Mutual Water Company
~~6)~~7) Pelger Mutual Water Company
~~7)~~8) Pleasant Grove-Verona Mutual Water Company
~~8)~~9) Princeton-Codora-Glenn Irrigation Company
~~9)~~10) Provident Irrigation District
~~10)~~11) Reclamation District No. 1004
~~11)~~12) Reclamation District No. 108
~~12)~~13) Redding, City of
~~13)~~14) Robert's Ditch Irrigation Company, Inc.
~~14)~~15) ~~Sartain~~ Carter Mutual Water Company
~~15)~~16) Sutter Mutual Water Company
~~16)~~17) ~~Swinford Tract Irrigation Company~~ (Mehrhof & Montgomery, now short-form contractor)
~~17)~~18) Tisdale Irrigation and Drainage Company

Standard Form – Individuals

1) ~~A& F Boeger Corp. and Boeger Land Company~~
2) Andreotti, ~~Arthur~~Arnold, et al.
3) Baber, Jack, et al.
4) ~~Cannell, Fred, et al.~~ Green Valley Corp.
5) ~~Carter, Jane Foster~~
6) ~~Colusa Properties, Inc.~~
7) Conaway Conservancy Group
8) Davis, Olive P., et al.
9) ~~Deseret Farms of California~~ Sacramento River Ranch, LLC
10) ~~Dommer, Elizabeth~~ Ben King
11) Forry, Laurie
12) ~~Forster, Rosemary Trust and Jerome~~ Abdul & Tahmina Rauf
13) Furlan Joint Venture
14) ~~Griffin, Joseph, et al.~~ Griffin & Prater Tenancy-in-Common
15) Henle Family Limited Partnership
16) Hershey Land Company
17) Hiatt, ~~Glenwood J., et al.~~Family Trust

18) Hiatt Family Trust/Illerich Family Trust
~~18)~~19) Hollins, Mariette B.
~~19)~~20) Howald Farms, Inc.
~~20)~~21) ~~King, Barbara~~ King, Laura
~~21)~~22) Knaggs Walnut Ranches Co., L.P.
~~22)~~23) Lockett, William P. and Jean B., 1998 Family Revocable Trust
~~23)~~24) Lomo Cold Storage
~~24)~~25) M & T, Inc.
~~25)~~26) MCM Properties, Inc.
~~26)~~27) O'Brien, Janice
~~27)~~28) Odysseus Farms
~~28)~~29) Oji Brothers Farm, Inc.
~~29)~~30) Oji, Mitsue, Family Partnership
~~30)~~31) Reynen, John, et al.
32) Jansen, Pete and Sandy
~~31)~~33) River Garden Farms
34) Schreiner, Joe and Celo
~~32)~~35) Siddiqui, Javed and Amna
~~33)~~36) Spence, Ruth Ann
~~34)~~37) Tarke, ~~James~~ Stephen
~~35)~~38) Wallace, ~~Construction, Incorporated~~ Jack, Trust
~~36)~~39) Wells, Joyce M.
~~37)~~40) ~~Whitney Construction not a SRSC~~
~~38)~~41) Wilson Ranch Partnership
~~39)~~42) Windswept Land & Livestock

Short-form Contracts

1) Alexander, Thomas,
2) ~~Amen, Henry, Estate~~ Reclamation District No. 1000
3) Anderson, Ray E., et ux. (1) & (2)
4) Beckley, Ralph, et ux.
5) Butler, Leslie, et ux.
6) Butte Creek Farms (A)
7) Butte Creek Farms (P)
8) Butte Creek Farms (Y)
9) Chesney, ~~R and A~~Adona, Bypass Trust et al.
10) ~~Chicago Almond Products Co. and American Almond Products Co., Inc.~~ The Nature Conservancy
11) ~~Chilton, Barbara~~ Siddigui, Jaued and Amna
12) Churkin, Michael, et al.
13) ~~Cribari, Emile, et ux.~~ Wisler, Jack
14) Daniell, Harry
15) Davis, Grover L., et ux.
16) ~~davis~~Wirth, Marilyn, et al.
17) Diamond Holdings, Inc., ~~A~~

