San Joaquin River Restoration Program Long-term Recapture and Recirculation of Restoration Flows EIS/EIR

Project Description Technical Memorandum

September 2017

Table of Contents

Tables

Figures

List of Abbreviations and Acronyms

AF	Acre-feet
cfs	cubic feet per second
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
CVC	Cross-Valley Canal
CVP	Central Valley Project
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EA	Environmental Assessment
EIS	Environmental Impact Statement
EIS/R	Environmental Impact Statement/Environmental Impact Report
FFPP	Forrest Frick Pumping Plant
FKC	Friant-Kern Canal
fps	feet per second
Friant Contractors	Friant Division Long-term Water Contractors
FWA	Friant Water Authority
hp	horsepower
ID	Irrigation District
LTRRRF	Long-Term Recapture and Recirculation of Restoration Flows
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOD	Notice of Determination
NRDC	Natural Resources Defense Council
PR&Gs	Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies
RA	Restoration Administrator
RCP	Reinforced concrete pipe
RGRCP	Rubber-gasketed reinforced concrete pipe
Reclamation	United States Department of the Interior, Bureau of Reclamation
Restoration Flows	San Joaquin River Restoration Program flows
ROD	Record of Decision
SCADA	Supervisory Control and Data Acquisition
Settlement	Stipulation of Settlement in Natural Resources Defense Council, et al., v. Kirk Rodgers, et al.
SJRRP	San Joaquin River Restoration Program
SJRRS Act	San Joaquin River Restoration Settlement Act (Public Law 111-11)
SWP	State Water Project
TAC	Technical Advisory Committee
TM	Technical Memorandum

USFWS	United States Fish and Wildlife Service
VFD	Variable frequency drive
WD	Water District
WSD	Water Storage District
WSP	Welded steel pipe

Note to Reviewers:

This Technical Memorandum was prepared by the San Joaquin River Restoration Program Team in support of preparing the Long-term Recapture and Recirculation of Restoration Flows Environmental Impact Statement. The purpose of circulating this document at this time is to facilitate early coordination regarding the alternatives under consideration by the San Joaquin River Restoration Program Team with the Settling Parties, Third Parties, regulatory agencies, stakeholders, and interested members of the public. Therefore, the content of this document may not necessarily be included in the Project Environmental Impact Statement. While the San Joaquin River Restoration Project Team is not requesting formal comments on this document, comments received will be considered to the extent possible.

1.0 Introduction

This Project Description Technical Memorandum (TM) identifies the alternatives selected for analysis in the Long-Term Recapture and Recirculation of Restoration Flows (LTRRRF) Environmental Impact Statement/Environmental Impact Report (EIS/R). The LTRRRF Project is a component of the overall San Joaquin River Restoration Program (SJRRP). The SJRRP was established in late 2006 to implement the Stipulation of Settlement (Settlement) in Natural Resources Defense Council (NRDC), et al., v. Kirk Rodgers, et al. Federal authorization for implementing the Settlement is provided in the San Joaquin River Restoration Settlement Act (SJRRS Act) (Public Law 111-11).

The United States Department of the Interior, Bureau of Reclamation, as the Federal lead agency under the National Environmental Policy Act (NEPA), and the Friant Water Authority (FWA) as the California Environmental Quality Act (CEQA) lead agency, have prepared this document as an initial step in preparation of an EIS/R for the LTRRRF.

1.1 Purpose of this TM

This Project Description TM is intended to:

- Summarize the alternatives formulation process;
- Document the alternatives evaluation methods and results;
- Document the concepts eliminated from further evaluation and the reasons for their elimination;
- Describe the alternatives to be evaluated in the LTRRRF EIS/R, including the No Action Alternative;
- Serve as the basis for the project description that will appear in the LTRRRF Project Draft EIS/R; and
- Obtain input and feedback from the Implementing Agencies[1], Settling Parties[2], Third Parties[3], and other stakeholders involved in the LTRRRF Project.

[1] Implementing Agencies refer to the agencies responsible for managing and implementing the SJRRP: the United States Department of the Interior, Bureau of Reclamation, United States Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources, and California Department of Fish and Wildlife.

[2] The Settling Parties are agencies and organizations that are parties to the settlement in the *NRDC, et al v. Rodgers, et al* litigation. These parties include plaintiffs (represented by the Natural Resources Defense Council), Friant parties (represented by the Friant Water Authority), and the Federal defendants (the United States Departments of the Interior and Commerce).

[3] Third Parties refer to groups that are not party to a lawsuit or agreement, but are implicated in such lawsuits or agreements and includes landowners and agencies that have a vested interest in implementing the SJRRP.

1.2 Background

In 1988, a coalition of environmental groups led by the NRDC filed a lawsuit challenging the renewal of long-term water service contracts between the United States and the Friant Contractors. After more than 18 years of litigation this lawsuit, known as NRDC, et al., v. Kirk Rodgers, et al., was settled. On September 13, 2006, the Settling Parties, including NRDC, Friant Water Users Authority (now FWA), and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement. The Settlement was subsequently approved by the U.S. Eastern District Court of California (Court) on October 23, 2006, and authorized for implementation through passage of the Settlement Act (Public Law 111-11). The Settlement contained two primary goals:

- **Restoration Goal** – To restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish

- **Water Management Goal** – To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim and Restoration flows provided for in the Settlement

The Settlement establishes a framework for accomplishing the Restoration and Water Management goals that will require environmental compliance, design, construction, and monitoring of projects over a multiple-year period. To achieve the Restoration Goal, the Settlement calls for a combination of channel and structural modifications along the San Joaquin River below Friant Dam, releases of water from Friant Dam to the confluence of the Merced River (referred to as Restoration Flows), and reintroduction of Chinook salmon. To achieve the Water Management Goal, the Settlement calls for a plan for recirculation, recapture, reuse, exchange, or transfer of Restoration Flows for the purpose of reducing or avoiding impacts to water deliveries to Friant Contractors caused by the release of Restoration Flows.

Implementing Agencies responsible for managing and implementing the SJRRP are Reclamation; U.S. Department of the Interior, Fish and Wildlife Service (USFWS); U.S. Department of Commerce, National Marine Fisheries Service (NMFS); California Department of Water Resources (DWR); and California Department of Fish and Wildlife (CDFW).

1.2.1 Long-term Recapture and Recirculation of Restoration Flows EIS/R

The LTRRRF EIS/R will analyze alternatives that would implement Section 16(a) of the Settlement, which requires the Secretary of the Interior and Settling Parties to develop a plan for recirculation, recapture, reuse, exchange, or transfer of Restoration Flows. Releasing Restoration Flows from Friant Dam affects water agencies that have contracts for delivery of this water. The SJRRP Restoration Flow Guidelines estimate a long-term annual average reduction in water deliveries to Friant Contractors of 185,000 acre-feet

(AF), with reductions to individual contractors applied proportional to contractors' Class 1 and Class 2[4] contract totals (SJRRP 2013).

The LTRRRF will consider alternatives to recapture Restoration Flows, primarily downstream of the Restoration Area (downstream of the confluence with the Merced River), and recirculate these flows to Friant Contractors. For the purposes of this document, recirculation is defined as recirculation, recapture, reuse, exchange, or transfer of SJRRP Restoration Flows. These actions would reduce the water supply impact on Friant Contractors associated with the Settlement and help achieve the Water Management Goal.

1.2.2 Study Area

The Study Area (Figure 1-1) for recapture and recirculation activities includes water district service areas, their associated infrastructure, and other areas that may be affected directly or indirectly by implementing recapture, recirculation, and storage actions. The Study Area also includes Central Valley Project (CVP) and State Water Project (SWP) service areas that may be affected by the transfer of recaptured water from Friant Contractors to CVP or SWP Contractors. Preliminary analysis of the initial alternatives indicates that they would not result in substantive changes to CVP and SWP facilities north of the Delta (such as Shasta, Oroville, and Folsom reservoirs), so these facilities are not included in the Study Area.

While the LTRRRF alternatives development process incorporated potential actions throughout this study area, the alternatives remaining after screening (and recognized within this document) do not include action in the entire study area. The proposed alternatives continue recapture of Restoration Flow in the Delta and Restoration Area and could incorporate recapture at new or existing facilities on the San Joaquin River downstream of the confluence with the Merced River. The EIS/R will identify areas where resources could be affected and will refine the Study area.

[4] Water districts with contracts to receive Class 1 water supplies receive the first 800,000 AF of delivered water and are generally held by districts with M&I water users and/or agricultural water users with limited access to good quality groundwater. Water districts with contracts for Class 2 supplies have access to a supplemental supply, based on availability, of up to 1,400,000 AF after Class 1 deliveries are met. Some Friant Division Contractors have both Class 1 and Class 2 supplies, while others have either Class 1 or Class 2 supplies.

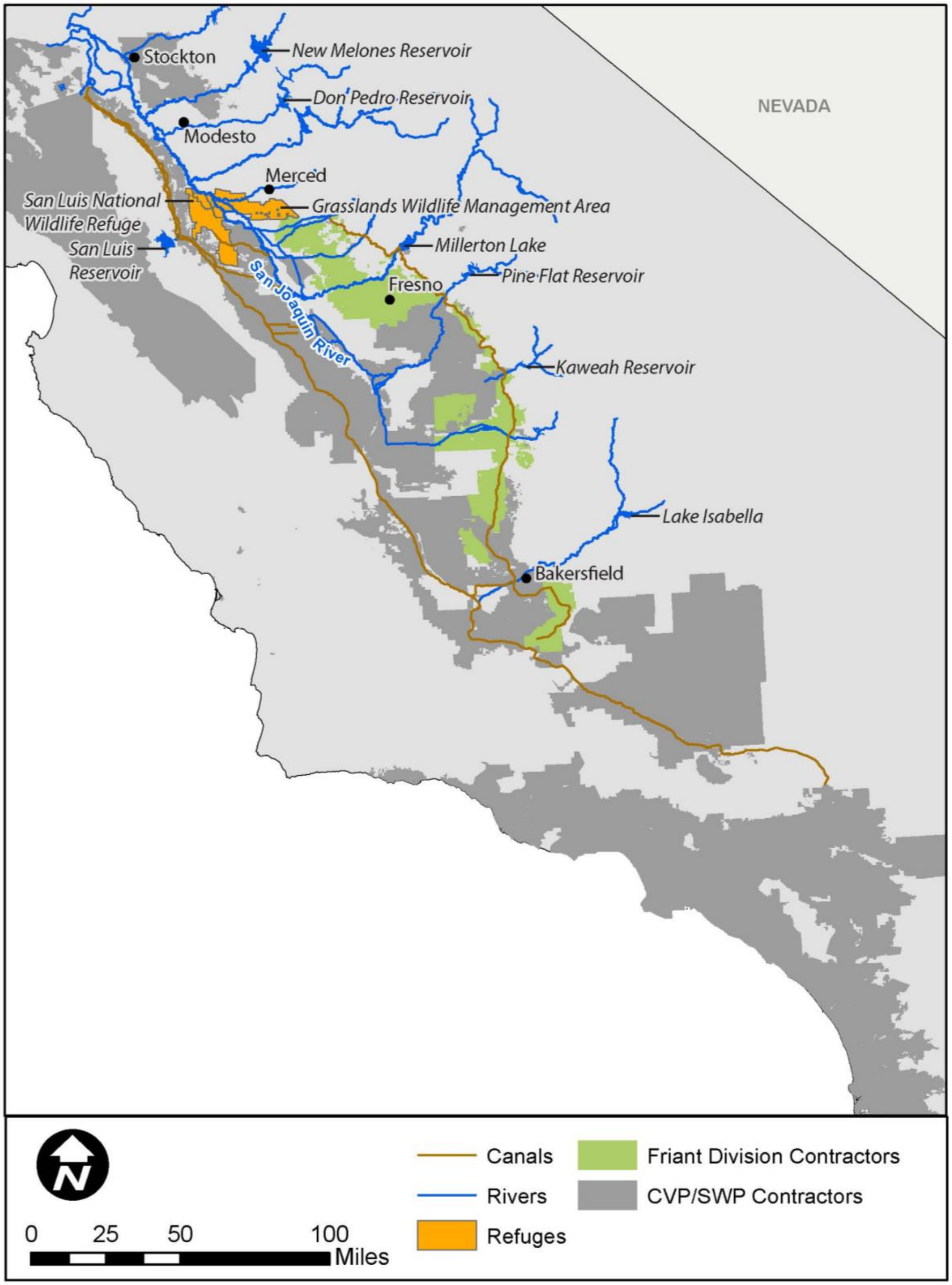

Figure 1-1.
Study Area for SJRRP Recapture and Recirculation

1.3 Purpose and Uses of the Long-term Recapture and Recirculation of Restoration Flows EIS/R

The LTRRRF EIS/R will analyze the project-specific direct, indirect, and cumulative impacts of recapturing and recirculating Restoration Flows, consistent with NEPA and CEQA requirements. The EIS/R will analyze three types of actions:

- Recapture: different locations and configurations where Restoration Flows could be diverted or recaptured;
- Recirculation: direct conveyance, transfers, or exchanges of Recaptured Restoration Flows for the purpose of reducing or avoiding impacts to the Friant Contractors; and
- Storage: means to store water during periods when demand for recirculated water is low or there is insufficient conveyance capacity.

The EIS/R will serve as an informational document for decision makers, public agencies, non-government organizations, and the general public regarding the potential direct and indirect environmental consequences of implementing any of the alternatives, including the No Action/No Project Alternative. The EIS/R will also support the permits, approvals, and other compliance, coordination, and consultation efforts required for the LTRRRF Project.

Consistent with 40 Code of Federal Regulations (CFR) Part 46.425, the Final EIS/R will identify a preferred alternative for implementation (or alternatives, if more than one exists). The preferred alternative will be identified in the Final EIS/R based on the information presented in the Draft EIS/R, in light of any potential revisions made in response to comments received on the Draft EIS. After the Final EIS/R is published, Reclamation will prepare a Record of Decision (ROD) and the FWA will prepare a Notice of Determination (NOD) to implement a selected alternative. Agencies with regulatory authority issuing permits or other types of approvals for the LTRRRF Project may adopt the EIS/R, consistent with their own policies and regulations, or use information included as the basis for their own environmental compliance.

1.4 Relationship to the SJRRP Program EIS/R

The SJRRP Draft Program EIS/R was released to the public in April 2011 and finalized in July 2012. Reclamation signed the ROD on September 28, 2012, and DWR filed the NOD on October 1, 2012. A Program EIS/R is prepared on a series of actions that can be characterized as one large project, in this case, the specific requirements of the SJRRP outlined the Settlement and authorized by the Act. A Program EIS/R generally establishes a framework for "tiered" or project-level environmental documents that are prepared in accordance with the overall program. The SJRRP Program EIS/R examined the requirements of the Settlement and the Act as a whole with some components analyzed at a project level, and others at a program level. The Settlement components analyzed at a project level in the SJRRP Program EIS/R include:

- Reoperation of Friant Dam and downstream flow control structures to route Interim and Restoration flows;
- Recapture of Interim and Restoration flows in the Restoration Area;
- Recapture of Interim and Restoration flows at existing CVP and SWP facilities in the Delta; and
- Associated monitoring and mitigation actions.

These project level actions, as described in the ROD, are currently being implemented by the SJRRP.

The SJRRP Program EIS/R also examined components of the Settlement and the Act at a program level, including actions to recapture Restoration Flows in the lower San Joaquin River and recirculate those flows. These actions were analyzed at a more general, broad level because specific project details were unknown and it was expected that these actions would require further planning and environmental review efforts. The ROD identified the Selected Alternative as Alternative C1, which includes new pumping infrastructure on the San Joaquin River to recapture Restoration Flows. The new infrastructure could include a new pumping plant on the San Joaquin River below the confluence with the Merced River or expansion of existing pumping plants. The ROD included requirements that recapture and recirculation of Restoration Flows would not impact CVP/SWP deliveries or operations of the CVP/SWP. The SJRRP Program EIS/R analyzed and disclosed the impacts of the alternatives to the level of detail appropriate given the information available at the time. Subsequent analyses, such as a project-specific LTRRRF EIS/R, are building on that analysis and must be consistent with the obligation of no adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP. The more detailed project-level analysis may result in a selected alternative for the LTRRRF Project that varies from the alternative selected in the 2012 ROD.

1.5 Purpose and Need for Action

The purpose of recapture and recirculation of Restoration Flows is to help achieve the SJRRP Water Management Goal to reduce or avoid water supply impacts to the Friant Contractors that may result from releasing Restoration Flows in accordance with the Settlement. Specifically, long-term recapture and recirculation actions are needed to satisfy the requirements of Paragraph 16 (a) of the Settlement, which directs the Secretary to develop and implement a plan for recirculation, recapture, reuse, exchange, or transfer of the Restoration flows for the purpose of reducing or avoiding impacts to water deliveries to all the Friant Division Long-term Contractors caused by the Restoration flows (Plan). Initial drafts of the Plan have provided the basis for alternatives formulation in the EIS/R. The EIS/R will provide environmental compliance for the Plan and support further development of the Plan in accordance with the criteria identified in Paragraph 16 (a) of the Settlement. Each Alternative will adhere to Reclamation's obligation to recapture and recirculate Restoration flows without causing adverse impacts to any non-Friant Division south-of-Delta water service contractors.

1.6 Responsibilities of Lead and Cooperating Agencies

Reclamation is the lead NEPA agency and the FWA is the lead CEQA agency in preparing the LTRRRF EIS/R. As lead agencies, Reclamation and the Friant Water Authority will be responsible for finalizing the alternatives and selecting a reasonable range of alternatives for analysis in the EIS/R, completing the Draft and Final EIS documents, completing the ROD and NOD selecting an alternative for implementation, implementing the selected alternative, and ensuring all environmental commitments have been completed.

Under NEPA, Cooperating Agencies are Tribes, federal, state, and local agencies (40 CFR Part 1501.6) which have the following:

- Jurisdiction by law, which means authority to approve, veto, or finance all or part of the proposal (40 CFR Part 1508.15); or
- Special expertise, for example, statutory responsibility, agency mission, or related program experience with respect to the proposal or reasonable alternatives (40 CFR Part 1508.26).

Several agencies were invited by Reclamation to act as Cooperating Agencies for the LTRRRF EIS/R, and Reclamation is waiting for responses from these agencies. The Cooperating Agencies will identify issues that need to be addressed in the EIS/R, provide data and other information relative to their expertise, provide input on development of the EIS/R, and review draft sections of the EIS/R.

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2.0 Alternatives Formulation Process

This section describes the process for formulating, evaluating, and finalizing the alternatives for the LTRRRF Project.

2.1 Alternatives Development Process

The alternatives development process for the LTRRRF has been a collaborative process with agencies and stakeholders. The process started with identifying the purpose and need of the action, and then proceeded to formulate and evaluate initial alternatives. Alternatives are defined as combinations of recapture, recirculation, and storage components that together would achieve the purpose and meet the need for the action. Figure 2-1 outlines the steps used to formulate and select the comprehensive alternatives that will be included in the EIS/R.

Figure 2-1.
Comprehensive Alternative Formulation and Screening Process

2.2 Stakeholder Involvement

The alternatives development process provided opportunities for stakeholder involvement and input. Primary stakeholders for the LTRRRF EIS/R include federal, state, and local agencies; the Settling Parties[5], Friant Division contractors CVP and SWP contractors and water users, and the public. This section describes how each stakeholder group fits into the alternatives development process and the opportunities they have had to provide input and comments on the project concepts and alternatives. In addition to these groups, the Restoration Administrator (RA) participates in regular coordination meetings with Reclamation staff and reports information to the Settling Party representatives and the Technical Advisory Committee (TAC).

The SJRRP has an extensive stakeholder involvement effort, including meetings with the above-listed stakeholders on topics related to the LTRRRF EIS/R. Reclamation also conducted public scoping meetings to gather input to inform the LTRRRF EIS/R alternatives development and impact analysis.

[5] The Settling Parties include the Natural Resources Defense Council, Friant Water Authority, and the United States Departments of the Interior and Commerce.

2.2.1 Settling Party and Contractor Involvement

Representatives from the Settling Parties (NRDC and Friant Water Authority) and other CVP Contractors have participated in the Water Management Goal Technical Feedback Meetings to provide input for the development, evaluation, and refinement of alternatives. The representatives have been and will continue to be invited to participate in alternatives development and analysis for the LTRRRF EIS/R.

During the alternatives development process, Reclamation held periodic meetings with individual Friant Contractors to review project progress and collect input on specific components included in the alternatives related to their districts (see Table 2-1). Recommendations from these meetings have been incorporated into the alternatives development process.

Reclamation has also held meetings with NRDC and other environmental agencies to help identify alternatives and the approach to analyze environmental impacts of those alternatives. Meetings were held on August 9, 2016; August 24, 2016; September 20, 2016; and are ongoing.

2.2.2 Agency Involvement

Reclamation provided opportunities to Implementing Agencies to review administrative drafts of the Initial Alternatives TM and this Project Description TM. These Implementing Agencies included federal and state agencies with jurisdiction by law or special expertise over potential environmental impacts from implementation of the alternatives. Feedback received was incorporated into the final drafts of these documents. The agencies that participated in these reviews included NMFS, USFWS, CDFW, and DWR.

2.2.3 Public Involvement

Reclamation held four public scoping meetings in August 2015 regarding the preparation of an EIS/R for the long-term recapture and recirculation of Restoration Flows. During the scoping meetings and throughout the public scoping comment period, Reclamation accepted comments to help determine the range of alternatives, the environmental effects, and the mitigation measures to be considered in the EIS/R. Suggestions regarding alternatives were documented in the Long-Term Recapture and Recirculation of Restoration Flows Environmental Impact Statement, Public Scoping Report (SJRRP 2015a) and have been considered throughout the alternatives development process. The initial alternatives were also presented at a public Water Management Goal Technical Feedback Meeting on September 16, 2016.

The public will have an opportunity to review and comment on the LTRRRF Draft EIS when this document is released for public review. The public will also have the opportunity to attend public meetings on the LTRRRF Draft EIS/R.

Table 2-1. Outreach Meetings

Meeting Date	Meeting Type	Topic of Meeting
9/19/2014	Water Management Goal Technical Feedback Meeting	Presentation of the Initial options identified for consideration in the Initial Alternatives TM
8/10/2015	Scoping Meeting	Public input on alternatives for consideration and concerns and issues to be considered in the EIS/R
8/11/2015	Scoping Meeting	Public input on alternatives for consideration and concerns and issues to be considered in the EIS/R
8/12/2015	Scoping Meeting	Public input on alternatives for consideration and concerns and issues to be considered in the EIS/R
8/13/2015	Scoping Meeting	Public input on alternatives for consideration and concerns and issues to be considered in the EIS/R
1/11/2016	Conference Call with Contra Costa Water District	Project overview and feedback on the potential inclusion of district storage facilities in project alternatives
1/20/2016	Water Management Goal Technical Feedback Meeting	Presentation of the initial alternatives formulated in the Initial Alternatives TM
3/17/2016	Meeting with Shafter-Wasco Irrigation District	Project overview and feedback on the potential inclusion of district conveyance and storage facilities in project alternatives
3/17/2016	Meeting with Arvin-Edison Water Storage District	Project overview and feedback on the potential inclusion of district storage facilities in alternatives
3/18/2016	Water Management Goal Technical Feedback Meeting	Presentation on the findings of analysis of new intake facility sizing options
4/5/2016	Meeting with Metropolitan Water District	Project overview and feedback on the potential inclusion of district storage facilities in project alternatives
9/16/2016	Water Management Goal Technical Feedback Meeting	Presentation on preliminary results from initial alternatives evaluation for the Project Description TM

Key:
EIS/R = Environmental Impact Statement/Environmental Impact Report
TM = Technical Memorandum

2.3 Initial Options Formulation

Initial options represent individual components that, when combined, will achieve the purpose of the action. The description of the initial options in this Project Description TM defines the starting point for the development of comprehensive alternatives that combine recapture, recirculation, and storage to reduce or avoid water supply impacts to Friant Contractors.

2.3.1 Formulating Initial Options

Initial Options for the recapture, recirculation, and storage of Restoration Flows were identified from previous studies such as the Water Management Goal Investment Strategy Final Report (SJRRP 2015b), feedback from public scoping and stakeholder meetings, and technical expertise from agency representatives. Table 2-2 shows a list of the initial options.

Table 2-2. Initial Options for Restoration Flows

Recapture Options	Recirculation Options	Storage Options
Existing Banta-Carbona ID Recapture	Mid-Valley Canal	Storage in Metropolitan WD
Existing Patterson ID Recapture	Trans-Valley Canal - Multi-District Alignment	Storage in Contra Costa WD
Existing West Stanislaus ID Recapture	Trans-Valley Canal - Tulare Alignment	Proposed In-Delta Storage
Expanded Banta-Carbona ID Recapture	Trans-Valley Canal - Poso Alignment	Storage in North of Delta Reservoirs
Expanded Patterson ID Recapture	Shafter-Wasco ID Direct Delivery and Exchange	Storage in San Joaquin River Tributary Reservoirs
Expanded West Stanislaus ID Recapture	Arvin-Edison WSD Direct Delivery and Exchange	Semitropic WSD Groundwater Storage Bank
New Recapture Facility	Kings River Exchange	Cawelo WD Groundwater Banking
• North Valley Regional Recycled Water Program Facilities	Kaweah and Tule River Exchange	Rosedale-Rio Bravo WSD
• Newman Wasteway	Fresno River “Red Top” Exchange	Kern Water Bank
• Recapture of seepage losses in Restoration Area	Transfers to buyers within the CVP/SWP service area	City of Bakersfield 2800 Acre Groundwater Recharge Facility
		Meyers Water Bank
		Arvin-Edison WSD Groundwater Banking
		Private Groundwater Banks (CalMat Company Groundwater Banks)

Key:
ID = Irrigation District
WD = Water District
WSD = Water Storage District

2.3.2 Screening Initial Options

These initial options were screened to eliminate impracticable options or options that would be inconsistent with Reclamation’s obligation to recapture and recirculate Restoration flows without causing adverse impacts to any non-Friant Division south-of-Delta water service contractors. The screening criteria considered:

- Ability to contribute to meeting the purpose of the proposal: the initial options could not by themselves satisfy the need for the proposal, but must be combined with other options. This criterion considered whether the initial option has the ability, when combined with other recapture, recirculation, and/or storage options, to contribute to an alternative’s ability to reduce or avoid impacts to water deliveries to all the Friant Contractors caused by the Restoration Flows.

- Potential technical and legal complexity: this criterion considered potential implementation challenges due to technical and legal issues. Technical issues could include unproven technologies, the need for extensive land acquisitions or land use conversions, and the requirement of complex agreements between multiple governmental organizations. Legal issues may include the need for a new legal authority, water rights conflicts, and disputed ownership of shared resources such as groundwater.

- Cost: this criterion considered qualitative estimates of construction and operations and maintenance costs for each option

The Program EIS/R identified a new recapture facility on the San Joaquin River with a capacity to divert up to 1,000 cubic feet per second (cfs). Initial analyses found that the size of this facility may be more difficult to permit and have greater potential for environmental effects than a smaller facility. It would also be substantially more expensive, and would not have substantial increases in the overall amount of water recaptured. As a result, the facility was sized for a diversion of up to 500 cfs, and combined with the use of existing local diversion facilities on the San Joaquin River.

Potential sites for the recapture facility were identified to avoid urban and refuge lands, site the diversion in a suitable geomorphic area on the river, avoid sensitive biological resources, and have a clear conveyance path from the diversion to the Delta-Mendota Canal (DMC). An investigation of the potential sites considered river geomorphology, terrestrial resources, and fishery resources. These evaluations indicated that the most suitable site was just downstream of the confluence with the Merced River. More details on this evaluation are in Appendix A to the LTRRRF Project Initial Alternatives TM (SJRRP 2016).

Chapter 4 of this Project Description TM presents a list of initial concepts eliminated from further consideration and the reasons for their elimination. The LTRRRF Project Initial Alternatives TM (SJRRP 2016) documents this elimination process in more detail.

2.4 Alternatives Formulation

Following the screening of initial options, comprehensive alternatives comprised of recapture, recirculation, and storage components were formulated to reflect a range of potential environmental effects. The five alternatives include one no action and four action alternatives, and range from an alternative with limited operational changes (Alternative 2: Continue Existing Recirculation Actions) to an alternative that includes more construction and operational changes (Alternative 5: Construct New Facilities). The alternatives were formulated to reflect the ROD requirement that Restoration Flows would not impact CVP/SWP deliveries or operations of the CVP/SWP.

2.5 Alternatives Evaluation Process

The next step in alternatives development included evaluating the alternatives to select a reasonable range of alternatives that would contribute to meeting the purpose of the project.

Evaluation criteria were developed to determine how well the initial alternatives met the overall purpose of the LTRRRF Project and provide a high-level consideration of the alternatives' potential impacts. The evaluation criteria also provided a means to compare alternatives. Evaluating the alternatives involved developing preliminary engineering design; preliminary cost estimates; and water operations modeling. Appendix A of this Project Description TM provides a complete overview of the alternatives evaluation, including a description of the evaluation criteria and the results of the evaluation. The initial alternatives presented in Appendix A, however, vary in several ways from the alternatives in the main body of this Project Description TM because they were modified to improve performance based on the initial evaluation results presented in the appendix. Primary differences between the initial alternatives in Appendix A and the alternatives in the main body of this Project Description TM include:

- Alternatives 4 and 5 do not include the use of surface water storage owned by Contra Costa Water District or Metropolitan Water District.
- Alternative 5 does not include groundwater storage options.

2.5.1 Alternatives Evaluation Criteria

The four primary evaluation criteria are based on the Federal planning criteria outlined in the Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies (PR&Gs). These criteria include completeness, effectiveness, acceptability, and efficiency. Each primary criterion is further defined by "performance measures" that help assess each alternative's performance related to the criterion. Table 2-3 presents the evaluation criteria and performance measures used to evaluate the initial alternatives.

Table 2-3. Evaluation Criteria Summary

Federal Planning Criteria	Evaluation Criteria	Performance Measure
Completeness	Addresses Recapture and Recirculation	The recapture, recirculation and storage components included in the alternative combine to reduce impacts to Friant Contractors from the release of Restoration Flows
Effectiveness	Supports Recapture and Recirculation	Amount of Restoration Flows returned to Friant Contractors over a given time period or sequence of various water years
		Amount of recaptured Restoration Flows lost during conveyance through spills and routing over a given time period or sequence of various water years
		Equity in returning/exchanging water to Friant Division Contractors
	Technical feasibility	Operational complexity
		Implementation timing, estimated with length of construction
Acceptability	Biological Effects	Acres of disturbed habitat
		Number of months when construction activities overlap with sensitive wildlife periods
		Potential to adversely affect fish from recapture
	Social Effects	Potential for CVP and SWP water supply impacts

Federal Planning Criteria	Evaluation Criteria	Performance Measure
		Number of land owners affected
		Quantity of farmland removed from production
		Total amount of affected land and parcels
	Physical Effects	Intensity of air quality impacts (average dollars/month of construction)
		Noise impacts (total construction duration in months and footprint size)
		Downstream erosion or geomorphic changes due to new or modified intake facilities
		Potential to affect water quality
Efficiency	Cost	Capital cost (construction and land)
		Annual O&M cost (operations and/or use of facilities)

2.5.2 Evaluation Results

The preliminary evaluation results for the alternatives are described in Appendix A of this document. The evaluation found that the four action alternatives provide a reasonable range of potential alternatives. No one alternative performed highly for all criteria, but they illustrate trade-offs between different key factors. For example, a new recapture facility helps Alternative 5 perform well for the effectiveness criteria, but it performs poorly for efficiency because of the high costs. Because of the trade-offs between alternatives, these action alternatives will remain for further evaluation in the EIS/R. While the evaluation did not recommend removing any alternatives, it did result in modifications to Alternatives 4 and 5. These alternatives originally included storage in San Luis Reservoir and other storage facilities (surface and/or groundwater storage facilities). The evaluation indicated that San Luis Reservoir has adequate storage for the Recaptured Flows, so the additional storage was removed from these alternatives.

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3.0 Description of the Alternatives for the EIS/R

This section describes the five comprehensive alternatives under consideration, including the No Action Alternative.

3.1 Alternative 1 – No Action Alternative

Alternative 1 (the No Action Alternative) for the SJRRP LTRRRF EIS/R reflects conditions if no further Federal action was taken to expand recapture opportunities and implement long-term recirculation, reuse, exchange, or transfer opportunities. However, Alternative 1 would include the elements of the Settlement that were analyzed at a project level in the Program EIS/R and efforts that have made substantial progress towards completing environmental compliance. This approach is consistent with regulatory guidance from NEPA and Reclamation's NEPA Handbook. It is also consistent with the way the No Action Alternatives have been defined in other SJRRP environmental documents, such as the Recirculation of Recaptured Water Year 2013-2017 SJRRP Flows Environmental Assessment (EA) and the Mendota Pool Bypass and Reach 2B Improvements Project EIS/R. Alternative 1 is not consistent with the Settlement because it does not fully contribute to implementation of the Settlement. It is being included to satisfy NEPA requirements as a basis of comparison for the action alternatives to expand recapture opportunities and implement long-term recirculation, reuse, exchange, or transfer opportunities evaluated in this EIS/R. Key components of Alternative 1 are shown in Figure 3-1.

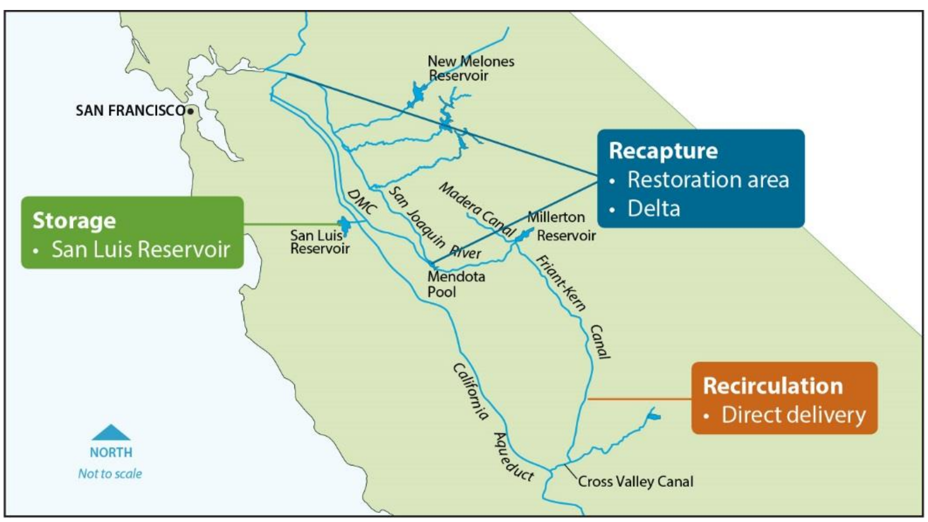

Figure 3-1.
Key Components for Alternative 1: No Action Alternative

3.1.1 Recapture

If the expanded Recapture opportunities and long-term Recirculation of Restoration Flows were not implemented, other components of the Settlement would still move forward. Alternative 1 would include implementation of the SJRRP elements that were analyzed at a project level as part of the selected alternative, C1, as described in the 2012 ROD. The actions analyzed at a project level that are related to recapture or recirculation include:

- Re-operate Friant Dam and downstream flow control structures to route Interim and Restoration flows;
- Recapture Interim and Restoration flows in the Restoration Area at Mendota Pool, Arroyo Canal, and Merced and San Luis National Wildlife Refuges;
- Recapture Interim and Restoration flows at existing CVP and SWP facilities in the Delta.

Alternative 1 would also include other elements of the SJRRP that have made substantial progress towards implementation and are likely to be implemented. These elements include the Madera Canal Capacity Restoration Project, seepage management projects or real estate actions, Part III groundwater projects, Fresno River Exchanges (the Red Top Project), use of Unreleased Restoration Flows, and the Mendota Pool Bypass and Reach 2B Improvements Project. Restoration Flows diverted within the Restoration Area would be delivered to water users in lieu of supplies from the DMC.

Under Alternative 1, Restoration Flows would continue to be released from Friant Dam. These flows would move downstream through the Restoration Area, and a portion of the Restoration Flows would be recaptured within the Restoration Area and the Delta. The portion of the Restoration Flows that is not lost (though infiltration or evaporation) or captured at these locations would become Delta outflow.

Alternative 1 would include some limits on the ability to recapture Restoration Flows:

1. Between Friant Dam and the confluence of the Merced River, flow releases would be reduced by riparian diversions and in-stream losses. The total monthly recapture of Restoration Flows could not exceed the flows released at Friant Dam minus the riparian diversions and losses.
2. The recapture of Restoration Flows in the Delta could not adversely affect the Secretary’s ability to meet contractual obligations existing as of the effective date of the Settlement, such as CVP Delta exports.

3.1.2 Recirculation

The Program EIS/R did not analyze recirculation options at a project level, and the Recirculation of Recaptured Water Year 2013-2017 SJRRP Flows EA only analyzed actions through Water Year 2017. Therefore, after February 2018, the existing recirculation, transfer, and exchange options will need to be reanalyzed, as appropriate, to identify any new or different environmental effects. Therefore, these actions are not included in Alternative 1.

Reclamation has awarded a financial assistance agreement to the Friant Water Authority to complete environmental compliance, design, and construction for the Friant-Kern Canal (FKC) Reverse Flow Pump-Back Project. In addition to providing greater operational flexibility during drought conditions, this project would enable direct delivery of recaptured water to the following districts: Shafter Wasco ID, Arvin-Edison Water Storage District (WSD), Southern San Joaquin Municipal Utility District, Delano-Earlimart ID, Lower Tule River ID, Saucelito ID, Terra Bella ID, Tea Pot Dome Water District (WD), and Porterville ID. This project would be implemented under Alternative 1 and would allow some recirculation to occur after 2018. While some of these districts could accept direct delivery of water without the FKC pumpback project, these direct delivery actions may need additional environmental compliance and are not included in Alternative 1.

3.1.3 Storage

Alternative 1 could move recaptured flows into San Luis Reservoir for storage. The SJRRP would be able to access available capacity in San Luis Reservoir; provided the ability to store recaptured Restoration flows would be subordinate to storage of CVP, SWP, non-CVP or non-SWP water intended to benefit CVP or SWP contractors.. In order to adhere to the obligation of no impacts to CVP/SWP deliveries or operations of the CVP/SWP, as San Luis Reservoir fills, recaptured flows in San Luis Reservoir would "spill" and would not be available for subsequent SJRRP-related uses, based on the priorities for storage.

Restoration Flows stored in San Luis Reservoir have a priority lower than: (1) the then-current year's CVP water, including Level II refuge water, (2) the then-current year's Level IV refuge water, (3) all rescheduled CVP water, (4) Cross-Valley Canal (CVC) Contractor water, (5) rescheduled Level IV refuge water, and (6) non-CVP water acquired or otherwise available to the San Luis and Delta-Mendota Water Authority's member agencies.

3.2 Elements Common to All Action Alternatives

3.2.1 Conservation Strategy

As part of SJRRP implementation, a comprehensive strategy for the conservation of listed and sensitive species and habitats has been prepared, and is being implemented in coordination with USFWS, NMFS, and CDFW. The goals of the strategy are as follows:

- Conserve riparian vegetation and waters of the United States, including wetlands
- Control and manage invasive species
- Conserve special-status species

The SJRRP's Conservation Strategy includes conservation measures for biological resources that may be affected by Project actions. The SJRRP Program EIS/R contains a full description of conservation measures (SJRRP 2011, pages 2-55 to 2-79). Table 3-1 shows the full list of potential conservation measures. As part of development of the LTRRRF EIS/R, the relevant conservation measures for each action alternative will be refined as the biological resources near new facilities are identified.

Table 3-1. Conservation Measures from the Conservation Strategy

Identifier	Conservation Measure
VP	**Vernal Pool Habitats**
VP-1	Avoid effects to species
VP-2	Minimize effects to species
VP-3	Compensate for temporary or permanent loss of habitat
CH	**Critical Habitat**
CH-1	Avoid and minimize effects to critical habitat
CH-2	Compensate for unavoidable adverse impacts of Federally-designated critical habitat
CTS	**California Tiger Salamander**
CTS-1	Avoid and minimize effects to species
CTS-2	Minimize effects to species
CTS-3	Compensate for temporary or permanent loss of habitat
PALM	**Palmate-bracted bird’s beak**
PALM-1	Avoid and minimize effects to species
VELB	**Valley Elderberry Longhorn Beetle**
VELB-1	Avoid and minimize effects to species
VELB-2	Compensate for temporary or permanent loss of habitat
BNLL	**Blunt-Nosed Leopard Lizard**
BNLL-1	Avoid and minimize effects to species
BNLL-2	Compensate for temporary or permanent loss of habitat or species
PLANTS	**Other Special-Status Plants**
PLANTS-1	Avoid and minimize effects to special-status plants
PLANTS-2	Compensate for temporary or permanent loss of special-status plants
GGS	**Giant Garter Snake**
GGS-1	Avoid and minimize loss of habitat for giant garter snake
GGS-2	Compensate for temporary or permanent loss of habitat
WPT	**Western Pond Turtle**
WPT-1	Avoid and minimize loss of individuals
EAGLE	**Bald Eagle and Golden Eagle**
EAGLE-1	Avoid and minimize effects to bald and golden eagles (as defined in the Bald and Golden Eagle Protection Act)
SWH	**Swainson’s Hawk**
SWH-1	Avoid and minimize impacts to Swainson’s Hawk
SWH-2	Compensate for loss of nest trees and foraging habitat
RAPTOR	**Other Nesting Raptors**
RAPTOR-1	Avoid and minimize loss of individual raptors
RAPTOR-2	Compensate for loss of nest trees
RNB	**Riparian Nesting Birds: Least Bell’s Vireo**
RNB-1	Avoid effects to species
RNB-2	Avoid, minimize, and compensate for effects to species
MBTA	**Other Birds Protected by the Migratory Bird Treaty Act**
MBTA-1	Avoid and minimize effects to species
BRO	**Burrowing Owl**
BRO-1	Avoid loss of species
BRO-2	Minimize impacts to species
BAT	**Special-Status Bats**
BAT-1	Avoid and minimize loss of species
BAT-2	Compensate for loss of habitat

Identifier	Conservation Measure
FKR	**Fresno Kangaroo Rat**
FKR-1	Avoid and minimize effects to species
FKR-2	Avoid disturbance of designated critical habitat
FKR-3	Compensate for temporary or permanent loss of habitat or species
SJKF	**San Joaquin Kit Fox**
SJKF-1	Avoid and minimize effects to species
SJKF-2	Compensate for loss of habitat
PL	**Pacific Lamprey**
PL-1	Avoid and minimize effects to species
DS	**Delta Smelt**
DS-1	Avoid and minimize effects to species
RHSNC	**Riparian Habitat and other Sensitive Natural Communities**
RHSNC-1	Avoid and minimize loss of riparian habitat and other sensitive natural communities
RHSNC-2	Compensate for loss of riparian habitat and other sensitive natural communities
WUS	**Waters of the United States/Waters of the State**
WUS-1	Identify and quantify wetlands and other waters of the United States
WUS-2	Obtain permits and compensate for any loss of wetlands and other waters of the United States/waters of the State
INV	**Invasive Plants**
INV-1	Implement the Invasive Vegetation Monitoring and Management Plan
CP	**Conservation Plans**
CP-1	Remain consistent with approved conservation plans
CP-2	Compensate effects consistent with approved conservation plans
GS	**Southern Distinct Population Segment of North American Green Sturgeon**
GS-1	Avoid and minimize loss of habitat and individuals
CVS	**Central Valley Steelhead**
CVS-1	Avoid loss of habitat and risk of take of species
CVS-2	Minimize loss of habitat and risk of take of species
WRCS	**Sacramento Valley Winter-Run Chinook Salmon**
WRCS	Avoid and minimize loss of habitat and individuals
SRCS	**Central Valley Spring-Run Chinook Salmon**
SRCS-1	Avoid and minimize loss of habitat and individuals
EFH	**Essential Fish Habitat (Pacific Salmonids and Starry Flounder)**
EFH-1	Avoid loss of habitat and risk of take of species
EFH-2	Minimize loss of habitat and risk of take from implementation of construction activities

3.2.2 Friant Contractor Exchanges

All of the action alternatives would recirculate recaptured water to some Friant Contractors, but none of the action alternatives would deliver water to all of the contractors. The action alternatives would rely on exchanges between the Friant Contractors to allow deliveries to contractors that could not be directly accessed through the recirculation options considered. As part of these exchanges, a Friant Contractor that could receive recirculated water would have less Friant water delivered, and those supplies would be delivered to other Friant Contractors that do not have access to recirculated water.

3.3 Alternative 2 – Continue Existing Temporary Recirculation Actions

Alternative 2 is the same as Alternative 1 but would extend the recirculation actions described in the Recirculation of Recaptured Water Year 2013-2017 EA beyond Water Year 2017. Figure 3-2 shows the key components of Alternative 2.

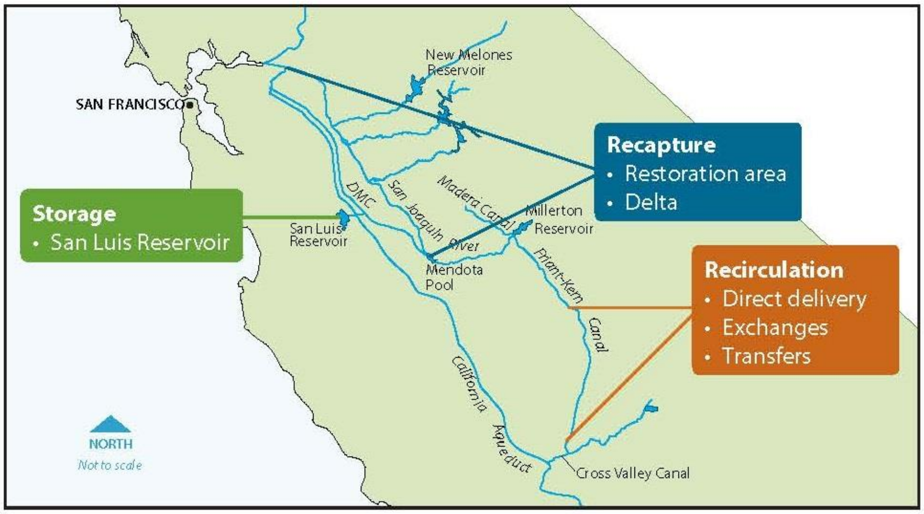

Figure 3-2.
Key Components for Alternative 2: Continue Existing Temporary Recirculation Actions

3.3.1 Recapture

Under Alternative 2, the Restoration Flows would continue to be recaptured in the Delta and the Restoration Area. Recapture would be accomplished in the same way as in Alternative 1, and would recapture the same amount of Restoration Flows.

3.3.2 Recirculation

Recaptured water would be recirculated to Friant Contractors using the actions described in the Recirculation of Recaptured Water Year 2013-2017 EA. Recirculation to the Friant Contractors would be accomplished through direct delivery, exchange, and/or transfer. This could require the exchange and/or transfer of recaptured Restoration Flows among Friant Contractors or non-Friant Contractors.

Alternative 2 would include direct deliveries of recaptured water from San Luis Reservoir to Friant Contractors through existing CVP, SWP, and local facilities. In addition to the direct delivery using the FKC pumpback facilities in Alternative 1, Restoration Flows could be delivered to contractors that have access to the DMC, California Aqueduct, San Luis Canal, and the Cross-Valley Canal (CVC), such as Shafter-Wasco ID or Arvin-Edison WSD.

A key difference between Alternative 1 and Alternative 2 is the inclusion of exchanges and transfers. Exchanges include multiple agencies exchanging one water supply source for another water supply source. Alternative 2 would include exchanges between Friant Contractors and non-Friant Contractors to recirculate water. Friant Contractors would make their recirculation water available in south-of-delta facilities to non-Friant Contractors. In exchange, the non-Friant Contractors would make a local supply of water available to the Friant Contractors. This action could involve a Friant Contractor acting on behalf of several other Friant Contractors to facilitate an exchange into Millerton Lake for integration into the Friant Division's CVP water supply. Alternative 2 includes exchanges that do not require new construction, including the Kings River, Kaweah/Tule River, and Kern River exchanges.

Water transfers involve an agency selling water to another agency (or agencies). Alternative 2 would include transfers of recaptured water among Friant Contractors and/or non-Friant Contractors. The transfers would use existing CVP, SWP, and local facilities. This may require several agreements, but would not include any new construction.

Shafter-Wasco ID. Restoration Flows could be recirculated to Shafter-Wasco ID in exchange for its Class 1 and Class 2 supplies that would otherwise be delivered through the FKC through two options with Semitropic WSD and through the North-Kern WSD. Semitropic WSD is located on the west side of the San Joaquin Valley with a turnout on the California Aqueduct. Recirculated Restoration Flows could be delivered to Shafter-Wasco ID through several interties with Semitropic WSD. In their north system these include the existing 50 cfs Semitropic WSD/Shafter-Wasco ID intertie and a new 32 cfs Kimberlina Road intertie (these interties would also support a 100 cfs flow from Shafter-Wasco ID west to Semitropic WSD). Through their south system, deliveries could occur through a new 50 cfs Madera Avenue Intertie. Both of these new interties were studied through the Investment Strategy. Recirculated Restoration Flows could also be delivered to Shafter Wasco ID through the Calloway Canal. The Calloway Canal was recently connected to the CVC Extension and extends through North-Kern WSD to the eastern boundary of Shafter Wasco ID. Both configurations of this option are graphically illustrated in Figure 3-3.

Arvin-Edison WSD. Restoration Flows could be recirculated to Arvin-Edison WSD in exchange for its Class 1 and/or Class 2 supplies that would otherwise be delivered through the FKC. Arvin-Edison WSD is situated in Kern County at the southern end of the San Joaquin Valley. The Arvin-Edison WSD diverts a majority of its water near the terminus of the FKC into its 13-mile intake canal and terminates at the Forrest Frick Pumping Plant (FFPP). The FFPP pumps water into the Arvin-Edison WSD north canal where it can then gravity-flow through the Arvin-Edison WSD north and south canals. The Arvin-Edison WSD also diverts water via the 4.5 mile, bi-directional, intertie pipeline from the California Aqueduct to the Arvin-Edison WSD south canal at a rate of 125 cfs, and pumps from the Arvin-Edison WSD south canal to the California Aqueduct at a rate of 175 cfs via an 84-inch diameter reinforced concrete pipe (RCP) with a 78-inch steel liner. Under Alternative 2, Arvin-Edison WSD could receive Recirculated

Restoration Flows from the California Aqueduct using available capacity in the south canal (as shown in Figure 3-3).

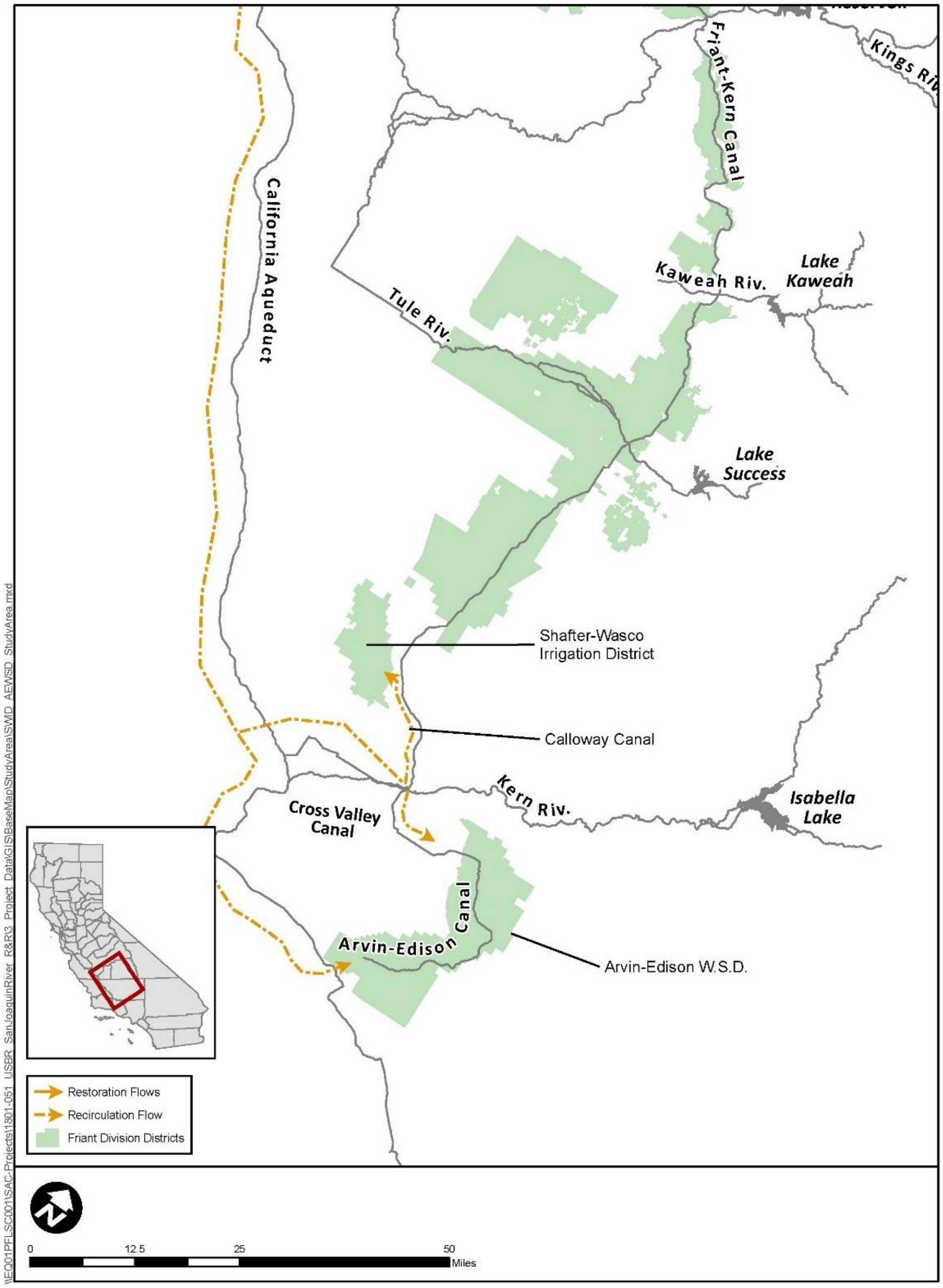

Figure 3-3.
Potential Direct Delivery Recirculation Options

Kings River Exchange. A water supply exchange could be made between districts that receive water from the Kings River and also have access to recirculated Restoration Flows from the California Aqueduct or from the southern end of the DMC at the Mendota Pool, to other districts with Kings River supplies. This exchange could be executed by the Tulare Lake Basin WSD, which receives water from both the SWP and the Kings River. It could also apply to the James ID and Tranquility ID, which have Kings River supplies and receive CVP water from the DMC at the Mendota Pool. Recirculated Restoration Flows could be delivered to these agencies through existing facilities connected to the SWP or CVP in exchange for their Kings River supplies stored in Pine Flat Reservoir. The Fresno ID and the City of Fresno could access these exchanged supplies in Pine Flat Reservoir as in-basin exchanges. Exchanges could be made with out of basin Friant Contractors through the Gould Canal intertie to the FKC. The Kings River Exchange is illustrated in Figure 3-4.

Kaweah and Tule River Exchange. The Tulare Lake Basin WSD is located on the west-side of the San Joaquin Valley with a turnout on the California Aqueduct for SWP contract water. The District also has water supplies originating from the Kaweah and Tule rivers (Tulare Lake Basin WSD also has Kings River supplies that could be exchanged as discussed above in the Kings River Exchange). Under this option, the Tulare Lake Basin WSD would exchange Kaweah and/or Tule river water for recirculated Restoration Flows conveyed through the California Aqueduct utilizing existing infrastructure. The water would be exchanged with Friant Contractors capable of receiving flows from the Kaweah and Tule rivers. These Friant Contractors include Tulare ID, Kaweah Delta Water Conservation District, Lindsay-Strathmore ID, and Ivanhoe ID for Kaweah River water and Lower Tule River ID and Porterville ID for Tule River water. Figure 3-5 graphically illustrates this exchange option.

Kern River Exchange. Recaptured Restoration Flows could be delivered to Kern River water users including North Kern WSD, Kern-Delta WD, Buena Vista WSD, Rosedale Rio-Bravo WSD, Improvement District No. 4, and Cawelo WD utilizing existing facilities. Recirculated Restoration Flows would be delivered via the California Aqueduct and the CVC in exchange for Kern River supplies delivered to Friant or CVC districts that also have access to Kern River water. These districts include Arvin-Edison WSD, Shafter-Wasco ID, and Kern Tulare WD. Exchanges between Kern River water users and Friant Contractors are graphically illustrated in Figure 3-6.

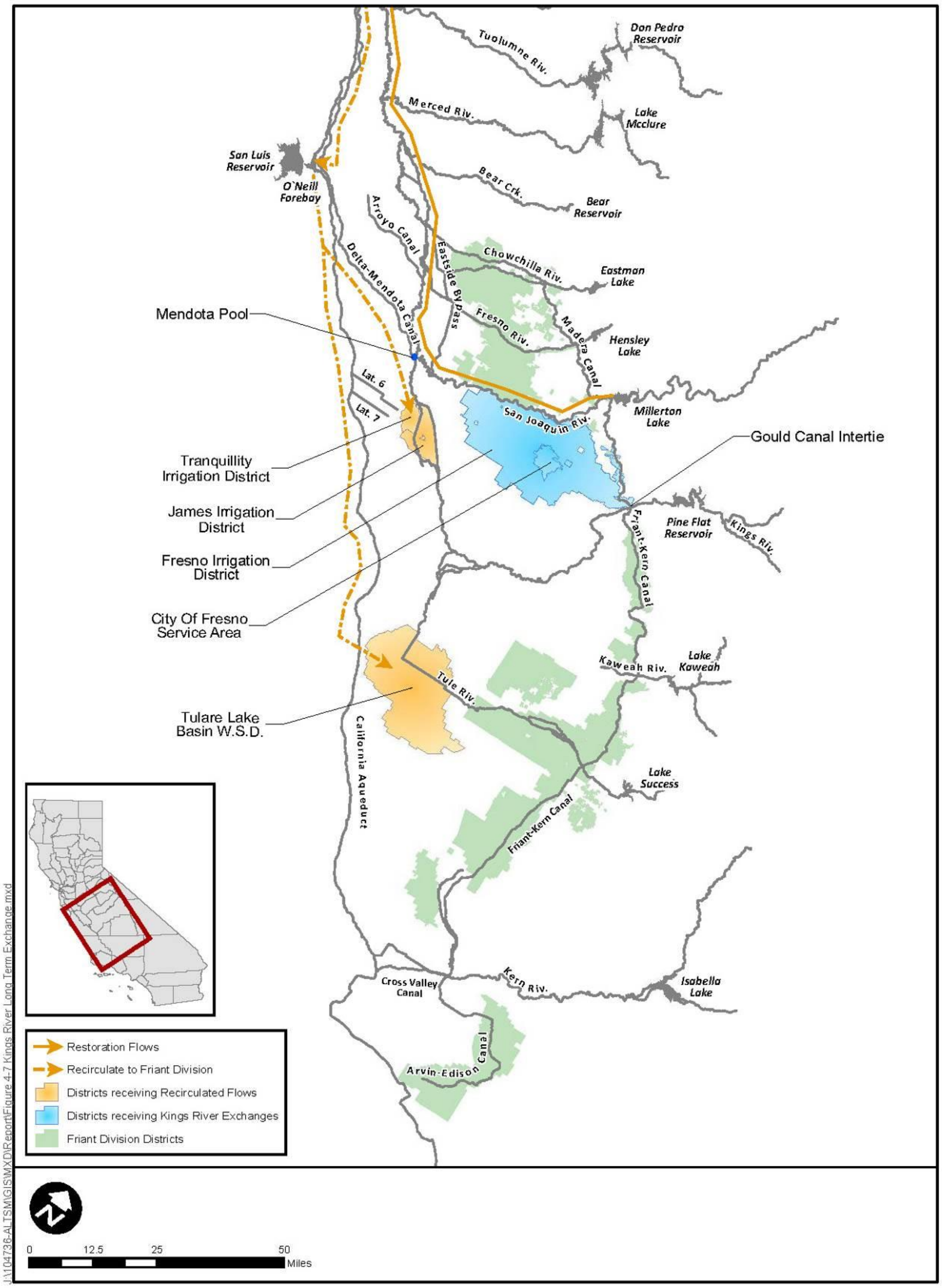

Figure 3-4.
Kings River Exchange

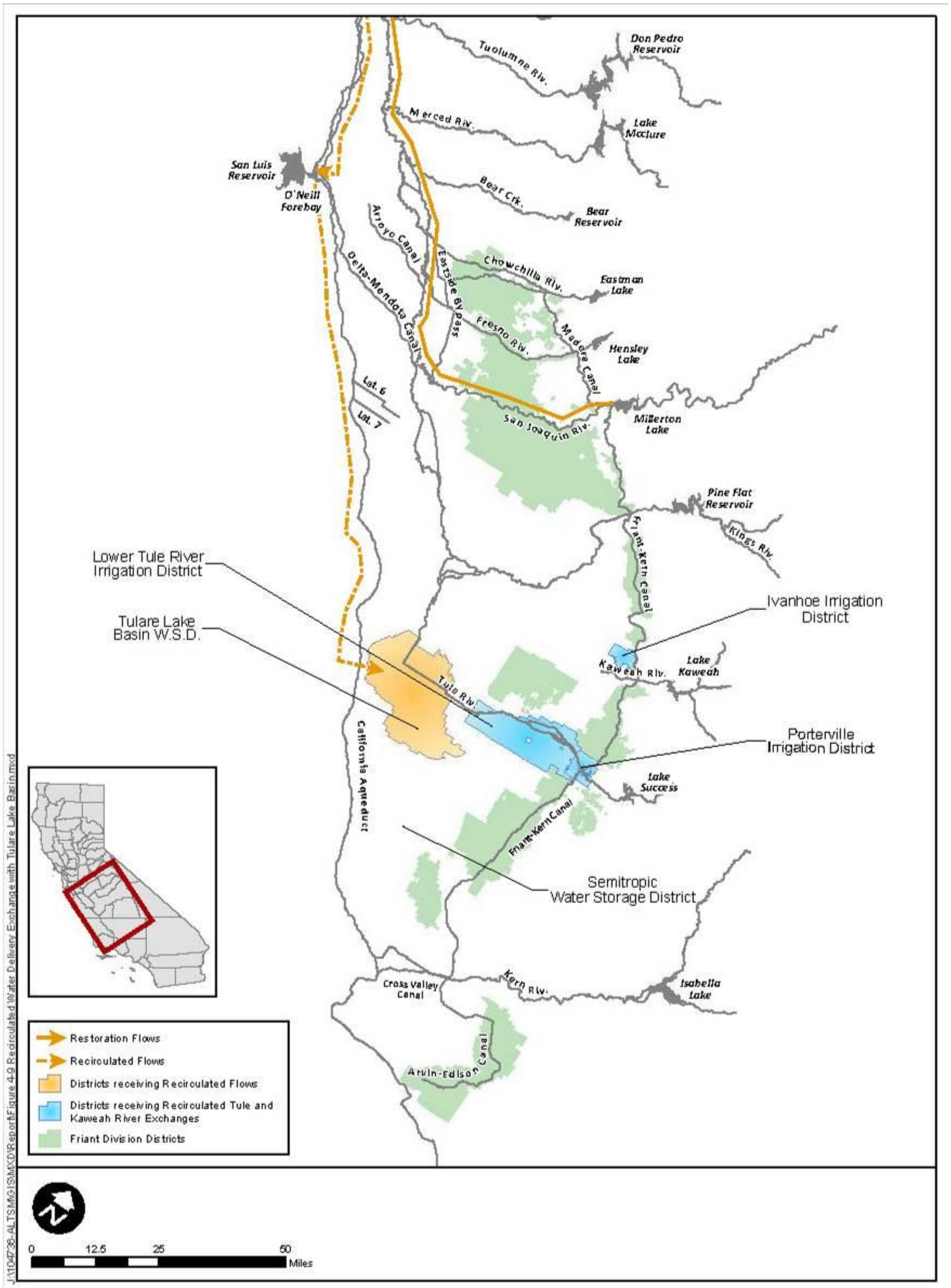

Figure 3-5.
Kaweah and Tule River Exchange

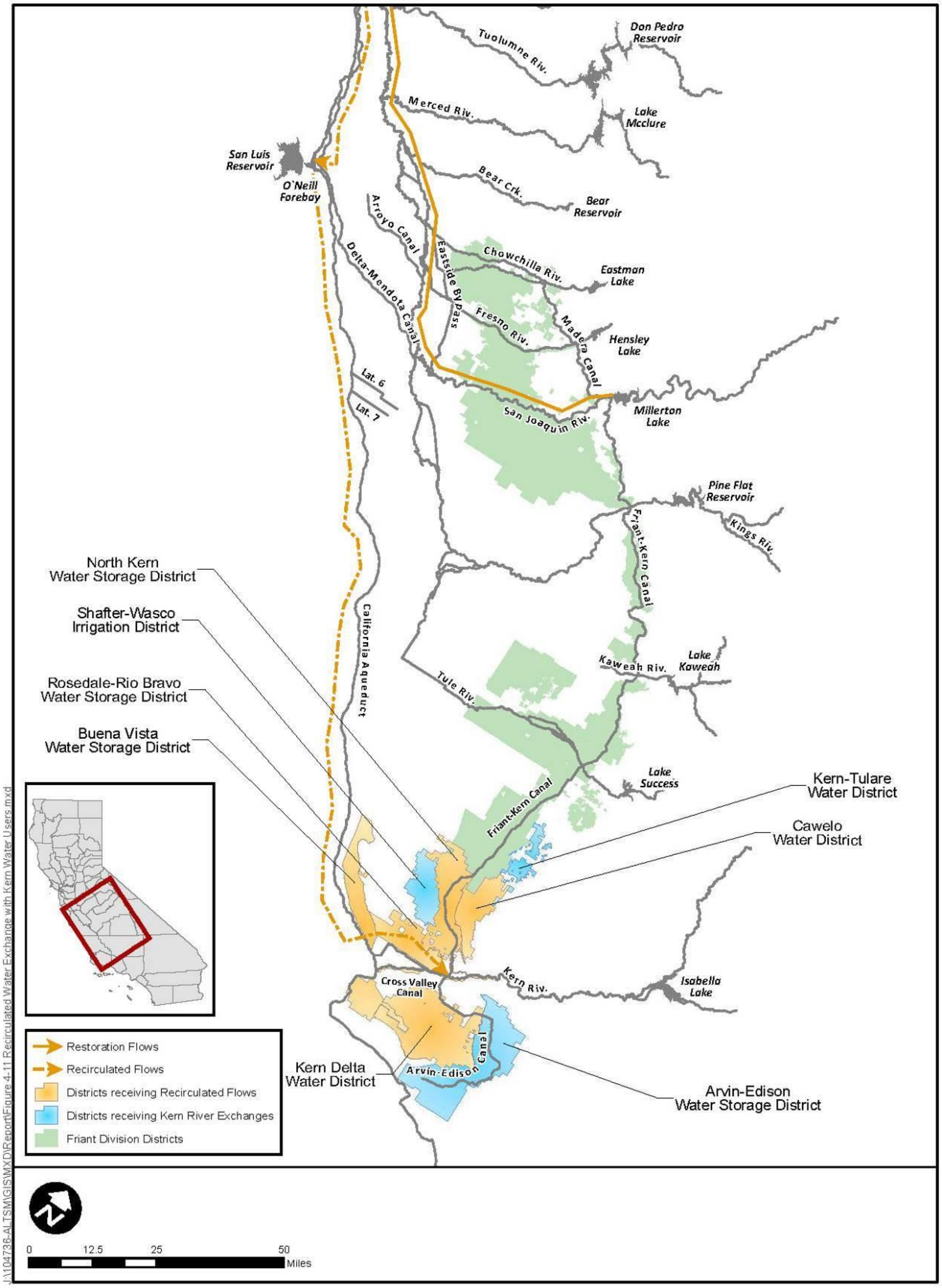

Figure 3-6.
Kern River Exchange

One potential configuration of an exchange between Buena Vista WSD, Arvin-Edison WSD, and Kern Tulare WD would provide Kern River water in wetter years to Arvin-Edison WSD and Kern Tulare WD in exchange for recirculated Restoration Flows delivered to Buena Vista WSD in dryer years.

Transfers to CVP or SWP Users. Friant Contractors could transfer recaptured Restoration Flows to CVP or SWP users that receive Delta exports from the DMC or California Aqueduct. Transfers could occur before or after the water is stored in San Luis Reservoir or another facility. This transaction would result in payment to the Friant Contractors.

3.3.3 Storage

Storage in Alternative 2 would be the same as Alternative 1. Recaptured Flows would be stored in the San Luis Reservoir until they could be recirculated to Friant users. The SJRRP would be able to access available capacity in San Luis Reservoir that was unused by the CVP and SWP. If the water was stored in the spring, and the CVP and SWP later had the opportunity to fill that storage, then the recaptured water in storage would "spill" and convert from Restoration Flows to CVP and SWP water.

3.4 Alternative 3 – Maximize Use of Existing Facilities

Alternative 3 would focus on increasing the volume of water recaptured and recirculated by including additional recapture locations. These new options would use existing facilities and would not involve new or expanded facilities. Figure 3-7 shows the key components of Alternative 3.

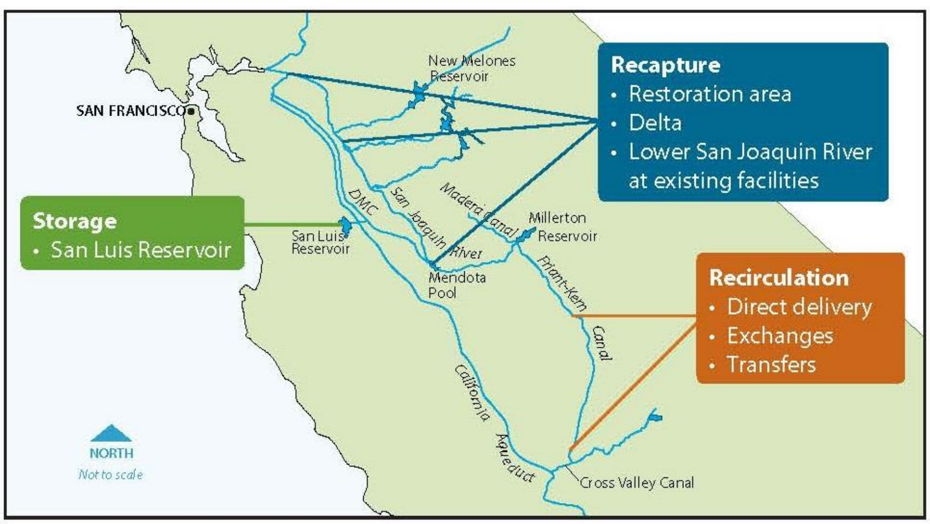

Figure 3-7.
Key Components for Alternative 3: Maximize Use of Existing Facilities

3.4.1 Recapture

Under Alternative 3, recapture would continue in the Delta and the Restoration Area, as described for Alternatives 1 and 2. In addition, water could be recaptured from the San Joaquin River using local diversion facilities at Banta-Carbona ID, Patterson ID, and West Stanislaus ID (Figure 3-8). These three districts divert water from the San Joaquin River and also have CVP contracts for water delivery from the DMC. For all three districts, Restoration Flows would be recaptured at the existing facilities and moved through district conveyance facilities to the DMC.

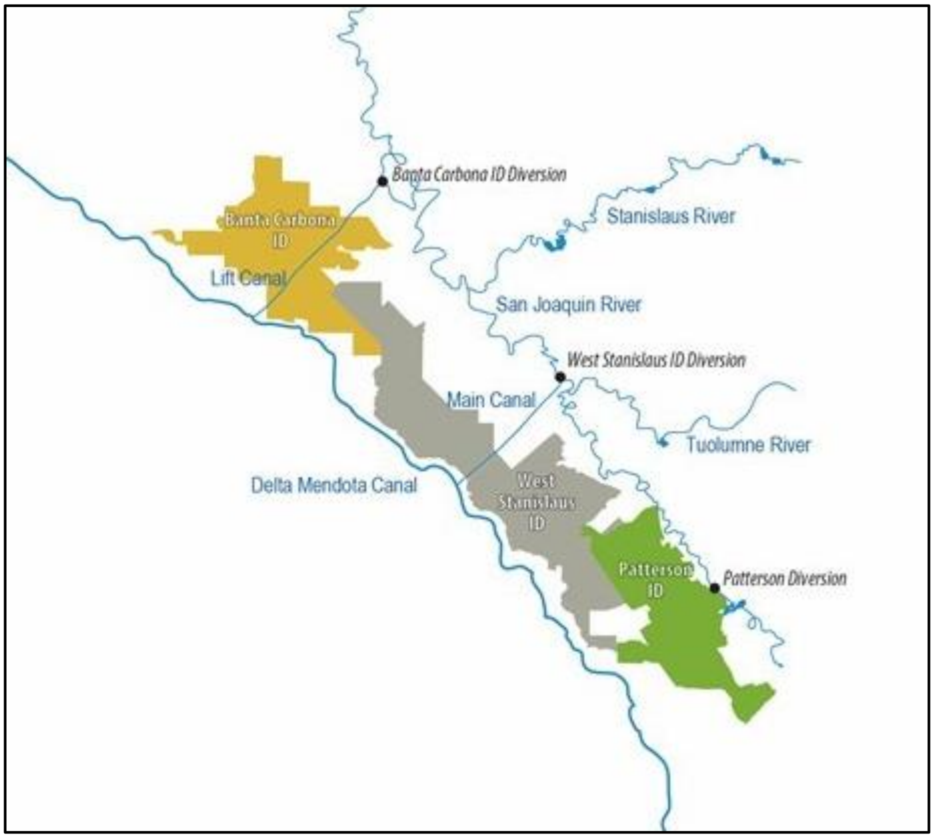

Figure 3-8.
Diversion Points for Banta-Carbona ID, West Stanislaus ID, and Patterson ID

Banta-Carbona ID. The Banta-Carbona ID diverts a majority of its water from the San Joaquin River into the Banta-Carbona Lift Canal. Banta-Carbona ID’s fish screen is currently rated at 250 cfs for smelt, and 400 cfs for salmon/steelhead. The existing system is a series of six pump stations that boost water into open channel sections before terminating at the DMC via a Banta-Carbona Pipeline. Banta-Carbona ID has a Pumping Plant 5A that is currently equipped for 120 cfs with additional bays for future expansion.

Patterson ID. The Patterson ID diverts water from the San Joaquin River into its conveyance system consisting of approximately 4 miles of unlined canals, 52 miles of lined canals, and 86 miles of pipelines. Currently, Patterson ID’s diversion capacity of 195 cfs is limited to 35 cfs once the water reaches the DMC, thus limiting water transfers.

The existing system is divided into 5 reaches and 6 pumping plants. Reach 1 is a concrete-lined channel with a capacity of 175 cfs from the fish screen at Pumping Plant 1 to Pumping Plant 2. Reach 2 is an open channel canal with a capacity of 155 cfs from Pumping Plant 2 to Pumping Plant 3. Reaches 3, 4, and 5 are also open channel canals with Pumping Plants 3, 4, and 5 having capacities of 95, 75, and 90 cfs, respectively. Pumping Plant 6 provides a 35 cfs capacity to the DMC through a 36-inch diameter pipeline. Figure 3-9 illustrates the existing conditions.

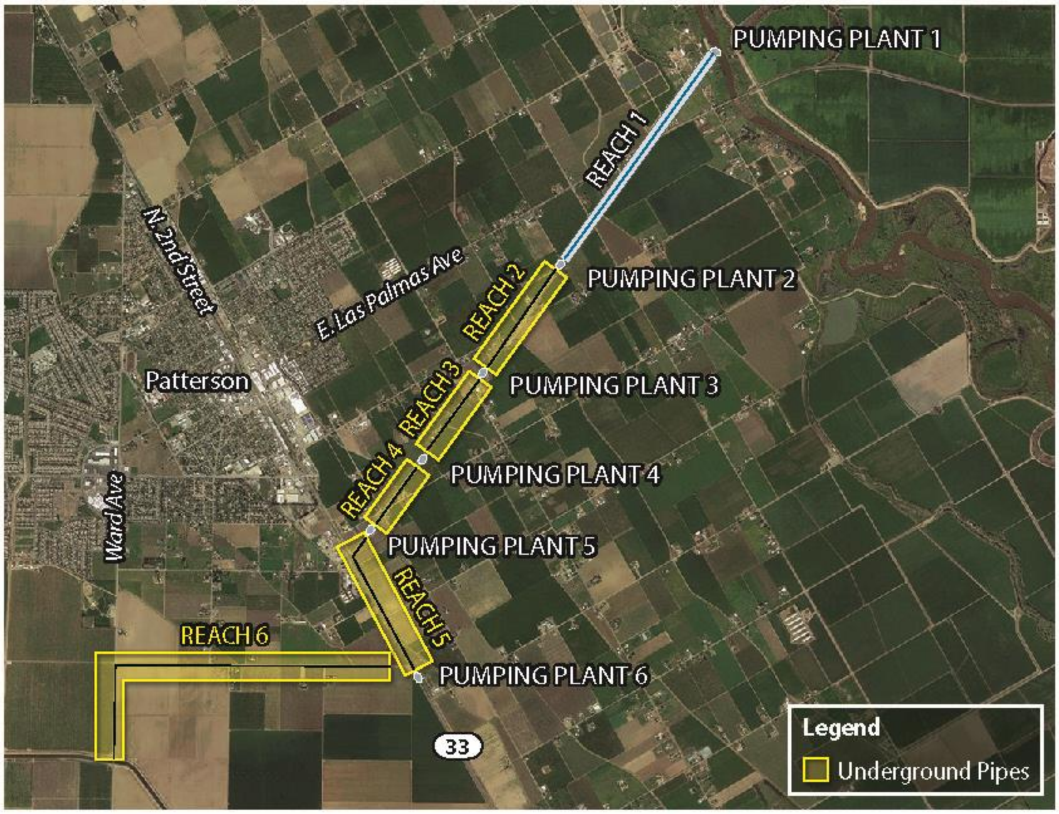

Figure 3-9.
Existing Reaches for Patterson ID

West Stanislaus ID. The West Stanislaus ID diverts water from the San Joaquin River into the West Stanislaus ID Main Canal. West Stanislaus ID's current diversion capacity of 350 cfs does not extend all the way to the DMC, thus limiting its ability for water transfers. There is no fish screen at the San Joaquin River; however, one is in design with a capacity of 350 cfs. Currently, the connection for the DMC can convey 250 cfs. The existing system conditions include the recently constructed 96-inch pipe at Pump Station 1A with a capacity of 350 cfs, which replaced previous Pump Stations 1 and 2. Pump Station 5A was also reconstructed as a 96-inch pipe with a capacity of 250 cfs to the DMC. Pump Stations 3 and 4 currently lift water from open channel to open channel and are to be replaced with Pump Station 3A with a capacity of 310 cfs. Pump Stations 1A and 5A are relatively new and Pump Station 3A is currently under design by the district at 310 cfs.

This alternative does not include any additional developments to these facilities to increase capacity, but it does assume completion of facilities currently in progress and the new fish screen that West Stanislaus ID is planning independently. If West Stanislaus ID does not construct a fish screen at its diversion facility, the facility would not be used to divert Restoration Flows in Alternative 3. Table 3-2 shows the estimated capacity at each facility that may be available to recapture Restoration Flow, by month. These estimates were provided by the districts, and are rough estimates that show available capacity after in-district demands are met. Diversion at these facilities would increase the potential to recapture Restoration Flows compared to Alternatives 1 and 2.

Table 3-2. Estimated Available Capacity to Recapture Restoration Flow under Alternative 3 (in cfs)

Month	Patterson ID	West Stanislaus ID	Banta Carbona ID
October	25	120	90
November	35	120	90
December	15	120	90
January	14	120	90
February	16	120	90
March	35	120	60
April	35	60	60
May	35	40	0
June	25	0	0
July	5	0	0
August	10	10	30
September	21	60	70

Notes:
ID: Irrigation District

3.4.2 Recirculation

The SJRRP would continue recirculation of water as described in Alternative 2. Recirculation options would include direct delivery, transfers, or exchanges.

3.4.3 Storage

Alternative 3 would store Restoration Flows in San Luis Reservoir as described in Alternative 1.

3.5 Alternative 4 – Expand Existing Facilities

Alternative 4 would expand existing facilities to increase their ability to recapture or recirculate water. Figure 3-10 shows the key components of Alternative 4. More detailed information on the design of this alternative is included in Appendix A, Attachment 1.

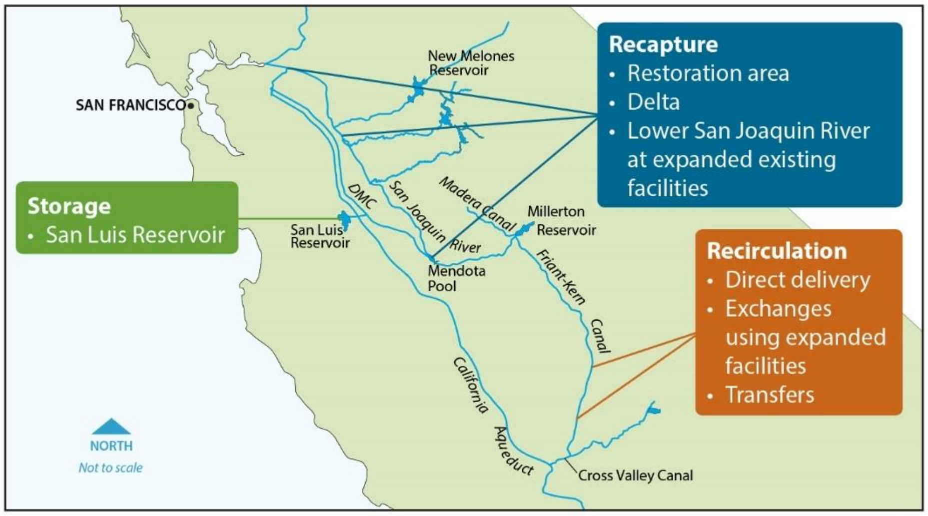

Figure 3-10.
Key Components for Alternative 4: Expand Existing Facilities

3.5.1 Recapture

Under Alternative 4, recapture would continue in the Delta and the Restoration Area, as described in previous alternatives. Additionally, local conveyance facilities would be expanded at Banta-Carbona ID (250 cfs capacity), Patterson ID (195 cfs capacity), and West Stanislaus ID (350 cfs capacity). The constructed expansions would allow additional Restoration Flows to be recaptured and conveyed to the DMC. Modified diversion facilities would increase the amount of Restoration Flows that could be recaptured compared to Alternative 3.

Banta-Carbona ID. This alternative would expand Banta-Carbona ID's conveyance capacity between the San Joaquin River and the DMC. Changes to the Banta-Carbona ID would expand the capacity in 10,400 lineal feet from lift station 4 to the DMC which includes approximately 4,000 feet of canal and 6,500 feet of pipeline. The Banta-Carbona ID currently has a 160-foot right-of-way along their existing facilities, giving them sufficient room to expand their capacity.

The proposed modifications would include the following:

- Replacement of Pumping Plant 4 to be capable of 250 cfs;
- Construction of a bypass around Pumping Plant 4 that would allow for flows to be routed in either direction between the DMC and the San Joaquin River;
- Addition of pumps to Pumping Plant 5A;
- Construction of control building at Pumping Plant 5A;
- Expansion of electric sub-station at Pumping Plant 4;
- Reconnection of existing turnouts and laterals.

This upgrade would include more than 3,600 cubic yards of canal earthwork, 102,270 square feet of canal lining, the upgrade and rebuilding of 2 pump stations, and installation of less than 1000 linear feet of 72-inch diameter pipe. This option is illustrated in Figure 3-11.

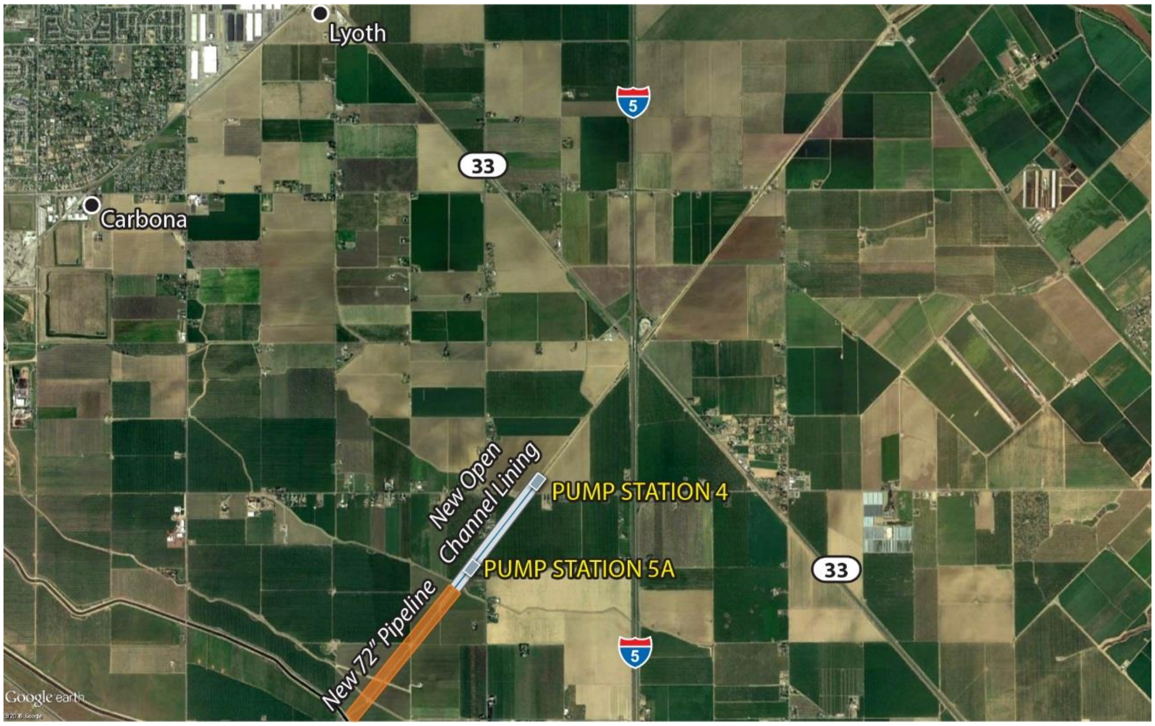

Figure 3-11.
Banta-Carbona ID Expansion

Patterson ID. Patterson ID has previously considered expanding their capabilities to convey 195 cfs from the San Joaquin River to the DMC and considered 5 alternatives in the Draft East West Conveyance Project Evaluation of Project Alternatives Report that was completed in 2013. Alternative B1 was selected from the report and is described below.

The expansion of the Patterson ID includes the following revisions to the existing conditions:

- Reach 1: Replace and refurbish the canal lining and appurtenances in Reach 1 with sufficient freeboard to accommodate 195 cfs;
- Reaches 2 and 3: Combine Reaches 2 and 3 and eliminate Pumping Plant 3 and increase the capacity of Pumping Plant 2 to 196 cfs. Install an 84-inch diameter rubber-gasketed reinforced concrete pipe (RGRCP) to replace the open-channel canal of Reach 2 to empty into Reach 3 which is a rebuilt, open-channel, concrete-lined canal with an increased capacity of 195 cfs;

- Reaches 4 and 5: Combine Reach 4 and the initial (approximate) 500 feet of Reach 5 and eliminate Pumping Plant 5 and increase the capacity of Pumping Plant 4 to 195 cfs. Install an 84-inch diameter RGRCP to replace the open-channel canal of Reach 4 to empty into Reach 5 which is a rebuilt, open-channel, concrete-lined canal with an increased capacity of 195 cfs;
- New DMC Connection: Create a turnout from Reach 5 to convey 160 cfs through a 72-inch diameter RGRCP to a new DMC pumping plant. The turnout would tunnel under the Union Pacific Railroad and Highway 33;

The combination of the new DMC section of pipeline and the existing 36-inch diameter pipeline from Pumping Plant 6 would convey a total flow of 195 cfs to the DMC.

Quantitatively, the expansion of Patterson ID's system amounts to the installation of 10 new pumps, approximately 70,000 cubic yards of canal earthwork, 355,000 square feet of canal lining, 6,400 linear feet of 84-inch diameter pipe, and more than 11,125 feet of 72-inch diameter pipe, including a jack and bore operation underneath the Union Pacific Railroad. There are multiple turnout replacements or upgrades and several road crossings. Figure 3-12 and Figure 3-13 illustrate the existing conditions and proposed expansions, respectively.

West Stanislaus ID. The expansion of West Stanislaus ID's lift and conveyance capacities would allow the district to convey 250 cfs between the San Joaquin River and the DMC.

The design would modify existing conditions by:

- Constructing Pump Station 3A to bypass Pump Stations 3 and 4 with a 108-inch diameter pipeline;
- Reconnecting existing turnouts and laterals to the new 96-inch diameter pipeline;
- Constructing a bypass around the pump stations that would allow flows to be routed in either direction;

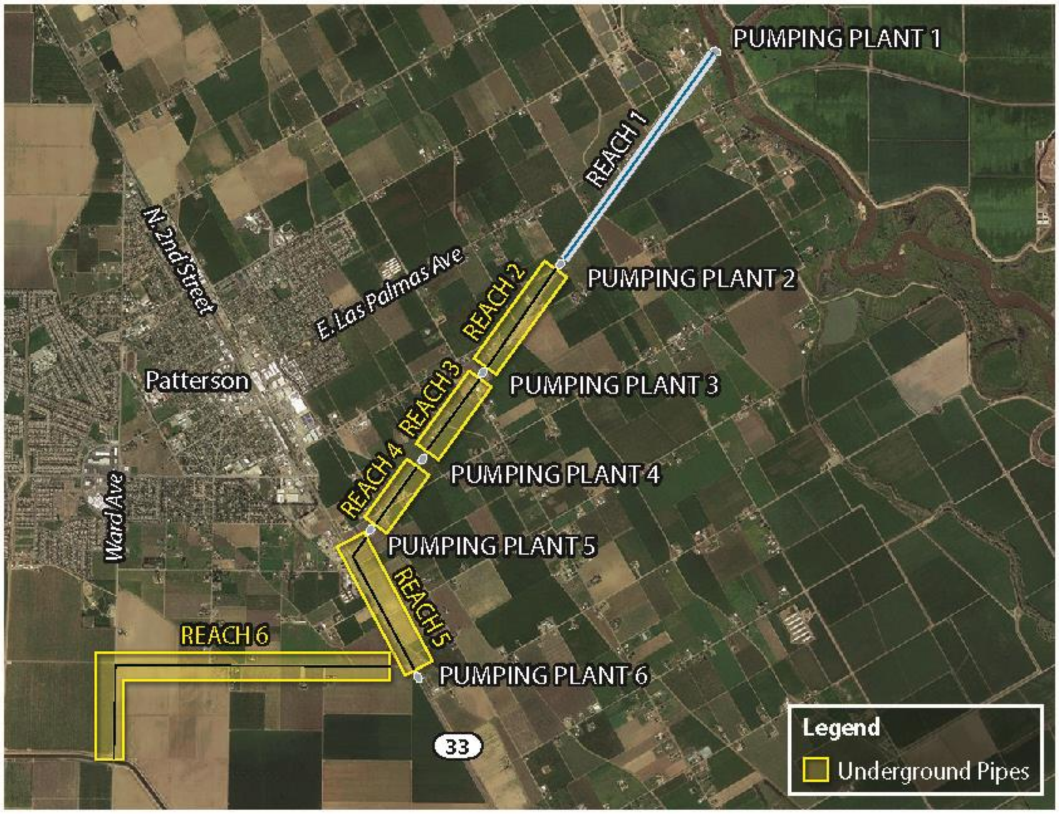

Figure 3-12.
Patterson ID Existing Conditions

Figure 3-13.
Patterson ID Expansion

The significant cost drivers of this alternative are the installation of Pump Station 3A, the upgrade of several turnouts, and installation of more than 3,195 linear feet of 108-inch diameter pipe, including the jack and bore operation under the Union Pacific Railroad. Figure 3-14 illustrates the proposed expansion.

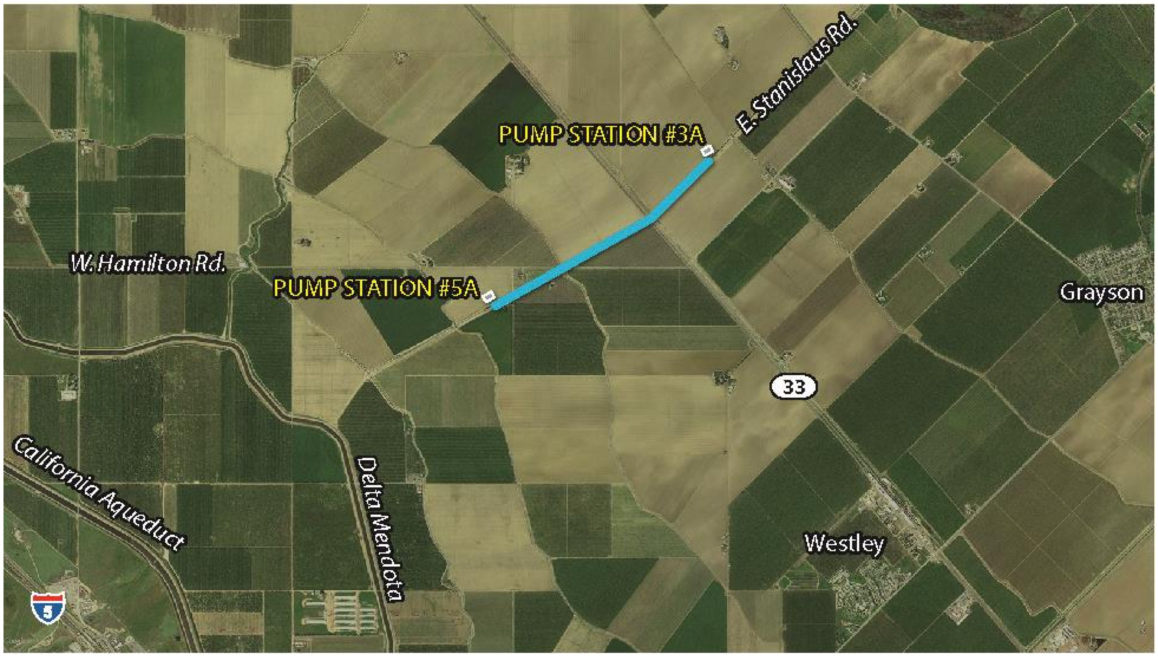

Figure 3-14.
West Stanislaus Proposed Expansion

Table 3-3 shows the estimated available capacity after the improvements in Alternative 4 to recapture Restoration Flows.

Table 3-3. Estimated Capacity to Recapture Restoration Flow under Alternative 4 (in cfs)

Month	Patterson ID	West Stanislaus ID	Banta Carbona ID
October	45	180	150
November	58	220	180
December	35	230	180
January	34	230	180
February	36	210	180
March	58	190	100
April	119	160	70
May	102	120	0
June	45	40	0
July	25	0	0
August	30	0	55
September	41	120	100

Notes:
ID: Irrigation District

3.5.2 Recirculation

The SJRRP would continue recirculating recaptured Restoration Flows as described in Alternatives 2 and 3. In addition, Alternative 4 would include exchanges that require new facilities, such as expansions to Arvin-Edison WSD facilities.

Arvin-Edison WSD. In addition to the exchanges with Arvin-Edison WSD included in Alternatives 2 and 3, Alternative 4 would include expanded facilities to allow increased delivery of Recaptured Restoration Flows. This expansion would increase the flow capacity of the current gravity-fed intertie pipeline from the California Aqueduct to the Arvin-Edison WSD south canal from 125 cfs to 175 cfs with the installation of a booster plant. The benefit of the booster plant on the intertie pipeline is to have additional capacity to deliver recaptured water to the Mettler Unit (land between Interstate 5 and Highway 99) to meet its demands in-lieu of using CVP supplies or groundwater. There is also the potential to increase flexibility for the Arvin-Edison WSD distribution system and deliver water to other systems within the district at times when there is capacity through the pump-back pumps. According to Arvin-Edison WSD, recaptured water delivered into the district through the intertie pipeline between March and August would typically be used for in-lieu recharge, while water delivered between September and February would typically be used for recharge. The intertie pipeline crosses various county roads, Interstate 5, and Highway 99. The work area is located where land-field crops are planted.

The proposed booster plant would include (values approximate):

- The installation of three 48-inch diameter low lift, high volume pumps (can pumps);
  - Two 90 cfs pumps, with 500 horsepower (hp) and a total dynamic head of 20 feet.
  - One 90 cfs pump, with 500 hp, a total dynamic head of 20 feet, and with variable speed drive. This pump would be used as a redundancy (extra pump) and would also have the ability to vary the flow.
- A pipeline manifold;
- An ultra-sonic flow meter;
- Isolation and check valves;
- A surge relief system;
- The acquisition of a 1-acre plant site with security fencing and base rock surfacing;
- The acquisition of an access easement to the site;
- An electrical system;
- A SCADA system.

3.5.3 Storage

Alternative 4 would store Restoration Flows in San Luis Reservoir as described in Alternative 1.

3.5.4 Construction

Banta-Carbona ID

Methods. The Banta-Carbona ID canal and pipeline work would be divided into 2 reaches and all reaches would be worked on simultaneously. Beginning with the demolition of Pumping Plant 4, construction would move to pipe and canal earthwork then concrete lining. The next step would be to reconstruct the pumping plant structures, install the pumps and motors, run the electrical work, and install the SCADA systems.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 122,000 cubic yards of material to local landfills (6,135 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-15 includes the projected schedule for the Banta-Carbona ID upgrade. The construction has an anticipated timeline of approximately nine months. The construction would be timed to avoid affecting the existing water users that depend on the distribution system. The maximum expected personnel on site in this schedule is: 1 earthwork crew (1 foreman, 2 operators, 2 laborers), 1 concrete crew (1 foreman, 3 laborers), 1 electrical crew (1 foreman, 2 journeymen), 1 structure/vertical crew (1 foreman, 4 laborers), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total of 19 - 20 staff on site at any one time. Work would be performed 8 hours per day, 5 days per week.

Patterson ID

Methods. This portion of the expansion is divided into 7 sections: five reaches, a section from Highway 33 to the DMC, and the drainage system installation. The work would begin with clearing and grubbing at the outfall of the highway/DMC section, followed by the demolition of Pumping Plant 5, working up to Pumping Plant 1, while pipe laying and canal lining are done in tandem between pumping plants. The bulk of the work would take place between January and April where jack and bore operations, excavation, canal earthwork, pipe laying, and canal concrete lining would be the primary activities.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 94,400 cubic yards of material to local landfills (4,720 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-15 includes the projected schedule for the Patterson ID upgrade. The construction has an anticipated timeline of 13 months. The longest expected portion of the project would be the pipe installation from Highway 33 to the DMC and the installation of the 18-inch drain line which could each take approximately 112 days. The maximum expected number of personnel on site for this project, using this schedule is estimated to be: 1 earthwork crew (1 foreman, 2 operators, 2 laborers), 1 pipe crew (1 foreman, 1 operator, 2 laborers), 1 structure/vertical crew (1 foreman, 4 laborers), 1 concrete crews (1 foreman, 3 laborers), 1 electrical crew (1 foreman, 2 journeymen), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total maximum of 23-24 people.

West Stanislaus ID

Methods. The West Stanislaus improvements in Reach 3 would begin with utility relocation to support the installation of a service road to support pipe installation. Structural work would then begin for Pump Station 3, and when complete, electrical and SCADA installations would occur.

Equipment, Materials, Spoils, and Safety. Approximately 4 acres of land would need to be leased to stage equipment and stockpile. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 37,800 cubic yards of material to local landfills (1,890 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-15 includes the projected schedule for the West Stanislaus upgrade. The construction has an anticipated timeline of 12 months. Maximum onsite staff estimate is 1 pipe laying crew (1 op, 2 labor, 1 foreman), 1 concrete crew (1 foreman, 3 labor), 1 Jack/Bore crew (1 foreman, 1 op, 3-4 laborers) and Project Staff (1 Superintendent, 1-2 Admin Staff) for a total of 15-17 persons.

Arvin-Edison WSD

Methods. Mobilization for the Arvin-Edison WSD booster plant installation would begin approximately 6 months after receiving the notice to proceed. Erosion and sediment control would be installed prior to the utility relocation, which includes construction power. Once complete, clearing and grubbing, followed by grading of the plant area would begin. The booster plant formwork and reinforcement would begin as the chain link fence and gate are installed. The concrete for the plant would be placed and cured, and the structure construction would begin. Once the structure is complete, installation of the pumps, electoral system, and SCADA system would begin in series.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 9,400 cubic yards of material to local landfills (470 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-15 includes the project schedule for the Arvin-Edison booster plant installation. The construction has an anticipated timeline of 10 months from receiving the Notice-to-Proceed to the final closeout. However, the majority of the work would be done in the last 7 months. Maximum personnel on the project site is likely: 1 concrete crew (1 foreman, 3 laborers), 1 fence installation crew (1 foreman, 2 laborers), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total of 9 to 10 persons on the project site.

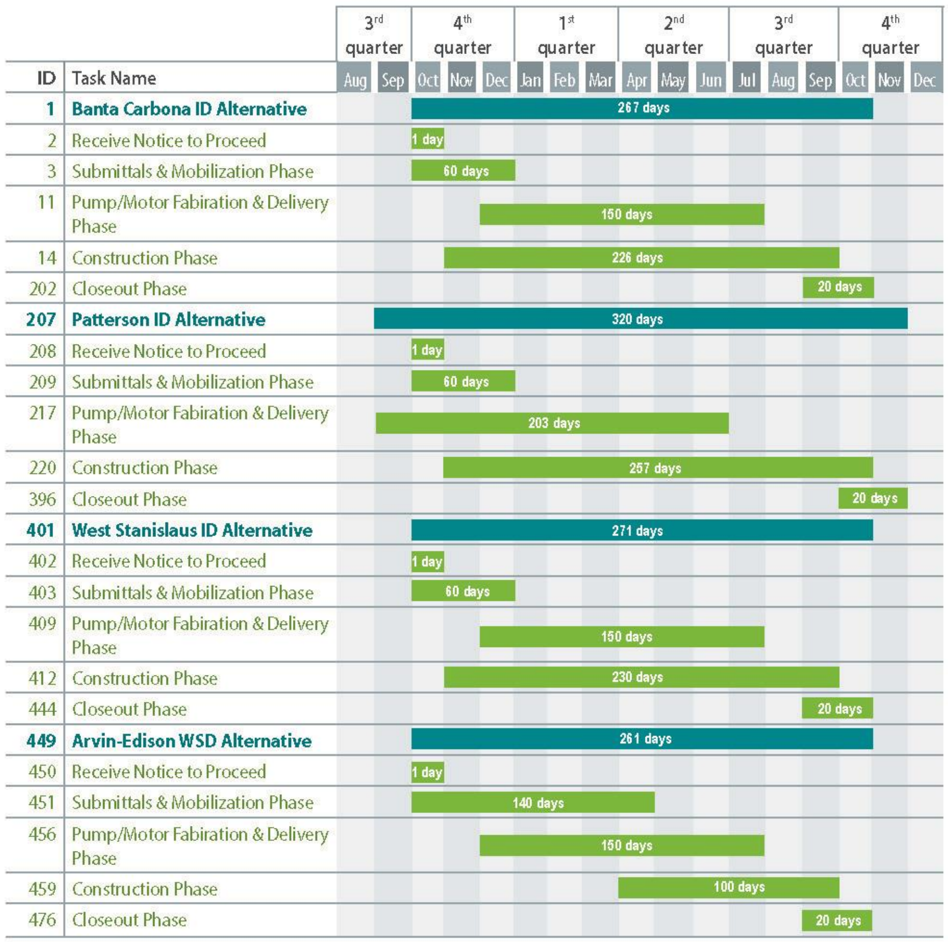

Figure 3-15.
Proposed Construction Schedule for Alternative 4 Expansions.

3.6 Alternative 5 – Construct New Facilities

Alternative 5 would construct a new recapture facility and include maximizing the use of existing facilities as described in Alternative 3, implement the Recirculation plan in Alternative 4, and would store Restoration Flows as described in Alternative 1. Figure 3-16 shows the key components of Alternative 5. More detailed information on the design of this alternative is included in Appendix A, Attachment 1.

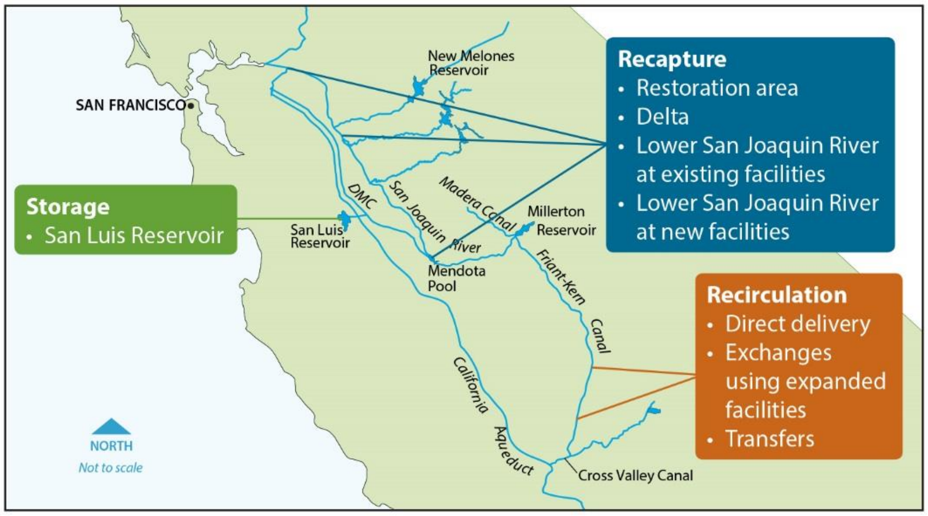

Figure 3-16.
Key Components for Alternative 5: Construct New Facilities

3.6.1 Recapture

The proposed location of the Intake Facility is Site 3-1 from the Initial Alternatives Technical Memorandum. This location was selected during the site visits and documented in the Reconnaissance Visit Memorandum. The intake facility site is located just south of Patterson along the San Joaquin River between Orange Avenue and Fig Avenue. A new diversion facility would be constructed on the San Joaquin River to recapture Restoration Flows with a maximum capacity of 500 cfs from the San Joaquin River to the DMC via three 72-inch steel pipelines. The proposed San Joaquin River Intake Facility consists of approximately 570 linear feet of fish screen, two sedimentation channels with chain and flight sediment collection systems along with submersible sediment pumps, and six 3000 horsepower (hp) vertical turbine pumps each with a variable frequency drive (VFD). The electrical building is located near the intake facility, where the six VFDs are to be housed. The electrical substation would be located near the electrical building, which would transform the incoming voltage to the necessary voltage required to power the vertical turbine pumps. The metering vault is also to be located on the intake site. Each of the 72-inch pipelines would have a flowmeter allowing for continuous flow monitoring of all flows leaving the intake facility.

As the water passes through the fish screens, it enters one of the two sedimentation basin/channels. As the water level rises in the sedimentation basin, the isolation gates close to allow undisturbed settling time. The sedimentation basins allow sediment to settle prior to being pumped to the DMC. After detention, water would flow through the diffuser wall and towards the vertical turbine intake pump. Currently, the intake pump station is designed to have 6 pumps operating when pumping 500 cfs. Each pump has a 42-inch discharge, and each pair of pumps connects to a 72-inch header. There are three pairs of pumps and three 72-inch pipelines that would convey water to the DMC. Surge Protection is provided on the three 72-inch force mains by large hydro pneumatic surge tanks.

The settled solids (sludge) are raked from the bottom of the sedimentation basin by a system of chain and flights. The sludge would be pushed into the solids collection trench. The solids collection trench is sloped to one end where pump(s) would send the sludge to the siltation basins for further settling. The siltation basins allow the sludge to be further settled and settled water can be set back to the San Joaquin River. The settled solids can be cleaned out of the basin and disposed of. The design includes three basins: one active, one being cleaned, and one standby.

The initial pipeline alignment is routed from the intake facility site to the DMC via Almond Avenue and Elfers Avenue to the DMC. To provide maximum reliability and flexibility while minimizing the required trench width, it is recommended to use three 72-inch diameter pipelines. The preliminary material is welded steel pipe (WSP). Welded steel pipe was chosen because there are multiple manufacturers of steel pipe that would compete with each other to help drive down costs. Steel pipe can also be readily configured into a pre-purchase alternative if so desired when all economic and schedule impacts have been fully evaluated.

At the discharge location, there is a transition structure with a weir to break the pressure head of the pipelines and allow the water to flow freely into the DMC with minimal scouring. The transition structure has been preliminarily sized with a weir length of 65 feet to provide a maximum velocity of 5 feet per second (fps) for the water flowing into the DMC. Figures 3-17 and 3-18 illustrate this alternative.

3.6.2 Recirculation

Alternative 5 would incorporate the same Recirculation plan as described in Alternative 4.

3.6.3 Storage

Alternative 5 would store Restoration Flows in San Luis Reservoir as described in Alternative 1.

Figure 3-17.
Alternative 5 Aerial Map

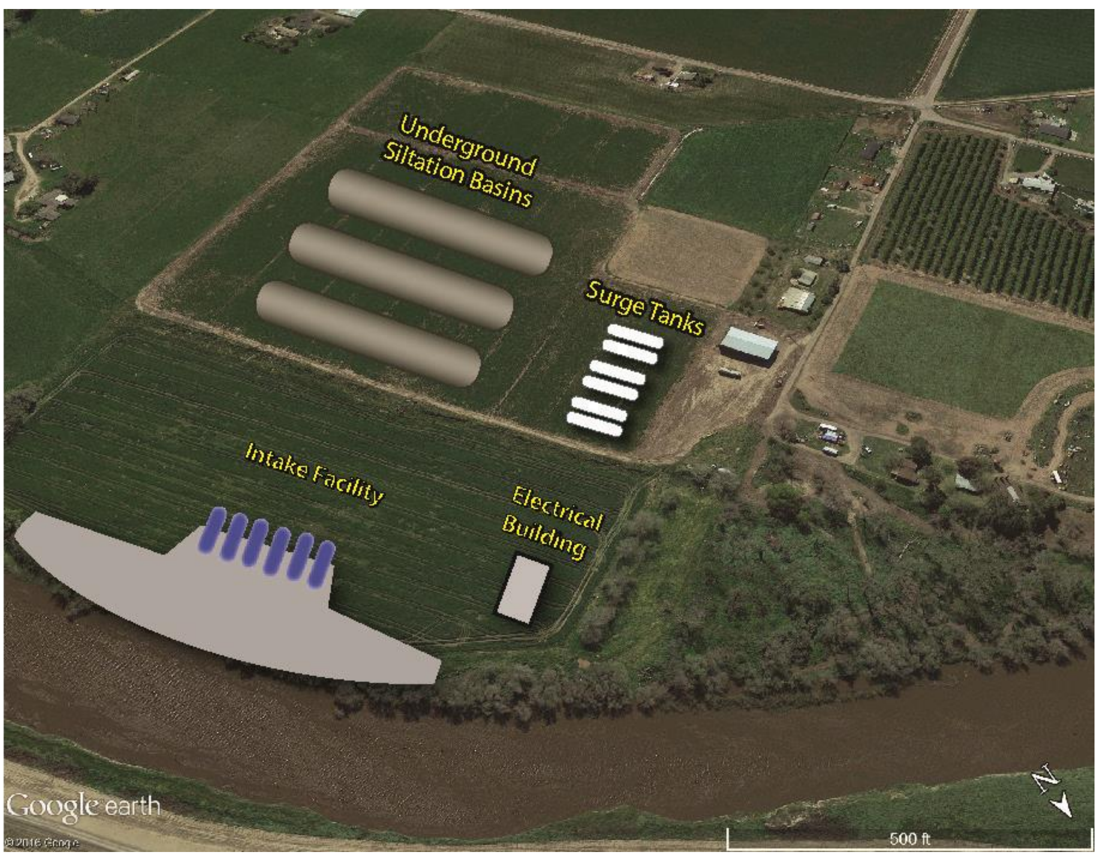

Figure 3-18.
Alternative 5 Intake Facility

3.6.4 Construction

Methods. The following is a brief description of the sequential major construction activities that might be associated with the construction of the land-side intake facilities:

1. Clear and grub construction staging area; install erosion control measures.
2. Mobilize construction equipment and materials.
3. Begin staged construction of setback levee.
4. Prepare levee foundation/make necessary ground improvements.
5. Install settlement and slope monitoring instrumentation.
6. Complete staged construction of setback levee and drain system.
7. Construct sheet pile wing walls.
8. Construct temporary sheet pile cofferdam on water side of levee.
9. Excavate for intake structure.
10. Install levee protection riprap.
11. Dewater levee side of cofferdam.
12. Place steel reinforcement and pour concrete foundation.
13. Form intake structure walls and place reinforcing steel.
14. Pour concrete for structure walls.
15. Continue forming and pouring structural elements/install structural steel.
16. Install piping and mechanical equipment (e.g., screens, louvers, pumps, wash pipes).
17. Install electrical and control equipment.
18. Remove cofferdam.
19. Complete finish work.
20. Testing.
21. Complete land-side facilities (surge facilities, support building final grading and paving, fencing).
22. Demobilization (O&M Manual preparation, review, and submittal; As-Built preparation, review, and submittal; Punchlist; Contractor releases).

Equipment, Materials, Spoils, and Safety. Construction equipment would include rear dump 18-wheel trucks, track type tractors, excavators, a wheel loader, a grader, backhoes, a compactor, scrapers, and a crawler crane. Most of the traffic would come from arrival of construction workers, materials, and equipment. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 491,078 cubic yards of material to local landfills (24,555 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. The proposed construction is anticipated to be completed within three years of receiving the Notice to Proceed. Work would be conducted during daylight hours, Monday through Friday, excluding holidays with a maximum number of 53 personnel on site per day.

Figure 3-19 shows the proposed construction schedule for the new recapture facility in Alternative 5.

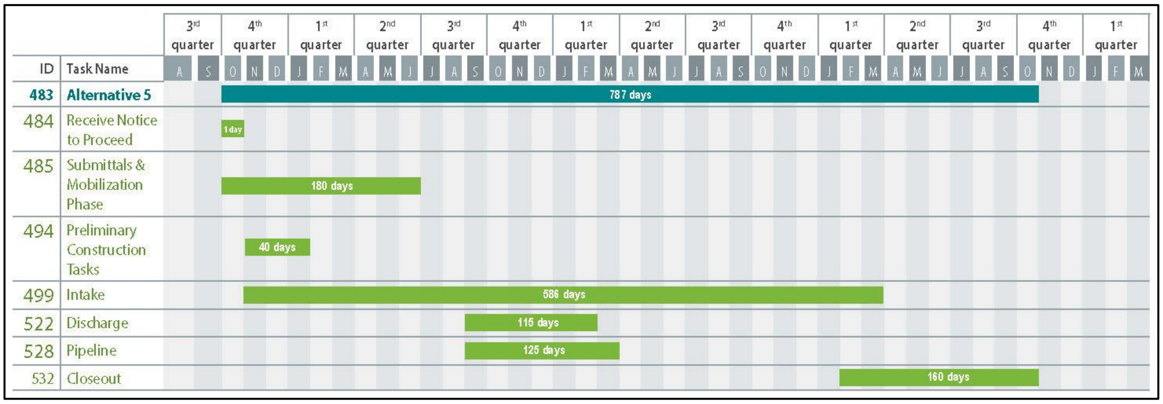

Figure 3-19.
Proposed Construction Schedule for Alternative 5.

3.7 Summary of Alternatives

Table 3-4 shows a summary of the five alternatives moving forward for further analysis in the EIS/R.

Table 3-4.
Summary of Alternatives Carried Forward

	Alternative 1: No Action	Alternative 2: Continue Existing Temporary Actions	Alternative 3: Maximize Use of Existing Facilities	Alternative 4: Expand Existing Facilities	Alternative 5: Construct New Facilities
Recapture	Delta Diversions Recapture within the Restoration Area	Alternative 1	Alternative 1 + Existing Banta-Carbona ID, West Stanislaus ID, Patterson ID	Alternative 1 + Expanded Banta-Carbona ID, West Stanislaus ID, Patterson ID	Alternative 3 + New Intake Facility
Recirculation	FKC Pumpback	Alternative 1 + FKC Exchanges with Existing Infrastructure (Kings River, Kaweah/Tule River, Kern River, Shafter Wasco ID, Arvin Edison WSD) Transfers	Alternative 2	Alternative 3 + Arvin Edison Expanded Direct Delivery & Exchange	Alternative 4
Storage	Storage in San Luis	Alternative 1	Alternative 1	Alternative 1	Alternative 1

Notes:
FKC – Friant-Kern Canal
ID – Irrigation District
WD – Water District

4.0 Alternatives Considered and Eliminated from Further Evaluation

The alternatives formulation process included several steps where options or alternatives were evaluated and screened. This section describes the options and alternatives that will not be further considered in the EIS/R, and the reasons for their elimination.

4.1 Initial Options Eliminated from Further Consideration

The Initial Alternatives TM (SJRRP 2016) described multiple options for the LTRRRF, and screened those options based on ability to meet the purpose and need for the proposed action, technical feasibility, and cost. The full list of options is shown in Table 2-2. Table 4-1 shows the options that were considered but will not be evaluated further, and the reasons that the options were not retained.

Table 4-1. Initial Options Eliminated from Further Consideration

Option	Reasons that Option was Not Retained
Recapture	
Recapture of seepage losses in Restoration Area	This option would require the design, installation and long-term operation of drains to intercept seepage losses in order to retain claim of this intercepted Restoration Flow. Returning this intercepted flow to the river would also likely trigger water quality permitting and compliance challenges.
Recirculation	
Recirculation through the Mid-Valley Canal	This option would require extensive land acquisition along with extensive design and construction costs. Implementation of this option would require a long implementation timeline when compared to many of the other recirculation options.
Trans-Valley Canal - Multi-District Alignment	This option would require extensive land acquisition along with extensive design and construction costs. Implementation of this option would require a long implementation timeline when compared to many of the other recirculation options.
Trans-Valley Canal - Tulare Alignment	This option would require extensive land acquisition along with extensive design and construction costs. Implementation of this option would require a long implementation timeline when compared to many of the other recirculation options.
Trans-Valley Canal - Poso Alignment	This option would require extensive land acquisition along with extensive design and construction costs. Implementation of this option would require a long implementation timeline when compared to many of the other recirculation options.
Storage	
Storage in North of Delta Reservoirs	North of Delta storage would require complicated agreements to allow for the crediting of unreleased flows in North-of-Delta reservoirs as Restoration Flows. These stored flows would then also be subject to existing export limitations at the Delta export pumps. The potential loss of flows and potential implementation challenges cause this option to receive a low score on technical/legal complexity and cost.

Option	Reasons that Option was Not Retained
Storage in San Joaquin River Tributary Reservoirs (Tuolumne River and Merced River)	Storage capacity in the San Joaquin River tributaries could be limited in the years that this storage would be necessary, and the complicated agreements needed to credit unreleased flows from these reservoirs as Restoration Flows cause this option to receive a low score on technical/legal complexity.
Proposed In-Delta Storage	Storage of Restoration Flows in an in-Delta storage facility could be limited by Delta export conditions during the periods of Friant Contractor irrigation demand when the Restoration Flows would need to be returned. Potential construction or partnership costs with the agencies currently pursuing in-Delta storage could also be large. Implementation of this option would require a long implementation timeline when compared to many of the other storage options.

4.2 Initial Alternatives Eliminated from Further Consideration

Appendix A describes the evaluation of the initial alternatives, and shows that no one alternative performs well for all evaluation criteria. Each of the alternatives helps evaluate different conditions, and together they create a reasonable range of alternatives. Therefore, all four action alternatives are recommended to move forward for evaluation in the LTRRRF EIS/R.

As discussed in Appendix A, the alternatives could store recirculated water in San Luis Reservoir in most conditions. Using only San Luis Reservoir results in only small amounts of water lost from storage under all action alternatives. Additional surface water and groundwater storage would likely have additional costs associated with implementation (either monetary or water costs) with minimal benefits; therefore, these measures are not recommended to move forward. They were removed from Alternatives 4 and 5, as described in this Project Description TM.

5.0 References

Bureau of Reclamation and Department of Water Resources. 2011. Draft Program Environmental Impact Statement/Environmental Impact Report. Accessed on 9/22/2016. Available from: http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=2940

San Joaquin River Restoration Program. 2013. Restoration Flow Guidelines. Accessed on 9/22/2016. Available from: http://www.restoresjr.net/download/program-documents/program-docs-2013/SJRRP_RFG_December_2013.pdf

San Joaquin River Restoration Program. 2015a. Long-Term Recapture and Recirculation of Restoration Flows Environmental Impact Statement, Public Scoping Report. Accessed on 11/10//2016. Available from: http://www.restoresjr.net/wp-content/uploads/SJRRP-RR-Scoping-Report-11032015.pdf

San Joaquin River Restoration Program. 2015b. Water Management Goal Investment Strategy. Accessed on 9/22/2016. Available from: http://www.restoresjr.net/download/program-documents/program-docs-2015/FinalInvestmentStrategy_20150403.pdf

San Joaquin River Restoration Program. 2016. Long-Term Recapture and Recirculation Initial Alternatives Technical Memorandum. Accessed on 9/22/2016. Available from: http://www.restoresjr.net/wp-content/uploads/SJRRP_InitialAlternatives_TM_20160520-FINAL-408comply.pdf

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San Joaquin River Restoration Program Long-Term Recapture and Recirculation EIS/R

Project Description Technical Memorandum Appendix A – Initial Alternatives Evaluation

September 2017

Table of Contents

Tables

Figures

List of Abbreviations and Acronyms

AF	Acre-feet
BO	Biological Opinion
cfs	cubic feet per second
CVC	Cross-Valley Canal
CVP	Central Valley Project
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EA	Environmental Assessment
EIS	Environmental Impact Statement
EIS/R	Environmental Impact Statement/Environmental Impact Report
FFPP	Forrest Frick Pumping Plant
FKC	Friant-Kern Canal
fps	feet per second
Friant Contractors	Friant Division Long-term Water Contractors
hp	horsepower
ID	Irrigation District
KCWA	Kern County Water Agency
LTRRRF	Long-Term Recapture and Recirculation of Restoration Flows
NEPA	National Environmental Policy Act
PEIS/R	Program Environmental Impact Statement/Environmental Impact Report
PR&Gs	Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies
RCP	Reinforced concrete pipe
RGRCP	Rubber-gasketed reinforced concrete pipe
Reclamation	United States Department of the Interior, Bureau of Reclamation
Restoration Flows	San Joaquin River Restoration Program flows
ROD	Record of Decision
SCADA	Supervisory Control and Data Acquisition
Settlement	Stipulation of Settlement in Natural Resources Defense Council, et al., v. Kirk Rodgers, et al.
SJRRP	San Joaquin River Restoration Program
SJRRS Act	San Joaquin River Restoration Settlement Act (Public Law 111-11)
SWP	State Water Project
TM	Technical Memorandum
VFD	Variable frequency drive
WD	Water District
WSD	Water Storage District
WSP	Welded steel pipe

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1.0 Introduction

This initial alternatives evaluation documents the initial alternatives selected for analysis in the Long-Term Recapture and Recirculation of Restoration Flows (LTRRRF) Environmental Impact Statement/Environmental Impact Report (EIS/R) as part of the San Joaquin River Restoration Program (SJRRP) established in 2006 to implement the Stipulation of Settlement (Settlement) in *Natural Resources Defense Council, et al., v. Kirk Rodgers, et al.*

The United States Department of the Interior, Bureau of Reclamation (Reclamation), as the Federal lead agency under the National Environmental Policy Act (NEPA), and the Friant Water Authority (FWA) as the California Environmental Quality Act (CEQA) lead agency, have prepared this document as an initial step in preparation of an EIS/R for the LTRRRF, which is a requirement under the Settlement. Federal authorization for implementing the Settlement is provided in the San Joaquin River Restoration Settlement Act (SJRRS Act) (Public Law 111-11).

1.1 Purpose of this Document

This initial alternatives evaluation is intended to:

- Summarize the alternatives formulation and evaluation process for the LTRRRF Project consistent with NEPA requirements;
- Document the alternatives evaluation methods and results;
- Document the alternatives eliminated from further evaluation and the reasons for their elimination;
- Describe the alternatives to be evaluated in the LTRRRF Project, including the No-Action Alternative;
- Serve as the basis for the project description that will appear in the LTRRRF EIS/R;
- Obtain input and feedback from the Implementing Agencies[1], Technical Work Groups, Settling Parties[2], Third Parties[3], landowners, and other stakeholders involved in the LTRRRF Project.

[1] Implementing Agencies refer to the agencies responsible for managing and implementing the SJRRP: the United States Department of the Interior, Bureau of Reclamation, United States Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources, and California Department of Fish and Wildlife.

[2] The Settling Parties are agencies and organizations that are parties to the settlement in the NRDC, et al v. Rodgers, et al litigation. These parties include plaintiffs (represented by the Natural Resources Defense Council), Friant parties (represented by the Friant Water Authority), and the Federal defendants (the United States Departments of the Interior and Commerce).

[3] Third Parties refer to groups that are not party to a lawsuit or agreement, but are implicated in such lawsuits or agreements and includes landowners and agencies that have a vested interest in implementing the SJRRP.

1.2 Study Area

The Study area (Figure 1-1) for recapture and recirculation activities includes water district service areas, their associated infrastructure, and other areas that may be affected directly or indirectly by implementing recapture, recirculation, and storage actions. The Study area also includes Central Valley Project (CVP) and State Water Project (SWP) service areas where CVP or SWP contractors may be involved in transfers of recaptured water from Friant Contractors. Preliminary analysis of the initial alternatives indicates that they would not result in substantive changes to CVP and SWP facilities north of the Delta (such as Shasta, Oroville, and Folsom reservoirs), so these facilities are not included in the Study Area.

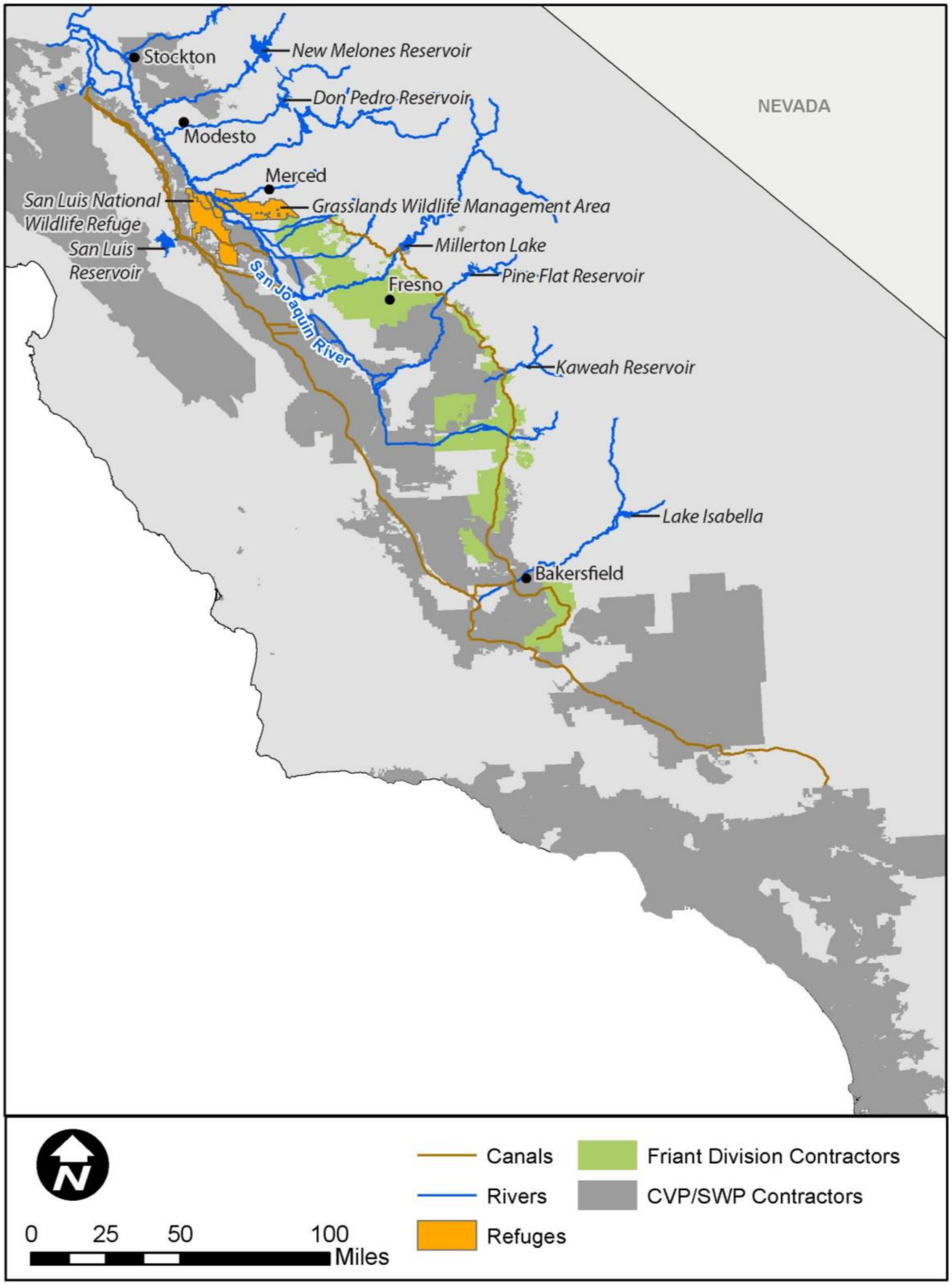


Figure 1-1.
Study Area for SJRRP Recapture and Recirculation

While the LTRRRF alternatives development process incorporated potential actions throughout this study area, the alternatives remaining after screening (and recognized within this document) do not include action in the entire study area. The proposed alternatives continue recapture of Restoration Flow in the Delta and Restoration Area and could incorporate recapture at new or existing facilities on the San Joaquin River downstream of the confluence with the Merced River. The EIS/R will identify areas where resources could be affected and will refine the Study area.

1.3 Relationship to Initial Alternatives Technical Memorandum (TM)

The *San Joaquin River Restoration Program Long-term Recapture and Recirculation Initial Alternatives Technical Memorandum* (TM) documents the first step in initial alternatives formulation for the LTRRRF Project. The TM presents the Purpose and Need for the LTRRRF Project, the opportunities and constraints, the process used to formulate initial alternatives and the description of the initial alternatives for the LTRRRF Project. The Initial Alternatives TM was used to gain feedback from the Implementing Agencies, Technical Work Groups, Settling Parties, Third Parties, landowners, and other stakeholders involved in the LTRRRF Project, and to refine the initial alternatives.

This initial alternatives evaluation document builds upon the initial alternatives described in the Initial Alternatives TM by comparing and evaluating the initial alternatives using the evaluation criteria presented in Section 4.0 and recommending a reasonable range of alternatives to be carried forward for analysis in the LTRRRF EIS/R (Section 6.0).

2.0 Alternative Evaluation Process

2.1 Purpose and Need, Opportunities, and Constraints

2.1.1 Purpose and Need

The purpose of recapture and recirculation of Restoration Flows is to help achieve the SJRRP Water Management Goal to reduce or avoid water supply impacts to the Friant Contractors that may result from releasing Restoration Flows in accordance with the Settlement. Specifically, long-term recapture and recirculation actions are needed to satisfy the requirements of Paragraph 16 (a) of the Settlement, which directs the Secretary to develop and implement a plan for recirculation, recapture, reuse, exchange, or transfer of the Restoration Flows for the purpose of reducing or avoiding impacts to water deliveries to all the Friant Division Long-term Contractors caused by the Restoration Flows (Plan). Initial drafts of the Plan have provided the basis for alternatives formulation in the EIS/R. The EIS/R will provide environmental compliance for the Plan and support further development of the Plan in accordance with the criteria identified in Paragraph 16 (a) of the Settlement.

2.1.2 Opportunities

The LTRRRF Project would help reduce water supply impacts to Friant Water Contractors caused by the release of Restoration Flows. This includes a reduction in groundwater overdraft and improved agricultural water supply.

2.1.2.1 Reduction in Groundwater Overdraft

Reduction in groundwater overdraft could be achieved by offsetting the use of groundwater with recirculated Restoration Flows (surface water) and through groundwater recharge. The ability to directly deliver recirculated Restoration Flows for irrigation would depend on the demand timing and quantity of the water available during periods of demand. Opportunities to maximize the use of recirculated Restoration Flows would require the storage of some of these flows to make them available later in the year when demand increases. Many of the Friant Contractors located on the southern portion of the Friant-Kern Canal (FKC) have groundwater recharge facilities that could store at least a portion of the recirculated Restoration Flows. The Investment Strategy has identified several high priority projects to assist Friant Contractors with additional groundwater storage facilities that could expand groundwater storage opportunities.

In 2014, California established the Sustainable Groundwater Management Act, which requires that groundwater basins be managed sustainably with no significant long-term overdraft. Several groundwater basins within the Friant service area are characterized by the State as overdrafted. The State will also have funding available through *Proposition 1: Water Bond - Funding for Water Quality, Supply, Treatment, and Storage Projects* to help address water supply and groundwater overdraft problems. Recirculated Restoration

Flows would play a critical role in reducing groundwater overdraft as well as in meeting the requirement of the SJRRS Act.

2.1.2.2 Improved Agricultural Supply

Recirculated Restoration Flows would reduce impacts to agricultural water supplies through direct use of the water, or by augmenting groundwater supplies for agriculture. Recirculation to the Friant Contractors would be accomplished through direct delivery, exchange, and/or transfer. New facilities to recirculate the water, defined long-term exchange agreements, and storage facilities would improve the delivery of recirculated water to the Friant Contractors, improving agricultural water supply (Reclamation 2014). Water supply conditions could also improve for the other non-Friant contractors involved in the exchanges or with access to the new facilities.

2.1.3 Constraints

Constraints provide limits on the planning process based on institutional, legal, and physical restrictions. Alternatives for the recapture of Restoration Flows will need to avoid adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP and thus consider the availability of diversion capacity at any existing or new recapture facilities and on conveyance capacity for recirculating that recaptured water to the Friant Contractors. The major conveyance facilities of the CVP and SWP that may be used to recapture and recirculate Restoration Flows and associated constraints that may limit their use include:

2.1.3.1 Delta Diversion and Conveyance Facilities

Restoration Flows reaching the Delta would be recaptured within the Delta at C.W. Bill Jones Pumping Plant or Harvey Banks Pumping Plant consistent with applicable laws, regulations, biological opinion(s) (BOs), and court orders in place at the time the water is recaptured. The recapture of Restoration Flows would be limited to available capacity at Jones and Banks Pumping Plants and in the Delta-Mendota Canal (DMC) or California Aqueduct. Available capacity is defined as that capacity that is left after satisfying all statutory and contractual obligations to existing water service or supply contracts, exchange contracts, settlement contracts, transfers or other agreements involving or intended to benefit CVP/SWP contractors served water through the CVP/SWP facilities.

2.1.3.2 San Luis Reservoir Storage Capacity

San Luis Reservoir is used jointly by both the CVP and SWP. The reservoir provides off-stream storage for excess winter and spring flows diverted from the Delta, with a total capacity of 2,028,000 acre-feet (AF). The CVP and SWP shares of storage at San Luis Reservoir are 965,660 AF and 1,062,180 AF, respectively. During spring and summer, scheduled demands are greater than the ability of Reclamation and the California Department of Water Resources (DWR) to pump water from the Jones and Banks Pumping Plants in the south Delta. During this time, water stored in San Luis Reservoir is released to make up the difference between Delta exports and demands. Since San Luis Reservoir receives very little natural inflow, water must be stored during fall and winter when the two Delta Pumping Plants can pump more water from the Delta than is needed to meet water demands. In water years when San Luis Reservoir fills, Restoration Flows stored in San Luis Reservoir that have not been recirculated via exchanges or direct deliveries would be the first water to be evacuated ("spilled") or converted to CVP water supplies available for allocation, as appropriate. In order to adhere to the obligation of no adverse impact to CVP/SWP deliveries or the operations of the CVP/SWP, Restoration Flows stored in San Luis Reservoir have a priority lower than: (1) the then-current year's CVP water, including Level II refuge water, (2) the then-current year's Level IV refuge water, (3) all rescheduled CVP water, (4) Cross-Valley Canal (CVC) Contractor water, (5) rescheduled Level IV refuge water, and (6) non-CVP water acquired or otherwise available to the San Luis and Delta-Mendota Water Authority's member agencies.

2.1.3.3 Legal and Institutional Constraints

Section 16 (a) of the Settlement includes several constraints to consider in the plan to recapture, recirculate, exchange, or transfer Restoration Flows. These constraints indicate that the plan must:

- Have no adverse impact on the Restoration Goal, downstream water quality, or fisheries;
- Be developed and implemented in accordance with all applicable laws, regulations, and standards;
- Be developed and implemented in a manner that does not adversely impact the Secretary's ability to meet contractual obligations existing as of the Effective Date of the Settlement; and
- Be consistent with agreements between Reclamation and DWR existing on the Effective Date of the Settlement, with regard to operation of the CVP and SWP.

The SJRRS Act also includes requirements that must be considered during development and evaluation of the plan:

- The plan must be subject to applicable provisions of California water law, must be developed not to adversely impact the Secretary's use of CVP facilities to make Project water (other than water released from Friant Dam pursuant to the Settlement) and water acquired through transfers available to existing south-of-Delta CVP contractors, and the coordinated operations agreement between Reclamation and DWR.
- Project impacts must be identified and mitigated, which will occur through the development of the LTRRRF EIS/R.
- Implementation of the Settlement and the reintroduction of California Central Valley Spring Run Chinook salmon pursuant to the Settlement and the SJRRS Act, shall not result in involuntary reduction in contract water allocations to CVP long-term contractors, other than Friant Division long-term contractors.

The SJRRP Program EIS/R incorporated provisions that recapture and recirculation would be consistent with these requirements of the Settlement and the SJRRS Act.

2.2 Alternatives Identification Process

2.2.1 Initial Concept Development

This document discusses the evaluation of alternatives that were originally identified in the Initial Alternatives TM. These alternatives have undergone further screening and refinements, based on comments received on the TM, preliminary engineering designs, and feedback from the Implementing Agencies, the landowners, the Technical Work Groups, the Settling Parties, and the Third Parties. This section summarizes the process to reach a set of alternatives for evaluation.

The initial options represent individual components, that when combined, will achieve the Purpose and Need for Federal action. The description of the initial options defines the starting point for the development of comprehensive alternatives that combine recapture, recirculation, and storage to reduce or avoid water supply impacts to Friant Contractors. The three types of options identified are:

- Recapture: different locations and configurations where Restoration Flows could be diverted or recaptured;
- Recirculation: direct conveyance, transfers, or exchanges of Recaptured Restoration Flows for the purpose of reducing or avoiding impacts to the Friant Contractors; and
- Storage: means to store water during periods when demand for recirculated water is low or there is insufficient conveyance capacity.

Initial Options for the recapture, recirculation, and storage of Restoration Flows were identified from previous studies such as the *Water Management Goal Investment Strategy Final Report* (SJRRP 2015) and conceptual opportunities provided during public scoping and stakeholder meetings. A list of the initial options is shown in Table 2-1.

These initial options were screened to eliminate impracticable options. The screening criteria evaluate each option’s capacity to contribute to the Purpose and Need, its potential technical and legal complexity, and its cost.

Table 2-1.
Initial Options for Restoration Flows

Recapture Options	Recirculation Options	Storage Options
Existing Banta-Carbona ID Recapture	Mid-Valley Canal	Storage in Metropolitan WD
Existing Patterson ID Recapture	Trans-Valley Canal - Multi-District Alignment	Storage in Contra Costa WD
Existing West Stanislaus ID Recapture	Trans-Valley Canal - Tulare Alignment	Proposed In-Delta Storage
Expanded Banta-Carbona ID Recapture	Trans-Valley Canal - Poso Alignment	Storage in North of Delta Reservoirs
Expanded Patterson ID Recapture	Shafter-Wasco ID Direct Delivery and Exchange	Storage in San Joaquin River Tributary Reservoirs
Expanded West Stanislaus ID Recapture	Arvin-Edison WSD Direct Delivery and Exchange	Semitropic WSD Groundwater Storage Bank
New Recapture Facility	Kings River Exchange	Cawelo WD Groundwater Banking
• North Valley Regional Recycled Water Program Facilities	Kaweah and Tule River Exchange	Rosedale-Rio Bravo WSD
• Newman Wasteway	Fresno River “Red Top” Exchange	Kern Water Bank
• Recapture of seepage losses in Restoration Area	Transfers to buyers within the CVP/SWP service area	City of Bakersfield 2800 Acre Groundwater Recharge Facility
		Meyers Water Bank
		Arvin-Edison WSD Groundwater Banking
		Private Groundwater Banks (CalMat Company Groundwater Banks)

Key:
ID = Irrigation District
WD = Water District
WSD = Water Storage District

2.2.2 Formulate Initial Alternatives

The formulation of comprehensive alternatives for consideration in the EIS/R relies on the combination of the recapture, recirculation, and storage options remaining following screening. The resulting action alternatives were designed to be capable of recapturing Restoration Flows and returning those flows to Friant Contractors at a time when they can be used.

2.2.3 Expand Initial Alternatives

The action alternatives reflect a range of potential environmental effects, from alternatives that are limited to operational changes (Alternative 2: Continue Existing Recirculation Actions) to an alternative that includes substantial construction (Alternative 5: Construct New Facilities). The alternatives were all developed with the assumption that Friant Contractors would agree to distribute water within the FKC

Service Area to account for Restoration Flows returned to Southern Friant Contractors (or others) in place of deliveries from Friant Dam.

2.3 Initial Alternatives Evaluation Methods

The draft screening criteria presented in Section 4.0 of this document will be used to compare the initial alternatives and select a reasonable range of alternatives that contribute to meeting the Purpose and Need of the project, and present alternatives that lessen or avoid potential significant environmental impacts. The primary screening criteria described correspond to the Federal planning criteria (completeness, effectiveness, efficiency, and acceptability) outlined in the *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies* (PR&Gs) (Council on Environmental Quality 2013). Within each of these four Federal planning criteria a set of sub-criteria was developed based on the LTRRRF EIS/R's Purpose and Need, available data, and comments received during the public scoping process. Each sub-criterion is further defined by "performance measures" that help measure each alternative's performance related to the criterion with qualitative or quantitative measures. The following steps outline the evaluation process:

Step 1: Develop Evaluation Criteria

- Identify a set of criteria that indicate how well the alternatives meet the goals and objectives of the LTRRRF Project and the overall SJRRP;
- Develop performance measures (quantitative or qualitative) that assess how well an alternative meets each criterion;
- Determine methods to analyze alternatives related to each performance measure.

Step 2: Complete Alternative Pre-Design

- Develop pre-design information for each Initial Alternative (and sub-alternative);
- Run hydraulic models to understand how alternatives would function;
- Design structures and features (at a preliminary level) to develop a complete alternative.

Step 3: Evaluate Initial Alternatives

- Identify data needed to evaluate the alternatives based on the evaluation criteria developed in Step 1;
- Use current level of design, existing data, and appropriate assumptions to determine how well each alternative meets the performance measures.

Step 4: Compare Alternatives

- Review overall information contained in completed evaluation criteria;
- Recommend alternatives to move forward that represent a broad range of how to meet the LTRRRF Purpose and Need.

The alternatives that move forward may be different than the alternatives described in this evaluation document because of changes made based on evaluation results and feedback; including, but not limited to, changes made to avoid initial alternatives that would cause adverse impacts to CVP deliveries or operations of the CVP/SWP.

2.3.1 Evaluation Criteria Development

To develop evaluation criteria for the LTRRRF Project initial alternatives, the LTRRRF Team reviewed scoping comments, comments on the Initial Alternatives TM, the Purpose and Need, and the opportunities and constraints identified for the project. A set of evaluation criteria was then developed and presented to the Implementing Agencies and Technical Work Groups for review and feedback. The criteria were then revised based on this feedback.

2.3.2 Evaluation Criteria Application

After the evaluation criteria were developed and revised based on feedback from the Implementing Agencies and Technical Work Groups, the next step involved gathering the information necessary to complete the evaluation and developing a ranking system to allow comparison between the initial alternatives.

2.3.3 Final Alternative Selection

The results of the alternatives evaluation will be reviewed, and a reasonable range of final alternatives will be recommended for analysis in the LTRRRF EIS/R that:

- Meet most of the Purpose and Need;
- Seek to maximize the quantity of recaptured Restoration Flows from the San Joaquin River while minimizing costs and environmental impacts.
- Avoid adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP.

The alternatives selected for analysis in the LTRRRF EIS/R may not be the alternatives that score the highest for the first evaluation criteria. Instead, the alternatives that move forward may represent trade-offs between those evaluation criteria to allow the best-performing alternative for different sets of criteria to move forward. In all circumstances, Reclamation will not move forward with an alternative that would adversely impact CVP/SWP deliveries or operations of the CVP/SWP (unless those impacts can be fully reduced or avoided through mitigation).

The alternatives selected may be the alternatives presented in Section 3, or could represent modifications made as a result of the evaluation findings. A preferred alternative will be identified in the final EIS/R. After the final EIS/R is published, Reclamation will prepare and adopt a Record of Decision (ROD) to implement a preferred alternative.

3.0 Initial Alternatives Description

This section provides detailed descriptions of the initial alternatives.

3.1 Initial Alternatives

The initial alternatives for consideration in the EIS/R rely on the combination of the recapture, recirculation, and storage options remaining following screening.

The alternatives describe actions to recapture, store, and recirculate Restoration Flows. While the descriptions indicate that the SJRRP would take actions, these actions could be taken by Reclamation or water agencies (individually or as a group). The implementing agencies for the actions within each alternative will be clarified as an action alternative moves forward; however, the potential environmental effects of each action would be the same regardless of the implementing agency. The following sections describe each alternative.

3.1.1 Alternative 1 – No Action Alternative

Alternative 1 (the No Action Alternative) for the SJRRP LTRRRF EIS/R reflects conditions if no further Federal action was taken to expand recapture opportunities and implement long-term recirculation, reuse, exchange, or transfer opportunities. However, Alternative 1 would include the elements of the Settlement that were analyzed at a project level in the Program Environmental Impact Statement/Environmental Impact Report (PEIS/R) and efforts that have made substantial progress towards completing environmental compliance. This approach is consistent with regulatory guidance from NEPA and Reclamation's NEPA Handbook. It is also consistent with the way the No Action Alternatives have been defined in other SJRRP environmental documents, such as the Recirculation of Recaptured Water Year 2013-2017 SJRRP Flows Environmental Assessment (EA) and the Mendota Pool Bypass and Reach 2B Improvements Project EIS/R. Alternative 1 is not consistent with the Settlement because it does not fully contribute to implementation of the Settlement. It is being included to satisfy NEPA requirements as a basis of comparison for the action alternatives to expand recapture opportunities and implement long-term recirculation, reuse, exchange, or transfer opportunities evaluated in this EIS/R. Key components of Alternative 1 are shown in Figure 3-1.

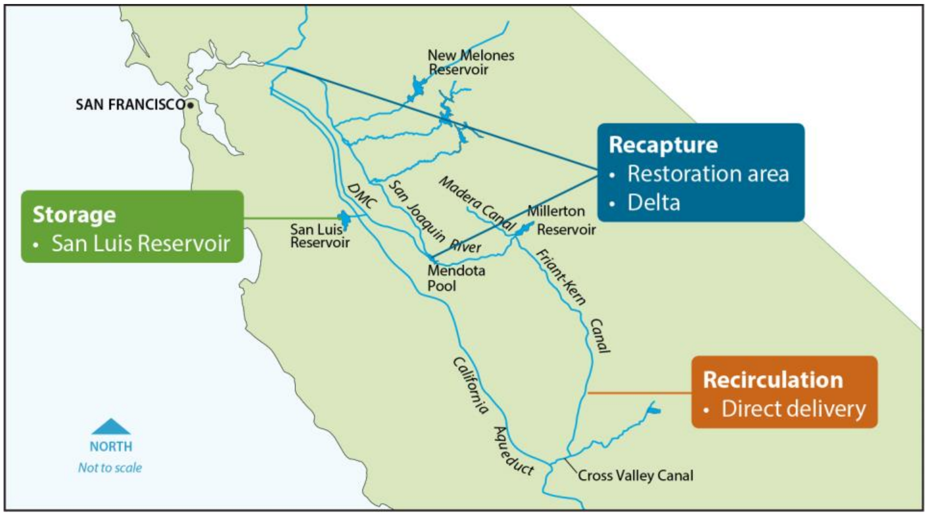


Figure 3-1.
Key Components for Alternative 1: No Action Alternative

3.1.1.1 Recapture

If the expanded Recapture opportunities and long-term Recirculation of Restoration Flows were not implemented, other components of the Settlement would still move forward. Alternative 1 would include implementation of the SJRRP elements that were analyzed at a project level as part of the selected alternative, C1, as described in the 2012 ROD. The actions analyzed at a project level that are related to recapture or recirculation include:

- Re-operate Friant Dam and downstream flow control structures to route Interim and Restoration flows;
- Recapture Interim and Restoration flows in the Restoration Area at Mendota Pool, Arroyo Canal, and Merced and San Luis National Wildlife Refuges;
- Recapture Interim and Restoration flows at existing CVP and SWP facilities in the Delta.

Alternative 1 would also include other elements of the SJRRP that have made substantial progress towards implementation and are likely to be implemented. These elements include the Madera Canal Capacity Restoration Project, seepage management projects or real estate actions, Part III groundwater projects, Fresno River Exchanges (the Red Top Project), use of Unreleased Restoration Flows, and the Mendota Pool Bypass and Reach 2B Improvements Project. Restoration Flows diverted within the Restoration Area would be delivered to water users in lieu of supplies from the DMC.

Under Alternative 1, Restoration Flows would continue to be released from Friant Dam. These flows would move downstream through the Restoration Area, and a portion of the Restoration Flows would be recaptured within the Restoration Area and the Delta. The portion of the Restoration Flows that is not lost (though infiltration or evaporation) or captured at these locations would become Delta outflow.

Alternative 1 would include some limits on the ability to recapture Restoration Flows:

1. Between Friant Dam and the confluence of the Merced River, flow releases would be reduced by riparian diversions and in-stream losses. The total monthly recapture of Restoration Flows could not exceed the flows released at Friant Dam minus the riparian diversions and losses.
2. The recapture of Restoration Flows in the Delta could not adversely affect the Secretary's ability to meet contractual obligations existing as of the effective date of the Settlement, such as CVP Delta exports.

3.1.1.2 Recirculation

The Program EIS/R did not analyze recirculation options at a project level, and the Recirculation of Recaptured Water Year 2013-2017 SJRRP Flows EA only analyzed actions through Water Year 2017. Therefore, after February 2018, the existing recirculation, transfer, and exchange options will need to be reanalyzed, as appropriate, to identify any new or different environmental effects. Therefore, these actions are not included in Alternative 1.

Reclamation has awarded a financial assistance agreement to the Friant Water Authority to complete environmental compliance, design, and construction for the Friant-Kern Canal (FKC) Reverse Flow Pump-Back Project. In addition to providing greater operational flexibility during drought conditions, this project would enable direct delivery of recaptured water to the following districts: Shafter Wasco ID, Arvin-Edison Water Storage District (WSD), Southern San Joaquin Municipal Utility District, Delano-Earlimart ID, Lower Tule River ID, Saucelito ID, Terra Bella ID, Tea Pot Dome Water District (WD), and Porterville ID. This project would be implemented under Alternative 1 and would allow some recirculation to occur after 2018. While some of these districts could accept direct delivery of water without the FKC pumpback project, these direct delivery actions may need additional environmental compliance and are not included in Alternative 1.

3.1.1.3 Storage

Alternative 1 could move recaptured flows into San Luis Reservoir for storage. The SJRRP would be able to access available capacity in San Luis Reservoir; provided the ability to store recaptured Restoration flows would be subordinate to storage of CVP, SWP, non-CVP or non-SWP water intended to benefit CVP/SWP contractors. As San Luis Reservoir fills, recaptured flows in San Luis Reservoir would "spill" based on the priorities presented in Section 2.1.3.2.

3.1.2 Alternative 2 – Continue Existing Temporary Recirculation Actions

Alternative 2 is the same as Alternative 1 but would extend the recirculation actions described in the Recirculation of Recaptured Water Year 2013-2017 EA beyond Water Year 2017. Figure 3-2 shows the key components of Alternative 2.

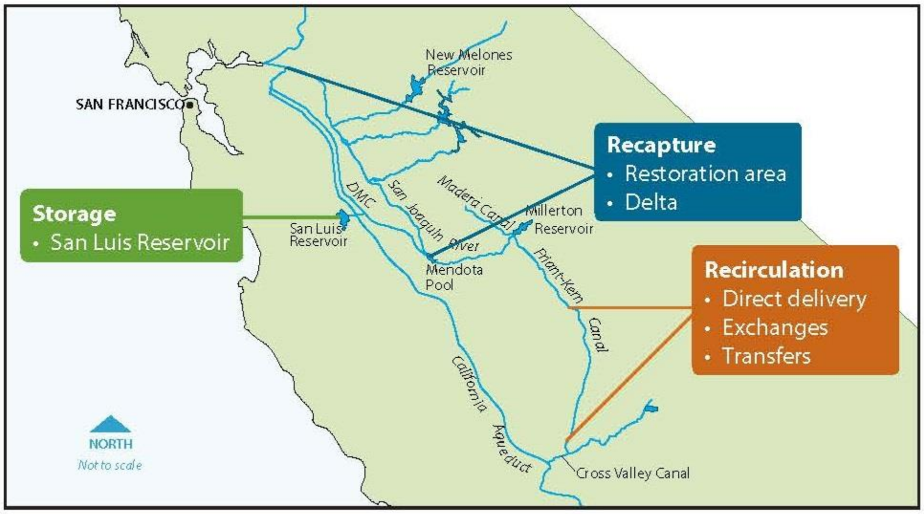


Figure 3-2.
Key Components for Alternative 2: Continue Existing Temporary Recirculation Actions

3.1.2.1 Recapture

Under Alternative 2, the Restoration Flows would continue to be recaptured in the Delta and the Restoration Area. Recapture would be accomplished in the same way as in Alternative 1, and would recapture the same amount of Restoration Flows.

3.1.2.2 Recirculation

Recaptured water would be recirculated to Friant Contractors using the actions described in the Recirculation of Recaptured Water Year 2013-2017 EA. Recirculation to the Friant Contractors would be accomplished through direct delivery, exchange, and/or transfer. This could require the exchange and/or transfer of recaptured Restoration Flows among Friant Contractors or non-Friant Contractors.

Alternative 2 would include direct deliveries of recaptured water from San Luis Reservoir to Friant Contractors through existing CVP, SWP, and local facilities. In addition to the direct delivery using the FKC pumpback facilities in Alternative 1, Restoration Flows could be delivered to contractors that have access to the DMC, California Aqueduct, San Luis Canal, and the CVC), such as Shafter-Wasco ID or Arvin-Edison WSD.

A key difference between Alternative 1 and Alternative 2 is the inclusion of exchanges and transfers. Exchanges include multiple agencies exchanging one water supply source for another water supply source. Alternative 2 would include exchanges between Friant Contractors and non-Friant Contractors to recirculate water. Friant Contractors would make their recirculation water available in south-of-delta facilities to non-Friant Contractors. In exchange, the non-Friant Contractors would make a local supply of water available to the Friant Contractors. This action could involve a Friant Contractor acting on behalf of several other Friant Contractors to facilitate an exchange into Millerton Lake for integration into the Friant Division's CVP water supply. Alternative 2 includes exchanges that do not require new construction, including the Kings River, Kaweah/Tule River, and Kern River exchanges.

Water transfers involve an agency selling water to another agency (or agencies). Alternative 2 would include transfers of recaptured water among Friant Contractors and/or non-Friant Contractors. The transfers would use existing CVP, SWP, and local facilities. This may require several agreements, but would not include any new construction.

Shafter-Wasco ID. Restoration Flows could be recirculated to Shafter-Wasco ID in exchange for its Class 1 and Class 2 supplies that would otherwise be delivered through the FKC through two options with Semitropic WSD and through the North-Kern WSD. Semitropic WSD is located on the west side of the San Joaquin Valley with a turnout on the California Aqueduct. Recirculated Restoration Flows could be delivered to Shafter-Wasco ID through several interties with Semitropic WSD. In their north system these include the existing 50 cfs Semitropic WSD/Shafter-Wasco ID intertie and a new 32 cfs Kimberlina Road intertie (these interties would also support a 100 cfs flow from Shafter-Wasco ID west to Semitropic WSD). Through their south system, deliveries could occur through a new 50 cfs Madera Avenue Intertie. Both of these new interties were studied through the Investment Strategy. Recirculated Restoration Flows could also be delivered to Shafter Wasco ID through the Calloway Canal. The Calloway Canal was recently connected to the CVC Extension and extends through North-Kern WSD to the eastern boundary of Shafter Wasco ID. Both configurations of this option are graphically illustrated in Figure 3-3.

Arvin-Edison WSD. Restoration Flows could be recirculated to Arvin-Edison WSD in exchange for its Class 1 and/or Class 2 supplies that would otherwise be delivered through the FKC. Arvin-Edison WSD is situated in Kern County at the southern end of the San Joaquin Valley. The Arvin-Edison WSD diverts a majority of its water near the terminus of the FKC into its 13-mile intake canal and terminates at the Forrest Frick Pumping Plant (FFPP). The FFPP pumps water into the Arvin-Edison WSD north canal where it can then gravity-flow through the Arvin-Edison WSD north and south canals. The Arvin-Edison WSD also diverts water via the 4.5 mile, bi-directional, intertie pipeline from the California Aqueduct to the Arvin-Edison WSD south canal at a rate of 125 cfs, and pumps from the Arvin-Edison WSD south canal to the California Aqueduct at a rate of 175 cfs via an 84-inch diameter reinforced concrete pipe (RCP) with a 78-inch steel liner. Under Alternative 2, Arvin-Edison WSD could receive Recirculated Restoration Flows from the California Aqueduct using available capacity in the south canal (as shown in Figure 3-3).

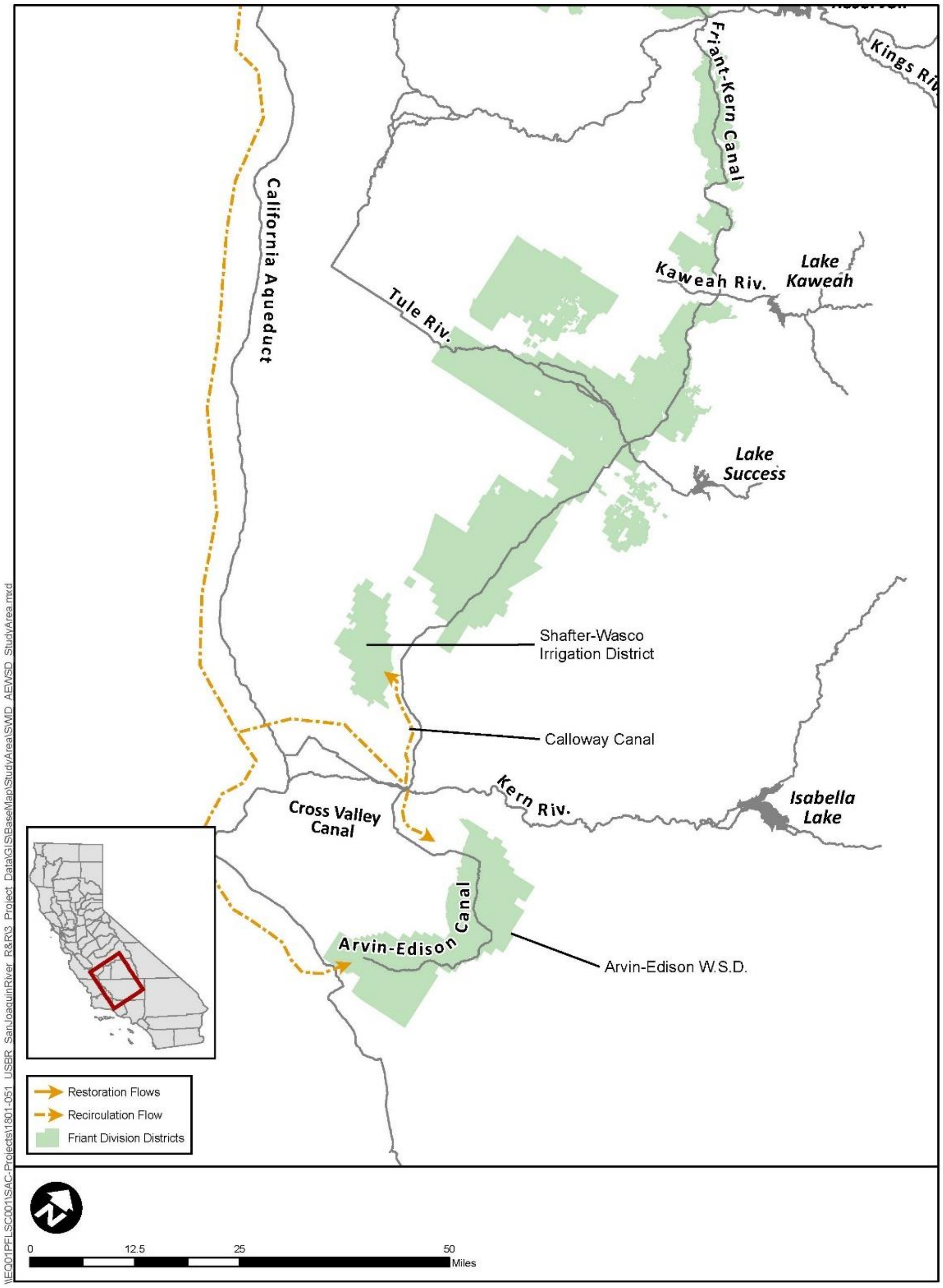


Figure 3-3.
Potential Direct Delivery Recirculation Options

King's River Exchange. A water supply exchange could be made between districts that receive water from the Kings River and also have access to recirculated Restoration Flows from the California Aqueduct or from the southern end of the DMC at the

Mendota Pool, to other districts with Kings River supplies. This exchange could be executed by the Tulare Lake Basin WSD, which receives water from both the SWP and the Kings River. It could also apply to the James ID and Tranquility ID, which have Kings River supplies and receive CVP water from the DMC at the Mendota Pool. Recirculated Restoration Flows could be delivered to these agencies through existing facilities connected to the SWP or CVP in exchange for their Kings River supplies stored in Pine Flat Reservoir. The Fresno ID and the City of Fresno could access these exchanged supplies in Pine Flat Reservoir as in-basin exchanges. Exchanges could be made with out of basin Friant Contractors through the Gould Canal intertie to the FKC. The Kings River Exchange is illustrated in Figure 3-4.

Kaweah and Tule River Exchange. The Tulare Lake Basin WSD is located on the west-side of the San Joaquin Valley with a turnout on the California Aqueduct for SWP contract water. The District also has water supplies originating from the Kaweah and Tule rivers (Tulare Lake Basin WSD also has Kings River supplies that could be exchanged as discussed above in the Kings River Exchange). Under this option, the Tulare Lake Basin WSD would exchange Kaweah and/or Tule river water for recirculated Restoration Flows conveyed through the California Aqueduct utilizing existing infrastructure. The water would be exchanged with Friant Contractors capable of receiving flows from the Kaweah and Tule rivers. These Friant Contractors include Tulare ID, Kaweah Delta Water Conservation District, Lindsay-Strathmore ID, and Ivanhoe ID for Kaweah River water and Lower Tule River ID and Porterville ID for Tule River water. Figure 3-5 graphically illustrates this exchange option.

Kern River Exchange. Recaptured Restoration Flows could be delivered to Kern River water users including North Kern WSD, Kern-Delta WD, Buena Vista WSD, Rosedale Rio-Bravo WSD, Improvement District No. 4, and Cawelo WD utilizing existing facilities. Recirculated Restoration Flows would be delivered via the California Aqueduct and the CVC in exchange for Kern River supplies delivered to Friant or CVC districts that also have access to Kern River water. These districts include Arvin-Edison WSD, Shafter-Wasco ID, and Kern Tulare WD. Exchanges between Kern River water users and Friant Contractors are graphically illustrated in Figure 3-6.

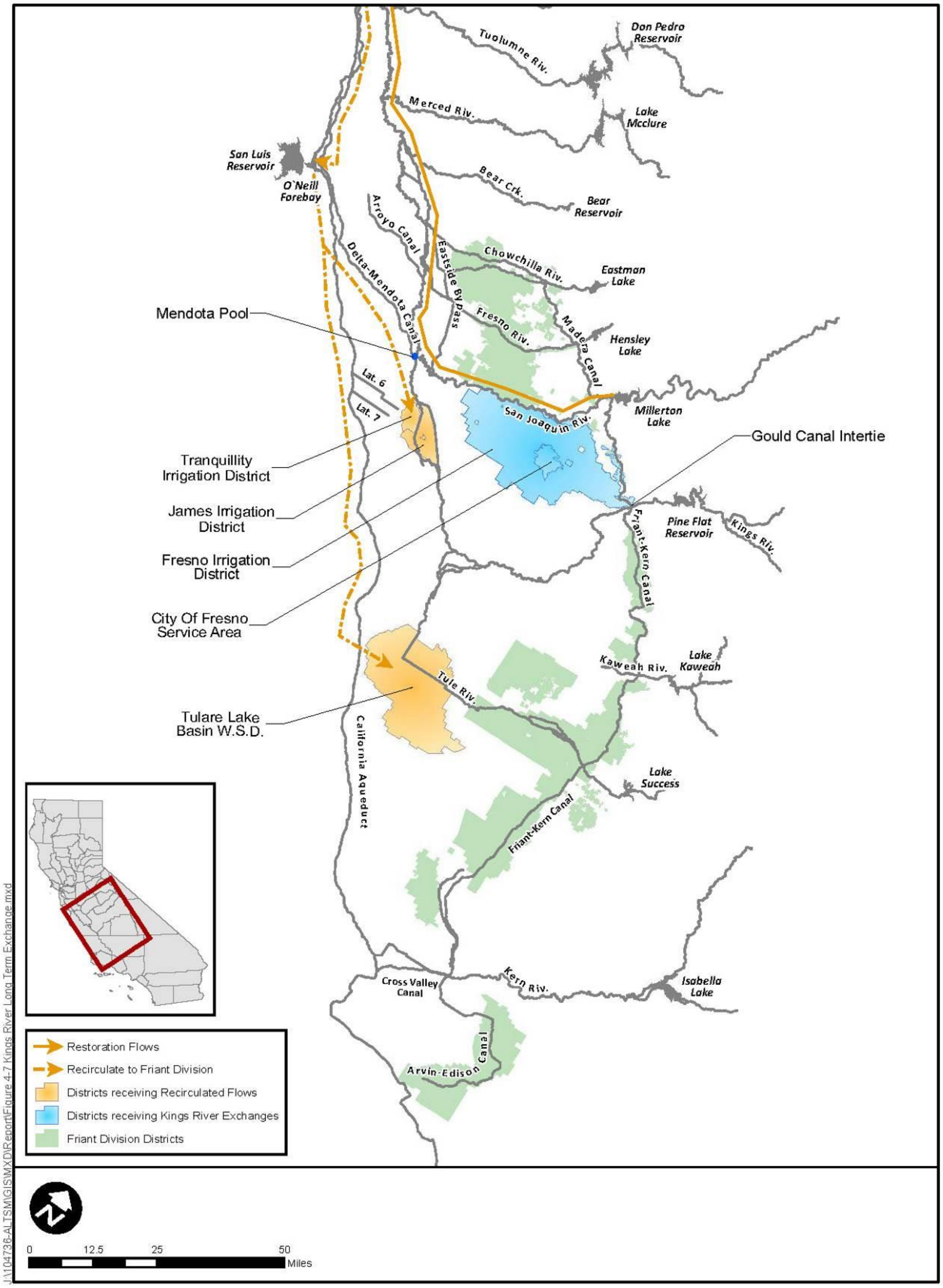


Figure 3-4.
Kings River Exchange

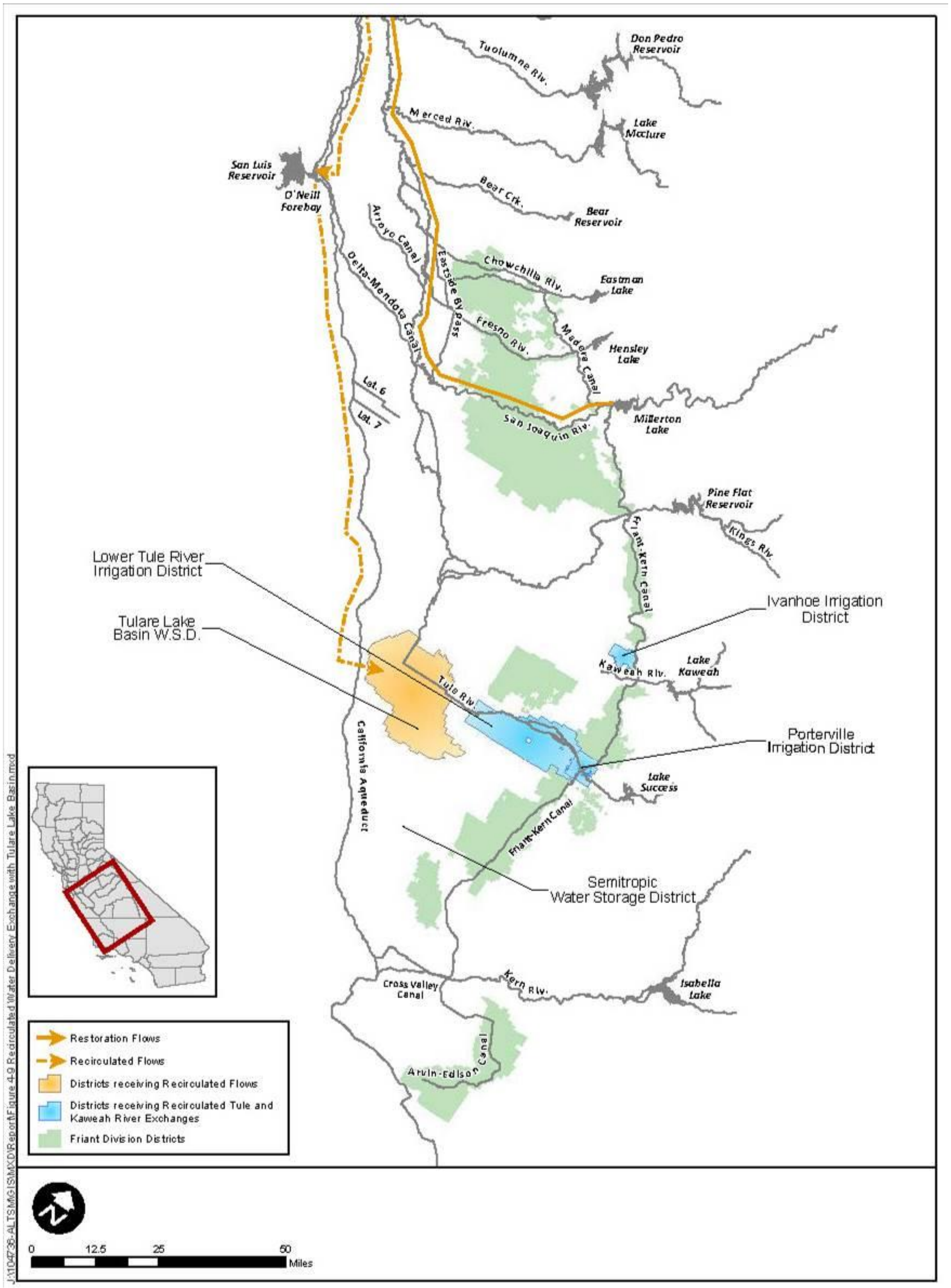


Figure 3-5.
Kaweah and Tule River Exchange

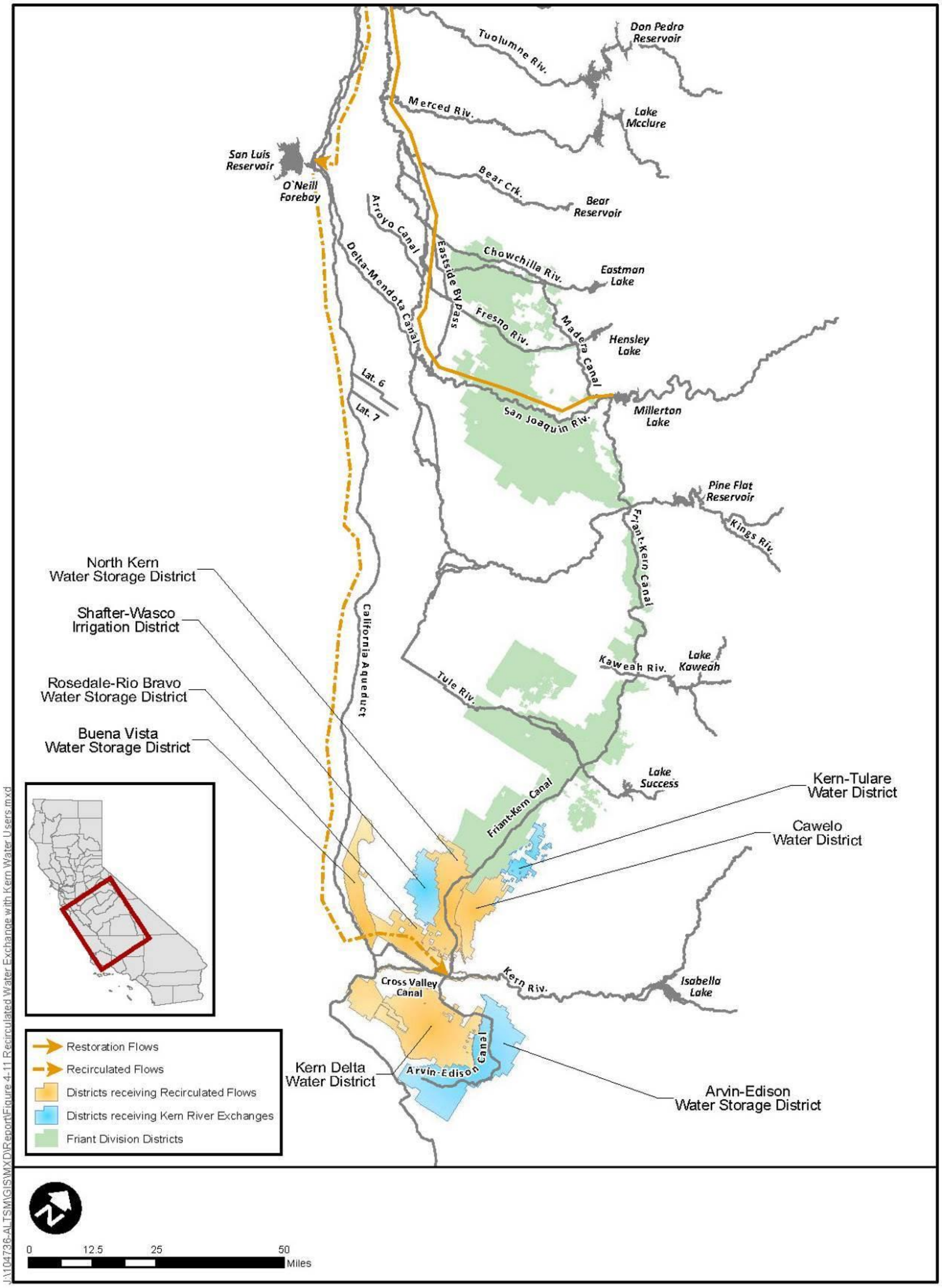


Figure 3-6.
Kern River Exchange

One potential configuration of an exchange between Buena Vista WSD, Arvin-Edison WSD, and Kern Tulare WD would provide Kern River water in wetter years to Arvin-Edison WSD and Kern Tulare WD in exchange for recirculated Restoration Flows delivered to Buena Vista WSD in dryer years.

Transfers to CVP or SWP Users. Friant Contractors could transfer recaptured Restoration Flows to CVP or SWP users that receive Delta exports from the DMC or California Aqueduct. Transfers could occur before or after the water is stored in San Luis Reservoir or another facility. This transaction would result in payment to the Friant Contractors.

3.1.2.3 Storage

Storage in Alternative 2 would be the same as Alternative 1. recaptured flows would be stored in the San Luis Reservoir until they could be recirculated to Friant users. The SJRRP would be able to access available capacity in San Luis Reservoir that was unused by the CVP and SWP. If the water was stored in the spring, and the CVP and SWP later had the opportunity to fill that storage, then the recaptured water in storage would "spill" and convert from Restoration Flows to CVP and SWP water.

3.1.3 Alternative 3 – Maximize use of Existing Facilities

Alternative 3 would focus on increasing the volume of water recaptured and recirculated by including additional recapture locations. These new options would use existing facilities and would not involve new or expanded facilities. Figure 3-7 shows the key components of Alternative 3.

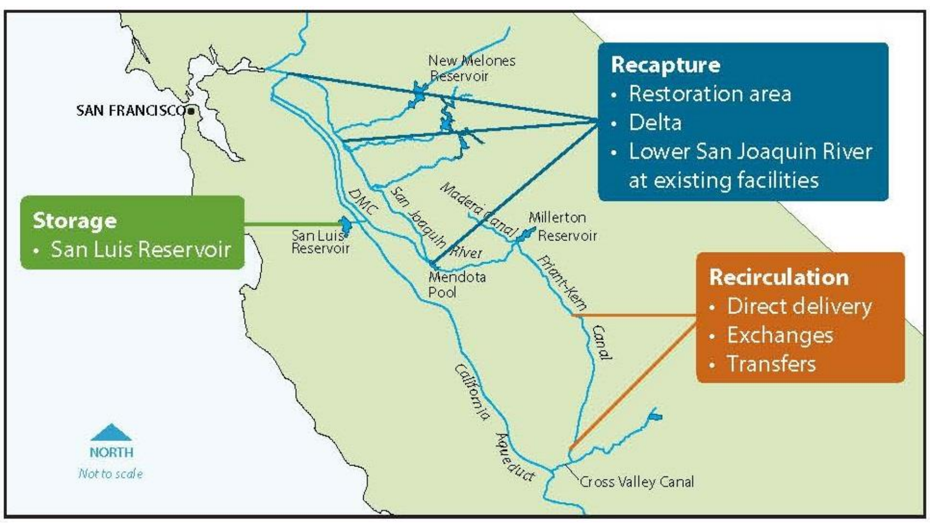


Figure 3-7.
Key Components for Alternative 3: Maximize Use of Existing Facilities

3.1.3.1 Recapture

Under Alternative 3, recapture would continue in the Delta and the Restoration Area, as described for Alternatives 1 and 2. In addition, water could be recaptured from the San

Joaquin River using local diversion facilities at Banta-Carbona ID, Patterson ID, and West Stanislaus ID (Figure 3-8). These three districts divert water from the San Joaquin River and also have CVP contracts for water delivery from the DMC. For all three districts, Restoration Flows would be recaptured at the existing facilities and moved through district conveyance facilities to the DMC.

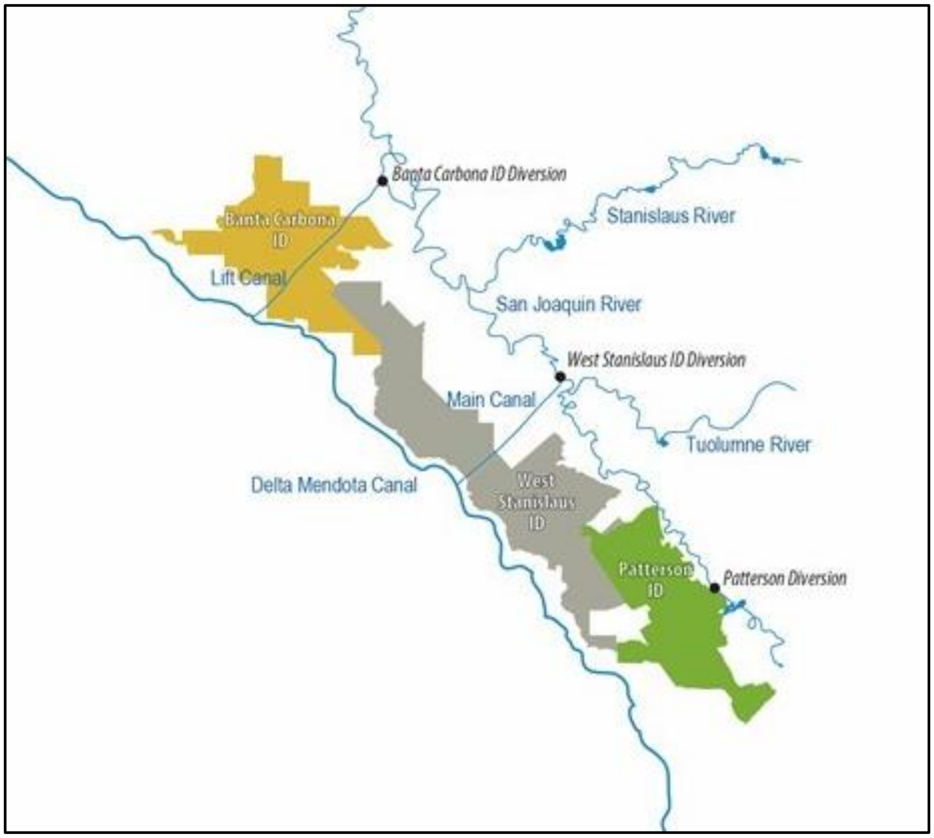


Figure 3-8.
Diversion Points for Banta-Carbona ID, West Stanislaus ID, and Patterson ID

Banta-Carbona ID. The Banta-Carbona ID diverts a majority of its water from the San Joaquin River into the Banta-Carbona Lift Canal. Banta-Carbona ID's fish screen is currently rated at 250 cfs for smelt, and 400 cfs for salmon/steelhead. The existing system is a series of six pump stations that boost water into open channel sections before terminating at the DMC via a Banta-Carbona pipeline. Banta-Carbona Pumping Plant 5A is equipped for 120 cfs with additional bays for future expansion.

Patterson ID. The Patterson ID diverts water from the San Joaquin River into its conveyance system consisting of approximately 4 miles of unlined canals, 52 miles of lined canals, and 86 miles of pipelines. Currently, Patterson ID's diversion capacity of 195 cfs is limited to 35 cfs once the water reaches the DMC, thus limiting water transfers. The existing system is divided into 5 reaches and 6 pumping plants. Reach 1 is a concrete-lined channel with a capacity of 175 cfs from the fish screen at Pumping Plant 1 to Pumping Plant 2. Reach 2 is an open channel canal with a capacity of 155 cfs from Pumping Plant 2 to Pumping Plant 3. Reaches 3, 4, and 5 are also open channel canals with Pumping Plants 3, 4, and 5 having capacities of 95, 75, and 90 cfs, respectively. Pumping Plant 6 provides a 35 cfs capacity to the DMC through a 36-inch diameter pipeline. Figure 3-9 illustrates the existing conditions.

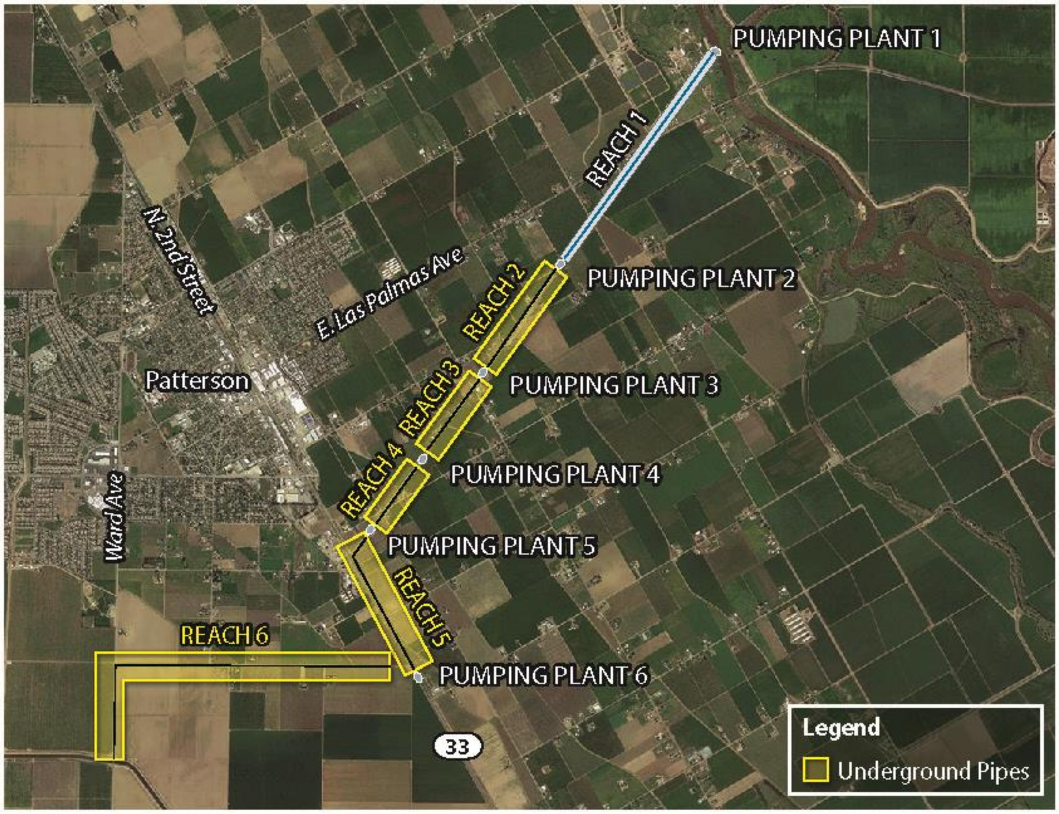


Figure 3-9
Existing Reaches for Patterson ID

West Stanislaus ID. The West Stanislaus ID diverts water from the San Joaquin River into the West Stanislaus ID Main Canal. West Stanislaus ID's current diversion capacity of 350 cfs does not extend all the way to the DMC, thus limiting its ability for water transfers. There is no fish screen at the San Joaquin River; however, one is in design with a capacity of 350 cfs. Currently, the connection for the DMC can convey 250 cfs. The existing system conditions include the recently constructed 96-inch pipe at Pump Station 1A with a capacity of 350 cfs, which replaced previous Pump Stations 1 and 2. Pump Station 5A was also reconstructed as a 96-inch pipe with a capacity of 250 cfs to the DMC. Pump Stations 3 and 4 currently lift water from open channel to open channel and are to be replaced with Pump Station 3A with a capacity of 310 cfs. Pump Stations 1A and 5A are relatively new and Pump Station 3A is currently under design by the district at 310 cfs.

This alternative does not include any additional developments to these facilities to increase capacity, but it does assume completion of facilities currently in progress and the new fish screen that West Stanislaus ID is planning independently. If West Stanislaus ID does not construct a fish screen at its diversion facility, the facility would not be used to divert Restoration Flows in Alternative 3. Table 3-2 shows the estimated capacity at each facility that may be available to recapture Restoration Flow, by month. These estimates were provided by the districts, and are rough estimates that show available capacity after in-district demands are met. Diversion at these facilities would increase the potential to recapture Restoration Flows compared to Alternatives 1 and 2.

Table 3-1. Estimated Available Capacity to Recapture Restoration Flow under Alternative 3 (in cfs)

Month	Patterson ID	West Stanislaus ID	Banta-Carbona ID	Total
October	25	120	90	235
November	35	120	90	245
December	15	120	90	225
January	14	120	90	224
February	16	120	90	226
March	35	120	60	215
April	35	60	60	155
May	35	40	0	75
June	25	0	0	25
July	5	0	0	5
August	10	10	30	50
September	21	60	70	151

Notes:
ID: Irrigation District

3.1.3.2 Recirculation

The SJRRP would continue recirculation of water as described in Alternative 2. Recirculation options would include direct delivery, transfers, or exchanges.

3.1.3.3 Storage

Alternative 3 would store Restoration Flows in San Luis Reservoir as described in Alternative 1.

3.1.4 Alternative 4 – Expand Existing Facilities

Alternative 4 would expand existing facilities to increase their ability to recapture or recirculate water. Figure 3-10 shows the key components of Alternative 4. More detailed information on the design of this alternative is included in Appendix A, Attachment 1.

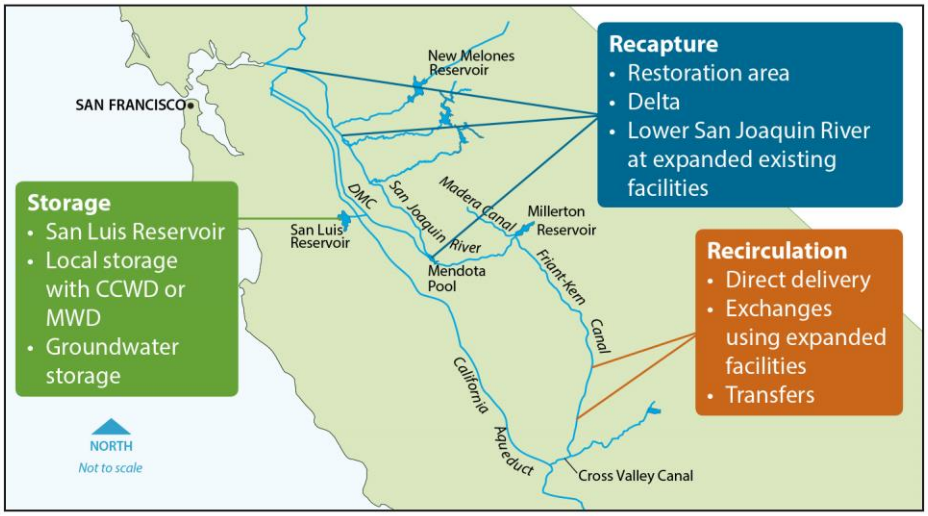


Figure 3-10.
Key Components for Alternative 4: Expand Existing Facilities

3.1.4.1 Recapture

Under Alternative 4, recapture would continue in the Delta and the Restoration Area, as described in previous alternatives. Additionally, local conveyance facilities would be expanded at Banta-Carbona ID (200 cfs capacity), Patterson ID (195 cfs capacity), and West Stanislaus ID (350 cfs capacity). The constructed expansions would allow additional Restoration Flows to be recaptured and conveyed to the DMC. Modified diversion facilities would increase the amount of Restoration Flows that could be recaptured compared to Alternative 3.

Banta-Carbona ID. This alternative would expand Banta-Carbona ID's conveyance capacity between the Pumping Plant 4 and the DMC. Changes to the Banta-Carbona ID would expand the capacity from 135 cfs to 250 cfs in 10,400 lineal feet from lift station 4 to the DMC which includes approximately 4,000 feet of canal and 6,500 feet of pipeline. The Banta Carbona ID currently has a 160-foot right-of-way along their existing facilities, giving them sufficient room to expand their capacity.

The proposed modifications include the following:

- Replacement of one pump station to be capable of 250 cfs;
- Construction of a bypass around Pumping Plant 4 that would allow for flows to be routed in either direction between the DMC and the San Joaquin River;
- Addition of pumps to Pumping Plant 5A;
- Reconnection of existing turnouts and laterals.

This upgrade would include more than 3,600 cubic yards of canal earthwork, 102,270 square feet of canal lining, the upgrade and rebuilding of 2 pump stations, and installation of less than 1000 linear feet of 72-inch diameter pipe. This option is illustrated in Figure 3-11.

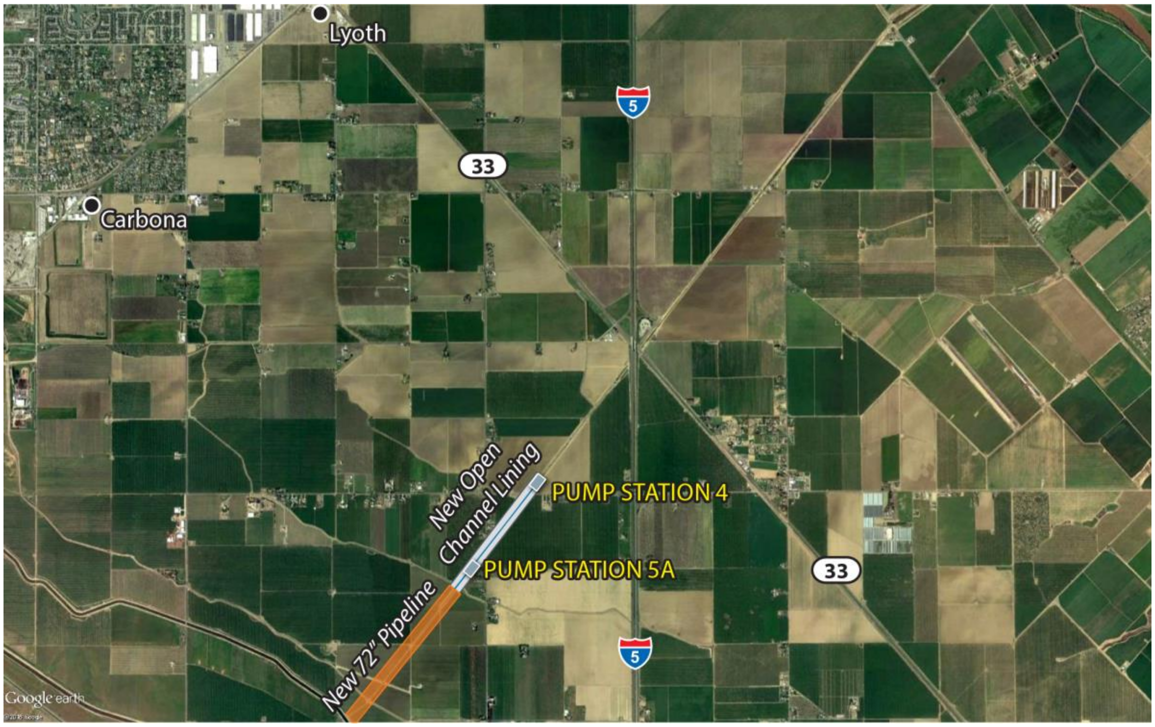


Figure 3-11.
Banta-Carbona ID Expansion

Patterson ID. Patterson ID has previously considered expanding their capabilities to convey 195 cfs from the San Joaquin River to the DMC and considered 5 alternatives in the Draft East West Conveyance Project Evaluation of Project Alternatives Report that was completed in 2013. Alternative B1 was selected from the report and is described below.