18) Drew, Jerry
19) Driscoll Strawberry Associates, Incorporated
20) Driver, Gary, et al.
21) Driver, Gregory E.
22) Driver~~, John A. and Clare M., Family Revocable Trust~~ Family Trust
23) Driver~~, John A., et ux.~~ Family Trust
24) Driver, William, et al.
25) Edson, Wallace and Mary
~~25)~~26) Eggleston, Ronald H., et ux.
~~26)~~27) Ehrke, Allen A., et ux.
~~27)~~28) ELH Sutter Properties, Inc.
~~28)~~29) ~~Sutter Properties, Inc. and Lauppe, B.~~ Natomas Basin Conservancy
~~29)~~30) ~~Elliot, Marlene, and Hradecky, Denton, CoTenancy~~ Rubio, Exeguiel and Elsa
~~30)~~31) Fedora, Sib, et al.
~~31)~~32) Freeman, Frank, et ux.
~~32)~~33) Furlan, Emile, et ux.
~~33)~~34) Gillaspy, Fay
~~34)~~35) Giovannetti, B. E. and Mary
~~35)~~36) Giusti, Richard, et al.
~~36)~~37) Gjermann, Hal
38) Gomes, Frank and Judy Trust
~~37)~~39) Hale & Marks
~~38)~~40) Hale & Marks
~~39)~~41) Heidrick, Emmett and Mildred, Trust
~~40)~~42) Heidrick, Emmett and Mildred, Trust
~~41)~~43) Heidrick, Joe, Family Trust
~~42)~~44) HighLow Nursery, Inc.
45) Howard, Theodore
~~43)~~46) J.B. Unlimited, Inc.
~~44)~~47) Jaeger, William, et al.
~~45)~~48) Kaiser Development Co.
~~46)~~49) Kary, Carol (1) & (2)
~~47)~~50) Lake California Property Owners Association
~~48)~~51) Lauppe, B. and K.
~~49)~~52) Lauppe, Burton
~~50)~~53) ~~Lee Farms~~ Cachil Dehe Band of Wintun Indians of the Colusa Indian Community
~~51)~~54) Leiser, Dorothy L.
~~52)~~55) Leviathan, Inc.
~~53)~~56) Locvich, ~~Paul~~ Loyd
~~54)~~57) Lonon, Michael, et al.
~~55)~~58) ~~M & L Farms~~ Dennis Wilson Farms, Inc.
~~56)~~59) ~~Martin, Andrew now~~ Gomes and ZelMar
~~57)~~60) ~~Mayfair Farms~~ Butte Creek Farms (M)
~~58)~~61) McLane, Robert
~~59)~~62) McLaughlin, Jack

63) Mehrhof and Montgomery (formerly Swinford Tract IC)
~~60)~~64) Micke, Daniel
~~61)~~65) ~~MirbachHarff Antonius~~ von Mirbach-Harff, Antonius Graff
~~62)~~66) Morehead, Joseph A., et ux.
~~63)~~67) Morey, Richard T.
~~64)~~68) Munson, James T., et ux.
~~65)~~69) Nelson, Thomas L., et ux.
~~66)~~70) Odysseus Farms Partnership
~~67)~~71) Penner, ~~H. H., et ux.~~ Roger and Leona
~~68)~~72) Pires, Lawrence J., et ux.
~~69)~~73) Quad H Ranches
74) Reische, Eric
~~70)~~75) Reische, Laverne C., et ux.
~~71)~~76) Richter Brothers, et al.~~-~~, now standard form contractor
~~72)~~77) ~~Ritchey, E. J., et ux.~~ Jansen, Pete and Sandy
~~73)~~78) ~~Riverby~~ River By Limited
~~74)~~79) Riverview Golf & Country Club
~~75)~~80) Sacramento, County of
~~76)~~81) Schreiner, Joe and Cleo
~~77)~~82) Seaver, Charles
~~78)~~83) Sekhon, Arjinderpal and Daljit
~~79)~~84) ~~Stegeman Station Ranch~~ Green Valley Corp.
~~80)~~85) Steidlmayer, Francis J., et al.
~~81)~~86) Tuttle, Charles W. Trust
~~82)~~87) Verona Farming Partnership
~~83)~~88) Wakida, Masaru, et ux.
~~84)~~89) Wakida, Masaru, et ux.
~~85)~~90) ~~Westfall, Ralph D.~~ Art Anderson
~~86)~~91) Willey, Edwin, et ux.
~~87)~~92) Williams Co., G.W.
~~88)~~93) ~~Wilson, Neil now Edson~~
~~89)~~94) Young, Russell L., et al.
95) ZelMar Ranches

Appendix B
Sacramento River Settlement Contractors
Environmental Impact Statement
Scoping Report

Appendix C
Contracts between U.S. Bureau of Reclamation and Sacramento River Settlement Contractors

Appendix D
Needs Analyses