The expansion of th Patterson ID conveyance facilities includes the following revisions to the existing conditions:

- Reach 1: Replace and refurbish the canal lining and appurtenances in Reach 1 with sufficient freeboard to accommodate 195 cfs;
- Reaches 2 and 3: Combine Reaches 2 and 3 and eliminate Pumping Plant 3 and increase the capacity of Pumping Plant 2 to 196 cfs. Install an 84-inch diameter rubber-gasketed reinforced concrete pipe (RGRCP) to replace the open-channel canal of Reach 2 to empty into Reach 3 which is a rebuilt, open-channel, concrete-lined canal with an increased capacity of 195 cfs;
- Reaches 4 and 5: Combine Reach 4 and the initial (approximate) 500 feet of Reach 5 and eliminate Pumping Plant 5 and increase the capacity of Pumping Plant 4 to 195 cfs. Install an 84-inch diameter RGRCP to replace the open-channel canal of Reach 4 to empty into Reach 5 which is a rebuilt, open-channel, concrete-lined canal with an increased capacity of 195 cfs;

- New DMC Connection: Create a turnout from Reach 5 to convey 160 cfs through a 72-inch diameter RGRCP to a new DMC pumping plant. The turnout would tunnel under the Union Pacific Railroad and Highway 33;
- The combination of the new DMC section of pipeline and the existing 36-inch diameter pipeline from Pumping Plant 6 would convey a total flow of 195 cfs to the DMC.

Quantitatively, the expansion of Patterson ID's system amounts to the installation of 10 new pumps, approximately 70,000 cubic yards of canal earthwork, 355,000 square feet of canal lining, 6,400 linear feet of 84-inch diameter pipe, and more than 11,125 feet of 72-inch diameter pipe, including a jack and bore operation underneath the Union Pacific Railroad. There are multiple turnout replacements or upgrades and several road crossings. Figure 3-12 and Figure 3-13 illustrate the existing conditions and proposed expansions, respectively.

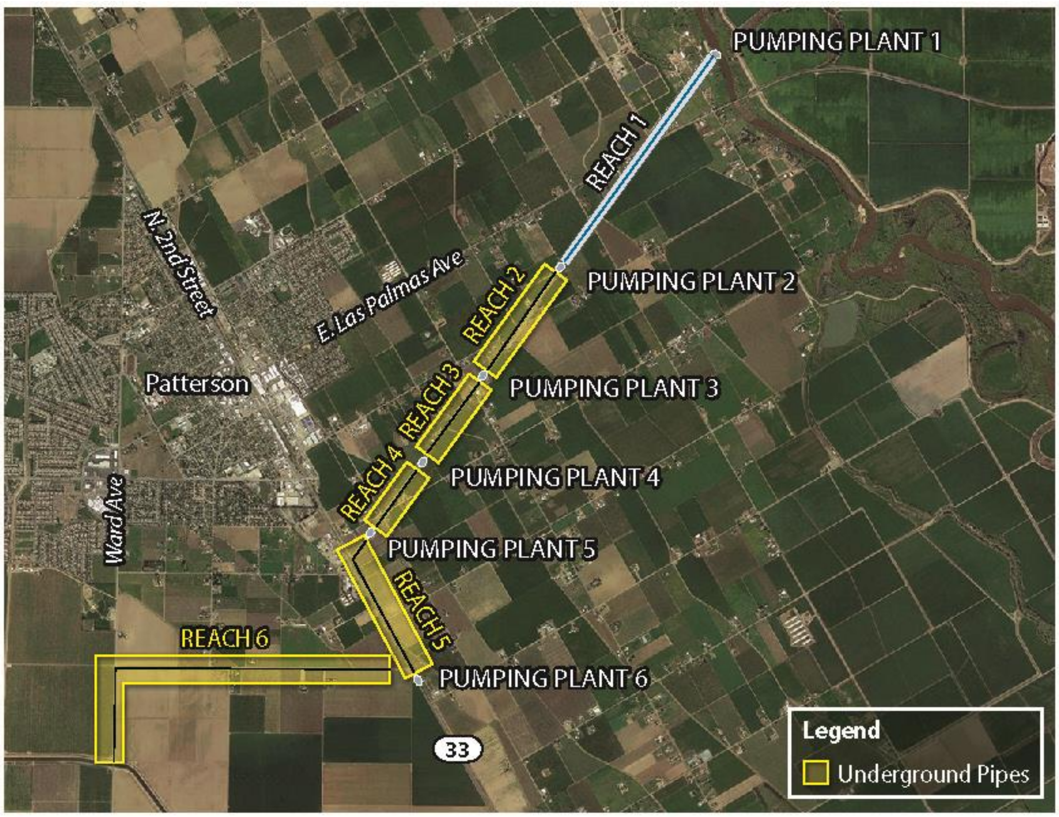


Figure 3-12.
Patterson ID Existing Conditions

Figure 3-13.
Patterson ID Expansion

West Stanislaus ID. The expansion of West Stanislaus ID's lift and conveyance capacities would allow the district to convey 250 cfs between the San Joaquin River and the DMC.

The design would modify existing conditions by:

- Constructing Pump Station 3A to bypass Pump Stations 3 and 4 with a 108-inch diameter pipeline;
- Reconnecting existing turnouts and laterals to the new 108-inch diameter pipeline;
- Constructing a bypass around the pump stations that would allow flows to be routed in either direction;
- Construction of electrical control room;
- Surge protection system;

The significant cost drivers of this alternative are the installation of Pump Station 3A, the upgrade of several turnouts, and installation of more than 3,195 linear feet of 108-inch diameter pipe, including the jack and bore operation under the Union Pacific Railroad. Figure 3-14 illustrates the proposed expansion.

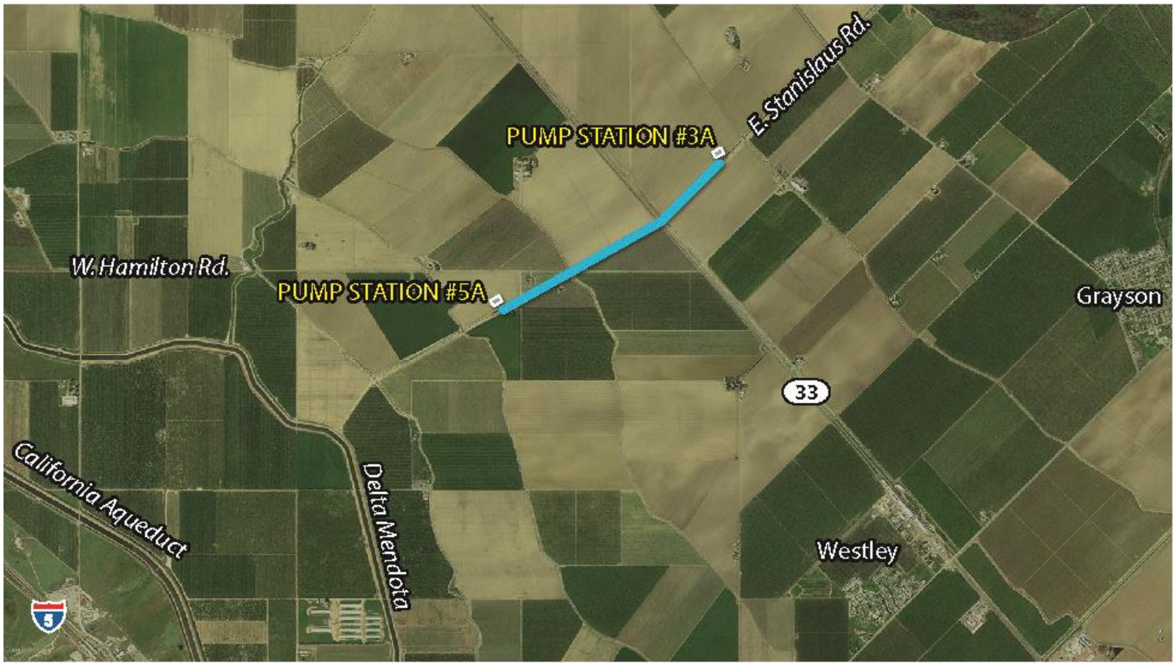


Figure 3-14.
West Stanislaus Proposed Expansion

Table 3-2 shows the estimated available capacity after the improvements in Alternative 4 to recapture Restoration Flows.

3.1.4.2 Recirculation

The SJRRP would continue recirculating recaptured Restoration Flows as described in Alternatives 2 and 3. In addition, Alternative 4 would include exchanges that require new facilities, such as expansions to Arvin-Edison WSD facilities.

Arivin-Edison WSD. In addition to the exchanges with Arvin-Edison WSD included in Alternatives 2 and 3, Alternative 4 would include expanded facilities to allow increased delivery of Recaptured Restoration Flows.

This expansion would increase the flow capacity of the current gravity-fed intertie pipeline from the California Aqueduct to the Arvin-Edison WSD south canal from 125 cfs to 175 cfs with the installation of a booster plant. The benefit of the booster plant on the intertie pipeline is to have additional capacity to deliver recaptured water to the Mettler Unit (land between Interstate 5 and Highway 99) to meet its demands in-lieu of using CVP supplies or groundwater. There is also the potential to increase flexibility for the Arvin-Edison WSD distribution system and deliver water to other systems within the district at times when there is capacity through the pump-back pumps. According to Arvin-Edison WSD, recaptured water delivered into the district through the intertie pipeline between March and August would typically be used for in-lieu recharge, while water delivered between September and February would typically be used for recharge. The intertie pipeline crosses various county roads, Interstate 5, and Highway 99. The work area is located where land-field crops are planted.

Table 3-2. Estimated Capacity to Recapture Restoration Flow under Alternative 4 (in cfs)

Month	Patterson ID	West Stanislaus ID	Banta-Carbona ID	Total
October	45	180	150	375
November	58	220	180	458
December	35	230	180	445
January	34	230	180	444
February	36	210	180	426
March	58	190	100	348
April	119	160	70	349
May	102	120	0	222
June	45	40	0	85
July	25	80	0	105
August	30	10	55	95
September	41	120	100	261

Notes:
ID: Irrigation District

The proposed booster plant would include (values approximate):

- The installation of three 48-inch diameter low lift, high volume pumps (can pumps);
  - Two 90 cfs pumps, with 500 horsepower (hp) and a total dynamic head of 20 feet.
  - One 90 cfs pump, with 500 hp, a total dynamic head of 20 feet, and with variable speed drive. This pump would be used as a redundancy (extra pump) and would also have the ability to vary the flow.
- A pipeline manifold;
- An ultra-sonic flow meter;
- Isolation and check valves;
- A surge relief system;
- The acquisition of a 1-acre plant site with security fencing and base rock surfacing;
- The acquisition if an access easement to the site;
- An electrical system;
- A SCADA system.

3.1.4.3 Storage

Alternative 4 would store Restoration Flows in San Luis Reservoir as described in Alternative 1. It would also include surface storage in local reservoirs owned by Contra Costa WD or Metropolitan WD. These storage agreements would reduce loss of Restoration Flows when San Luis Reservoir fills during wetter conditions, which would increase delivery of Restoration Flows to Friant Contractors.

Contra Costa WD. Contra Costa WD has one main reservoir in its central and eastern Contra County service area, Los Vaqueros Reservoir. Currently, Los Vaqueros Reservoir has a total capacity of 160,000 AF. As of December 2014, the reservoir was 70 percent full, with 112,343 AF stored (Los Vaqueros Reservoir & Watershed 2014). Contra Costa WD diverts water from the Delta at four intake locations (end of Rock Slough, on Old River, on Victoria Canal, and Mallard Slough). In periods when storage capacity is not available in San Luis Reservoir or when Delta export capacity is not available, Restoration Flows could be stored in Los Vaqueros Reservoir. To recirculate the Restoration Flows, Contra Costa WD would either exchange their available Delta supplies for diversion at the Delta Pumps or release the stored water back to the Delta for export when needed by the Friant Contractors. The release of water back to the Delta for export to the Friant Contractors would be subject to available export capacity which is limited during the irrigation demand season. This option would also be used primarily to store recaptured Restoration Flows in wet water years when storage in San Luis Reservoir is not available. It is likely that during these periods available storage in the Los Vaqueros Reservoir would be limited. Studies to expand Los Vaqueros Reservoir beyond its current capacity are being completed by Reclamation in partnership with Contra Costa WD but are contingent on the identification of additional partners to share the funding of any expanded capacity (Contra Costa Times 2014).

Metropolitan WD. Metropolitan WD relies on reservoirs in its southern California service area, three of which it operates (Lake Matthews, Lake Skinner, and Diamond Valley Reservoir) and three SWP reservoirs operated by DWR in coordination with Metropolitan WD (Perris, Castaic, and Silverwood). These are shown on Figure 3-15. Collectively, the reservoirs have a capacity of 1,571,000 AF. As noted above, this storage option would be used primarily to store recaptured Restoration Flows in wet water years when storage in San Luis Reservoir is not available. It is possible that during these periods Metropolitan WD could effectively store Restoration Flows in Metropolitan WD reservoirs either directly or through exchanges with other water supplies.

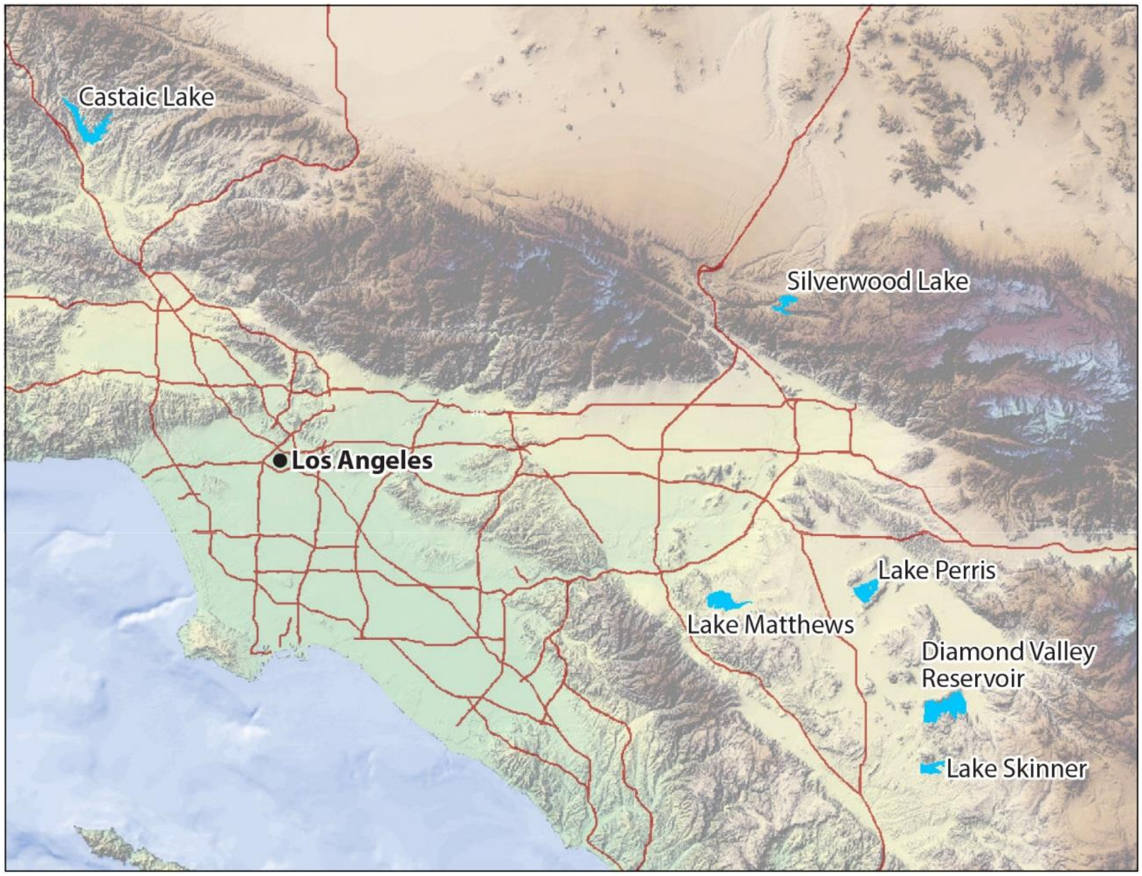


Figure 3-15.
Metropolitan WD and SWP Reservoirs

3.1.4.4 Construction

Banta-Carbona ID

Methods. The Banta-Carbona ID canal and pipeline work would be divided into 2 reaches and all reaches would be worked on simultaneously. Beginning with the demolition of Pumping Plant 4, construction would move to pipe and canal earthwork. The next step would be to reconstruct the pumping plant structure, install the pumps and motors, run the electrical work, and install the SCADA systems.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 122,000 cubic yards of material to local landfills (6,135 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-16 includes the projected schedule for the Banta-Carbona ID upgrade. The construction has an anticipated timeline of approximately nine months. The construction would be timed to avoid affecting the existing water users that depend on the distribution system. The maximum expected personnel on site in this schedule is: 1 earthwork crew (1 foreman, 2 operators, 2 laborers), 1 concrete crew (1 foreman, 3 laborers), 1 electrical crew (1 foreman, 2 journeymen), 1 structure/vertical crew (1 foreman, 4 laborers), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total of 19 - 20 staff on site at any one time. Work would be performed 8 hours per day, 5 days per week.

Patterson ID

Methods. This portion of the expansion is divided into 7 sections: five reaches, a section from Highway 33 to the DMC, and the drainage system installation. The work would begin with clearing and grubbing at the outfall of the highway/DMC section, followed by the demolition of Pumping Plant 5, working up to Pumping Plant 1, while pipe laying and canal lining are done in tandem between pumping plants. The bulk of the work would take place between January and April where jack and bore operations, excavation, canal earthwork, pipe laying, and canal concrete lining would be the primary activities.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 94,400 cubic yards of material to local landfills (4,720 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-16 includes the projected schedule for the Patterson ID upgrade. The construction has an anticipated timeline of 13 months. The longest expected portion of the project would be the pipe installation from Highway 33 to the DMC and the installation of the 18-inch drain line which could each take approximately 112 days. The maximum expected number of personnel on site for this project, using this schedule is estimated to be: 1 earthwork crew (1 foreman, 2 operators, 2 laborers), 1 pipe crew (1 foreman, 1 operator, 2 laborers), 1 structure/vertical crew (1 foreman, 4 laborers), 1 concrete crews (1 foreman, 3 laborers), 1 electrical crew (1 foreman, 2 journeymen), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total maximum of 23-24 people.

West Stanislaus ID

Methods. The West Stanislaus expansion work would begin with utility relocation and installation of a service road, followed by pipe installation begins in Reach 3. Structural work would begin for Pump Station 3, and when complete, electrical and SCADA installations would occur in both sections concurrently.

Equipment, Materials, Spoils, and Safety. Approximately 4 acres of land will need to be leased to stage equipment and stockpile. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 37,800 cubic yards of material to local landfills (1,890 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-16 includes the projected schedule for the West Stanislaus upgrade. The construction has an anticipated timeline of 12 months. Maximum onsite staff estimate is 1 pipe laying crew (1 op, 2 labor, 1 foreman), 1 concrete crew (1 foreman, 3 labor), 1 Jack/Bore crew (1 foreman, 1 op, 3-4 laborers) and Project Staff (1 Superintendent, 1-2 Admin Staff) for a total of 15-17 persons.

Arvin-Edison WSD

Methods. Mobilization for the Arvin-Edison WSD booster plant installation would begin approximately 6 months after receiving the notice to proceed. Erosion and sediment control would be installed prior to the utility relocation, which includes construction power. Once complete, clearing and grubbing, followed by grading of the plant area would begin. The booster plant formwork and reinforcement would begin as the chain link fence and gate are installed. The concrete for the plant would be placed and cured, and the structure construction would begin. Once the structure in complete, installation of the pumps, electoral system, and SCADA system would begin in series.

Equipment, Materials, Spoils, and Safety. Most of the traffic would come from arrival of construction workers, materials, and equipment on-site. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 9,400 cubic yards of material to local landfills (470 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. Figure 3-16 includes the project schedule for the Arvin-Edison booster plant installation. The construction has an anticipated timeline of 10 months from receiving the Notice-to-Proceed to the final closeout. However, the majority of the work would be done in the last 7 months. Maximum personnel on the project site is likely: 1 concrete crew (1 foreman, 3 laborers), 1 fence installation crew (1 foreman, 2 laborers), and Project Staff (1 Superintendent, 1-2 Admin staff) for a total of 9 to 10 persons on the project site.

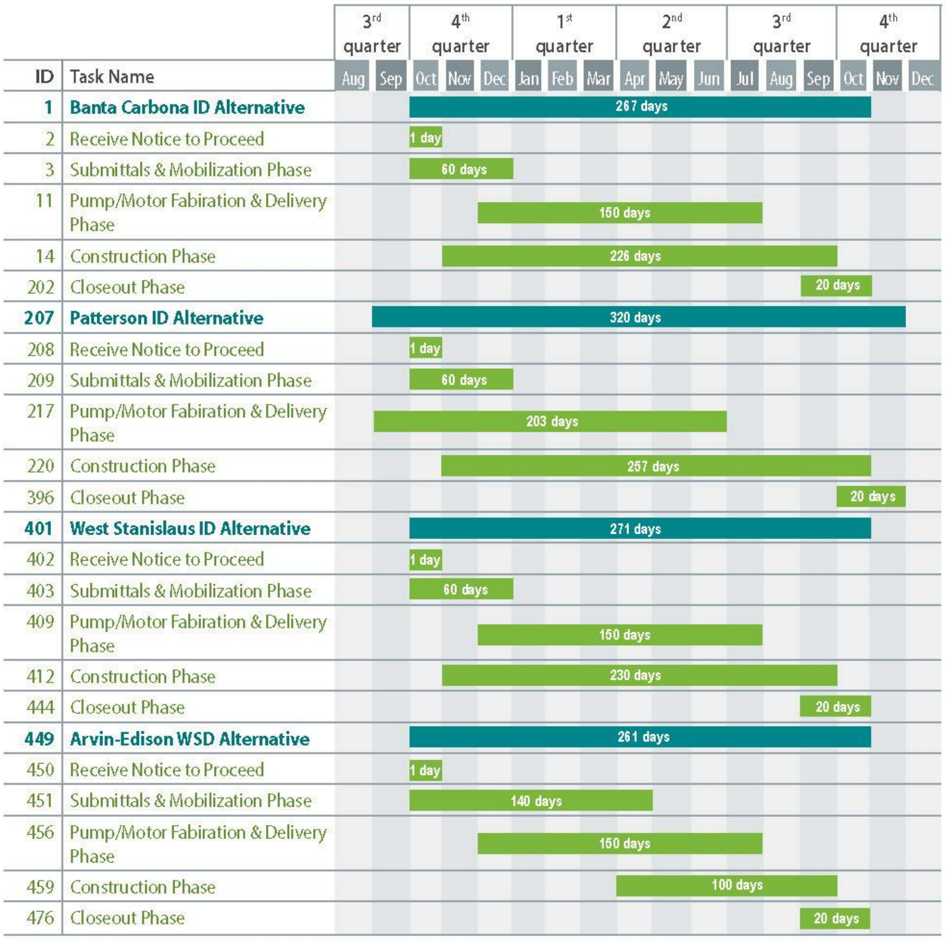


Figure 3-16.
Proposed Construction Schedule for Alternative 4 Expansions.

3.1.5 Alternative 5 – Construct New Facilities

Alternative 5 would construct a new recapture facility and include maximizing the use of existing facilities as described in Alternative 3, implement the Recirculation plan in Alternative 4, and incorporate additional storage options to maximize delivery of recaptured water. Figure 3-17 shows the key components of Alternative 5. More detailed information on the design of this alternative is included in Attachment 1.

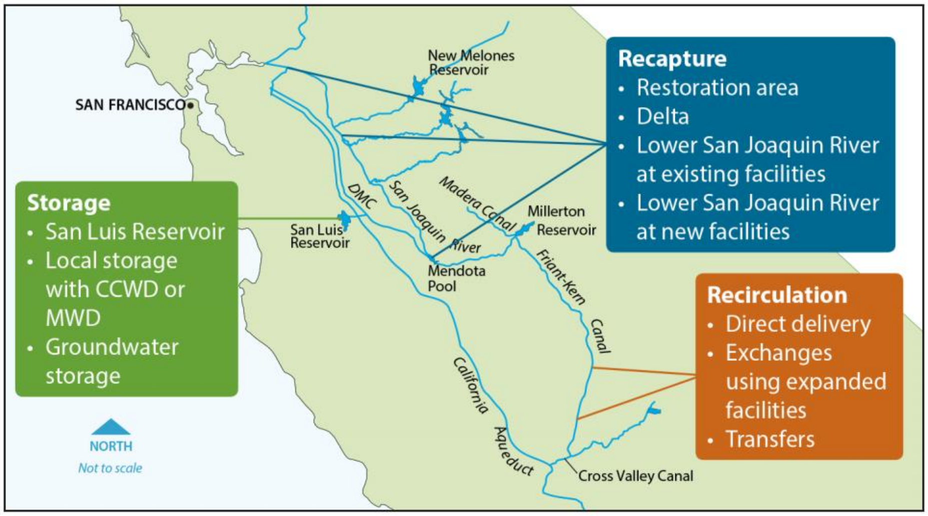


Figure 3-17.
Key Components for Alternative 5: Construct New Facilities

3.1.5.1 Recapture

The proposed location of the Intake Facility is Site 3-1 from the Initial Alternatives Technical Memorandum. This location was selected during the site visits and documented in the Reconnaissance Visit Memorandum. The intake facility site is located just south of Patterson along the San Joaquin River between Orange Avenue and Fig Avenue.

A new diversion facility would be constructed on the San Joaquin River to recapture Restoration Flows with a maximum capacity of 500 cfs from the San Joaquin River to the DMC via three 72-inch steel pipelines. The proposed San Joaquin River Intake Facility consists of approximately 570 linear feet of fish screen, two sedimentation channels with chain and flight sediment collection systems along with submersible sediment pumps, and six 3000 horsepower (hp) vertical turbine pumps each with a variable frequency drive (VFD). The electrical building is located near the intake facility, where the six VFDs are to be housed. The electrical substation would be located near the electrical building, which would transform the incoming voltage to the necessary voltage required to power the vertical turbine pumps. The metering vault is also to be located on the intake site. Each of the 72-inch pipelines would have a flowmeter allowing for continuous flow monitoring of all flows leaving the intake facility.

As the water passes through the fish screens, it enters one of the two sedimentation basin/channels. As the water level rises in the sedimentation basin, the isolation gates close to allow undisturbed settling time. The sedimentation basins allow sediment to settle prior to being pumped to the DMC. After detention, water would flow through the diffuser wall and towards the vertical turbine intake pump. Currently, the intake pump station is designed to have 6 pumps operating when pumping 500 cfs. Each pump has a 42-inch discharge, and each pair of pumps connects to a 72-inch header. There are three pairs of pumps and three 72-inch pipelines that would convey water to the DMC. Surge

Protection is provided on the three 72-inch force mains by large hydro pneumatic surge tanks.

The settled solids (sludge) are raked from the bottom of the sedimentation basin by a system of chain and flights. The sludge would be pushed into the solids collection trench. The solids collection trench is sloped to one end where pump(s) would send the sludge to the siltation basins for further settling. The siltation basins allow the sludge to be further settled and settled water can be set back to the San Joaquin River. The settled solids can be cleaned out of the basin and disposed of. The design includes three basins: one active, one being cleaned, and one standby.

The initial pipeline alignment is routed from the intake facility site to the DMC via Almond Avenue and Elfers Avenue to the DMC. To provide maximum reliability and flexibility while minimizing the required trench width, it is recommended to use three 72-inch diameter pipelines. The preliminary material is welded steel pipe (WSP). WSP was chosen because there are multiple manufacturers of steel pipe that would compete with each other to help drive down costs. Steel pipe can also be readily configured into a pre-purchase alternative if so desired when all economic and schedule impacts have been fully evaluated.

At the discharge location, there is a transition structure with a weir to break the pressure head of the pipelines and allow the water to flow freely into the DMC with minimal scouring. The transition structure has been preliminarily sized with a weir length of 65 feet to provide a maximum velocity of 5 feet per second (fps) for the water flowing into the DMC. Figures 3-18 and 3-19 illustrate this alternative.

Figure 3-18.
Alternative 5 Aerial Map

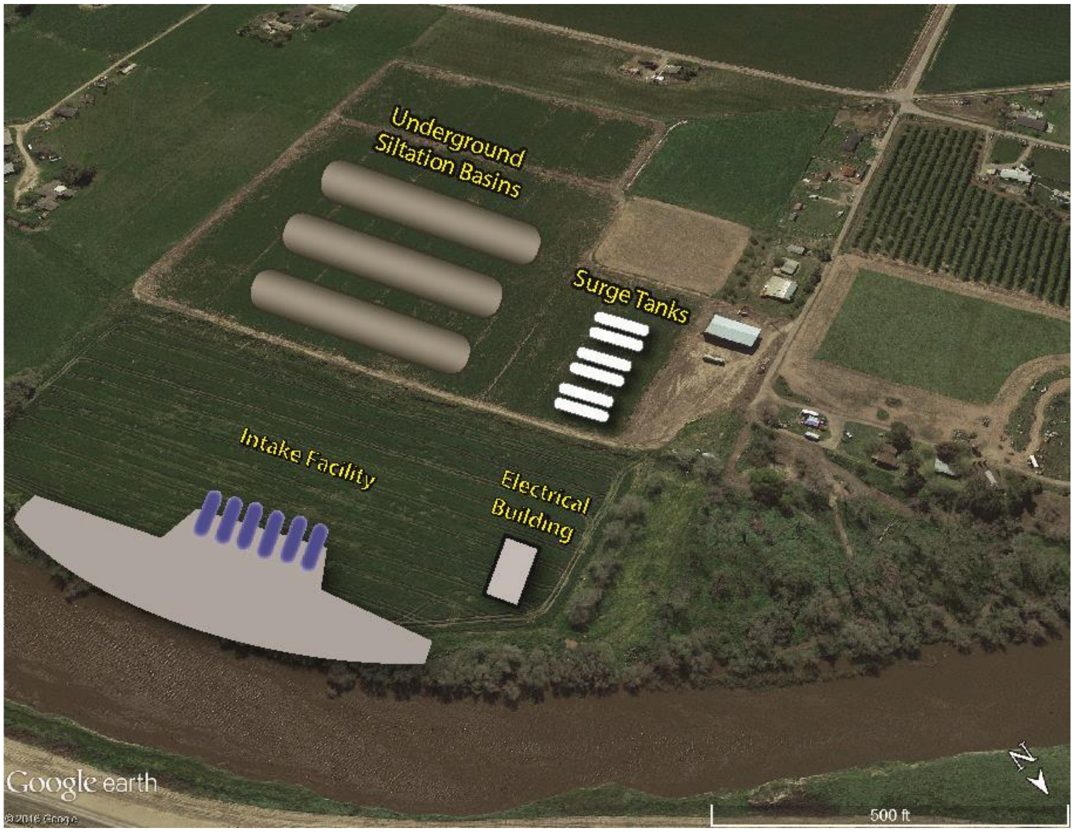


Figure 3-19.
Alternative 5 Intake Facility

3.1.5.2 Recirculation

Alternative 5 would incorporate the same Recirculation plan as described in Alternative 4.

3.1.5.3 Storage

Alternative 5 would incorporate options to store Restoration Flows as Alternative 4, and also include the option of groundwater storage facilities. These storage agreements would prevent loss of Restoration Flows when San Luis Reservoir spills during wetter conditions, which would increase delivery of Restoration Flows to Friant users.

There are several groundwater banks that could potentially store recaptured Restoration Flows through in-lieu recharge or direct recharge that are connected to conveyance facilities used to recirculate Restoration Flows (Figure 3-20). In-lieu recharge would take place during the irrigation season (April to September) and direct recharge with percolation ponds could take place throughout the year. The potential groundwater storage facilities include banks in the Friant Division that were identified and investigated in the Investment Strategy Report and others outside of the Friant Division that include WSDs and banks operated by private companies. These banks are identified in Table 3-3 and further described below.

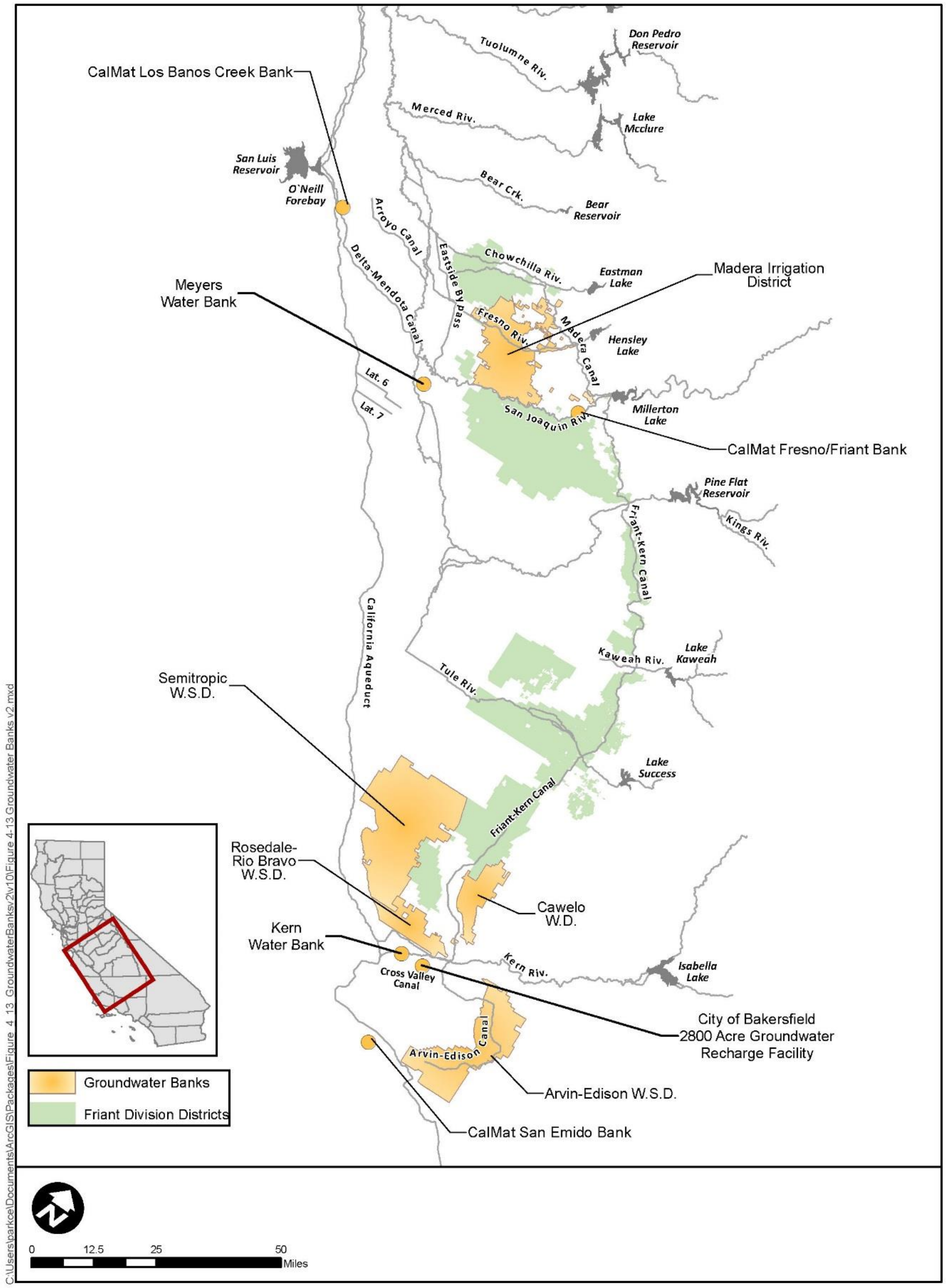


Figure 3-20.
Groundwater Bank Storage Options

Table 3-3. Potential Groundwater Storage Facilities

Bank	Location	Total Storage Capacity	Connection
Semitropic Groundwater Bank	Kern County	1,650,000 AF	California Aqueduct
Cawelo WD	Kern County	120,000 AF	CVC
Rosedale-Rio Bravo WSD	Kern County	930,000 AF	CVC
Kern Water Bank	Kern County	1,500,000 AF	California Aqueduct & CVC
City of Bakersfield 2800 Acre Groundwater Recharge Facility	Kern County	168,000 AF (maximum annual recharge)	CVC & FKC
Meyers Water Bank	Fresno County	Approximately 60,000 AF	Mendota Pool
Arvin-Edison WSD	Kern County	150,000 AF (maximum annual recharge)	CVC & California Aqueduct
Private Groundwater Banks (CalMat Company)	Fresno County, Merced County, & Kern County	Unknown	San Joaquin River, DMC and California Aqueduct

Semitropic WSD Groundwater Storage Bank. Semitropic WSD in Kern County, northwest of Bakersfield, could accept recaptured Restoration Flows for storage and recirculate the water to the Friant Contractors through exchanges or pump-back from its turnout on the California Aqueduct. With exchanges, Semitropic WSD would send its SWP allocation to the Friant Contractors with the ability to directly take the water from the CVC. With pump-back, Semitropic WSD would pump stored groundwater into the California Aqueduct or utilize its Shafter Wasco ID intertie to recirculate Restoration Flows to Friant Contractors. Semitropic WSD has a total groundwater storage capacity of 1,650,000 AF, with a single-year recharge capacity of 315,000 AF shared with all its groundwater banking partners (Semitropic WSD 2004). The original 1,000,000 AF groundwater bank is currently fully allocated to existing banking partners, but the District's 650,000 AF Stored Water Recovery Unit has approximately 470,000 AF of uncommitted storage space available (Semitropic WSD 2015). The Semitropic Stored Water Recovery Unit would support a total annual banked groundwater pump-back of 200,000 AF that would be split by banking partners making calls on their stored supply that year. Semitropic WSD typically stores water through in-lieu recharge, but also has direct recharge facilities. In addition to use of storage capacity in the Stored Water Recovery Unit, Restoration Flows could potentially be stored utilizing available space in the original 1,000,000 AF groundwater bank through sharing agreements with original banking partners. Use of this shared space would likely be subject to priority agreements with the original banking partner(s) with whom the agreement is established to prevent conflicts over storage use and access to both in-lieu recharge and stored water return capacity.

The Semitropic WSD has also proposed the development of a new temporary surface water storage facility on 40,000 acres of farmland in the historic Tulare Lake bed designed to capture Kings River flood flows (Los Angeles Times 2015). This new facility would be comprised of three shallow reservoirs built on land with permanent easements that would be connected to the existing Semitropic WSD groundwater recharge facilities (Los Angeles Times 2015). This new facility would store an estimated

250,000 to 500,000 AF of flood flows (Los Angeles Times 2015). Depending on the structure of the easements that would be secured to develop these facilities they could also be potentially used to store recaptured Restoration Flows.

Cawelo WD. Cawelo WD in Kern County is connected to the CVC and has the potential to store recaptured Restoration Flows. Cawelo WD offers groundwater banking through both in-lieu and direct recharge. Its in-lieu water banking program has a storage capacity of 120,000 AF. The largest direct recharge storage site within the district is the Famoso Groundwater Banking Project Basins, which covers 370 acres, has a 400 AF capacity, and is located off Poso Creek (Cawelo WD 2014). Banked water could be returned to Friant Contractors through exchanges or delivered to the California Aqueduct during Cawelo WD's off-peak periods.

The District currently has two banking partners, the Zone 7 Water Agency and the Dudley Ridge WD, with agreements to store water in the bank. Zone 7 has an agreement to deliver up to 10,000 AF of water per year and return 10,000 AF of water per year through SWP entitlement or groundwater pump-back supplied exchanges (Wells Fargo Securities 2010). The Dudley Ridge WD agreement provided the Cawelo WD funding to build facilities to intercept and store high flows on Poso Creek for an estimated annual yield of 7,000 AF. The agreement provides for the storage of 29,800 AF of water for Dudley Ridge with the annual pump-back return of up to 2,000 AF and an estimated annual return of 693 AF per year over the term of the agreement (Cawelo WD 2007). Space in the District's aquifer for a new banking partner would be limited, but similar to the storage sharing agreement between current banking partners described above for the Semitropic WSD, an agreement with Zone 7 Water Agency or the Dudley Ridge WD could be developed to share unused bank capacity. The agreement would likely include measures to prevent conflicts over storage use and access to both recharge and stored water return capacity.

Rosedale-Rio Bravo WSD. Rosedale-Rio Bravo WSD in Kern County uses water from the SWP delivered through the CVC and Kern River water to recharge the groundwater aquifer that landowners within its service area use for their water supply. Rosedale-Rio Bravo WSD covers 44,000 acres and has a maximum annual recharge of 234,000 AF per year and a maximum annual recovery of 45,000 AF per year (Rosedale-Rio Bravo WSD 2012). There could be available capacity to store recaptured Restoration Flows in Rosedale-Rio Bravo WSD, which has an estimated total storage capacity of more than 930,000 AF (Rosedale-Rio Bravo WSD 2001, as cited in ESA 2008). Currently, Rosedale-Rio Bravo WSD offers a 2:1 banking program in which participating entities agree to a 2:1 (stored: returned) ratio agreement. In 2013 groundwater storage levels in the District were approximately 608,000 AF, with 326,800 dedicated to banking partners (Rosedale-Rio Bravo WSD 2015). Use of the Rosedale-Rio Bravo WSD to store Restoration Flows could be limited given available space in the bank for new banking partners.

Kern Water Bank. Kern Water Bank in Kern County, located between the California Aqueduct and Bakersfield, is connected to the California Aqueduct and the CVC and has the potential to store recaptured Restoration Flows. Kern Water Bank is one of the largest groundwater banking agencies in the county, covering 20,000 acres with an estimated readily-accessible storage capacity of approximately 1.5 million AF. Kern Water Bank can recharge up to 72,000 AF per month using approximately 7,000 acres of recharge ponds and can recover approximately 240,000 AF over a 10-month period (Kern Water Bank Authority No Date). Kern Water Bank currently receives water from the SWP, CVP via the California Aqueduct and the FKC, and the Kern River. The 1.5 million AF storage capacity of the Kern Water Bank is currently dedicated to members of the Joint Powers Authority, Dudley Ridge WD, Kern County Water Agency (KCWA) on behalf of its Improvement District 4, Semitropic WSD, Tejon-Castaic WD, Westside Mutual Water Company, and Wheeler Ridge-Maricopa WSD. Use of the Kern Water Bank to store Restoration Flows would need to rely on a storage sharing agreement with one or more of the Joint Powers Authority members, similar to the option described above for the Semitropic WSD, to prevent conflicts over storage use and access to both recharge and stored water return capacity.

City of Bakersfield 2800 Acre Groundwater Recharge Facility. 2800 Acres in Kern County is connected to the CVC and is capable of taking recirculated Restoration Flows. 2800 Acres banks an average of 22,000 TAF annually through direct recharge using spreading ponds (Bakersfield 2000). 2800 Acres has a maximum annual recharge of 168,000 AF and an average annual recovery of 46,000 AF (KCWA No Date, as cited in Pacific Institute No Date). 2800 Acres has previously banked and recovered CVP water, discharging it into the CVC and further conveying it to the FKC (Reclamation 2009).

Meyers Water Bank. Meyers Water Bank in Fresno County is a privately owned groundwater bank that is connected to the Mendota Pool and is capable of storing recaptured Restoration Flows. The Meyers Water Bank is currently being used to store Restoration Flows. CVP and non-CVP water is pumped from Mendota Pool for storage via direct recharge using ponds covering more than 90 acres, with a capacity of approximately 60,000 AF (Reclamation 2012). Recaptured water would be pumped back to Mendota Pool, where it could then be recirculated to Friant Contractors through the James ID and Tranquility ID Kings River exchange mechanism or exchanged into San Luis Reservoir.

Arvin-Edison WSD (Arvin-Edison) Groundwater Banking. Arvin-Edison is a Friant Contractor located in Kern County at the terminus of the FKC, with a connection to the CVC and the California Aqueduct. Arvin-Edison has a maximum annual recharge of nearly 160,000 AF and a maximum annual recovery of 150,000 AF (Arvin-Edison WSD 2016). Due to declining water levels during extended dry periods, recovery rates decline nearly 20% per year for consecutive dry periods. Opportunities may exist to partner with agencies that have agreements with Arvin-Edison WSD to use a portion of their groundwater storage.

Private Groundwater Banks (CalMat Company Groundwater Banks). The CalMat Company, a subsidiary of Vulcan Materials Company, operates multiple groundwater banks at quarry sites owned by Vulcan Materials. CalMat Company submitted a proposed option during public scoping that would allow for the storage of recaptured Restoration Flows at its groundwater banks. These included banks that CalMat operates along the San Joaquin River near Friant Dam, along Los Banos Creek near San Luis Reservoir, and along the California Aqueduct in Kern County. The location of the Los Banos Creek Bank could allow for stored groundwater to be pumped into the DMC, the California Aqueduct, or the San Joaquin River Exchange Contractor's Outside Canal, potentially allowing for recirculation and exchange operations similar to those accessing Restoration Flows stored in San Luis Reservoir. The San Emido Bank located near the California Aqueduct in Kern County could be used to store recaptured Restoration Flows that could be returned to the aqueduct upstream of the Arvin-Edison WSD South Canal connection. The Fresno/Friant Bank located adjacent to the San Joaquin River downstream of Friant Dam would have a more limited potential use for storage of recaptured Restoration Flows. Total bank storage capacity, recharge, and withdrawal rates for these facilities have not been established by CalMat. Determination of these values in coordination with CalMat will be necessary if these banks are included in the alternatives evaluated in the EIS/R.

3.1.5.4 Construction

Methods. The following is a brief description of the sequential major construction activities that might be associated with the construction of the land-side intake facilities:

1. Clear and grub construction staging area; install erosion control measures.
2. Mobilize construction equipment and materials.
3. Begin staged construction of setback levee.
4. Prepare levee foundation/make necessary ground improvements.
5. Install settlement and slope monitoring instrumentation.
6. Complete staged construction of setback levee and drain system.
7. Construct sheet pile wing walls.
8. Construct temporary sheet pile cofferdam on water side of levee.
9. Excavate for intake structure.
10. Install levee protection riprap.
11. Dewater levee side of cofferdam.
12. Place steel reinforcement and pour concrete foundation.
13. Form intake structure walls and place reinforcing steel.
14. Pour concrete for structure walls.
15. Continue forming and pouring structural elements/install structural steel.
16. Install piping and mechanical equipment (e.g., screens, louvers, pumps, wash pipes).
17. Install electrical and control equipment.
18. Remove cofferdam.
19. Complete finish work.
20. Testing.
21. Complete land-side facilities (surge facilities, support building final grading and paving, fencing).
22. Demobilization (O&M Manual preparation, review, and submittal; As-Built preparation, review, and submittal; Punchlist; Contractor releases).

Equipment, Materials, Spoils, and Safety. Construction equipment would include rear dump 18-wheel trucks, track type tractors, excavators, a wheel loader, a grader, backhoes, a compactor, scrapers, and a crawler crane. Most of the traffic would come from arrival of construction workers, materials, and equipment. Construction related traffic would likely begin two weeks after receiving the Notice to Proceed. Several deliveries would be expected per day, as well as transport and disposal of approximately 491,078 cubic yards of material to local landfills (24,555 round trips using a 20-yard truck), along with regular commuting of construction personnel.

Construction Schedule. The proposed construction is anticipated to be completed within three years of receiving the Notice to Proceed. Work would be conducted during daylight hours, Monday through Friday, excluding holidays with a maximum number of 53 personnel on site per day.

Figure 3-21 shows the proposed construction schedule for the new recapture facility in Alternative 5.

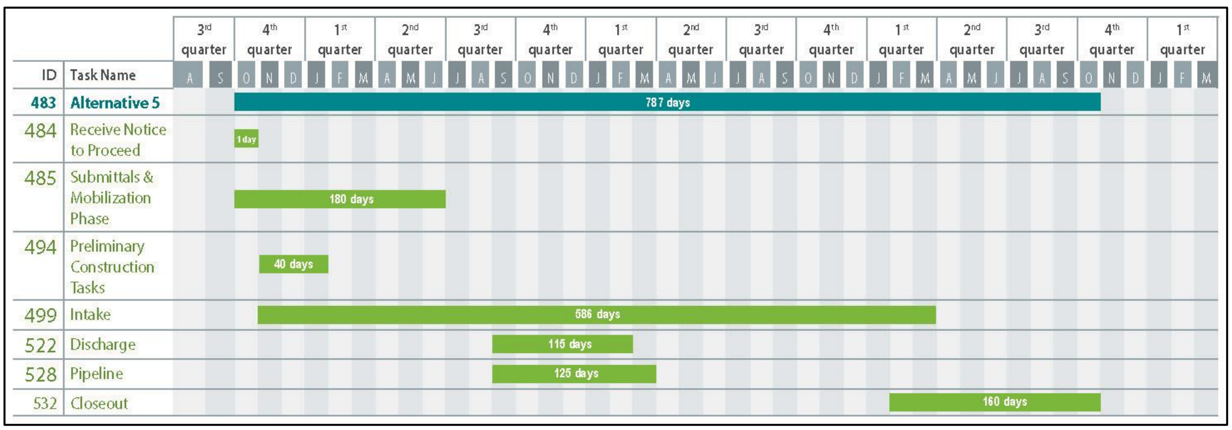


Figure 3-21.
Proposed Construction Schedule for Alternative 5.

4.0 Initial Alternatives Evaluation Criteria

This section describes the evaluation criteria used to evaluate and screen the initial alternatives. The purpose of this evaluation is to compare and contrast initial alternatives that meet most of the need for the proposal of the project and minimize environmental impacts.

The four primary evaluation criteria are based on the Federal planning criteria outlined the PR&Gs. These criteria include completeness, effectiveness, acceptability, and efficiency. Each primary criterion is further defined by "performance measures" that help assess each alternative's performance related to the criterion.

4.1 Completeness

The completeness criterion addresses whether an alternative includes all actions necessary to meet the LTRRRF Purpose and Need. The sub-criterion developed for completeness evaluates the degree to which each alternative addresses both recapture and recirculation.

4.1.1 Addresses Recapture and Recirculation

A complete alternative includes recapture and recirculation elements to meet the Purpose and Need of the LTRRRF EIS/R:

> *To help achieve the San Joaquin River Restoration Program (SJRRP) Water Management Goal by recapturing and recirculating Restoration Flows to reduce Friant Contractor water supply impacts caused by releasing the Restoration Flows. Specifically, the long-term Recapture and Recirculation needs to satisfy the requirements of Paragraph 16 (a) of the San Joaquin River Settlement (Settlement), which directs the Secretary to develop and implement a plan for recirculation, recapture, reuse, exchange or transfer of the Restoration Flows for the purpose of reducing or avoiding impacts to water deliveries to all the Friant Division Long-Term Contractors caused by the Restoration Flows.*

4.1.1.1 Performance Measures

The performance measure for completeness evaluates the alternatives ability to meet the Purpose and Need to reduce or avoid impacts to water deliveries to all the Friant Division Long-Term Contractors caused by the Restoration Flows.

4.2 Effectiveness

The effectiveness criterion addresses how effective a particular alternative is at recapturing and recirculating Restoration Flows. The effectiveness sub-criterion will indicate the degree to which each alternative supports the recapture and recirculation of Restoration Flows.

4.2.1 Supports Recapture and Recirculation

This sub-criterion will use models to estimate the recaptured quantity of Restoration Flows at various recapture sites, effective storage of these Restoration Flows and recirculation to Friant Contractors in all water year types. The CalSim II model estimated the amount of Restoration Flow that could be recaptured at various locations during each month. This information fed into a spreadsheet-based "recirculation calculator" that estimated how much water could be recirculated or stored, and any losses. Attachment 2 describes the modeling effort in more detail. All other performance measures being equal, the alternative that recirculates the largest quantity of water performs the best related to this criterion.

4.2.1.1 Performance Measures

The performance measures associated with recapture and recirculation are:

- Amount of Restoration Flows recirculated to Friant Contractors in AF over a given time period or sequence of various water years;
- Amount of recaptured Restoration Flows lost during conveyance through spills and routing (AF) over a given time period or sequence of various water years;
- Equity in returning/exchanging water to all Friant Division Contractors.

4.2.2 Technical Feasibility

The technical feasibility sub-criterion considers how practical the initial alternatives are for implementation, based on the technologies proposed for use, the complexity of operating the system and using those technologies, and the amount of time the project would take to implement, including approvals, permitting, etc.

4.2.2.1 Performance Measures

- Operational complexity;
- Implementation timing, estimated with length of permitting and/or construction.

4.3 Acceptability

The acceptability criterion addresses the viability of an alternative with respect to acceptance by State and local resource and regulatory entities and compatibility with existing laws. The performance measures for acceptability evaluate the potential for effects on biological, physical, and social resources in the Study area.

4.3.1 Biological Effects

The biological effects criterion evaluates how habitat and species could be affected by any of the initial alternatives. The first performance measure includes how many acres of different habitat types would be affected (disturbed or removed completely) by each

Initial Alternative. While native vegetation in the Study area would be preserved wherever possible, the presence of construction vehicles and equipment could cause noise, dust, and vibration impacts and physical damage that could affect vegetation and wildlife.

Because a large variety of bird species that have the potential to occur in the initial alternatives' area of effect, the second performance measure includes how many months of construction would need to occur during sensitive wildlife periods.

The initial alternatives could also affect fish in the San Joaquin River during construction of a new or expanded intake facility. Also, diverting water from the San Joaquin River has the potential to affect fish that are in the area of the diversion (through entrainment or changes in predation) or downstream of the diversion (through less suitable in-river conditions). Section 16(a)(1) of the Settlement includes a provision that the LTRRRF Plan must "ensure that any recirculation, recapture, reuse, exchange or transfer of the Interim Flows and Restoration Flows shall have no adverse impact on the Restoration Goal, downstream water quality, or fisheries." This performance measure will consider the flow diverted from the San Joaquin River as a percent of the flow in the river at that location, as estimated by the modeling described in Attachment 2. While higher percentages diverted do not directly identify an impact to fish, the alternatives with higher percentages have more potential for impacts to fish. Higher percentages diverted will perform more poorly for this criterion, and will indicate the need to complete additional analyses as part of the EIS/R to fully consider consistency with Section 16(a)(1) of the Settlement including potential impacts to fish.

4.3.1.1 Performance Measures

- Acres of disturbed habitat;
- Number of months when construction activities overlap with sensitive wildlife periods (February through September - nesting/breeding season for birds, including raptors);
- Potential to adversely affect fish at and downstream of recapture sites.

4.3.2 Social Effects

Through the public scoping process for the LTRRRF EIS/R, stakeholders expressed concerns about the potential for implementation of recapture and recirculation to impact CVP and SWP water supplies because of operational changes associated with the recapture of Restoration Flows. This performance measure evaluates that potential through the modeling results described in Section 4.2.1.1 (and in more detail in Attachment 2). Any impacts to CVP and SWP contractors will be reduced under all alternatives by delivering recaptured water to these entities before recirculating water to Friant; however, increased effects from the modeling indicate a more complex operation.

The second performance measure evaluates the initial alternatives' reliance on facilities and land that is owned or controlled by willing participants for the development of the alternative. More affected landowners indicates a more complex project.

The third performance measure examines how many acres of agricultural lands would be removed from production and the associated reduction in annual agricultural production that would occur.

The final performance measure evaluates the total amount of land that would be affected under each Initial Alternative and the total number of parcels that would be affected.

4.3.2.1 Performance Measures

- Potential for CVP and SWP water supply impacts;
- Number of land owners affected;
- Quantity of farmland removed from production;
- Total amount of affected land and parcels.

4.3.3 Physical Effects

Physical effects represent direct physical impacts on the environment that would result from implementation of the initial alternatives. The performance measures for this subcategory examine air quality, noise, erosion and geomorphic changes in the river, and water quality. The performance measures focus on providing comparative estimates of potential impacts by using indicators of what those impacts could be. For example, air quality emissions are unknown at this phase of the project; however, an alternative would likely have greater emissions if it has more construction activities at a given time (estimated by dollars per month of construction).

Similar to the fisheries discussion in Section 4.3.1.1, water quality impacts will be estimated by the percent change in river flow caused by the diversion of Restoration Flows. While this measure does not directly indicate a potential effect to water quality, it does indicate the need for more detailed analysis of water quality impacts in the EIS/R.

4.3.3.1 Performance Measures

- Intensity of air quality impacts (average dollars/month of construction);
- Noise impacts (total construction duration in months);
- Downstream erosion or geomorphic changes due to new or modified intake facilities;
- Potential to affect water quality.

4.4 Efficiency

The efficiency criterion measures the viability and appropriateness of an alternative from the perspective of the Nation’s general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

4.4.1 Cost

The performance measures under the cost category include the one-time cost of construction and the present value of the cost of long-term operation and maintenance (O&M). Efficiency often looks at cost-effectiveness by including a measure of costs and benefits. In this evaluation, benefits are captured in the effectiveness criterion, so this measure focuses on cost.

4.4.1.1 Performance Measures

- Capital cost (construction and land);
- Annual O&M cost (operations and/or use of facilities).

4.5 Summary of Evaluation Criteria

Table 4-1 presents a summary of the evaluation criteria for selecting alternatives to be evaluated in the LTRRRF EIS/R.

Table 4-1. Evaluation Criteria Summary

Federal Planning Criteria	Evaluation Criteria	Performance Measure
Completeness	Addresses Recapture and Recirculation	The recapture, recirculation and storage components included in the alternative combine to reduce impacts to Friant Contractors from the release of Restoration Flows
Effectiveness	Supports Recapture and Recirculation	Amount of Restoration Flows returned to Friant Contractors over a given time period or sequence of various water years
		Amount of recaptured Restoration Flows lost during conveyance through spills and routing over a given time period or sequence of various water years
		Equity in returning/exchanging water to Friant Division Contractors
	Technical feasibility	Operational complexity
		Implementation timing, estimated with length of construction
Acceptability	Biological Effects	Acres of disturbed habitat
		Number of months when construction activities overlap with sensitive wildlife periods
		Potential to adversely affect fish from recapture
	Social Effects	Potential for CVP and SWP water supply impacts
		Number of land owners affected
		Quantity of farmland removed from production
		Total amount of affected land and parcels
	Physical Effects	Intensity of air quality impacts (average dollars/month of construction)
		Noise impacts (total construction duration in months and footprint size)

Federal Planning Criteria	Evaluation Criteria	Performance Measure
		Downstream erosion or geomorphic changes due to new or modified intake facilities
		Potential to affect water quality
Efficiency	Cost	Capital cost (construction and land)
		Annual O&M cost (operations and/or use of facilities)

4.6 Applying Criteria and Rating Initial Alternatives

The initial evaluation of alternatives will identify a rating for each of the performance measures summarized in Table 4-1. Most of the data presented will use objective measurements for each performance measure, such as volume of water delivered, acres impacted, estimated dollars required or lost, based on appraisal-level designs for each alternative. However, some of the criteria in the evaluation will use qualitative assessments to estimate results. Assumptions about current conditions and future effects of the alternatives are inherently involved at the current level of design. These assumptions have been based on information collected from similar projects and professional experience.

5.0 Initial Alternatives Evaluation Results

5.1 Project Objectives

This section presents the results of the initial alternatives evaluation. The performance measures are represented by colors with blue indicating high favorability, turquoise representing medium favorability, and light green denotes low favorability.

5.2 Completeness

All alternatives include both recapture and recirculation elements to achieve the purpose and need of the LTRRRF EIS/R. Because all alternatives meet this completeness criterion, it is not discussed in more detail.

5.3 Effectiveness

While all alternatives contribute to both recapture and recirculation of Restoration Flows, the alternatives vary in the amounts recaptured and recirculated.

5.3.1 Supports Recapture and Recirculation

The first performance measure studies the amount of Restoration Flows recaptured and recirculated to Friant Contractors over a given time period or sequence of various water years. Table 5-1 shows recaptured water in the Delta and on the San Joaquin River. The table also shows the rating for how each alternative performs. Alternative 5 performs the best for this performance measure because of the new recapture facility, and Alternatives 3 and 4 perform moderately because of the multiple recapture options. Alternative 2 performs the same as Alternative 1 (the No Action Alternative).

Table 5-1. Average Annual Recaptured Water (in TAF)

Alternative	Delta Recapture	San Joaquin River Recapture	Total Recapture	Performance Rating
Alternative 1	64	0	64	Low
Alternative 2	64	0	64	Low
Alternative 3	37	50	87	Medium
Alternative 4	32	63	95	Medium
Alternative 5	21	89	110	High

Figure 5-1 shows how recapture varies by year type. While wet years have the highest allocation of Restoration Flows, some of the Restoration Flow targets are met by flood flows. If flood releases are necessary at the same time that Restoration Flows are scheduled, the entire release from Friant Dam would be a flood release. (Restoration Flows and flood flows would not be in the river or bypass channels at the same time.) These flood flows would not be available for recapture, and they would primarily occur during wet years and normal-wet years (to a lesser extent). The lower recapture amounts during wet years reflect these flood flows and other capacity limitations during wet years. No water is recaptured during Critical Low years.

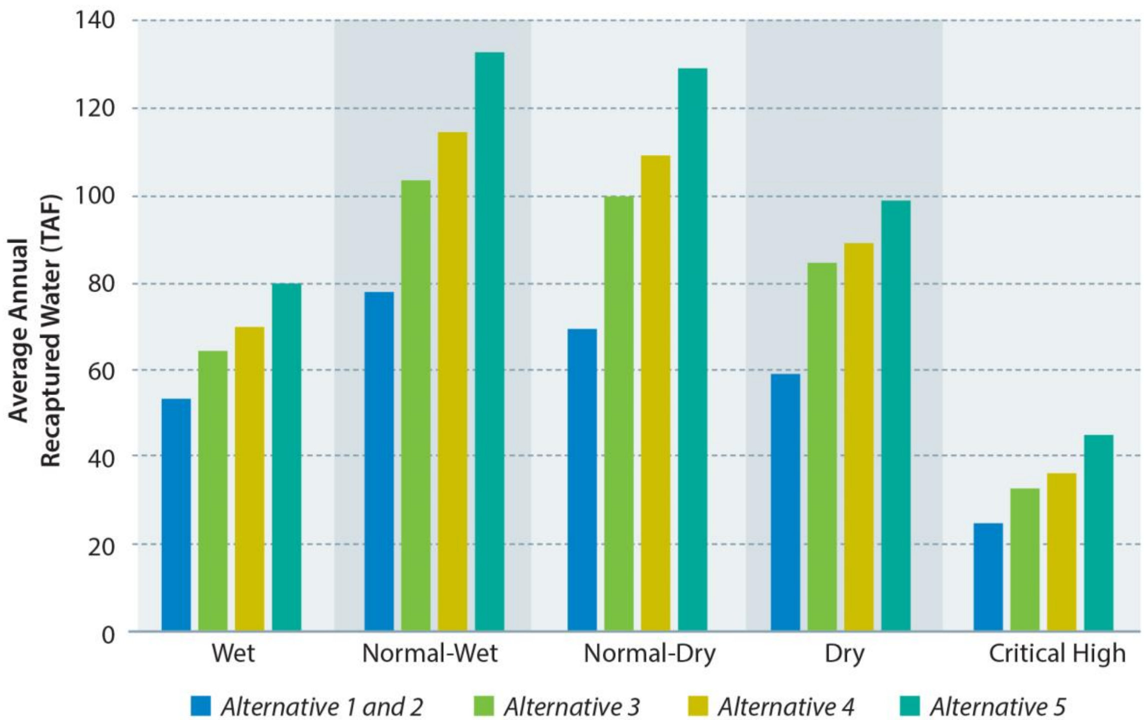


Figure 5-1.
Recaptured Restoration Flows by Year Type

The second performance measure examines the amount of recaptured Restoration Flows lost during conveyance though spills and routing. Table 5-2 shows the average annual amount recaptured, recirculated through direct delivery, recirculated through other exchanges or transfers, and water lost from storage for all alternatives. The modeling effort included an assumed priority for recirculation that first tried to direct deliver water as soon as it was recaptured, then stored water that was not able to be delivered immediately. During the irrigation season, the stored water was then delivered through direct delivery, exchanges, and transfers. This priority was only assumed for modeling, and may not be implemented under each alternative. This priority helped identify if existing recirculation options were adequate to deliver all recaptured water, and the modeling found that all recaptured water could be recirculated with direct delivery. Exchanges and transfers were not necessary to recirculate water, but could provide flexibility to the Friant contractors in recirculating water.

Table 5-2. Average Annual Water Recirculated and Lost from Storage (in TAF)

Alternative	Recaptured Water	Recirculated through Direct Delivery	Recirculated through Exchanges or Transfers	Water Lost from Storage in San Luis Reservoir
Alternative 1	64.1	63.9	0	0.5
Alternative 2	64.1	63.9	0	0.5
Alternative 3	87.1	86.1	0	1.0
Alternative 4	95.1	93.9	0	1.1
Alternative 5	110.3	109.0	0	1.2

Table 5-3 shows the amount of water lost from storage in each year type and the rating for how each alternative performs. The modeling effort used available storage in San Luis Reservoir first, before considering other surface water or groundwater storage in Alternatives 4 and 5. The evaluation found that very little water was lost from storage in San Luis Reservoir; therefore, additional storage was not necessary. All alternatives perform well for this performance measure.

Table 5-3. Average Annual Water Lost from San Luis Reservoir Storage by Year Type (in TAF)

Alternative	Wet	Normal-Wet	Normal-Dry	Dry	Critical High	Performance Rating
Alternative 1	1	1	0	0	0	High
Alternative 2	1	1	0	0	0	High
Alternative 3	2	1	0	1	0	High
Alternative 4	1	2	0	1	0	High
Alternative 5	0	3	1	1	0	High

While all the alternatives provide equity in return/exchange of water to all Friant Contractors, Alternatives 4 and 5 allow for more flexibility to deliver the recirculated water. While Alternatives 2 and 3 rely on existing infrastructure without change, Alternatives 4 and 5 include expansions to other districts and exchanges as well as increased storage capacity at the Contra Costa WD and Metropolitan WD to reduce loss of Restoration Flows when the San Luis Reservoir fills during wetter seasons. Alternatives 2 and 3 are ranked with a low favorability, and Alternatives 4 and 5 are ranked with a high favorability.

Table 5-4 summarizes the alternative ratings for the “Supports Recapture and Recirculation” evaluation criterion.

Table 5-4. Supports Recapture and Recirculation Evaluation Results

Supports Recapture and Recirculation	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Amount of Restoration Flows Recirculated to Friant Contractors	Low Performance	Medium Performance	Medium Performance	High Performance
Amount of Recaptured Restoration Flows Lost	High Performance	High Performance	High Performance	Low Performance
Equity in Return/Exchange	Low Performance	Low Performance	High Performance	High Performance

Legend:

High Performance	Medium Performance	Low Performance

5.3.2 Technical Feasibility

In general, all of the alternatives have been designed to be technically feasible. While all alternatives are achievable, the complexity of each alternative varies. Alternative 2 provides the highest technical feasibility with its low complexity due to no changes to existing operations. Alternative 3 is measured at a medium technical feasibility as a result of anticipated operational changes. Due to the high complexity of new operational implementations in Alternatives 4 and 5, these alternatives are rated with a low technical feasibility.

As the complexity of each alternative increases, the project schedule will also increase. Alternative 2 is measured with the high rating as there is no new construction and can be started right away. Alternative 3 involves implementing changes in daily operations and is ranked with medium favorability. Alternatives 4 and 5 are ranked with a low rating due to the amount of operation changes, permitting, and construction involved.

Table 5-5 summarizes the alternative ratings for the “Technical Feasibility” evaluation criterion.

Table 5-5. Technical Feasibility Evaluation Results

Technical Feasibility	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Operational Complexity	High Performance	Medium Performance	Low Performance	Low Performance
Implementation Timing	High Performance	Medium Performance	Low Performance	Low Performance

Legend:

High Performance	Medium Performance	Low Performance

5.4 Acceptability

This section provides the results of the acceptability criterion which examines biological effects, social effects, and physical effects. Some of these impacts are driven by land use changes associated with constructing new facilities. Table 5-6 shows the land use changes associated with Alternatives 4 and 5 (the alternatives that include construction of new facilities).

Table 5-6. Land Use Effects from Construction in Alternatives 4 and 5

Alternative and Conveyance Facility	Land Use	Acres
Alternative 4: Banta-Carbona ID Expansion		*2*
	Agriculture	1
Alternative 4: Patterson ID Expansion		*165*
	Agriculture	96
	Annual Grasses and Forbs	38
	Riparian Forest	0.5
	Rural Residential	8
	Urban	21
	Water	2
Alternative 4: West Stanislaus ID Expansion		*29*
	Agriculture	15
	Urban	1
	Water	13
Alternative 4: Arvin-Edison WSD Pumping Facility		*5*
	Agriculture	5
Alternative 5: New Recapture Facility		*63*
	Agriculture	61
	Riparian Forest	2
Alternative 5: New Conveyance		*181*
	Agriculture	159
	Annual Grasses and Forbs	2
	Rural Residential	14
	Urban	4
	Water	2

Sources: California Department of Fish and Wildlife and California State University Chico 2013; California State University Stanislaus 2012.

5.4.1 Biological Effects

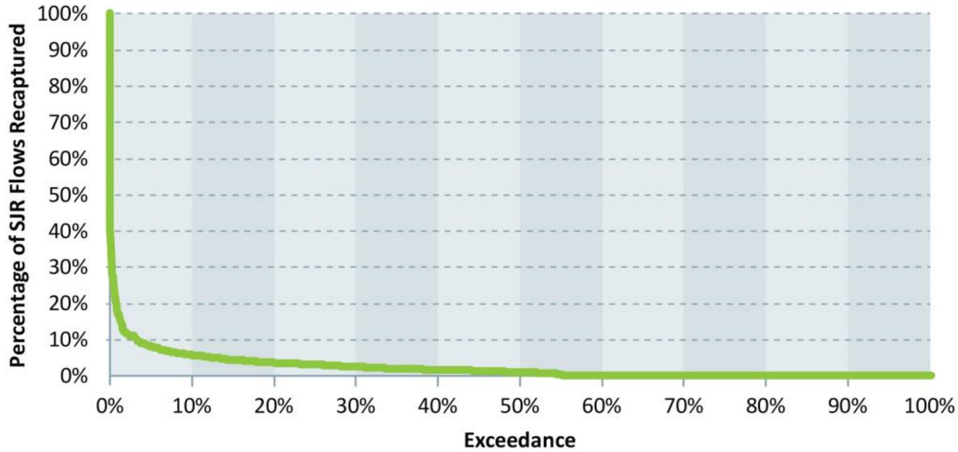
The alternatives would have varying effects on habitats. Alternatives 2 and 3 would not involve construction of new facilities; therefore, they would not affect existing habitat areas. Alternative 4 would expand conveyance facilities in four local IDs. These construction efforts would primarily be adjacent to existing canals and pump stations, where biological habitat is limited. As shown in Table 5-6, the alternatives would affect a small area of riparian forest and annual grasses and forbs. Alternative 5 would construct a new recapture facility along the San Joaquin River, which would have permanent changes to the area around the new facility. Alternative 5 would also involve temporary construction impacts from the pipeline that would convey the water to the DMC.

Alternatives 4 and 5 have similar amounts of changed land use, and would both receive a moderate rating, Alternatives 2 and 3 would have the highest performance.

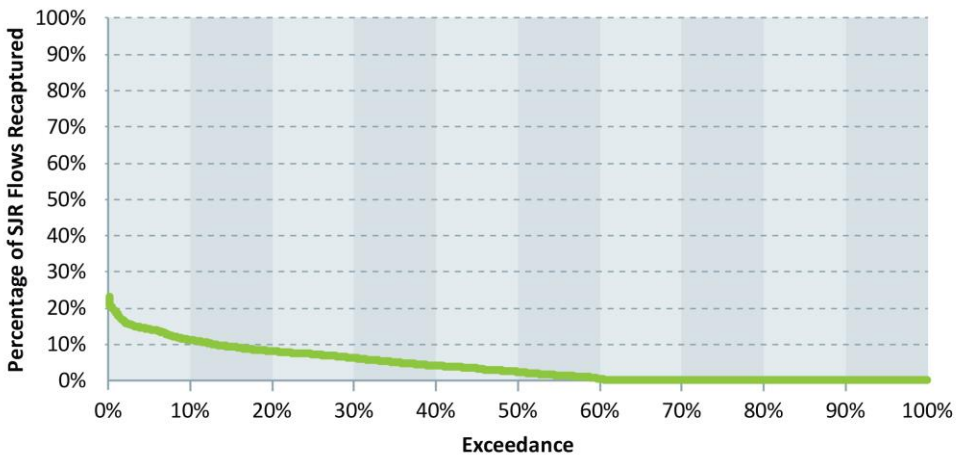
The second performance measure looks at number of months where construction overlaps with sensitive wildlife periods (where birds, including raptors are nesting and breeding), which are typically February through September. As Alternatives 2 and 3 propose no new construction, they are ranked with a high performance. Alternative 4 receives a moderate rating because construction would last for only one sensitive period. Alternative 5 receives a low performance rating because construction of a new diversion facility and conveyance pipelines to the DMC would continue through multiple sensitive wildlife periods.

Alternative 5 would include a new diversion facility with a state-of-the-art fish screen to prevent entrainment or impingement. Each action alternative would divert water in different locations. Diversions from the San Joaquin River have a greater potential to affect fish if they divert a larger percent of the river flow because these diversions could cause entrainment or predation near the facility, and reduce flow in the river downstream of the diversion. While a higher percent diversion does not directly indicate impacts to fish, it does indicate that more evaluation is necessary to understand these impacts. Figures 5-2 through 5-4 show the percentages of flow that would be diverted downstream of the Merced River confluence, the Tuolumne River confluence, and the Banta-Carbona ID diversion. These figures consider how often a percent is exceeded. For example, in Figure 5-2, the percent diverted from the San Joaquin River downstream from the Merced River with implementation of Alternative 3, exceeds six percent less than 10 percent of the time. The diversions at the Tuolumne River and Banta-Carbona ID consider all Restoration Flow that has been recaptured either at these locations or upstream, compared to the flow in the river at that location. For example, the percent recaptured downstream of Banta-Carbona ID includes diversions from Patterson ID, West Stanislaus ID, and a new facility (in Alternative 5). Attachment 2 also includes tables that show the flow changes in these locations by month by year type. Based on this information, Alternative 2 performs the highest because it recaptures the same water as the No Action Alternative. Alternatives 3 and 4 perform moderately, and Alternative 5 has low performance compared to the other alternatives.

San Joaquin River downstream from Merced River Confluence



San Joaquin River downstream from Tuolumne River Confluence



San Joaquin River downstream from Banta-Carbona ID

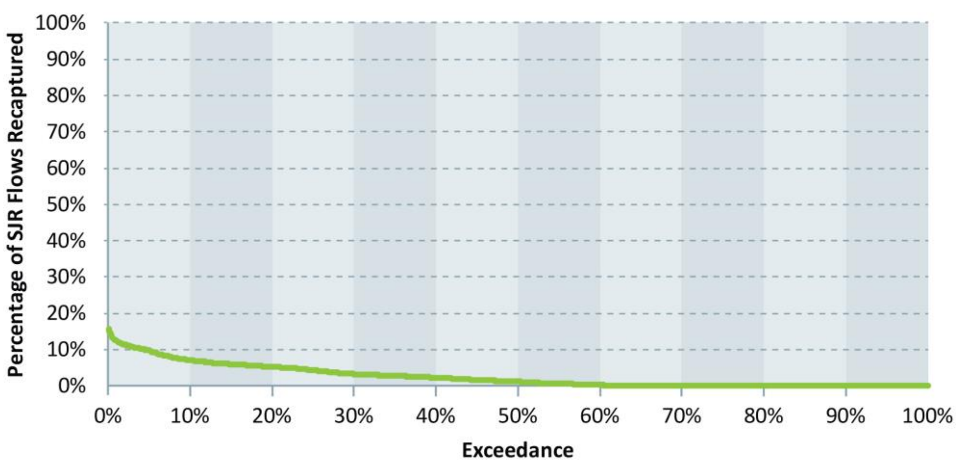
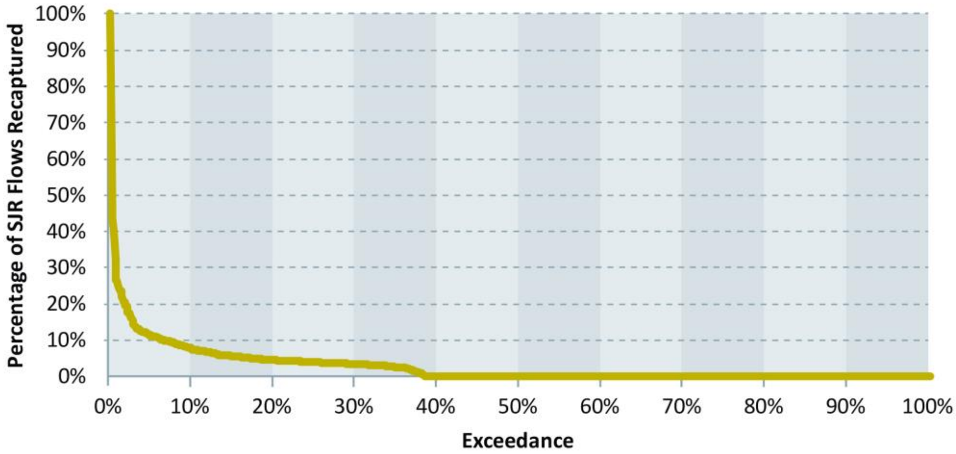
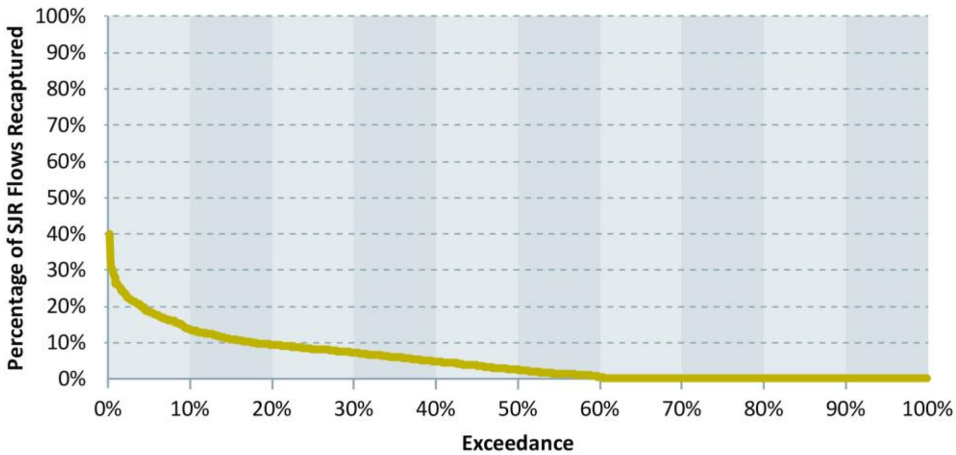


Figure 5-2.
Percent of San Joaquin River Flow Diverted under Alternative 3

San Joaquin River downstream from Merced River Confluence



San Joaquin River downstream from Tuolumne River Confluence



San Joaquin River downstream from Banta-Carbona ID

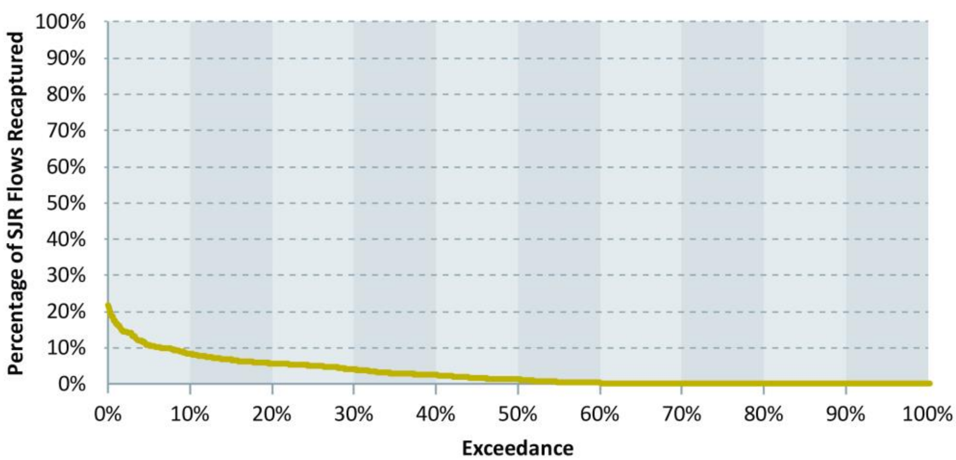
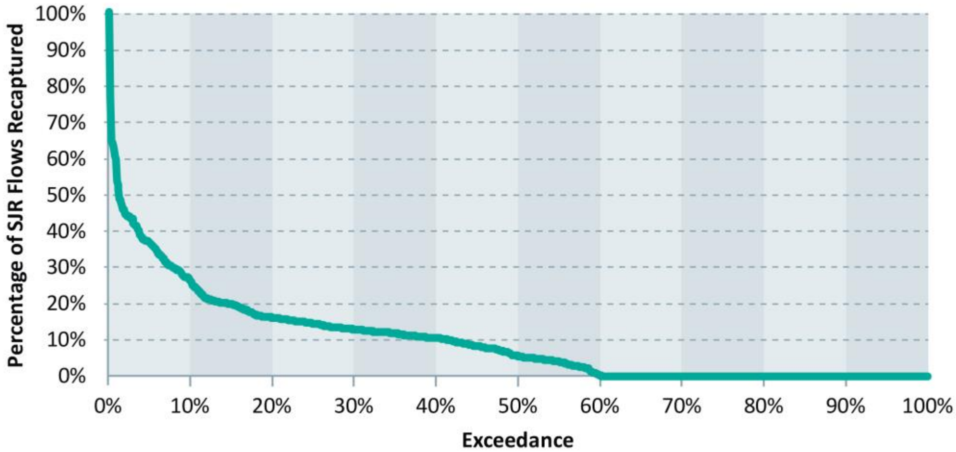
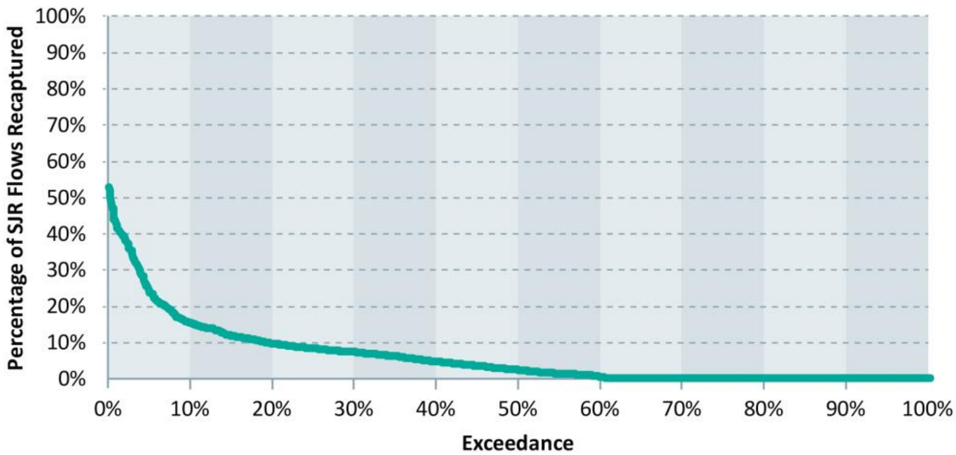


Figure 5-3.
Percent of San Joaquin River Flow Diverted under Alternative 4

San Joaquin River downstream from Merced River Confluence



San Joaquin River downstream from Tuolumne River Confluence



San Joaquin River downstream from Banta-Carbona ID

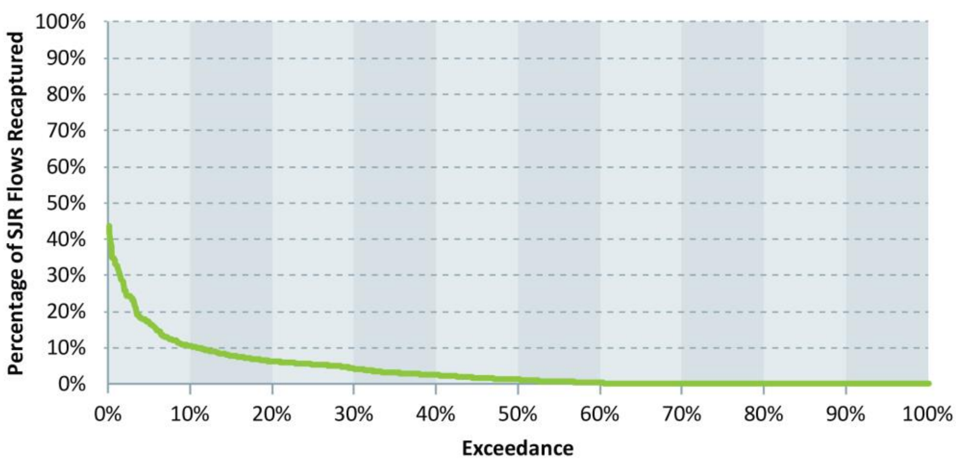


Figure 5-4.
Percent of San Joaquin River Flow Diverted under Alternative 5

Table 5-7 summarizes the alternative ratings for the "Biological Effects" evaluation criterion.

Table 5-7. Biological Effects Evaluation Results

Biological Effects	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Acres of Disturbed Habitat				
Months of Construction Overlap with Sensitive Wildlife Seasons				
Potential to Adversely Affect Fish				

Legend:

High Performance	Medium Performance	Low Performance

5.4.2 Social Effects

This performance measure looks at how each alternative will affect the surrounding areas.

Current modeling examined effects to both CVP and SWP deliveries. Table 5-8 shows the change in monthly average deliveries to CVP users during all years, and Table 5-9 shows this information averaged over only dry years (when the delivery impacts were the greatest). Tables 5-10 and 5-11 show the same information for SWP years. While all alternatives show an affect to other users, this effect is small and would be further reduced because recaptured water would be used to address these decreases before water is recirculated to Friant. Because these impacts would be reduced under all alternatives, all alternatives receive a moderate rating.

Table 5-8. Change in Monthly Average Deliveries to CVP Users in All Years (in thousands of AF)

Month	No Action Alternative	Alternative 2 Change from No Action	Alternative 3 Change from No Action	Alternative 4 Change from No Action	Alternative 5 Change from No Action
October	259	0 (0%)	0 (0%)	0 (0%)	0 (0%)
November	139	0 (0%)	0 (0%)	0 (0%)	0 (0%)
December	97	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	97	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	114	0 (0%)	0 (0%)	0 (0%)	0 (0%)
March	156	0 (0%)	0 (0%)	0 (0%)	0 (0%)
April	471	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	589	0 (0%)	0 (0%)	0 (0%)	0 (0%)
June	820	0 (0%)	0 (0%)	0 (0%)	0 (0%)
July	876	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
August	703	0 (0%)	0 (0%)	0 (0%)	0 (0%)
September	332	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 5-9. Change in Monthly Average Deliveries to CVP Users in Dry Years (in thousands of AF)

Month	No Action Alternative	Alternative 2 Change from No Action	Alternative 3 Change from No Action	Alternative 4 Change from No Action	Alternative 5 Change from No Action
October	259	0(0%)	0 (0%)	0 (0%)	0 (0%)
November	138	0 (0%)	0 (0%)	0 (0%)	0 (0%)
December	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	92	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	108	0 (0%)	0 (0%)	0 (0%)	0 (0%)
March	136	0 (0%)	0 (0%)	0 (0%)	0 (0%)
April	462	0 (0%)	0 (0%)	-1 (0%)	0 (0%)
May	550	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
June	751	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
July	787	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
August	638	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
September	303	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 5-10. Change in Monthly Average Deliveries to SWP Users in All Years (in thousands of AF)

Month	No Action Alternative	Alternative 2 Change from No Action	Alternative 3 Change from No Action	Alternative 4 Change from No Action	Alternative 5 Change from No Action
October	341	0 (0%)	1 (0%)	1 (0%)	1 (0%)
November	305	0 (0%)	0 (0%)	0 (0%)	0 (0%)
December	268	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	51	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	40	0 (0%)	0 (0%)	0 (0%)	0 (-1%)
March	86	0 (0%)	0 (0%)	0 (0%)	0 (0%)
April	242	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	353	0 (0%)	0 (0%)	0 (0%)	0 (0%)
June	454	0 (0%)	0 (0%)	0 (0%)	0 (0%)
July	499	0 (0%)	0 (0%)	0 (0%)	0 (0%)
August	478	0 (0%)	0 (0%)	0 (0%)	0 (0%)
September	379	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 5-11. Change in Monthly Average Deliveries to SWP Users in Dry Years (in thousands of AF)

Month	No Action Alternative	Alternative 2 Change from No Action	Alternative 3 Change from No Action	Alternative 4 Change from No Action	Alternative 5 Change from No Action
October	317	0(0%)	0 (0%)	2 (0%)	1 (0%)
November	280	0 (0%)	0 (0%)	1 (0%)	1 (0%)
December	246	0 (0%)	0 (0%)	1 (0%)	1 (0%)
January	33	0 (0%)	0 (0%)	1 (2%)	1 (2%)
February	13	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
March	24	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
April	199	0 (0%)	-3 (-1%)	-2 (-1%)	-2 (-1%)
May	294	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
June	405	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
July	468	0 (0%)	-2 (0%)	-2 (0%)	-1 (0%)
August	439	0 (0%)	-4 (-1%)	-3 (-1%)	-3 (-1%)
September	349	0 (0%)	-3 (-1%)	-3 (-1%)	-2 (-1%)

The second sub-criterion focuses on the number of landowners who would be affected by activities involved in each alternative. Because Alternatives 2 and 3 involve no new construction, it receives a high rating. Alternative 4 would have an effect on a small number of landowners, as construction would occur on or near existing facilities. It is ranked with a medium rating. Alternative 5 receives a low rating because of the complexity of the construction project and the land acquisition required to construct the new facility.

Another performance measure listed under Social Effects is the quantity of farmland permanently removed from production in acres. Because there is no new construction in Alternatives 2 and 3, they receive a high rating. Alternative 4 does involve new construction, but it would not remove farmland from production, so it also receives a high rating. Alternative 5 would remove some land from production permanently around the new diversion facility, but it would not be a very large parcel. The farmland effects from pipeline construction would be temporary; therefore, Alternative 5 receives a moderate rating.

The final performance measure focuses on the total amount of affected land and parcels in acres of land affected. Similar to the above, Alternatives 2 and 3 will not affect additional lands and receive high ratings. As shown in Table 5-6, Alternatives 4 and 5 would affect a similar amount of land near new facilities, and both alternatives receive a medium rating.

Table 5-12 summarizes the alternative ratings for the “Social Effects” evaluation criterion.

Table 5-12. Social Effects Evaluation Results

Social Effects	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Potential for CVP and SWP Water Supply Impacts				
Number of Landowners Affected				
Quantity of Farmland Removed from Production				
Total Amount of Affected Land				

Legend:

High Performance	Medium Performance	Low Performance

5.4.3 Physical Effects

To estimate which alternatives could have greater air quality impacts, the cost per month of construction was calculated. Alternatives with higher monthly costs have the potential for more air quality impacts due to the likeliness of high intensity construction with more equipment and vehicles producing emissions. Because there is no new construction, Alternatives 2 and 3 would not have a negative effect on air quality; therefore, they receive high ratings. Construction activities would affect air quality in Alternative 4, and it receives a medium ranking because it has moderate costs per day. Because of the larger construction effort, Alternative 5 would have the most effect on air quality and receives a low rating.

To determine noise impacts, the total months of construction were compared for each of the alternatives. The alternatives requiring the most months of construction were expected to produce the longest lasting noise impacts. Alternatives 2 and 3 receive high ratings because they do not involve any construction. Alternative 4 receives a moderate rating because construction would last about a year total, with about eight months for each project component. Alternative 5 construction would continue for multiple years, so it receives a low rating.

As part of pre-design, the study team evaluated changes in erosion or geomorphic changes due to new or existing intake facilities. Alternatives 2-4 continue to use the existing flow channel and are not believed to pose a sufficient change in erosion or cause geomorphic changes in the area. Therefore, all three alternatives receive a high rating. Eight potential intake sites were evaluated for the selection of Alternative 5. The assessment considered two items: the stability and capacity to support the infrastructure necessary for a positive barrier fish screen that meets all appropriate criteria for screening juvenile salmonids, and potential impacts of an intake facility on special-status plant and wildlife species and sensitive natural communities. Of the eight locations, the site just south of Patterson along the San Joaquin River between Orange Avenue and Fig Avenue was selected as it was the highest ranked of the eight with moderate geomorphic stability and very good suitability for migrating salmonids. Alternative 5 receives a moderate rating because it has is relatively stable from a geomorphic perspective, but the new diversion site could result in some small effects.

Potential to affect water quality would be driven by reduction in San Joaquin River flow, which could reduce the dilution potential for water quality downstream. Compared to existing conditions, all alternatives would improve conditions. Figures 5-2 to 5-4 show flow changes compared to the No Action Alternative. Alternative 5 would have the greatest potential for flow changes, followed by Alternative 4 and Alternative 3. The changes in flow do not directly result in a water quality impact, but will require further evaluation in the EIS/R.

Table 5-13 summarizes the alternative ratings for the "Physical Effects" evaluation criterion.

Table 5-13. Physical Effects Evaluation Results

Physical Effects	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Intensity of Air Quality Impacts	High	High	Medium	Low
Noise Impacts	High	High	Medium	Low
Downstream Erosion or Geomorphic Changes Due to New Intake	High	High	High	Medium
Potential to Affect Water Quality	High	Medium	Medium	Low

Legend:

High Performance	Medium Performance	Low Performance

5.5 Efficiency

This section evaluates the cost involved with each alternative measuring Capital Cost, and Operations and Maintenance Costs.

5.5.1 Cost

The cost estimates focus on construction, operation, maintenance, and replacement of new facilities. The detailed cost estimates are included in Attachment 1. There may be some cost (monetary or water) associated with exchanges and transfers; however, these costs are much smaller than the new facility costs and are not calculated for the purpose of this preliminary evaluation.

Capital Cost

Table 5-14 shows the construction costs for Alternatives 4 and 5. The alternatives have similar costs, but Alternative 4 is a little less expensive than Alternative 5. Alternative 5 receives a poor rating, Alternative 4 receives a moderate rating, and Alternatives 2 and 3 receive a high rating.

Table 5-14. Construction Cost Estimates

Alternative Component	Construction Cost Estimates
Alternative 4: Patterson ID Expansion	$50,686,000
Alternative 4: West Stanislaus ID Expansion	$26,422,000
Alternative 4: Banta-Carbona ID Expansion	$40,927,000
Alternative 4: Arvin-Edison WSD Pumping Plant	$6,711,000
Alternative 4 Total	**$124,746,000**
Alternative 5 New Recapture Facility and Conveyance	**$145,926,000**

Operations, Maintenance, and Replacement Cost

Operations and maintenance (O&M) and replacement costs are specific to each facility. O&M costs include costs associated with new or expanded facilities, as well as payments to local districts associated with the use of existing facilities. Local districts would charge "wheeling costs" to convey water through their facilities, which represent a payment for the cost of the infrastructure and O&M costs (similar to rental costs). These wheeling costs have been $100 per acre-foot in recent years. Additionally, project proponents may want to purchase "options" in advance that would reserve available capacity at each District to use for diversion of Restoration Flows. Option payments have not been used for this purpose historically, so existing estimates are not available. For the purposes of comparison, a payment of $10 per acre-foot/month of capacity was included (based on the capacity when most water could be diverted in April). These wheeling and option costs have been included in Alternatives 3 and 5, where Restoration Flows may be diverted using local districts' facilities. Alternative 4 would include an expansion to local facilities. The expansion would also benefit the local districts, so it is likely that the wheeling and option fees would not be necessary under Alternative 4. However, payments for O&M and replacement of the facilities would still be necessary and are included.

The O&M costs for new facilities are similar every year over the life of the project, and replacement costs are periodic costs to replace key equipment as needed. These costs, along with the construction costs, are considered over the life of the project to identify the Total Present Worth. The future costs are discounted to show the present value of those costs. Table 5-15 shows the approximate annual O&M costs, replacement costs, and total present worth for each alternative component. When comparing total present worth (which encompasses construction, O&M, and replacement costs), Alternative 5 receives a poor rating, Alternative 4 receives a moderate rating, and Alternatives 2 and 3 receive a high rating.

Table 5-15. Total Present Worth Estimates

Alternative Component	Approximate Annual O&M Costs	Total Replacement Costs	Total Present Worth of Discounted Costs
Alternative 3: Option Costs to Use Local District Facilities	$146,000		$3,545,000
Alternative 3: Wheeling Costs for Local District Facilities	$5,000,000		$121,600,000
Alternative 3 Total	**$5,146,000**		**$125,145,000**
Alternative 4: Patterson ID Expansion	$1,216,000	$21,446,000	$88,849,000
Alternative 4: West Stanislaus ID Expansion	$1,430,000	$28,146,000	$72,406,000
Alternative 4: Banta-Carbona ID Expansion	$657,000	$37,939,000	$72,124,000
Alternative 4: Arvin-Edison WSD Pumping Plant	$200,000	$7,242,000	$14,512,000
Alternative 4 Total	**$3,503,000**	**$94,773,000**	**$247,891,000**
Alternative 5: New Recapture Facility and Conveyance	$5,920,000	$59,018,000	$313,550,000
Alternative 5: Option Costs to Use Local District Facilities	$146,000		$3,545,000
Alternative 5: Wheeling Costs for Local District Facilities	$1,800,000		$43,776,000
Alternative 5 Total	**$7,866,000**	**$59,018,000**	**$360,871,000**

Table 5-16 shows the results of the evaluation related to the "Efficiency" evaluation criterion.

Table 5-16. Efficiency Evaluation Results

Efficiency	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Construction Costs				
Total Present Worth of Construction and O&M Costs				

Legend:

High Performance	Medium Performance	Low Performance

6.0 Conclusions and Recommendations

This section presents the conclusions of the initial alternatives evaluation, including the alternatives recommended to be carried forward for further analysis and the changes recommended to improve performance of these alternatives. It also presents the next steps involved in the LTRRRF Project.

6.1 Alternatives Carried Forward for Further Analysis

As shown in Section 5, no one alternative performs well for all evaluation criteria. Each of the alternatives helps evaluate different conditions, and together they create a reasonable range of alternatives. Therefore, all four action alternatives are recommended to move forward for evaluation in the LTRRRF EIS/R.

6.2 Recommended Changes to Action Alternatives

As discussed in Section 5, the alternatives were able to recirculate almost all recaptured flow using only direct delivery. While exchanges and transfers were not needed to recirculate flows, they are recommended to remain in the alternatives. Exchanges and transfers provide the Friant contractors additional flexibility in how they may recirculate water, and they have minimal costs associated with implementation.

The modeling effort indicates that San Luis Reservoir has available storage for recaptured flows in most conditions. Using only San Luis Reservoir results in only small amounts of water lost from storage under all action alternatives. Additional surface water and groundwater storage would likely have additional costs associated with implementation (either monetary or water costs) with minimal benefits; therefore, these measures are not recommended to move forward. They will be removed from Alternatives 4 and 5.

6.3 Next Steps

This document recommends five alternatives be carried forward for further review: Alternative 1 (No Action Alternative), Alternative 2 (Continue Existing Actions), Alternative 3 (Maximize Use of Existing Facilities), Alternative 4 (Expand Existing Facilities), and Alternative 5 (Construct New Facilities). Table 6-1 below summarizes the main elements of these alternatives carried forward for analysis in the LTRRRF EIS/R.

Table 6-1.
Summary of Alternatives Carried Forward

	Alternative 1: No Action	Alternative 2: Continue Existing Temporary Actions	Alternative 3: Maximize Use of Existing Facilities	Alternative 4: Expand Existing Facilities	Alternative 5: Construct New Facilities
Recapture	Delta Diversions Recapture within the Restoration Area	Alternative 1	Alternative 1 + Existing Banta-Carbona ID, West Stanislaus ID, Patterson ID	Alternative 1 + Expanded Banta-Carbona ID, West Stanislaus ID, Patterson ID	Alternative 3 + New Intake Facility
Recirculation	FKC Pumpback	Alternative 1 + FKC Exchanges with Existing Infrastructure (Kings River, Kaweah/Tule River, Kern River, Shafter Wasco ID, Arvin Edison WSD) Transfers	Alternative 2	Alternative 3 + Arvin Edison Expanded Direct Delivery & Exchange	Alternative 4
Storage	Storage in San Luis	Alternative 1	Alternative 1	Alternative 1	Alternative 1

Notes:
FKC – Friant-Kern Canal
ID – Irrigation District
WD – Water District

These alternatives will be further refined and additional analysis will be completed, as necessary. A Project Description TM will then be developed, which provides detailed descriptions of the alternatives to be analyzed in the EIS/R and documents any additional analysis or refinements that have occurred. The Project Description TM will provide the basis of the Project Description chapter of the EIS/R. After the Project Description TM is complete and approved by Reclamation, work will start on the LTRRRF Draft EIS/R.

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7.0 References

Arvin-Edison Water Storage District. 2016. AEWSD. 2016. Personal communication with Jeevan Muhar, AEWSD on April 2, 2016.

California. 2014. Water Quality, Supply, and Infrastructure Improvement Act of 2014, Cal Assemb. B. 1471. (2013-2014). Chapter 559. Accessed on: 2015 08 31. Available at http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140AB1471.

California Department of Fish and Wildlife and California State University Chico. 2013. Fine-Scale Riparian Vegetation Mapping of the Central Valley Flood Protection Plan Area. Final Report. Developed for the California Department of Water Resources Flood Protection Program. Systemwide Planning Area Major Rivers and Tributaries. Accessed on 9/22/2016. Available online: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=74420

California State University, Stanislaus. 2012. Endangered Species Recovery Program Land Use/Land Cover Model for the San Joaquin Valley. Accessed on 9/22/2016. Available at: http://sjvgreenprint.ice.ucdavis.edu/content/data-list

Cawelo WD. 2007. *Cawelo Water District Amended Groundwater Management Plan.* Draft. July 2007.

______. 2014. *Cawelo Water District Agricultural Water Management Plan*. February 2014. Accessed on: 2014 11 12. Available at: http://www.water.ca.gov/wateruseefficiency/sb7/docs/2014/plans/Cawelo%20Final%202012%20AWMP.pdf.

City of Bakersfield. 2000. *Bakersfield Water Balance Report 2000*. Accessed on: 2015 01 15. Available at: http://www.csub.edu/~dbaron/Sci360B/2000waterrpt-1.pdf.

Contra Costa Times. 2014. *Federal bill calls for expanding Los Vaqueros Reservoir near Brentwood.* April 10, 2014.

Council on Environmental Quality. 2013. *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies*. March 2008.

ESA. 2008. *Strand Ranch Integrated Banking Project, Final Environmental Impact Report*. May 2008. Accessed on: 2014 11 17. Available at: http://www.irwd.com/images/pdf/doing-business/environmental-documents/env-documents-2013/FEIR_Strand_Ranch.pdf.

Kern County Water Agency (KCWA). No date. *Kern County: Groundwater Banking Projects. Flyer*. Bakersfield, CA. Date issued: February 5, 2010.

Kern Water Bank Authority. No Date. *Kern Water Bank Authority Website*. Accessed on: 2014 12 13. Available at: http://www.kwb.org/index.cfm/fuseaction/Pages.Page/id/330.

Los Angeles Times. 2015. *To save water, an underground movement to bank El Niño's rainfall*. November 9, 2015. Accessed on 2016 02 03. Available at: http://www.latimes.com/local/california/la-me-water-storage-20151109-story.html.

Los Vaqueros Reservoir & Watershed. 2014. *Los Vaqueros Reservoir and Watershed Website*. Accessed on: 2014 12 13. Available at: http://www.ccwater.com/losvaqueros/.

Reclamation. 2009. *Finding of No Significant Impact. Kern-Tulare Water District Return of Banked Water*. Accessed on: 2015 01 02. Available at: http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=4553.

______. 2012. *Draft Finding of No Significant Impact. Amendment to the Meyers Groundwater Banking Exchange Agreement*. July 2012. Accessed on: 2014 12 30. Available at: http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=10155.

Rosedale-Rio Bravo Water Storage District. 2001. *Final Master Environmental Impact Report Groundwater Storage, Banking, Exchange, Extraction & Conjunctive Use Program*. Prepared by Boyle Engineering Corporation, BKR0100201. July 2001.

______. 2012. *Rosedale-Rio Bravo Water Storage District's Water Management Programs*. Accessed on: 2013 11 12. Available at: http://www.rrbwsd.com/water-management-programs.

______. 2015. *2013 Operations Report.* Accessed on: 2016 09 23. Available at: http://www.rrbwsd.com/wp-content/uploads/2015/03/Final-RRBWSD-2013-Operations-Report.pdf

San Joaquin River Restoration Program. 2015. Water Management Goal Investment Strategy. Accessed on 9/22/2016. Available from: http://www.restoresjr.net/download/program-documents/program-docs-2015/FinalInvestmentStrategy_20150403.pdf

Semitropic WSD. 2004. *Groundwater Banking*. Accessed on: 2014 11 11. Available at: http://www.semitropic.com/GroundwaterBanking.htm.

.2015. *Banking Partners and Allocation*. Accessed on: 2015 09 17. Available at: http://www.semitropic.com/BankingPartners.htm.

Wells Fargo Securities. 2010. *North Kern/Cawelo Financing Authority. Water Revenue Bonds, 2010 Series B Cawelo Water District Project*. May 11, 2010. Accessed on: 2015 09 07. Available at: ftp://ftp.firsttrust.ca/Public/Fixed%20Income%20OS/FT%20258/660313BK2%20NORTH%20KERN%20CAWELO%20FINANCING%20AUTHORITY.pdf.

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San Joaquin River Restoration Program Long-Term Recapture and Recirculation EIS/R

Initial Alternatives Evaluation

Attachment 1

September 2017

Table of Contents

Tables

List of Abbreviations and Acronyms

cfs	cubic feet per second
CDFW	California Department of Fish and Wildlife
CSUC	California State University Chico
CVP	Central Valley Project
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
Friant Contractors	Friant Division Long-term Water Contractors
GIS	Geographic Information System
NMFS	National Marine Fisheries Service
NRDC	Natural Resources Defense Council
Restoration Flows	San Joaquin River Restoration Program flows
RM	river mile
Settlement	Stipulation of Settlement in NRDC, et al., v. Kirk Rodgers, et al.
SJRRP	San Joaquin River Restoration Program
TM	Technical Memorandum

1.0 Introduction

This attachment presents the 10% design descriptions and drawings for the construction actions included in Alternative 4 and Alternative 5 detailed in the Initial Alternatives Evaluation. These actions include upgrades to conveyance infrastructure at Patterson Irrigation District, West Stanislaus Irrigation District, Banta-Carbona Irrigation District and Arvin Edison Water Storage District under Alternative 4 and construction of a new recapture facility and conveyance infrastructure under Alternative 5.

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2.0 Expansion of Facilities at Patterson Irrigation District

Patterson Irrigation District (ID) diverts a majority of its water from the San Joaquin River into their conveyance system consisting of approximately 4 miles of unlined canals, 52 miles of lined canals, and 86 miles of pipelines. Patterson ID's current diversion capacity of 195 cubic feet per second (cfs) does not extend all the way to the Delta Mendota Canal (DMC) thus limiting its ability for water transfers. Currently, the connection to the DMC can convey 35 cfs.

Patterson Irrigation District has previously considered expanding their capabilities to convey 195 cfs from the San Joaquin River to the DMC and considered 5 alternatives in the Draft East West Conveyance Project Evaluation of Project Alternatives Report that was completed in 2013. They recently selected one alternative, labeled as B1 in the evaluation, which is described after the existing conditions, below.

2.1 Existing Condition

The existing condition includes:

- Reach 1 is an open channel, concrete lined canal with a capacity of 175 cfs from the Fish Screen and Pumping Plant 1 (PP1) to Pumping Plant PP2,
- Reach 2 is an open channel canal with a capacity of 155 cfs from PP2 to PP3,
- Reach 3 is an open channel canal with a capacity of 95 cfs from PP3 to PP4,
- Reach 4 is an open channel canal with a capacity of 75 cfs from PP4 to PP5,
- Reach 5 is an open channel canal with 90 cfs capacity from PP5 to PP6,
- Pumping Plant PP6 provides 35 cfs flow capacity through a 36 inch diameter pipeline into the DMC from Reach 5.

2.2 Alternative

The alternative that Patterson ID selected to construct, designated in the evaluation as B1, includes the following revisions to the existing conditions:

- Reach 1 replace and refurbish canal lining and appurtenances with sufficient freeboard to accommodate 195 cfs,

- Reach 2 and Reach 3 combined by eliminating PP3, increasing the capacity of PP2 to 195 cfs (@1135 HP), and an 84 inch diameter Rubber Gasketed Reinforced Concrete Pipe (RGRCP) installed replacing the open channel canal

(Reach 2) which empties into the former Reach 3 canal which is rebuilt, open channel concrete lined canal, with an increased capacity of 195 cfs,

- Reach 4 and the initial ~500 ft of Reach 5 combined by eliminating PP5 and increasing the capacity of PP4 to 195 cfs (@1105 HP), using an 84 inch diameter RGRCP to replace the open channel canal (Reach 4) which empties into Reach 5 which is a rebuilt, open channel concrete lined canal, with an increased capacity of 195 cfs,:
- The new alternative also creates a turnout from Reach 5, which will convey 160 cfs to a New DMC Pumping Plant via a 72 inch diameter RGRCP under the Southern Pacific Railroad and Highway 33,
- The New DMC section of pipeline, combined with the existing 36 inch diameter pipeline from PP6, will convey a combined volume of 195 cfs to the DMC.

Quantitatively, the upgrade in Patterson ID to meet 195 cfs flow to the DMC amounts to installation of 10 new pumps, ~70,000 CYD of Canal Earthwork, 355,000 SF of canal lining, 6,400 linear FT of 84" Pipe and more than 11,125 linear FT of 72" diameter Pipe, including a jack & bore operation underneath the Southern Pacific Railroad. There are multiple turnout replacements or upgrades and several road crossings.

2.3 Assumptions

The new alternative includes rebuilding the "Big DMC" blending pipeline either as a combination of this expansion contract or a later contract and site work to include improved drainage. The designs and cost estimates developed for Alternative 4 assume that this work is being done by Patterson ID as a separate, unassociated contract. Additionally, the revisions to the sediment basins are also assumed to be separate work on a different contract.

3.0 Expansion of Facilities at West Stanislaus Irrigation District

West Stanislaus Irrigation District (ID) diverts a majority of its water from the San Joaquin River into the West Stanislaus ID Main Canal. West Stanislaus ID's current diversion capacity of 350 cubic feet per second (cfs) does not extend all the way to the Delta Mendota Canal (DMC) thus limiting its ability for water transfers. Currently, the connection to the DMC can convey 250 cfs.

West Stanislaus ID is in the process of upgrading their existing facilities. Pump Stations 1A and 5A are new as of the last few years and Pump Station 3A is currently under design (310 cfs) by the District. The proposed project would complete the expansion of pumping and conveyance capacities between the San Joaquin River on the east side of West Stanislaus ID and the Delta-Mendota Canal in the west. This expansion will allow the district to convey 310 cfs at pump station 3A by replacing pump stations 3 and 4. By helping complete this infrastructure improvement, West Stanislaus ID would allow, under separate agreements, Restoration Flows to be recaptured and conveyed through their facilities for direct delivery into the Delta-Mendota Canal for storage in San Luis Reservoir, until it can be returned back to the Friant Division via the California Aqueduct and Cross Valley Canal.

3.1 Existing Conditions

The existing conditions includes:

- Pump Station 1A and a 96 inch pipe were recently constructed for a capacity of 350 cfs and replaced existing pump stations 1 and 2.
- Pump Station 5A and a 96 inch pipe were recently constructed for a capacity of 250 cfs to the DMC.
- Pump Stations 3 and 4 currently lift water from open channel to open channel and are to be replaced with Pump Station 3A.
- There currently is no fish screen at the San Joaquin River, however, one is currently in design for a capacity of approximately 350 cfs.

3.2 Alternative

The proposed design would modify the existing facilities to convey 250 cfs from the San Joaquin River to the DMC:

- Construct pump station 3A to bypass existing pump station 3 and 4 with a 108 inch pipeline

- Existing turnouts and laterals would need to be reconnected to the new 108 inch pipeline
- Construct a bypass around the pump stations that would allow for flows to be routed around the pump station during the irrigation season, as well as allow for reverse flow from the DMC to the San Joaquin River

The significant cost drivers of this alternative are the installation of Pump Station 3A, upgrade of several turnouts and installation of more than 3,195 linear FT of 108" diameter pipe, including the jack and bore operation under the Union Pacific Railroad.

3.3 Assumptions

- There is adequate storage volume in the existing open channel reaches to allow for 350 cfs. Open channel segments would be operated in water level control when pumping.
- The Canal is bi-directional and will need to allow for gravity flow from the DMC towards the San Joaquin River.
- Existing electrical transmission lines are sufficient to serve the project.

4.0 Expansion of Facilities at Banta-Carbona Irrigation District

Banta-Carbona Irrigation District (ID) diverts a majority of its water from the San Joaquin River into the Banta-Carbona Lift Canal. From the Banta-Carbona Lift Canal the water is conveyed through a series lift stations and open channels before terminating in the Delta Mendota Canal (DMC) via a Banta-Carbona pipeline. The District's fish screen is rated 250 cfs for smelt and 400 cfs for salmon/steelhead. The current diversion capacity to the DMC is 90 cubic feet per second (cfs) along the downstream portion of the conveyance system.

The proposed project would allow the district to convey 200 cfs from the San Joaquin River to the Delta- Mendota Canal for storage in San Luis Reservoir until it can be returned back to the Friant Division via the California Aqueduct and Cross Valley Canal. This project would expand the capacity in 10,400 lineal feet from lift station #4 to the DMC, which includes approximately 4,000 feet of canal and 6,500 feet of pipeline. Banta-Carbona ID currently has a 160 foot right-of-way along their existing facilities, giving them sufficient room to expand the available capacity.

4.1 Existing Conditions

It should be noted that very limited information was available for the existing topography and sizes of the existing facilities. Topographic information shown on the plans is from the USGS NED model with a resolution varying from 10-30 meters.

The existing system is a series of six pump stations that lift water into open channel sections and a pipeline detailed in Table 4-1.

Table 4-1. Banta-Carbona Conveyance System Capacities

Pump Station	Flow (CFS)
Pump Station 1	200
Pump Station 2	220
Pump Station 3	200
Pump Station 4	160
Pump Station 5	130
Pump Station 5A	120

Pump station (5A) is just upstream of pump station 5This pump station is equipped for 120 cfs with additional bays for future expansion.

4.2 Alternative

The proposed design would convey 200 cfs from the San Joaquin River to the DMC, and include the following:

- Replacement of one pumping plant to be capable of 250 cfs,
- Construction of a bypass around Pumping Plant 4 that would allow for flows to be routed around the pumping plant during the irrigation season, as well as allow for reverse flow from the DMC to the San Joaquin River
- Addition of pumps to Pumping Plant 5A upstream of pump station 5
- Existing turnouts and laterals will need to be reconnected

The significant cost drivers for this alternative include the replacement of Pumping Plant 4, building of a control room, standpipe, and addition of pumps and motors at Pumping Plant 5A, installation of less than 1000 linear FT of 72” diameter Pipe, the replacement of the diversion box at the DMC, and the expansion of BCID’s electrical Substation #2.

4.3 Assumptions

- Existing pump stations are near their current life expectancy
- Existing box structure at the DMC needs to be replaced to accommodate connecting to a 72-inch diameter pipeline
- Future bays for pump station 5A upstream of pump station 5 can be used to add capacity for the full 250 cfs.
- Existing electrical transmission lines are sufficient to serve the project, but the Sub-station location adjacent to Pumping Plant 4 needs to be expanded. In addition 60 kv to 4160 transformers will need to be added to serve the additional load at Pumping Plant 5.

5.0 Expansion of Facilities at Arvin Edison Water Storage District

Arvin-Edison Water Storage District (AEWSD or District) diverts a majority of its water near the terminus of the Friant-Kern Canal (FKC) into its 13 mile Intake Canal and terminates at the Forrest Frick Pumping Plant (FFPP). The FFPP pumps water into the AEWSD North Canal where it can then gravity flow through the AEWSD North and South canals. AEWSD also diverts water via the 4.5 mile, bidirectional, Intertie Pipeline from the California Aqueduct into its South Canal terminus. The Intertie Pipeline gravity feeds from the California Aqueduct to the AEWSD South Canal at a rate of 125 cfs, and pumps from the AEWSD South Canal to the California Aqueduct at a rate of 175 cfs via an 84-inch diameter reinforced concrete pipe (RCP) with a 78-inch steel liner.

This project would increase the flow capacity of the current, gravity-fed intertie pipeline from the California Aqueduct to the AEWSD South Canal from 125 cfs to 175 cfs with the installation of a Booster Plant. The main benefit of the booster plant on the Intertie Pipeline is to have additional capacity to deliver recaptured water to the Mettler Unit (land between Interstate 5 and Highway 99) to meet its demands in-lieu of using Central Valley Project (CVP) supplies or groundwater. There is also the potential to increase flexibility for the AEWSD distribution system and deliver water to other systems within the District at times when there is capacity through the pump-back pumps. According to AEWSD, recaptured water delivered into the District through the Intertie Pipeline between March and August will typically be used for in-lieu recharge, while water delivered between September and February will typically be used for recharge.

5.1 Existing Conditions

The existing conditions includes:

- AEWSD uses SCADA system on Intertie Pipeline
- Existing 84 inch diameter reinforced concrete pipeline sleeved with a 78 inch diameter steel pipe
- Road Crossings
  - Various County Roads
  - Interstate 5
  - Highway 99
- Land-Field Crops planted

5.2 Alternative

The proposed booster plant includes:

- 3-48 inch diameter low lift high volume pumps (Can Pumps)
  - 1-90 cfs pump, 500 Hp w/ Total Dynamic Head of 20 ft
  - 1-90 cfs pump, 500 Hp w/ Total Dynamic Head of 20 ft
  - 1-90 cfs pump, 500 Hp w/ Total Dynamic Head of 20 ft, with Variable Speed Drive, this pump will be used as a redundancy (extra pump) and as well will have the ability to vary the flow.
- Pipeline Manifold
- Flow Meter-Ultra-Sonic
- Isolation Valves and check valves
- Surge Relief System
- Acquisition of a 1 Acre Plant Site, with security fencing, base rock surfacing
- Acquisition of an Access Easement (roadway easement to access site)
- Electrical System
- SCADA System

5.3 Assumptions

- The Arvin Edison South Canal will have the capacity to handle the 175 cfs.
- With additional valves needed to install the booster plant, there will be an increase in head loss through the intertie pipeline. The additional head-loss could result in a lower flow in the gravity direction.
- It is assumed Southern California Edison (SCE) will be able to handle the additional load of the pumping plant at this location. Verification by SCE will be determined after the application for service is submitted to SCE.

6.0 New Intake Facility

The proposed San Joaquin River Intake Facility has the capacity to pump a maximum of 500 cubic feet per second (cfs) from the San Joaquin River just south of Paterson to the Delta Mendota Canal (DMC) via three 72-inch steel pipelines. The proposed San Joaquin River Intake Facility consists of approximately 570 linear feet of fish screen, two sedimentation channels with chain and flight sediment collection systems along with submersible sediment pumps, and six 3000 horsepower (hp) vertical turbine pumps each with a variable frequency drive (VFD). The electrical building is located nearby the intake facility, where the six VFDs are to be stored. The electrical substation will be located near the electrical building, which will transform the incoming voltage to the necessary voltage required to power the vertical turbine pumps. The metering vault is also to be located on the intake site. Each of the 72-inch pipelines will have a flowmeter. This allows for continuous flow monitoring of all flows leaving the intake facility.

6.1 Primary Systems

The proposed location of the Intake Facility is Site 3-1 from the Initial Alternatives Technical Memorandum. This location was selected during the site visits and documented in the Reconnaissance Visit Memorandum. The intake facility site is located just south of Patterson along the San Joaquin River between Orange Avenue and Fig Avenue.

The proposed intake facility was designed utilizing the criteria presented in Table 6-1.

Table 6-1. Intake Facility Design Criteria

Description	Units	Alternative
San Joaquin River Intake Preliminary Design Criteria		
Dimension of fish screen	FT x FT	10 W x 12 H
Approach velocity[1]	FPS	0.33
Effective area of 10 w x 12 h screen	FT^2	102.52
Available height for 10 ft wide screen	FT	4.67
Effective area of fish screen per screen	FT^2	39.88
Number of screens required lower level	NO.	38
Number of screens attached to lower screens	NO.	38
Total wedge wire fish screen 10 w x 12 h	NO.	76
Capacity, each	CFS	13.16
Capacity, each	MGD	8.50
Invert of screen	FT	34.95
Minimum river depth[2]	FT	0.07

Description	Units	Alternative
Average river depth[3]	FT	4.84
Maximum river depth[4]	FT	23.55
San Joaquin River bottom elevation[5]	FT	34.78

Notes:

[1] Approach Velocity is defined by the California Department of Fish and Wildlife. http://www.dfg.ca.gov/fish/Resources/Projects/Engin/Engin_ScreenCriteria.asp

[2] The river depth is monitored by the California Data Exchange Center (CDEC). The minimum river depth was extrapolated from data collected from the San Joaquin River NR Crows Landing (SCL) location. The minimum water depth occurred over a 24-hour period on 8/6/2015. The river depth ranged from 0.18 ft to 0.07 ft.

[3] The river depth is monitored by the California Data Exchange Center (CDEC). The average river depth was calculated from data collected from the San Joaquin River NR Crows Landing (SCL) location from 8/202004 to 3/2/2016. The average water depth was calculated to be 4.84 ft.

[4] The river depth is monitored by the California Data Exchange Center (CDEC). The maximum river depth was extrapolated from data collected from the San Joaquin River NR Crows Landing (SCL) location. The maximum water depth occurred on 4/10/2006. The maximum river depth was 23.55 ft.

[5] The bottom of the San Joaquin River was estimated from the data collected by the California Data Exchange Center (CDEC). This elevation should be confirmed during the design. As the water passes through the fish screens, it enters one of the two sedimentation basin/channels. As the water level rises in the sedimentation basin, the isolation gates close to allow undisturbed settling time. The sedimentation basins allow sediment to settle prior to being pumped to the DMC.

The sedimentation channels were designed per the criteria presented in Table 6-2.

Table 6-2. Sedimentation Basin Design Criteria

Description	Units	Alternative
Number of bays	NO.	2
Sedimentation basins per bay	NO.	2
Length of basins	FT	285
Width of basins	FT	44
Nominal height	FT	13.05
Water depth (average)	FT	13.05
Volume per basin	GAL	1,224,000
Total volume	GAL	2,448,000
Detention time at 323 mgd	MIN	11

After detention, water will flow through the diffuser wall and towards the vertical turbine intake pump. Currently, the intake pump station is designed to have 6 pumps operating when pumping 500 cfs. Each pump has a 42-inch discharge, and each pair of pumps connects to a 72-inch header. There are three pairs of pumps and three 72-inch pipelines that will convey water to the DMC.

The pump station was designed per the criteria presented in Table 6-3.

Table 6-3. Pump Station Design Criteria

Description	Units	Alternative
Type: vertical turbine pumps		
Number of pumps	NO.	6
DESIGN CAPACITY		
Each pump	MGD	54
	CFS	83
Total	MGD	323
	CFS	500
Design total dynamic head	FT	265
Each pump	HP	3500
Number of vfds	NO.	6

The initial pipeline alignment is routed from the intake facility site to the DMC via Almond Avenue and Elfers Avenue to the DMC. To provide maximum reliability and flexibility while minimizing the required trench width, it's recommended to use three 72-inch diameter pipelines. The preliminary material is welded steel pipe (WSP). WSP was chosen because are multiple manufacturers of steel pipe that will compete with each other to help drive down costs. Steel pipe can also be readily configured into a pre-purchase alternative if so desired when all economic and schedule impacts have been fully evaluated.

Table 6-4. Potential Pipeline Material Evaluation

Pipe Material	Advantages	Disadvantages
Ductile Iron Pipe	• Less stringent bedding requirements • Easy to install and adapt to field conditions • More rapid contractor production rates • Time proven, durable product	• Delivery time would be slower for large diameter DIP and fittings vs. PCCP due to remote manufacturing sites (Birmingham, Alabama for sizes greater than 48" diameter) • Pipe sizes above 64" not currently in manufacture in the United States and no active US standard exists • Must have corrosion protection in corrosive soils
Steel Pipe	• High strength for pressure applications • Structural integrity when adequately protected from corrosive environment • Highly adaptable to special applications, bend, and fitting requirements since these are custom designed	• More stringent bedding requirements • Must have corrosion protection in corrosive soils • Requires a coating system • Time consuming welding for restrained joints and higher degree of field quality control to inspect welding versus DIP

Pipe Material	Advantages	Disadvantages
Prestressed Concrete Cylinder Pipe	• Good corrosion protection • Proven material for large diameter water main construction • Less stringent bedding requirements	• Prior PCCP systems were subject to fabrication problems • When failures occur historically, they are often sudden, catastrophic in nature • Product must be carefully engineered and should undergo extensive third party factory testing
Fiberglass Reinforced Polymer Pipe	• Superior corrosion protection • Less stringent bedding requirements	• Integral restraint systems non-existent or require careful design – present unique engineering challenges • No proven track record for water transmission application • Difficulty of obtaining reliable pipe fittings in larger diameters

The design criteria for the pipelines is presented in Table 6-5.

Table 6-5. Buried Pipeline Design Criteria

Description	Units	Alternative
Number of pipelines	NO.	3
Flow per pipeline	MGD	108
Flow per pipeline	CFS	167
Pipe diameter, each	INCHES	72
Velocity at maximum flow rate	FPS	5.89

At the discharge location, there is a transition structure with a weir to break the pressure head of the pipelines and allow the water to flow freely into the DMC with minimal scouring. The transition structure has been preliminarily sized with a weir length of 65 ft to provide a maximum velocity of 5 fps for the water flowing into the DMC.

Table 6-6. Canal Energy Dispersion Structure Design Criteria

Description	Units	Alternative
Weir length	FT	65
Height of water over weir	FT	1.87

6.2 Secondary Systems

The settled solids (sludge) are raked from the bottom of the sedimentation basin by a system of chain and flights. The sludge will be pushed into the solids collection trench. The solids collection trench is sloped to one end where pump(s) will send the sludge to the siltation basins for further settling before being pumped back to transport trucks for disposal offsite.

The sludge collection system was designed per the criteria presented in Table 6-7.

Table 6-7. Sludge Collection System Design Criteria

Description	Units	Alternative 1
Sludge collectors	TYPE	Chain and flight
Collectors per basin	NO.	4
Drives per basin	NO.	2
Cross collectors per basin	NO.	2
Drives per basin	NO.	2
Pump sumps per basin	NO.	2
Number of pumps per pump sump	NO.	2
Pumped flow per pump	GPM	1750
Total pumped flow to siltation basins	MGD	10

The siltation basins allow the sludge to be further settled and settled water can be set back to the San Joaquin River. The settled solids can be cleaned out of the basin and disposed of as preferred by the Bureau of Reclamation. The design includes three basins, one duty, one being cleaned, and one standby. The design criteria for the Siltation Basins are presented in Table 6-8.

Table 6-8. Siltation Basin Design Criteria

Description	Units	Alternative
Number of basins (duty, standby, being cleaned)	NO.	3
Length of basin	FT	500
Width of basins	FT	135
Average water depth	FT	10
Basin volume	MG	5.05
Detention time at 10 mgd pump rate	HR	12.12

Surge Protection is provided on the three 72-inch force mains by large hydro pneumatic surge tanks. One surge tank is provided for each 42-inch pump discharge. The preliminary design criteria are presented in Table 6-9.

Table 6-9. Surge Tank Design Criteria

Description	Units	Alternative
Surge tanks	NO.	6
Tank orientation	-	Horizontal
Tank length	FT	65
Tank diameter	FT	12
Tank volume	GAL	55,500
Maximum operating pressure	PSI	125

6.3 Electrical Power System

6.3.1 Electrical Design Overview

The information in this section forms the basis of design for the electrical distribution systems for the San Joaquin River Pump Station.

Design and construction of the electrical system will be based upon the following criteria:

- Applicable Codes and Standards
- Redundancy and reliability
- Heavy-duty industrial type quality
- Easy accessibility and maintainability for electrical equipment
- Safety

6.3.2 Applicable Codes and Standards

The design, electrical equipment, materials, and installation will comply with the latest editions of the following codes and standards:

- American National Standards Association (ANSI)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- National Fire Protection Association (NFPA)
- National Electric Code (NEC)
- International Society of Automation (ISA)
- Insulated Cable Engineers Association (ICEA)
- Occupational Safety and Health Administration (OSHA)
- American Society for Testing Materials (ASTM)
- InterNational Electrical Testing Association (NETA)
- Factory Mutual (FM)
- Underwriters Laboratories (UL)
- Illuminating Engineering Society (IES)

Equipment, materials, and installation will also comply with the requirements of the local authority having jurisdiction (AHJ).

6.3.3 Electrical System

6.3.3.1 Electrical Service

Primary electrical service for the pump station will be obtained from the Turlock Irrigation District (TID). The District operates transmission at 115kV and distributes at 12.47kV. Both options are available for primary supply to the pump station.

The 115kV option would require tapping an existing line and installing new overhead transmission lines and obtaining easements. Preliminary discussions indicate that the closest line would be adjacent to the highway west of Patterson. A new line would have to be routed around the city. This option is complex due to the approval process and the time required to obtain easements. A formal planning study would be required to confirm existing line capacity, feasibility, costs and routing for new line extension.

The existing 115kV/12.47kV Rogers substation is located west of the City of Patterson. The substation has two transformers with provision to add a third transformer. Given the size of the new load, the third transformer may be required to supply the pump station at 12.47kV. Multiple circuits would be required to supply the estimated 18.5 MVA (approx. 850 Amps) load. The number of circuits will be determined based on TID distribution and protection standards, cost, plus overall redundancy requirements (N+1, N+2, or full redundancy). These circuits could be routed through existing easements and possibly use existing infrastructure. An alternative would be to allow TID to use the pipeline route for the new underground primary cables. A formal planning study would be required to confirm existing substation capacity, feasibility, costs and routing for new distribution circuits.

A substation located on the pump station site will step down the incoming primary voltage to the pump station utilization voltage. The size and configuration of the primary switchgear will vary greatly according to the incoming voltage level.

Overhead service at the 115kV voltage level would require more land area for overhead line termination structures, open buswork, isolation switches, and outdoor oil or vacuum circuit breakers for transformer protection. Under this scenario, it is assumed that a single 115 kV line would feed both transformers through a closed bus-tie.

Underground service at 12.47kV would be a more compact arrangement. Underground distribution circuits would terminate in 15kV outdoor walk-in ANSI vacuum circuit breaker type switchgear. Metering and incoming line protection would be coordinated with TID.

The outdoor substation would be equipped with two 12/16/20 MVA outdoor liquid filled power transformers. Each would be kept loaded, with the ability to transfer all the load to a single transformer if the other were unavailable. Transformer size could be reduced if reduced pumping is acceptable under outage conditions. Secondary voltage options for the pump station distribution system would be 4.16 kV or 6.6 kV for direct-to-drive (no transformer) VFDs. The 4.16 kV system was chosen as the best option for the pump station.

Alternatively, with a 12.47 kV service, the two 12/16/20 MVA substation transformers could be replaced with individual 3 MVA, 12.47/4.16 kV outdoor padmount transformers for each VFD.

Table 6-10 shows the estimated preliminary electrical load for the pump station.

Table 6-10. Preliminary Electrical Load Analysis

Load Served	KVA	Amperage (A)
3000 hp Pump[1]	3000	416
3000 hp Pump[1]	3000	416
3000 hp Pump[1]	3000	416
3000 hp Pump[1]	3000	416
3000 hp Pump[1]	3000	416
3000 hp Pump[1]	3000	416
3000 hp Standby Pump[1]	3000	416
Station Transformer	500	69.4
Total KVA and Amperage at 4160V, 3-phase	18500	2565

[1] Motor KVA is assumed to be approximately equal to HP. Full load amperage (FLA) values are calculated accordingly.

6.3.3.2 Pump Station

The pump station power distribution system would be sized for the connected load including the standby pump. A 3000A service would be required from each 12/16/20 MVA substation transformers to a medium voltage 5 kV, 3000 Amp metal-clad vacuum circuit breaker switchgear located in the pump station electrical room. The options for this ampacity at 5kV are underground cables in duct bank, cables in tray, or bus duct. Bus duct must be kept short and protected from condensation. The recommended option is cable, either in ductbank or tray, depending on station layout.

The 3000A switchgear would be constructed in a manually operated Main-Tie-Main (MTM) configuration to distribute power to six pump variable frequency drives (VFDs) and a 4160VΔ-480Y/277V three-phase station transformer. The pump load will be split evenly among the switchgear buses.

During normal operation, the main circuit breakers will be closed, and the tie circuit breaker would be open. If one main circuit breaker is open for service, the tie circuit breaker can be closed (while the other main remains closed). A mechanical kirk-key interlock system will be provided to allow manual breaker operations. Safety features such as remote racking and breaker control will be provided. Each main circuit breaker and associated switchgear bus will have 3000 Amp capacity to accommodate five pumps and a station load transformer.

A liquid-filled 4160VΔ-480Y/277V, three-phase pad-mounted transformers will feed a low voltage 480V MCC or distribution switchboard. The low voltage equipment will distribute power to the pump support equipment, the pump station HVAC equipment, valves, lighting, and other miscellaneous loads. The low voltage power distribution system will incorporate an outdoor 480V standby diesel generator with an ATS to provide backup power for a redundant system.

Electrical Room The pump station electrical room will be sized to house the medium voltage switchgear, six medium voltage VFDs, low voltage distribution equipment, motor control center (MCC), low voltage panelboards, a 480VΔ-208Y/120V dry-type step-down transformer, and other miscellaneous control and distribution equipment. Provisions for code required working clearance space will be made around electrical equipment.

The medium voltage metal-clad switchgear will require front and rear access. The liquid-filled pad-mounted station transformer will be located outdoors, in close proximity to the electrical room. The electrical room will be climate controlled to limit room temperature so that it does not exceed approximately 35C under maximum pumping conditions.

Conduit and cable will be provided for the medium voltage and low voltage cable installation. A separate conduit system will be provided for low voltage cables.

Power Redundancy The medium voltage 5 kV switchgear would provide power for six pumps with both busses in service and three pumps with one bus out of service. The manual MTM switchgear configuration would allow all six pumps to operate while one of the substation transformers is out of service. No automatic transfer is being planned because of the need for the pumps to hydraulically stabilize after a power outage.

No onsite 4160V power generation is anticipated to operate the pumps in the event of a total power outage. A second transformer will provide some redundancy at the electrical substation.

The low voltage power distribution system will incorporate an outdoor 480V standby diesel generator with an ATS to provide backup power to the station loads. The kW rating of the generator will be confirmed during detailed design.

A central uninterruptable power supply (UPS) will be included for all critical control circuits and life safety equipment.

Power Factor The electrical distribution system will be designed to maintain a minimum 0.90 lagging power factor. The VFDs will be specified to maintain an internal lagging power factor between 0.95 and unity. Further external power factor correction equipment is not anticipated to be necessary since the main load is the medium voltage induction pump motors controlled by the VFDs.

Harmonic Distortion Limits The recommended limits for total current and voltage harmonic distortion in IEEE Std. 519 – IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems will be considered in the design of the pump station power distribution systems. The point of common coupling (PCC) will be defined as the bus of the medium voltage switchgear feeding the pump VFDs. A preliminary harmonic analysis will be performed during design to confirm any further harmonic mitigation equipment required for the system. The evaluation will include VFDs, other nonlinear load, cable sizes, utility capacitors and other relevant equipment. Additionally, a preliminary and final harmonic analysis for the actual proposed equipment will be required to be submitted by the Vendor/Contractor. After the installation, harmonic field testing will be performed to validate the analysis and compliance with the specified requirements.

6.4 Electrical Equipment

This section includes basic and generic guidelines for major electrical equipment. All electrical equipment will be UL listed, where applicable standards exist. Specific technical requirements will be outlined in the project specifications.

6.4.1 Power Distribution Equipment

6.4.1.1 Medium Voltage Switchgear

Switchgear bus configuration options include 3000A and 4000A bus sizes. Based on redundancy requirements, a 3000A MTM configuration was chosen for the electrical system design. This configuration allows for a maximum of six pumps and a transformer for miscellaneous station loads to be fed through either main circuit breaker with the tie closed.

The 3000A, 5 kV medium voltage metal-clad circuit breaker switchgear will be draw-out, vacuum interrupter type with stored energy trip/close mechanism. The switchgear will be provided with lightning surge protective devices at each incoming main supply side and each load side feeder. These devices will protect against transients due to lightning strikes or abnormal spikes due to equipment switching. Protective relaying scheme will consist of SEL 751A relays for each main circuit breaker and for each feeder circuit breaker. Protective relays will have a provision for Ethernet communication to SCADA.

6.4.1.2 Low Voltage Motor Control

The low voltage 480V motor control center will be equipped with full voltage combination motor starters, low voltage variable frequency drives (VFDs) where applicable, and feeder breakers as defined by the process and HVAC load requirements. The MCC bus will be tin-plated copper. The MCC will be a NEMA 1A indoor type, front-accessible, and suitable for against-the-wall mounting. The incoming power will be fed from a service entrance rated Main Circuit Breaker upstream of the ATS. Feeder circuit breakers will be 600V, molded case type with removable thermal-magnetic trip units. Combination starters will be installed integral to the MCC, and will include a motor circuit protector (MCP) in series with a motor contactor and a solid-state overload protective device.

Spare circuit breakers will be installed for future use. The MCC will be equipped with surge protective devices.

6.4.1.3 Panelboards

120/240V, single-phase, 208Y/120V, three-phase and 480V, three-phase panelboards will be used to distribute power to HVAC equipment, lighting, and other general purpose loads. Panelboards will be equipped with molded case bolt-on type circuit breakers and surge protective devices. Spare circuit breakers will be provided in each panelboard for future use.

6.4.1.4 Pad-mounted Transformers

Pad-mounted transformers will be rated for the pump station loads, with 4,160V three-phase delta primary connection and 480Y/277V three-phase solidly grounded wye secondary connection. The transformer kVA rating will be confirmed during detailed design based on the load. Transformer windings and internal leads will be copper. Insulating fluid will be FR3, less flammable, biodegradable type. Transformers will be provided with dead front construction and with primary no-load manual tap changing capability. The transformers will be installed outdoors in close proximity to the electrical room.

6.4.2 Pump Motor Starting Equipment

The pump motor starting equipment will be medium voltage air-cooled VFDs for installation in a climate controlled space. VFD and motor procurement method has not yet been determined.

6.4.2.1 Variable Frequency Drives

Air-cooled VFDs require external HVAC cooling equipment and the annual energy cost associated with the cooling equipment must be considered. VFDs will be 4160V, Direct-to-Drive PowerFlex 7000 by Rockwell Automation, Robicon Perfect Harmony WC3 by Siemens, or ACS 1000 by ABB. Cooling components will be integral to the VFD line-up where possible. The overall VFD line-up will include line filters, isolation or phase-shifting transformers if needed for harmonic mitigation. Vendor supplied harmonic mitigation equipment will be specified to manage voltage and current distortion and line notching. VFDs will be specified to maintain a 95 percent lagging minimum true power factor (fundamental and displacement power factor) throughout the operating speed range. VFDs will be not be specified with a constant speed “bypass” feature.

The VFD ampacity rating will exceed the motor FLA rating. Each integrated line-up will be front accessible and rear aligned. Each VFD will have a main input isolation switch and line contactor. An output contactor will be provided if needed for VFD protection from back EMF due to motor reverse rotation. VFDs will be designed to control the motor speed throughout the entire pump operating range.

In addition to the medium voltage power, each VFD will be designed to accept external low voltage auxiliary power circuits. A 480V, three-phase input power source will be provided from the pump station low voltage system to power the cooling fans, anti-condensation heaters and other miscellaneous devices. A 120V, single-phase UPS source will be provided to power machine condition monitoring equipment such as RTD interface modules, vibration monitoring, and other critical equipment that requires uninterruptible power.

VFD standard internal motor protective features will be used for motor protection. Redundant motor protective relay are not planned. Each VFD will have a RTD interface module that will interface with the motor winding and bearing RTDs to generate alarms and shutdowns. Additional RTD interface module will be provided for isolation transformer winding RTDs if needed. The VFDs will be equipped with an LCD operator interface used for control, monitoring, and troubleshooting. Each VFD will be equipped with a power monitor for monitoring of voltage, current, power, power factor, and total harmonic distortion.

Each VFD will have a logic controller where the pump control logic is stored. The control logic will be developed during detailed design. VFDs will communicate with the pump station PLC via Ethernet.

Factory witness testing will be included for each VFD. Each VFD will undergo tests listed in the specifications including guaranteed efficiency test prior to shipment to the site. Additionally, one or more VFDs could be shipped to the pump testing facility for a pump-motor-VFD compatibility test.

6.4.3 Motors

All motors will be squirrel cage induction type unless defined otherwise by process requirements.

6.4.3.1 Medium Voltage Pump Motors

After evaluating the cost, availability and technical parameters, induction motors were selected as the most appropriate type for this application.

Induction motors will be 4 kV, air cooled or totally enclosed water-to-air cooled (TEWAC), solid shaft, copper wound stator, and copper bar construction squirrel cage type. Motors will be inverter duty type. Motors will have a 1.15 normal service factor/1.0 on VFD power. Motors will have Class F insulation or better, with Class B temperature rise. Motor will have a reasonably high efficiency. A guaranteed efficiency will be obtained from the motor manufacturer, and will be used in determining an overall guaranteed wire-to-water efficiency.

Each motor will be designed for reverse rotation in the event of power failure for up to 30 minutes of valve closure time.

Motors will have insulated bearings to prevent shaft circulating currents. Motors will be provided with space heaters to protect inside the enclosure against condensation when the motors are idle. Each motor will be supplied with six stator RTDs, two in each phase. Each motor bearing will be monitored via RTDs. Motors will have provisions for installation of vibration sensors.

Factory witness testing will be specified for each motor. Each motor will undergo tests listed in detailed standard specifications before shipment to the site. Additionally, one or more motors can be shipped to the pump testing facility for pump-motor-VFD compatibility testing.

6.4.3.2 Low Voltage Induction Motors

Enclosures for both horizontal and vertical motors will be totally enclosed fan cooled (TEFC), or as required by the process equipment for indoor and outdoor locations. In wet and/or corrosive locations, chemical industry severe-duty motors will be used.

Motors larger than ½ hp will be three-phase. Motors smaller and including ½ hp will be single-phase. Motors will be the premium efficiency type. Motor insulation will be designed for Class F insulation with Class B temperature rise. All motor windings will be copper wire. Motors connected to VFDs will be inverter duty rated and will conform to detailed standards outlined in the latest edition of NEMA MG1, Part 31. Motors will have a 1.15 service factor, NEMA design letter to fit the application, and locked rotor kVA Code G or better.

All non-TEFC three-phase motors will be provided with 120 Volt space heaters to prevent moisture condensation. All motors operated on VFDs will be provided with winding temperature detectors. Where applicable, constant speed motors will be provided with winding temperature detectors to protect motors against damage from overheating caused by single phasing, overload, high temperature, abnormal voltage, locked rotor, frequent starts, or ventilation failure. Bearings for horizontal and vertical motors of all sizes will be grease lubricated, with grease addition and relief fittings.

Where applicable, a disconnecting means will be provided for each motor and will be located in sight of motor and driven equipment location.

6.5 Lighting System

The lighting design will be based on the state energy code recommended criteria. The lighting control and maximum allowable W/ft² for interior lighting will conform to the latest edition of the code.

Table 6-11 lists the suggested average illuminance values and control for different areas.

Table 6-11. Target Illuminance Value and Control

Area	Illuminance Value (foot candles)	Recommended Control
Process Room	35	Bi-level switching
Electrical Room	40	Bi-level switching
Control Room	50	Occupancy sensor with manual override
Restroom	20	Occupancy sensor with manual override
Exterior (entrance)	5	Photo control
Roadway – Exterior	0.5-1.0	Photo control
Emergency Lighting	1 (on the floor)	-

Recommended light fixtures and lamps for different areas are shown in Table 6-12.

Table 6-12. Recommended Light Fixtures

Area	Light Fixture	Lamp	Voltage
Process Room	High bay	LED	277V
Electrical Room	High/Low bay	LED	277V
Control Room	Recessed	LED	120V
Restroom	Industrial	LED	120V
Chemical Rooms	Corrosive-resistant	LED	120V
Shop Room	Industrial	LED	120V
Wall mounted – Exterior	Wall mounted	LED	208V
Roadway - Exterior	Pole mounted (flood lights)	LED	277V

Due to their long lifespan and low energy consumption, LED light fixtures are the preferred fixture type.

6.6 Grounding and Lightning Protection System

Buildings and structures will be protected by UL approved lightning protection systems that will be bonded together and to the plant grounding loop. Lightning protection system will comply with UL-96A and NFPA-780 design standards. Grounding will be in accordance to the latest edition of NEC, IEEE standards, and other pertinent industry codes. Ground loops will be provided for each building and major structure. Ground loop will consist of 10-ft grounding electrodes, installed at a minimum 20 feet separation and interconnected using #4/0 American Wire Gauge (AWG) bare copper wire. If needed, test wells will be provided at opposite corners of each structure or building. Ground loops around buildings and structures will be direct buried. Supplemental grounding conductor will be provided from each power distribution equipment and control panel to the ground loop.

All electrical equipment enclosures, motor and transformer frames, conduit systems, exposed structural steel, concrete steel reinforcement, and lightning protection system will be bonded to the system ground loop. Exothermic welding system will be used for permanent grounding connections.

All electrical power distribution equipment and control panels will be specified with surge protective devices.

6.7 Conduits and Wires

6.7.1 Conduits

Table 6-13 outlines the intended raceway application requirements for different locations.

Table 6-13. Raceway Application

Location/Circuit Type	Raceway Type
All locations - Raceways containing circuits above 600 Volts.	• Exposed – Rigid aluminum conduit. • Underground – Schedule 40 polyvinyl chloride (PVC) conduit in concrete reinforced ductbank.
All locations • Class 2 and 3 signal wiring and 4-20 mA instrumentation cables, non-fiber (copper) data highway. • Fire alarm, security, and communications system wiring.	• Exposed – Galvanized rigid steel (GRS) conduit. • PVC-coated rigid steel conduit in corrosive areas. • Concealed - GRS conduit. • Underground - GRS conduit in concrete reinforced ductbank.
Clean, dry finished areas - Offices, administrative areas, lobbies, control room, lunch room, toilets, and laboratories, etc.	• Exposed - Rigid aluminum conduit. • Flexible, armor interlocked cable assembly (Type MC) or flexible conduit may be used for above the ceiling lighting wiring in these areas. • Cable trays can be used below access floors in control rooms.
Clean, dry non-finished areas - Electrical rooms, generator rooms, mechanical rooms, shops, dry storage, etc.	• Exposed – Rigid aluminum conduit. • Embedded within concrete floor slabs - Schedule 40 PVC conduit.
Process areas - Non-corrosive, non-hazardous locations designated as DAMP or WET on the Drawings.	• Exposed - Rigid aluminum conduit. • Embedded within concrete floor slabs - Schedule 40 PVC conduit.
Corrosive areas - Chemical storage and handling areas and locations where designated corrosive on the Drawings.	• Exposed – PVC-coated GRS or PVC-coated aluminum conduit.
Outdoor areas - All locations.	• Exposed - Rigid aluminum conduit. • Embedded within concrete structures - Schedule 40 PVC conduit. • Underground – Schedule 40 PVC encased in reinforced concrete ductbank. 90-degree bends will be RGS. Transition stub-ups through concrete slabs will be PVC-coated GRS. Underground raceway entrances to buildings, structures, vaults, and manholes will be PVC-coated GRS, not less than 10 feet long.

A short run of liquid-tight flexible metal conduits will be used for connections to motors, transformers, and other equipment where vibration is present or may require removal. Expansion-deflection fittings will be used where expansion is anticipated.

All underground ductbank systems will be steel-reinforced and concrete-encased. Spare conduits will be provided in underground ductbanks for future use. All spare conduits will be provided with a pull string.

6.7.2 Wire and Cable

5 kV cable will be single conductor, shielded, annealed stranded copper with 105 degree C rating and 133 percent insulation level. The cable will have ethylene-propylene rubber (EPR) insulation and polyvinylchloride (PVC) jacket. 5 kV cable terminations will be heat-shrinkable type suitable for outdoor and indoor installation as applicable and recommended by the cable manufacturer. Cable installed on cable trays will be TC rated.

All 600V wires and cables will be of annealed, 98 percent conductivity, soft drawn copper. All conductors will be stranded. Except for control, instrumentation, and signal circuits, wire smaller than No. 12 American Wire Gauge (AWG) will not be used. Cable installed on cable trays will be TC rated for cable tray installation. 600V wire for power and control circuits will be type THHN/THWN-2 or XHHW for conduit installation.

Typically, the maximum wire size will be limited to 500 KCMIL copper for both 5 kV and 600V cables. Parallel conductors will be used for circuits requiring greater ampacity. The maximum allowable voltage drop for any circuit will be three percent. The wire sizes will be selected to limit voltage drop to three percent.

Instrumentation wire will be shielded with 300V PVC insulation and overall PVC jacket. Instrumentation wire will be single pair, three-conductor, or multiple pair cable, as required. Conductors will be stranded and twisted, no smaller than No. 16 AWG.

Power and control conductors will be color coded, or coded using electrical tape in sizes where colored insulation is not available. All wiring will be tagged and coded with an identification number. Spare wires will be pulled in control runs for future use.

6.7.3 Support Material

Conduit mounting hardware, conduit racks, accessories and components will be galvanized steel for indoor dry areas, 316 stainless steel for wet and outdoor areas, and PVC-coated steel or FRP for corrosive areas. Supports will be designed for the appropriate seismic activity. Welding of conduit support structures consisting of strut will not be allowed; the use of listed fittings for strut assemblies will be enforced.

6.8 Area Classification and NEMA Classification of Electrical Equipment

Table 6-14 represents the recommended area classifications and the associated National Electrical Manufacturers Association (NEMA) ratings for the electrical equipment enclosures located in these different areas of the facilities.

Table 6-14. Area Classification and NEMA Classification of Electrical Enclosures

Area	Area Classification	NEMA Classification	Enclosure Material
Process Rooms	Wet area	NEMA 4X	316 Stainless steel
Chemical Areas	Corrosive area	NEMA 4X	See Note 1
Electrical Room	Dry area	NEMA 1 or NEMA 12	Painted carbon steel
Control Room	Dry area	NEMA 1	Painted carbon steel
Restroom	Dry	NEMA 1	Painted Carbon Steel
Shop Rooms	Dry	NEMA 12	Painted Carbon Steel
Exterior	Wet area	NEMA 4X	316 Stainless steel
Interior/ Exterior	Flood areas	NEMA 6/6P	See Note 2

Note 1. The design engineer will provide a materials recommendation based upon the actual chemical additives.
Note 2. Equipment will be located wherever possible outside of locations prone to flood. If equipment must be placed in locations prone to these conditions, NEMA 6/6P rated equipment will be installed in vaults if available.

6.9 Electrical System Analysis

During detailed design, a preliminary electrical system analysis will be performed for the pump station power distribution system and will include:

- Load Flow
- Short Circuit Study
- Selective Coordination Study
- Harmonic Study
- Arc Flash Study

During construction, the construction contractor will be obligated to produce preliminary and final electrical system studies, including an arc flash study as outlined in detailed technical specifications. Arc flash labels will be specified to be provided by the contractor based on the approved arc flash study for all electrical equipment. The final study will contain “as left” field ratings and settings of the electrical equipment and devices.

6.10 Electrical System Testing and Settings

Electrical equipment will be tested after installation to assure that all electrical equipment is operational and within industry and manufacturer's tolerances, and is installed in accordance with design specifications. The tests and inspections will determine suitability for energizing equipment, and will confirm the equipment is installed per the Contract Documents and as a benchmark for the Owner to use for future maintenance testing. Testing and commissioning will be performed in accordance with the latest revision of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems”.

A list of specific tests will be outlined in the detailed technical specifications.

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7.0 Design Drawings and Cost Estimates

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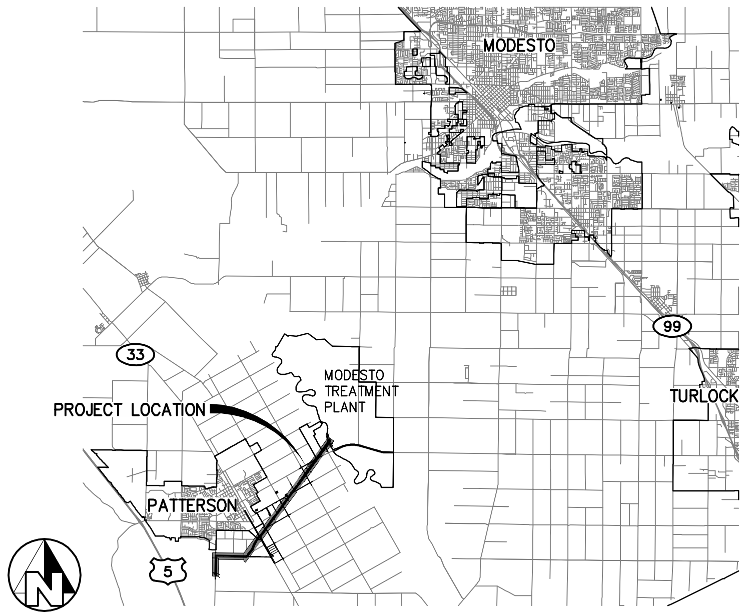

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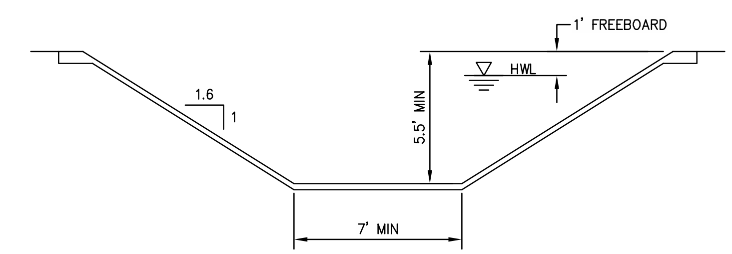
GENERAL NOTES

1. PATTERSON ID SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING DISTRICT FACILITIES.
2. USED MATERIAL, REJECTS, MISFITS, OR SECONDS, ETC. ARE NOT ACCEPTABLE FOR USE ON PATTERSON ID FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS AND PATTERSON ID SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE ENGINEER AWARE OF ANY DISCREPANCIES.
5. ALL CAST-IN-PLACE CONCRETE STRUCTURES SHALL BE FORMED INSIDE AND OUT AND CONCRETE VIBRATED SUFFICIENTLY TO PROVIDE FOR SMOOTH SURFACED WALLS/FLOORS WITHOUT VOIDS AND HONEYCOMBS.
6. PATTERSON ID SHALL INSPECT ALL WORK PHASES ON CONCRETE FACILITIES FOR CONFORMANCE TO PATTERSON ID SPECIFICATIONS. REINFORCING SHALL NOT BE ENCASED IN CONCRETE WITHOUT PRIOR PATTERSON ID INSPECTIONS. LIKEWISE, CONCRETE SHALL NOT BE COVERED WITH EARTH PRIOR TO PATTERSON ID INSPECTION.
7. THRUST RESTRAINTS TO BE PROVIDED AT ALL PIPELINE BENDS, WHETHER OR NOT SHOWN ON THE PLANS.



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MINIMUM REQUIRED CROSS SECTION FOR 195 CFS

ABBREVIATIONS

AVE	AVENUE
CFS	CUBIC FEET PER SECOND
DMC	DELTA MENDOTA CANAL
(E)	EXISTING
E	EAST
FT	FOOT/FEET
HWL	HIGH WATER LEVEL
ID	IRRIGATION DISTRICT
INV	INVERT
MIN	MINIMUM
N	NORTH
PID	PATTERSON IRRIGATION DISTRICT
PS	PUMP STATION
RGRCP	RUBBER GASKETED REINFORCED CONCRETE PIPE
R/W	RIGHT OF WAY
S	SOUTH
S=	SLOPE
STA	STATION
W	WEST

SPECIAL NOTE

WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSTRUED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

TOPOGRAPHY NOTE

NAD 83 ZONE 3F

DESIGN SURVEY SHALL FURTHER DEFINE DATUM.

SHEET INDEX

SHEET NO.	DESCRIPTION
GENERAL	
G1	COVER
PLAN AND PROFILE	
PP1	STA 0+00 TO 110+00
PP2	STA 110+00 TO STA 220+00
PP3	STA 220+00 TO STA 290+00
CIVIL	
C1	195 CFS PUMP STATION

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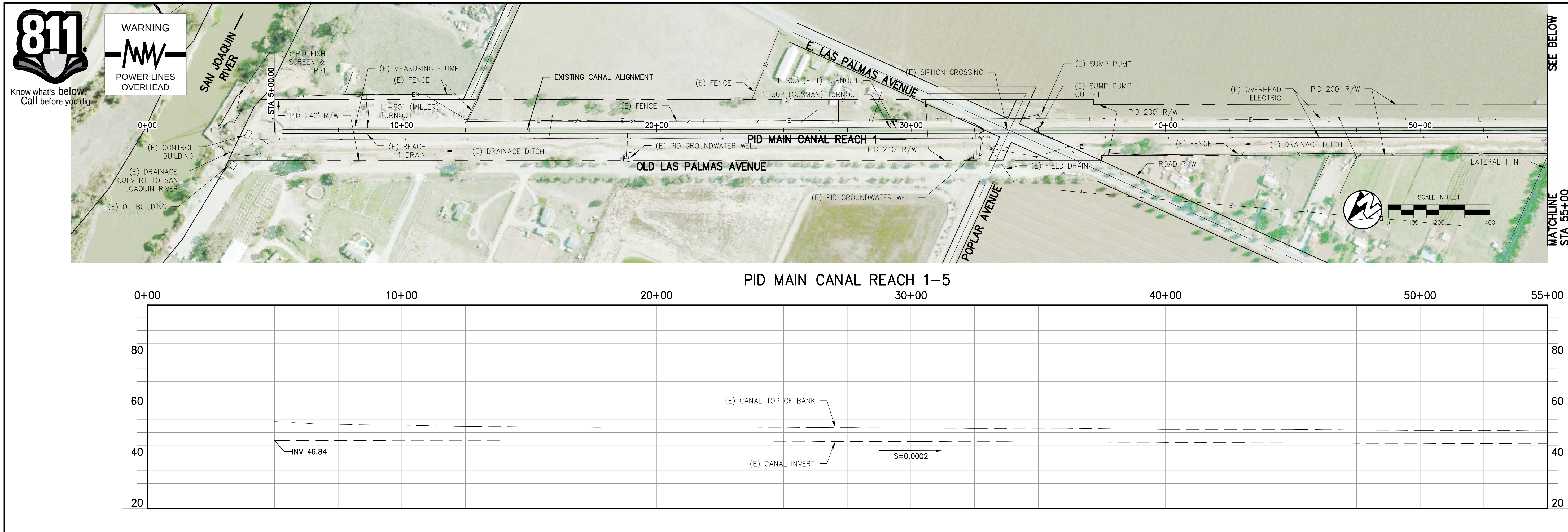

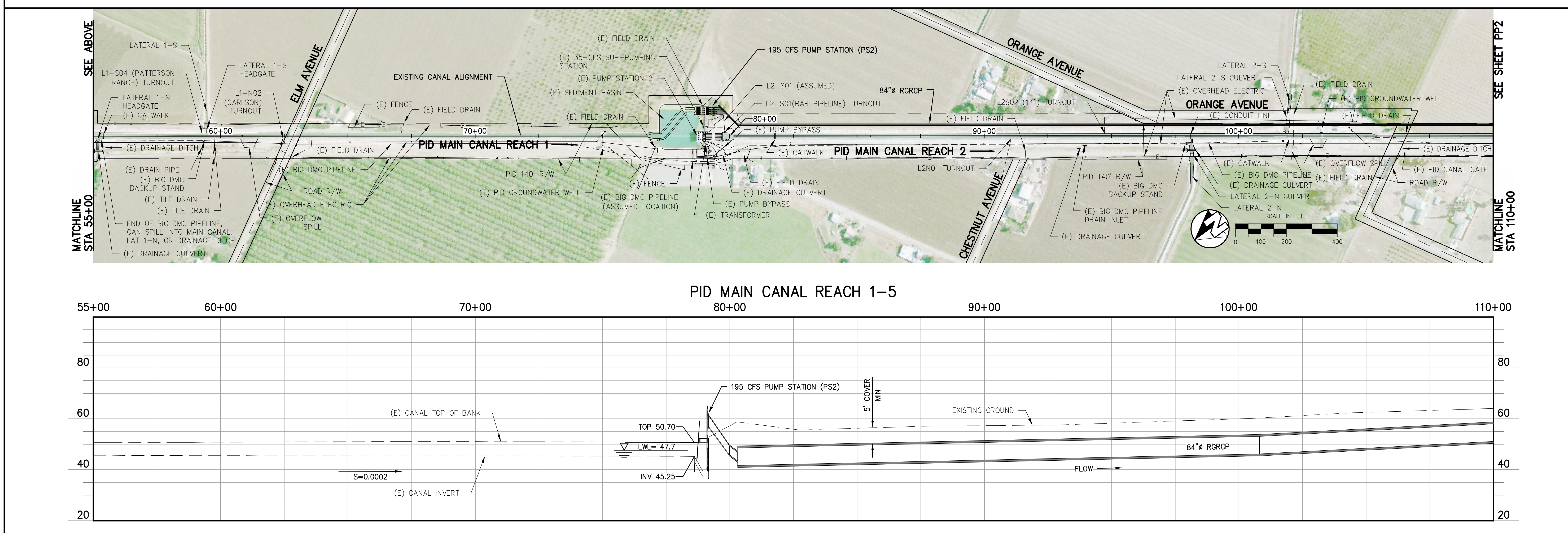

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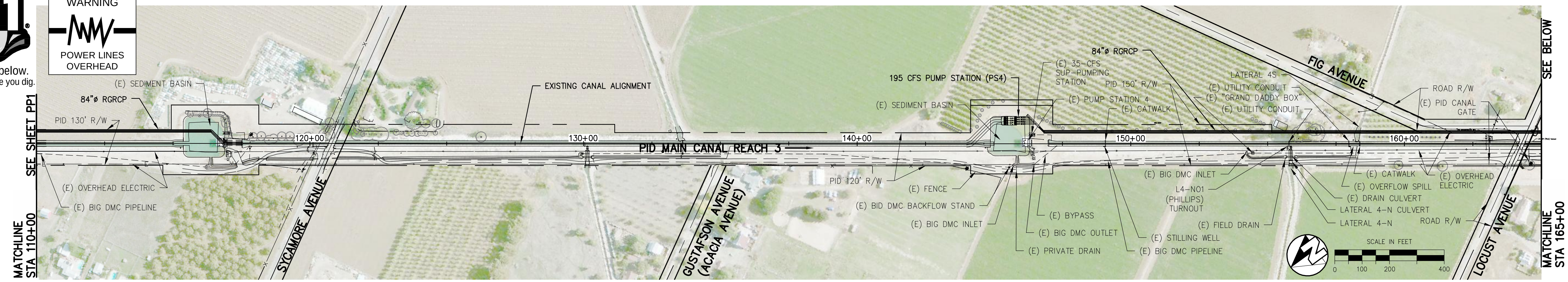

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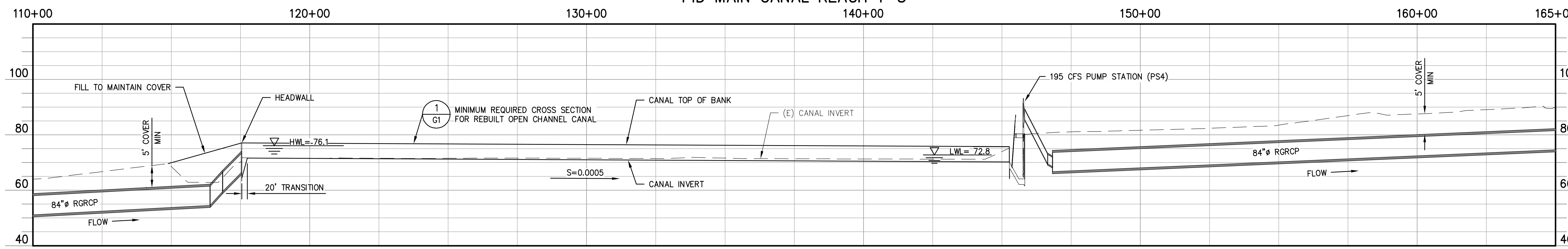

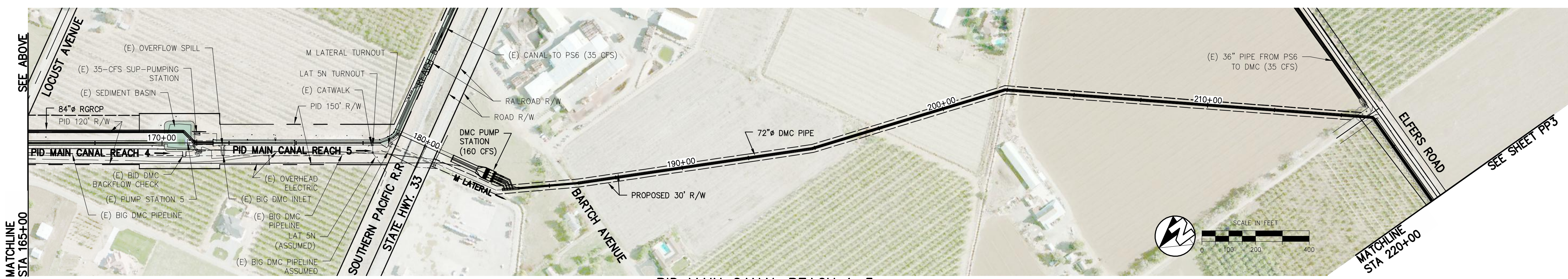

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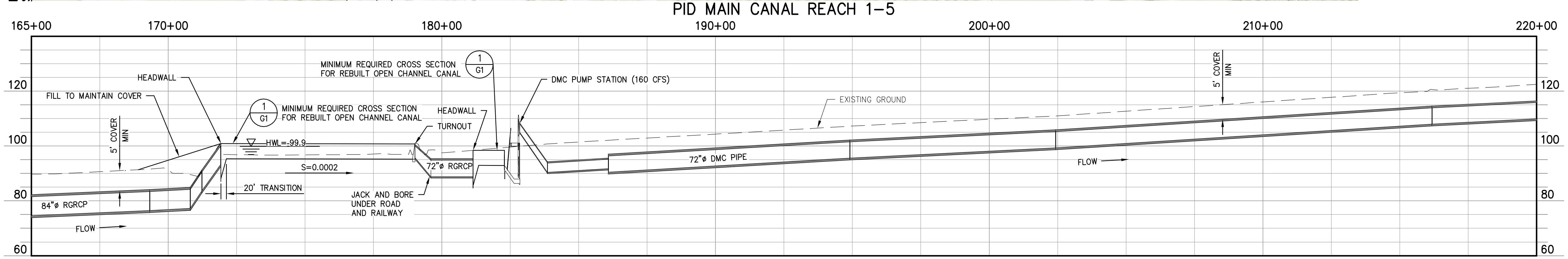

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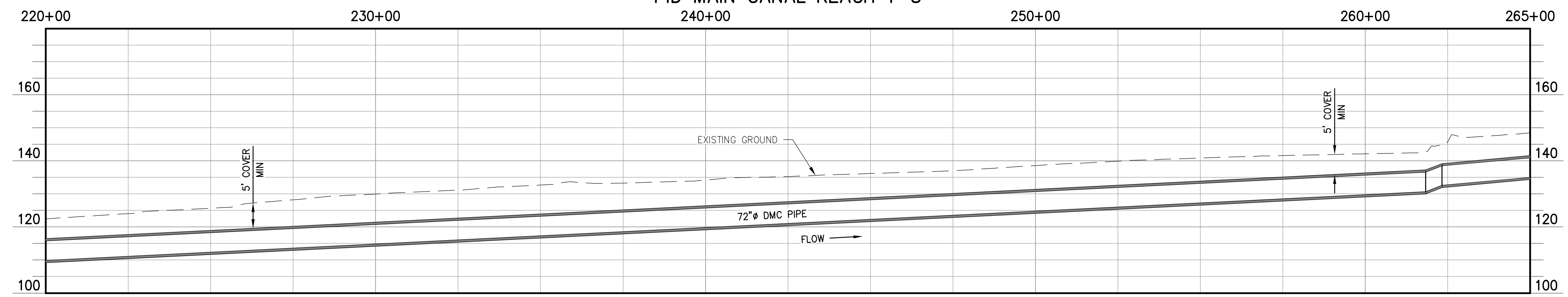
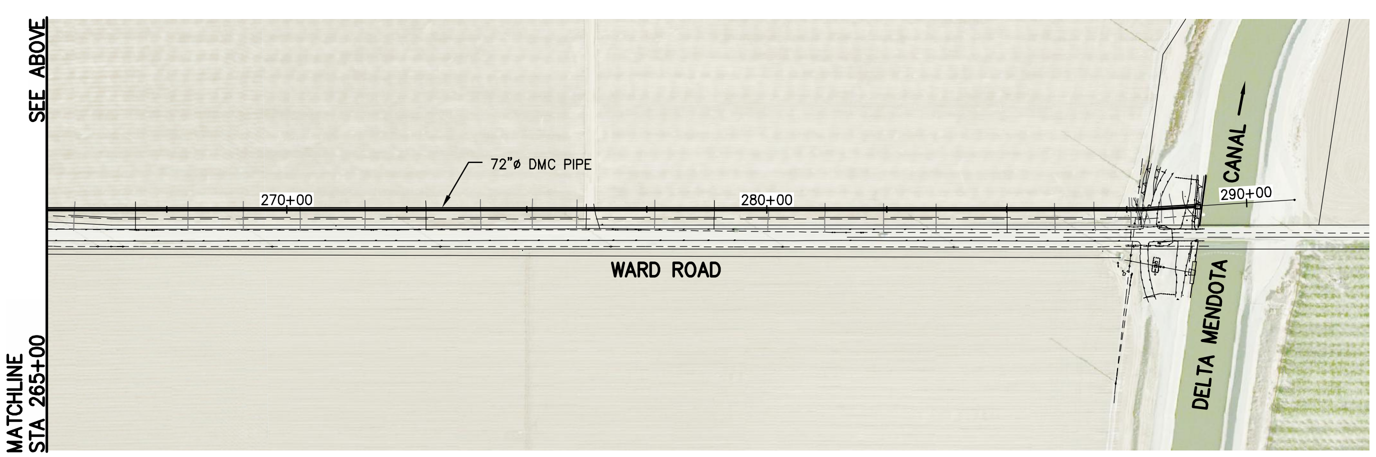
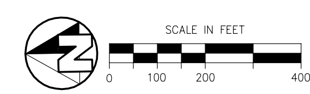
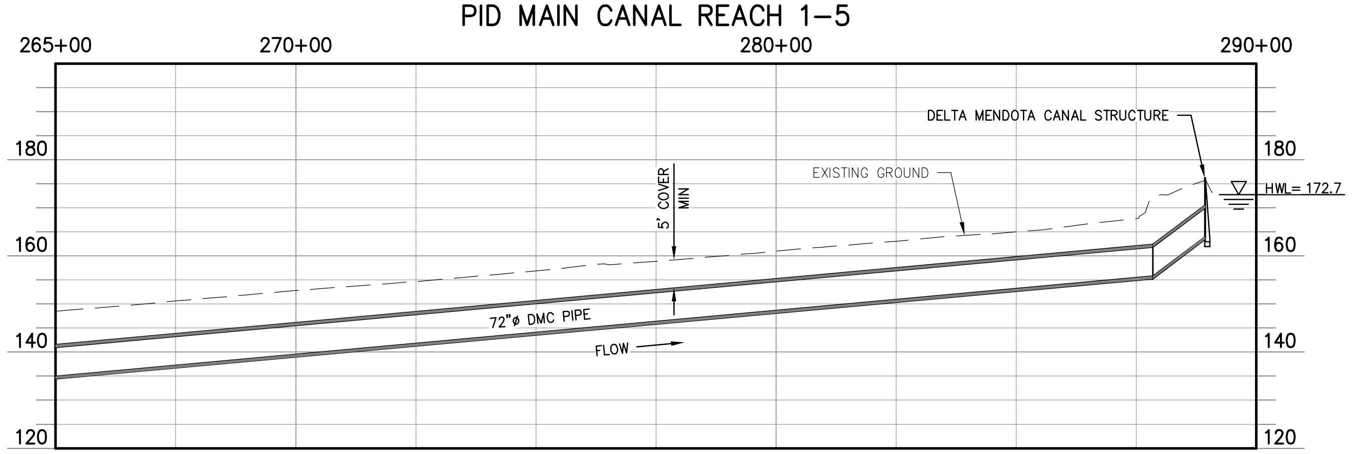
WARNING
POWER LINES OVERHEAD









HYDRAULICS	
PUMP STATION #2 TO PUMP STATION #4	
TOTAL FLOW RATE (CFS)	195
PUMP STATION #2 LOW WATER PUMPING LEVEL (FT)	47
PUMP STATION #4 HIGH WATER LEVEL (FT)	76
STATIC LIFT (FT)	29
HEAD LOSS (FT)	9
TOTAL DYNAMIC HEAD (FT)	38
MOTOR HORSE POWER (EA)	300
PUMP STATION #4 TO THE DELTA MENDOTA CANAL PUMP STATION	
TOTAL FLOW RATE (CFS)	195
PUMP STATION #4 LOW WATER PUMPING LEVEL (FT)	72
DELTA MENDOTA CANAL PUMP STATION HIGH WATER LEVEL (FT)	100
STATIC LIFT (FT)	28
HEAD LOSS (FT)	7
TOTAL DYNAMIC HEAD (FT)	35
MOTOR HORSE POWER (EA)	300
DELTA MENDOTA CANAL PUMP STATION TO THE DELTA MENDOTA CANAL	
TOTAL FLOW RATE (CFS)	160
DELTA MENDOTA CANAL PUMP STATION LOW WATER PUMPING LEVEL (FT)	94
DELTA MENDOTA CANAL HIGH WATER LEVEL (FT)	173
STATIC LIFT (FT)	79
HEAD LOSS (FT)	23
TOTAL DYNAMIC HEAD (FT)	102
MOTOR HORSE POWER (EA)	700

NOTE:
1) ALL ELEVATIONS AND CALCULATIONS ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED.
2) LOW WATER PUMPING LEVEL IS ASSUMED TO BE 3 FT BELOW THE TOP OF BANK.
3) HIGH WATER LEVEL AT THE PUMP STATIONS ARE ASSUMED TO BE 1 FT BELOW TOP OF BANK.
4) HIGH WATER LEVEL AT THE DELTA MENDOTA CANAL IS ASSUMED TO BE 3 FT BELOW TOP OF BANK.

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10% - PRELIMINARY
NOT FOR CONSTRUCTION
6/10/2016

No.	REVISION	BY	DATE

FOR REVIEW ONLY

SJRRP RECAPTURE AND RECIRCULATION
EXPANDED EXISTING FACILITIES
CDM SMITH
PATTERSON, CALIFORNIA

PLAN AND PROFILE

STA 220+00 TO STA 290+00

EST. 1968
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company
286 WEST CROMWELL AVENUE
FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.ppeng.com

DESIGN ENGINEER: ALEX COLLINS
LICENSE NO: 78242
DRAFTED BY: STG/PAD
CHECKED BY: RSH
DATE: 6/10/2016
JOB NO: 190214C1
PROJECT NO: ----
PHASE: ----

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET PP3

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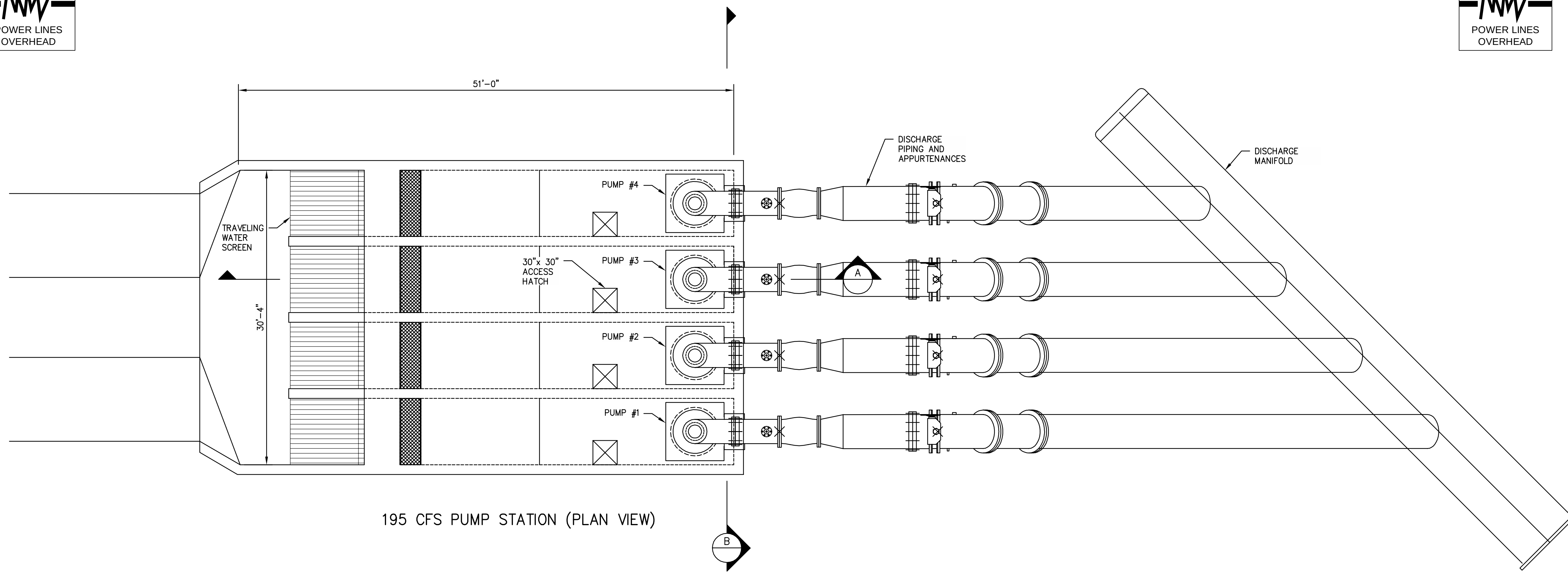
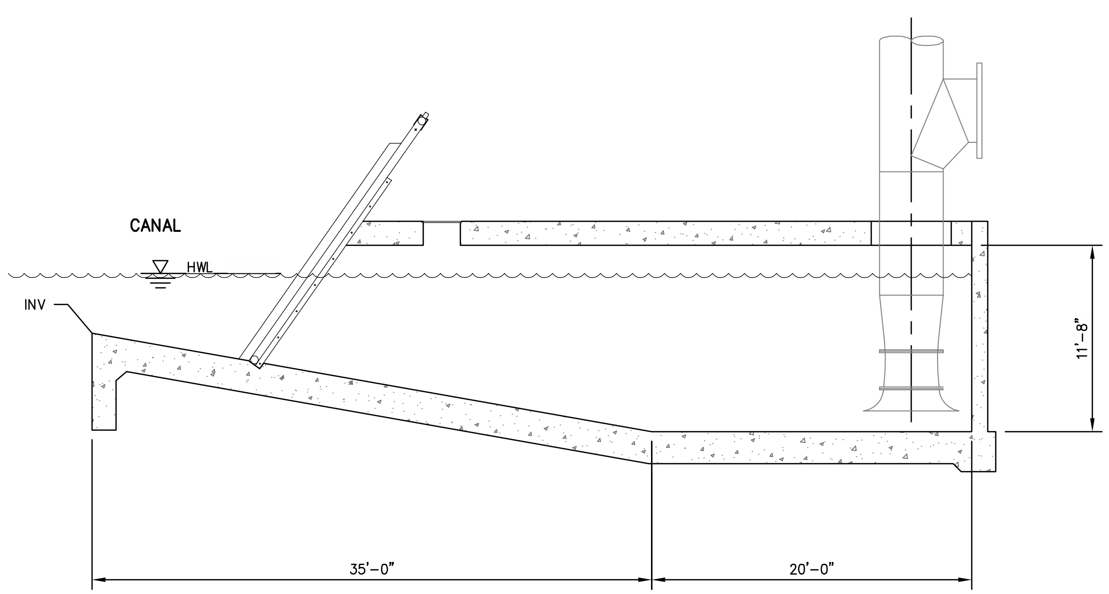
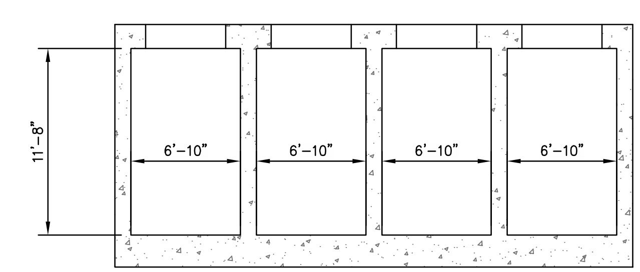


195 CFS PUMP STATION (PLAN VIEW)



SECTION A



SECTION B

FEET 0 3 6

TYPICAL PUMP STATION 2 AND 4

WARNING — POWER LINES OVERHEAD

811 Know what's below. Call before you dig.

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PATTERSON, CALIFORNIA

CIVIL

195 CFS PUMP STATION

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DATE: 6/10/2016
JOB NO: 190214C1
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PHASE: ----

ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET C1

5 OF 5

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FEATURE:			PROJECT:				
		Cost Estimate **Patterson Irrigation District Alternative** **Recapture and Recirculate Alternative Analysis**		**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program**			
			WOID:	USBR	**ESTIMATE LEVEL:**		Preliminary
			REGION:	Mid Pacific	**PRICE LEVEL:**		June 2016
		7/22/2016	**FILE:**	C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[2016-0922 PID Est-Wst Convey cost est.xls]LCC			

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Field Costs					
	1.00	**Interceptor Dewatering**					
	1.01	Clearing and Grubbing		10	AC	$1,123	$11,230
	1.02	Demolition (existing channel, and sedimentation basins)		5	LS	$19,858	$99,290
	1.03	15' All-Weather Access Road surfacing (Reach 2 to Hwy 33 Single Bank, Reach 1 Both Banks)		3,444	CY	$82	$282,408
	1.04	Barbed Wire Fencing (each side of R/W PP1 to Hwy 33)		34,800	LF	$11	$382,800
	2.00	**Pumps**					
	2.01	Pumps and Motors - 195 cfs @ 1200 HP		2	EA	$696,384	$1,392,768
	2.02	Pumps and Motors - 160 cfs @ 2800 HP		1	LS	$1,624,896	$1,624,896
	2.03	Pump Station Structure and Appurtenances (PS2 & PS4)		2	EA	$1,289,470	$2,578,940
	2.04	Hwy 33 to DMC Pump Station Structure and Appurtenances		1	LS	$1,066,660	$1,066,660
	2.05	Control Building, Site Electrical, SCADA, and Programming (PS2 & PS4)		2	EA	$866,340	$1,732,680
	2.06	Hwy 33 to DMC Control Building, Site Electrical, SCADA, and Programming		1	LS	$1,851,940	$1,851,940
	2.07	Surge Protection (PS2 & PS4)		2	EA	$74,295	$148,590
	2.08	Hwy 33 to DMC Surge Protection		1	LS	$60,960	$60,960
	3.00	**Canals**					
	3.01	Canal Earthwork		69,500	CY	$9	$647,740
	3.02	Non-Reinforced Concrete Lining (3" Thick)		354,997	SF	$3	$1,171,490
	3.03	Lateral Turnouts		5	EA	$46,730	$233,650
	3.04	Landowner Turnout/ Canal Bypass Replacement		6	EA	$33,548	$201,288
	3.05	Clear Span Bridge Replacement		2	EA	$200,000	$400,000
	3.06	Catwalks		640	SF	$159	$101,594
	3.07	District Ground Well Modification/Sump Pump Outlet		4	EA	$8,692	$34,768
	4.00	**Pipe**					
	4.01	Furnish and Install 84" C-361 RGRCP (B-150)		6,400	LF	$715	$4,576,000
	4.02	Furnish and Install 72" C-361 RGRCP		11,125	LF	$617	$6,864,125
	4.03	Landowner Turnout/ Canal Bypass Replacement		5	EA	$14,740	$73,700
	4.04	Pipe Turnout Facility		4	EA	$63,494	$253,976
	4.05	Road Crossing		3	EA	$5,737	$17,211
	4.06	District Ground Well Modification/Sump Pump Outlet		2	EA	$8,692	$17,384
	4.07	Jack and Bore 72" Diam. Under Highway 33/Southern Pacific Rail Road Crossing		150	LF	$2,675	$401,250
	4.08	DMC Box Culvert Discharge		1	LS	$290,000	$290,000
	5.00	**Drainage Service**					
	5.01	Furnish and Install HDPE Type S, 18 inch Diameter		17,400	LF	$22	$382,278
	5.02	Replace Farm Drain Connections		20	EA	$7,265	$145,300
	5.03	Road/Lateral Crossings		15	EA	$5,081	$76,215
	6.00	**Field Costs Subtotal**					
	6.01	Field Costs Subtotal (Items 1.01 Through 5.08)					**$27,121,131**
	7.00	**General Conditions**					
	7.01	Mobilization, Bonds, Insurance, Temporary Facilities, & Demobilization		10.00	%	$27,121,131	$2,712,113
	7.05	Traffic Control (0.25% Or $10,000 Minimum)		7.00	EA	$25,000	$175,000
	7.06	Utility Relocation		3.00	%	$27,121,131	$813,634
	7.10	General Conditions Subtotal (Items 7.01 Through 7.09)					**$3,700,747**
	8.00	**Field Costs & Contingency Summary**					
	8.01	Field Costs Subtotal (Items 6.01 + 7.10)					**$30,821,878**
	8.02	Field Costs Contingency		30.00	%	$30,821,878	$9,246,563
	8.03	Field & Contingency Costs Subtotal (Items 8.01 + 8.02)					**$40,068,441**
(1.a. cont) The power requirements are computed as follows =(5200 hp) x (0.746 kW / hp) x (38 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 =							
	9.00	**Total Field Costs**					
	9.01	Total Field Costs (Item 8.03)					**$40,068,441**
		Non-Contract Costs					

FEATURE:		PROJECT:				
	Cost Estimate **Patterson Irrigation District Alternative** **Recapture and Recirculate Alternative Analysis**	**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program**				
		WOID: USBR		**ESTIMATE LEVEL:**	Preliminary	
		REGION: Mid Pacific		**PRICE LEVEL:**	June 2016	
	7/22/2016	**FILE:** C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[2016-0922 PID Est-Wst Convey cost est.xls]LCC				

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
	103.00	**Permitting & Compliance**		**7.00**	**%**		
	103.01	Permitting		7.00	%	$40,068,441	$2,804,791
	105.00	**Construction Management**		**15.00**	**%**		
	105.01	Engineering		8.00	%	$40,068,441	$3,205,475
	105.02	Construction Management		7.00	%	$40,068,441	$2,804,791
	107.00	**Non-Contract Costs & Contingency Summary**					
	107.01	Non-Contract Costs Subtotal (Items 103.01 Through 105.02)					**$8,815,057**
	107.02	Non-Contract Costs Contingency		15.00	%	$8,815,057	$1,322,259
	107.03	Non-Contract & Contingency Costs Subtotal (Items 107.01 + 107.02)					**$10,137,316**
	108.00	**Total Non-Contract Costs**					
	108.01	Non-Contract Costs (Item 107.03)					**$10,137,316**
		Land Acquisition Costs					
	201.00	**Land Acquisition Costs**					
	201.01	Land Acquisition Costs For Required Right Of Way		1.00	AC	$ 480,000	$480,000
		Total Construction Costs					
	301.00	**Total Construction Costs**					
	301.01	Total Field Costs (Item 9.01)					**$40,068,441**
	301.02	Total Non-Contract Costs (Item 108.01)					**$10,137,316**
	301.03	Subtotal Field & Non-Contract Costs (Items 301.01 + 301.02)					**$50,205,757**
	301.04	Total Land Acquisition Costs (Item 202.03)					**$480,000**
	301.05	Total Construction Costs (Items 301.03 + 301.04) (rounded to 1000's)					**$50,686,000**

Notes and Assumptions:

1 This cost estimate only includes improvements to the Districts system, & doesn't account for any capital cost already invested.
2 Cost estimate based on 10% Plans.
3 Unit price comes from RS Means, supplier quotes, Caltrans and bid canvasses from similar projects.
4 This cost estimate was prepared assuming certain fittings may be welded in-lieu of flanged fittings bases on similar projects.
5 This cost estimate assumes power can be provided to site with minimal improvements.
6 Contract Award Date and NTP dates are unknown.
7 Canal operations are unknown, so no schedule or cost adjustments have been made to accommodate work windows or weather days.
8 Item 3.04: Assumed to be a 24 inch concrete turnout with knife gate, 50 ft of steel pipe and a butterfly valve
9 Item 3.06: 40 ft long by 8 ft wide = 320 SF.
10 Item 3.07: Assumes 12 inch pipe and valve.
11 Item 4.03: Assumed to be a 12 inch valve with 50 ft of steel pipe.
12 Item 4.04: 24" valve to pipe to gate with concrete transition.
13 Item 4.05: Road crossing assumes 30 ft width, 10 ft depth, 36Inch pipe, ACP replacement 8" thick.
14 Item 5.02: Use 18 inch HDPE, two connections 50 ft excavation length 10 ft deep x 6 ft width.

QUANTITIES		PRICES	
BY WR Vanderwaal/D Manning/P Dansby	**CHECKED** A Collins	**BY** WR Vanderwaal/D Manning	**CHECKED** A Collins 7/22/2016
DATE PREPARED July 22, 2016	**PEER REVIEW** O Kubit	**DATE PREPARED** July 22, 2016	**PEER REVIEW** O Kubit 7/22/2016

Annual Costs of Project (All costs should be in 2016 Dollars) Project: SJRRP Recapture and Recirculate - Patterson ID Expanded Existing Facilities							
	Initial Costs	Annual Costs [1]				Discounting Calculations	
		Operations	Maintenance	Replacement[2,3]	Total Costs (a) + (b) + (c) + (d)	Discount Factor[4]	Discounted Project Costs (e) x (f)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2016	50,686,000	796,000	420,000		51,902,000	1.000	**$51,902,000**
2017		796,000	420,000		1,216,000	0.966	**$1,175,000**
2018		796,000	420,000		1,216,000	0.933	**$1,135,000**
2019		796,000	420,000		1,216,000	0.902	**$1,097,000**
2020		796,000	420,000		1,216,000	0.872	**$1,060,000**
2021		796,000	420,000		1,216,000	0.843	**$1,025,000**
2022		796,000	420,000		1,216,000	0.815	**$991,000**
2023		796,000	420,000		1,216,000	0.787	**$957,000**
2024		796,000	420,000		1,216,000	0.760	**$924,000**
2025		796,000	420,000		1,216,000	0.734	**$893,000**
2026		796,000	420,000		1,216,000	0.709	**$862,000**
2027		796,000	420,000		1,216,000	0.685	**$833,000**
2028		796,000	420,000		1,216,000	0.662	**$805,000**
2029		796,000	420,000		1,216,000	0.640	**$778,000**
2030		796,000	420,000	4,819,000	6,035,000	0.618	**$3,730,000**
2031		796,000	420,000		1,216,000	0.597	**$726,000**
2032		796,000	420,000		1,216,000	0.577	**$702,000**
2033		796,000	420,000		1,216,000	0.558	**$679,000**
2034		796,000	420,000		1,216,000	0.539	**$655,000**
2035		796,000	420,000		1,216,000	0.521	**$634,000**
2036		796,000	420,000		1,216,000	0.503	**$612,000**
2037		796,000	420,000		1,216,000	0.486	**$591,000**
2038		796,000	420,000		1,216,000	0.470	**$572,000**
2039		796,000	420,000		1,216,000	0.454	**$552,000**
2040		796,000	420,000	2,508,000	3,724,000	0.439	**$1,635,000**
2041		796,000	420,000		1,216,000	0.424	**$516,000**
2042		796,000	420,000		1,216,000	0.410	**$499,000**
2043		796,000	420,000		1,216,000	0.396	**$482,000**
2044		796,000	420,000		1,216,000	0.383	**$466,000**
2045		796,000	420,000	9,300,000	10,516,000	0.370	**$3,891,000**
2046		796,000	420,000		1,216,000	0.358	**$435,000**
2047		796,000	420,000		1,216,000	0.346	**$421,000**
2048		796,000	420,000		1,216,000	0.334	**$406,000**
2049		796,000	420,000		1,216,000	0.323	**$393,000**
2050		796,000	420,000		1,216,000	0.312	**$379,000**
2051		796,000	420,000		1,216,000	0.301	**$366,000**
2052		796,000	420,000		1,216,000	0.291	**$354,000**
2053		796,000	420,000		1,216,000	0.281	**$342,000**
2054		796,000	420,000		1,216,000	0.272	**$331,000**
2055		796,000	420,000		1,216,000	0.263	**$320,000**
2056		796,000	420,000		1,216,000	0.254	**$309,000**
2057		796,000	420,000		1,216,000	0.245	**$298,000**
2058		796,000	420,000		1,216,000	0.237	**$288,000**
2059		796,000	420,000		1,216,000	0.229	**$278,000**
2060		796,000	420,000	4,819,000	6,035,000	0.221	**$1,334,000**
2061		796,000	420,000		1,216,000	0.214	**$260,000**
2062		796,000	420,000		1,216,000	0.207	**$252,000**
2063		796,000	420,000		1,216,000	0.200	**$243,000**
2064		796,000	420,000		1,216,000	0.193	**$235,000**
2065		796,000	420,000		1,216,000	0.186	**$226,000**
Total Present Worth of Discounted Costs (Sum of column (g))							**$88,849,000**

Comments:

(1) The incremental change in O&M and replacement costs attributable to the project

(1.a.) Operation costs include the electrical costs of running the pumps as listed below at $.18/KWH plus a 25% contingency.

Pump Plant#	Flow (CFS)	Estimated TDH	Horsepower
	195	175	5200.0 hp
		Total	**5200.0 hp**

(1.a. cont) The power requirements are computed as follows =(5200 hp) x (0.746 kW / hp) x (38 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 = $796,012

Average electric rate calculated from PG&E Small Agricultural Rate running 24 hours/day, 7 days a week for 365 days during the year during the highest flow period of the wet restoration year type

(1B) Annual Maintenance costs** are: Discharge Pipe = $11,767,801 * 1.5% ($176,517), Concrete Lined Canal = $2,006,428 * 1.5% ($30,096), Pumping Plant Manifold = $3,855,150 * 1.5% ($57,827) & Electrical motors, controls & connections = $3,584,620 * 2% ($71,692) the sum = $336,133 (then multiply by 25%) = $420,166

(2) Replacement costs are the costs to replace the equipment with a 25% contingency not including engineering, or construction management, mobilization and demobilization, or land grading

(3) All replacement intervals are modified replacement intervals from Table 3.1, 1981 printing of the American Society of Agricultural Engineers, "Design and Operation of Farm Irrigation Systems" by Jensen. The intervals are modified to meet local conditions and professional experience

(4) Estimated Discount Rate 3.375% ,2015 fiscal year rate set by Reclamation for Federal water resource planning (Federal Register, Vol.79, No.248)

(5) Costs from the Engineers Opinion of Probable Costs as follows:

Cost Item	Amount	Replacement**
Concrete Lined Canal	$ 2,006,428	Every 25 years
Pump Plant Manifold & Discharge	$ 3,855,150	Every 15 years
Electrical Motors, Controls, Connections	$ 3,584,620	Every 30 years
		Every 15 years

(this is treated the same as open farm ditches found in Jensen)

**Annual maintenance percentages and replacement periods based on Jensen, M.E., Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, 1981

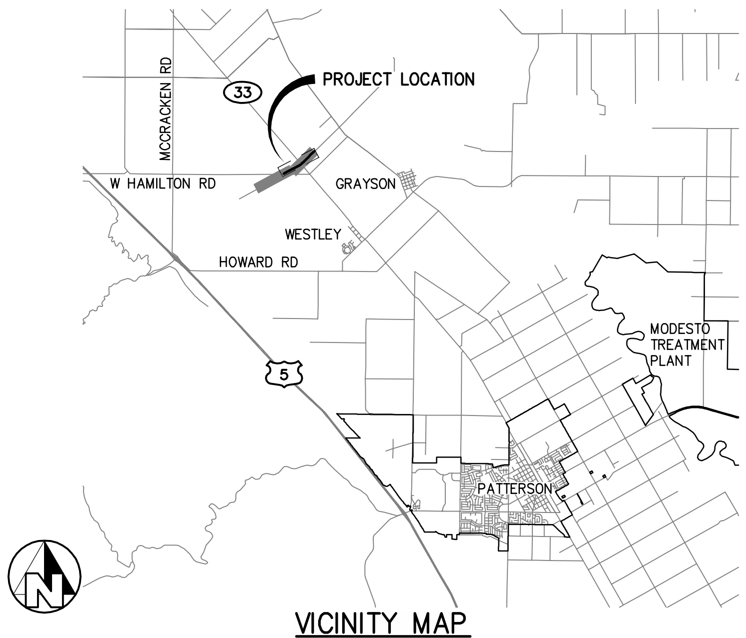
811 Know what's below. Call before you dig.

WARNING
POWER LINES OVERHEAD

CDM SMITH

WEST STANISLAUS I.D. - WESTLEY, CALIFORNIA

WEST STANISLAUS IRRIGATION DISTRICT SJRRP RECAPTURE AND RECIRCULATION EXPANDED EXISTING FACILITIES



VICINITY MAP
NOT TO SCALE

SITE MAP

SCALE IN FEET
0 1500 3000 6000

GENERAL NOTES

1. WEST STANISLAUS ID SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING DISTRICT FACILITIES.
2. USED MATERIAL, REJECTS, MISFITS, OR SECONDS, ETC. ARE NOT ACCEPTABLE FOR USE ON WEST STANISLAUS ID FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS AND WEST STANISLAUS ID SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE ENGINEER AWARE OF ANY DISCREPANCIES.
5. ALL CAST-IN-PLACE CONCRETE STRUCTURES SHALL BE FORMED INSIDE AND OUT AND CONCRETE VIBRATED SUFFICIENTLY TO PROVIDE FOR SMOOTH SURFACED WALLS/FLOORS WITHOUT VOIDS AND HONEYCOMBS.
6. WEST STANISLAUS ID SHALL INSPECT ALL WORK PHASES ON CONCRETE FACILITIES FOR CONFORMANCE TO WEST STANISLAUS ID SPECIFICATIONS. REINFORCING SHALL NOT BE ENCASED IN CONCRETE WITHOUT PRIOR WEST STANISLAUS ID INSPECTIONS. LIKEWISE, CONCRETE SHALL NOT BE COVERED WITH EARTH PRIOR TO WEST STANISLAUS ID INSPECTION.
7. THRUST RESTRAINTS TO BE PROVIDED AT ALL PIPELINE BENDS, WHETHER OR NOT SHOWN ON THE PLANS.

ABBREVIATIONS

AVE	AVENUE
CFS	CUBIC FEET PER SECOND
(E)	EXISTING
E	EAST
HWL	HIGH WATER LEVEL
ID	IRRIGATION DISTRICT
INV	INVERT
LWL	LOW WATER LEVEL
MIN	MINIMUM
N	NORTH
RD	ROAD
S	SOUTH
W	WEST
WSID	WEST STANISLAUS IRRIGATION DISTRICT

SPECIAL NOTE

WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSTRUED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

TOPOGRAPHY NOTE

NAD 83 ZONE 3F

DESIGN SURVEY SHALL FURTHER DEFINE DATUM.

SHEET INDEX

SHEET NO.	DESCRIPTION
GENERAL	
G1	COVER
PLAN AND PROFILE	
PP1	STA 10+00-70+00
CIVIL	
C1	PUMP STATION 3A

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No.	REVISION	BY	DATE

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8/24/2017

FOR REVIEW ONLY

SJRRP RECAPTURE AND RECIRCULATION
EXPANDED EXISTING FACILITIES
CDM SMITH
WEST STANISLAUS I.D. - WESTLEY, CALIFORNIA

GENERAL

COVER

EST. 1968
PROVOST & PRITCHARD CONSULTING GROUP
An Employee Owned Company
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FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.ppeng.com

DESIGN ENGINEER: ALEX COLLINS
LICENSE NO: 78242
DRAFTED BY: STG\PAD
CHECKED BY: RSH
DATE: 8/24/2017
JOB NO: 01902 14C10
PROJECT NO:
PHASE:

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

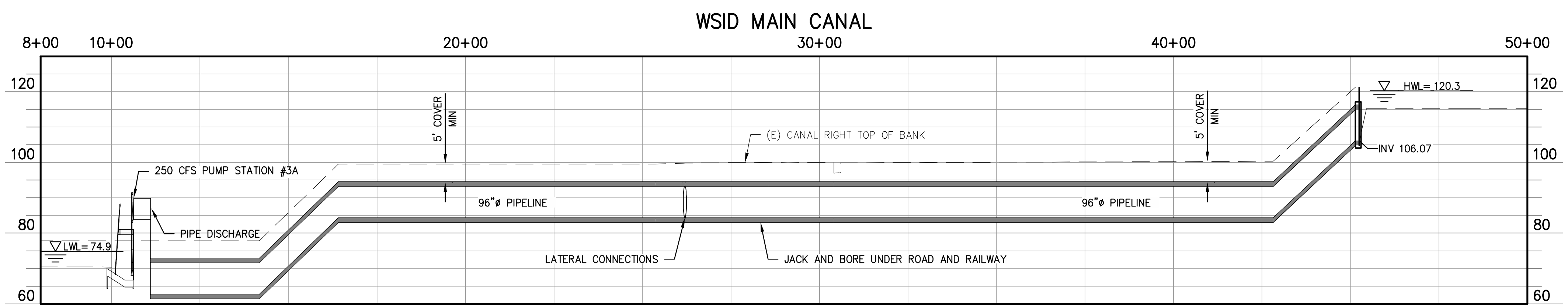
SHEET G1

1 OF 3

8/24/2017 12:10 PM \\ppeng.com\pzdata\Clients\CDM-1902\190214C1-SJRRP Recap_Recirc\CAD-WestStanislaus\DWG\SHEET\G1 COVER.dwg - Tretawney Bullis

Know what's below. Call before you dig.

WARNING
POWER LINES OVERHEAD



SCALE IN FEET
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HYDRAULICS	
PUMP STATION #3A TO PUMP STATION #5A	
TOTAL FLOW RATE (CFS)	250
PUMP STATION #3A LOW WATER PUMPING LEVEL (FT)	74
PUMP STATION #5A HIGH WATER LEVEL (FT)	120
STATIC LIFT (FT)	46
HEAD LOSS (FT)	10
TOTAL DYNAMIC HEAD (FT)	56
MOTOR HORSE POWER (EA)	700

1) ALL ELEVATIONS AND CALCULATIONS ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED.
2) LOW WATER PUMPING LEVEL IS ASSUMED TO BE 3 FT BELOW THE TOP OF BANK.
3) HIGH WATER LEVEL AT THE PUMP STATION IS ASSUMED TO BE 1 FT BELOW TOP OF BANK.
4) HIGH WATER LEVEL AT THE DELTA MENDOTA CANAL IS FROM EXISTING TOPO.

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PLAN AND PROFILE

STA 10+00-70+00

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DESIGN ENGINEER: ALEX COLLINS
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SHEET PP1

2 OF 3

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WARNING
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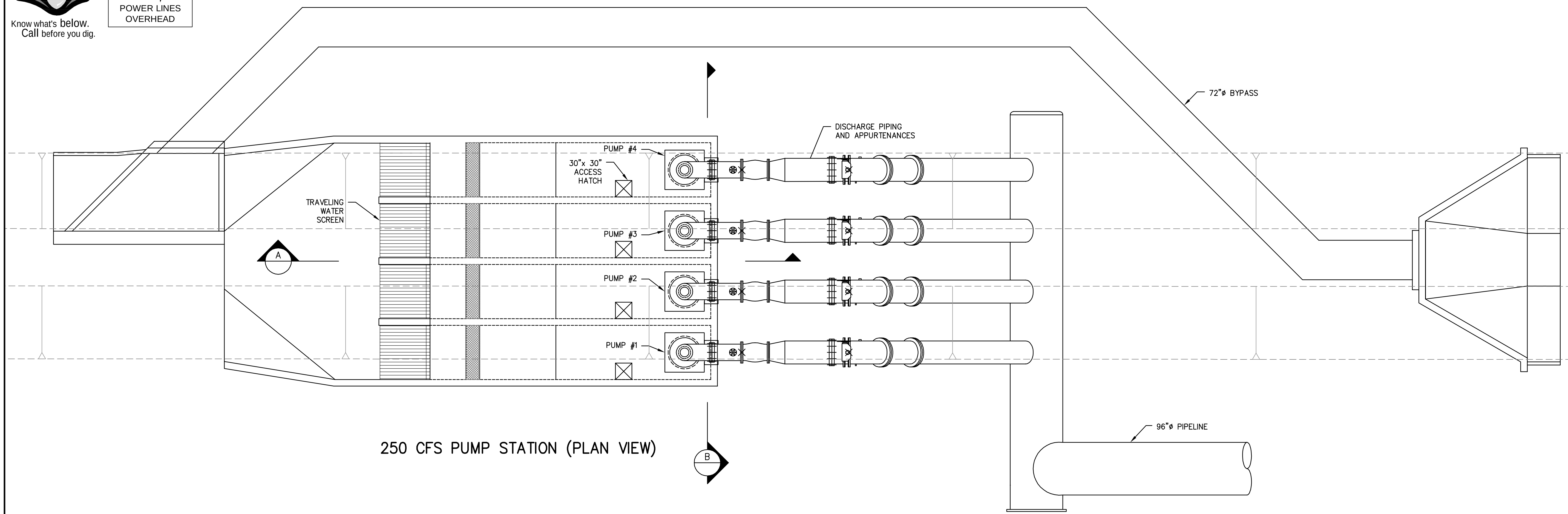
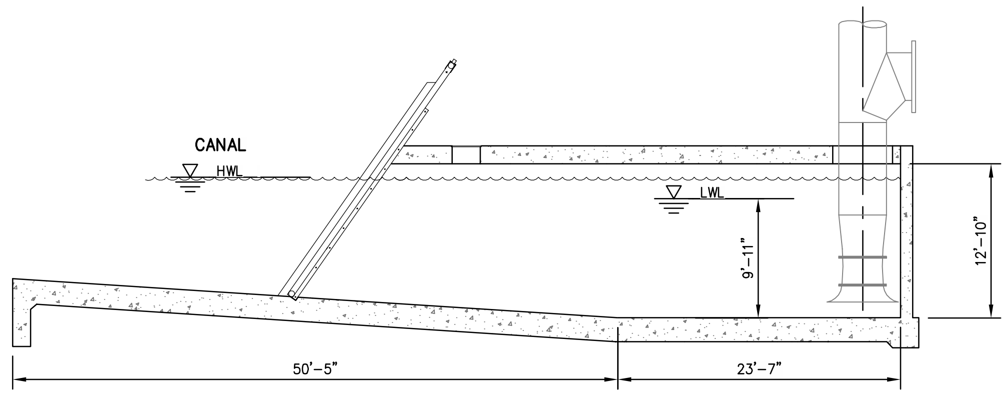
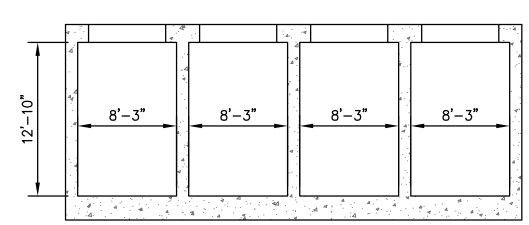


250 CFS PUMP STATION (PLAN VIEW)



SECTION A



SECTION B

FEET
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SHEET C1

FEATURE:		PROJECT:				
Cost Estimate **West Stanislaus ID Alternative** **Recapture and Recirculate Alternative Analysis** *8/23/2017*		**Central Valley Project** **USBR Recapture & Recirculate** **San Joaquin River Restoration Program**				
		WOID:	USBR	**ESTIMATE LEVEL:**	Preliminary	
		REGION:	Mid Pacific	**PRICE LEVEL:**	August 2017	
		FILE:	\\EQ01PFLSC001\SAC-Projects\1801-051_USBR_SanJoaquinRiver_R&R\4_Project_Docs\4.06_ProjectDescriptionTM\FinalProjectDescTM\[2017-0822 WSID Exp Exst Facil cost Est.xls]CDM Format			

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Field Costs					
	1.00	**Interceptor Dewatering**					
	1.01	Clearing and Grubbing		4	AC	$1,142	$4,568
	1.02	15' Wide All-weather Access Road (3" Thick Gravel Road)		444	CY	$82	$36,408.00
	2.00	**Pump and Motors**					
	2.01	250 CFS @ 2,600 HP Pump and Motor		1	LS	$1,539,200	$1,539,200
	2.02	PS3A Pump Station Structure and Appurtenances		1	LS	$1,671,350	$1,671,350
	2.03	PS3A Control Building, Site Electrical, SCADA, and Programming		1	LS	$1,672,385	$1,672,385
	2.04	PS3A Surge Protection		1	LS	$97,500	$97,500
	2.05	PS3A 72" Bypass		1	LS	$325,750	$325,750
	3.00	**Pipe**					
	3.01	Furnish & Install 96" RGRCP		3,195	LF	$829	$2,648,655
	3.02	Jack & Bore Pipe under Union Pacific RR		1	EA	$1,729,000	$1,729,000
	3.03	Turnout to Lateral (3-N & 3-S)		2	EA	$55,623	$111,246
	6.00	**Field Costs Subtotal**					
	6.01	Field Costs Subtotal (Items 1.01 Through 3.03)					**$9,836,062**
	7.00	**General Conditions**					
	7.01	Mobilization, Bonds, Insurance, Temporary Facilities, & Demobilization		10.00	%	$9,836,062	$983,606
	7.02	General Conditions Subtotal					**$983,606**
	8.00	**Field Costs & Contingency Summary**					
	8.01	Field Costs Subtotal (Items 6.01 + 7.01)					**$10,819,668**
	8.02	Field Costs Contingency		30.00	%	$10,819,668	$3,245,900
	8.03	Field & Contingency Costs Subtotal (Items 8.01 + 8.02)					**$14,065,569**
	9.00	**Total Field Costs**					
	9.01	Total Field Costs (Item 8.03)					**$14,065,569**
		Non-Contract Costs					
	103.00	**Permitting & Compliance**		**7.00**	**%**		
	103.01	Permitting		7.00	%	$14,065,569	$984,590
	105.00	**Construction Management**		**15.00**	**%**		
	105.01	Engineering		8.00	%	$14,065,569	$1,125,245
	105.02	Construction Management		7.00	%	$14,065,569	$984,590
	107.00	**Non-Contract Costs & Contingency Summary**					
	107.01	Non-Contract Costs Subtotal (Items 101.01 Through 106.05)					**$3,094,425**
	107.02	Non-Contract Costs Contingency		15.00	%	$3,094,425	$464,164
	107.03	Non-Contract & Contingency Costs Subtotal (Items 107.01 + 107.02)					**$3,558,589**

FEATURE:	PROJECT:
Cost Estimate **West Stanislaus ID Alternative** **Recapture and Recirculate Alternative Analysis** *8/23/2017*	**Central Valley Project** **USBR Recapture & Recirculate** **San Joaquin River Restoration Program** **WOID:** USBR **ESTIMATE LEVEL:** Preliminary **REGION:** Mid Pacific **PRICE LEVEL:** August 2017 **FILE:** \\EQ01PFLSC001\SAC-Projects\1801-051_USBR_SanJoaquinRiver_R&R\4_Project_Docs\4.06_ProjectDescriptionTM\FinalProjectDescTM\[2017-0822 WSID Exp Exst Facil cost Est.xls]CDM Format

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
	108.00	**Total Non-Contract Costs**					
	108.01	Non-Contract Costs (Item 107.03)					**$3,558,589**
		Land Acquisition Costs					
	201.00	**Land Acquisition Costs**					
	201.01	Land Acquisition Costs For Required Right Of Way		4.00	AC	$ 35,000	$140,000
	202.00	**Land Acquisition Costs & Contingency Summary**					
	202.01	Land Acquisition Costs Subtotal					**$140,000**
		Total Construction Costs					
	301.00	**Total Construction Costs**					
	301.01	Total Field Costs (Item 9.01)					**$14,065,569**
	301.02	Total Non-Contract Costs (Item 108.01)					**$3,558,589**
	301.03	Subtotal Field & Non-Contract Costs (Items 301.01 + 301.02)					**$17,624,158**
	301.04	Total Land Acquisition Costs (Item 202.03)					**$140,000**
	301.05	Total Construction Costs (Items 301.03 + 301.04) (rounded to 1,000s)					**$17,764,000**

Notes and Assumptions:

1. This cost estimate only includes improvements to the Districts system, & doesn't account for any capital cost already invested.
2. Cost estimate based on 10% Plans.
3. Unit price comes from RS Means, supplier quotes, Caltrans and bid canvasses from similar projects.
4. This cost estimate was prepared assuming certain fittings may be welded in-lieu of flanged fittings bases on similar projects.
5. This cost estimate assumes power can be provided to site with minimal improvements.
6. There is no land acquisition required for this project.
7. Contract Award Date and NTP dates are unknown.
8. Canal operations are unknown, so no schedule or cost adjustments have been made to accommodate work windows or weather days.
9. Item 3.02: Assume Jacking/Boring or Microtunneling a length of 200 feet, sending and receiving pit.
10. Item 3.03: Assumed 48" Lateral Turnouts for 3-s and 3-N.
11. Item 201.01: Construction Easements required. Approximately 4 acre @ $0.80 per SFT.

QUANTITIES		PRICES	
BY WR Vanderwaal/D Manning/P Dansby	**CHECKED** A Collins	**BY** WR Vanderwaal/D Manning	**CHECKED** A Collins 8/24/2017
DATE PREPARED August 22, 2017	**PEER REVIEW** O Kubit	**DATE PREPARED** August 22, 2017	**PEER REVIEW** O Kubit 8/24/2017

Annual Costs of Project (All costs should be in 2016 Dollars) Project: SJRRP Recapture and Recirculate - West Stanislaus ID - Expanded Existing Facilities							
	Initial Costs	Annual Costs [1]				Discounting Calculations	
		Operations	Maintenance	Replacement[2,3]	Total Costs (a) + (b) + (c) + (d)	Discount Factor[4]	Discounted Project Costs (e) x (f)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2016	17,764,000	640,000	130,000		18,534,000	1.000	**$18,534,000**
2017		640,000	130,000		770,000	0.966	**$744,000**
2018		640,000	130,000		770,000	0.933	**$718,000**
2019		640,000	130,000		770,000	0.902	**$695,000**
2020		640,000	130,000		770,000	0.872	**$671,000**
2021		640,000	130,000		770,000	0.843	**$649,000**
2022		640,000	130,000		770,000	0.815	**$628,000**
2023		640,000	130,000		770,000	0.787	**$606,000**
2024		640,000	130,000		770,000	0.760	**$585,000**
2025		640,000	130,000		770,000	0.734	**$565,000**
2026		640,000	130,000		770,000	0.709	**$546,000**
2027		640,000	130,000		770,000	0.685	**$527,000**
2028		640,000	130,000		770,000	0.662	**$510,000**
2029		640,000	130,000		770,000	0.640	**$493,000**
2030		640,000	130,000	5,781,000	6,551,000	0.618	**$4,049,000**
2031		640,000	130,000		770,000	0.597	**$460,000**
2032		640,000	130,000		770,000	0.577	**$444,000**
2033		640,000	130,000		770,000	0.558	**$430,000**
2034		640,000	130,000		770,000	0.539	**$415,000**
2035		640,000	130,000		770,000	0.521	**$401,000**
2036		640,000	130,000		770,000	0.503	**$387,000**
2037		640,000	130,000		770,000	0.486	**$374,000**
2038		640,000	130,000		770,000	0.470	**$362,000**
2039		640,000	130,000		770,000	0.454	**$350,000**
2040		640,000	130,000		770,000	0.439	**$338,000**
2041		640,000	130,000		770,000	0.424	**$326,000**
2042		640,000	130,000		770,000	0.410	**$316,000**
2043		640,000	130,000		770,000	0.396	**$305,000**
2044		640,000	130,000		770,000	0.383	**$295,000**
2045		640,000	130,000	7,985,000	8,755,000	0.370	**$3,239,000**
2046		640,000	130,000		770,000	0.358	**$276,000**
2047		640,000	130,000		770,000	0.346	**$266,000**
2048		640,000	130,000		770,000	0.334	**$257,000**
2049		640,000	130,000		770,000	0.323	**$249,000**
2050		640,000	130,000		770,000	0.312	**$240,000**
2051		640,000	130,000		770,000	0.301	**$232,000**
2052		640,000	130,000		770,000	0.291	**$224,000**
2053		640,000	130,000		770,000	0.281	**$216,000**
2054		640,000	130,000		770,000	0.272	**$209,000**
2055		640,000	130,000		770,000	0.263	**$203,000**
2056		640,000	130,000		770,000	0.254	**$196,000**
2057		640,000	130,000		770,000	0.245	**$189,000**
2058		640,000	130,000		770,000	0.237	**$182,000**
2059		640,000	130,000		770,000	0.229	**$176,000**
2060		640,000	130,000	5,781,000	6,551,000	0.221	**$1,448,000**
2061		640,000	130,000		770,000	0.214	**$165,000**
2062		640,000	130,000		770,000	0.207	**$159,000**
2063		640,000	130,000		770,000	0.200	**$154,000**
2064		640,000	130,000		770,000	0.193	**$149,000**
2065		640,000	130,000	$ -	770,000	0.186	**$143,000**
Total Present Worth of Discounted Costs (Sum of column (g))							**$44,295,000**

Comments:

(1) The incremental change in O&M and replacement costs attributable to the project

(1.a.) Operation costs include the electrical costs of running the pumps as listed below at $.18/KWH plus a 25% contingency.

West Stan rebuilding one plant and adding one pump at another station			
Pump Plant#	Flow (CFS)	Estimated TDH	Horsepower
3A	250	56	2600.0 hp
		Total	**2600.0 hp**

The power requirements are computed as follows =(2600 hp) x (0.746 kW / hp) x (61 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 = $638,904

Average electric rate calculated from PG&E Small Agricultural Rate running 24 hours/day, 7 days a week for 365 days during the year during the highest flow period of the wet restoration year type

(1B) Annual Maintenance costs** are: Discharge Pipe = $2,760,000 * 1.5% (40,070), Pumping Plant Manifold = $1,865,000 * 1.5% ($28,000) & Electrical motors, controls & connections = $1,763,000 * 2% ($35,260) the sum = $103,330 (then multiply by 25%) = $129,200

(2) Replacement costs are the costs to replace the equipment with a 25% contingency not including engineering, or construction management, mobilization and demobilization, or land grading

(3) All replacement intervals are modified replacement intervals from Table 3.1, 1981 printing of the American Society of Agricultural Engineers, "Design and Operation of Farm Irrigation Systems" by Jensen. The intervals are modified to meet local conditions and professional experience

(4) Estimated Discount Rate 3.375% ,2015 fiscal year rate set by Reclamation for Federal water resource planning (Federal Register, Vol.79, No.248, 12/29/14)

(5) Costs from the Engineers Opinion of Probable Costs as follows:

Cost Item	Amount	Replacement**
Pump Plant Manifold & Discharge	$1,865,000	Every 15 years
Electrical Motors, Controls, Connections	$ 1,763,000.00	Every 30 years
Pipe	$2,760,000	Every 15 years
		Every 15 years

**Annual maintenance percentages and replacement periods based on Jensen, M.E., Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, 1981

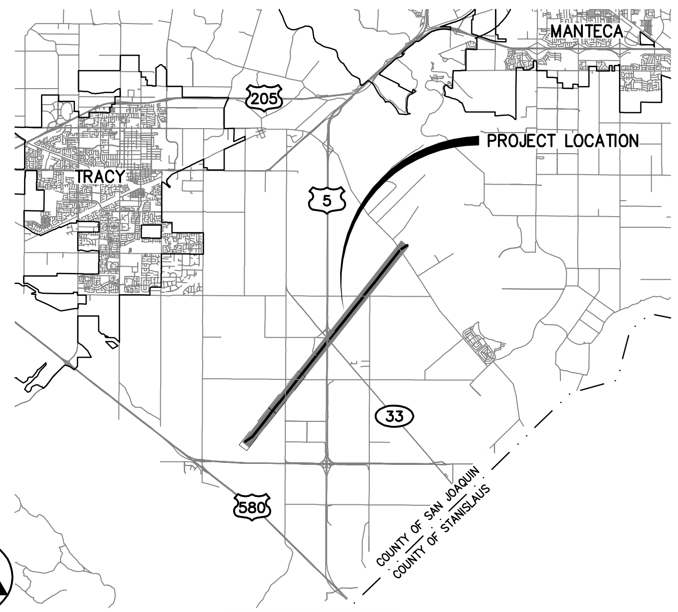
Know what's below. Call before you dig.

WARNING
POWER LINES OVERHEAD

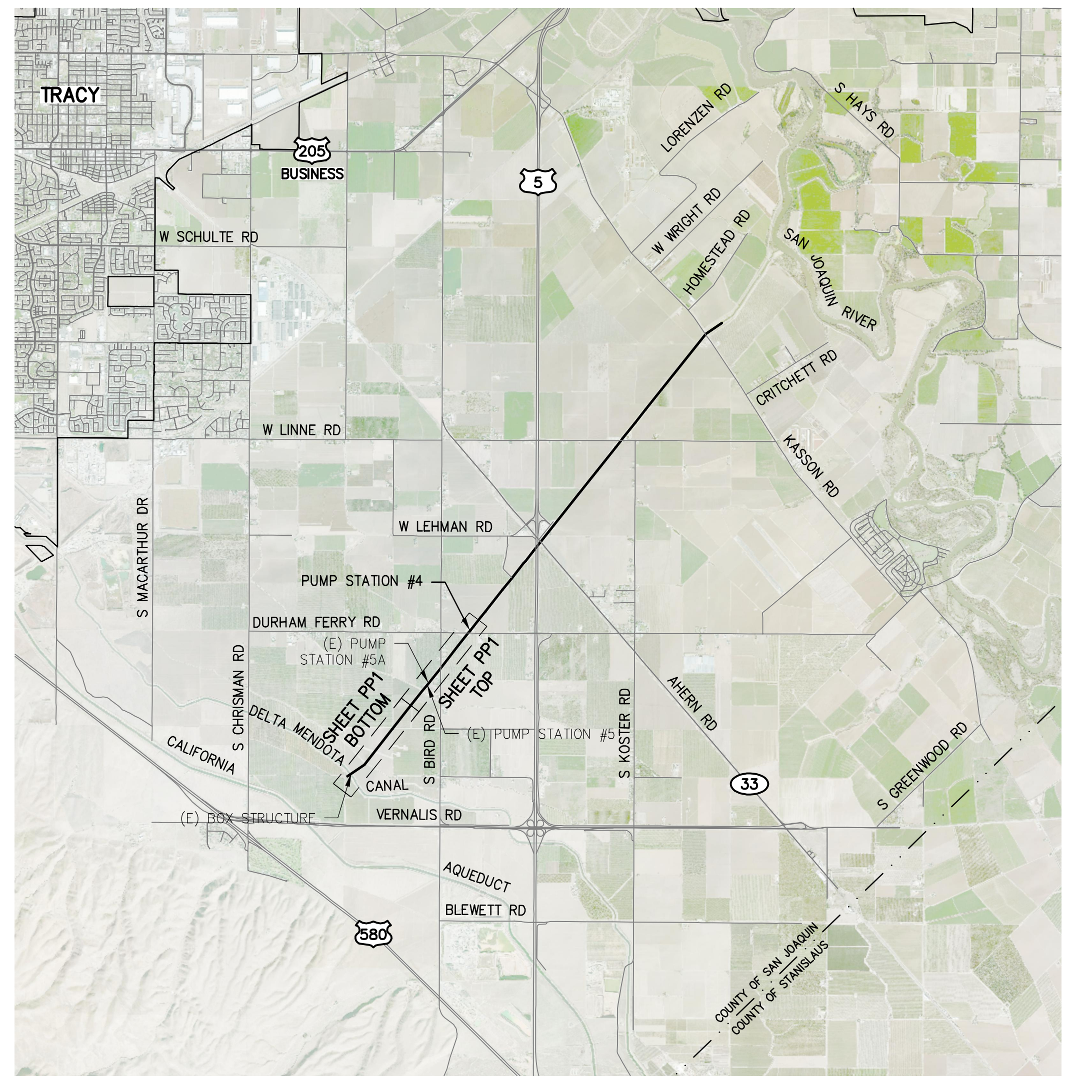
CDM SMITH

BANTA CARBONA I.D. - TRACY, CALIFORNIA

BANTA CARBONA IRRIGATION DISTRICT
SJRRP RECAPTURE AND RECIRCULATION
EXPANDED EXISTING FACILITIES



VICINITY MAP
NOT TO SCALE



SITE MAP

SCALE IN MILES
0 .5 MI 1 MI 2 MI

GENERAL NOTES

1. BANTA CARBONA ID SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING DISTRICT FACILITIES.
2. USED MATERIAL, REJECTS, MISFITS, OR SECONDS, ETC. ARE NOT ACCEPTABLE FOR USE ON BANTA CARBONA ID FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS AND BANTA CARBONA ID SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE ENGINEER AWARE OF ANY DISCREPANCIES.
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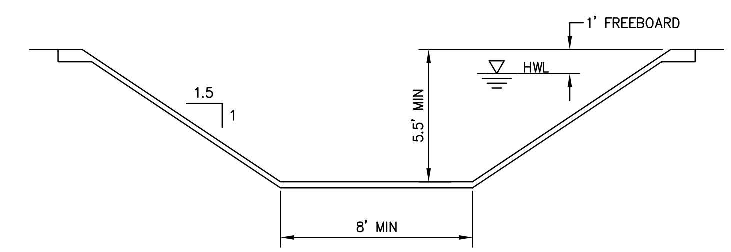
7. THRUST RESTRAINTS TO BE PROVIDED AT ALL PIPELINE BENDS, WHETHER OR NOT SHOWN ON THE PLANS.



SLOPE = 0.0005 FT/FT

MANNINGS N CONCRETE LINED = 0.015

FEET
0 2 4

1
G1

MINIMUM REQUIRED CROSS SECTIONS FOR 250 CFS

ABBREVIATIONS

APPROX	APPROXIMATE
CFS	CUBIC FEET PER SECOND
DR	DRIVE
(E)	EXISTING
E	EAST
FT	FOOT/FEET
HWL	HIGH WATER LEVEL
ID	IRRIGATION DISTRICT
LWL	LOW WATER LEVEL
MIN	MINIMUM
N	NORTH
RD	ROAD
S	SOUTH
S=	SLOPE
W	WEST

SPECIAL NOTE

WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSTRUED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

TOPOGRAPHY NOTE

NAD 83 ZONE 3F

ELEVATION INFORMATION WAS OBTAINED FROM THE USGS NATIONAL ELEVATION DATASET (NED) MODEL WITH A RESOLUTION VARYING FROM 10-30 METERS. NO GROUND SURVEY WAS PERFORMED FOR THIS PHASE OF THE WORK AND IS THEREFORE APPROXIMATE IN NATURE.

DESIGN SURVEY SHALL FURTHER DEFINE DATUM.

SHEET INDEX

SHEET NO.	DESCRIPTION
GENERAL	
G1	COVER
PLAN AND PROFILE	
PP1	STA 270+00 TO 380+00
CIVIL	
C1	250 CFS PUMP STATION

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SJRRP RECAPTURE AND RECIRCULATION
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GENERAL

COVER

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559/449-2700 FAX 559/449-2715
www.ppeng.com

DESIGN ENGINEER: ALEX COLLINS
LICENSE NO: 78242

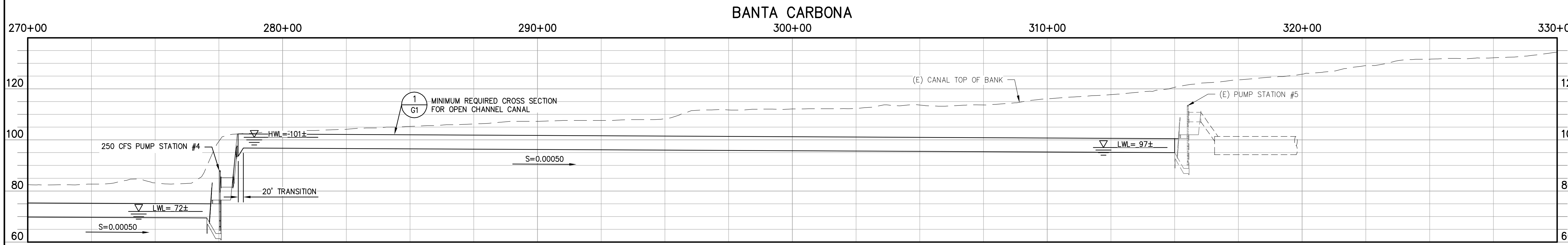
DRAFTED BY:	CHECKED BY:
STG\PAD	RSH

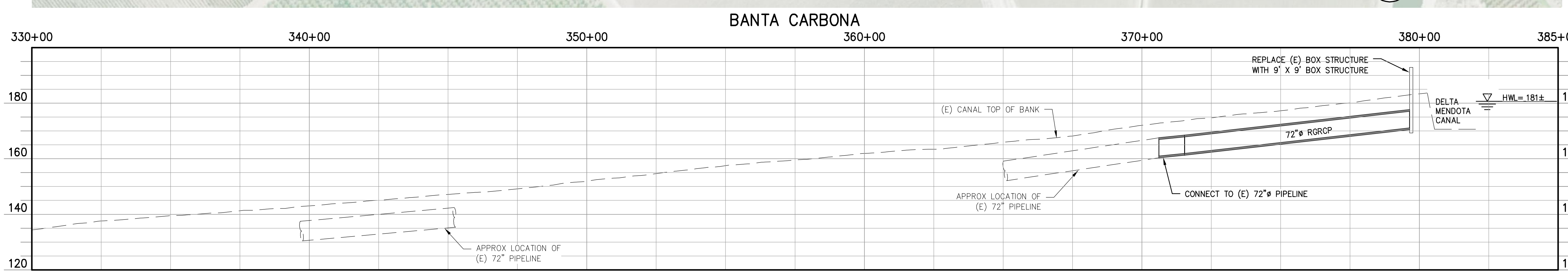
DATE: 8/28/2017
JOB NO: 01902 14C10
PROJECT NO:
PHASE:

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET G1

8/28/2017 2:32 PM \\ppeng.com\pzdata\Clients\CDM-1902\190214C1-SJRRP Recap_Recirc\CAD-BantaCarbona\DWG\SHEET\G1 COVER.dwg - Trelawney Bullis





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PLAN AND PROFILE
STA 270+00 TO 380+00

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DRAFTED BY: STG\PAD
CHECKED BY: RSH
DATE: 8/28/2017
JOB NO: 01902 14C10
PROJECT NO:
PHASE:

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET PP1

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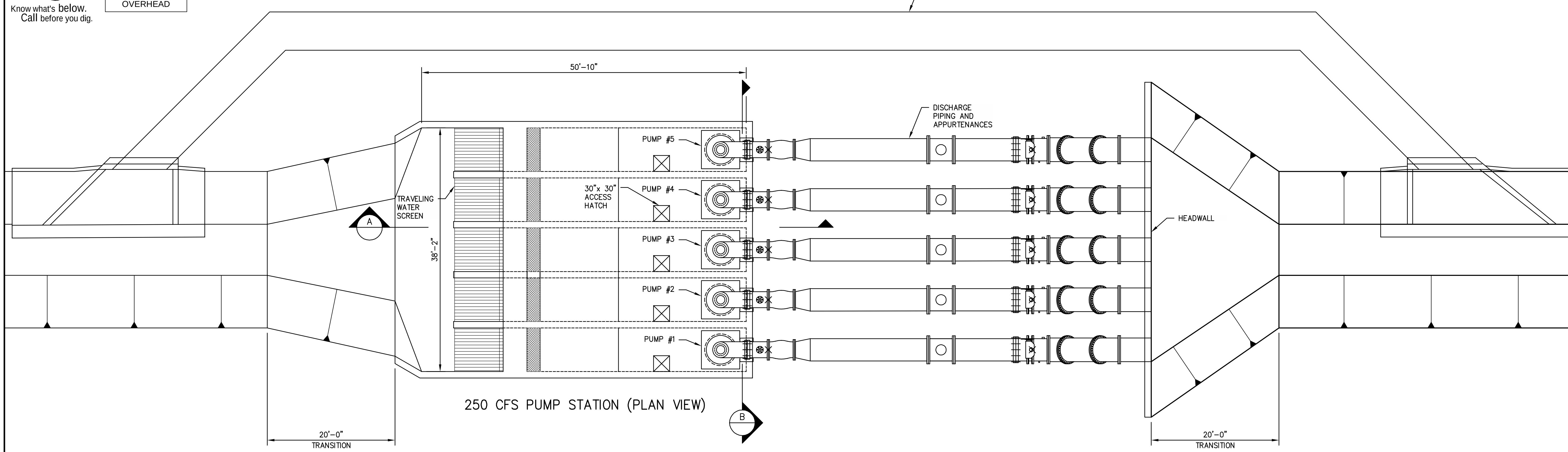
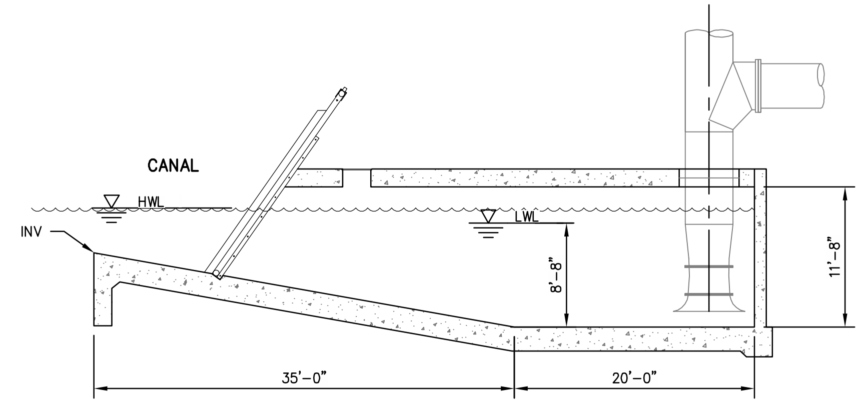
Know what's below. Call before you dig.

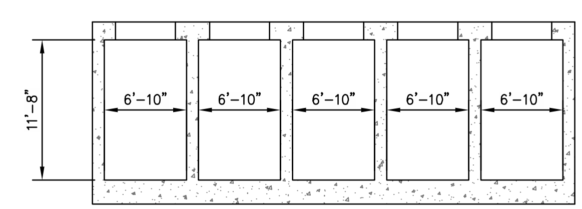
WARNING
POWER LINES OVERHEAD



250 CFS PUMP STATION (PLAN VIEW)



SECTION A



SECTION B

HYDRAULICS	
PUMP STATION #4 TO PUMP STATION 5A	
TOTAL FLOW RATE (CFS)	250
PUMP STATION #4 LOW WATER PUMPING LEVEL (FT)	72
PUMP STATION 5A HIGH WATER PUMPING LEVEL (FT)	101
STATIC LIFT (FT)	29
HEAD LOSS (FT)	8
TOTAL DYNAMIC HEAD (FT)	37
MOTOR HORSE POWER (EA)	350

NOTE:
1) ALL ELEVATIONS AND CALCULATIONS ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED.
2) LOW WATER PUMPING LEVEL IS ASSUMED TO BE 3 FT BELOW THE TOP OF BANK.
3) HIGH WATER LEVEL AT THE PUMP STATIONS ARE ASSUMED TO BE 1 FT BELOW TOP OF BANK.
4) HIGH WATER LEVEL AT THE DELTA MENDOTA CANAL IS ASSUMED TO BE 3 FT BELOW TOP OF BANK.
5) PUMP STATION #4 IS ASSUMED TO HAVE FIVE PUMPS & MOTORS AT 50 CFS EACH.

FEET 0 4 8

PUMP STATION 4

HYDRAULICS	
PUMP STATION 5A TO THE DELTA MENDOTA CANAL	
TOTAL FLOW RATE (CFS)	250
PUMP STATION #5 LOW WATER PUMPING LEVEL (FT)	97
DELTA MENDOTA CANAL HIGH WATER LEVEL (FT)	181
STATIC LIFT (FT)	84
HEAD LOSS (FT)	22
TOTAL DYNAMIC HEAD (FT)	106
MOTOR HORSE POWER (EA)	700

NOTE:
1) ALL ELEVATIONS AND CALCULATIONS ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED.
2) LOW WATER PUMPING LEVEL IS ASSUMED TO BE 3 FT BELOW THE TOP OF BANK.
3) HIGH WATER LEVEL AT THE PUMP STATIONS ARE ASSUMED TO BE 1 FT BELOW TOP OF BANK.
4) HIGH WATER LEVEL AT THE DELTA MENDOTA CANAL IS ASSUMED TO BE 3 FT BELOW TOP OF BANK.
5) PUMP STATION 5A IS ASSUMED TO HAVE THREE PUMPS & MOTORS AT 45 CFS EACH.

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SHEET C1
3 OF 3

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FEATURE:

Cost Estimate
Banta Carbona Irrigation District
Recapture and Recirculate Alternative Analysis

8/28/2017

PROJECT:

Central Valley Project
USBR Recapture and Recirculate
San Joaquin River Restoration Program

WOID:	USBR	**ESTIMATE LEVEL:**	Preliminary
REGION:	Mid Pacific	**PRICE LEVEL:**	August 2017
FILE:	\\EQ01PFLSC001\SAC-Projects\1801-051_USBR_SanJoaquinRiver_R&R\4_Project_Docs\4.06_ProjectDescriptionTM\FinalProjectDescTM\[2017-0831 BantaCarb Exp Exst Facilit cost Est.xls]CDM format Cost Estimate		

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Field Costs					
	1.00	**Site Work**					
	1.01	Clearing and Grubbing		26	AC	$1,142	$29,692
	1.02	Demolition of existing pumping plants		1	EA	$19,858	$19,858
	1.03	Traffic Control (Road Crossings)		1	EA	$25,000	$25,000
	1.04	15' Wide All-Weather Access Road (3" Thick Gravel Road)		3,250	CY	$82.00	$266,507
	2.00	**Pumps**					
	2.01	250 CFS @ 1,500 HP (Pump Station 4)		1	LS	$888,000	$888,000
	2.02	135 CFS @ 2,100 HP (Pump Station 5)		1	LS	$1,243,200	$1,243,200
		Pump Facility					
	2.03	Pump Station Structure and Appurtenances (Pump Stations 4)		1	LS	$1,582,545	$1,582,545
	2.04	Discharge Manifold and Appurtenances (Pump Station 5)		1	LS	$863,967	$863,967
	2.05	Control Building, Site Electrical, SCADA, and Programming (Pump Station 4)		1	LS	$1,071,585	$1,071,585
	2.06	Control Building, Site Electrical, SCADA, and Programming (Pump Station 5)		1	LS	$1,448,385	$1,448,385
	2.07	Surge Protection (Pump Stations 4 & 5)		2	EA	$97,250	$194,500
	3.00	**Electrical**					
	3.01	Expand Substation #2		1	LS	$305,000	$305,000
	3.02	Upgrade Electrical Distribution		3,700	LF	$50	$185,000
	4.00	**Canals**					
	4.01	Canal Earthwork		3,675	CY	$9	$33,443
	4.02	Non-Reinforced Concrete Lining (3" Thick)		102,277	SF	$3	$333,423
	4.03	Landowner Turnouts		2	EA	$42,922	$85,844
	4.04	Combination Check Structure & Lateral Turnout		1	EA	$121,451	$121,451
	5.00	**Discharge Pipe**					
	5.01	Furnish & Install 72" RGRCP to complete connection with DMC		1,000	LF	$655	$655,000
	5.02	Remove and Replace DMC Box Structure		1	LS	$132,000	$132,000
	6.00	**General Conditions**					
	6.01	Misc. Utility Relocation		3.00	%	$9,484,399	$284,532
	6.02	Mobilization/demobilization, bonds & insurance, worker protection, miscellaneous facilities and operations, permitting		10.00	%	$9,768,931	$976,893
	7.00	**Field Costs & Contingency Summary**					
	7.01	Field Costs Subtotal					**$10,745,824**
	7.02	Field Costs Contingency		30.00	%	$10,745,824	$3,223,747
	7.03	Field & Contingency Costs Subtotal (Items 7.01 + 7.02)					**$13,969,572**
	8.00	**Total Field Costs**					
	8.01	Total Field Costs (Item 8.03)					**$13,969,572**
		Non-Contract Costs					
	103.00	**Permitting & Compliance**		**7.00**	**%**		
	103.01	All Permitting & Compliance		7.00	%	$13,969,572	$977,870
	105.00	**Engineering and Construction Management**		**15.00**	**%**		
	105.01	Engineering Support		8.00	%	$13,969,572	$1,117,566
	105.02	Construction Management		7.00	%	$13,969,572	$977,870
	107.00	**Non-Contract Costs & Contingency Summary**					

FEATURE:	PROJECT:
Cost Estimate **Banta Carbona Irrigation District** **Recapture and Recirculate Alternative Analysis** *8/28/2017*	**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program** **WOID:** USBR **ESTIMATE LEVEL:** Preliminary **REGION:** Mid Pacific **PRICE LEVEL:** August 2017 **FILE:** \\EQ01PFLSC001\SAC-Projects\1801-051_USBR_SanJoaquinRiver_R&R\4_Project_Docs\4.06_ProjectDescriptionTM\FinalProjectDescTM\[2017-0831 BantaCarb Exp Exst Facilit cost Est.xls]CDM format Cost Estimate

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
	107.01	Non-Contract Costs Subtotal (Items 103.01 Through 105.02)					**$3,073,306**
	107.02	Non-Contract Costs Contingency		15.00	%	$3,073,306	$460,996
	107.03	Non-Contract & Contingency Costs Subtotal (Items 107.01 + 107.02)					**$3,534,302**
	107.00	**Non-Contract Costs & Contingency Summary**					
	107.01	Non-Contract Costs Subtotal (Items 101.01 Through 106.05)					**$3,534,302**
		Land Acquisition Costs					
		No land acquisition actions planned					
		Total Construction Costs					
	301.00	**Total Construction Costs**					
	301.01	Total Field Costs (Item 8.01)					**$13,969,572**
	301.02	Total Non-Contract Costs (Item 107.01)					**$3,534,302**
	301.03	Subtotal Field & Non-Contract Costs (Items 301.01 + 301.02)					**$17,503,873**
	301.04	Total Land Acquisition Costs					**$0**
	301.05	Total Construction Costs (Items 301.03 + 301.04) (rounded to thousands)					**$17,504,000**

Notes and Assumptions:

1. This cost estimate only includes improvements to the Districts system, & doesn't account for any capital cost already invested.
2. Cost estimate based on 10% Plans.
3. Unit price comes from RS Means, supplier quotes, Caltrans and bid canvasses from similar projects.
4. This cost estimate was prepared assuming certain fittings may be welded in-lieu of flanged fittings bases on similar projects.
5. This cost estimate assumes power can be provided to site with minimal improvements.
6. There is no land acquisition required for this project.
7. Contract Award Date and NTP dates are unknown.
8. Canal operations are unknown, so no schedule or cost adjustments have been made to accommodate work windows or weather days.
9. Item 4.03: Landowner Turnouts are 24 inches.
10. Item 4.04: Combination scaled Type 10 AG Reclamation Check structure and 48" Turnout

QUANTITIES		PRICES		
BY	**CHECKED**	**BY**	**CHECKED**	
WR Vanderwaal/D Manning/P Dansby	A Collins	WR Vanderwaal/D Manning	A Collins	8/30/2017
DATE PREPARED	**PEER REVIEW**	**DATE PREPARED**	**PEER REVIEW**	
August 18, 2017	O Kubit	August 18, 2017	O Kubit	8/31/2017

Annual Costs of Project (All costs should be in 2016 Dollars) Project: SJRRP Recapture and Recirculate - Banta Carbona ID - Expanded Existing Facilities							
	Initial Costs	Annual Costs (1)				Discounting Calculations	
		Operations	Maintenance	Replacement(2,3)	Total Costs (a) + (b) + (c) + (d)	Discount Factor(4)	Discounted Project Costs (e) x (f)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2016	17,504,000	322,000	220,000		18,046,000	1.000	**$18,046,000**
2017		322,000	220,000		542,000	0.966	**$524,000**
2018		322,000	220,000		542,000	0.933	**$506,000**
2019		322,000	220,000		542,000	0.902	**$489,000**
2020		322,000	220,000		542,000	0.872	**$473,000**
2021		322,000	220,000		542,000	0.843	**$457,000**
2022		322,000	220,000		542,000	0.815	**$442,000**
2023		322,000	220,000		542,000	0.787	**$427,000**
2024		322,000	220,000		542,000	0.760	**$412,000**
2025		322,000	220,000		542,000	0.734	**$398,000**
2026		322,000	220,000		542,000	0.709	**$384,000**
2027		322,000	220,000		542,000	0.685	**$371,000**
2028		322,000	220,000		542,000	0.662	**$359,000**
2029		322,000	220,000		542,000	0.640	**$347,000**
2030		322,000	220,000	8,944,000	9,486,000	0.618	**$5,862,000**
2031		322,000	220,000		542,000	0.597	**$324,000**
2032		322,000	220,000		542,000	0.577	**$313,000**
2033		322,000	220,000		542,000	0.558	**$302,000**
2034		322,000	220,000		542,000	0.539	**$292,000**
2035		322,000	220,000		542,000	0.521	**$282,000**
2036		322,000	220,000		542,000	0.503	**$273,000**
2037		322,000	220,000		542,000	0.486	**$263,000**
2038		322,000	220,000		542,000	0.470	**$255,000**
2039		322,000	220,000		542,000	0.454	**$246,000**
2040		322,000	220,000	718,000	1,260,000	0.439	**$553,000**
2041		322,000	220,000		542,000	0.424	**$230,000**
2042		322,000	220,000		542,000	0.410	**$222,000**
2043		322,000	220,000		542,000	0.396	**$215,000**
2044		322,000	220,000		542,000	0.383	**$208,000**
2045		322,000	220,000	12,094,000	12,636,000	0.370	**$4,675,000**
2046		322,000	220,000		542,000	0.358	**$194,000**
2047		322,000	220,000		542,000	0.346	**$188,000**
2048		322,000	220,000		542,000	0.334	**$181,000**
2049		322,000	220,000		542,000	0.323	**$175,000**
2050		322,000	220,000		542,000	0.312	**$169,000**
2051		322,000	220,000		542,000	0.301	**$163,000**
2052		322,000	220,000		542,000	0.291	**$158,000**
2053		322,000	220,000		542,000	0.281	**$152,000**
2054		322,000	220,000		542,000	0.272	**$147,000**
2055		322,000	220,000		542,000	0.263	**$143,000**
2056		322,000	220,000		542,000	0.254	**$138,000**
2057		322,000	220,000		542,000	0.245	**$133,000**
2058		322,000	220,000		542,000	0.237	**$128,000**
2059		322,000	220,000		542,000	0.229	**$124,000**
2060		322,000	220,000	8,944,000	9,486,000	0.221	**$2,096,000**
2061		322,000	220,000		542,000	0.214	**$116,000**
2062		322,000	220,000		542,000	0.207	**$112,000**
2063		322,000	220,000		542,000	0.200	**$108,000**
2064		322,000	220,000		542,000	0.193	**$105,000**
2065		322,000	220,000		542,000	0.186	**$101,000**
Total Present Worth of Discounted Costs (Sum of column (g))							**$42,981,000**

Comments:

(1) The incremental change in O&M and replacement costs attributable to the project
(1.a.) Operation costs include the electrical costs of running the pumps as listed below at $.18/KWH plus a 25% contingency.

BC Adding 5 Pumping Plants, 5 pumps each			
Pump Plant#	Flow (CFS)	Estimated TDH	Horsepower
	250	230	8000.0 hp
		Total	**8000.0 hp**

The power requirements are computed as follows =(8,000 hp) x (0.746 kW / hp) x (10 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 = $322,272
Average electric rate calculated from PG&E Small Agricultural Rate running 24 hours/day, 7 days a week for 365 days during the year during the highest flow period of the wet restoration year type

(1B) Annual Maintenance costs** are: Discharge Pipe = $655,000 * 1.5% (9,830), Concrete Lined Canal = $574,000 * 1.5% ($8,610), Pumping Plant Manifold = $7,156,000 * 1.5% ($107,340) & Electrical motors, controls & connections = $2,520,000 * 2% ($50,400) the sum = $176,200 (then multiply by 25%) = $220,000 (rounded)

(2) Replacement costs are the costs to replace the equipment with a 25% contingency not including engineering, or construction management, mobilization and demobilization, or land grading

(3) All replacement intervals are modified replacement intervals from Table 3.1, 1981 printing of the American Society of Agricultural Engineers, "Design and Operation of Farm Irrigation Systems" by Jensen. The intervals are modified to meet local conditions and professional experience

(4) Estimated Discount Rate 3.375% ,2015 fiscal year rate set by Reclamation for Federal water resource planning (Federal Register, Vol.79, No.248, 12/29/14)

(5) Costs from the Engineers Opinion of Probable Costs as follows:

Cost Item	Amount	Replacement**
Concrete Lined Canal	$ 574,161	Every 25 years
Pump Plant Manifold & Discharge	$ 7,155,507	Every 15 years
Electrical Motors, Controls, Connections	$ 2,519,970	Every 30 years

(this is treated the same as open farm ditches found in Jensen)

**Annual maintenance percentages and replacement periods based on Jensen, M.E., Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, 1981

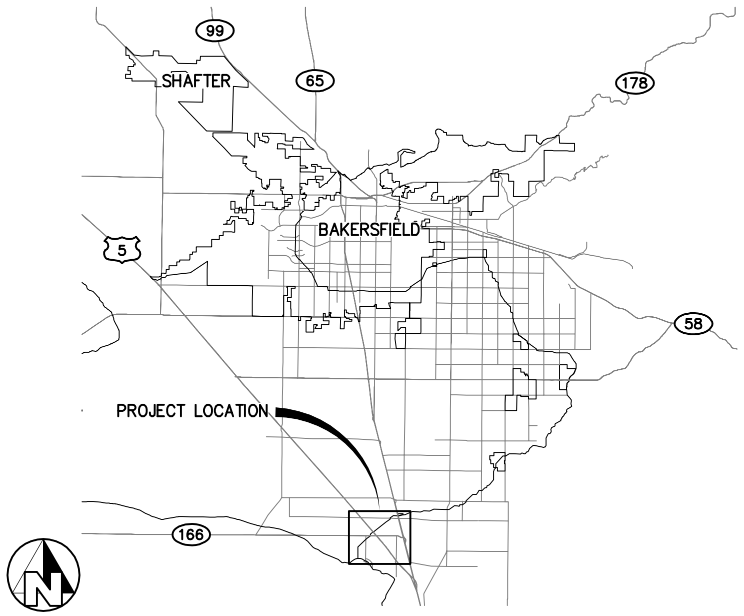
CDM SMITH

KERN COUNTY, CALIFORNIA

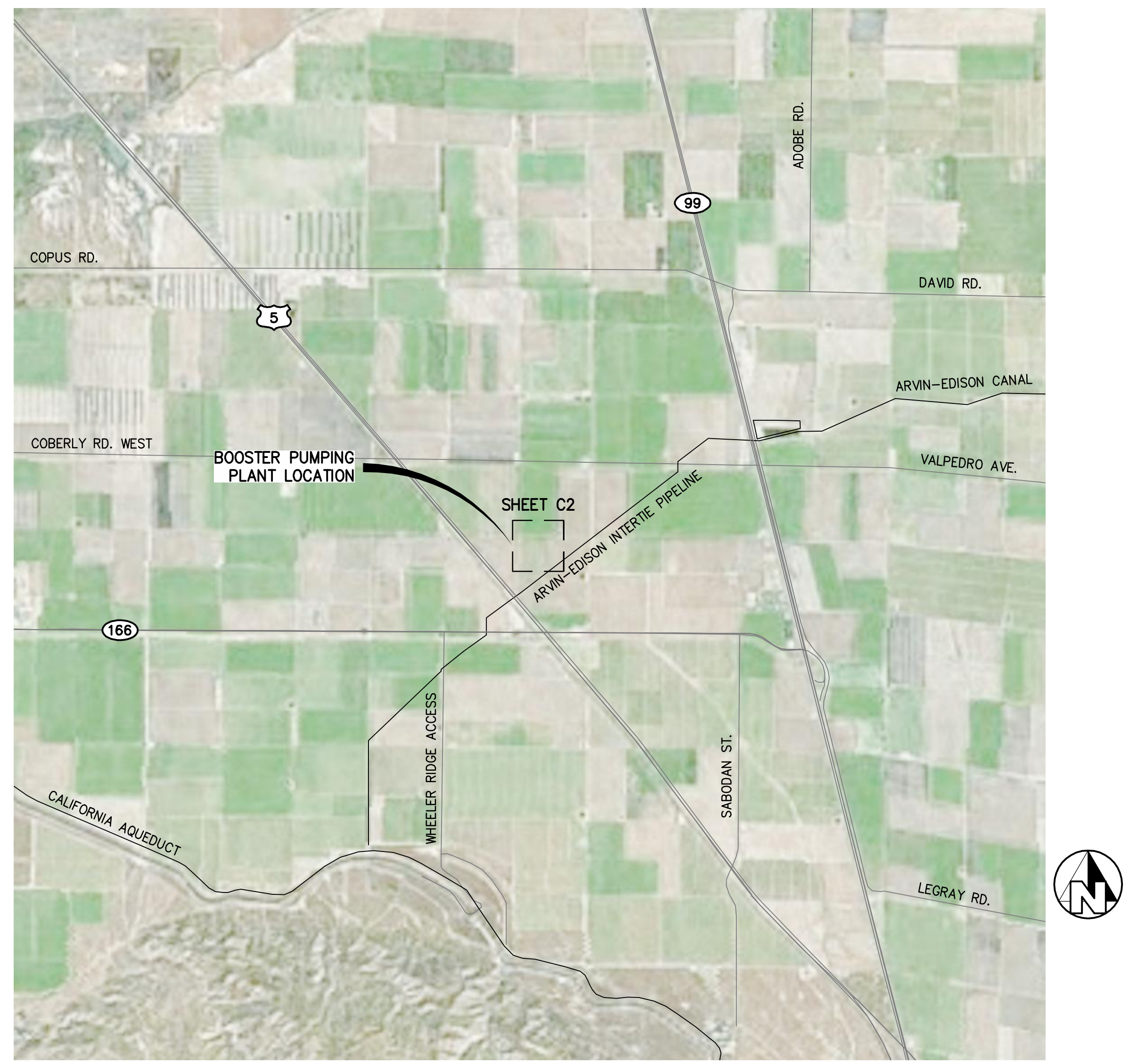
SJRRP RECAPTURE AND RECIRCULATION AEWSD INTERTIE PIPELINE BOOSTER PLANT

811 Know what's below. Call before you dig.

WARNING POWER LINES OVERHEAD



VICINITY MAP
NOT TO SCALE



SITE MAP
NOT TO SCALE

GENERAL NOTES

1. ARVIN-EDISON WSD SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING DISTRICT FACILITIES.
2. USED MATERIAL, REJECTS, MISFITS, OR SECONDS, ETC. ARE NOT ACCEPTABLE FOR USE ON ARVIN-EDISON WSD FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS AND ARVIN-EDISON WSD SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE ENGINEER AWARE OF ANY DISCREPANCIES.
5. ALL CAST-IN-PLACE CONCRETE STRUCTURES SHALL BE FORMED INSIDE AND OUT AND CONCRETE VIBRATED SUFFICIENTLY TO PROVIDE FOR SMOOTH SURFACED WALLS/FLOORS WITHOUT VOIDS AND HONEYCOMBS.
6. ARVIN-EDISON WSD SHALL INSPECT ALL WORK PHASES ON CONCRETE FACILITIES FOR CONFORMANCE TO ARVIN-EDISON WSD SPECIFICATIONS. REINFORCING SHALL NOT BE ENCASED IN CONCRETE WITHOUT PRIOR ARVIN-EDISON WSD INSPECTIONS. LIKEWISE, CONCRETE SHALL NOT BE COVERED WITH EARTH PRIOR TO ARVIN-EDISON WSD INSPECTION.
7. THRUST RESTRAINTS TO BE PROVIDED AT ALL PIPELINE BENDS, WHETHER OR NOT SHOWN ON THE PLANS.

ABBREVIATIONS

AEWSD	ARVIN-EDISON WATER STORAGE DISTRICT
APN	ASSESSOR'S PARCEL NUMBER
AV	AIR VENT
AVE	AVENUE
(E)	EXISTING
EG	EXISTING GRADE
ELL	ELBOW
F&I	FURNISH & INSTALL
FLG	FLANGE
FT	FOOT/FEET
HP	HORSEPOWER
HWY	HIGHWAY
INV	INVERT
LF	LINEAR FEET
MFR	MANUFACTURER
PV	PRESSURE VALVE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
ST	STREET
W/	WITH
WSD	WATER STORAGE DISTRICT

SPECIAL NOTE

WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSTRUED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

TOPOGRAPHY NOTE

NAD 83 ZONE 3F

DESIGN SURVEY SHALL FURTHER DEFINE DATUM.

SHEET INDEX

SHEET NO.	DESCRIPTION
GENERAL	
G1	COVER
CIVIL	
C1	SITE PLAN
C2	BOOSTER PLANT LAYOUT
C3	HGL
C4	HGL
C5	HGL
C6	HGL
DETAILS	
D1	PIPING LAYOUT

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No.	REVISION	BY	DATE

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CDM SMITH
KERN COUNTY, CALIFORNIA
GENERAL
COVER

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DESIGN ENGINEER: CALVIN MONREAL
LICENSE NO: 65453
DRAFTED BY: DJM/PAD
CHECKED BY: CM
DATE: 6/10/2016
JOB NO: 190214C1
PROJECT NO: ----
PHASE: ----

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET G1

1 OF 8

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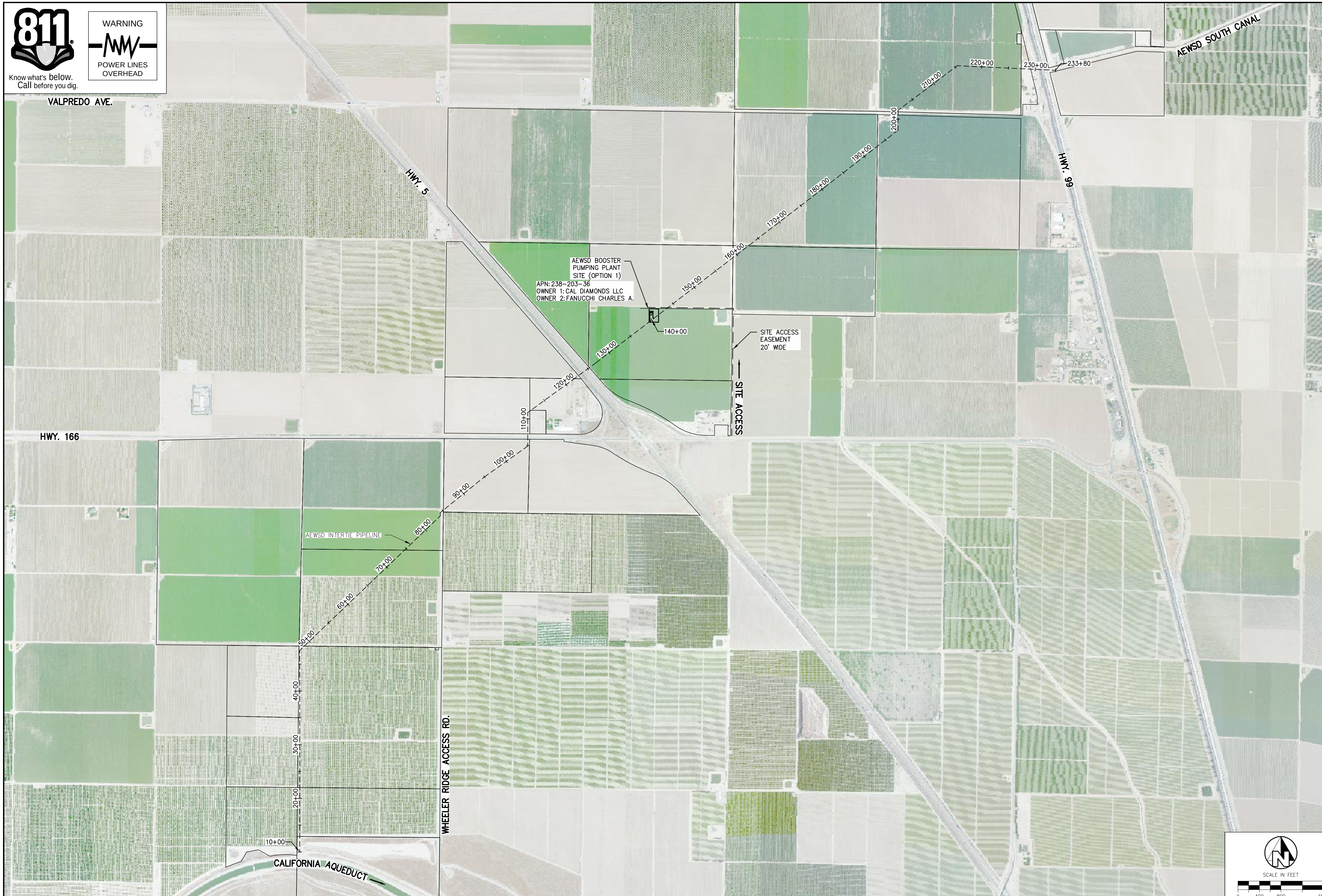

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SITE PLAN

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SHEET C1

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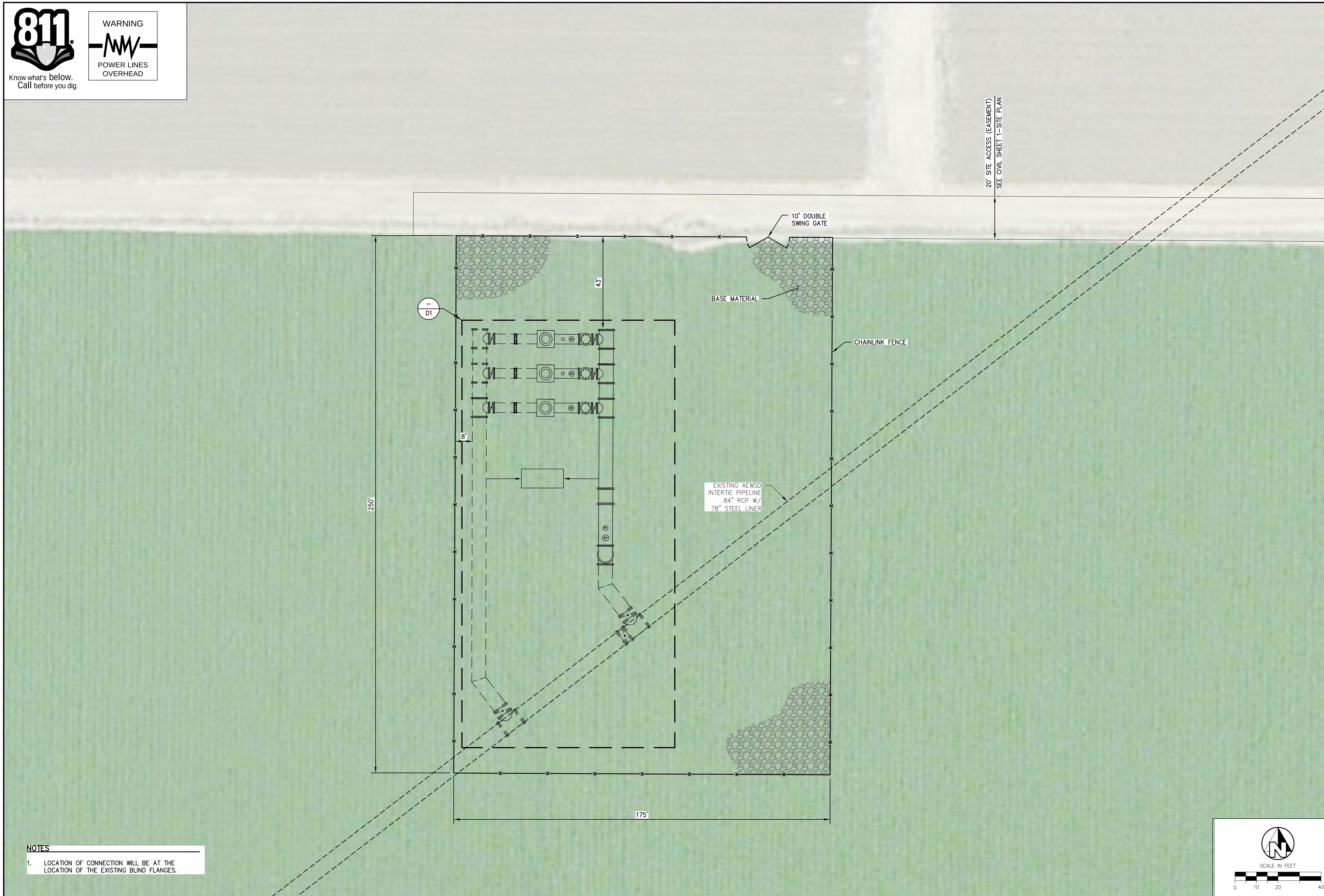

NOTES

1. LOCATION OF CONNECTION WILL BE AT THE LOCATION OF THE EXISTING BLIND FLANGES.

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BOOSTER PLANT LAYOUT

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SHEET C2

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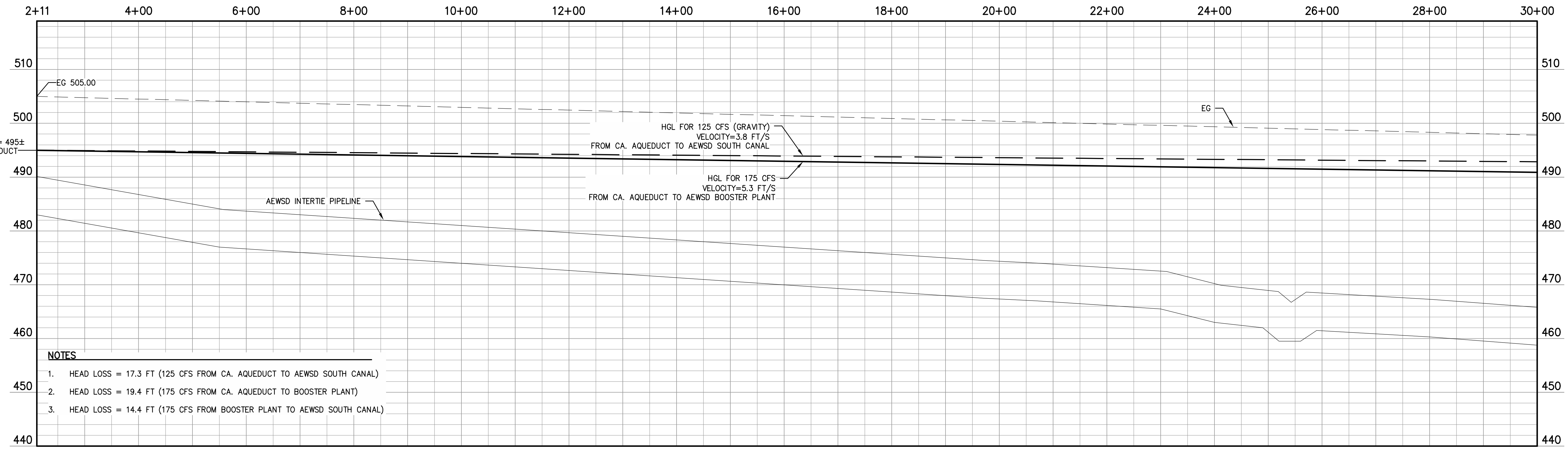

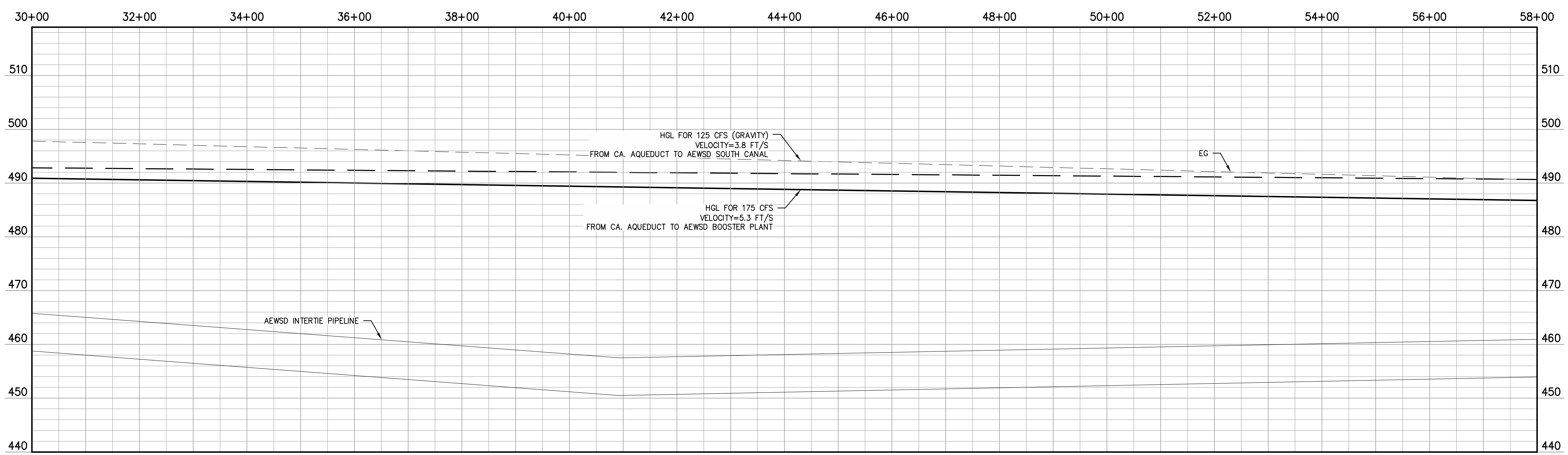

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SHEET C3

4 OF 8

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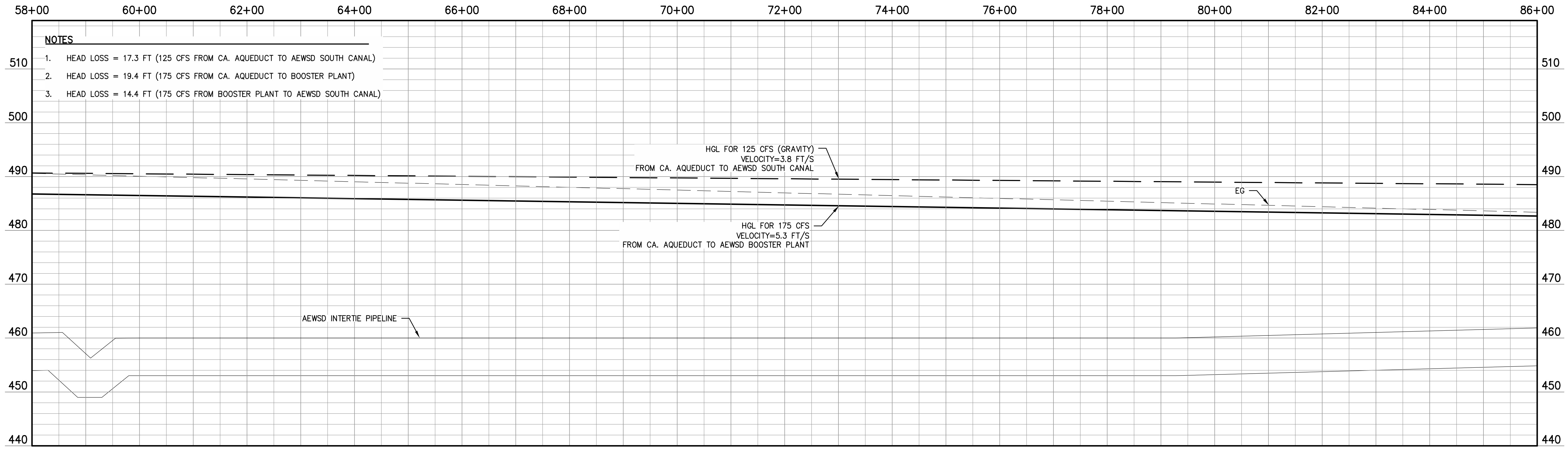

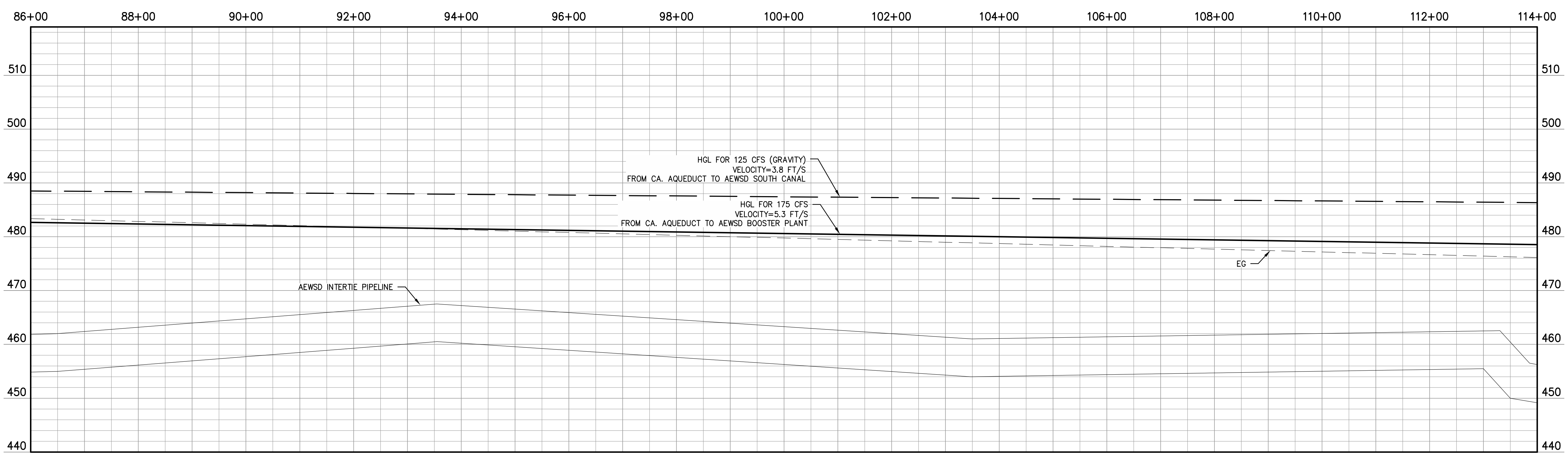

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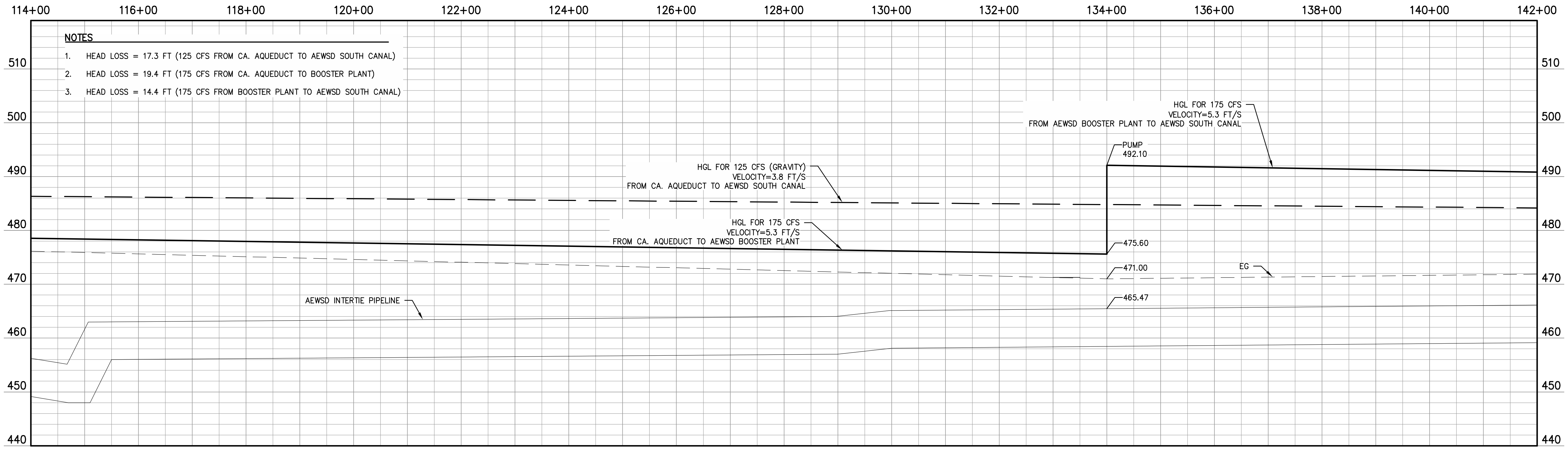
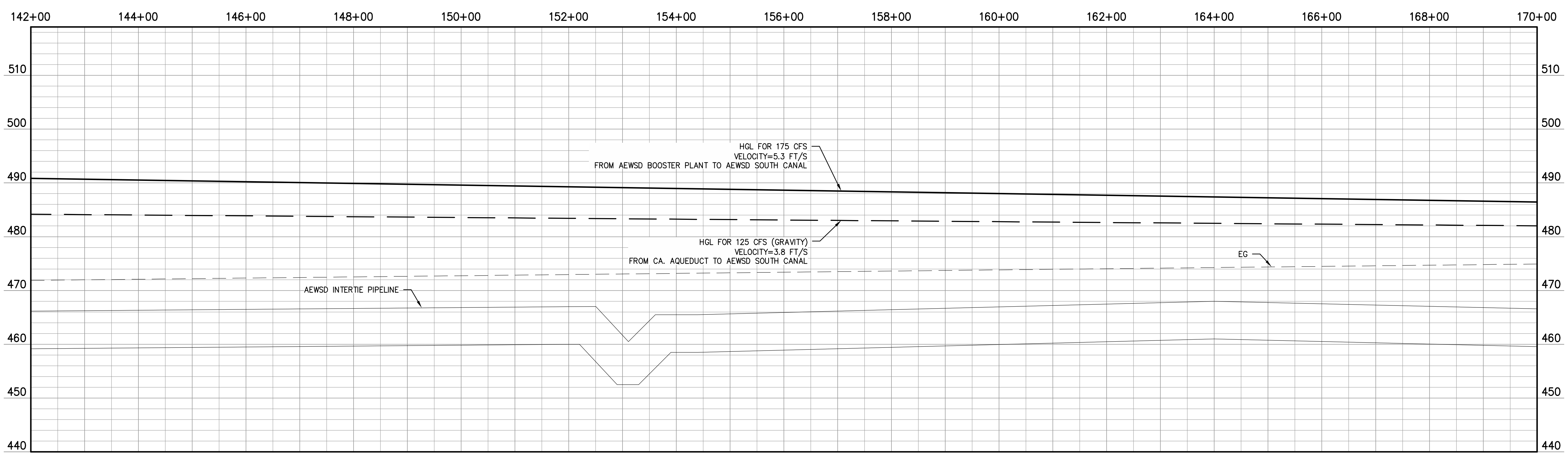
SHEET C4





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SHEET C5

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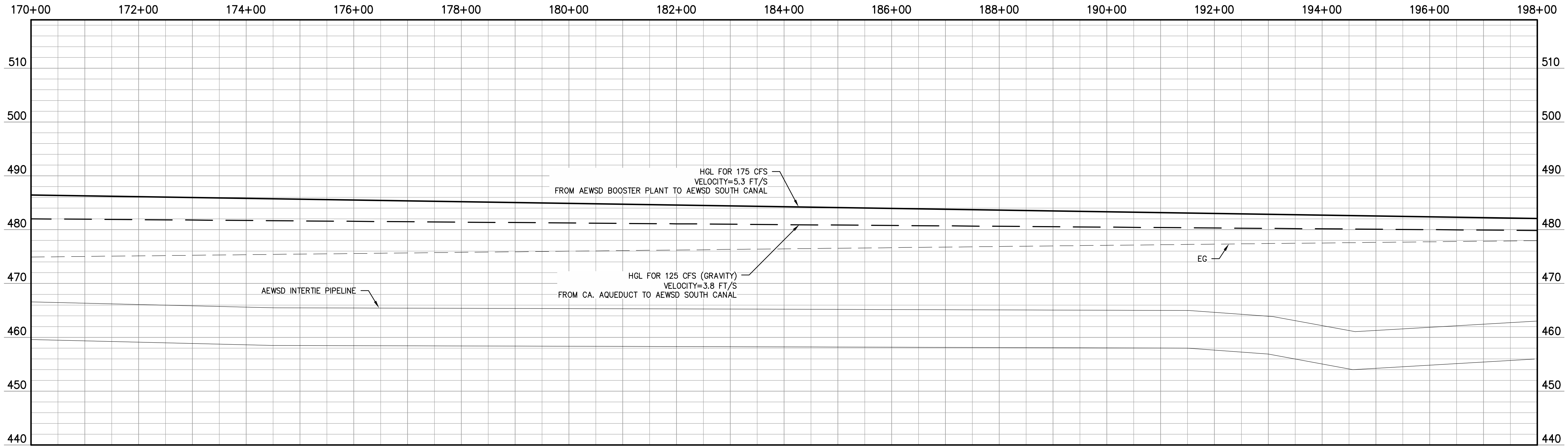

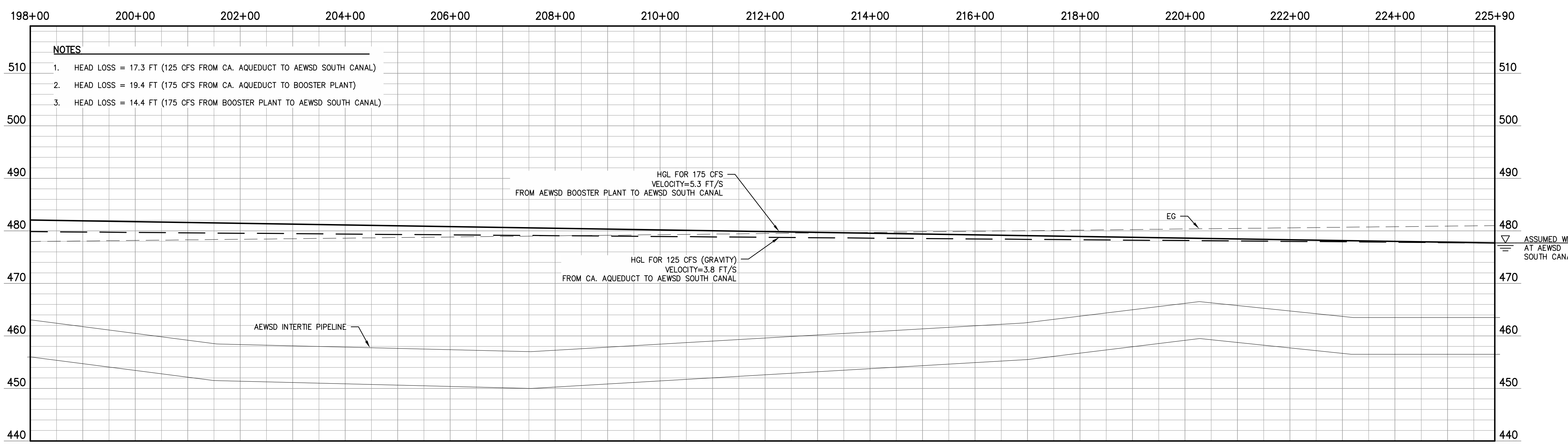

NOTES

1. HEAD LOSS = 17.3 FT (125 CFS FROM CA. AQUEDUCT TO AEWSD SOUTH CANAL)
2. HEAD LOSS = 19.4 FT (175 CFS FROM CA. AQUEDUCT TO BOOSTER PLANT)
3. HEAD LOSS = 14.4 FT (175 CFS FROM BOOSTER PLANT TO AEWSD SOUTH CANAL)

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SHEET C6

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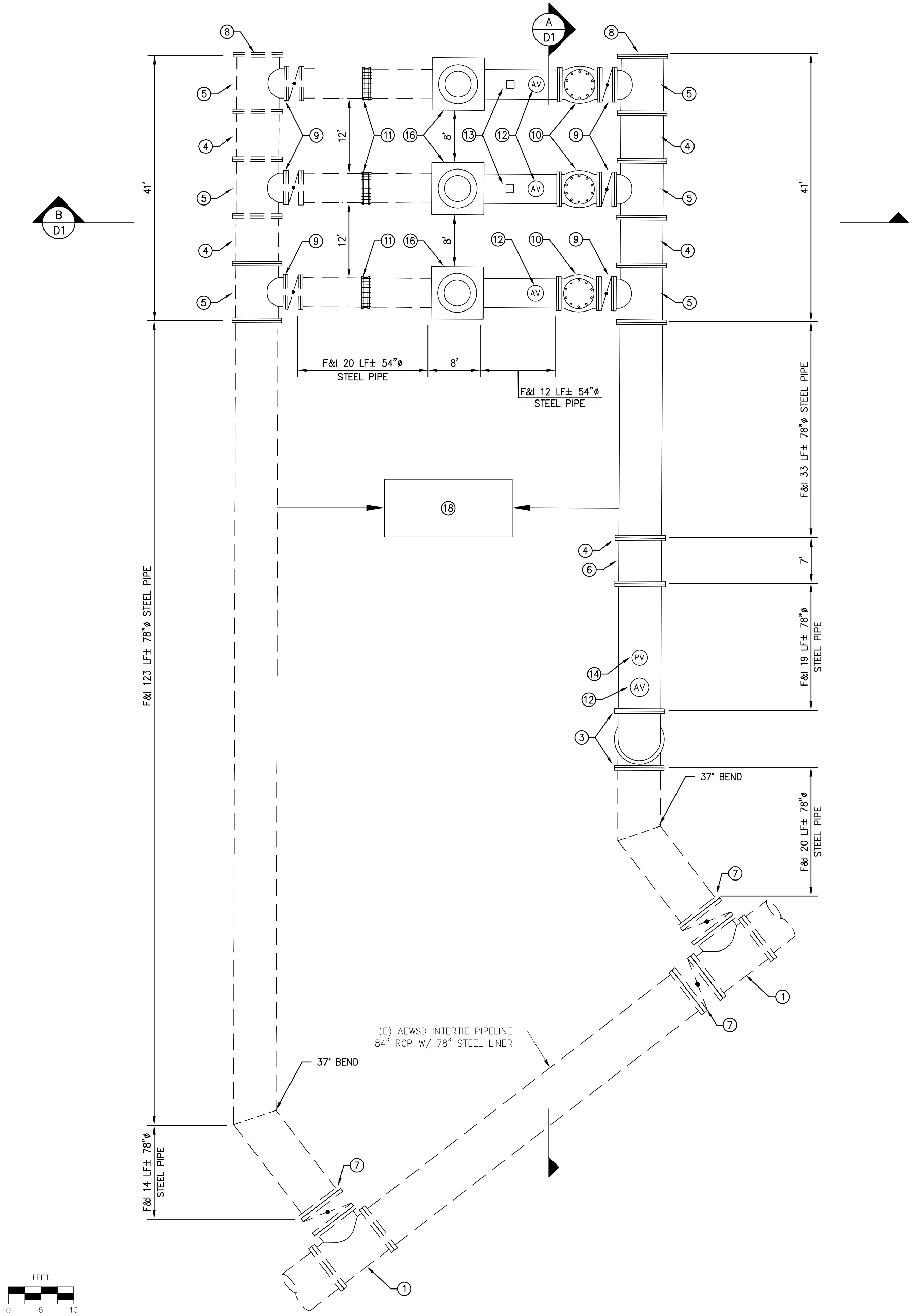


1 D1

PLAN

MATERIALS LIST

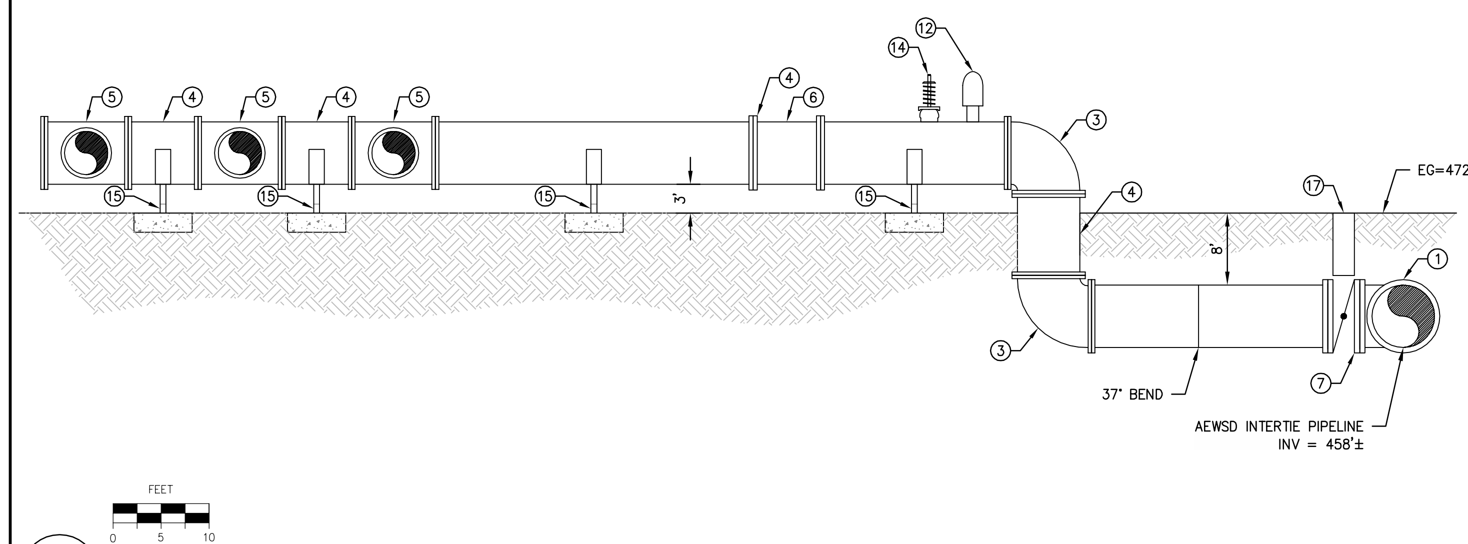
1. 84" X 78" REDUCING TEE
2. 84" BUTTERFLY VALVE
3. 78" 90° ELBOW
4. 78" SPOOL PIECE
5. 78" X 54" FLG X FLG REDUCING TEE
6. ACOUSTIC/ULTRASONIC TYPE FLOWMETER
7. 78" BUTTERFLY VALVE
8. 78" BLIND FLG
9. 54" BUTTERFLY VALVE
10. 54" CHECK VALVE
11. 54" FLEXIBLE COUPLING
12. COMBINATION AIR RELEASE VALVE
13. PRESSURE SWITCH/PRESSURE GAUGE
14. PRESSURE RELIEF VALVE
15. PIPE SUPPORT
16. 42" VERTICAL TURBINE PUMP W/ 300 HP MOTOR
17. VALVE CAN
18. SURGE PROTECTION

2 D1

MATERIAL LIST

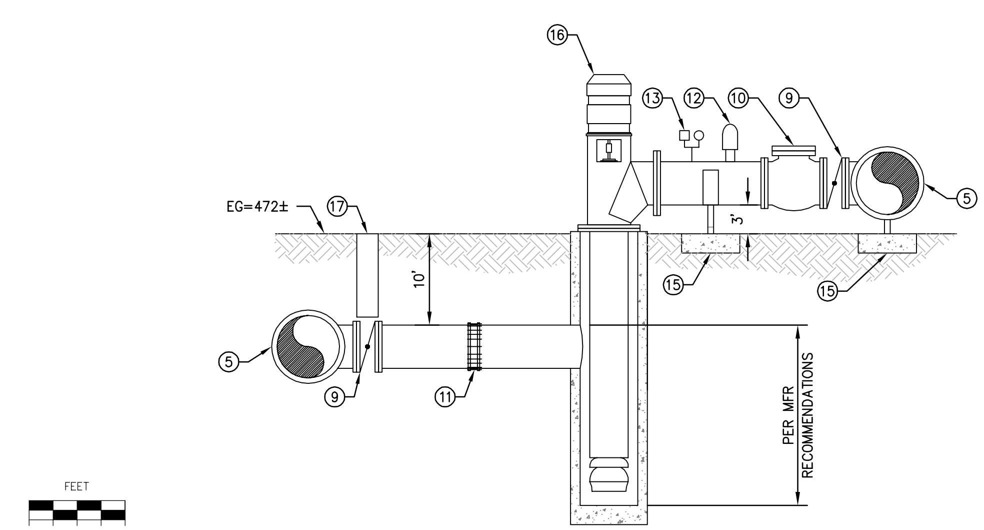
NOTES

1. ELEVATIONS TAKEN FROM AEWSD INTERTIE PIPELINE AS-BUILT PLANS (AUGUST 13, 1999), TO BE CONFIRMED WITH TOPO SURVEY.
2. CONFIGURATION MAY CHANGE AS MORE INFORMATION BECOMES AVAILABLE.



A D1

SECTION A



B D1

SECTION B

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SHEET D1

8 OF 8

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FEATURE:	PROJECT:
Cost Estimate **Arvin-Edison Irrigation District** **Recapture and Recirculate Alternative Analysis** *7/22/2016*	**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program** **WOID:** USBR **ESTIMATE LEVEL:** Preliminary **REGION:** Mid Pacific **PRICE LEVEL:** June 2016 **FILE:** C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[2016-0922 AEWSD Booster Pump Plant Cost Est.xls]LCC Cost Est

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Field Costs					
	1.00	**Site Work**					
	1.01	Clearing and Grubbing		1	AC	$1,100	$1,100
	1.02	Chain Link Fence (H=6')		850	LF	$30	$25,500.00
	1.03	Chain Link Swing Gates (H=6'; W=10')		2	EA	$700	$1,400.00
	1.04	3" thick Class II Base Material (site and access road)		960	CY	$82	$78,720.00
	2.00	**Booster Pumping Plant**					
	2.01	Pumping Plant manifold, Appurtenances, and Concrete Pad		1	LS	$1,602,000	$1,602,000
	2.02	Pumps , Motor and Cans - 90 cfs @ 300 HP per pump		1	LS	$1,077,000	$1,077,000
	2.03	Control Building, Site Electrical, SCADA, and Programming		1	LS	$832,000	$832,000
	2.04	Surge Protection		1	LS	$147,000	$147,000
	6.00	**Field Costs Subtotal**					
	6.01	Field Costs Subtotal (Items 1.01 Through 5.08)					**$3,764,720**
	7.00	**General Conditions**					
	7.01	Mobilization, Bonds, Insurance, Temporary Facilities, & Demobilization		10.00	%	$3,764,720	$376,472
	7.10	General Conditions Subtotal (Items 7.01 Through 7.09)					**$376,472**
	8.00	**Field Costs & Contingency Summary**					
	8.01	Field Costs Subtotal (Items 6.01 + 7.10)					**$4,141,192**
	8.02	Field Costs Contingency		30.00	%	$4,141,192	$1,242,358
	8.03	Field & Contingency Costs Subtotal (Items 8.01 + 8.02)					**$5,383,550**
	9.00	**Total Field Costs**					
	9.01	Total Field Costs (Item 8.03)					**$5,383,550**
		Non-Contract Costs					
	103.00	**Permitting & Compliance**		**7.00**	**%**		
	103.01	Permitting		7.00	%	$5,383,550	$376,848
	105.00	**Construction Management**		**15.00**	**%**		
	105.01	Engineering		8.00	%	$5,383,550	$430,684
	105.02	Construction Management		7.00	%	$5,383,550	$376,848
	107.00	**Non-Contract Costs & Contingency Summary**					
	107.01	Non-Contract Costs Subtotal (Items 103.01 Through 105.02)					**$1,184,381**
	107.02	Non-Contract Costs Contingency		15.00	%	$1,184,381	$177,657
	107.03	Non-Contract & Contingency Costs Subtotal (Items 107.01 + 107.02)					**$1,362,038**
	108.00	**Total Non-Contract Costs**					
	108.01	Non-Contract Costs (Item 107.03)					**$1,362,038**
		Land Acquisition Costs					
	201.00	**Land Acquisition Costs**					
	201.01	Land Acquisition Costs For Required Right Of Way		1.00	AC	$ 25,000.00	$25,000
		Total Construction Costs					
	301.00	**Total Construction Costs**					
	301.01	Total Field Costs (Item 9.01)					**$5,383,550**
	301.02	Total Non-Contract Costs (Item 108.01)					**$1,362,038**
	301.03	Subtotal Field & Non-Contract Costs (Items 301.01 + 301.02)					**$6,745,588**
	301.04	Total Land Acquisition Costs (Item 202.03)					**$25,000**
	301.05	Total Construction Costs (Items 301.03 + 301.04) (rounded to 100's)					**$6,771,000**

FEATURE:	PROJECT:
Cost Estimate **Arvin-Edison Irrigation District** **Recapture and Recirculate Alternative Analysis** *7/22/2016*	**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program** **WOID:** USBR **ESTIMATE LEVEL:** Preliminary **REGION:** Mid Pacific **PRICE LEVEL:** June 2016 **FILE:** C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[2016-0922 AEWSD Booster Pump Plant Cost Est.xls]LCC Cost Est

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Notes and Assumptions:					
	1	This cost estimate only includes improvements to the Districts system, & doesn't account for any capital cost already invested.					
	2	Cost estimate based on 10% Plans.					
	3	Unit prices developed from RS Means, supplier quotes, Caltrans and bid canvasses from similar projects.					
	4	This cost estimate was prepared assuming certain fittings may be welded in-lieu of flanged fittings. Cost based on similar projects.					
	5	This cost estimate assumes power can be provided to site with minimal improvements.					
	6	A hydraulic analysis of the system is required.					
	7	Contract Award Date and NTP dates are unknown.					
	8	Canal operations are unknown, so no schedule or cost adjustments have been made to accommodate work windows or weather days.					
	10	Manifold piping includes pipe supports, flex coupling, 1 butterfly valve, 1-check valve, 2-combination ARV's, and a 45 degree bend.					
	11	It is assumed the existing pipe is designed to convey the desired flow of 175 cfs at the necessary pressure.					

QUANTITIES		PRICES	
BY WR Vanderwaal/D Manning/P Dansby	**CHECKED** A Collins	**BY** WR Vanderwaal/D Manning	**CHECKED** A Collins 7/22/2016
DATE PREPARED July 22, 2016	**PEER REVIEW** O Kubit	**DATE PREPARED** July 22, 2016	**PEER REVIEW** O Kubit 7/22/2016

Annual Costs of Project (All costs should be in 2016 Dollars) Project: SJRRP Recapture and Recirculation, Arvin Edison WSD - Intertie Pipeline Booster Plan							
	Initial Costs	Annual Costs [1]				Discounting Calculations	
		Operations	Maintenance	Replacement[2,3]	Total Costs (a) + (b) + (c) + (d)	Discount Factor[4]	Discounted Project Costs (e) x (f)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2016	6,771,000	145,000	55,000		6,971,000	1.000	**$6,971,000**
2017		145,000	55,000		200,000	0.966	**$193,000**
2018		145,000	55,000		200,000	0.933	**$187,000**
2019		145,000	55,000		200,000	0.902	**$180,000**
2020		145,000	55,000		200,000	0.872	**$174,000**
2021		145,000	55,000		200,000	0.843	**$169,000**
2022		145,000	55,000		200,000	0.815	**$163,000**
2023		145,000	55,000		200,000	0.787	**$157,000**
2024		145,000	55,000		200,000	0.760	**$152,000**
2025		145,000	55,000		200,000	0.734	**$147,000**
2026		145,000	55,000		200,000	0.709	**$142,000**
2027		145,000	55,000		200,000	0.685	**$137,000**
2028		145,000	55,000		200,000	0.662	**$132,000**
2029		145,000	55,000		200,000	0.640	**$128,000**
2030		145,000	55,000	2,003,000	2,203,000	0.618	**$1,361,000**
2031		145,000	55,000		200,000	0.597	**$119,000**
2032		145,000	55,000		200,000	0.577	**$115,000**
2033		145,000	55,000		200,000	0.558	**$112,000**
2034		145,000	55,000		200,000	0.539	**$108,000**
2035		145,000	55,000		200,000	0.521	**$104,000**
2036		145,000	55,000		200,000	0.503	**$101,000**
2037		145,000	55,000		200,000	0.486	**$97,000**
2038		145,000	55,000		200,000	0.470	**$94,000**
2039		145,000	55,000		200,000	0.454	**$91,000**
2040		145,000	55,000		200,000	0.439	**$88,000**
2041		145,000	55,000		200,000	0.424	**$85,000**
2042		145,000	55,000		200,000	0.410	**$82,000**
2043		145,000	55,000		200,000	0.396	**$79,000**
2044		145,000	55,000		200,000	0.383	**$77,000**
2045		145,000	55,000	3,236,000	3,436,000	0.370	**$1,271,000**
2046		145,000	55,000		200,000	0.358	**$72,000**
2047		145,000	55,000		200,000	0.346	**$69,000**
2048		145,000	55,000		200,000	0.334	**$67,000**
2049		145,000	55,000		200,000	0.323	**$65,000**
2050		145,000	55,000		200,000	0.312	**$62,000**
2051		145,000	55,000		200,000	0.301	**$60,000**
2052		145,000	55,000		200,000	0.291	**$58,000**
2053		145,000	55,000		200,000	0.281	**$56,000**
2054		145,000	55,000		200,000	0.272	**$54,000**
2055		145,000	55,000		200,000	0.263	**$53,000**
2056		145,000	55,000		200,000	0.254	**$51,000**
2057		145,000	55,000		200,000	0.245	**$49,000**
2058		145,000	55,000		200,000	0.237	**$47,000**
2059		145,000	55,000		200,000	0.229	**$46,000**
2060		145,000	55,000	2,003,000	2,203,000	0.221	**$487,000**
2061		145,000	55,000		200,000	0.214	**$43,000**
2062		145,000	55,000		200,000	0.207	**$41,000**
2063		145,000	55,000		200,000	0.200	**$40,000**
2064		145,000	55,000		200,000	0.193	**$39,000**
2065		145,000	55,000		200,000	0.186	**$37,000**
Total Present Worth of Discounted Costs (Sum of column (g))							**$14,512,000**

Comments:

(1) The incremental change in O&M and replacement costs attributable to the project

(1.a.) Operation costs include the electrical costs of running the sumps as listed below at $.18/KWH plus a 25% contingency.

AE adding 3 pumps				
Pump #	Flow (CFS)	Estimated TDH	Horsepower	
# 1	60	10	300.0 hp	
# 2	60	10	300.0 hp	
# 3	60	10	300.0 hp	3rd pump is backup only
		Total	**900.0 hp**	

The power requirements are computed as follows =(600 hp) x (0.746 kW / hp) x (60 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 = $145,022

Average electric rate calculated from PG&E Small Agricultural Rate running 24 hours/day, 7 days a week for 365 days during the year during the highest flow period of the wet restoration year type

(1B) Annual Maintenance costs** are: Pumping Plant Manifold = $1,602,000 * 1.5% ($24,030) & Electrical motors, controls & connections = $987,000 * 2% ($19,740) the sum = $43,770 (then multiply by 25%) = $54,713

(2) Replacement costs are the costs to replace the equipment with a 25% contingency not including engineering, or construction management, mobilization and demobilization, or land grading

(3) All replacement intervals are modified replacement intervals from Table 3.1, 1981 printing of the American Society of Agricultural Engineers, "Design and Operation of Farm Irrigation Systems" by Jensen. The intervals are modified to meet local conditions and professional experience

(4) Estimated Discount Rate 3.375% ,2015 fiscal year rate set by Reclamation for Federal water resource planning (Federal Register, Vol.79, No.248)

(5) Costs from the Engineers Opinion of Probable Costs as follows:

Cost Item	Amount	Replacement**
		Every 30 years
Pump Plant Manifold & Discharge	$ 1,602,000	Every 15 years
Electrical Motors, Controls, Connections	$ 987,000	Every 30 years
		Every 40 years
		Every 15 years

**Annual maintenance percentages and replacement periods based on Jensen, M.E., Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, 1981

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SAN JOAQUIN RIVER RESTORATION PROGRAM

10% CONCEPTUAL DESIGN DRAWINGS
DRAFT REVIEW SET
AUGUST 2016

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VICINITY MAP

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DRAWING LIST

PAGE NO.	SHEET CODE	SHEET DESCRIPTION:
		GENERAL
1	G-1	COVER, VICINITY, AND LOCATION MAPS
2	G-2	DRAWING INDEX, SHEET CODE LEGEND, NOTES, ABBREVIATIONS, SYMBOLS
3	G-3	DESIGN CRITERIA
4	G-4	PROCESS SCHEMATIC
5	G-5	HYDRAULIC PROFILE
		CIVIL
6	C-1	OVERALL SITE PLAN
7	C-2	PIPELINE ALIGNMENT 1 OF 4
8	C-3	PIPELINE ALIGNMENT 2 OF 4
9	C-4	PIPELINE ALIGNMENT 3 OF 4
10	C-5	PIPELINE ALIGNMENT 4 OF 4
11	C-6	DISCHARGE STRUCTURE AND DETAILS
		MECHANICAL
12	M-1	INTAKE FACILITY LAYOUT
13	M-2	INTAKE FACILITY SECTIONS
14	M-3	SILTATION BASIN LAYOUT
		ELECTRICAL
15	E-1	INTAKE FACILITY SINGLE LINE DIAGRAM

SHEET CODE LEGEND

EXAMPLE: C–1

DISCIPLINE CODE* — SHT NO. OF SERIES

*SEE CODE TABLE BELOW

DISCIPLINE CODE	
C	CIVIL
E	ELECTRICAL
G	GENERAL
M	MECHANICAL

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AA	AQUA AMMONIA
ABC	AGGREGATE BASE COURSE
AC	ASPHALTIC CONCRETE, ASBESTOS CEMENT
AFF	ABOVE FINISH FLOOR
ALR	ALARM
AMP	APERE, AMPLIFIER
APPROX	APPROXIMATELY
ARV	AIR RELEASE VALVE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AT	APERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
A/V	AIR/VACUUM VALVE
A/VRV	AIR VACUUM AND AIR RELEASE VALVE
AWWA	AMERICAN WATER WORKS ASSOCIATION
BF	BLIND FLANGE
BFP	BACKFLOW PREVENTER
BFV	BUTTERFLY VALVE
BLDG	BUILDING
BOT,BOTT	BOTTOM, BOTTOM OF CURB
BPV	BACK PRESSURE VALVE
BR	BRINE
BS	BLACK STEEL
C	CHANNEL COMPRESSOR, CONDUIT, CURRENT, CLOSED, CIVIL, DRY AIR, COOLER
C&G	CURB & GUTTER
CB	CATCH BASIN
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CI	CURB INLET, CAST IRON
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT, CONTROL JOINT
CL	CHLORINE IN CARRIAGE WATER
CLG	CHLORINE GAS
C/L	CHAIN LINK
CM(P)	CORRUGATED METAL (PIPE)
CO	CLEANOUT
COL	COLUMN, COLOR
CONC	CONCRETE
CONT	CONTINUOUS, CONTINUATION, CONTINUED
CORP	CORPORATION
CORR	CORRUGATED, CORRIDOR
CP	CONTROL PANEL
CPVC(P)	CHLORINATED POLYVINYLCHLORIDE (PIPE)
CRC	CHEMICAL RESISTANT COATING
CS	CAUSTIC SODA, CUP SINK, CARBON STEEL, CONTROL STATION
CSP	CARBON STEEL PIPE
CT	CURRENT TRANSFORMER
CTJ	CONTROL JOINT
CTR	CENTER (ED)
CU	CUBIC, COPPER
CU FT	CUBIC FEET
CUP	COPPER PIPE
CV	CHECK VALVE, CONTROL VALVE, CONTROL VARIABLE
CY	CUBIC YARD
D	DRAIN, DEEP, DEPTH
DCV	DOUBLE CHECK VALVE
DEG	DEGREE
DET	DETAIL
DEMO	DEMOLISH, DEMOLITION
DI	DROP INLET
DIA	DIAMETER
DIM	DIMENSION
DI(P)	DUCTILE IRON (PIPE)
DWG	DRAWING
(E)	EXISTING
E	EAST
EA	EACH
ECC	ECCENTRIC
ELEC	ELECTRIC(AL)
ELEV	ELEVATION
ELL	ELBOW
EMBED	EMBEDMENT
EPDM	ETHYLENE PROPYLENE DIENE MONOMER
EQPT, EQUIP	EQUIPMENT
EX, EXIST	EXISTING
FC	FLEXIBLE COUPLING
FCA	FLANGE COUPLING ADAPTER
FDC	FIRE DEPT CONNECTION
FH	FIRE HYDRANT
FLEX	FLEXIBLE
FLG	FLANGE(D)
FLGA	FLANGE ADAPTER
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
ESH, ESEW	EMERGENCY SHOWER AND EYEWASH
FT	FOOT, FEET
G	GATE, GENERAL, GROUND
GAL	GALLONS
GALV	GALVANIZED
GASP	GALVANIZED STEEL PIPE
GEN	GENERATOR, GENERAL
GND	GROUND
GPD	GALLONS PER DAY
GPM	GALLONS PER MINUTE
GSP	GALVANIZED STEEL PIPE
GV	GATE VALVE
HFS	HYDROFLUOROSILICIC ACID
HP	HORSE POWER, HEAT PUMP, HIGH POINT
HYD	HYDRAULIC, HYDRANT
IE	INVERT ELEVATION
IRR	IRRIGATION WATER
MANUF	MANUFACTURER
MATL	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM, MINUTE
MJ	MECHANICAL JOINT
MSL	MEAN SEA LEVEL
N	NORTH, NORTHING
NA, N/A	NOT APPLICABLE
NG	NATURAL GAS
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE
OCL	SODIUM HYPOCHLORITE
P	PUMP
PCBS	PLASTIC COATED BLACK SEAL
PCSP	PLASTIC COATED STEEL PIPE
PE (P)	POLYETHYLENE (PIPE), PLAIN END
PEH	POLYETHYLENE HOSE
PIV	POST INDICATOR VALVE
PRV	PRESSURE (REGULATING, RELIEF, REDUCING) VALVE
PS	PUMP STATION
PSI	POUNDS PER SQUARE INCH
PVC(P)	POLYVINYL CHLORIDE (PIPE)
PVCH	POLYVINYL CHLORIDE HOSE
PVMT	PAVEMENT
PW	PLANT WATER, POTABLE WATER
RAD	RADIUS
REQD	REQUIRED
RPZ	REDUCED PRESSURE ZONE VALVE ASSEMBLY
RW	RAW WATER
R/W	RIGHT OF WAY
S	SOUTH
SAM	SAMPLE WATER
SCH(ED)	SCHEDULE
SCLP	STEEL CEMENT MORTAR LINED PIPE
SD	STORM DRAIN
SFW	SOFTENED WATER
SHT	SHEET
SCCP	STEEL CEMENT MORTAR LINED AND COATED PIPE
SPARE	SPARE CHEMICAL
SPEC	SPECIFICATION(S), SPECIFIED
SS	SANITARY SEWER, STAINLESS STEEL
STA	STATION
STL	STEEL
STRUCT	STRUCTURAL
TEMP	TEMPERATURE, TEMPERED, TEMPORARY
TOC	TOP OF CONCRETE, TOP OF CURB
TW	TREATED WATER, TEPID WATER
TYP	TYPICAL
TVSS	TRANSIENT VOLTAGE SURGE SUPRESSOR
UNO	UNLESS NOTED OTHERWISE
V	VENT
W	WEST, WATER
XFMR	TRANSFORMER
YH	YARD HYDRANT
ZOP	ZINC ORTHOPHOSPHATE

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SAN JOAQUIN RIVER RESTORATION PROGRAM
Drawing Index, Sheet Code Legend, Notes, and Abbreviations

Date

Drawing Index, Sheet Code Legend, Notes, and Abbreviations

G–2

SHEET 2 OF 14

DATE AND TIME PLOTTED Not Plotted
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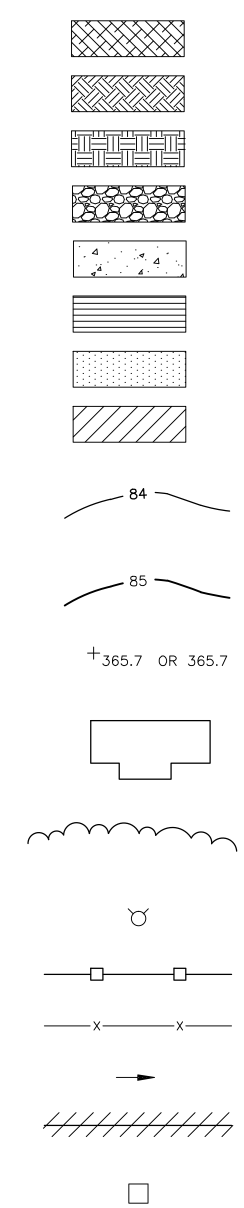
CAD SYSTEM AUTOCAD
CAD FILENAME UNKNOWN

PRELIMINARY - NOT FOR CONSTRUCTION

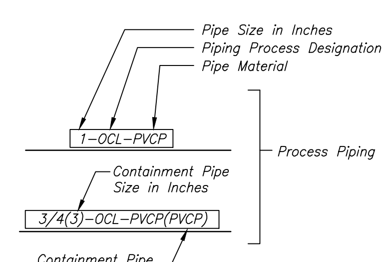
Design Criteria

PRELIMINARY DESIGN CRITERIA		
DESCRIPTIDN	**UNITS**	**ALTERNATIVE 1**
SAN JOAQUIN RIVER INTAKE PRELIMINARY DESIGN CRITERIA		
DIMENSION OF FISH SCREEN	FTxFT	10 W x 12 H
APPROACH VELOCITY[1]	FPS	0.33
EFFECTIVE AREA OF 10 W x 12 H SCREEN	FT^2	102.52
AVAILABLE HEIGHT FOR 10 FT WIDE SCREEN	FT	4.67
EFFECTIVE AREA OF FISH SCREEN PER SCREEN	FT^2	39.88
NUMBEER OF SCREENS REQUIRED LOWER LEVEL	NO.	38
NUMBER OF SCREENS ATTACHED TO LOWER SCREENS	NO.	38
TOTALWEDGE WIRE FISH SCREEN 10 W BY 12 H	NO.	76
CAPACITY, EACH	CFS	13.16
CAPACITY, EACH	MGD	8.50
INVERT OF SCREEN	FT	34.95
MINIMUM RIVER DEPTH[2]	FT	0.07
AVERAGE RIVER DEPTH[3]	FT	4.84
MAXIMUM RIVER DEPTH[4]	FT	23.55
SAN JOAQUIN RIVER BOTTOM ELEVATION[5]	FT	34.78
SEDIMENTATIDN BASIN PRELIMINARY DESIGN CRITERIA		
NUMBER OF BAYS	NO.	**2**
SEDIMENTATION BASINS PER BAY	NO.	2
LENGTH OF BASINS	FT	285
WIDTH OF BASINS	FT	44
NOMINAL HEIGHT	FT	13.05
WATER DEPTH (AVERAGE)	FT	13.05
VOLUME PER BASIN	GAL	1,224,000
TOTAL VOLUME	GAL	2,448,000
DETENTION TIME AT 323 MGD	MIN	11
ISDLATIDN WALL PRELIMINARY DESIGN CRITERIA		
NUMBER OF BAYS	NO.	**2**
LENGTH OF WALL FULL HEIGHT FOR BASIN ISOLATION	FT	285
NUMBER OF 5 FT HIGH BY 6 FT WIDE SLUICE GATES	NO.	20
NUMBER OF 3 1/2 FT H BY 3 FT W SLUICE GATES	NO.	20
SLUDGE CDLLECTIDN SYSTEM PRELIMINARY DESIGN CRITERIA		
SLUDGE COLLECTORS	TYPE	CHAIN AND FLIGHT
COLLECTORS PER BASIN	NO.	4
DRIVES PER BASIN	NO.	2
CROSS COLLECTORS PER BASIN	NO.	2
DRIVES PER BASIN	NO.	2
PUMP SUMPS PER BASIN	NO.	2
NUMBER OF PUMPS PER PUMP SUMP	NO.	2
PUMPED FLOW PER PUMP	GPM	1750
TOTAL PUMPED FLOW TO SILTATION BASINS	MGD	10
DIFFUSSER WALL FROM SEDIMENTATION TD PUMP BAYS PRELIMINARY DESIGN CRITERIA		
LENGTH OF WALL	FT	285
HEIGHT OF WALL AT EL 39.50 FT	FT	13.05
NUMBER OF 12 IN DIA ORIFICES FROM EL 29.00 TO EL 38.00	NO.	354
SILTATIDN BASINS PRELIMINARY DESIGN CRTERIA		
NUMBER OF BASINS (DUTY, STAND-BY, BEING CLEANED)	NO.	3
LENGTH OF BASIN	FT	500
WIDTH OF BASINS	FT	135
AVERAGE WATER DEPTH	FT	10
BASIN VOLUME	MG	5.05
DETENTION TIME AT 10 MGD PUMP RATE	HR	12.12
PUMP STATIDN PRELIMINARY DESIGN CRITERIA		
TYPE: VERTICAL TURBINE PUMPS		
NUMBER OF PUMPS	NO.	6
DESIGN CAPACITY		
EACH PUMP	MGD	54
	CFS	83
TOTAL	MGD	323
	CFS	500
DESIGN TOTAL DYNAMIC HEAD	FT	265
EACH PUMP	HP	3500
NUMBER OF VFDS	NO.	6
SURGE TANK PRELIMINARY DESIGN CRITERIA		
SURGE TANKS	NO.	6
TANK ORIENTATION	-	HORIZONTAL
TANK LENGTH	FT	65
TANK DIAMETER	FT	12
TANK VOLUME	GAL	55,500
MAXIMUM OPERATING PRESSURE	PSI	125
BURIED WATER LINE TD DELTA MENDOTA CANAL PRELIMINARY DESIGN CRITERIA		
NUMBER OF PIPELINES	NO.	3
FLOW PER PIPELINE	MGD	108
FLOW PER PIPELINE	CFS	167
PIPE DIAMETER, EACH	INCHES	72
VELOCITY AT MAXIMUM FLOW RATE	FPS	5.89
CANAL ENERGY DISPERSION STRUCTURE DESIGN CRITERIA		
WEIR LENGTH	FT	65
HEIGHT OF WATER OVER WEIR	FT	1.87
VELOCITY	FPS	4.1

Civil Symbols



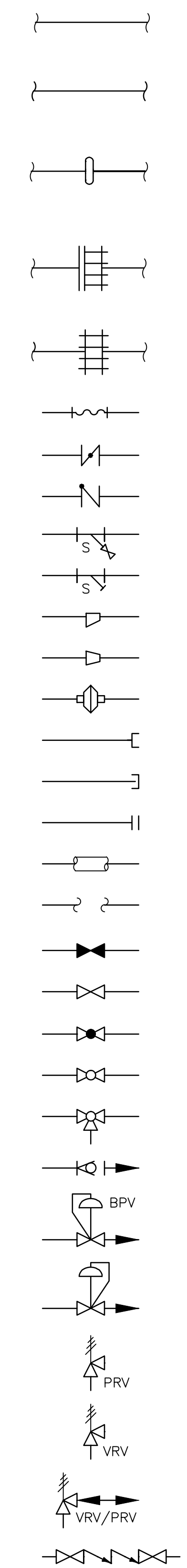
Piping Identification



Note:

Labels for Existing Pipes are Screened

Pipe and Valve Symbols



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SAN JOAQUIN RIVER RESTORATION PROGRAM
Design Criteria and Symbols

Date

Design Criteria and Symbols

G-3

SHEET 3 OF 14

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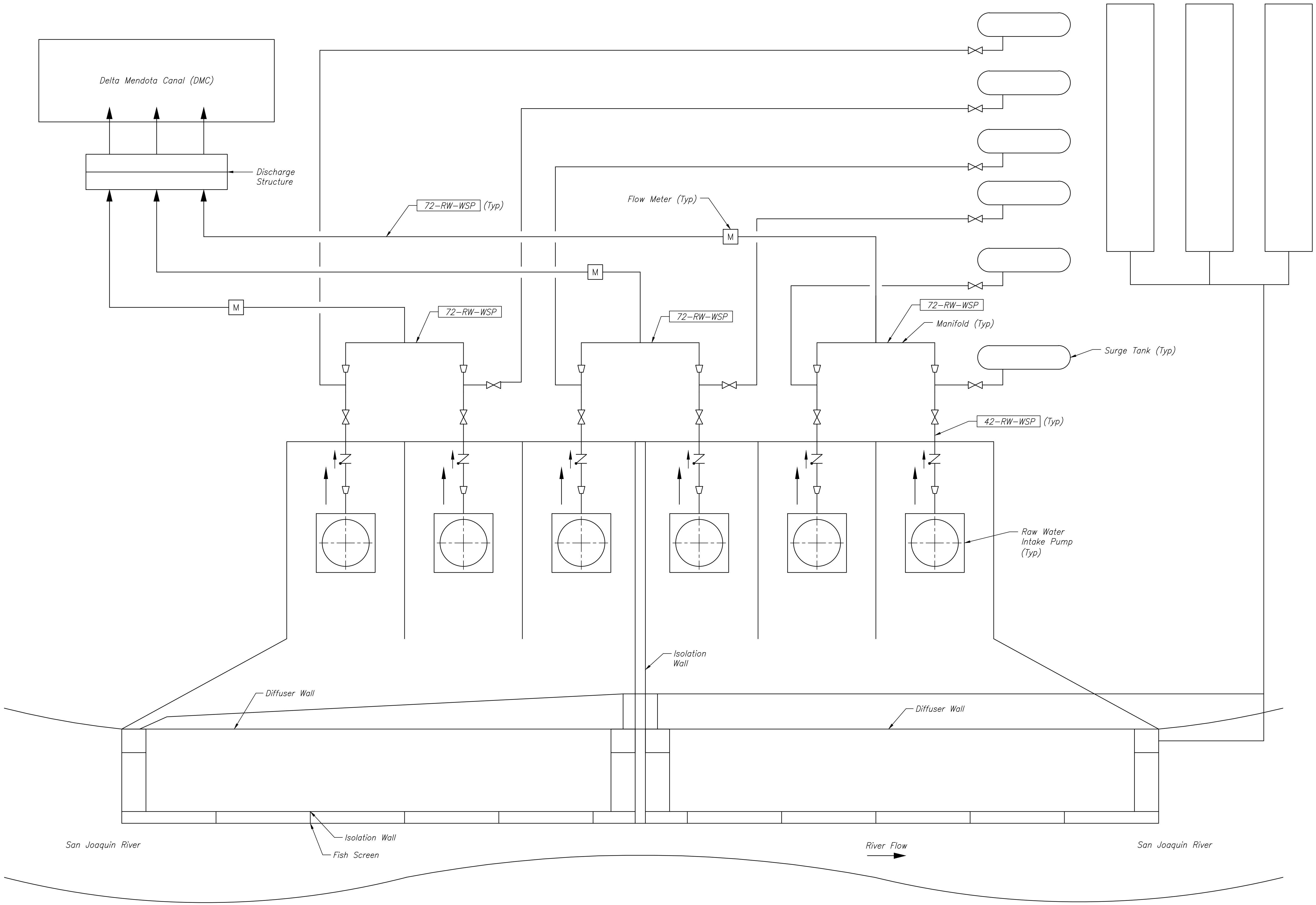
CAD FILENAME UNKNOWN



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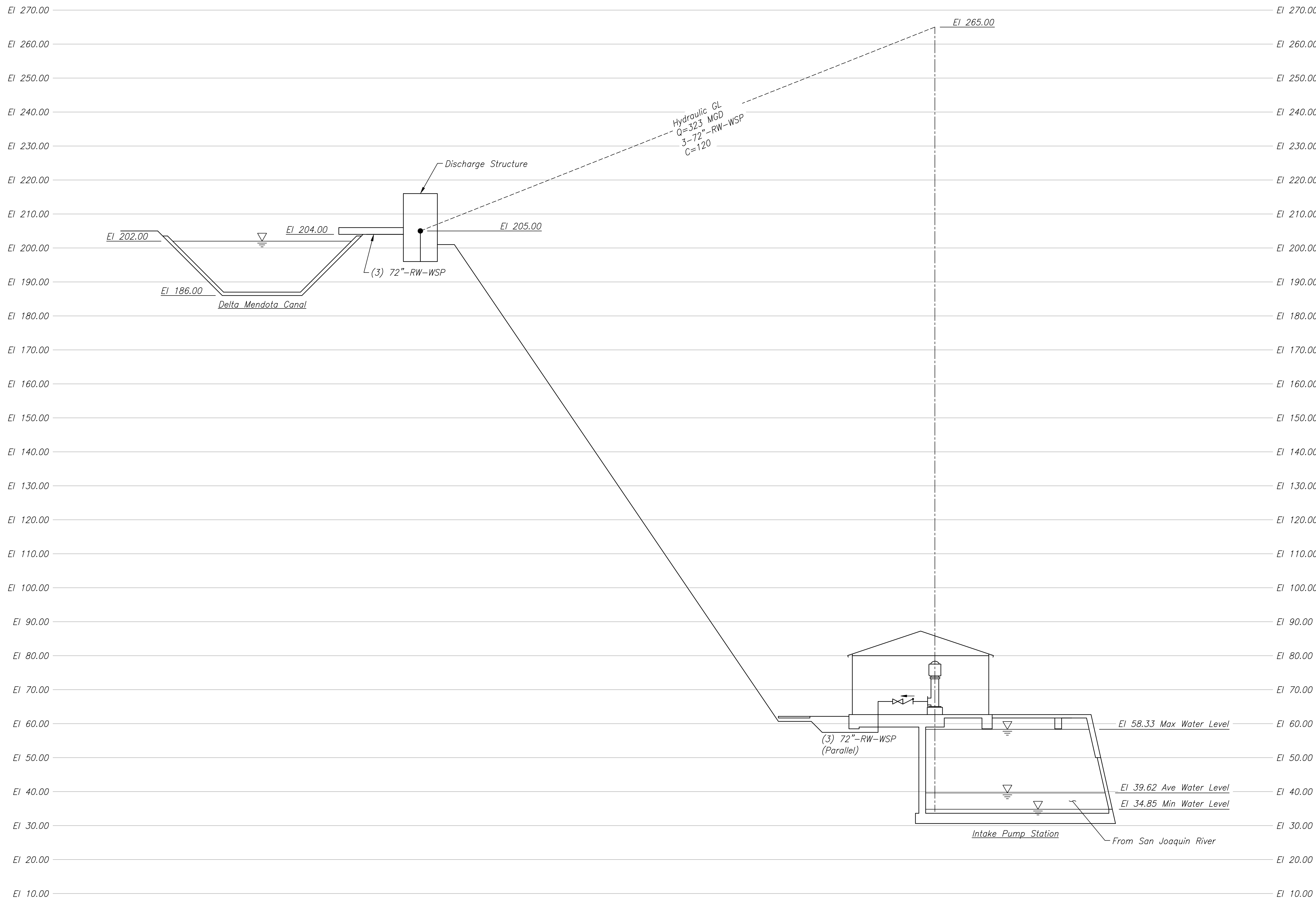
SAN JOAQUIN RIVER RESTORATION PROGRAM
Process Flow Diagram

Date

Process Flow Diagram

G-4

SHEET 4 OF 14



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SAN JOAQUIN RIVER RESTORATION PROGRAM
Hydraulic Profile

Date

Hydraulic Profile

G-5

SHEET 5 OF 14

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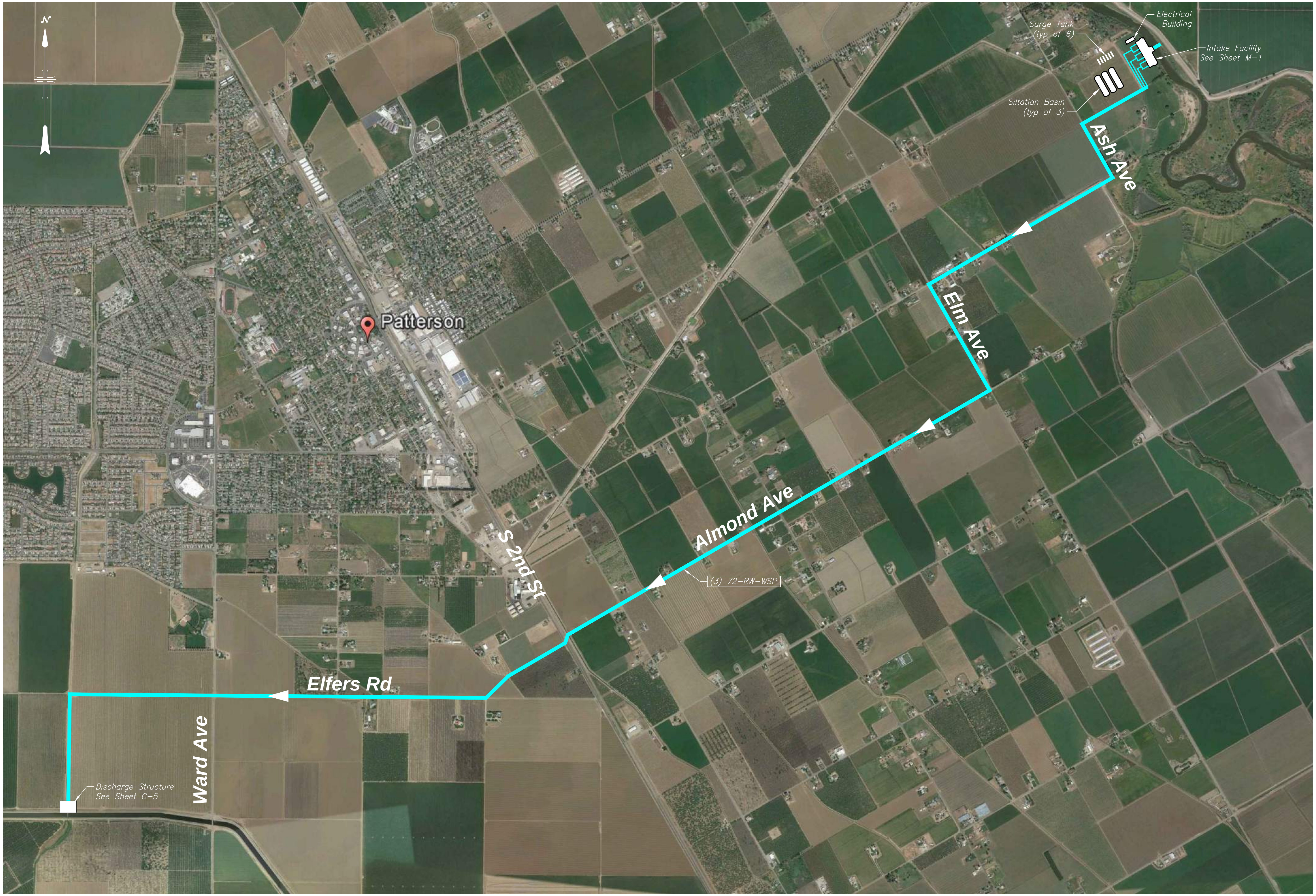

PLAN

1000 0 1000 2000 3000
SCALE OF FEET

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SAN JOAQUIN RIVER RESTORATION PROGRAM
Overall Site Plan

Date

Overall Site Plan

C-1
SHEET 6 OF 14

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AUTOCAD
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SAN JOAQUIN RIVER RESTORATION PROGRAM
Pipeline Alignment
1 of 4

Date

Pipeline Alignment
1 of 4

C-2

SHEET 7 OF 14

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PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
UNKNOWN

PLAN

300 0 300 600 900
SCALE OF FEET

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MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
Pipeline Alignment
2 of 4

Date

Pipeline Alignment
2 of 4

C-3

SHEET 8 OF 14

DATE AND TIME PLOTTED
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PLOTTED BY
Not Plotted

CAD SYSTEM
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CAD FILENAME
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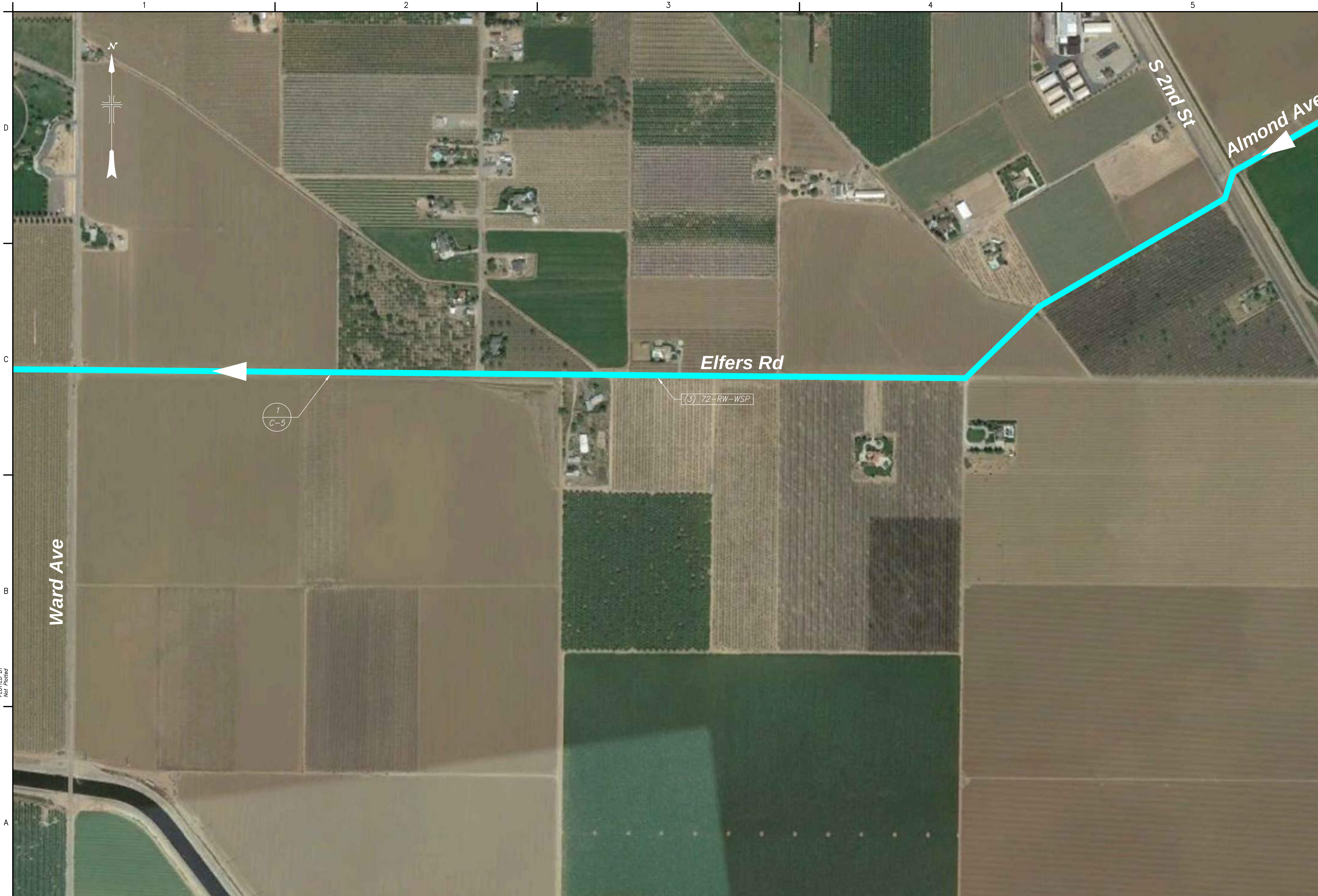

PLAN

300 0 300 600 900
SCALE OF FEET

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MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
Pipeline Alignment
3 of 4

Date

Pipeline Alignment
3 of 4

C-4
SHEET 9 OF 14

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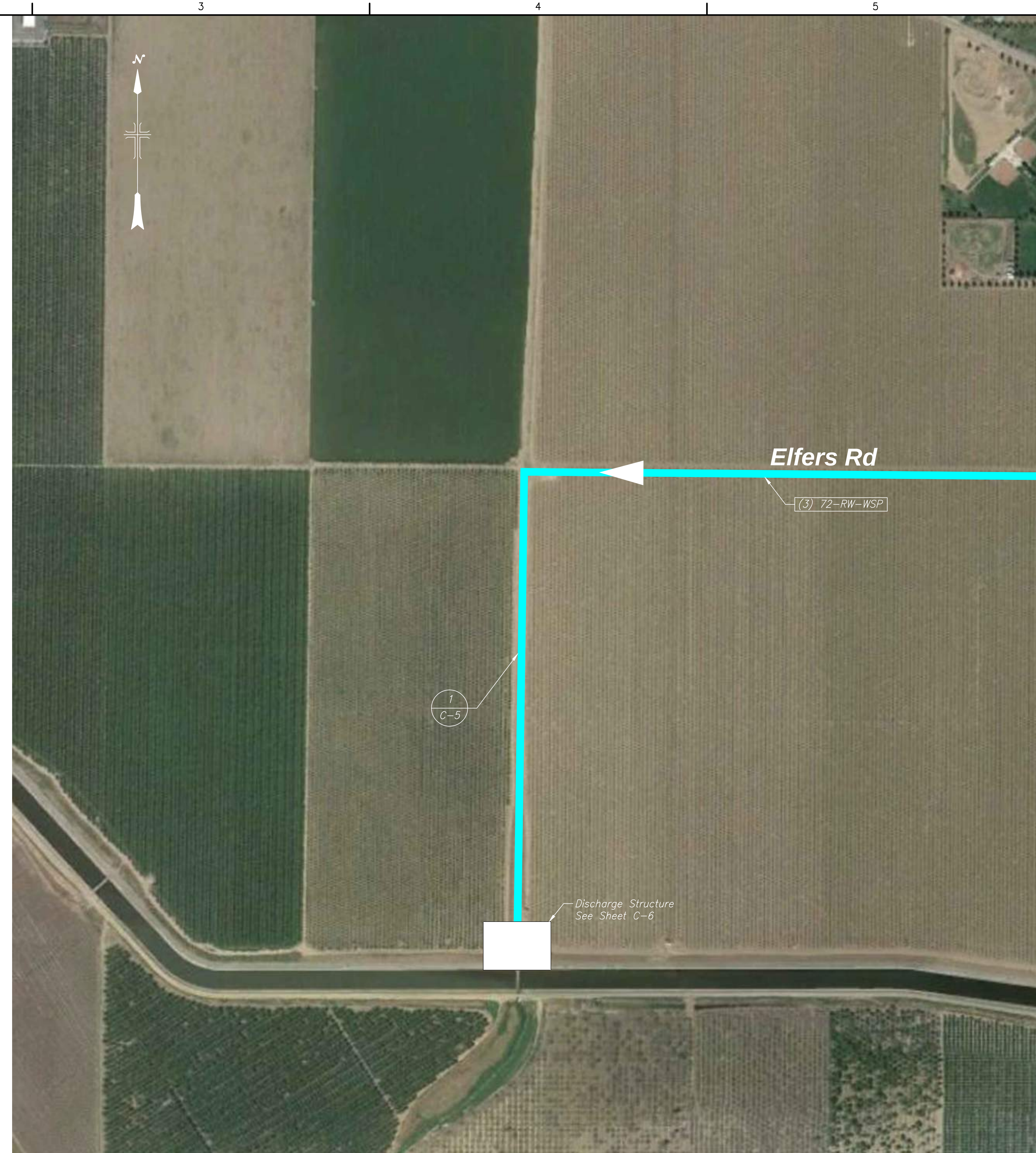

PLAN

300 0 300 600 900
SCALE OF FEET

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SAN JOAQUIN RIVER RESTORATION PROGRAM
Pipeline Alignment
4 of 4

Date

Pipeline Alignment
4 of 4

C–5
SHEET 10 OF 14

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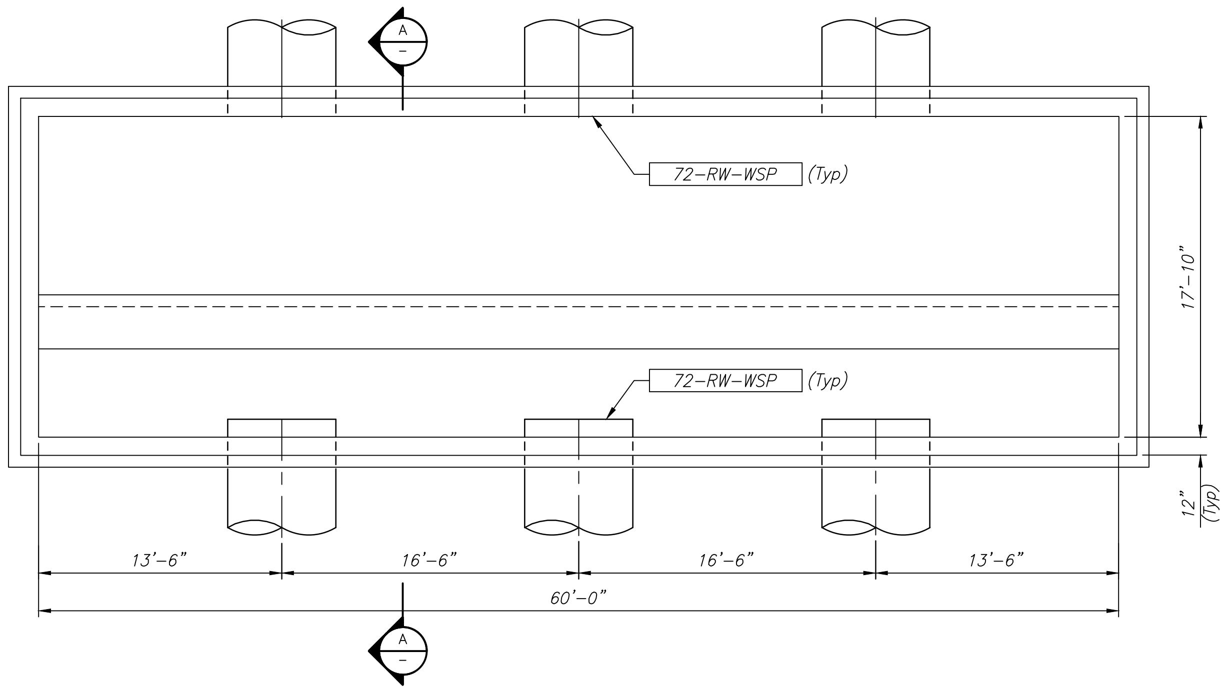
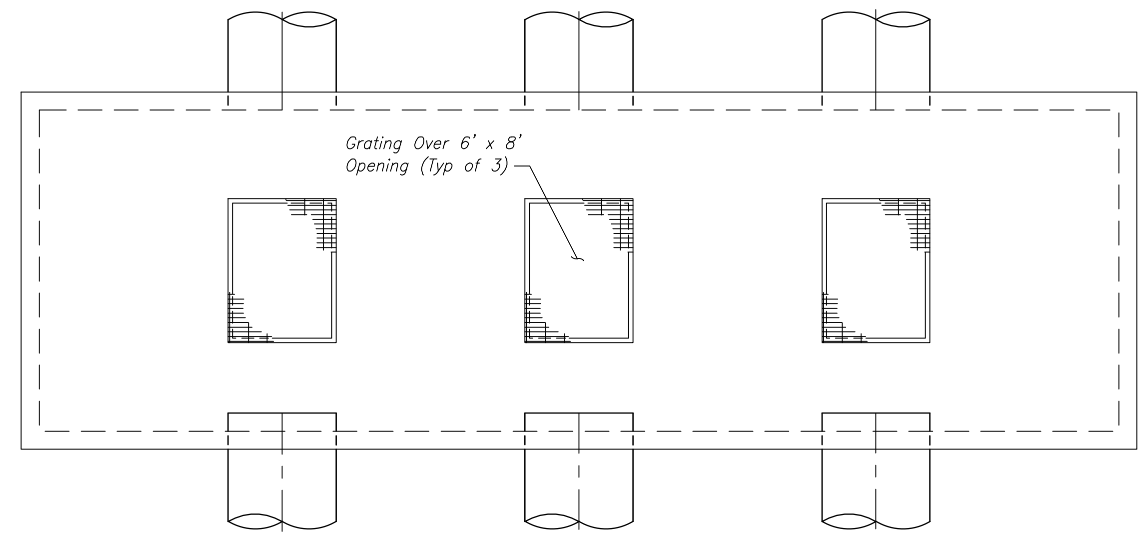


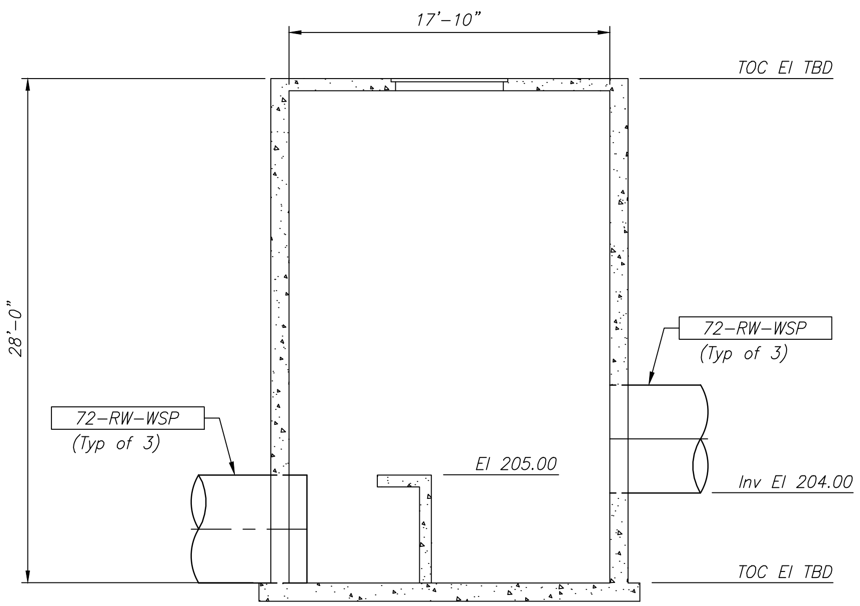
DISCHARGE OUTLET LOWER PLAN

SCALE OF FEET

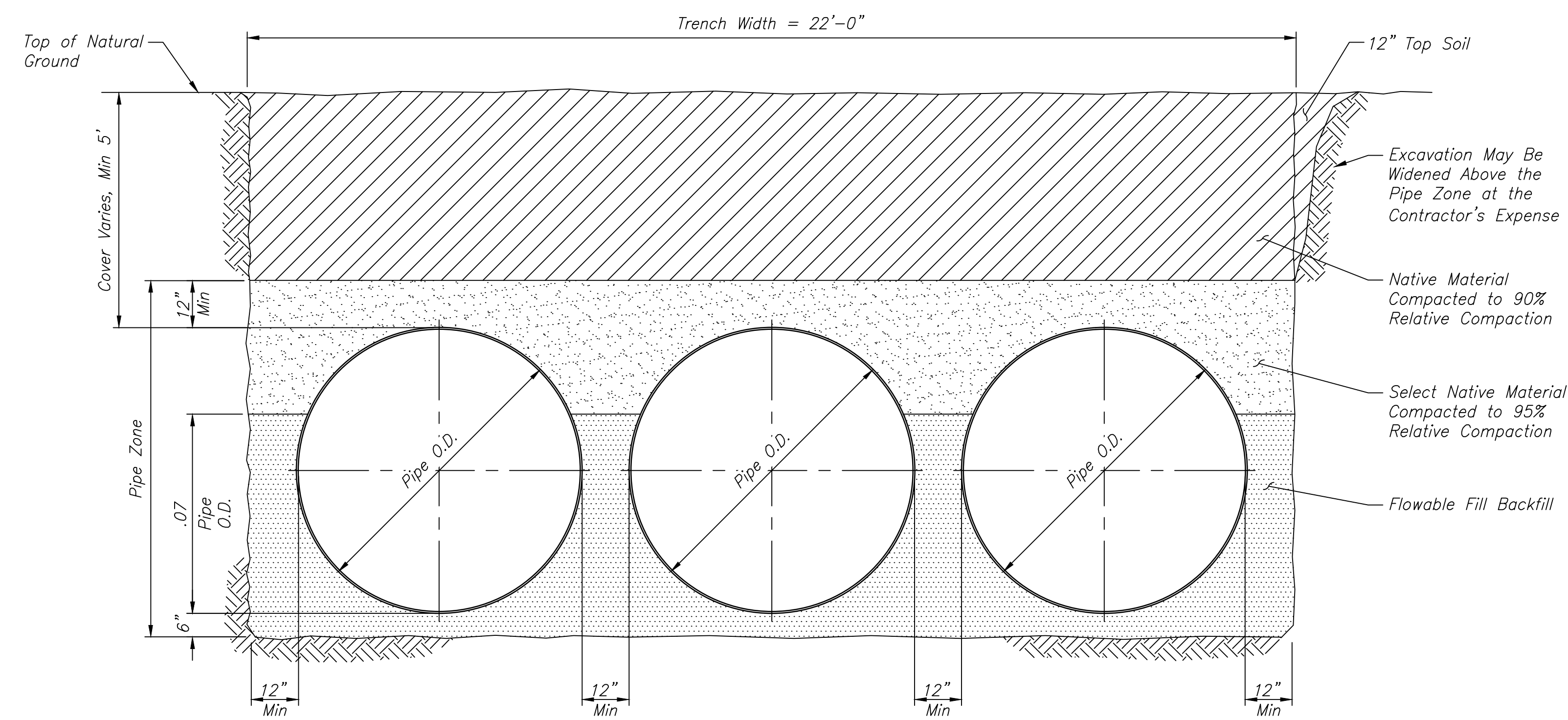


DISCHARGE OUTLET TOP DECK PLAN

SCALE OF FEET



SECTION A
SCALE: 3/16" = 1'-0"



Notes:

1. Relative compaction values shall be relative to ASTM D698 and confirmed by ASTM 6938.
2. Trench detail does not show structural requirements of the pipe section. Pipeline design engineer shall be responsible for the structural design and specification of the pipe/soil cross section along alignment, as well as review of the shop drawings and verifying the structural adequacy of the pipes supplied.

Steel Pipe – Typical Trench 1
SCALE: NTS

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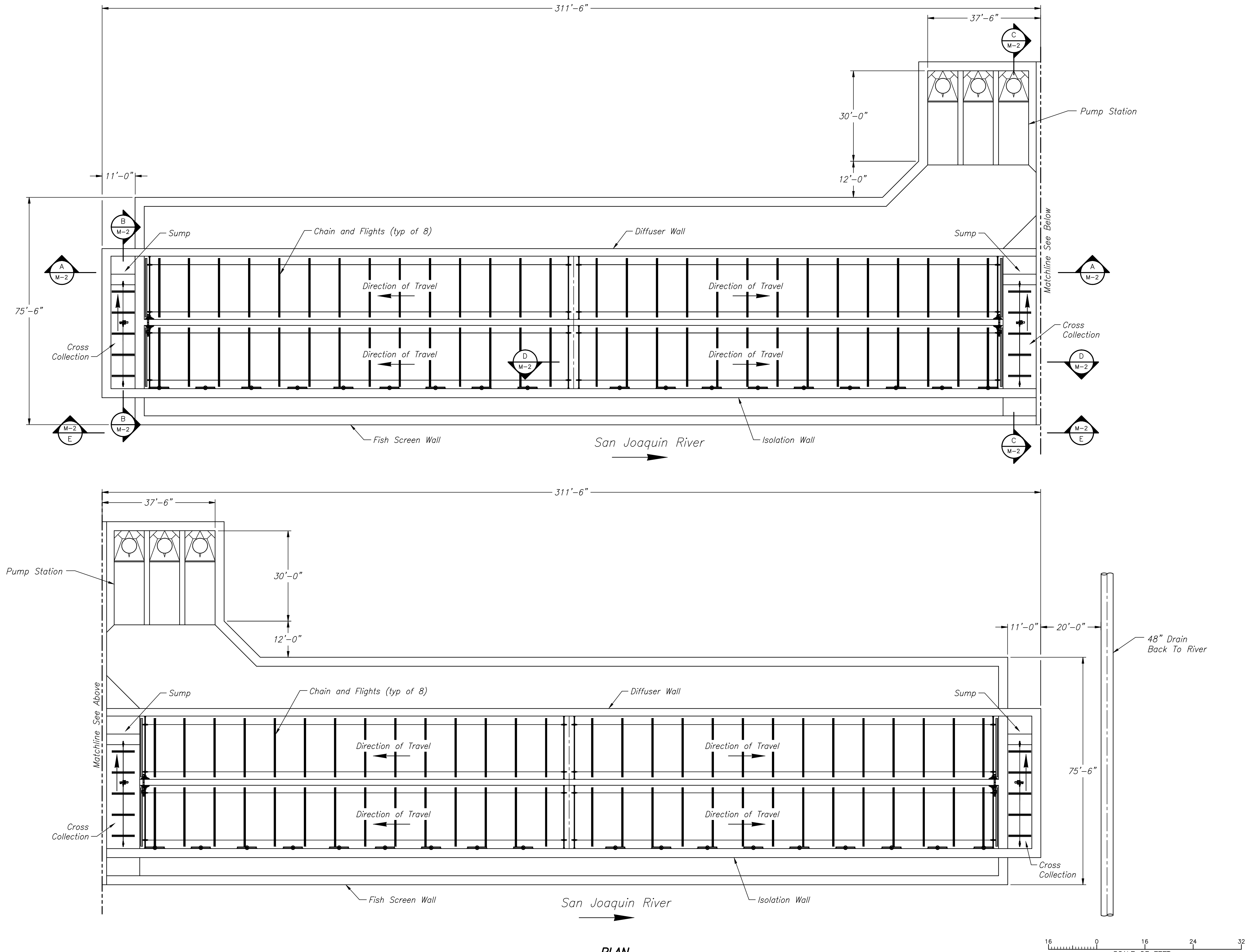
SAN JOAQUIN RIVER RESTORATION PROGRAM
Discharge Structure and Details

Date

Discharge Structure and Details

C–6
SHEET 11 OF 14

DATE AND TIME PLOTTED Not Plotted
PLOTTED BY Not Plotted
CAD SYSTEM AUTOCAD
CAD FILENAME UNKNOWN



PLAN

PRELIMINARY - NOT FOR CONSTRUCTION

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MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
Intake Facility Layout

Date

Intake Facility Layout

M-1

SHEET 2 OF XX

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DATE AND TIME PLOTTED Not Plotted
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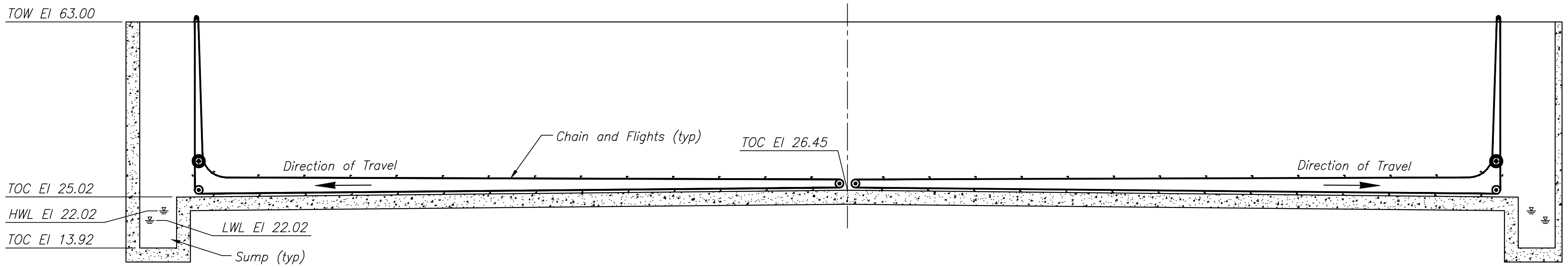
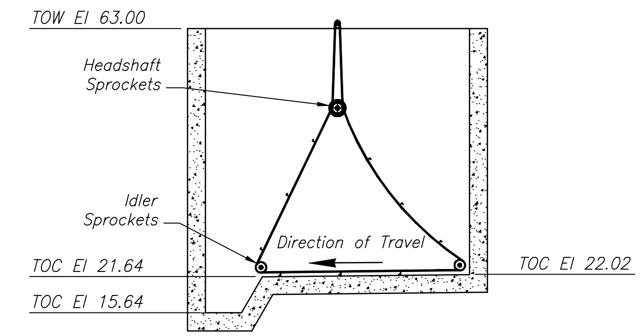
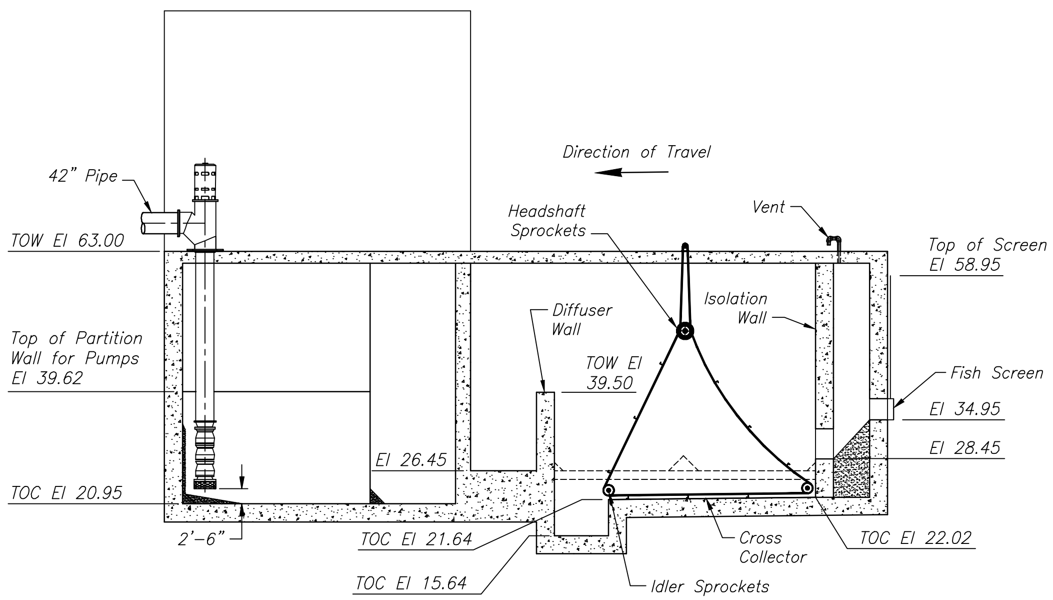


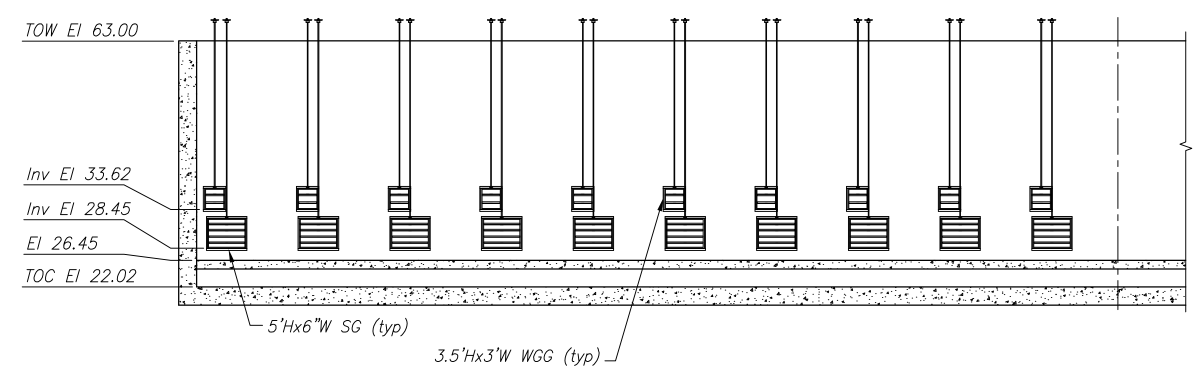
SECTION A M-1
SCALE: 1/16" = 1'-0"



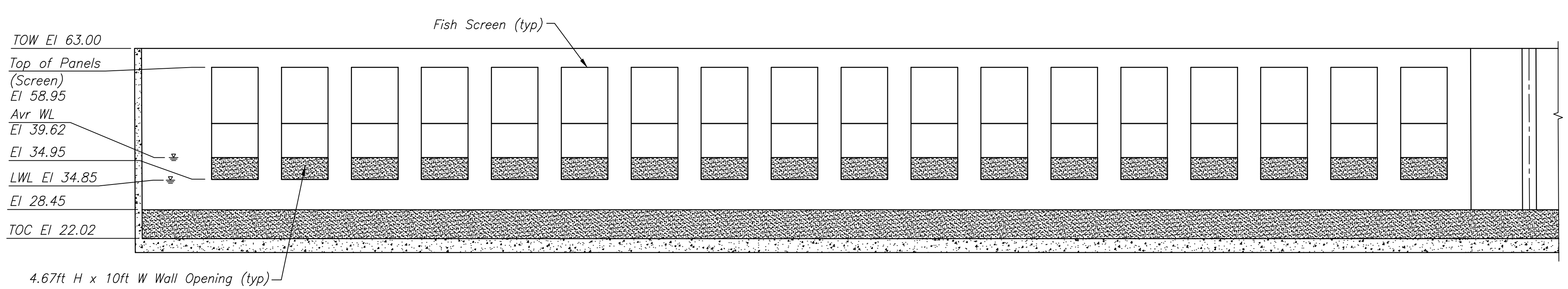
SECTION B M-1
SCALE: 1/16" = 1'-0"



SECTION C M-1
SCALE: 1/16" = 1'-0"



SECTION D M-1
SCALE: 1/16" = 1'-0"



SECTION E M-1
SCALE: 1/16" = 1'-0"

Note:

Support Piles Not Shown For Clarity

16 0 16 24 32
SCALE OF FEET

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MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
Intake Facility Layout

Date

Intake Facility Sections

M-2
SHEET 2 OF XX

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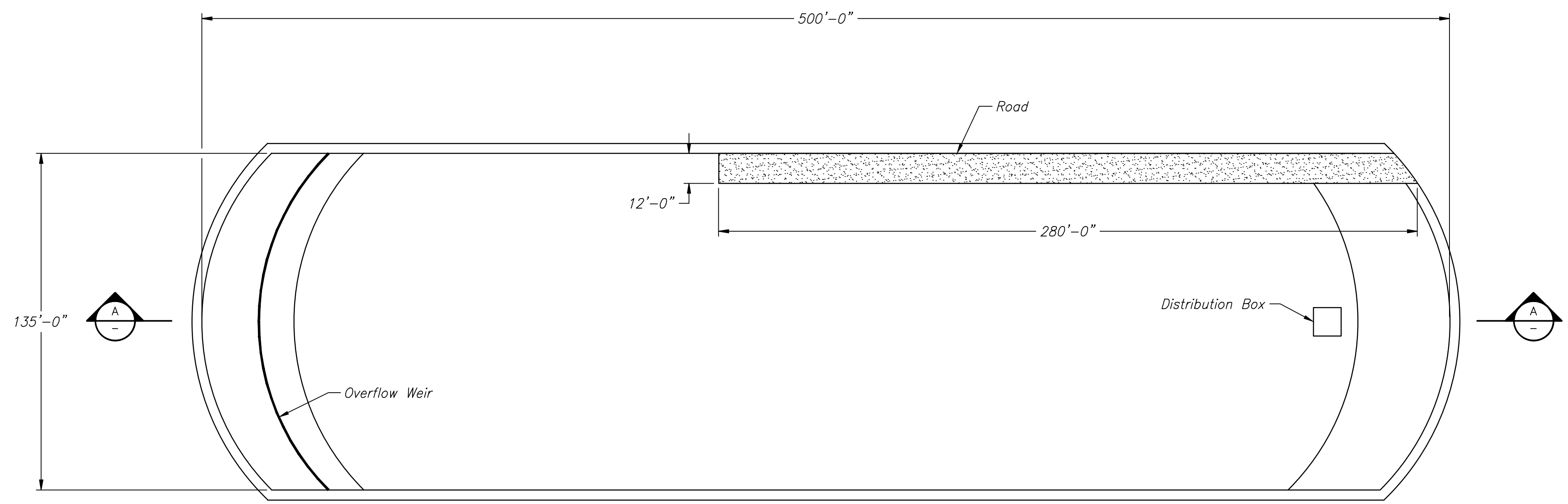
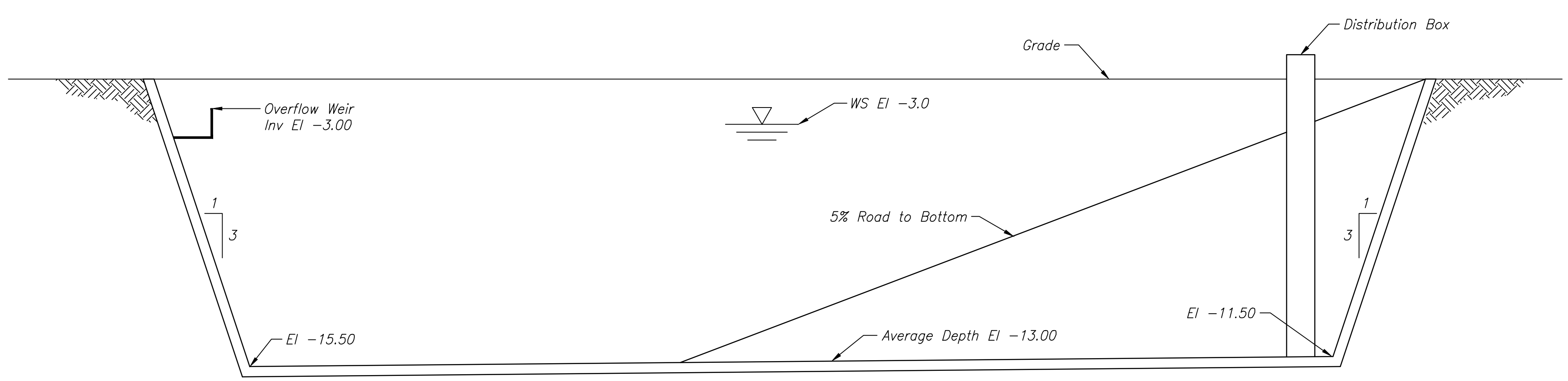
RECLAMATION
Managing Water in the West



PLAN



SECTION
SCALE: 1/32" = 1'-0"
A

32 0 32 64 94
SCALE OF FEET

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BUREAU OF RECLAMATION
MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
Intake Facility Layout

Date

Siltation Basin Layout

M-3
SHEET 3 OF XX

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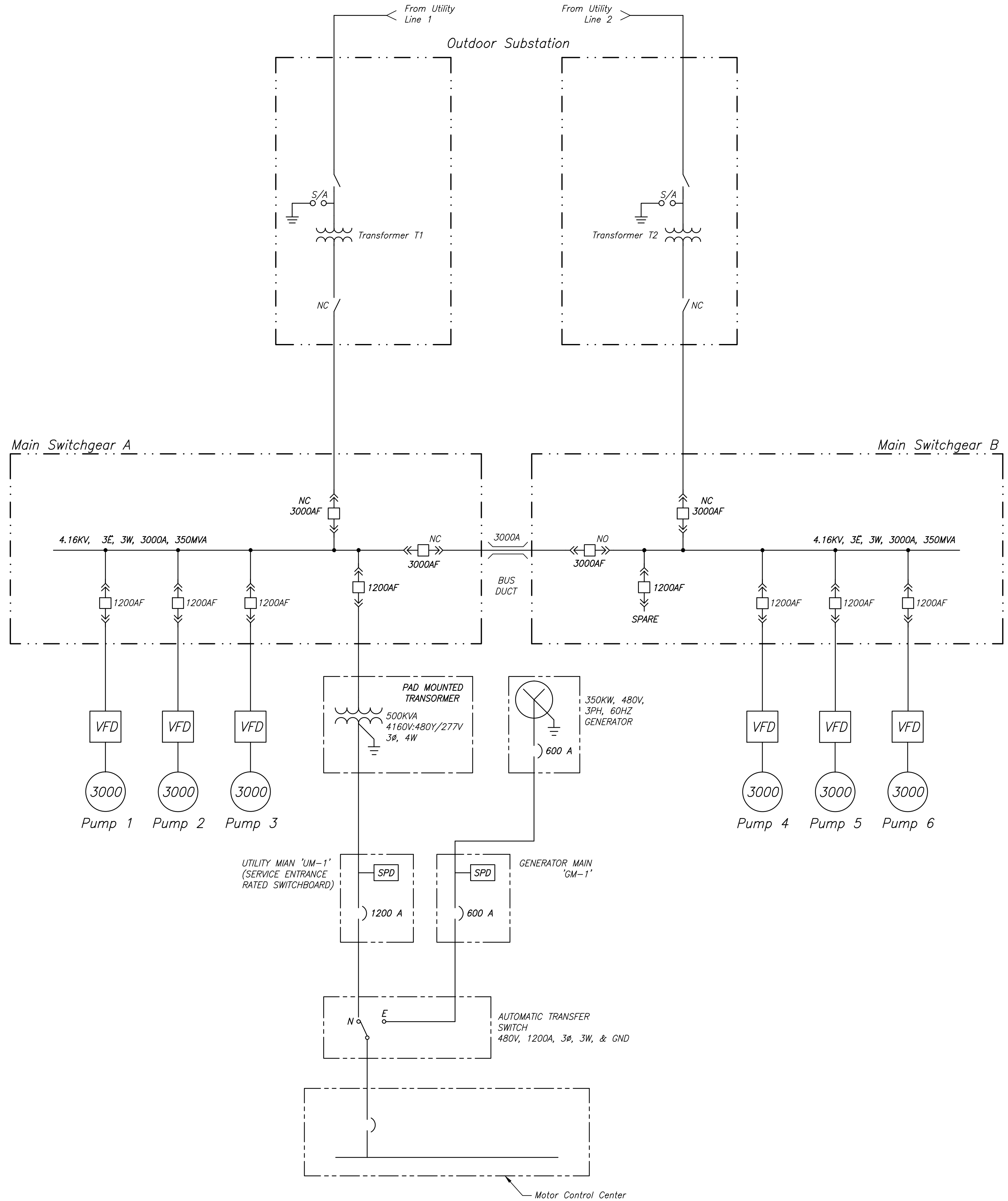

RECLAMATION
Managing Water in the West

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MID-PACIFIC REGION

SAN JOAQUIN RIVER RESTORATION PROGRAM
One Line Diagram

Date

One Line Diagram

E-1
SHEET 14 OF 14

PRELIMINARY - NOT FOR CONSTRUCTION

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Not Plotted

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CAD FILENAME
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FEATURE:

Cost Estimate
New Conveyance Facility Design
Recapture and Recirculate Alternative Analysis

8/26/2016

PROJECT:
Central Valley Project
USBR Recapture and Recirculate
San Joaquin River Restoration Program

WOID:	USBR	**ESTIMATE LEVEL:**	Preliminary
REGION:	Mid Pacific	**PRICE LEVEL:**	August 2016
FILE:	C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[SJRRP_RecapRecirc_New Conveyance Facility.9.21.2016.xls]LCC		

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
		Field Costs					
	1.00	**Site Work**					
	1.01	Clearing and Grubbing		52	AC	$ 1,123	$ 57,835
	1.02	Traffic Control - (8 Major I/S and 4 Minor I/S)		1	LS	$ 240,000	$ 240,000
	1.03	15' Wide All-Weather Access Road (3" Thick Gravel Road)		692	CY	$ 82	$ 56,728
	2.00	**Intake Facility**					
	2.01	Fish Screens - CDM designated 570 LF of Fish Screen (actual dimensions vary, includes cofferdam & dewatering, excavation)		570	LF	$ 11,045	$ 6,296,000
	2.02	Isolation Wall - CDM designated 570 LF (actual dimensions vary)		570	LF	$ 2,569	$ 1,465,000
	2.03	Sediment Basin - includes chains & flights, sludge pumps		1	LS	$ 7,083,000	$ 7,083,000
	2.04	Diffuser Wall - CDM designated 570 LF with 12" orifice holes (actual dimensions vary)		570	LF	$ 4,061	$ 2,315,000
	2.05	Pump Station - includes 6 pump and motors and their installation		1	LS	$ 6,679,000	$ 6,679,000
	2.06	Discharge Piping - 42" pipes to Surge Tanks and into 72" Header		1	LS	$ 1,693,000	$ 1,693,000
	3.00	**Meter Vault**					
	3.01	Meters and vault - per Magmeter includes vault		3	EA	$ 82,038	$ 247,000
	4.00	**Piping from Intake Facility to Discharge Structure to DMC**					
	4.01	Piping from Intake to Discharge (including Hwy & Canal crossing - Jack/Bore)		35,600	LF	$ 1,267	$ 45,089,000
	5.00	**Discharge structure**					
	5.01	Discharge Structure - concrete vault including baffle		1	LS	$ 118,000	$ 118,000
	6.00	**Siltation Basins – 3 basins**					
	6.01	Siltation Basins - Cost per Basin		3	EA	$ 500,440	$ 1,502,000
	7.00	**Surge Tanks – 6 tanks dimensions on design criteria table on G-3**					
	7.01	Surge Tanks - six x steel, presurized tanks		6	EA	$ 383,333	$ 2,300,000
	8.00	**Electrical building (105 ft x 40 ft)**					
	8.01	Electrical Building, including HVAC		4,200	SF	$ 110	$ 463,000
	8.02	Electrical Equipment, including Transformers, MCC, etc…		1	LS	$ 3,210,000	$ 3,210,000
	9.00	**General Conditions**					
	9.01	Misc. Utility Relocation		3.00	%	$ 78,815,000	$ 2,365,000
	9.02	Mobilization/demobilization, bonds & insurance, worker protection, miscellaneous facilities and operations, permitting		10.00	%	$ 81,180,000	$ 8,118,000
	10.00	**Field Costs & Contingency Summary**					
	10.01	Field Costs Subtotal					**$ 89,298,000**
	10.02	Field Costs Contingency		30.00	%	$ 89,298,000	$ 26,790,000
	10.03	Field & Contingency Costs Subtotal (Items 10.01 + 10.02)					**$ 116,088,000**
	11.00	**Total Field Costs**					
	11.01	Total Field Costs (Item 10.03)					**$ 116,088,000**
		Non-Contract Costs					
	103.00	**Permitting & Compliance**		**5.00**	**%**		
	103.01	All Permitting & Compliance		5.00	%	$ 116,088,000	$ 5,804,400
	105.00	**Engineering and Construction Management**		**12.00**	**%**		
	105.01	Engineering Support		7.00	%	$ 116,088,000	$ 8,127,000
	105.02	Construction Management		5.00	%	$ 116,088,000	$ 5,805,000
	107.00	**Non-Contract Costs & Contingency Summary**					

FEATURE:			PROJECT:				
		Cost Estimate **New Conveyance Facility Design** **Recapture and Recirculate Alternative Analysis** *8/26/2016*	**Central Valley Project** **USBR Recapture and Recirculate** **San Joaquin River Restoration Program**				
			WOID: USBR		**ESTIMATE LEVEL:**		Preliminary
			REGION: Mid Pacific		**PRICE LEVEL:**		August 2016
			FILE: C:\Users\parkce\Desktop\Recirculation\10percentdrawings\Costs\[SJRRP_RecapRecirc_New Conveyance Facility.9.21.2016.xls]LCC				

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE@	AMOUNT
(1.a. con	107.01	Non-Contract Costs Subtotal (Items 103.01 Through 105.02)					**$ 19,737,000**
	107.02	Non-Contract Costs Contingency		10.00	%	$ 19,737,000	$ 1,974,000
	107.03	Non-Contract & Contingency Costs Subtotal (Items 107.01 + 107.02)					**$ 21,711,000**
	108.00	**Non-Contract Costs & Contingency Summary**					
	108.01	Non-Contract Costs Subtotal (Items 101.01 Through 106.05)					**$ 21,711,000**
(3) All replaceme		**Land Acquisition Costs**					
	201.00	**,2015 fiscal year rate set by Reclamation for Federal water resource planning (Fede**		7.00	%	$ 116,088,000	**$ 8,127,000**
		Total Construction Costs					
	301.00	**Total Construction Costs**					
	301.01	Total Field Costs (Item 11.01)					**$ 116,088,000**
	301.02	Total Non-Contract Costs (Item 108.01)					**$ 21,711,000**
	301.03	Subtotal Field & Non-Contract Costs (Items 301.01 + 301.02)					**$ 137,799,000**
	301.04	Total Land Acquisition Costs (Items 201.00)					**$ 8,127,000**
	301.05	Total Construction Costs (Items 301.03 + 301.04) (rounded to thousands)					**$ 145,926,000**

Notes and Assumptions:

1 This cost estimate doesn't account for any capital cost previously invested.
2 Cost estimate based on 10% Plans.
3 Unit price comes from RS Means, supplier quotes, Caltrans and bid canvasses from similar projects.
4 This cost estimate was prepared assuming certain fittings may be welded in-lieu of flanged fittings bases on similar projects.
5 This cost estimate assumes power can be provided to site with minimal improvements.
6 The exact amount of land acquisition is not clear in the 10% plans
7 Contract Award Date and NTP dates are unknown.
8 Exact excavation quantities are uncertain as existing ground is not shown in plans
9 Assumes minor canals can be cut through and that major canals and RR will require jack/bore crossing.
10 Assumes pipeline alignment is outside of the paved area, except at road crossings and traffic control will not be required for extended reaches of shoulder closures or road closures.
11 Non Contract costs are lowered on this estimate (compared with othe alternatives) due to the overall size of the project. Larger projects require lower percentage of CM.

QUANTITIES		PRICES	
BY WR Vanderwaal	**CHECKED** A Collins	**BY** WR Vanderwaal	**CHECKED** A Collins
DATE PREPARED 8.26.2016	**PEER REVIEW** O Kubit	**DATE PREPARED** 8.26.2016	**PEER REVIEW** O Kubit

Annual Costs of Project (All costs should be in 2016 Dollars) Project: SJRRP Recapture and Recirculate - Banta Carbona ID - Expanded Existing Facilities							
	Initial Costs	Annual Costs [1]				Discounting Calculations	
		Operations	Maintenance	Replacement[2,3]	Total Costs (a) + (b) + (c) + (d)	Discount Factor[4]	Discounted Project Costs (e) x (f)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2016	145,926,000	4,720,000	1,200,000		151,846,000	1.000	**$151,846,000**
2017		4,720,000	1,200,000		5,920,000	0.966	**$5,719,000**
2018		4,720,000	1,200,000		5,920,000	0.933	**$5,523,000**
2019		4,720,000	1,200,000		5,920,000	0.902	**$5,340,000**
2020		4,720,000	1,200,000		5,920,000	0.872	**$5,162,000**
2021		4,720,000	1,200,000		5,920,000	0.843	**$4,991,000**
2022		4,720,000	1,200,000		5,920,000	0.815	**$4,825,000**
2023		4,720,000	1,200,000		5,920,000	0.787	**$4,659,000**
2024		4,720,000	1,200,000		5,920,000	0.760	**$4,499,000**
2025		4,720,000	1,200,000		5,920,000	0.734	**$4,345,000**
2026		4,720,000	1,200,000		5,920,000	0.709	**$4,197,000**
2027		4,720,000	1,200,000		5,920,000	0.685	**$4,055,000**
2028		4,720,000	1,200,000		5,920,000	0.662	**$3,919,000**
2029		4,720,000	1,200,000		5,920,000	0.640	**$3,789,000**
2030		4,720,000	1,200,000	18,335,000	24,255,000	0.618	**$14,990,000**
2031		4,720,000	1,200,000		5,920,000	0.597	**$3,534,000**
2032		4,720,000	1,200,000		5,920,000	0.577	**$3,416,000**
2033		4,720,000	1,200,000		5,920,000	0.558	**$3,303,000**
2034		4,720,000	1,200,000		5,920,000	0.539	**$3,191,000**
2035		4,720,000	1,200,000		5,920,000	0.521	**$3,084,000**
2036		4,720,000	1,200,000		5,920,000	0.503	**$2,978,000**
2037		4,720,000	1,200,000		5,920,000	0.486	**$2,877,000**
2038		4,720,000	1,200,000		5,920,000	0.470	**$2,782,000**
2039		4,720,000	1,200,000		5,920,000	0.454	**$2,688,000**
2040		4,720,000	1,200,000		5,920,000	0.439	**$2,599,000**
2041		4,720,000	1,200,000		5,920,000	0.424	**$2,510,000**
2042		4,720,000	1,200,000		5,920,000	0.410	**$2,427,000**
2043		4,720,000	1,200,000		5,920,000	0.396	**$2,344,000**
2044		4,720,000	1,200,000		5,920,000	0.383	**$2,267,000**
2045		4,720,000	1,200,000	22,348,000	28,268,000	0.370	**$10,459,000**
2046		4,720,000	1,200,000		5,920,000	0.358	**$2,119,000**
2047		4,720,000	1,200,000		5,920,000	0.346	**$2,048,000**
2048		4,720,000	1,200,000		5,920,000	0.334	**$1,977,000**
2049		4,720,000	1,200,000		5,920,000	0.323	**$1,912,000**
2050		4,720,000	1,200,000		5,920,000	0.312	**$1,847,000**
2051		4,720,000	1,200,000		5,920,000	0.301	**$1,782,000**
2052		4,720,000	1,200,000		5,920,000	0.291	**$1,723,000**
2053		4,720,000	1,200,000		5,920,000	0.281	**$1,664,000**
2054		4,720,000	1,200,000		5,920,000	0.272	**$1,610,000**
2055		4,720,000	1,200,000		5,920,000	0.263	**$1,557,000**
2056		4,720,000	1,200,000		5,920,000	0.254	**$1,504,000**
2057		4,720,000	1,200,000		5,920,000	0.245	**$1,450,000**
2058		4,720,000	1,200,000		5,920,000	0.237	**$1,403,000**
2059		4,720,000	1,200,000		5,920,000	0.229	**$1,356,000**
2060		4,720,000	1,200,000	18,335,000	24,255,000	0.221	**$5,360,000**
2061		4,720,000	1,200,000		5,920,000	0.214	**$1,267,000**
2062		4,720,000	1,200,000		5,920,000	0.207	**$1,225,000**
2063		4,720,000	1,200,000		5,920,000	0.200	**$1,184,000**
2064		4,720,000	1,200,000		5,920,000	0.193	**$1,143,000**
2065		4,720,000	1,200,000		5,920,000	0.186	**$1,101,000**
Total Present Worth of Discounted Costs (Sum of column (g))							**$313,550,000**

Comments:

(1) The incremental change in O&M and replacement costs attributable to the project

(1.a.) Operation costs include the electrical costs of running the pumps as listed below at $.18/KWH plus a 25% contingency.

BC Adding 5 Pumping Plants, 5 pumps each			
Pump #	Flow (CFS)	Estimated TDH	Horsepower
# 1	83	230.15	2750.0 hp
#2	83	230.15	2750.0 hp
#3	83	230.15	2750.0 hp
#4	83	230.15	2750.0 hp
#5	83	230.15	2750.0 hp
#6	83	230.15	2750.0 hp
	498	**Total**	**16500.0 hp**

(1.a. cont.) The power requirements are computed as follows =(16,500 hp) x (0.746 kW / hp) x (71 days / year) x (24 hrs / day) x ($0.18 / kW-hr) x 1.25 = $4,719,271
Average electric rate calculated from PG&E Small Agricultural Rate running 24 hours/day, 7 days a week for 365 days during the year during the highest flow period of the wet restoration year type

(1B) Annual Maintenance costs** are: Fish Screen = $6,296,000 * 1.5% ($94,440), Pipeline = $45,089,000 * 1.5% ($676,335), Pumping Plant Manifold = $8,372,000 * 1.5% ($125,580) & Electrical motors, controls & connections = $3,210,000 * 2% ($64,200) the sum = $960,555 (then multiply by 25%) = $1,201,000

(2) Replacement costs are the costs to replace the equipment with a 25% contingency not including engineering, or construction management, mobilization and demobilization, or land grading

(3) All replacement intervals are modified replacement intervals from Table 3.1, 1981 printing of the American Society of Agricultural Engineers, "Design and Operation of Farm Irrigation Systems" by Jensen. The intervals are modified to meet local conditions and professional experience

(4) Estimated Discount Rate 3.375% ,2015 fiscal year rate set by Reclamation for Federal water resource planning (Federal Register, Vol.79, No.248)

(5) Costs from the Engineers Opinion of Probable Costs as follows:

Cost Item	Amount	Replacement**
Pump Plant Manifold & Discharge	$ 8,372,000	Every 15 years
Electrical Motors, Controls, Connections	$ 3,210,000	Every 30 years
Fish Screen	$ 6,296,000	Every 15 years

(this is treated the same as open farm ditches found in Jensen)

San Joaquin River Restoration Program Long-Term Recapture and Recirculation of Restoration Flows

Project Description Technical Memorandum Appendix A, Attachment 2 - Water Operations Modeling

September 2017

Table of Contents

Tables

Figures

1.0 Background and Project Description

The *Recapture and Recirculation Water Operations Modeling Appendix* (Modeling Appendix) documents the modeling approach and results from the operations modeling used in evaluating the Alternatives for the Long-term Recapture and Recirculation (R&R) of San Joaquin River Restoration Flows (Restoration Flows).

The modeling tools and assumptions used in analysis of R&R Alternatives have been described in this technical appendix. CalSim II is the primary modeling tool used in this analysis. CalSim II is a water supply operations model that includes CVP, SWP, and Friant Division water supply operations. Model results for each Alternative were compared to results of a No Action Alternative to quantify changes in water deliveries, reservoir storage levels, river flows, and CVP/SWP operations in the Sacramento-San Joaquin River Delta (Delta).

The models were not modified to ensure consistency with all contraints. For example, the models were not changed to ensure avoidance of adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP. Instead, Reclamation modeled the alternatives without all contraints to assess the level of potential impact, if any, that might occur and to use that information to further refine the alternatives developed for detailed consideration in the LTRRRF EIS/R and identify as necessary, mitigation actions to avoid these impacts.

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2.0 Water Operations Modeling

Water operations modeling is a key step in the analysis of Alternatives. This section provides a brief description of the model used to analyze Alternatives including a brief account of the assumptions and limitations.

2.1 Operations Model

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

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

2.2 CalSim II Assumptions and Limitations

There are limitations to the use of CalSim II for most projects. CalSim II is a monthly model and does not capture daily fluctuations in flow, reservoir storage, or Delta exports.

CalSim II is a simulation by optimization model of a very complex system. This complexity, combined with mathematical optimization techniques, can create relatively large differences in model results in some months or years for comparatively small differences in simulated conditions in the CVP/SWP system. These differences are more model nuance than effects of a project Alternative. Model runs in support of the EIS/R were reviewed for model nuances and in some cases adjustments were made to eliminate unrealistic differences between project Alternatives. However, there can still be differences in simulation results that are more a function of the model than expected change due to a project Alternative. Interpretation of these differences is important when reviewing results to avoid drawing erroneous conclusions.

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3.0 Alternative 1: No Action Alternative

3.1 Description

The No Action Alternative for the SJRRP Long-Term Recapture and Recirculation of Restoration Flows EIS/R reflects conditions if no further Federal action was taken to expand recapture opportunities and long-term recirculation, reuse, exchange, or transfer opportunities. Under the No Action Alternative, Restoration Flows would continue to be released from Friant Dam. These flows would move downstream through the Restoration Area, and a portion of the Restoration Flows would be recaptured within the Restoration Area and the Delta. The portion of the Restoration Flows that is not lost or captured at these locations would become Delta outflow. A detailed description of No Action Alternative can be found in Chapter 3 of the Project Description Techincal Memorandum.

No Action Alternative represents the base CVP and SWP operations and physical conditions at about year 2030. The CalSim II model is used in the analysis of the CVP and SWP operations under the different Alternatives based off a model version published by Reclamation in January, 2016. The model includes actions under the reasonable and prudent Alternatives from National Marine Fishery Service's 2009 Biological Opinion (BO) for Chinook salmon and U.S. Fish and Wildlife Service's 2008 BO for delta smelt. These assumptions are consistent with the Reclamation's 2015 Final Coordinated Long-Term Operations of the Central Valley Project and State Water Project Environmental Impact Statement (2015 LTO EIS) NAA assumptions (Reclamation 2015, Appendix 5A). A detailed list of modeling assumptions governing CVP/SWP operations is included in Attachment A.

3.2 Approach

The baseline model published by Reclamation was modified to include specific logic to account for Restoration Flows entering the Delta and to quantify the recapture of restoration water under the existing physical and regulatory constraints at the Delta export facilities. The recapture logic was based on several factors such as availability of Restoration Flows in the Delta and regulatory constraints that determines the ability to recapture Restoration Flows in the Delta. The following section presents a brief summary of these operational constraints that are built into the baseline model.

3.2.1 Delta Recapture

Recapture of the Restoration Flows in the Delta under Alternative 1 is dependent on the volume of Restoration Flows entering the Delta, physical capacity, regulations, agreements that constrain the ability of the CVP and SWP to export water, and Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP. Many of the regulatory requirements are specified in SWRCB Decision 1641. Additional regulatory requirements are specified in the United States Fish and Wildlife Service's (USFWS) biological opinion for Delta smelt, and the National Marine Fisheries Service's (NMFS) biological opinion for Chinook salmon (BiOps). Requirements listed in the BiOps tend to constrain Delta exports during spring months when Restoration Flows may be available for recapture in the Delta. Delta export capacity and regulatory requirements likely to affect recapture are summarized in the following sections.

3.2.1.1 Available Restoration Flows

The restoration releases at Friant approximates to 240,000 acre-feet annually, depending upon the water year type, with a low of 116,000 acre-feet in a critical low year and up to 672,000 acre-feet in a wet year. The volume of Restoration Flows available for recapture is limited by losses along the river. Recapture at the Delta export locations are further limited by recapture along the SJR that can vary depending on the recapture assumptions under the Alternatives. A constraint is included in each of the five Alternative models to limit the monthly Delta recapture by the available Restoration Flows in the San Joaquin River at Vernalis.

3.2.1.2 Physical Export Capacity

One constraint to recapture of Restoration Flows in the Delta is the physical capacity of CVP and SWP pumping plants. Jones Pumping Plant diversion capacity is approximately 4,600 cfs year-round. The physical capacity of Banks Pumping Plant is 10,300 cfs. U.S. Army Corps of Engineers permits to protect the navigable capacity of Delta channels typically restrict the capacity to 6,680 cfs. However, during the period of mid-December through mid-March the maximum diversion rate is increased by up to one-third of the flow of the San Joaquin River at Vernalis when San Joaquin River flow is above 1,000 cfs. Diversions are limited to 8,500 cfs during this period from mid-December through mid-March. Therefore, Restoration Flows that reach Vernalis during the period of mid-December through mid-March may increase the allowable maximum diversion at Banks Pumping Plant allowed under the U.S. Army Corps of Engineers permit. However, the Corps of Engineers permit typically does not limit Banks exports during these months. Logic for the recapture of Restoration Flows at Delta export facilities remains the same for the different Alternatives. However, export volumes vary between the Alternatives depending on the flow in the San Joaquin River at Vernalis.

3.2.1.3 SWRCB Decision 1641 E/I Ratio

In addition to the physical capacity constraints and the Corps permits on Banks pumping, there are additional regulatory restrictions on the CVP and SWP's ability to divert water from the Delta. The SWRCB issued revised Decision 1641 (D-1641) in March 2000 to implement the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. SWRCB D-1641 contains several different regulatory restrictions that can affect the ability to recapture Restoration Flows at different times of the year.

D-1641 directly limits exports from April 15 through approximately May 15 to the maximum of 1,500 cfs or the 3-day average of San Joaquin River flow at Vernalis.

Exports are also limited based on Delta inflow by the Export-to-Inflow (E/I) ratio. Combined CVP/SWP exports can be 35 percent of inflow from February through June, with potential for relaxation in February, and 65 percent of inflow from July through January. Restoration Flows that enter the Delta at times when these D-1641 conditions are limiting exports, may increase the allowable exports at Jones, Banks, or both pumping plants. Additional constraints are included in the model for each Alternative to limit the increase in allowable exports due to Restoration Flows when D-1641 E/I ratio is controlling Delta exports. Reclamation has not yet determined how the increase in allowable exports may be allocated between the CVP and SWP and among CVP contractors.

3.2.1.4 BiOps Old and Middle River Flow Requirements

The BiOps for Delta smelt and Chinook salmon in 2008 and 2009 include requirements for flows in Old and Middle rivers (OMR) in the south Delta. CVP/SWP pumping from the south Delta can create reverse, or negative flows, in Old and Middle rivers. Negative OMR flows can increase the risk of entrainment of Delta smelt and salmon in the Delta pumps. Therefore, requirements in the Delta smelt and Chinook salmon BiOps limit the magnitude of negative flows in Old and Middle rivers. Requirements in the Delta smelt BiOp can limit reverse OMR flows to between -1,250 and -5,000 cfs depending on the risk of entrainment as determined by the smelt working group. Smelt-related OMR requirements can restrict Delta exports from December through June. The salmon BiOp includes OMR flow requirements that can affect CVP/SWP operations from January through mid-June. Salmon-related OMR requirements limit negative flows between -2,500 cfs and -5,000 cfs during periods of salmon presence in the Delta.

Statistical relationships between Delta exports, San Joaquin River flow at Vernalis, and OMR flows were developed by Hutton based on observed data (Hutton, 2007). These relationships show that approximately half of any additional San Joaquin River flow can be exported without increasing negative flows in Old and Middle rivers. This means that if OMR requirements are limiting Delta exports, as is frequently the case during the December through June period, the release of Restoration Flows increase the ability to export water from the Delta by approximately half of the Restoration Flow entering the Delta. Constraints are included in the model for each Alternative to limit the recapture in at Delta export facilities by the increase in allowable exports due to Restoration Flows, when OMR flow requirements control Delta exports. Reclamation has not yet determined how the increase in allowable exports may be allocated between the CVP and SWP and among CVP contractors.

3.2.1.5 San Joaquin River Inflow-Export Ratio

The salmon BiOp also includes a restriction on Delta exports during April and May as a function of San Joaquin River flow based on the San Joaquin Valley Classification (60-20-20 Index). Table 3-1 summarizes the San Joaquin River inflow to export (I/E) ratio in the salmon BiOp.

Table 3-1. San Joaquin River Inflow to Export Ratio Specified in NMFS' Biological Opinion

San Joaquin Valley Classification	Vernalis flow: CVP/SWP combined exports
Critical	1:1
Dry	2:1
Below Normal	3:1
Above Normal	4:1
Wet	4:1

Restoration Flows in the San Joaquin River at Vernalis increase the allowable exports during April and May by up to the full amount of the Restoration Flow in critical years if San Joaquin River I/E ratio is constraining exports. Constraints are included in the model for each Alternative to limit the recapture in Delta by the increase in allowable exports due to Restoration Flows, when SJR I/E ratio controls Delta exports.

Additionally, it is also assumed that there is no recapture of Restoration Flows in the Delta when the Delta is in surplus conditions to allow for other project exports.

The restoration releases from Friant are simulated as CVP releases from storage, in terms of meeting flow obligations in the Delta under Co-ordinated Operations Agreement (COA). The Restoration Flows can support increased pumping by the CVP up to a specific limit depending on the physical capacity, regulations, and other constraints in the Delta. Reclamation has not yet determined how the increase in allowable exports may be allocated as among CVP contractors. The recapture modeling also assumes that there is no recapture of the Restoration Flows in the Delta when Friant Dam is making flood releases.

3.2.2 Results

This section presents a brief summary of the modeling results for the No Action Alternative, beginning with an analysis of monthly Restoration Flows. Figure 3-1 shows monthly average Restoration Flows for the simulation period 1922 through 2003. Restoration Flows are at the highest during the months of March and April and at the lowest during July through September. More than 50 percent of annual volume of Restoration Flow is released in March and April.

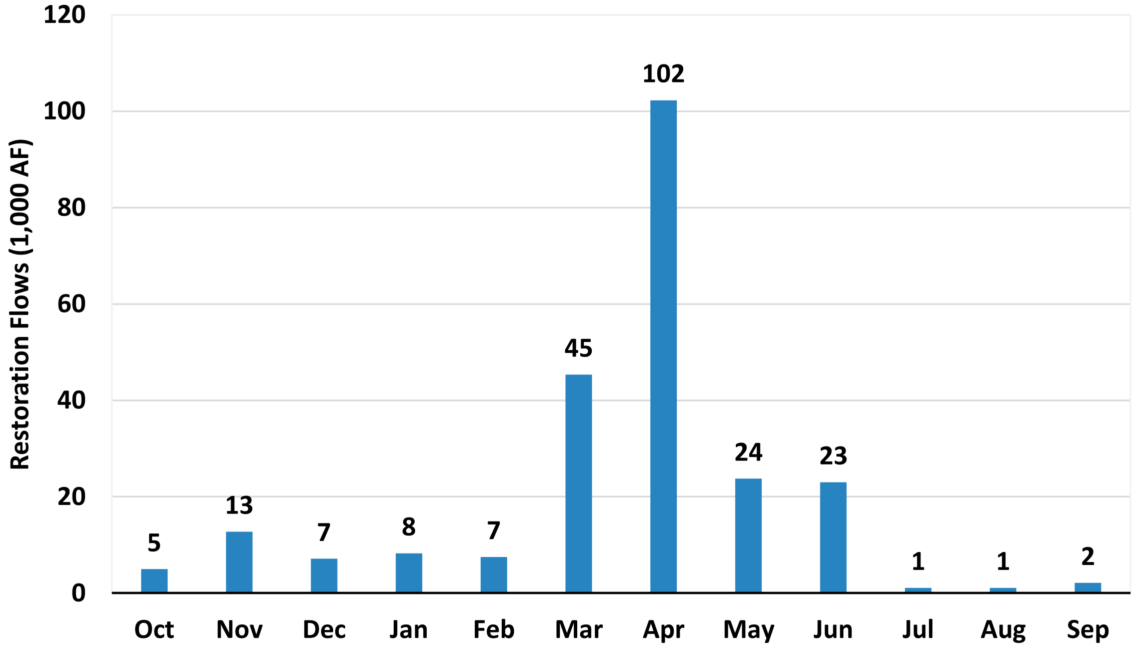

Figure 3-1.
Monthly Summary of Restoration Flows

Table 3-2 shows the contribution of Restoration Flows to the total San Joaquin River flows at Vernalis, as a flow percentage under the No Action Alternative. For example, during October of a wet year, Restoration Flow is approximately 2 percent of the San Joaquin River flow. Restoration Flows in the San Joaquin River at Vernalis range from 0 percent in July and August to a maximum of 23 percent in April under the No Action Alternative on an average basis.

Table 3-2. Percent of Restoration Flows at Vernalis under No Action Alternative

Month	Wet	Normal-Wet	Normal-Dry	Dry	Average
Oct	2%	2%	3%	4%	3%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	22[illegible]	31%	1[illegible]
[illegible]	23%	31%	25%	[illegible]	23%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 3-3 shows a monthly summary of recaptured flows under the No Action Alternative. On an annual average basis, the total recapture is nearly 64 TAF under the No Action Alternative. Maximum monthly recapture occurs during April followed by March, which corresponds to the months with the highest Restoration Flows in the river. Model results for recaptured flows provided in this attachment represent a volume of water recaptured under an alternative, and potentially available for recirculation to Friant Division contractors. The volume actually recirculated to Friant Division contractors may be less than the total recaptured flow, after consideration of Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP

Table 3-3. Monthly Summary of Recapture under the No Action Alternative

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Delta Recapture TAF	4	9	3	3	2	17	19	2	3	0	0	1	64

*Note: Delta recapture includes both SWP and CVP recapture at Banks and Jones pumping plants respectively.

Figure 3-2 shows a summary of recapture by water year type along with a summary of the Restoration Flows. During wet years, approximately 10 percent of the Restoration Flows are recaptured. The volume of water recaptured during wet years is lower than the volume of water recaptured during normal-wet, normal-dry, and dry years. During wet years, Delta export and conveyance canals are frequently operated at or near capacity to move water under Delta surplus conditions. The movement of this water limits the ability to recapture Restoration Flows in the Delta. Additionally, there is no recapture when flood releases are made from Friant dam and flood releases tend to occur more often during the wet years.

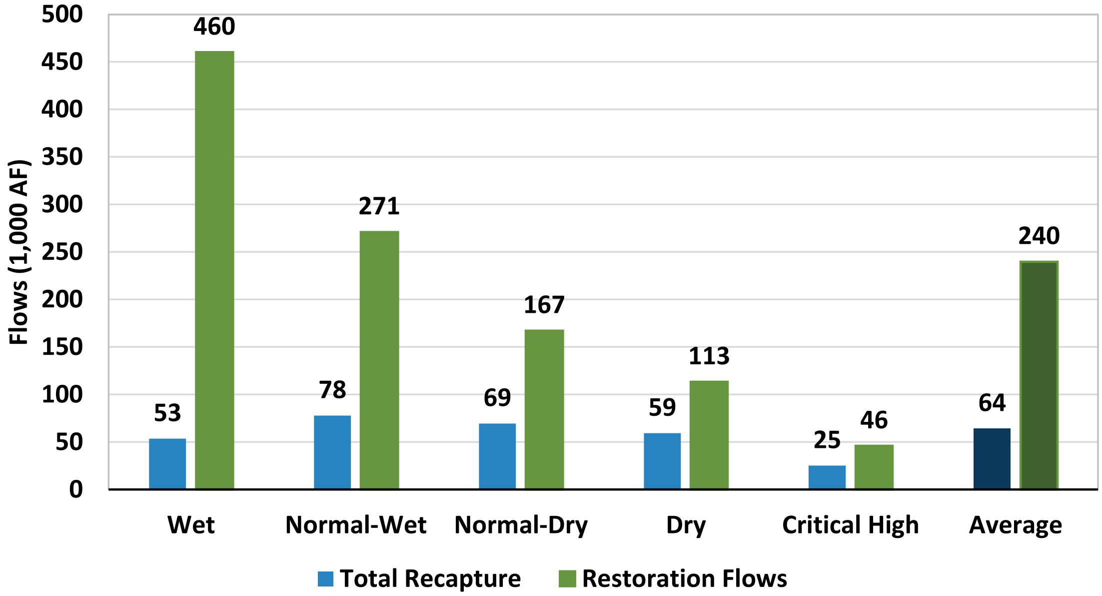

Figure 3-2.
Recapture Summary by Water Year Type under No Action Alternative

Figure 3-3 shows how the monthly recaptured volumes are always either equal to or less than the monthly available Restoration Flows.

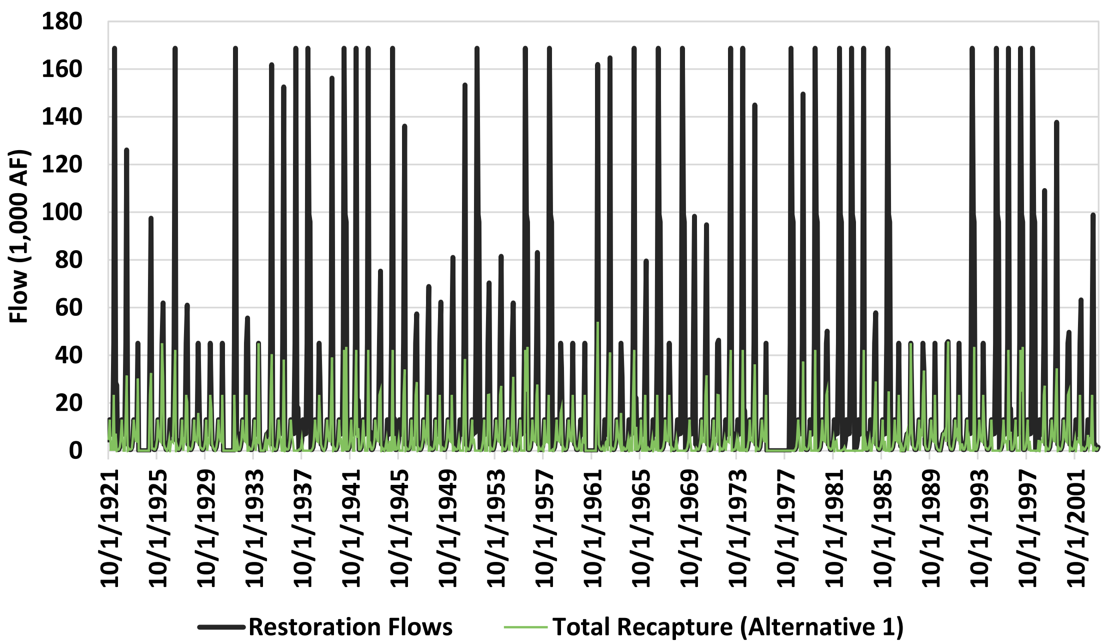

Figure 3-3.
Comparison of Restoration Flows and Recapture Volumes under No Action Alternative

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4.0 Alternative 2

4.1 Description

Alternative 2 would focus on continuing existing recapture, recirculation, and storage options. Under Alternative 2, the SJRRP would continue to recapture Restoration Flows in the Delta and the Restoration Area. Recapture would be accomplished in the same way as in the No Action Alternative, and would recapture the same amount of Restoration Flows.

The SJRRP would recirculate the water to Friant Contractors using the actions described in the Recirculation of Recaptured Water Year 2013-2017 EA. Recirculation to the Friant Contractors would be accomplished through direct delivery, exchange, and/or transfer. This could require the exchange and/or transfer of recaptured Restoration Flows among Friant Contractors or non-Friant Contractors.

Alternative 2 would include direct deliveries of recirculation water from San Luis Reservoir to Friant Contractors through existing CVP, SWP, and local facilities. Restoration Flows could be delivered to contractors with access to the Delta-Mendota Canal, California Aqueduct, San Luis Canal, Cross Valley Canal, or the southern portion of the Friant-Kern Canal (FKC) that can be accessed using the pump-back in the Friant-Kern Canal. Direct delivery could be made to the following districts: Shafter Wasco Irrigation District, Arvin-Edison Water Storage District, Southern San Joaquin Municipal Utility District, Delano-Earlimart Irrigation District, Lower Tule River Irrigation District, Saucelito Irrigation District, Terra Bella Irrigation District, Tea Pot Dome Water District, and Porterville Irrigation District.

4.2 Approach

As described earlier, the recapture analysis for Alternative 2 is performed in the same way as in the No Action Alternative and contains the same assumptions as the No Action Alternative. The difference between the No Action Alternative and Alternative 2 is in the recirculation of the recaptured Restoration Flows in the Delta. The No Action Alternative assumes no recirculation whereas Alternative 2 would recirculate the water. The following section explains how the recirculation was performed.

4.3 Recirculation Model

A monthly time-step spreadsheet model was developed to simulate surface water operations in portions of the CVP and SWP to evaluate opportunities to recirculate recaptured water to the Friant Division with Friant-Kern Canal pump-back capacity. The spreadsheet model was developed with a combination of historical data, contract provisions, and CalSim II simulation results. Recirculation is assumed to be dependent on the following factors:

- Monthly estimates of total available recaptured water which is the sum of monthly Delta recapture and recapture along the San Joaquin River.
- Available capacity to store water in San Luis Reservoir if the recaptured water cannot be directly delivered to Friant contractors.
- Available capacity in the California Aqueduct, Cross Valley Canal, Arvin-Edison Intertie, and Friant-Kern Canal pump-back.
- Recapture water delivered to contractors that have access to the DMC, California Aqueduct, San Luis Canal, CVC, or the southern portion of the Friant-Kern Canal that can be accessed using the pump-back facility. (Shafter Wasco ID, Arvin-Edison WSD, Southern San Joaquin Municipal Utility District, Delano-Earlimart ID, Lower Tule River ID, Saucelito ID, Terra Bella ID, Tea Pot Dome WD, and Porterville ID.
- Monthly Class 1 and Class 2 deliveries to the above listed Friant contractors

Outputs from CalSim II model include monthly estimates of recapture in the Delta and/or along the lower San Joaquin River. Recaptured water is then simulated as routed to the Friant contractors using the recirculation model. The spreadsheet model layers FKC pump-back operations on CalSim II results for different project alternatives. The spreadsheet model includes the limitations associated with each component and simulates FKC pump-back operations to quantify water deliveries to the Friant Division. The following sections describe key assumptions and model operations for the key components.

4.3.1 Integrated Operations with San Luis Reservoir

The time-series of recaptured, available water was input to the spreadsheet model to evaluate additional constraints on available conveyance capacity and demand for water within the Friant Division. The spreadsheet model delivers available water when supply, demand, and conveyance capacity align on a monthly time-step; i.e. water is available in a month when there is capacity to move it to meet a demand within the Friant Division. In months when there is available water but either no available conveyance capacity or demand it may be possible to use available storage capacity in San Luis Reservoir to hold and re-time recaptured water until there is both available conveyance capacity and demand within the Friant Division. The use of available San Luis Reservoir capacity increases the ability to re-circulate SJRRP flows back to the Friant Division. Additionally, the use of San Luis Reservoir may help reduce the significance of the uncertainty surrounding the timing of when recirculated SJRRP flows would be available and the limitations of the current method to estimate these flows.

San Luis Reservoir is a joint facility of both the CVP and SWP with a total capacity of 2.04 million acre-feet. The CVP portion of San Luis Reservoir is approximately 972 thousand acre-feet (TAF) with the SWP operating the remaining capacity. The spreadsheet model uses CalSim II simulation results of San Luis Reservoir storage to determine available storage capacity for each project Alternative. Available storage capacity is calculated as the difference between maximum physical capacity and simulated monthly storage. For this analysis, it was assumed that recaptured SJRRP flows could be stored in available San Luis Reservoir capacity for both the CVP and SWP. Figure 4-1 illustrates the average monthly CVP and SWP storage in San Luis Reservoir, the total reservoir capacity, and the available storage capacity.

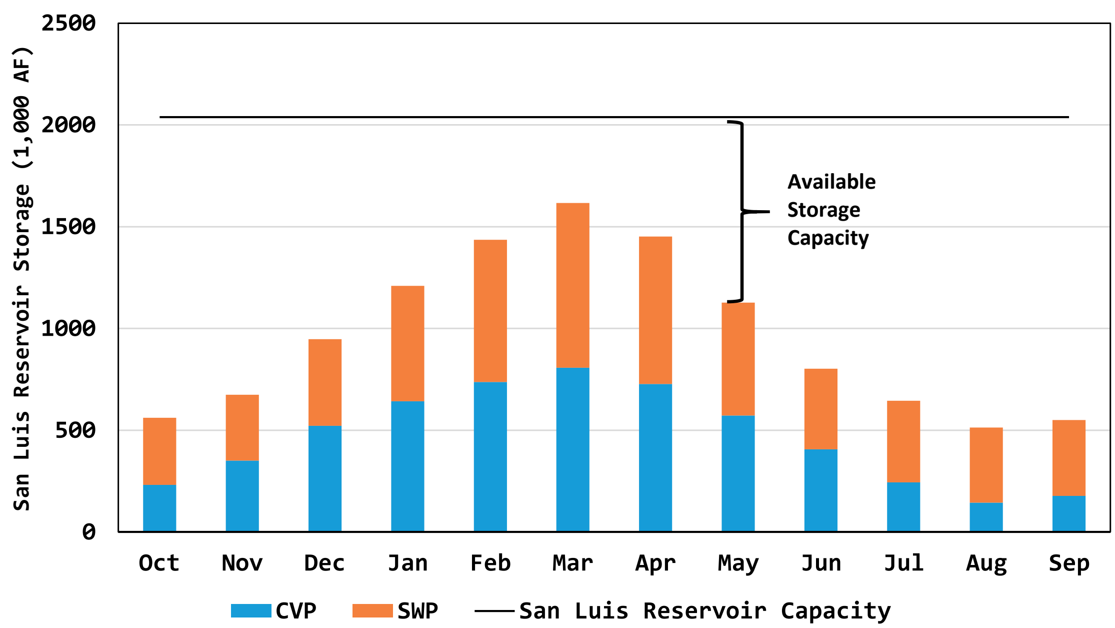


Figure 4-1.
Average Monthly San Luis Reservoir Available Storage Capacity

Recaptured water can be stored in San Luis Reservoir until it is possible to deliver the water to the Friant Division. The spreadsheet model attempts to deliver the water as soon as there is available conveyance capacity and demand. Recaptured water held in San Luis Reservoir has the potential to spill if not delivered. The spreadsheet model simulates this operation wherein recaptured water is lost if CVP and SWP baseline operations fill San Luis Reservoir. Review of CalSim II simulated CVP and SWP storage levels in San Luis Reservoir under the No Action Alternative indicate that there is available storage capacity in San Luis Reservoir in more than 85 percent of the years. Figure 4-2 shows an exceedance probability plot of annual high point in San Luis storage.

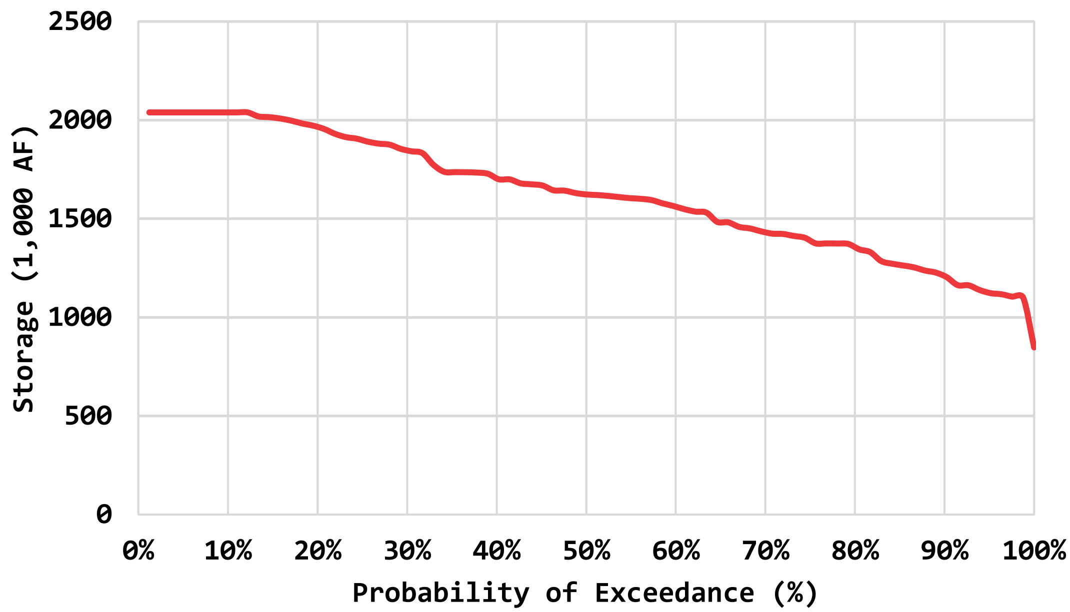


Figure 4-2.
Annual Maximum Total San Luis Storage

4.3.2 Available Conveyance Capacity

The ability to deliver available recaptured water to the Friant Division is constrained at times by available conveyance capacity, including FKC pump-back capacity. The spreadsheet model calculates available conveyance capacity to move water south from San Luis Reservoir through the California Aqueduct and into the Friant Division. Water can move from the California Aqueduct east into the Friant Division by several routes. FKC pump-back analysis considers two routes to convey water: 1) directly from the California Aqueduct into Arvin-Edison Water Storage District (WSD) through an intertie pipeline that connects the California Aqueduct and the Arvin-Edison WSD South Canal, and 2) the Cross Valley Canal (CVC) that connects the California Aqueduct to the northern portion of Arvin-Edison WSD and the terminus of the FKC. Water that will be pumped back up the FKC must move through the CVC into the FKC.

Available capacity is defined as the difference between the physical capacity and the existing water deliveries. The spreadsheet model is used to calculate the available capacity on a monthly time-step for each conveyance route based on operational outputs for the different project Alternatives. The following sections describe assumptions for physical capacity, existing water deliveries, and resulting available capacity for each conveyance facility.

4.3.3 California Aqueduct

The spreadsheet model calculates the available capacity in the California Aqueduct from below the Joint Use Reach to the CVC turnout. This reach is typically the location of capacity constraints on the California Aqueduct, though capacity in this reach rarely constrains the ability to re-circulate water to the Friant Division. The physical capacity of the California Aqueduct in this reach ranges from 8,100 cfs to 5,950 cfs. Existing water deliveries for the project Alternatives in this reach were taken from their respective CalSim II simulations and are primarily a function of SWP operations. Table 4-1 provides the average, maximum, and minimum monthly available capacity in the California Aqueduct to re-circulate water to the Friant Division.

Table 4-1. Estimated Available Capacity in the California Aqueduct (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	187	168	228	299	255	263	241	212	178	154	136	148
Maximum	317	323	337	360	333	349	332	309	288	294	292	280
Minimum	87	0	15	36	33	36	160	98	54	57	10	58

4.3.4 Cross Valley Canal

The Cross Valley Canal connects the California Aqueduct with the southern end of the FKC. The CVC is used to move water both east and west depending on the availability of supplies from the Friant Division, the Kern River, and the SWP. CVC capacity was expanded in the mid-2000's to increase west-to-east conveyance capacity to 1,400 cfs, and east-to-west conveyance capacity to approximately 700 cfs. For this analysis, water is only moved from west-to-east, i.e. from the California Aqueduct toward the FKC. Transfers from the CVC into the FKC are limited to 500 cfs through the use of a 500 cfs bi-directional intertie. The CVC also connects to the Arvin-Edison WSD Canal through a 400 cfs intertie.

The existing use of the CVC is dependent on many factors mostly related to the availability of water from various sources. For example, if surplus flows are available from the FKC or the Kern River the CVC is typically used to convey water from Bakersfield to recharge locations west of the City. If surplus water is available from the SWP (Article 21), water is moved from the California Aqueduct east to recharge locations. At times water may be moving in both directions from the east and west ends of the CVC to turnouts in the middle of the canal. Conversely, during periods of limited water supplies from the Friant Division or the SWP, water may be moved from the middle of the canal in either or both directions.

For modeling purposes the quantity and direction of flow in the CVC is based on FKC delivery of uncontrolled flows as simulated in CalSim II, historical availability of Kern River flows, CalSim II results for availability of SWP Article 21 water, and groundwater pumping determined as a function of SWP allocation from CalSim II. These factors can vary significantly throughout the year and from one year to the next. Table 4-2 provides the average, maximum, and minimum monthly available capacity in the CVC for moving water west-to-east to facilitate FKC pump-back operations.

Table 4-2. Estimated Available Capacity in CVC (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	53	51	53	52	40	22	24	21	16	18	28	48
Maximum	61	59	61	61	57	56	49	51	39	31	46	59
Minimum	15	15	15	10	0	0	0	0	0	0	10	29

4.3.5 Arvin-Edison WSD Intertie Pipeline

Arvin-Edison WSD has a bi-directional intertie pipeline between their South Canal and the California Aqueduct. Because this analysis is focused on the ability to re-circulate water west-to-east from the California Aqueduct to Arvin-Edison WSD, only the capacity into Arvin-Edison WSD is considered. The capacity of the intertie pipeline in this direction is 125 cfs. Assumptions regarding Arvin-Edison WSD's existing use of the intertie pipeline were developed from conversations with the District engineer. The monthly average physical capacity, district use, and available capacity is presented as Table 4-3. This monthly pattern of available capacity is assumed in each year of the simulation.

Table 4-3. Physical Capacity, Existing Use, and Available Capacity of Intertie Pipeline (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Physical Capacity	7.7	7.4	7.7	7.7	6.9	7.7	7.4	7.7	7.4	7.7	7.7	7.4
Existing Use	2.0	0.0	0.0	3.0	3.0	1.0	1.0	2.0	2.0	2.0	3.0	3.0
Available Capacity	5.7	7.4	7.7	4.7	3.9	6.7	6.4	5.7	5.4	5.7	4.7	4.4

Re-circulated water can be delivered to Arvin-Edison WSD either through the intertie pipeline or the CVC. In either case, FKC pump-back is not required.

4.3.6 Friant-Kern Canal Pump-back

Water can be delivered to Friant districts near the southern end of the FKC by pumping back up the canal over the lower check structures. Facilities currently exist to move water into the FKC from the CVC and pump water over the Shafter Wasco and Poso Creek check structures at approximately 80 and 50 cfs, respectively. This analysis assumes that operations on other reaches of the FKC could be adjusted to meet all canal demands with a portion of the demand being met from pump-back operations. Table 4-4 presents the pump-back capacity data used in the recirculation calculation.

Table 4-4. Friant-Kern Canal Pump-back Capacities

Section	Pump-back Capacity (cfs)
CVC to FKC (Kern check)	500
Shafter	200
Poso Creek	150
Reservoir Check	75
Deer Creek	75

4.3.7 Demand for Recirculated Water

The final component of the analysis is the demand for water by Friant contractors that can be served from the California Aqueduct, CVC, and FKC through pump-back. Recirculated water can be delivered throughout the Arvin-Edison WSD through a combination of the CVC and intertie pipeline with the California Aqueduct, without FKC pump-back. In addition to Arvin-Edison WSD, all or a portion of three other Friant contractors can be served through either existing or proposed FKC pump-back facilities. Other Friant contractors that can currently receive recirculated water include Shafter-Wasco Irrigation District (SWID) and a portion of Southern San Joaquin Municipal Utilities District (SSJMUD). The remainder of SSJMUD and a portion of Delano Earlimart Irrigation District (DEID) could receive recirculated water through proposed FKC pump-back facilities. The spreadsheet model attempts to deliver water to these contractors under Class 1 and Class 2 contracts. Additionally, the model assumes that there is no delivery of recirculated water to Friant contractors when Friant Dam is making releases for flood control.

4.3.8 Delivery Priorities

The spreadsheet model attempts to deliver available water back to the Friant Division by a set of assumed priorities for the use of available conveyance routes. Conveyance priorities are determined in an attempt to minimize the cost of delivering water by minimizing the required pumping. Therefore, water is first delivered to Arvin-Edison WSD through the intertie pipeline with the California Aqueduct. Second, water is delivered to Arvin-Edison WSD through the CVC. Third, water is delivered to other Friant Division contractors that can be supplied through FKC pump-back operations with an attempt to deliver to the southern-most districts first to minimize the volume of water that must be pumped. Additionally, water is delivered first to meet Class 1 and Class 2 contract deliveries that would otherwise be met directly from Friant Dam and the FKC.

4.4 Results

This section presents a brief summary of the modeling results for Alternative 2. As explained earlier, the results of recapture and other system-wide operational changes under Alternative 2 are the same as the No Action Alternative. However, Alternative 2 includes the recirculation option where the recaptured water would be directly delivered to Friant contractors through existing CVP, SWP, and local facilities. Model results for recaptured flows provided in this attachment represent a volume of water recaptured under an alternative, and potentially available for recirculation to Friant Division contractors. The volume actually recirculated to Friant Division contractors may be less than the total recaptured flow, after consideration of Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP.

Table 4-5 summarizes direct delivery of recaptured Restoration Flows under Alternative 2. On an annual average basis, almost all of the recaptured water can be delivered to the Friant contractors using existing facilities. Table 4-5 indicates the average direct delivery volume could be greater than the recaptured volume in a given year type. For example, the total recapture under Alternative 2 during wet years is 53

TAF, whereas the recirculated volume is 57 TAF which is 4 TAF greater than the recaptured volume. This difference is due to the carryover of stored Restoration Flows in San Luis Reservoir from previous years of different year type. The recirculation analysis does not consider any losses of stored Restoration Flows either due to evaporation or other conveyance losses.

Table 4-5. Summary of Recirculation under Alternative 2

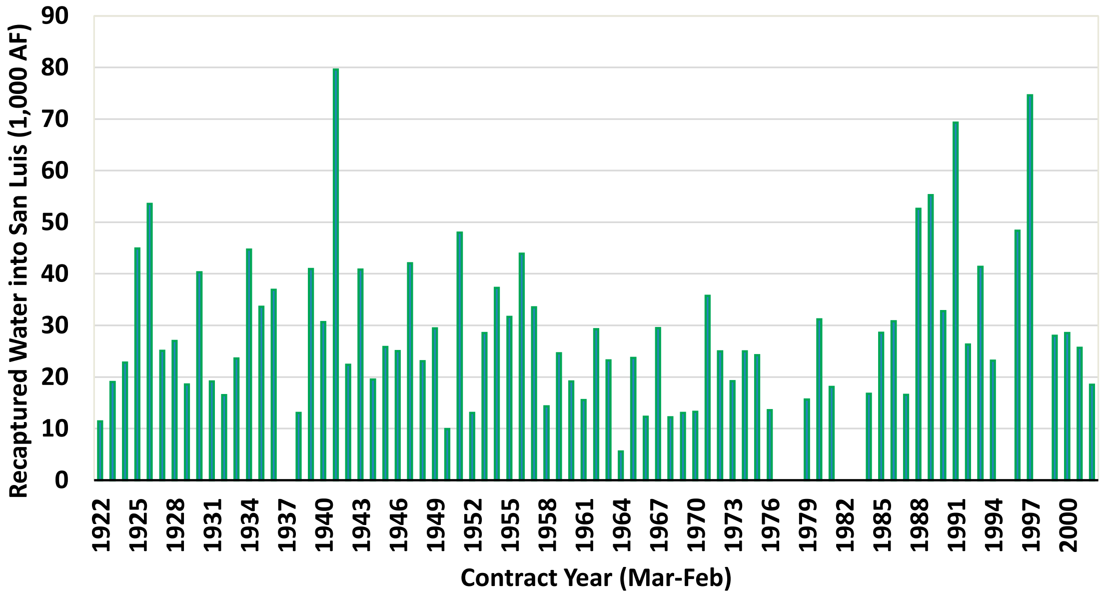
	All Years	Wet	Normal-Wet	Normal-Dry	Dry	Critical High	Critical Low
Total Recapture	**64**	**53**	**78**	**69**	**59**	**25**	**0**
Arvin Edison WSD	32	42	47	23	15	5	0
Shafter Wasco ID	12	5	11	18	13	6	0
South San Joaquin Municipal Utility District	12	5	11	17	16	9	0
Delano - Earlimart ID	5	3	5	7	8	7	0
Saucelito ID	1	0	0	1	1	1	0
Tea Pot Dome WD	0	0	0	0	0	0	0
Lower Tule River ID	1	1	1	1	1	1	0
Terra Bella ID	1	1	1	1	2	2	0
Porterville ID	0	0	0	0	0	0	0
Total Direct Delivery	**64**	**57**	**76**	**68**	**56**	**31**	**0**
San Luis Reservoir Spills	0	1	1	0	0	0	0

*Note: Total recapture refers to recapture at Jones Pumping Plant (CVP) and Banks Pumping Plant (SWP)

Total direct delivery is the sum of deliveries to the various Friant contractors listed in the Table.

Figure 4-3 shows the annual volume of recaptured Restoration Flows stored in San Luis Reservoir. Results show the volume of Restoration Flows pumped into San Luis Reservoir ranges from 0 TAF to 80 TAF with an average of nearly 26 TAF. Recaptured Restoration Flows are stored in San Luis only when there is no potential for direct delivery to Friant contractors. Water stored in San Luis may be delivered immediately or after few months depending on demand and other factors.

1



2

3 **Figure 4-3.**

4 **Annual Volume of Restoration Flows Stored in San Luis Reservoir**

5

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5.0 Alternative 3

5.1 Description

Alternative 3 would focus on increasing the volume of water recaptured and recirculated by including additional recapture locations. These new options would use existing facilities and would not involve new or expanded facilities. Under Alternative 3, the SJRRP would continue to recapture Restoration Flows in the Delta and the Restoration Area, as described for Alternatives 1 and 2. In addition, the SJRRP would recapture flows from the San Joaquin River using local diversion facilities at West Stanislaus Irrigation District, Patterson Irrigation District, and Banta-Carbona Irrigation District and the wildlife refuges. This alternative does not include any additional improvements to these facilities to increase capacity, but it does assume completion of the new fish screen that West Stanislaus Irrigation District is planning independently.

Diversion at these facilities would increase the amount of Restoration Flows that could be recaptured compared to Alternatives 1 and 2. Thus Alternative 3 is similar to Alternatives 1 and 2 except that Alternative 3 would include additional recapture along the San Joaquin River below the confluence with Merced River. Recapture of Restoration Flows along the San Joaquin River under these Alternatives is assumed to be dependent on the following factors:

1. Available physical capacity to move Restoration Flows from SJR to Delta Mendota Canal (DMC).
2. Available capacity in the DMC to convey water to O'Neill Forebay.

Table 5-1 shows the available capacities for recapture along the three San Joaquin districts under existing conditions.

Table 5-1. Capacity for Recapture along the San Joaquin River under Alternative 3

Month	Patterson Irrigation District (cfs)	West Stanislaus Irrigation District (cfs)	Banta-Carbona Irrigation District (cfs)	Total (cfs)
Oct	25	120	90	235
Nov	38	120	90	245
Dec	15	120	90	225
Jan	14	120	90	224
Feb	16	120	90	226
Mar	38	120	60	215
Apr	99	60	60	155
May	82	40	0	75
Jun	25	0	0	25
Jul	5	0	0	5
Aug	10	10	30	50
Sep	21	60	70	151

Recirculation mechanisms for Alternative 3 are the same as Alternative 2. The only difference between Alternative 2 and 3 is the increased recapture capacity under Alternative 3.

5.2 Results

This section presents a brief summary of the modeling results for Alternative 3. Table 5-2 shows the percentage of Restoration Flows at Vernalis under Alternative 3. Restoration Flows in the San Joaquin River at Vernalis range from 0 percent in July and August to a maximum of 19 percent in April under Alternative 3, on a monthly average basis. Restoration Flows at Vernalis decrease on an average by nearly 2 percent compared with flows under the No Action Alternative.

Table 5-2. Percent of Restoration Flows at Vernalis under Alternative 3

Month	Wet	Normal-Wet	Normal-Dry	Dry	Average
Oct	1%	1%	0%	0%	0%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	16	23%	[redacted]
[redacted]	22%	29%	19%	[redacted]	19%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 5-3 shows a monthly summary of recapture volumes under Alternative 3. Table 5-3 also includes a monthly summary of recapture at the three irrigation districts (Patterson, West Stanislaus and Banta-Carbona). The highest recapture would occur at West Stanislaus Irrigation District followed by recapture of remaining Restoration Flows at the other two districts and in the Delta.Banta-Carbona Recapture at Patterson Irrigation District and West Stanislaus Irrigation District and capacity in the DMC to move the recaptured water to San Luis Reservoir in the model limits the amount of Restoration Flows that remain for potential recapture by Banta-Carbona Irrigation District. Actual operation of the alternative in the long-term could result in periods when capacity at the other diversions is not fully available and recapture by Banta-Carbona Irrigation District would occur.

Table 5-3. Monthly Summary of Recapture under Alternative 3

Month	Delta Recapture	San Joaquin River Recapture			Total Recapture
		Patterson ID	West Stanislaus ID	Banta-Carbona ID	
	TAF	TAF	TAF	TAF	TAF
Oct	1	1	2	0	4
Nov	3	1	5	0	10
Dec	1	0	3	0	4
Jan	0	1	5	0	6
Feb	0	0	3	0	4
Mar	12	1	8	0	22
Apr	16	2	9	0	27
May	1	2	2	0	4
Jun	2	1	2	0	5
Jul	0	0	0	0	0
Aug	0	0	0	0	0
Sep	1	0	0	0	1
Total	37	10	40	0	87

Note: ID= Irrigation District
Total Recapture = Delta Recapture + San Joaquin River Recapture

Figure 5-1 shows a summary of recapture by water year type compared against Restoration Flows. During wet years, approximately 15 percent of the Restoration Flows are recaptured. The volume of water recaptured during wet years is lower than the volume of water recaptured during normal-wet, normal-dry, and dry years. During wet years, the recapture and conveyance capacities are limited due to surplus flow conditions in the Delta. Additionally, there is no recapture when there is a flood release from Friant dam and flood releases tend to occur more often during wet years.

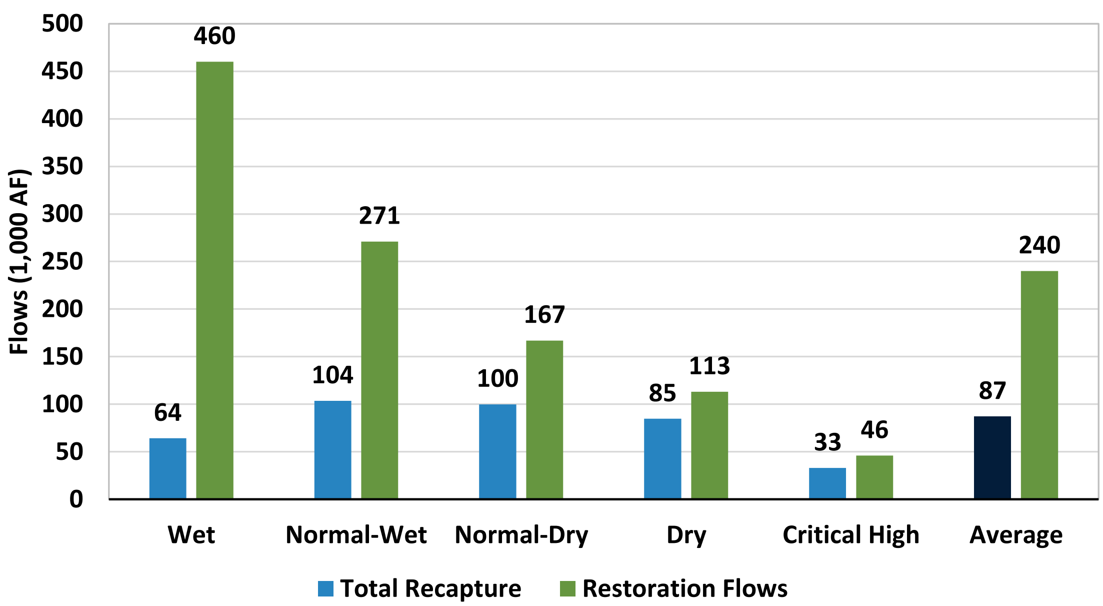

Figure 5-1.
Recapture Summary by Water Year Type under Alternative 3

Figure 5-2 shows how the monthly recaptured volumes are always either equal to or less than the monthly available Restoration Flows.

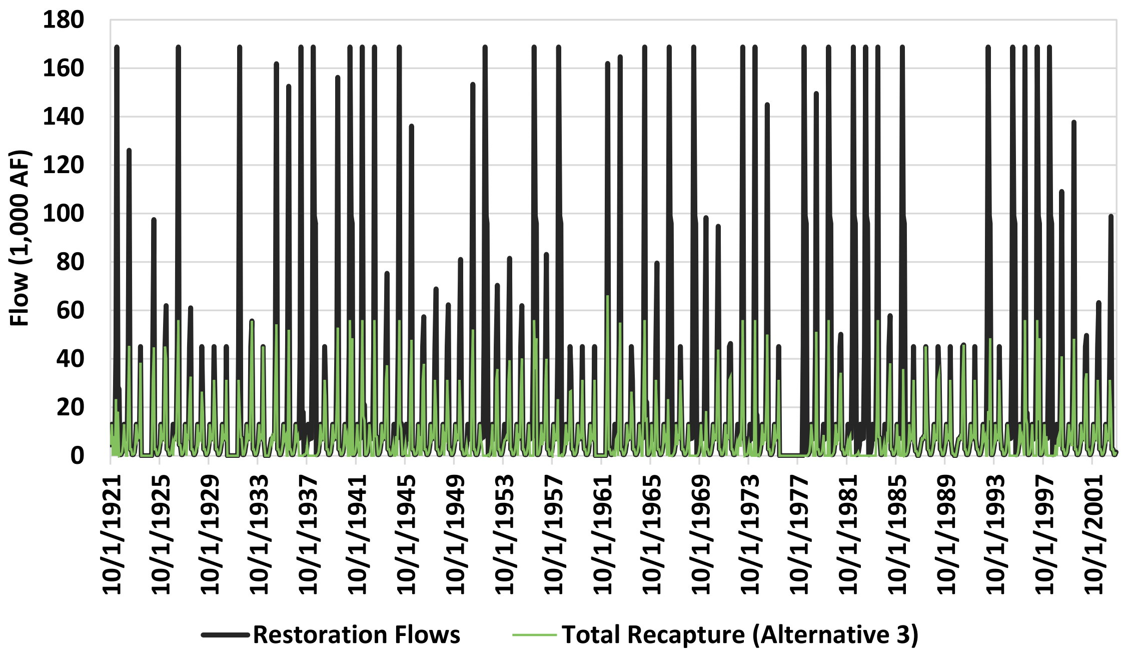

Figure 5-2.
Comparison of Restoration Flows and Recapture Volumes under Alternative 3

Model results for recaptured flows provided in this attachment represent a volume of water recaptured under an alternative, and potentially available for recirculation to Friant Division contractors. The volume actually recirculated to Friant Division contractors may be less than the total recaptured flow, after consideration of Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP.

Table 5-4 is a summary of direct delivery of recaptured restoration water under Alternative 3. On an annual average basis, nearly all the recaptured water can be delivered to Friant contractors using existing facilities. San Luis Reservoir could spill up to 1 TAF of recaptured and stored Restoration Flows on an annual average basis. Results in Table 5-4 indicate the direct delivery volumes in a given year type could be greater than the recaptured volumes. For example, the total recapture of Restoration Flows under Alternative 3 during wet years is 64 TAF, whereas the recirculated volume is 70 TAF which is 6 TAF greater than the recaptured volume. This difference is due to the carryover of stored Restoration Flows in San Luis from the previous year with a different year type. The recirculation analysis does not consider any losses of stored Restoration Flows either due to evaporation or other conveyance losses.

Table 5-4. Summary of Recirculation under Alternative 3

	All Years	Wet	Normal-Wet	Normal-Dry	Dry	Critical High	Critical Low
Total Recapture	**87**	**64**	**104**	**100**	**85**	**33**	**0**
Arvin Edison WSD	43	51	63	35	21	10	0
Shafter Wasco ID	18	7	17	28	23	11	0
South San Joaquin Municipal Utility District	16	6	14	22	21	16	0
Delano - Earlimart ID	6	4	5	7	9	9	0
Saucelito ID	1	0	0	1	1	1	0
Tea Pot Dome WD	0	0	0	0	0	0	0
Lower Tule River ID	1	1	1	1	1	1	0
Terra Bella ID	1	1	1	1	2	2	0
Porterville ID	0	0	0	0	0	0	0
Total Direct Delivery	**86**	**70**	**101**	**95**	**79**	**50**	**0**
San Luis Reservoir Spills	1	2	1	0	1	0	0

*Note: Total recapture refers to recapture at Jones Pumping Plant (CVP) and Banks Pumping Plant (SWP) and at existing facilities along the SJR
Total direct delivery is the sum of deliveries to the various listed Friant contractors listed in the Table.

Figure 5-3 show the annual volume of recaptured Restoration Flows stored in San Luis Reservoir. Results show the volume of Restoration Flows pumped into San Luis ranges from 0 TAF to nearly 100 TAF with an average of nearly 43 TAF. Restoration water is stored in San Luis only when there is no potential for direct delivery to Friant contractors. Water stored in San Luis may be delivered immediately or after few months depending on demand and other factors.

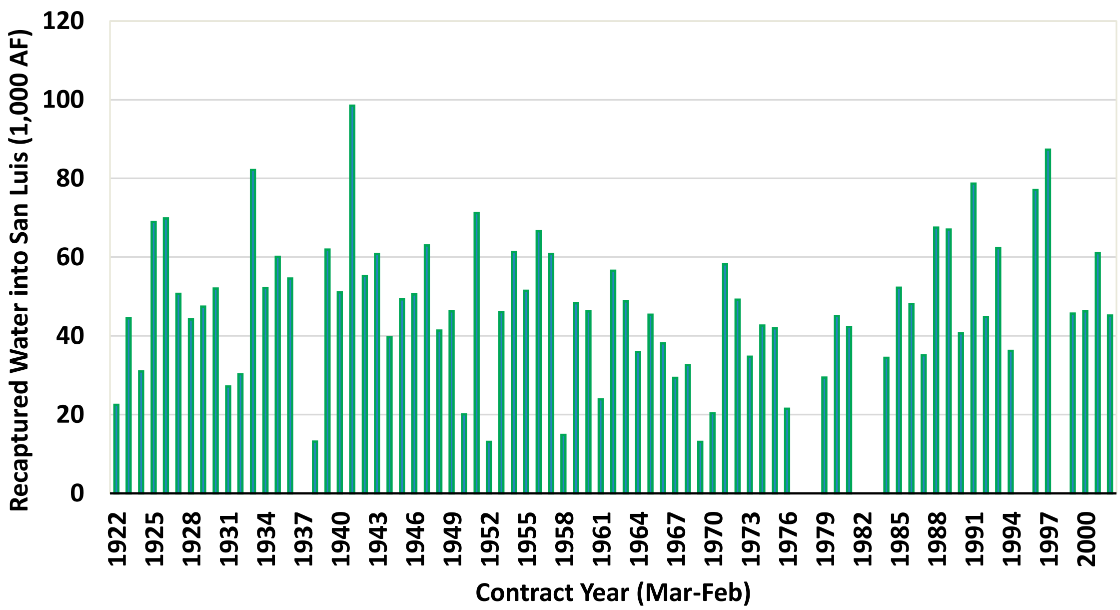

Figure 5-3.
Annual Volume of Restoration Flows Stored in San Luis Reservoir under Alternative 3

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6.0 Alternative 4

6.1 Description

Alternative 4 would increase use of existing facilities by expanding facilities to increase their ability to recapture or recirculate water. Alternative 4 also includes additional options to store water during years that San Luis Reservoir fills with CVP and SWP water supplies.

Under Alternative 4, the SJRRP would continue to recapture Restoration Flows in the Delta and the Restoration Area, as described for Alternatives 1 and 2. Additionally, the SJRRP would construct improvements to expand existing local diversion facilities at West Stanislaus Irrigation District, Patterson Irrigation District, and Banta-Carbona Irrigation District. The constructed improvements would allow additional Restoration Flows to be recaptured and conveyed to the Delta-Mendota Canal. Improved diversion facilities would increase the amount of Restoration Flows that could be recaptured compared to Alternative 3. Table 6-1 shows expanded capacities at the three districts.

Table 6-1. Expanded Capacity for Recapture along the San Joaquin River

Month	Patterson Irrigation District (cfs)	West Stanislaus Irrigation District (cfs)	Banta-Carbona Irrigation District (cfs)	Total (cfs)
Oct	45	180	150	375
Nov	58	220	180	458
Dec	35	230	180	445
Jan	34	230	180	444
Feb	36	210	180	426
Mar	58	190	100	348
Apr	119	160	70	349
May	102	120	0	222
Jun	45	40	0	85
Jul	25	80	0	105
Aug	30	10	55	95
Sep	41	120	100	261

Alternative 4 would store Restoration Flows in San Luis Reservoir and recirculate to the Friant contractors as described for the previous Alternatives.

6.2 Results

This section presents a brief summary of the modeling results for Alternative 4. Table 6-2 shows the percentage of Restoration Flows at Vernalis under Alternative 4. Restoration Flows in the San Joaquin River flow at Vernalis range from 0 percent in July and August to a maximum of 18 percent in April under Alternative 3 on a monthly average basis. Restoration Flows at Vernalis decrease on an average by nearly 2 percent based a comparison against the river flows under No Action Alternative.

Table 6-2. Percent of Restoration Flows at Vernalis under Alternative 4

Month	Wet	Normal-Wet	Normal-Dry	Dry	Average
Oct	1%	1%	0%	0%	0%

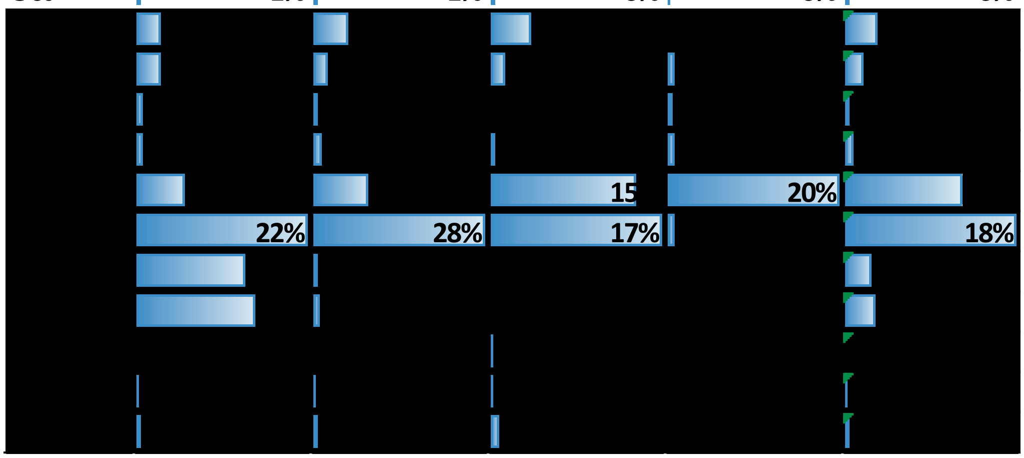

Table 6-3 in a monthly summary of recapture volumes under Alternative 4. Table 6-3 also includes a monthly summary of recapture at the three irrigation districts (Patterson, West Stanislaus and Banta-Carbona). Highest recapture would occur at West Stanislaus Irrigation District followed by recapture of remaining Restoration Flows at the other two districts and in the Delta. Most of the recapture occurs during March and April when the Restoration Flows are higher. Recapture at Patterson Irrigation District and West Stanislaus Irrigation District and capacity in the DMC to move the recaptured water to San Luis Reservoir in the model limits the amount of Restoration Flows that remain for potential recapture by the Banta-Carbona Irrigation DistrictBanta-Carbona. Actual operation of the alternative in the long-term could result in periods when capacity at the other diversions is not fully available and recapture by Banta-Carbona Irrigation District would occur.

Table 6-3. Monthly Summary of Recapture under Alternative 4

Month	Delta Recapture	San Joaquin River Recapture			Total Recapture
		Patterson ID	West Stanislaus ID	Banta-Carbona ID	
	TAF	TAF	TAF	TAF	TAF
Oct	1	1	2	0	4
Nov	3	1	5	0	10
Dec	1	1	3	0	4
Jan	0	1	5	0	6
Feb	0	1	3	0	4
Mar	10	2	10	2	24
Apr	14	5	10	2	32
May	0	2	2	0	5
Jun	2	1	2	0	5

Month	Delta Recapture	San Joaquin River Recapture			Total Recapture
		Patterson ID	West Stanislaus ID	Banta-Carbona ID	
	TAF	TAF	TAF	TAF	TAF
Jul	0	0	0	0	0
Aug	0	0	0	0	0
Sep	1	0	0	0	1
Total	33	15	43	5	95

*Note: ID= Irrigation District
Total Recapture = Delta Recapture + San Joaquin River Recapture

Figure 6-1 shows a summary of recapture by water year type compared against Restoration Flows. During wet years, approximately 15 percent of the Restoration Flows are recaptured. And the volume of water recaptured during wet years is lower than the volume of water recaptured during normal-dry and dry years. During wet years, the recapture and conveyance capacities are limited due to surplus flow conditions in the Delta. Additionally, there is no recapture when there is a flood release from Friant dam which tend to occur more often during the wet years. Figure 6-2 shows how the monthly recaptured volumes are always either equal to or less than the monthly available Restoration Flows under Alternative 4.

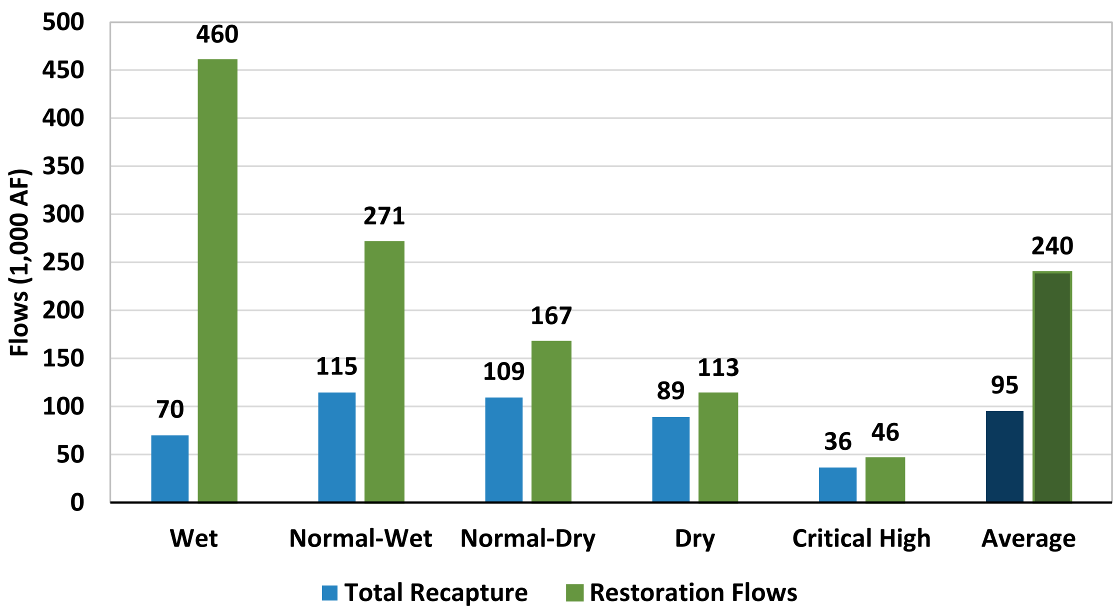

Figure 6-1.
Comparison of Restoration Flows and Recapture Volumes under Alternative 4

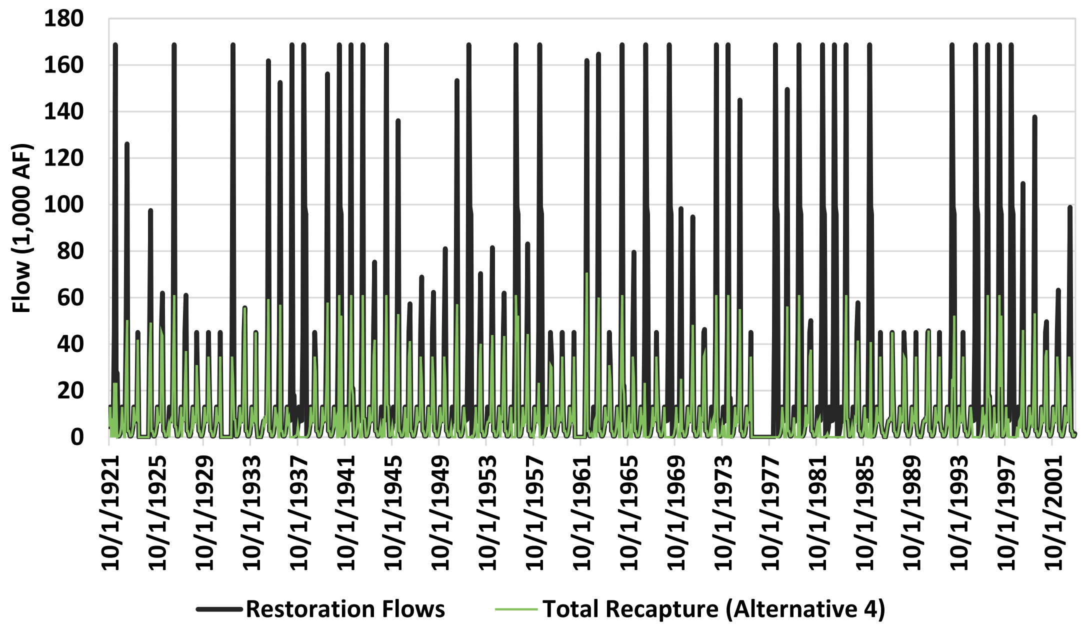

Figure 6-2.
Comparison of Restoration Flows and Recapture Volumes under Alternative 4

Model results for recaptured flows provided in this attachment represent a volume of water recaptured under an alternative, and potentially available for recirculation to Friant Division contractors. The volume actually recirculated to Friant Division contractors may be less than the total recaptured flow, after consideration of Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP.

Table 6-4 present a summary of direct delivery of recaptured restoration water under Alternative 4. On an annual average basis, nearly all the recaptured water can be delivered to the Friant contractors using the existing facilities. San Luis Reservoir could spill up to 1 TAF of the stored Restoration Flows on an annual average basis. Table 6-4 indicates that the direct delivery volumes in a given year type could be greater than the recaptured volumes. For example, the total recapture of Restoration Flows under Alternative 3 during Wet years is 75 TAF, whereas the recirculated volume is 70 TAF which is 5 TAF greater than the recaptured volume. This difference is due to the carryover of stored Restoration Flows in San Luis from the previous year with a different year type. The recirculation analysis does not consider any losses of stored Restoration Flows either due to evaporation or other conveyance losses.

Table 6-4. Summary of Recirculation under Alternative 4

	All Years	Wet	Normal-Wet	Normal-Dry	Dry	Critical High	Critical Low
Total Recapture	**95**	**70**	**115**	**109**	**89**	**36**	**0**
Arvin Edison WSD	47	54	72	38	23	10	0
Shafter Wasco ID	21	8	18	33	25	12	0
South San Joaquin Municipal Utility District	16	7	14	23	23	17	0
Delano - Earlimart ID	6	4	5	7	9	9	0
Saucelito ID	1	0	0	1	1	1	0
Tea Pot Dome WD	0	0	0	0	0	0	0
Lower Tule River ID	1	1	1	1	1	1	0
Terra Bella ID	1	1	1	1	2	2	0
Porterville ID	0	0	0	0	0	0	0
Total Direct Delivery	**94**	**75**	**112**	**104**	**84**	**53**	**0**
San Luis Reservoir Spills	1	1	2	0	1	0	0

*Note: Total recapture refers to recapture at Jones Pumping Plant (CVP) and Banks Pumping Plant (SWP) and using the expanded facilities along the SJR.
Total direct delivery is the sum of deliveries to the various listed Friant contractors listed in the Table.

Figure 6-3 shows the annual volume of recaptured Restoration Flows that is stored in San Luis Reservoir under Alternative 4. Results show that the volume of Restoration Flows pumped into San Luis ranges from 0 TAF to nearly 107 TAF with an average of nearly 49 TAF. Restoration water is stored in San Luis only when there is no potential for direct delivery to Friant contractors. Water stored in San Luis may be delivered immediately or after few months depending on demand and other factors.

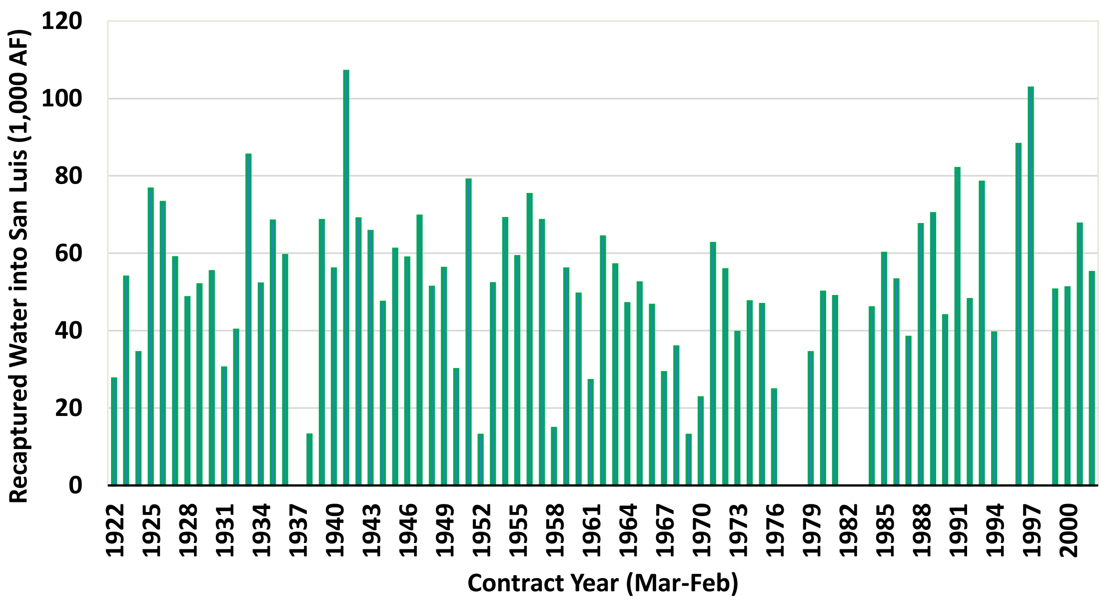

Figure 6-3.
Annual Volume of Restoration Flows Stored in San Luis Reservoir under Alternative 4

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7.0 Alternative 5

7.1 Description

Alternative 5 would construct a new recapture facility and incorporate additional storage options to maximize delivery of recaptured water. The SJRRP would construct a new diversion facility with a capacity of 500 cfs intake capacity on the San Joaquin River to recapture Restoration Flows. The facility would deliver the water to the Delta-Mendota Canal upstream from San Luis Reservoir. Alternative 5 would also include diverting Restoration Flows in the Delta and the Restoration Area, as described for Alternatives 1 and 2. The SJRRP would continue recirculation of water as described in Alternative 4.

7.2 Results

This section presents a brief summary of the modeling results for Alternative 5. Table 7-1 shows the percentage of Restoration Flows at Vernalis under Alternative 5. Restoration Flows in the San Joaquin River flow at Vernalis range from 0 percent in July and August to a maximum of 13 percent in April under Alternative 5 on a monthly average basis. Restoration Flows at Vernalis decrease on an average by nearly 3 percent based a comparison against the river flows under No Action Alternative.

Table 7-1. Percent of Restoration Flows at Vernalis under Alternative 5

Month	Wet	Normal-Wet	Normal-Dry	Dry	Average
Oct	1%	1%	0%	0%	0%

[redacted]

Table 7-2 shows a monthly summary of recapture volumes under Alternative 5. Table 7-2 also includes a monthly summary of recapture at the three irrigation districts (Patterson, West Stanislaus and Banta-Carbona). Highest recapture would occur at the new intake. Delta recapture under Alterative 5 is lowest compared to all the Alternatives due to higher recapture along the San Joaquin River. Most of the recapture occurs during March and April when the Restoration Flows are higher. Recapture at at the new intake and at the two districts upstream and capacity in the DMC to move the recaptured water to San Luis Reservoir in the model limits the amount of Restoration Flows that remain for potential recapture by the Banta-Carbona Irrigation District Actual operation of the alternative in the long-term could result in periods when capacity at the other diversions is not fully available and recapture by Banta-Carbona Irrigation District would occur.

Table 7-2. Monthly Summary of Recapture under Alternative 5

Month	Delta Recapture	San Joaquin River Recapture				Total Recapture
		Patterson ID	West Stanislaus ID	Banta-Carbona ID	New Intake	
	TAF	TAF	TAF	TAF	TAF	TAF
Oct	1	0	0	0	3	4
Nov	3	0	0	0	7	10
Dec	1	0	0	0	3	4
Jan	0	0	0	0	6	6
Feb	0	0	0	0	4	4
Mar	4	1	7	0	18	30
Apr	10	1	8	0	21	40
May	0	0	0	0	5	6
Jun	1	0	0	0	4	6
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	1	0	0	0	1	1
Total	22	3	15	0	71	110

*Note: ID= Irrigation District
Total Recapture = Delta Recapture + San Joaquin River Recapture

Figure 7-1 shows a summary of recapture by water year type compared against Restoration Flows. During wet years, approximately 17 percent of the Restoration Flows are recaptured. And the volume of water recaptured during wet years is lower than the volume of water recaptured during normal-dry and dry years. During wet years, the recapture and conveyance capacities are limited due to surplus flow conditions in the Delta. Additionally, there is no recapture when there is a flood release from Friant dam which tend to occur more often during the wet years. Figure 7-2 shows how the monthly recaptured volumes are always either equal to or less than the monthly available Restoration Flows under Alternative 4.

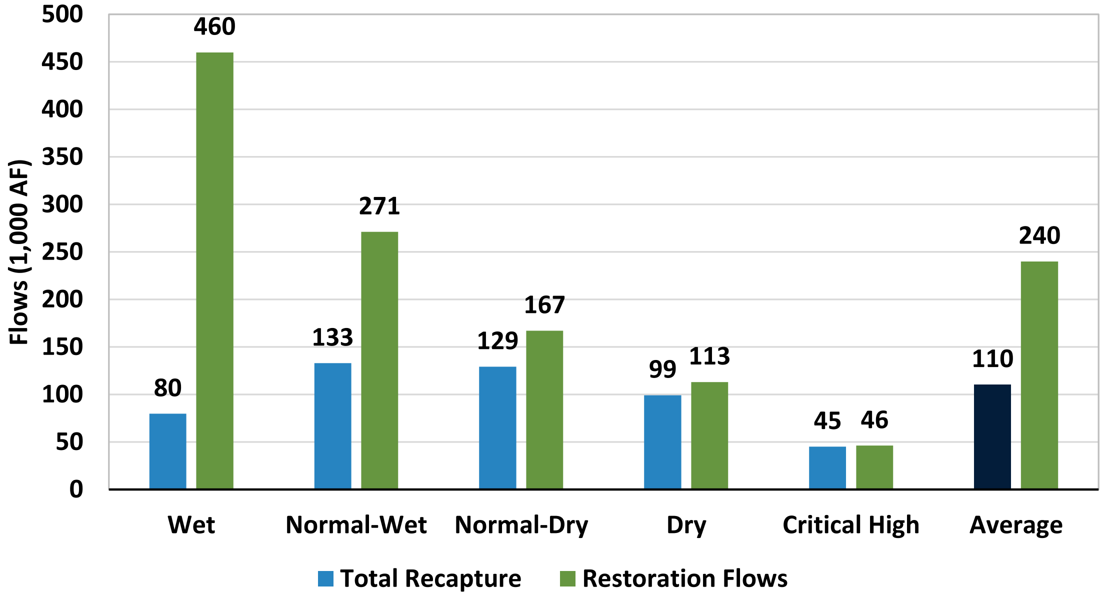

Figure 7-1.
Recapture Summary by Water Year Type under Alternative 4

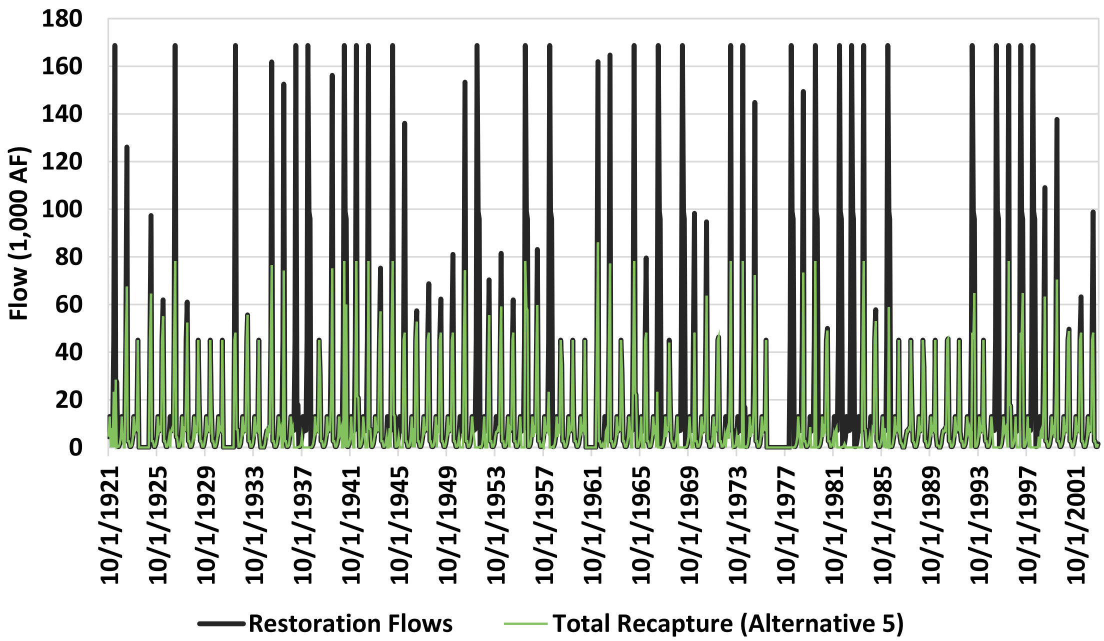

Figure 7-2.
Comparison of Restoration Flows and Recapture Volumes under Alternative 5

Model results for recaptured flows provided in this attachment represent a volume of water recaptured under an alternative, and potentially available for recirculation to Friant Division contractors. The volume actually recirculated to Friant Division contractors may be less than the total recaptured flow, after consideration of Reclamation's obligation to not cause adverse impacts to CVP/SWP deliveries or operations of the CVP/SWP.

Figure 7-3 show the annual volume of recaptured Restoration Flows that is stored in San Luis Reservoir under Alternative 5. Results show that the volume of Restoration Flows pumped into San Luis ranges from 0 TAF to nearly 138 TAF with an average of nearly 66 TAF. Restoration water is stored in San Luis only when there is no potential for direct delivery to Friant contractors. Water stored in San Luis may be delivered immediately or after few months depending on demand and other factors.

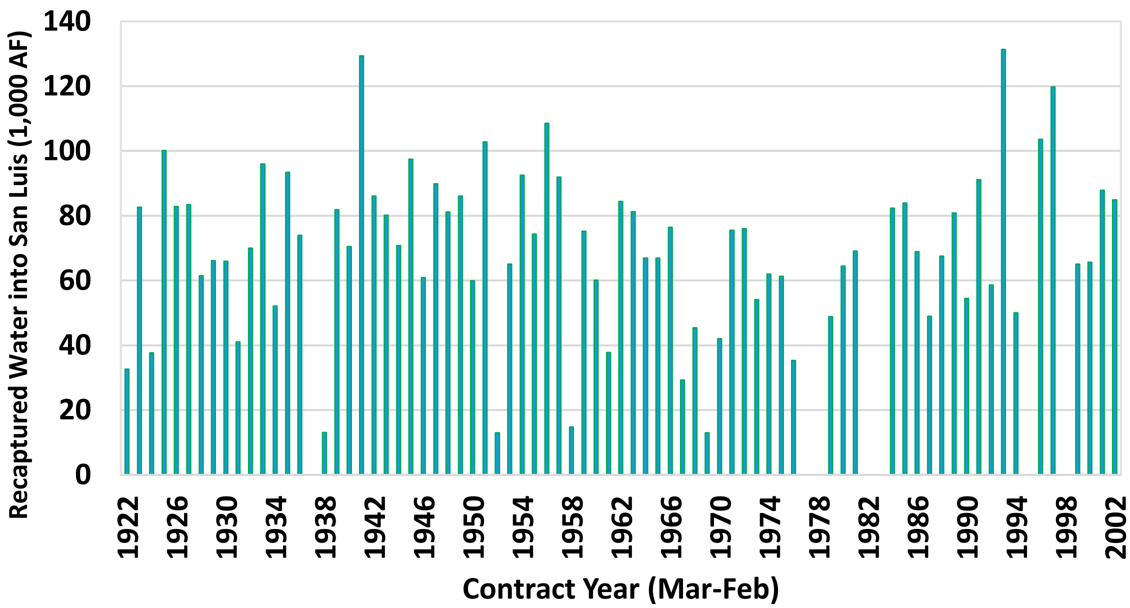

Figure 7-3.
Annual Volume of Restoration Flows Stored in San Luis Reservoir under Alternative 5

8.0 Summary

This section presents an overall comparative summary of the different project Alternatives against the No Action Alternative. Figure 8-1 show annual average recapture under all Alternatives compared against the Restoration Flows. The volume of Restoration Flows recaptured, is higher under the Action Alternatives in comparison to the No Action Alternative. The total recapture increases from Alternative 2 through 5 as recapture along the San Joaquin River increases. Figure 8-1 also shows how Delta recapture is lower under Alternatives 3, 4 and 5 as compared to the No Action Alternative. Additional recapture along the San Joaquin limits the volume of Restoration Flows available for recapture at the Delta pumps, thus resulting in a lower Delta recapture under Alternative 3, 4 and 5 when compared to the No Action Alternative.

Alternative 5 would result in the highest recapture of Restoration Flows due to the combined recapture at the 500 cfs new intake facility and by using the existing facilities along the San Joaquin River and in the Delta. The total recapture of Restoration Flows range from 64 TAF under the No Action Alternative to 110 TAF under Alternative 5.

Total recapture under Alternative 4 is nearly 95 TAF which is 6 TAF (~7 percent) greater than Alternative 3 on an annual average basis. Recapture along the San Joaquin River under Alternative 4 increases by nearly 10 TAF on an annual average basis in comparison to Alternative 3. Out of the 10 TAF, nearly 9 TAF of the increased recapture occurs during March and April when the Restoration Flows in these two months constitute more than 50 percent of the annual Restoration Flows volumetrically. Although the capacity for recapture under Alternative 4 is approximately 30 percent more than the capacity under Alternative 3 on an average basis, recapture under Alternative 4 does not increase proportionately due to limitations in available Restoration Flows except during March and April when recapture is limited by the capacity.

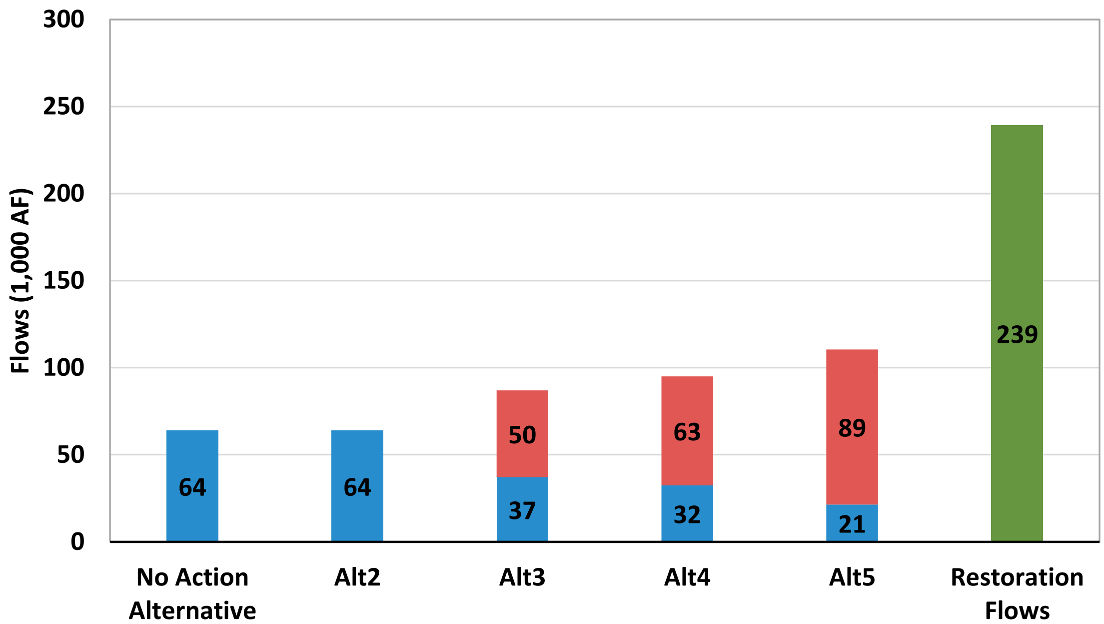

Figure 8-1.
Comparison of Recapture Volumes between Alternatives

8.1 Summary of System-Wide Operations

This section presents a summary of system-wide operations under the different Alternatives. Table 8-1 presents an overall summary of changes under the different Alternatives as compared against the No Action Alternative.

The modeling assumes that the recapture is limited by the availability of restoration flows on a monthly time-step. Additionally, in the Delta, the recapture is limited by the estimated increase in Delta export capacity provided by the restoration flows under different regulatory constraints such as Old and Middle River flow criteria and San Joaquin River Inflow/Export ratio. Recapture along the San Joaquin River is restricted when Friant Dam is making releases for flood control. Several other capacity constraints are also considered in the recapture calculations. These constraints ensure that there is no recapture of water that is not labelled as restoration flows and hence the system-wide changes under the different Alternatives are minimal.

Results show reductions in the San Joaquin River flows under Alternative 3, 4 and 5. These changes in the San Joaquin River flow are a direct result of the recapture of Restoration Flows at West Stanislaus Irrigation District, Patterson Irrigation District, and Banta-Carbona Irrigation District. The reductions in the San Joaquin River flows is highest under Alternative 5.

Results show no change in the combined Sacramento River flows and Yolo Bypass flows under the project Alternatives as compared against the No Action Alternative. Delta exports are reduced under the project Alternatives as compared against the No Action Alternative. As San Joaquin River inflows into Delta decrease with additional recapture under Alternative 3, 4 and 5, delta exports decrease as per the regulatory conditions that limits the exports based on flow in the San Joaquin River. With reduced San Joaquin River inflows into Delta, Delta outflows also diminish along with a reduction in exports. For example: Under Alternative 5, San Joaquin River flow at Vernalis is reduced by 89 TAF which results in a reduction of Delta exports and Delta outflows by 44 TAF and 45 TAF respectively. Total CVP and SWP deliveries change by less than 1 percent under the project Alternatives in comparison to No Action Alternative. Similarly, there are very minimal changes in the reservoir storages. New Melones storages decrease by less than 2 percent on an average basis under Alternative 5. This reduction is an effect of reduced restoration flows in the river especially under Alternative 5 which has the highest recapture of restoration flows upstream of the confluence of Stanislaus River. Under Alternative 5 New Melones makes additional releases to maintain the flow standards at Vernalis that was partly met by restoration flows under the No Action Alternative.

Modeling results do not indicate any changes to system-wide deliveries. Overall, the results show very minimal changes to the CVP/SWP system operations. Figures 8-2 through 8-17 shows operational results for key parameters under the different Alternatives using exceedance plots. Additionally, Tables A1 through A228 are presented in Attachment A that provide a summary by month and water year type.

Table 8-1. Average Annual Summary of Simulated Delta Inflows, Diversions, Exports and Outflows

Locations	No Action Alternative	Alt2	Alt3	Alt4	Alt5	Change under Alt2	Change under Alt3	Change under Alt4	Change under Alt5
Inflows and Exports (TAF)									
Friant Releases	590	590	590	590	590	0.0	0	0	0
Friant Deliveries	1,118	1,118	1,118	1,118	1,118	0.0	0	0	0
SJR Below Merced	1,290	1,290	1,280	1,275	1,287	0.0	-10	-15	-3
SJR Below Tuolumne	2,568	2,568	2,518	2,510	2,479	0.0	-50	-58	-89
SJR Below Stanislaus	3,136	3,136	3,088	3,080	3,050	0.0	-49	-57	-86
SJR near Vernalis	3,136	3,136	3,088	3,075	3,050	0.0	-49	-61	-86
Merced River	505	505	505	505	505	0.0	0	0	0
Tuolumne River	871	871	871	871	871	0.0	0	0	0
Stanislaus River	544	544	546	546	547	0.0	1	1	3
Sacramento River near Freeport	15,381	15,381	15,382	15,381	15,382	0.0	1	1	1
Yolo Bypass	2,592	2,592	2,590	2,590	2,590	0.0	-1	-1	-2
Banks Pumping Plant	2,679	2,679	2,665	2,663	2,658	0.0	-14	-16	-21
Jones Pumping Plant	2,222	2,222	2,206	2,204	2,200	0.0	-16	-18	-23
Delta Recapture	64	64	37	32	21	0.0	-27	-32	-43
Delta Recapture (SWP)	32	32	18	16	11	0.0	-13	-16	-21
Delta Recapture (CVP)	32	32	19	16	11	0.0	-14	-16	-21
New Facility Recapture	N/A	N/A	N/A	N/A	71	N/A	N/A	N/A	71
Banta Carbona ID Recapture	N/A	N/A	0	5	0	N/A	0	5	0
Patterson ID Recapture	N/A	N/A	10	15	3	N/A	10	15	3
West Stan ID Recapture	N/A	N/A	40	43	15	N/A	40	43	15
Net Delta Outflow	15,744	15,744	15,725	15,715	15,700	0.0	-19	-28	-43
Total Recapture	64	64	87	95	110	0	23	31	46
CVP Deliveries (TAF)									
Settlement Contractors	1,862	1,862	1,862	1,862	1,862	0.0	0	0	0
Water Service Contractors North-of-De	222	222	222	222	222	0.0	0	0	0
Exchange Contractors	853	853	853	853	853	0.0	0	0	0
Water Service Contractors South-of-De	860	860	858	858	859	0.0	-2	-2	-1
MI Contractors North-of-Delta	202	202	202	202	202	0.0	0	0	0
Refuges North-of-Delta	83	83	83	83	83	0.0	0	0	0
MI Contractors South-of-Delta	115	115	115	115	115	0.0	0	0	0
Refuges South-of-Delta	273	273	273	273	273	0.0	0	0	0
Cross Valley Canal Contractors	55	55	55	55	55	0.0	0	0	0
Total CVP Deliveries	4,525	4,525	4,523	4,523	4,524	0.0	-3	-2	-1
SWP Deliveries (TAF)									
[redacted]									
CVP Average End of September Storage (TAF)									
[redacted]									
SWP Average End of September Storage (TAF)									
[redacted]									

*Note: SJR= San Joaquin River
ID= Irrigation District
N/A= Not Applicable

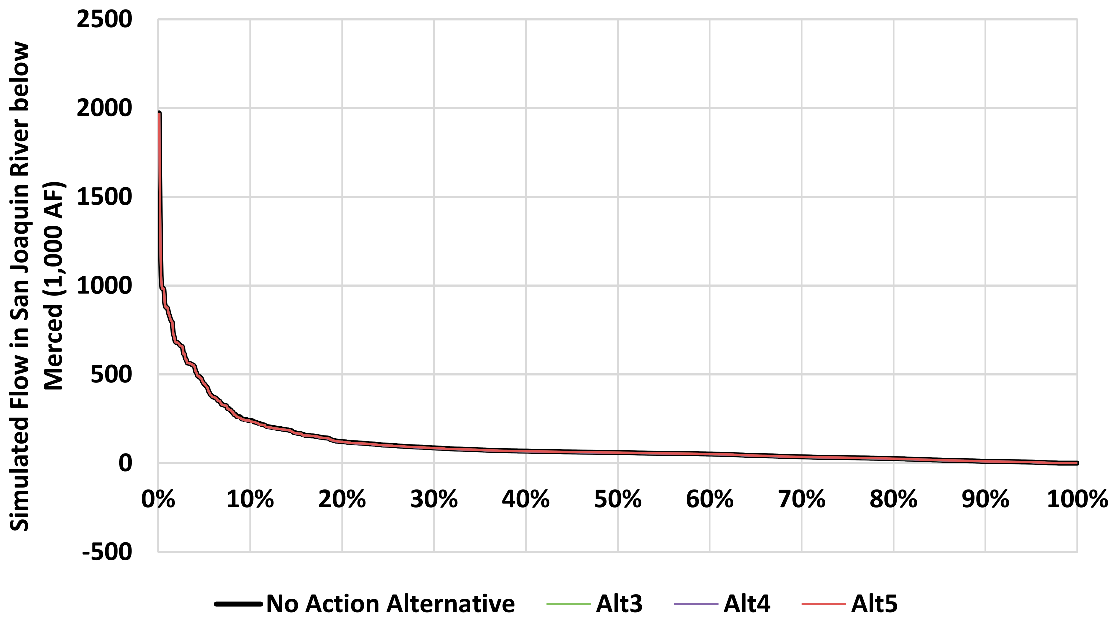

Figure 8-2.
Exceedance Plot of Simulated Flow in San Joaquin River below Merced

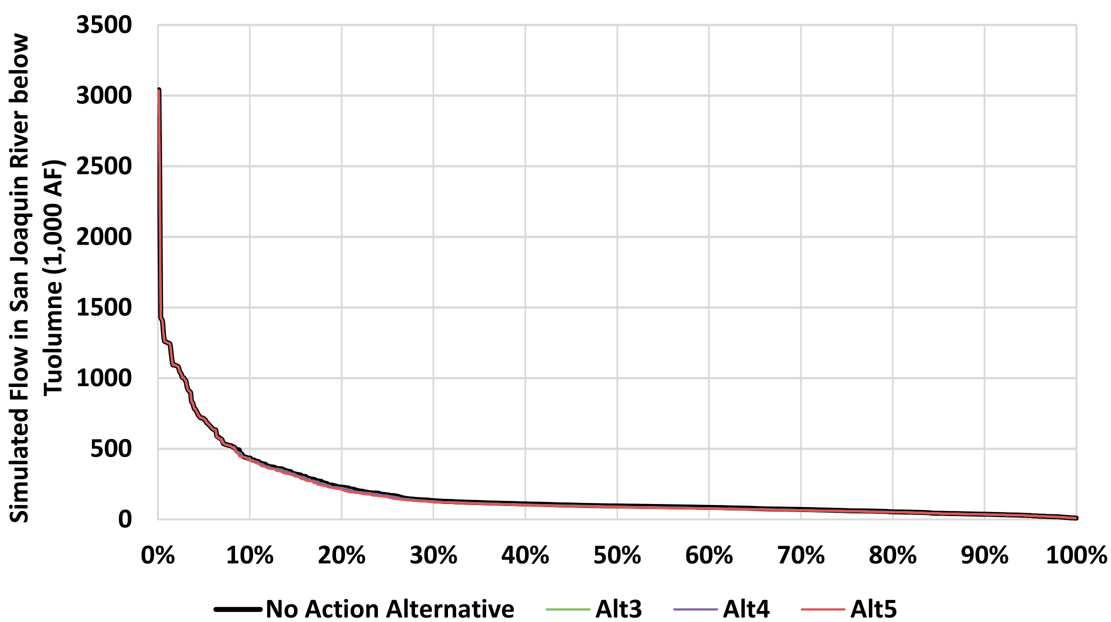

Figure 8-3.
Exceedance Plot of Simulated Flow in San Joaquin River below Tuolumne

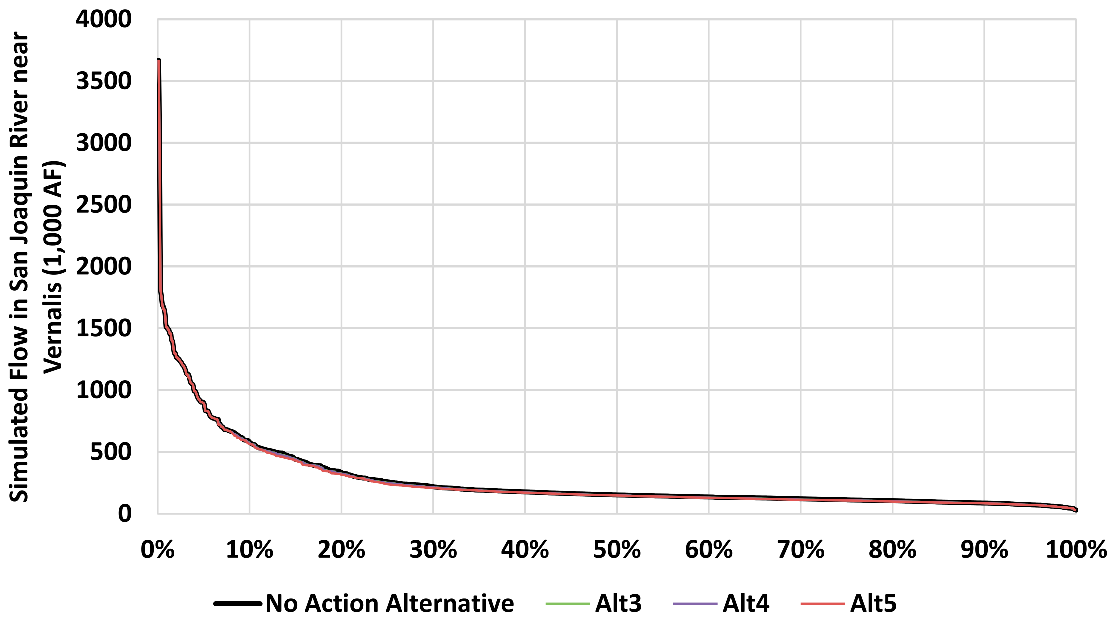

Figure 8-4.
Exceedance Plot of Simulated Flow in San Joaquin River near Vernalis

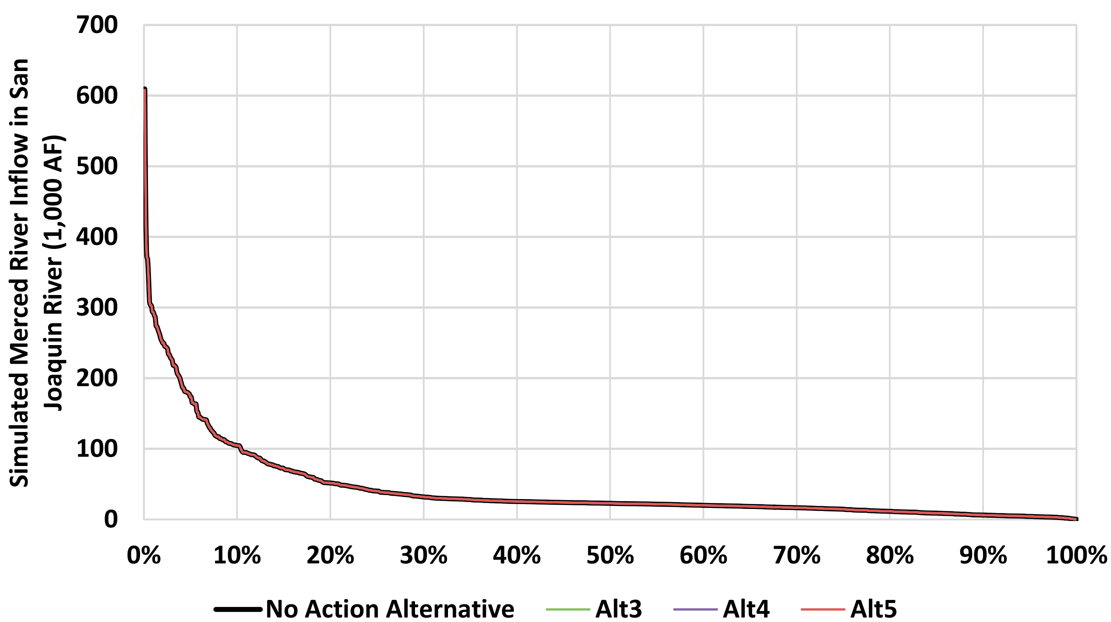

Figure 8-5.
Exceedance Plot of Simulated Merced River Inflow in San Joaquin River

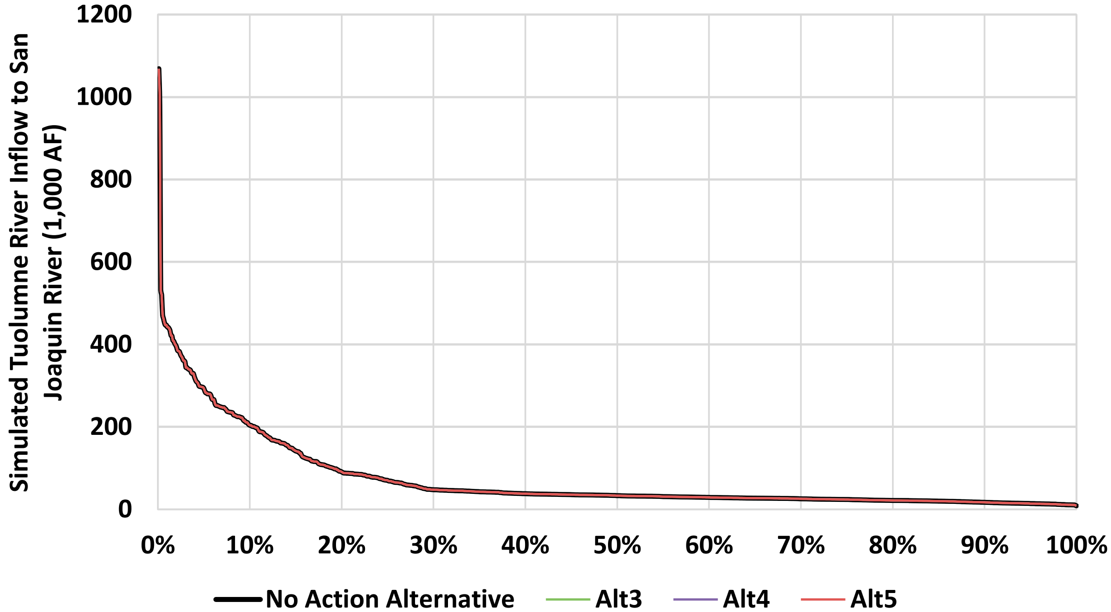

Figure 8-6.
Exceedance Plot of Simulated Tuolumne River Inflow to San Joaquin River

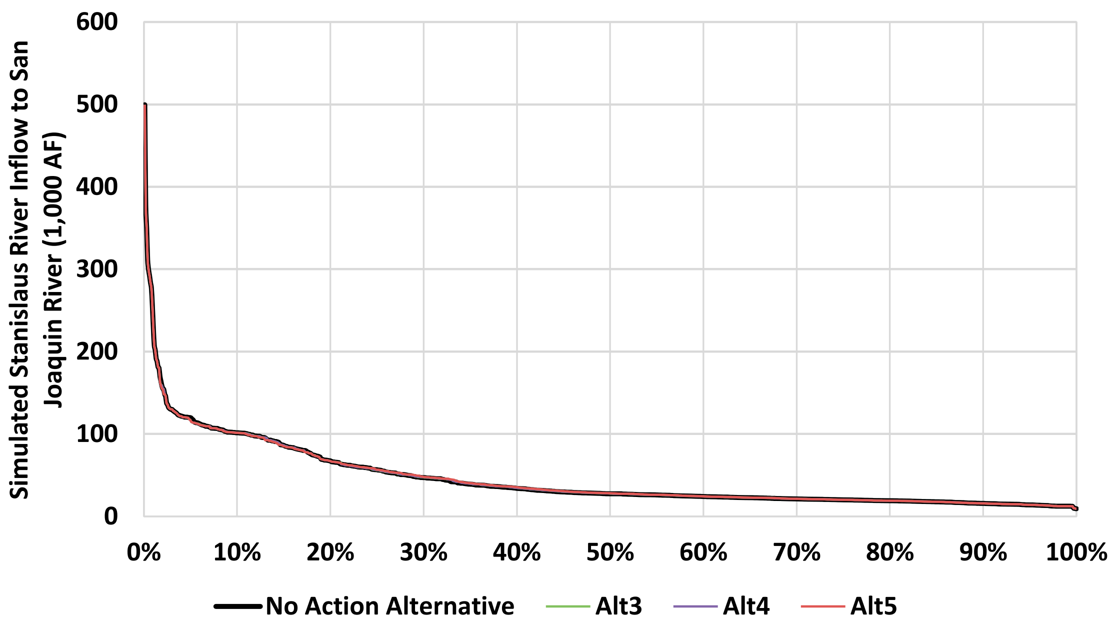

Figure 8-7.
Exceedance Plot of Simulated Stanislaus River Inflow to San Joaquin River

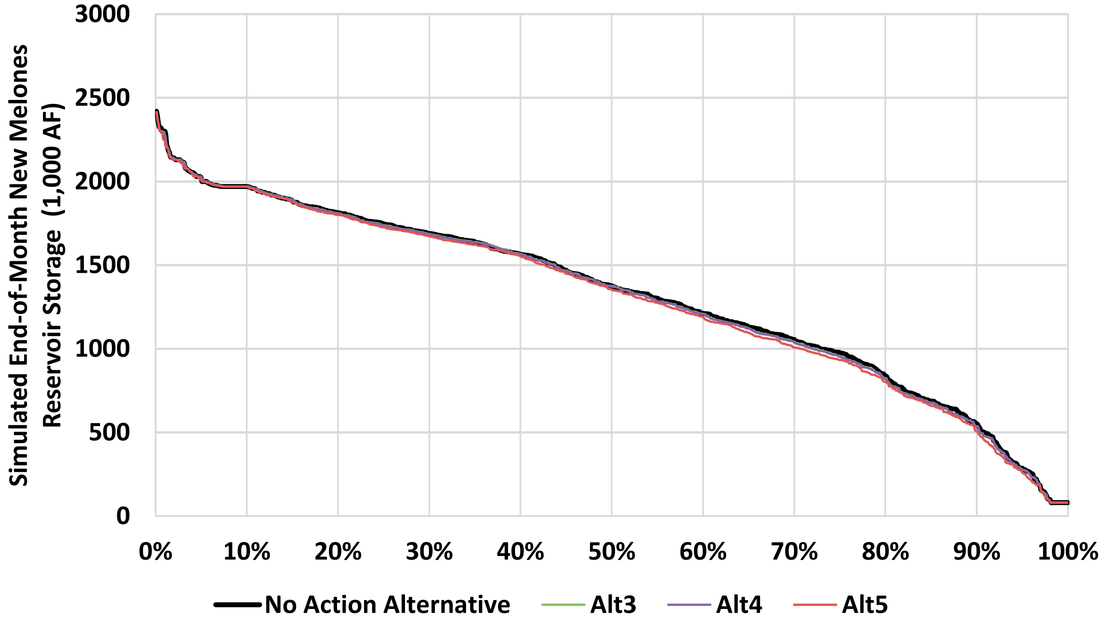

Figure 8-8.
Exceedance Plot of Simulated End-of-Month New Melones Reservoir Storage

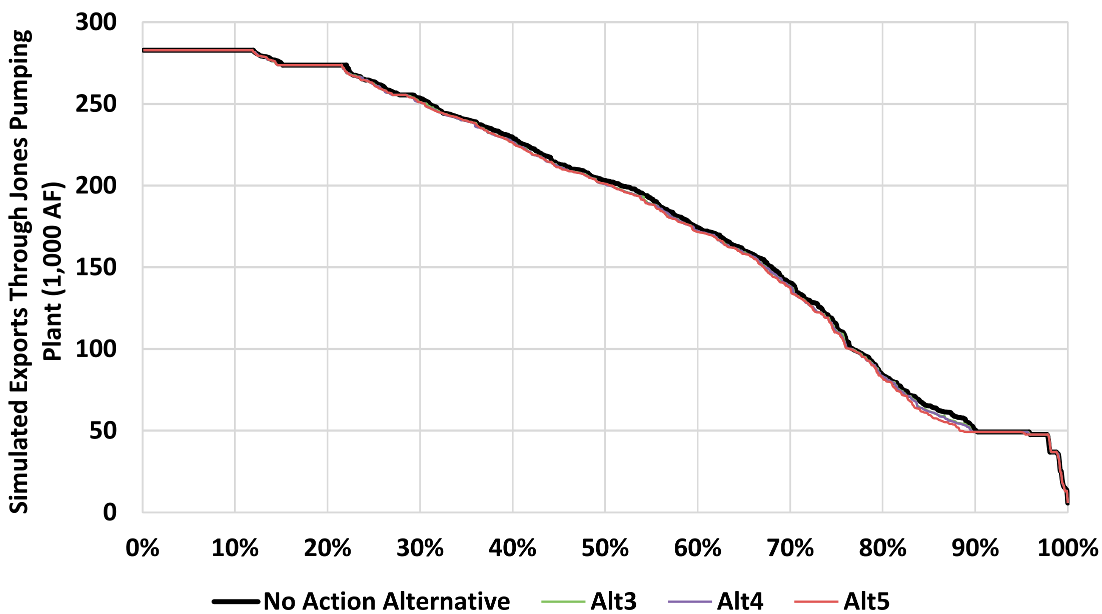

Figure 8-9.
Exceedance Plot of Simulated Exports through Jones Pumping Plant

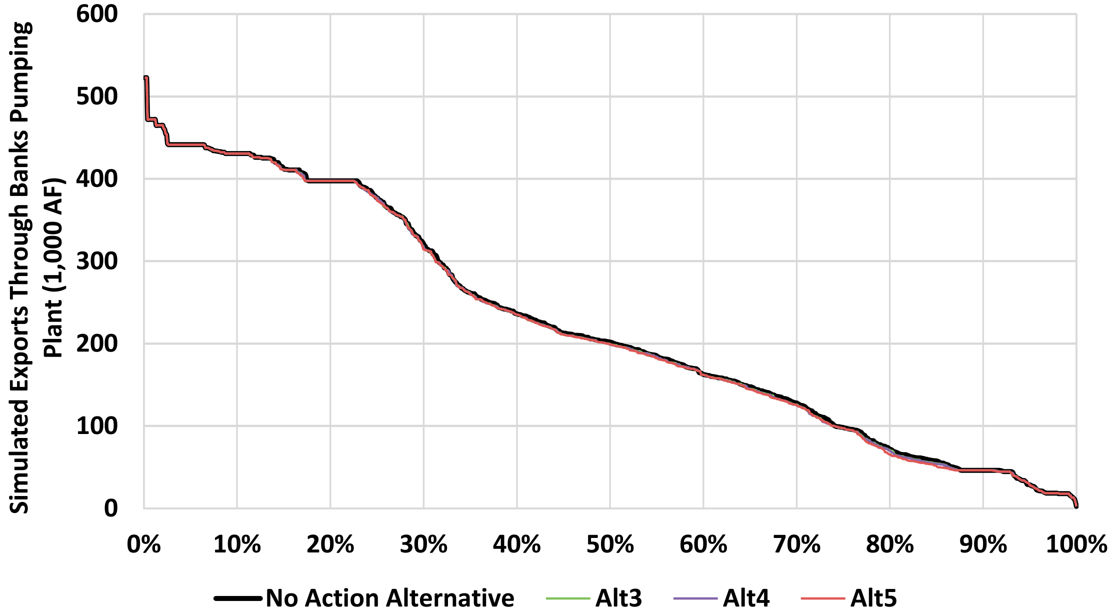

Figure 8-10.
Exceedance Plot of Simulated Exports through Banks Pumping Plant

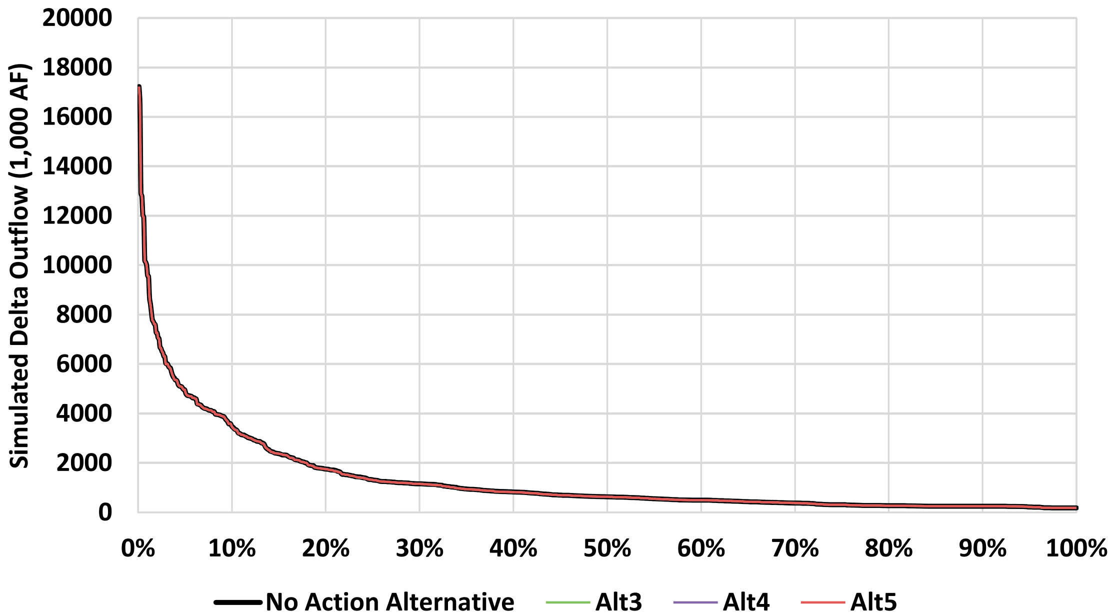

Figure 8-11.
Exceedance Plot of Simulated Delta Outflow

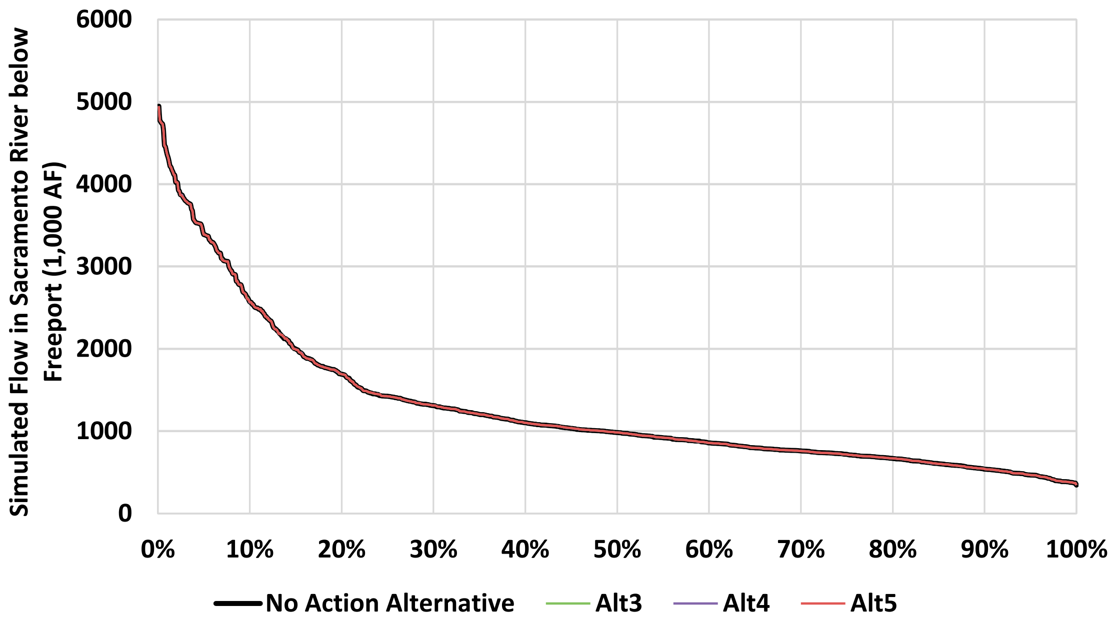

Figure 8-12.
Exceedance Plot of Simulated Flow in Sacramento River below Freeport

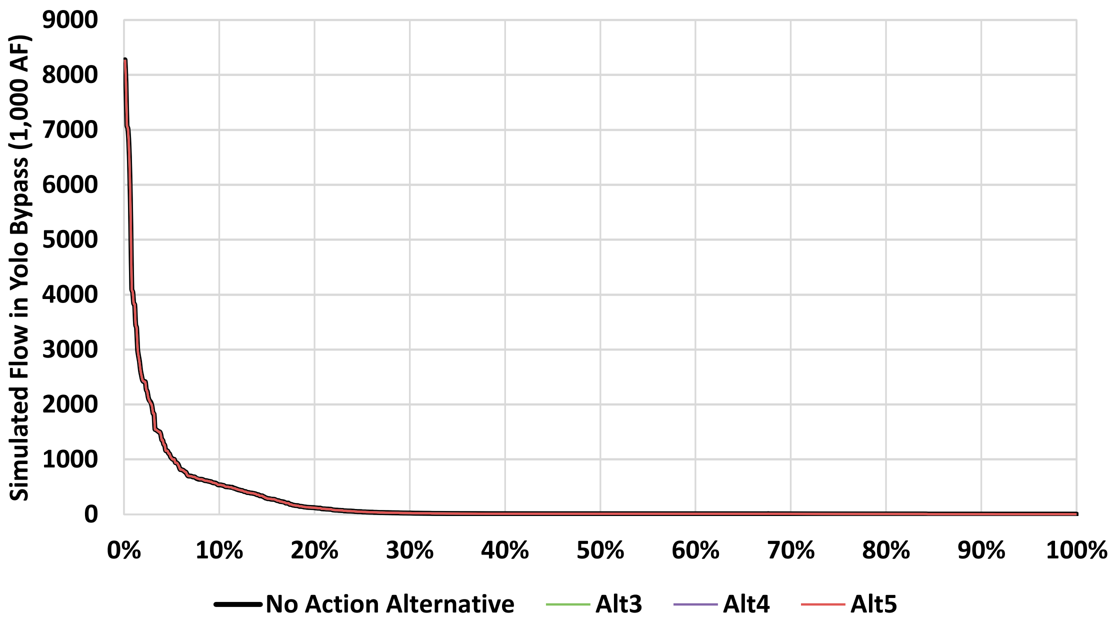

Figure 8-13.
Exceedance Plot of Simulated Flow in Yolo Bypass

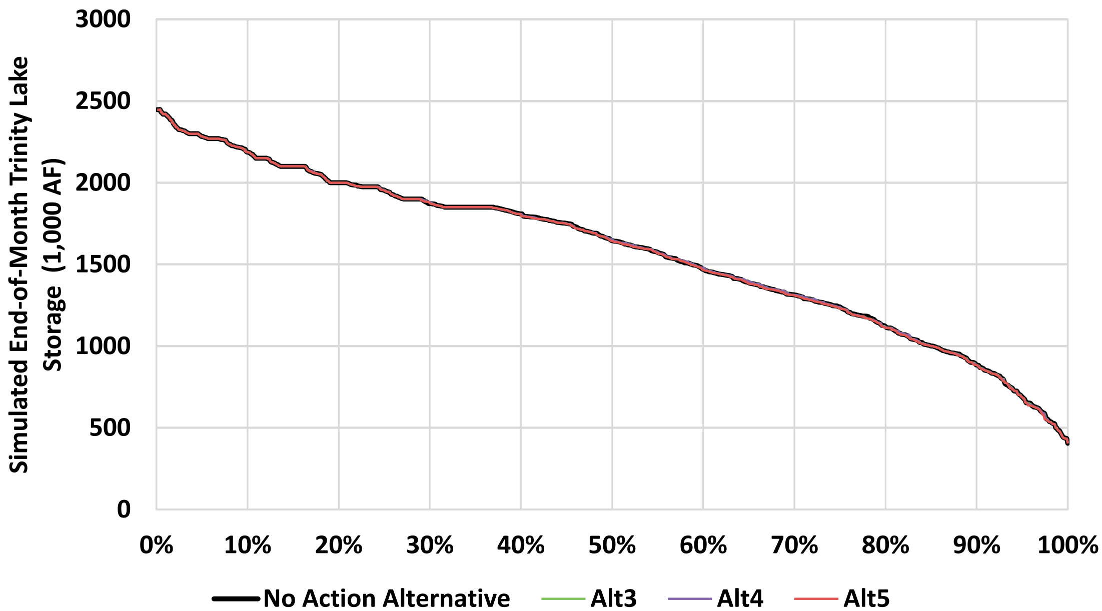

Figure 8-14.
Exceedance Plot of Simulated End-of-Month Trinity Lake Storage

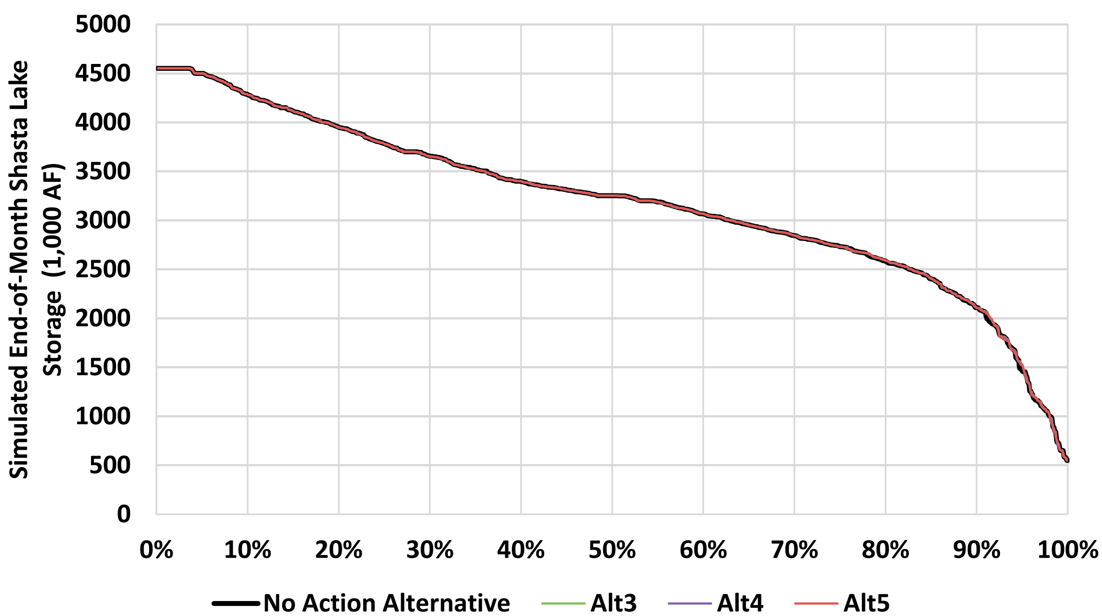

Figure 8-15.
Exceedance Plot of Simulated End-of-Month Shasta Lake Storage

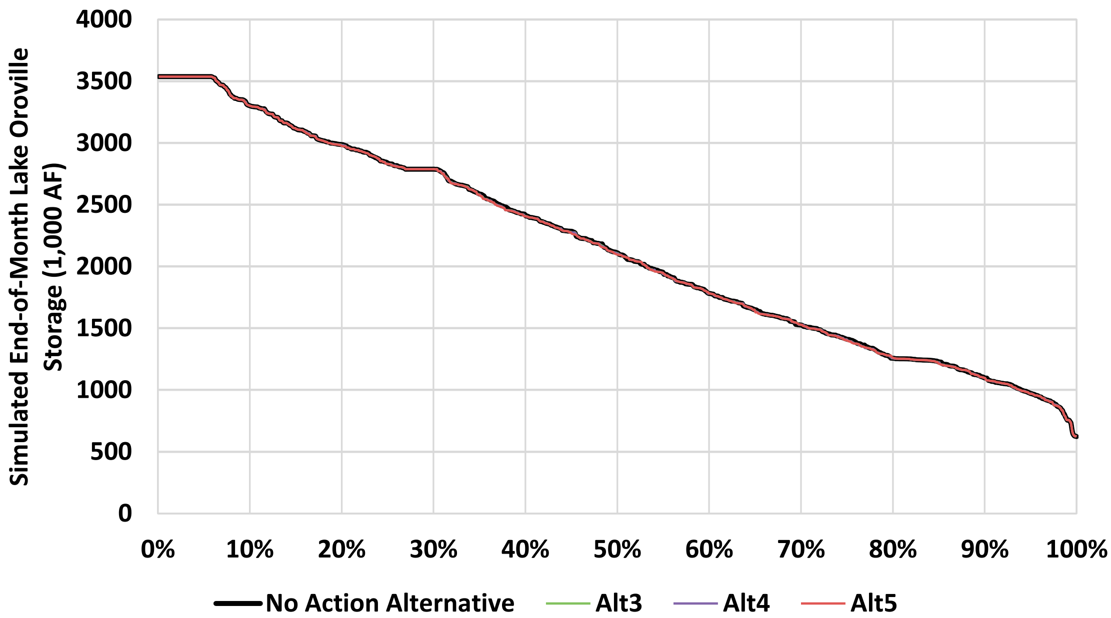

Figure 8-16.
Exceedance Plot of Simulated End-of-Month Lake Oroville Storage

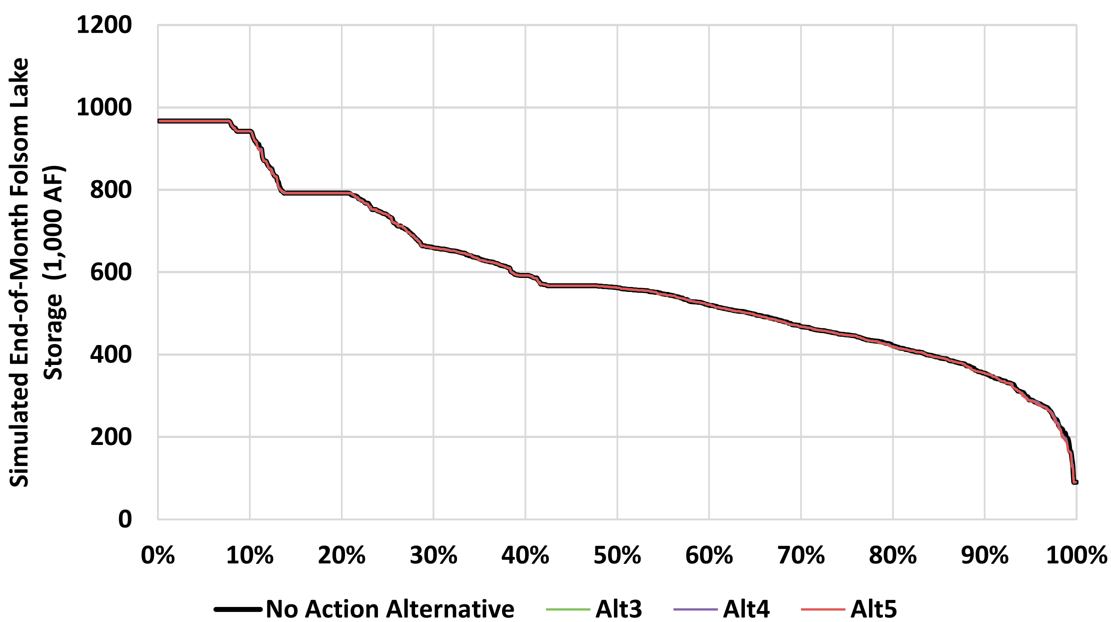

Figure 8-17.
Exceedance Plot of Simulated End-of-Month Folsom Lake Storage

Table A1: Monthly Average Simulated Friant Releases for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	465	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	484	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	639	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	692	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,326	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	2,385	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,085	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1,053	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	624	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	343	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	344	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A2: Monthly Average Simulated Friant Releases for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	390	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	535	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	655	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	983	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	735	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	2,100	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	4,358	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2,877	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,749	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,312	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A3: Monthly Average Simulated Friant Releases for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	467	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	354	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	534	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	728	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,037	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	2,905	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	379	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	404	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A4: Monthly Average Simulated Friant Releases for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	467	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	589	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	424	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	540	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,782	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A5: Monthly Average Simulated Friant Releases for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	350	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	467	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	493	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	790	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,105	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A6: Monthly Average Simulated Friant Releases for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	291	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	353	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	278	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	275	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	446	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	961	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	435	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	298	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	298	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	313	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	313	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	319	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A7: Monthly Average Simulated Friant-Kern Canal Diversions for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	610	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	213	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	133	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	231	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	772	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	743	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,267	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,757	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,712	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2,758	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	2,322	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,348	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A8: Monthly Average Simulated Friant-Kern Canal Diversions for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	369	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	238	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	441	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,252	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,041	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,723	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2,475	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	3,929	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	3,810	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	3,273	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	2,017	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A9: Monthly Average Simulated Friant-Kern Canal Diversions for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	505	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	140	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	116	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	222	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	675	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	929	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,614	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2,194	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	3,164	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	3,043	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	2,671	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,496	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A10: Monthly Average Simulated Friant-Kern Canal Diversions for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	450	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	138	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	170	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	174	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	693	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	626	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,173	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,627	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,311	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2,465	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	2,159	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,172	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A11: Monthly Average Simulated Friant-Kern Canal Diversions for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	408	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	130	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	64	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	152	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	649	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	580	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,088	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,389	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,065	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2,202	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	1,935	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,047	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A12: Monthly Average Simulated Friant-Kern Canal Diversions for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	412	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	178	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	29	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	313	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	338	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	459	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	645	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1,287	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,584	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	994	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	585	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18A)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A13: Monthly Average Simulated Madera Canal Diversions for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	34	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	139	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	522	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	851	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	945	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	763	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	255	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A14: Monthly Average Simulated Madera Canal Diversions for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	98	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	17	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	86	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	284	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	991	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1,181	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,195	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	1,107	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	516	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A15: Monthly Average Simulated Madera Canal Diversions for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	30	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	74	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	256	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	602	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	951	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,064	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	876	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	283	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A16: Monthly Average Simulated Madera Canal Diversions for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	17	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	304	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	800	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	968	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	683	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	124	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A17: Monthly Average Simulated Madera Canal Diversions for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	31	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	237	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	706	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	859	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	593	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A18: Monthly Average Simulated Madera Canal Diversions for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	147	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	418	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	503	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	338	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	75	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D18B)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A19: Monthly Average Friant Kern Class 1 Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	42	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	63	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	104	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	129	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	109	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	60	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A20: Monthly Average Friant Kern Class 1 Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	36	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	35	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	57	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	104	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	147	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	133	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	78	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A21: Monthly Average Friant Kern Class 1 Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	29	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	51	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	72	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	118	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	139	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	121	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A22: Monthly Average Friant Kern Class 1 Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	33	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	56	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	118	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	131	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	114	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	58	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A23: Monthly Average Friant Kern Class 1 Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	20	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	32	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	55	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	79	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	115	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	126	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	110	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	55	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A24: Monthly Average Friant Kern Class 1 Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	20	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	35	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	71	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	90	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	54	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	29	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C1_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A25: Monthly Average Friant Kern Class 2 Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	16	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	32	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	37	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	30	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A26: Monthly Average Friant Kern Class 2 Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	32	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	57	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	72	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	87	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	61	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	36	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A27: Monthly Average Friant Kern Class 2 Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	16	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	42	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	49	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	49	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	36	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A28: Monthly Average Friant Kern Class 2 Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A29: Monthly Average Friant Kern Class 2 Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A30: Monthly Average Friant Kern Class 2 Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (FK_C2_DEL_)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A31: Monthly Average Simulated End-of-Month Millerton Lake Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	219	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	240	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	279	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	325	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	360	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	375	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	345	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	390	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	403	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	319	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	229	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	217	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A32: Monthly Average Simulated End-of-Month Millerton Lake Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	292	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	316	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	386	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	405	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	453	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	355	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	397	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	493	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	458	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	347	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	296	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A33: Monthly Average Simulated End-of-Month Millerton Lake Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	222	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	263	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	310	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	357	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	392	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	439	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	367	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	448	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	466	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	356	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	229	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	204	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A34: Monthly Average Simulated End-of-Month Millerton Lake Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	194	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	220	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	261	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	296	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	337	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	331	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	322	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	375	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	374	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	273	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	183	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	184	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A35: Monthly Average Simulated End-of-Month Millerton Lake Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	175	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	189	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	241	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	305	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	352	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	373	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	392	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	421	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	368	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	242	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	162	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	178	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A36: Monthly Average Simulated End-of-Month Millerton Lake Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	161	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	161	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	185	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	238	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	283	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	232	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	290	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	306	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	255	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	174	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	145	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	168	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S18)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A37: Monthly Average Simulated Flow in San Joaquin River below Merced for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	685	0 (0%)	-16 (-2%)	-20 (-3%)	-54 (-8%)
Nov	1,238	0 (0%)	-18 (-1%)	-21 (-2%)	-112 (-9%)
Dec	1,590	0 (0%)	-7 (0%)	-11 (-1%)	-53 (-3%)
Jan	2,345	0 (0%)	-9 (0%)	-17 (-1%)	-91 (-4%)
Feb	3,270	0 (0%)	-7 (0%)	-12 (0%)	-65 (-2%)
Mar	3,116	0 (0%)	-21 (-1%)	-35 (-1%)	-309 (-10%)
Apr	3,250	0 (0%)	-27 (-1%)	-87 (-3%)	-375 (-12%)
May	2,032	0 (0%)	-25 (-1%)	-27 (-1%)	-79 (-4%)
Jun	1,776	0 (0%)	-18 (-1%)	-17 (-1%)	-70 (-4%)
Jul	937	0 (0%)	-2 (0%)	-1 (0%)	-3 (0%)
Aug	514	0 (0%)	-2 (0%)	-1 (0%)	-2 (0%)
Sep	743	0 (0%)	-7 (-1%)	-3 (0%)	-11 (-1%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A38: Monthly Average Simulated Flow in San Joaquin River below Merced for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	919	0 (0%)	-18 (-2%)	-22 (-2%)	-50 (-5%)
Nov	1,652	0 (0%)	-18 (-1%)	-22 (-1%)	-99 (-6%)
Dec	2,348	0 (0%)	-4 (0%)	-6 (0%)	-24 (-1%)
Jan	3,793	0 (0%)	-8 (0%)	-16 (0%)	-71 (-2%)
Feb	3,965	0 (0%)	-7 (0%)	-12 (0%)	-54 (-1%)
Mar	6,486	0 (0%)	-1 (0%)	-2 (0%)	-14 (0%)
Apr	6,849	0 (0%)	-16 (0%)	-55 (-1%)	-245 (-4%)
May	5,579	0 (0%)	-15 (0%)	-38 (-1%)	-158 (-3%)
Jun	5,230	0 (0%)	-9 (0%)	-15 (0%)	-133 (-3%)
Jul	2,823	0 (0%)	-1 (0%)	0 (0%)	-2 (0%)
Aug	1,269	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,153	0 (0%)	-4 (0%)	0 (0%)	-5 (0%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A39: Monthly Average Simulated Flow in San Joaquin River below Merced for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	790	0 (0%)	-18 (-2%)	-16 (-2%)	-56 (-7%)
Nov	1,178	0 (0%)	-17 (-1%)	-21 (-2%)	-96 (-8%)
Dec	1,278	0 (0%)	-8 (-1%)	-10 (-1%)	-49 (-4%)
Jan	1,984	0 (0%)	-11 (-1%)	-20 (-1%)	-100 (-5%)
Feb	3,816	0 (0%)	-7 (0%)	-11 (0%)	-54 (-1%)
Mar	2,405	0 (0%)	-20 (-1%)	-33 (-1%)	-301 (-13%)
Apr	3,436	0 (0%)	-35 (-1%)	-119 (-3%)	-535 (-16%)
May	1,070	0 (0%)	-35 (-3%)	-30 (-3%)	-72 (-7%)
Jun	565	0 (0%)	-23 (-4%)	-11 (-2%)	-64 (-11%)
Jul	333	0 (0%)	-4 (-1%)	-1 (0%)	-5 (-2%)
Aug	464	0 (0%)	-3 (-1%)	-1 (0%)	-2 (-1%)
Sep	788	0 (0%)	-9 (-1%)	-2 (0%)	-12 (-2%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A40: Monthly Average Simulated Flow in San Joaquin River below Merced for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	555	0 (0%)	-17 (-3%)	-30 (-5%)	-55 (-10%)
Nov	1,147	0 (0%)	-15 (-1%)	-24 (-2%)	-110 (-10%)
Dec	1,681	0 (0%)	-8 (0%)	-15 (-1%)	-56 (-3%)
Jan	1,216	0 (0%)	-12 (-1%)	-26 (-2%)	-119 (-10%)
Feb	2,007	0 (0%)	-9 (0%)	-18 (-1%)	-86 (-4%)
Mar	1,671	0 (0%)	-32 (-2%)	-54 (-3%)	-453 (-27%)
Apr	1,981	0 (0%)	-35 (-2%)	-119 (-6%)	-535 (-27%)
May	514	0 (0%)	-35 (-7%)	-24 (-5%)	-44 (-9%)
Jun	426	0 (0%)	-25 (-6%)	-24 (-6%)	-44 (-10%)
Jul	163	0 (0%)	-3 (-2%)	-2 (-1%)	-4 (-2%)
Aug	148	0 (0%)	-2 (-1%)	-1 (0%)	-3 (-2%)
Sep	535	0 (0%)	-5 (-1%)	-2 (0%)	-6 (-1%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A41: Monthly Average Simulated Flow in San Joaquin River below Merced for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	529	0(0%)	-21 (-4%)	-28 (-5%)	-67 (-13%)
Nov	1,093	0 (0%)	-24 (-2%)	-27 (-2%)	-137 (-12%)
Dec	1,426	0 (0%)	-10 (-1%)	-19 (-1%)	-85 (-6%)
Jan	2,637	0 (0%)	-10 (0%)	-18 (-1%)	-100 (-4%)
Feb	4,208	0 (0%)	-7 (0%)	-11 (0%)	-70 (-2%)
Mar	1,475	0 (0%)	-32 (-2%)	-54 (-4%)	-494 (-33%)
Apr	1,203	0 (0%)	-35 (-3%)	-119 (-10%)	-514 (-43%)
May	423	0 (0%)	-35 (-8%)	-27 (-6%)	-44 (-10%)
Jun	269	0 (0%)	-25 (-9%)	-27 (-10%)	-44 (-16%)
Jul	100	0 (0%)	-4 (-4%)	-4 (-4%)	-6 (-6%)
Aug	130	0 (0%)	-6 (-4%)	-4 (-3%)	-6 (-5%)
Sep	522	0 (0%)	-13 (-2%)	-10 (-2%)	-17 (-3%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A42: Monthly Average Simulated Flow in San Joaquin River below Merced for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	445	0(0%)	-9 (-2%)	-8 (-2%)	-46 (-10%)
Nov	865	0 (0%)	-15 (-2%)	-15 (-2%)	-132 (-15%)
Dec	850	0(0%)	-6 (-1%)	-9 (-1%)	-71 (-8%)
Jan	1,165	0 (0%)	-5 (0%)	-9 (-1%)	-81 (-7%)
Feb	1,834	0 (0%)	-7 (0%)	-10 (-1%)	-74 (-4%)
Mar	1,277	0 (0%)	-33 (-3%)	-54 (-4%)	-494 (-39%)
Apr	361	0 (0%)	-22 (-6%)	-54 (-15%)	-168 (-47%)
May	215	0 (0%)	-16 (-7%)	-12 (-6%)	-25 (-11%)
Jun	129	0 (0%)	-12 (-9%)	-12 (-9%)	-25 (-19%)
Jul	21	0 (0%)	-1 (-3%)	-1 (-4%)	-1 (-6%)
Aug	42	0 (0%)	-1 (-3%)	-1 (-3%)	-3 (-6%)
Sep	433	0 (0%)	-9 (-2%)	-5 (-1%)	-17 (-4%)

Source: CalSim-II Simulation Output Parameter (C620)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A43: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,346	0 (0%)	-54 (-4%)	-54 (-4%)	-54 (-4%)
Nov	1,824	0 (0%)	-111 (-6%)	-112 (-6%)	-112 (-6%)
Dec	2,376	0 (0%)	-54 (-2%)	-53 (-2%)	-53 (-2%)
Jan	3,627	0 (0%)	-91 (-2%)	-91 (-2%)	-91 (-2%)
Feb	5,002	0 (0%)	-65 (-1%)	-65 (-1%)	-65 (-1%)
Mar	5,426	0 (0%)	-157 (-3%)	-192 (-4%)	-420 (-8%)
Apr	5,534	0 (0%)	-182 (-3%)	-264 (-5%)	-504 (-9%)
May	3,641	0 (0%)	-53 (-1%)	-64 (-2%)	-87 (-2%)
Jun	3,167	0 (0%)	-46 (-1%)	-52 (-2%)	-73 (-2%)
Jul	2,091	0 (0%)	-4 (0%)	-4 (0%)	-4 (0%)
Aug	1,060	0 (0%)	-3 (0%)	-3 (0%)	-3 (0%)
Sep	1,304	0 (0%)	-11 (-1%)	-11 (-1%)	-11 (-1%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A44: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,862	0 (0%)	-50 (-3%)	-50 (-3%)	-50 (-3%)
Nov	2,610	0 (0%)	-102 (-4%)	-99 (-4%)	-99 (-4%)
Dec	3,734	0 (0%)	-27 (-1%)	-24 (-1%)	-24 (-1%)
Jan	6,161	0 (0%)	-71 (-1%)	-71 (-1%)	-71 (-1%)
Feb	6,556	0 (0%)	-54 (-1%)	-54 (-1%)	-54 (-1%)
Mar	11,097	0 (0%)	-11 (0%)	-13 (0%)	-14 (0%)
Apr	11,094	0 (0%)	-112 (-1%)	-168 (-2%)	-341 (-3%)
May	8,476	0 (0%)	-71 (-1%)	-106 (-1%)	-184 (-2%)
Jun	8,934	0 (0%)	-53 (-1%)	-69 (-1%)	-144 (-2%)
Jul	5,800	0 (0%)	-2 (0%)	-2 (0%)	-2 (0%)
Aug	2,083	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	1,971	0 (0%)	-4 (0%)	-5 (0%)	-5 (0%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A45: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,545	0 (0%)	-56 (-4%)	-56 (-4%)	-56 (-4%)
Nov	1,765	0 (0%)	-94 (-5%)	-96 (-5%)	-96 (-5%)
Dec	2,030	0 (0%)	-50 (-2%)	-49 (-2%)	-49 (-2%)
Jan	3,018	0 (0%)	-100 (-3%)	-100 (-3%)	-100 (-3%)
Feb	5,700	0 (0%)	-54 (-1%)	-54 (-1%)	-54 (-1%)
Mar	4,889	0 (0%)	-148 (-3%)	-182 (-4%)	-410 (-8%)
Apr	5,849	0 (0%)	-245 (-4%)	-366 (-6%)	-745 (-13%)
May	2,694	0 (0%)	-70 (-3%)	-72 (-3%)	-72 (-3%)
Jun	1,253	0 (0%)	-60 (-5%)	-64 (-5%)	-64 (-5%)
Jul	964	0 (0%)	-6 (-1%)	-5 (-1%)	-5 (-1%)
Aug	1,082	0 (0%)	-3 (0%)	-3 (0%)	-3 (0%)
Sep	1,426	0 (0%)	-12 (-1%)	-12 (-1%)	-12 (-1%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A46: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,142	0 (0%)	-55 (-5%)	-55 (-5%)	-55 (-5%)
Nov	1,547	0 (0%)	-95 (-6%)	-110 (-7%)	-110 (-7%)
Dec	2,369	0 (0%)	-54 (-2%)	-56 (-2%)	-56 (-2%)
Jan	1,908	0 (0%)	-119 (-6%)	-119 (-6%)	-119 (-6%)
Feb	2,812	0 (0%)	-86 (-3%)	-86 (-3%)	-86 (-3%)
Mar	3,150	0 (0%)	-239 (-8%)	-290 (-9%)	-597 (-19%)
Apr	3,794	0 (0%)	-245 (-6%)	-366 (-10%)	-745 (-20%)
May	1,807	0 (0%)	-44 (-2%)	-44 (-2%)	-44 (-2%)
Jun	862	0 (0%)	-44 (-5%)	-44 (-5%)	-44 (-5%)
Jul	558	0 (0%)	-4 (-1%)	-4 (-1%)	-4 (-1%)
Aug	586	0 (0%)	-3 (-1%)	-3 (-1%)	-3 (-1%)
Sep	984	0 (0%)	-6 (-1%)	-6 (-1%)	-6 (-1%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A47: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,026	0(0%)	-67 (-7%)	-67 (-7%)	-67 (-7%)
Nov	1,483	0 (0%)	-137 (-9%)	-137 (-9%)	-137 (-9%)
Dec	1,826	0 (0%)	-85 (-5%)	-85 (-5%)	-85 (-5%)
Jan	3,899	0 (0%)	-100 (-3%)	-100 (-3%)	-100 (-3%)
Feb	6,616	0 (0%)	-70 (-1%)	-70 (-1%)	-70 (-1%)
Mar	2,449	0 (0%)	-243 (-10%)	-298 (-12%)	-674 (-28%)
Apr	2,289	0 (0%)	-245 (-11%)	-361 (-16%)	-663 (-29%)
May	1,247	0 (0%)	-44 (-4%)	-44 (-4%)	-44 (-4%)
Jun	633	0 (0%)	-44 (-7%)	-44 (-7%)	-44 (-7%)
Jul	440	0 (0%)	-7 (-2%)	-7 (-2%)	-7 (-1%)
Aug	534	0 (0%)	-6 (-1%)	-6 (-1%)	-6 (-1%)
Sep	950	0 (0%)	-17 (-2%)	-17 (-2%)	-17 (-2%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A48: Monthly Average Simulated Flow in San Joaquin River below Tuolumne for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	772	0(0%)	-46 (-6%)	-46 (-6%)	-46 (-6%)
Nov	1,194	0 (0%)	-132 (-11%)	-132 (-11%)	-132 (-11%)
Dec	1,162	0(0%)	-71 (-6%)	-71 (-6%)	-71 (-6%)
Jan	1,544	0 (0%)	-81 (-5%)	-81 (-5%)	-81 (-5%)
Feb	2,261	0 (0%)	-74 (-3%)	-74 (-3%)	-74 (-3%)
Mar	1,724	0 (0%)	-247 (-14%)	-303 (-18%)	-688 (-40%)
Apr	929	0 (0%)	-122 (-13%)	-147 (-16%)	-183 (-20%)
May	769	0 (0%)	-25 (-3%)	-25 (-3%)	-25 (-3%)
Jun	362	0 (0%)	-25 (-7%)	-25 (-7%)	-25 (-7%)
Jul	239	0 (0%)	-3 (-1%)	-4 (-1%)	-4 (-1%)
Aug	315	0 (0%)	-3 (-1%)	-3 (-1%)	-3 (-1%)
Sep	728	0 (0%)	-17 (-2%)	-17 (-2%)	-17 (-2%)

Source: CalSim-II Simulation Output Parameter (C630)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A49: Monthly Average Simulated Flow in San Joaquin River near Vernalis for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,710	0 (0%)	-55 (-2%)	-55 (-2%)	-55 (-2%)
Nov	2,605	0 (0%)	-111 (-4%)	-113 (-4%)	-113 (-4%)
Dec	3,248	0 (0%)	-54 (-2%)	-55 (-2%)	-63 (-2%)
Jan	4,821	0 (0%)	-90 (-2%)	-90 (-2%)	-90 (-2%)
Feb	6,203	0 (0%)	-48 (-1%)	-48 (-1%)	-51 (-1%)
Mar	7,165	0 (0%)	-145 (-2%)	-175 (-2%)	-357 (-5%)
Apr	7,473	0 (0%)	-187 (-2%)	-269 (-4%)	-508 (-7%)
May	5,746	0 (0%)	-51 (-1%)	-60 (-1%)	-81 (-1%)
Jun	4,609	0 (0%)	-34 (-1%)	-38 (-1%)	-60 (-1%)
Jul	3,187	0 (0%)	-8 (0%)	-8 (0%)	-10 (0%)
Aug	2,031	0 (0%)	-11 (-1%)	-14 (-1%)	-24 (-1%)
Sep	2,312	0 (0%)	-11 (0%)	-12 (-1%)	-17 (-1%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A50: Monthly Average Simulated Flow in San Joaquin River near Vernalis for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,458	0 (0%)	-50 (-1%)	-50 (-1%)	-50 (-1%)
Nov	3,753	0 (0%)	-104 (-3%)	-100 (-3%)	-100 (-3%)
Dec	5,099	0 (0%)	-34 (-1%)	-38 (-1%)	-63 (-1%)
Jan	8,236	0 (0%)	-71 (-1%)	-71 (-1%)	-71 (-1%)
Feb	8,605	0 (0%)	-32 (0%)	-32 (0%)	-40 (0%)
Mar	14,535	0 (0%)	-16 (0%)	-19 (0%)	-19 (0%)
Apr	13,765	0 (0%)	-114 (-1%)	-169 (-1%)	-342 (-2%)
May	11,617	0 (0%)	-65 (-1%)	-95 (-1%)	-163 (-1%)
Jun	11,060	0 (0%)	-46 (0%)	-59 (-1%)	-126 (-1%)
Jul	7,588	0 (0%)	-12 (0%)	-13 (0%)	-19 (0%)
Aug	3,445	0 (0%)	-28 (-1%)	-38 (-1%)	-72 (-2%)
Sep	3,388	0 (0%)	-5 (0%)	-6 (0%)	-22 (-1%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A51: Monthly Average Simulated Flow in San Joaquin River near Vernalis for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,001	0 (0%)	-56 (-2%)	-56 (-2%)	-56 (-2%)
Nov	2,466	0 (0%)	-94 (-4%)	-96 (-4%)	-96 (-4%)
Dec	2,699	0 (0%)	-50 (-2%)	-49 (-2%)	-49 (-2%)
Jan	3,861	0 (0%)	-100 (-3%)	-100 (-3%)	-100 (-3%)
Feb	6,557	0 (0%)	-46 (-1%)	-46 (-1%)	-46 (-1%)
Mar	6,817	0 (0%)	-113 (-2%)	-135 (-2%)	-266 (-4%)
Apr	8,062	0 (0%)	-245 (-3%)	-366 (-5%)	-741 (-9%)
May	5,063	0 (0%)	-62 (-1%)	-64 (-1%)	-63 (-1%)
Jun	3,096	0 (0%)	-28 (-1%)	-28 (-1%)	-28 (-1%)
Jul	1,968	0 (0%)	-6 (0%)	-6 (0%)	-5 (0%)
Aug	1,995	0 (0%)	-3 (0%)	-3 (0%)	-3 (0%)
Sep	2,399	0 (0%)	-12 (-1%)	-12 (0%)	-12 (0%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A52: Monthly Average Simulated Flow in San Joaquin River near Vernalis for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,445	0 (0%)	-60 (-2%)	-60 (-2%)	-60 (-2%)
Nov	2,187	0 (0%)	-95 (-4%)	-110 (-5%)	-110 (-5%)
Dec	3,153	0 (0%)	-54 (-2%)	-56 (-2%)	-56 (-2%)
Jan	2,920	0 (0%)	-120 (-4%)	-120 (-4%)	-120 (-4%)
Feb	3,619	0 (0%)	-54 (-1%)	-54 (-1%)	-54 (-1%)
Mar	4,119	0 (0%)	-225 (-5%)	-271 (-7%)	-518 (-13%)
Apr	5,462	0 (0%)	-269 (-5%)	-390 (-7%)	-769 (-14%)
May	3,607	0 (0%)	-44 (-1%)	-44 (-1%)	-44 (-1%)
Jun	2,052	0 (0%)	-30 (-1%)	-30 (-1%)	-31 (-1%)
Jul	1,407	0 (0%)	-4 (0%)	-4 (0%)	-4 (0%)
Aug	1,418	0 (0%)	-3 (0%)	-3 (0%)	-3 (0%)
Sep	1,818	0 (0%)	-6 (0%)	-6 (0%)	-6 (0%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A53: Monthly Average Simulated Flow in San Joaquin River near Vernalis for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,306	0(0%)	-67 (-3%)	-67 (-3%)	-67 (-3%)
Nov	2,112	0 (0%)	-137 (-6%)	-137 (-6%)	-137 (-6%)
Dec	2,536	0 (0%)	-78 (-3%)	-78 (-3%)	-78 (-3%)
Jan	4,847	0 (0%)	-95 (-2%)	-95 (-2%)	-95 (-2%)
Feb	7,700	0 (0%)	-40 (-1%)	-40 (-1%)	-40 (-1%)
Mar	3,147	0 (0%)	-214 (-7%)	-259 (-8%)	-527 (-17%)
Apr	3,977	0 (0%)	-245 (-6%)	-361 (-9%)	-663 (-17%)
May	2,782	0 (0%)	-43 (-2%)	-43 (-2%)	-43 (-2%)
Jun	1,517	0 (0%)	-26 (-2%)	-26 (-2%)	-26 (-2%)
Jul	1,178	0 (0%)	-9 (-1%)	-9 (-1%)	-9 (-1%)
Aug	1,326	0 (0%)	-13 (-1%)	-12 (-1%)	-12 (-1%)
Sep	1,783	0 (0%)	-21 (-1%)	-21 (-1%)	-21 (-1%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A54: Monthly Average Simulated Flow in San Joaquin River near Vernalis for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,804	0(0%)	-46 (-3%)	-46 (-3%)	-46 (-3%)
Nov	1,743	0 (0%)	-132 (-8%)	-132 (-8%)	-132 (-8%)
Dec	1,704	0(0%)	-71 (-4%)	-71 (-4%)	-71 (-4%)
Jan	2,122	0 (0%)	-81 (-4%)	-81 (-4%)	-81 (-4%)
Feb	2,945	0 (0%)	-78 (-3%)	-77 (-3%)	-78 (-3%)
Mar	2,196	0 (0%)	-247 (-11%)	-303 (-14%)	-688 (-31%)
Apr	1,922	0 (0%)	-124 (-6%)	-148 (-8%)	-186 (-10%)
May	1,771	0 (0%)	-32 (-2%)	-33 (-2%)	-36 (-2%)
Jun	1,036	0 (0%)	-34 (-3%)	-34 (-3%)	-42 (-4%)
Jul	886	0 (0%)	-5 (-1%)	-6 (-1%)	-6 (-1%)
Aug	1,018	0 (0%)	-1 (0%)	-2 (0%)	0 (0%)
Sep	1,442	0 (0%)	-17 (-1%)	-17 (-1%)	-20 (-1%)

Source: CalSim-II Simulation Output Parameter (C639)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A55: Monthly Average Simulated Merced River Inflow into San Joaquin River for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	461	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	438	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	630	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	942	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,232	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	878	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	491	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	814	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	969	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	750	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	501	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	293	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A56: Monthly Average Simulated Merced River Inflow into San Joaquin River for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	665	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	557	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	886	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1,474	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,618	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,945	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,047	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,994	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,725	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2,108	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	1,226	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	669	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A57: Monthly Average Simulated Merced River Inflow into San Joaquin River for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	546	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	443	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	609	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	964	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,588	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	684	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	344	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	650	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	348	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	327	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	442	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	331	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A58: Monthly Average Simulated Merced River Inflow into San Joaquin River for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	338	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	394	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	739	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	534	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	837	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	392	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	279	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	224	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	282	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	173	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	129	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	75	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A59: Monthly Average Simulated Merced River Inflow into San Joaquin River for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	310	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	385	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	417	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	951	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,388	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	346	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	234	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	228	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	186	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	127	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	116	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	63	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A60: Monthly Average Simulated Merced River Inflow into San Joaquin River for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	279	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	333	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	357	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	419	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	444	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	299	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	185	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	165	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	150	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	108	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	88	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	55	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C566)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A61: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	580	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	574	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	786	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1,282	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,724	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	2,279	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	2,217	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,551	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1,371	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,135	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	484	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	481	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A62: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	848	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	943	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1,385	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2,367	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	2,582	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	4,570	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	4,163	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2,819	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	3,666	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	2,937	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	733	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	723	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A63: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	660	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	574	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	751	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1,033	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,876	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	2,445	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	2,335	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,557	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	657	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	601	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	545	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	547	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A64: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	494	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	385	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	688	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	691	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	797	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1,447	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,740	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,229	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	409	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	370	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	368	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	359	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A65: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	405	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	382	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	400	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1,261	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	2,404	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	949	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1,022	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	767	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	341	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	320	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	337	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	340	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A66: Monthly Average Simulated Tuolumne River Inflow into San Joaquin River for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	302	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	317	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	312	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	378	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	416	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	430	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	538	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	541	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	260	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	250	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	263	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	265	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C545)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A67: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	917	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Nov	392	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	428	0 (0%)	-1 (0%)	-3 (-1%)	-10 (-2%)
Jan	618	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Feb	674	0 (0%)	17 (3%)	17 (3%)	14 (2%)
Mar	925	0 (0%)	12 (1%)	17 (2%)	62 (7%)
Apr	1,313	0 (0%)	-5 (0%)	-4 (0%)	-4 (0%)
May	1,259	0 (0%)	2 (0%)	3 (0%)	6 (0%)
Jun	878	0 (0%)	12 (1%)	13 (1%)	14 (2%)
Jul	534	0 (0%)	-4 (-1%)	-4 (-1%)	-6 (-1%)
Aug	525	0 (0%)	-9 (-2%)	-12 (-2%)	-22 (-4%)
Sep	553	0 (0%)	-1 (0%)	-1 (0%)	-6 (-1%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A68: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,081	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	611	0 (0%)	-2 (0%)	-2 (0%)	-2 (0%)
Dec	797	0 (0%)	-7 (-1%)	-14 (-2%)	-39 (-5%)
Jan	1,283	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1,291	0 (0%)	22 (2%)	22 (2%)	14 (1%)
Mar	1,840	0 (0%)	-5 (0%)	-5 (0%)	-5 (0%)
Apr	1,652	0 (0%)	-2 (0%)	-1 (0%)	-1 (0%)
May	1,692	0 (0%)	6 (0%)	11 (1%)	21 (1%)
Jun	1,350	0 (0%)	7 (1%)	10 (1%)	17 (1%)
Jul	886	0 (0%)	-11 (-1%)	-12 (-1%)	-18 (-2%)
Aug	818	0 (0%)	-28 (-3%)	-38 (-5%)	-72 (-9%)
Sep	907	0 (0%)	-1 (0%)	-1 (0%)	-16 (-2%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A69: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	938	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	299	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	259	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	337	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	387	0 (0%)	8 (2%)	8 (2%)	8 (2%)
Mar	981	0 (0%)	35 (4%)	46 (5%)	144 (15%)
Apr	1,458	0 (0%)	0 (0%)	0 (0%)	4 (0%)
May	1,370	0 (0%)	8 (1%)	8 (1%)	8 (1%)
Jun	1,215	0 (0%)	32 (3%)	36 (3%)	37 (3%)
Jul	454	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	459	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	476	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A70: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	893	0 (0%)	-5 (-1%)	-5 (-1%)	-5 (-1%)
Nov	323	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	316	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	362	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Feb	481	0 (0%)	32 (7%)	32 (7%)	32 (7%)
Mar	569	0 (0%)	14 (2%)	18 (3%)	79 (14%)
Apr	1,224	0 (0%)	-24 (-2%)	-24 (-2%)	-24 (-2%)
May	1,181	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	692	0 (0%)	14 (2%)	14 (2%)	14 (2%)
Jul	430	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	428	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	418	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A71: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	863	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	308	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	279	0 (0%)	7 (2%)	7 (2%)	7 (2%)
Jan	370	0 (0%)	5 (1%)	5 (1%)	5 (1%)
Feb	462	0 (0%)	30 (6%)	30 (6%)	30 (6%)
Mar	327	0 (0%)	29 (9%)	39 (12%)	148 (45%)
Apr	1,324	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1,122	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Jun	464	0 (0%)	18 (4%)	18 (4%)	18 (4%)
Jul	355	0 (0%)	-3 (-1%)	-3 (-1%)	-3 (-1%)
Aug	393	0 (0%)	-6 (-2%)	-6 (-2%)	-6 (-2%)
Sep	401	0 (0%)	-4 (-1%)	-4 (-1%)	-4 (-1%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A72: Monthly Average Simulated Stanislaus River Inflow into San Joaquin River for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	712	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	282	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	262	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	315	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	370	0 (0%)	-4 (-1%)	-3 (-1%)	-5 (-1%)
Mar	274	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	722	0 (0%)	-2 (0%)	-1 (0%)	-3 (0%)
May	674	0 (0%)	-7 (-1%)	-8 (-1%)	-12 (-2%)
Jun	319	0 (0%)	-9 (-3%)	-9 (-3%)	-17 (-5%)
Jul	315	0 (0%)	-2 (-1%)	-3 (-1%)	-3 (-1%)
Aug	338	0 (0%)	3 (1%)	2 (0%)	4 (1%)
Sep	332	0 (0%)	0 (0%)	0 (0%)	-3 (-1%)

Source: CalSim-II Simulation Output Parameter (C528)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A73: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,204	0 (0%)	-5 (0%)	-7 (-1%)	-21 (-2%)
Nov	1,213	0 (0%)	-5 (0%)	-7 (-1%)	-21 (-2%)
Dec	1,245	0 (0%)	-5 (0%)	-7 (-1%)	-20 (-2%)
Jan	1,295	0 (0%)	-5 (0%)	-7 (-1%)	-20 (-2%)
Feb	1,355	0 (0%)	-6 (0%)	-8 (-1%)	-21 (-2%)
Mar	1,393	0 (0%)	-7 (0%)	-9 (-1%)	-25 (-2%)
Apr	1,380	0 (0%)	-6 (0%)	-8 (-1%)	-24 (-2%)
May	1,408	0 (0%)	-6 (0%)	-9 (-1%)	-24 (-2%)
Jun	1,426	0 (0%)	-7 (0%)	-9 (-1%)	-25 (-2%)
Jul	1,360	0 (0%)	-6 (0%)	-8 (-1%)	-24 (-2%)
Aug	1,277	0 (0%)	-6 (0%)	-8 (-1%)	-22 (-2%)
Sep	1,231	0 (0%)	-6 (0%)	-8 (-1%)	-22 (-2%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A74: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,661	0 (0%)	-2 (0%)	-5 (0%)	-19 (-1%)
Nov	1,666	0 (0%)	-2 (0%)	-5 (0%)	-19 (-1%)
Dec	1,689	0 (0%)	-2 (0%)	-4 (0%)	-17 (-1%)
Jan	1,722	0 (0%)	-2 (0%)	-4 (0%)	-17 (-1%)
Feb	1,759	0 (0%)	-3 (0%)	-5 (0%)	-17 (-1%)
Mar	1,609	0 (0%)	-4 (0%)	-7 (0%)	-24 (-1%)
Apr	1,666	0 (0%)	-4 (0%)	-7 (0%)	-24 (-1%)
May	1,799	0 (0%)	-4 (0%)	-8 (0%)	-25 (-1%)
Jun	1,915	0 (0%)	-5 (0%)	-8 (0%)	-26 (-1%)
Jul	1,867	0 (0%)	-4 (0%)	-7 (0%)	-25 (-1%)
Aug	1,766	0 (0%)	-2 (0%)	-5 (0%)	-20 (-1%)
Sep	1,703	0 (0%)	-2 (0%)	-5 (0%)	-19 (-1%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A75: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,325	0 (0%)	-9 (-1%)	-11 (-1%)	-25 (-2%)
Nov	1,337	0 (0%)	-9 (-1%)	-11 (-1%)	-25 (-2%)
Dec	1,368	0 (0%)	-9 (-1%)	-11 (-1%)	-25 (-2%)
Jan	1,425	0 (0%)	-9 (-1%)	-11 (-1%)	-25 (-2%)
Feb	1,496	0 (0%)	-9 (-1%)	-11 (-1%)	-25 (-2%)
Mar	1,439	0 (0%)	-7 (0%)	-9 (-1%)	-24 (-2%)
Apr	1,445	0 (0%)	-7 (0%)	-9 (-1%)	-24 (-2%)
May	1,527	0 (0%)	-8 (0%)	-9 (-1%)	-25 (-2%)
Jun	1,533	0 (0%)	-10 (-1%)	-12 (-1%)	-27 (-2%)
Jul	1,459	0 (0%)	-9 (-1%)	-12 (-1%)	-27 (-2%)
Aug	1,375	0 (0%)	-9 (-1%)	-11 (-1%)	-27 (-2%)
Sep	1,333	0 (0%)	-9 (-1%)	-11 (-1%)	-26 (-2%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A76: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,133	0 (0%)	-1 (0%)	-3 (0%)	-17 (-2%)
Nov	1,157	0 (0%)	-1 (0%)	-3 (0%)	-17 (-2%)
Dec	1,207	0 (0%)	-1 (0%)	-3 (0%)	-17 (-1%)
Jan	1,245	0 (0%)	-1 (0%)	-3 (0%)	-17 (-1%)
Feb	1,295	0 (0%)	-3 (0%)	-5 (0%)	-19 (-1%)
Mar	1,371	0 (0%)	-9 (-1%)	-11 (-1%)	-28 (-2%)
Apr	1,333	0 (0%)	-7 (-1%)	-9 (-1%)	-26 (-2%)
May	1,351	0 (0%)	-6 (0%)	-8 (-1%)	-25 (-2%)
Jun	1,361	0 (0%)	-6 (0%)	-8 (-1%)	-25 (-2%)
Jul	1,286	0 (0%)	-5 (0%)	-7 (-1%)	-24 (-2%)
Aug	1,202	0 (0%)	-4 (0%)	-7 (-1%)	-23 (-2%)
Sep	1,154	0 (0%)	-4 (0%)	-6 (-1%)	-23 (-2%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A77: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,039	0(0%)	-2 (0%)	-5 (0%)	-24 (-2%)
Nov	1,047	0 (0%)	-2 (0%)	-4 (0%)	-23 (-2%)
Dec	1,109	0 (0%)	-2 (0%)	-4 (0%)	-23 (-2%)
Jan	1,215	0 (0%)	-2 (0%)	-4 (0%)	-23 (-2%)
Feb	1,342	0 (0%)	-3 (0%)	-6 (0%)	-24 (-2%)
Mar	1,516	0 (0%)	-8 (-1%)	-11 (-1%)	-30 (-2%)
Apr	1,440	0 (0%)	-8 (-1%)	-10 (-1%)	-29 (-2%)
May	1,354	0 (0%)	-7 (-1%)	-9 (-1%)	-29 (-2%)
Jun	1,291	0 (0%)	-7 (-1%)	-9 (-1%)	-28 (-2%)
Jul	1,203	0 (0%)	-5 (0%)	-8 (-1%)	-27 (-2%)
Aug	1,118	0 (0%)	-4 (0%)	-6 (-1%)	-25 (-2%)
Sep	1,076	0 (0%)	-3 (0%)	-5 (0%)	-24 (-2%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A78: Monthly Average Simulated End-of-Month New Melones Reservoir Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	578	0(0%)	-10 (-2%)	-11 (-2%)	-18 (-3%)
Nov	577	0 (0%)	-11 (-2%)	-11 (-2%)	-18 (-3%)
Dec	587	0(0%)	-11 (-2%)	-11 (-2%)	-19 (-3%)
Jan	617	0 (0%)	-11 (-2%)	-12 (-2%)	-19 (-3%)
Feb	654	0 (0%)	-11 (-2%)	-12 (-2%)	-19 (-3%)
Mar	938	0 (0%)	-7 (-1%)	-8 (-1%)	-19 (-2%)
Apr	873	0 (0%)	-8 (-1%)	-8 (-1%)	-19 (-2%)
May	794	0 (0%)	-8 (-1%)	-8 (-1%)	-18 (-2%)
Jun	746	0 (0%)	-8 (-1%)	-9 (-1%)	-17 (-2%)
Jul	687	0 (0%)	-8 (-1%)	-8 (-1%)	-16 (-2%)
Aug	634	0 (0%)	-9 (-1%)	-10 (-2%)	-17 (-3%)
Sep	608	0 (0%)	-10 (-2%)	-10 (-2%)	-18 (-3%)

Source: CalSim-II Simulation Output Parameter (S10)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on San Joaquin Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A79: Monthly Average Simulated Exports Through Jones Pumping Plant for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,569	0 (0%)	-36 (-1%)	-38 (-1%)	-41 (-1%)
Nov	3,608	0 (0%)	-39 (-1%)	-41 (-1%)	-34 (-1%)
Dec	3,957	0 (0%)	-47 (-1%)	-51 (-1%)	-50 (-1%)
Jan	3,225	0 (0%)	-22 (-1%)	-20 (-1%)	-23 (-1%)
Feb	3,304	0 (0%)	-13 (0%)	-9 (0%)	-9 (0%)
Mar	3,158	0 (0%)	-37 (-1%)	-43 (-1%)	-74 (-2%)
Apr	1,217	0 (0%)	-30 (-2%)	-42 (-3%)	-73 (-6%)
May	1,078	0 (0%)	-4 (0%)	-5 (0%)	-6 (-1%)
Jun	2,590	0 (0%)	-32 (-1%)	-36 (-1%)	-44 (-2%)
Jul	3,389	0 (0%)	-3 (0%)	-10 (0%)	-13 (0%)
Aug	3,722	0 (0%)	5 (0%)	5 (0%)	5 (0%)
Sep	3,990	0 (0%)	-6 (0%)	-8 (0%)	-12 (0%)

Source: CalSim-II Simulation Output Parameter (D418)

Simulation period: 1922–2003

Key:

cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot

Alt=Alternative

Based on Sacramento Valley Year Type

Change as measured from Future No Action Alternative

Values in paranthesis indicate percentage change. Calculated as

(Alt X minus No Action Alt)/No Action Alt

Table A80: Monthly Average Simulated Exports Through Jones Pumping Plant for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,654	0 (0%)	-38 (-1%)	-35 (-1%)	-39 (-1%)
Nov	3,859	0 (0%)	-23 (-1%)	-21 (-1%)	-16 (0%)
Dec	4,042	0 (0%)	-17 (0%)	-17 (0%)	-20 (0%)
Jan	3,668	0 (0%)	-16 (0%)	-16 (0%)	-16 (0%)
Feb	4,068	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Mar	3,824	0 (0%)	-15 (0%)	-18 (0%)	0 (0%)
Apr	1,568	0 (0%)	-18 (-1%)	-28 (-2%)	-55 (-4%)
May	1,448	0 (0%)	-5 (0%)	-7 (0%)	-11 (-1%)
Jun	3,834	0 (0%)	-15 (0%)	-21 (-1%)	-32 (-1%)
Jul	4,455	0 (0%)	-5 (0%)	-7 (0%)	-4 (0%)
Aug	4,569	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	4,344	0 (0%)	-9 (0%)	-10 (0%)	-22 (-1%)

Source: CalSim-II Simulation Output Parameter (D418)

Simulation period: 1922–2003

Key:

cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot

Alt=Alternative

Based on Sacramento Valley Year Type

Change as measured from Future No Action Alternative

Values in paranthesis indicate percentage change. Calculated as

(Alt X minus No Action Alt)/No Action Alt

Table A81: Monthly Average Simulated Exports Through Jones Pumping Plant for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,533	0 (0%)	-67 (-2%)	-57 (-2%)	-68 (-2%)
Nov	3,816	0 (0%)	-11 (0%)	-5 (0%)	-3 (0%)
Dec	4,007	0 (0%)	-19 (0%)	-22 (-1%)	-22 (-1%)
Jan	2,810	0 (0%)	-22 (-1%)	2 (0%)	-33 (-1%)
Feb	3,016	0 (0%)	-8 (0%)	-8 (0%)	-9 (0%)
Mar	3,782	0 (0%)	-13 (0%)	-19 (-1%)	-29 (-1%)
Apr	1,086	0 (0%)	-23 (-2%)	-34 (-3%)	-70 (-6%)
May	876	0 (0%)	-2 (0%)	-3 (0%)	-5 (-1%)
Jun	3,257	0 (0%)	-6 (0%)	-4 (0%)	-3 (0%)
Jul	3,927	0 (0%)	-18 (0%)	-23 (-1%)	-24 (-1%)
Aug	4,502	0 (0%)	-1 (0%)	-1 (0%)	0 (0%)
Sep	4,258	0 (0%)	17 (0%)	20 (0%)	21 (0%)

Source: CalSim-II Simulation Output Parameter (D418)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A82: Monthly Average Simulated Exports Through Jones Pumping Plant for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,752	0 (0%)	-26 (-1%)	-26 (-1%)	-29 (-1%)
Nov	3,871	0 (0%)	-31 (-1%)	-32 (-1%)	-39 (-1%)
Dec	4,227	0 (0%)	-6 (0%)	-34 (-1%)	-17 (0%)
Jan	3,022	0 (0%)	-19 (-1%)	-11 (0%)	-5 (0%)
Feb	3,102	0 (0%)	-9 (0%)	-8 (0%)	-6 (0%)
Mar	3,244	0 (0%)	-46 (-1%)	-62 (-2%)	-96 (-3%)
Apr	1,008	0 (0%)	-33 (-3%)	-46 (-5%)	-81 (-8%)
May	829	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,632	0 (0%)	-124 (-5%)	-126 (-5%)	-158 (-6%)
Jul	3,941	0 (0%)	55 (1%)	44 (1%)	35 (1%)
Aug	4,280	0 (0%)	-19 (0%)	-13 (0%)	-6 (0%)
Sep	4,387	0 (0%)	5 (0%)	6 (0%)	9 (0%)

Source: CalSim-II Simulation Output Parameter (D418)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A83: Monthly Average Simulated Exports Through Jones Pumping Plant for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,513	0(0%)	-24 (-1%)	-39 (-1%)	-43 (-1%)
Nov	3,293	0 (0%)	-60 (-2%)	-71 (-2%)	-44 (-1%)
Dec	4,123	0 (0%)	-144 (-3%)	-143 (-3%)	-141 (-3%)
Jan	3,243	0 (0%)	-23 (-1%)	-25 (-1%)	-23 (-1%)
Feb	2,970	0 (0%)	-22 (-1%)	-6 (0%)	-6 (0%)
Mar	2,579	0 (0%)	-55 (-2%)	-79 (-3%)	-145 (-6%)
Apr	1,118	0 (0%)	-50 (-4%)	-69 (-6%)	-109 (-10%)
May	894	0 (0%)	-5 (-1%)	-5 (-1%)	-5 (-1%)
Jun	1,674	0 (0%)	-19 (-1%)	-17 (-1%)	-6 (0%)
Jul	2,672	0 (0%)	-41 (-2%)	-44 (-2%)	-51 (-2%)
Aug	3,231	0 (0%)	22 (1%)	21 (1%)	18 (1%)
Sep	3,836	0 (0%)	-7 (0%)	-11 (0%)	-13 (0%)

Source: CalSim-II Simulation Output Parameter (D418)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A84: Monthly Average Simulated Exports Through Jones Pumping Plant for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,293	0(0%)	-32 (-1%)	-36 (-1%)	-28 (-1%)
Nov	3,020	0 (0%)	-83 (-3%)	-88 (-3%)	-86 (-3%)
Dec	3,162	0(0%)	-43 (-1%)	-36 (-1%)	-43 (-1%)
Jan	2,889	0 (0%)	-37 (-1%)	-53 (-2%)	-49 (-2%)
Feb	2,672	0 (0%)	-33 (-1%)	-35 (-1%)	-37 (-1%)
Mar	1,858	0 (0%)	-72 (-4%)	-47 (-3%)	-146 (-8%)
Apr	980	0 (0%)	-30 (-3%)	-37 (-4%)	-52 (-5%)
May	1,042	0 (0%)	-7 (-1%)	-7 (-1%)	-9 (-1%)
Jun	553	0 (0%)	-8 (-1%)	-25 (-5%)	-32 (-6%)
Jul	972	0 (0%)	3 (0%)	-12 (-1%)	-17 (-2%)
Aug	1,194	0 (0%)	23 (2%)	19 (2%)	14 (1%)
Sep	2,721	0 (0%)	-31 (-1%)	-45 (-2%)	-45 (-2%)

Source: CalSim-II Simulation Output Parameter (D418)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A85: Monthly Average Simulated Exports Through Banks Pumping Plant for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,203	0 (0%)	-19 (-1%)	-18 (-1%)	-16 (0%)
Nov	3,761	0 (0%)	-26 (-1%)	-26 (-1%)	-29 (-1%)
Dec	4,749	0 (0%)	-58 (-1%)	-57 (-1%)	-60 (-1%)
Jan	3,602	0 (0%)	-23 (-1%)	-25 (-1%)	-24 (-1%)
Feb	4,016	0 (0%)	-14 (0%)	-14 (0%)	-14 (0%)
Mar	4,010	0 (0%)	-33 (-1%)	-38 (-1%)	-79 (-2%)
Apr	1,192	0 (0%)	-30 (-2%)	-42 (-4%)	-74 (-6%)
May	1,014	0 (0%)	-5 (-1%)	-6 (-1%)	-8 (-1%)
Jun	2,439	0 (0%)	-3 (0%)	-5 (0%)	-4 (0%)
Jul	5,880	0 (0%)	13 (0%)	14 (0%)	16 (0%)
Aug	5,440	0 (0%)	-17 (0%)	-19 (0%)	-22 (0%)
Sep	5,023	0 (0%)	-18 (0%)	-29 (-1%)	-33 (-1%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A86: Monthly Average Simulated Exports Through Banks Pumping Plant for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,668	0 (0%)	-25 (-1%)	-24 (-1%)	-19 (-1%)
Nov	4,597	0 (0%)	-17 (0%)	-15 (0%)	-23 (0%)
Dec	4,979	0 (0%)	-15 (0%)	-16 (0%)	-18 (0%)
Jan	4,452	0 (0%)	-16 (0%)	-16 (0%)	-16 (0%)
Feb	5,607	0 (0%)	-8 (0%)	-8 (0%)	-8 (0%)
Mar	5,928	0 (0%)	-7 (0%)	-10 (0%)	-19 (0%)
Apr	1,767	0 (0%)	-19 (-1%)	-28 (-2%)	-57 (-3%)
May	1,634	0 (0%)	-6 (0%)	-8 (0%)	-13 (-1%)
Jun	4,099	0 (0%)	-5 (0%)	-11 (0%)	-14 (0%)
Jul	6,909	0 (0%)	-2 (0%)	-3 (0%)	-4 (0%)
Aug	7,102	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	6,511	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A87: Monthly Average Simulated Exports Through Banks Pumping Plant for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,199	0 (0%)	-29 (-1%)	-30 (-1%)	-30 (-1%)
Nov	3,470	0 (0%)	-18 (-1%)	-18 (-1%)	-15 (0%)
Dec	5,330	0 (0%)	-17 (0%)	-19 (0%)	-19 (0%)
Jan	3,510	0 (0%)	-22 (-1%)	-23 (-1%)	-19 (-1%)
Feb	3,858	0 (0%)	-9 (0%)	-9 (0%)	-9 (0%)
Mar	4,672	0 (0%)	-25 (-1%)	-36 (-1%)	-61 (-1%)
Apr	1,078	0 (0%)	-23 (-2%)	-34 (-3%)	-70 (-6%)
May	839	0 (0%)	-2 (0%)	-4 (0%)	-5 (-1%)
Jun	2,975	0 (0%)	-5 (0%)	-10 (0%)	-25 (-1%)
Jul	6,559	0 (0%)	-9 (0%)	12 (0%)	11 (0%)
Aug	7,013	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	6,680	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A88: Monthly Average Simulated Exports Through Banks Pumping Plant for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	3,236	0 (0%)	8 (0%)	7 (0%)	14 (0%)
Nov	3,970	0 (0%)	-25 (-1%)	-26 (-1%)	-21 (-1%)
Dec	4,986	0 (0%)	-18 (0%)	-19 (0%)	-22 (0%)
Jan	3,279	0 (0%)	-24 (-1%)	-33 (-1%)	-39 (-1%)
Feb	3,907	0 (0%)	5 (0%)	5 (0%)	1 (0%)
Mar	3,868	0 (0%)	-33 (-1%)	-52 (-1%)	-100 (-3%)
Apr	999	0 (0%)	-35 (-3%)	-48 (-5%)	-84 (-8%)
May	786	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	2,087	0 (0%)	-5 (0%)	-3 (0%)	29 (1%)
Jul	6,972	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	7,106	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	6,405	0 (0%)	-89 (-1%)	-88 (-1%)	-98 (-2%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A89: Monthly Average Simulated Exports Through Banks Pumping Plant for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,951	0(0%)	-17 (-1%)	-12 (0%)	-20 (-1%)
Nov	3,562	0 (0%)	-33 (-1%)	-36 (-1%)	-37 (-1%)
Dec	4,934	0 (0%)	-192 (-4%)	-188 (-4%)	-190 (-4%)
Jan	3,242	0 (0%)	-27 (-1%)	-19 (-1%)	-18 (-1%)
Feb	2,968	0 (0%)	-27 (-1%)	-25 (-1%)	-26 (-1%)
Mar	2,475	0 (0%)	-56 (-2%)	-81 (-3%)	-140 (-6%)
Apr	951	0 (0%)	-50 (-5%)	-68 (-7%)	-114 (-12%)
May	760	0 (0%)	-10 (-1%)	-10 (-1%)	-10 (-1%)
Jun	1,354	0 (0%)	7 (1%)	4 (0%)	0 (0%)
Jul	5,594	0 (0%)	76 (1%)	79 (1%)	86 (2%)
Aug	3,674	0 (0%)	-75 (-2%)	-85 (-2%)	-97 (-3%)
Sep	3,111	0 (0%)	-19 (-1%)	-69 (-2%)	-77 (-2%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A90: Monthly Average Simulated Exports Through Banks Pumping Plant for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,539	0(0%)	-30 (-1%)	-33 (-1%)	-23 (-1%)
Nov	2,292	0 (0%)	-45 (-2%)	-43 (-2%)	-52 (-2%)
Dec	3,117	0(0%)	-40 (-1%)	-33 (-1%)	-39 (-1%)
Jan	2,773	0 (0%)	-31 (-1%)	-45 (-2%)	-42 (-2%)
Feb	2,425	0 (0%)	-36 (-1%)	-35 (-1%)	-35 (-1%)
Mar	1,665	0 (0%)	-63 (-4%)	-22 (-1%)	-111 (-7%)
Apr	649	0 (0%)	-23 (-4%)	-31 (-5%)	-42 (-6%)
May	496	0 (0%)	-7 (-1%)	-8 (-2%)	-7 (-1%)
Jun	345	0 (0%)	-6 (-2%)	-6 (-2%)	-7 (-2%)
Jul	2,124	0 (0%)	-14 (-1%)	-27 (-1%)	-21 (-1%)
Aug	969	0 (0%)	-3 (0%)	-4 (0%)	-4 (0%)
Sep	1,398	0 (0%)	10 (1%)	10 (1%)	6 (0%)

Source: CalSim-II Simulation Output Parameter (D419)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A91: Monthly Average Simulated Delta Outflow for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	5,917	0 (0%)	2 (0%)	1 (0%)	-11 (0%)
Nov	11,425	0 (0%)	-18 (0%)	-15 (0%)	-12 (0%)
Dec	20,761	0 (0%)	22 (0%)	17 (0%)	8 (0%)
Jan	42,103	0 (0%)	-61 (0%)	-59 (0%)	-64 (0%)
Feb	52,878	0 (0%)	-31 (0%)	-33 (0%)	-35 (0%)
Mar	42,288	0 (0%)	-67 (0%)	-114 (0%)	-195 (0%)
Apr	31,044	0 (0%)	-128 (0%)	-216 (-1%)	-350 (-1%)
May	22,128	0 (0%)	-30 (0%)	-40 (0%)	-49 (0%)
Jun	12,362	0 (0%)	4 (0%)	-1 (0%)	0 (0%)
Jul	7,787	0 (0%)	13 (0%)	18 (0%)	19 (0%)
Aug	4,445	0 (0%)	-10 (0%)	-13 (0%)	-17 (0%)
Sep	9,725	0 (0%)	-8 (0%)	-13 (0%)	-12 (0%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A92: Monthly Average Simulated Delta Outflow for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	7,630	0 (0%)	-25 (0%)	-31 (0%)	-48 (-1%)
Nov	17,307	0 (0%)	-26 (0%)	-27 (0%)	-29 (0%)
Dec	42,348	0 (0%)	-94 (0%)	-105 (0%)	-142 (0%)
Jan	84,274	0 (0%)	-27 (0%)	-31 (0%)	-55 (0%)
Feb	96,682	0 (0%)	-52 (0%)	-53 (0%)	-60 (0%)
Mar	78,274	0 (0%)	-40 (0%)	-58 (0%)	-86 (0%)
Apr	55,588	0 (0%)	-119 (0%)	-210 (0%)	-363 (-1%)
May	39,936	0 (0%)	-54 (0%)	-82 (0%)	-115 (0%)
Jun	22,429	0 (0%)	-16 (0%)	-28 (0%)	-29 (0%)
Jul	11,156	0 (0%)	17 (0%)	27 (0%)	37 (0%)
Aug	5,100	0 (0%)	-13 (0%)	-17 (0%)	-38 (-1%)
Sep	19,553	0 (0%)	12 (0%)	15 (0%)	18 (0%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A93: Monthly Average Simulated Delta Outflow for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	5,218	0 (0%)	31 (1%)	19 (0%)	20 (0%)
Nov	11,577	0 (0%)	-16 (0%)	7 (0%)	6 (0%)
Dec	17,979	0 (0%)	-12 (0%)	-13 (0%)	-18 (0%)
Jan	46,845	0 (0%)	-51 (0%)	-72 (0%)	-26 (0%)
Feb	61,243	0 (0%)	-34 (0%)	-41 (0%)	-25 (0%)
Mar	51,521	0 (0%)	-6 (0%)	34 (0%)	-22 (0%)
Apr	33,282	0 (0%)	-149 (0%)	-269 (-1%)	-453 (-1%)
May	24,084	0 (0%)	-47 (0%)	-66 (0%)	-75 (0%)
Jun	11,345	0 (0%)	21 (0%)	24 (0%)	28 (0%)
Jul	9,389	0 (0%)	12 (0%)	33 (0%)	34 (0%)
Aug	4,000	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	11,836	0 (0%)	-39 (0%)	-39 (0%)	-39 (0%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A94: Monthly Average Simulated Delta Outflow for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	5,454	0 (0%)	-12 (0%)	0 (0%)	-13 (0%)
Nov	8,623	0 (0%)	-24 (0%)	-28 (0%)	-13 (0%)
Dec	11,651	0 (0%)	-16 (0%)	-16 (0%)	3 (0%)
Jan	21,724	0 (0%)	-35 (0%)	-31 (0%)	-29 (0%)
Feb	36,105	0 (0%)	38 (0%)	26 (0%)	1 (0%)
Mar	22,712	0 (0%)	-109 (0%)	-153 (-1%)	-264 (-1%)
Apr	23,118	0 (0%)	-206 (-1%)	-334 (-1%)	-540 (-2%)
May	16,008	0 (0%)	-16 (0%)	-13 (0%)	14 (0%)
Jun	7,889	0 (0%)	34 (0%)	34 (0%)	26 (0%)
Jul	6,967	0 (0%)	32 (0%)	26 (0%)	10 (0%)
Aug	4,053	0 (0%)	-2 (0%)	-4 (0%)	-6 (0%)
Sep	3,911	0 (0%)	-37 (-1%)	-37 (-1%)	-39 (-1%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A95: Monthly Average Simulated Delta Outflow for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	5,184	0(0%)	23 (0%)	23 (0%)	20 (0%)
Nov	8,503	0 (0%)	22 (0%)	22 (0%)	19 (0%)
Dec	8,513	0 (0%)	248 (3%)	251 (3%)	254 (3%)
Jan	14,377	0 (0%)	-62 (0%)	-68 (0%)	-71 (0%)
Feb	22,786	0 (0%)	-46 (0%)	-48 (0%)	-44 (0%)
Mar	19,673	0 (0%)	-116 (-1%)	-167 (-1%)	-301 (-2%)
Apr	14,765	0 (0%)	-115 (-1%)	-207 (-1%)	-318 (-2%)
May	10,536	0 (0%)	-11 (0%)	-4 (0%)	-13 (0%)
Jun	6,664	0 (0%)	1 (0%)	-8 (0%)	-4 (0%)
Jul	5,009	0 (0%)	3 (0%)	2 (0%)	1 (0%)
Aug	4,209	0 (0%)	-4 (0%)	-7 (0%)	-4 (0%)
Sep	3,126	0 (0%)	0 (0%)	-26 (-1%)	-26 (-1%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A96: Monthly Average Simulated Delta Outflow for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	4,542	0(0%)	11 (0%)	18 (0%)	-10 (0%)
Nov	6,181	0 (0%)	-55 (-1%)	-52 (-1%)	-34 (-1%)
Dec	5,769	0(0%)	14 (0%)	-2 (0%)	-4 (0%)
Jan	11,354	0 (0%)	-176 (-2%)	-124 (-1%)	-155 (-1%)
Feb	14,310	0 (0%)	-39 (0%)	-31 (0%)	-21 (0%)
Mar	11,845	0 (0%)	-62 (-1%)	-261 (-2%)	-364 (-3%)
Apr	9,293	0 (0%)	-52 (-1%)	-49 (-1%)	-46 (0%)
May	6,118	0 (0%)	-7 (0%)	-7 (0%)	-7 (0%)
Jun	5,330	0 (0%)	2 (0%)	4 (0%)	8 (0%)
Jul	4,009	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Aug	4,282	0 (0%)	-36 (-1%)	-38 (-1%)	-22 (-1%)
Sep	3,000	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C406)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A97: Monthly Average Simulated Flow in Sacramento River below Freeport for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	11,015	0 (0%)	4 (0%)	2 (0%)	-10 (0%)
Nov	15,775	0 (0%)	27 (0%)	30 (0%)	39 (0%)
Dec	21,640	0 (0%)	-13 (0%)	-19 (0%)	-21 (0%)
Jan	29,881	0 (0%)	-17 (0%)	-13 (0%)	-19 (0%)
Feb	36,349	0 (0%)	-2 (0%)	0 (0%)	1 (0%)
Mar	30,835	0 (0%)	9 (0%)	10 (0%)	12 (0%)
Apr	22,435	0 (0%)	-1 (0%)	5 (0%)	12 (0%)
May	19,242	0 (0%)	9 (0%)	11 (0%)	15 (0%)
Jun	16,203	0 (0%)	4 (0%)	1 (0%)	12 (0%)
Jul	18,273	0 (0%)	30 (0%)	31 (0%)	32 (0%)
Aug	14,399	0 (0%)	-12 (0%)	-14 (0%)	-11 (0%)
Sep	17,902	0 (0%)	-17 (0%)	-35 (0%)	-37 (0%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A98: Monthly Average Simulated Flow in Sacramento River below Freeport for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	12,832	0 (0%)	-30 (0%)	-32 (0%)	-46 (0%)
Nov	20,839	0 (0%)	46 (0%)	46 (0%)	42 (0%)
Dec	34,346	0 (0%)	-19 (0%)	-22 (0%)	-35 (0%)
Jan	48,441	0 (0%)	-4 (0%)	-4 (0%)	-17 (0%)
Feb	55,762	0 (0%)	-4 (0%)	-5 (0%)	-5 (0%)
Mar	47,701	0 (0%)	-4 (0%)	-15 (0%)	-21 (0%)
Apr	35,587	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
May	31,457	0 (0%)	0 (0%)	0 (0%)	-3 (0%)
Jun	23,321	0 (0%)	10 (0%)	11 (0%)	28 (0%)
Jul	19,980	0 (0%)	23 (0%)	30 (0%)	48 (0%)
Aug	16,222	0 (0%)	13 (0%)	19 (0%)	29 (0%)
Sep	28,409	0 (0%)	8 (0%)	11 (0%)	15 (0%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A99: Monthly Average Simulated Flow in Sacramento River below Freeport for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	10,651	0 (0%)	-11 (0%)	-12 (0%)	-23 (0%)
Nov	16,373	0 (0%)	29 (0%)	56 (0%)	60 (0%)
Dec	21,402	0 (0%)	-4 (0%)	-6 (0%)	-10 (0%)
Jan	36,127	0 (0%)	5 (0%)	7 (0%)	17 (0%)
Feb	43,652	0 (0%)	-7 (0%)	-10 (0%)	-8 (0%)
Mar	40,177	0 (0%)	26 (0%)	78 (0%)	69 (0%)
Apr	24,711	0 (0%)	0 (0%)	-1 (0%)	0 (0%)
May	21,118	0 (0%)	3 (0%)	3 (0%)	11 (0%)
Jun	16,308	0 (0%)	32 (0%)	39 (0%)	60 (0%)
Jul	21,821	0 (0%)	-10 (0%)	27 (0%)	26 (0%)
Aug	16,542	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	22,163	0 (0%)	-9 (0%)	-7 (0%)	-5 (0%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A100: Monthly Average Simulated Flow in Sacramento River below Freeport for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	10,896	0 (0%)	34 (0%)	43 (0%)	34 (0%)
Nov	14,142	0 (0%)	16 (0%)	24 (0%)	36 (0%)
Dec	16,277	0 (0%)	1 (0%)	-26 (0%)	-1 (0%)
Jan	20,830	0 (0%)	4 (0%)	8 (0%)	9 (0%)
Feb	29,973	0 (0%)	-2 (0%)	-12 (0%)	-18 (0%)
Mar	21,569	0 (0%)	-2 (0%)	0 (0%)	4 (0%)
Apr	17,669	0 (0%)	-21 (0%)	-20 (0%)	-30 (0%)
May	14,600	0 (0%)	40 (0%)	45 (0%)	71 (0%)
Jun	13,833	0 (0%)	-62 (0%)	-62 (0%)	-71 (-1%)
Jul	20,738	0 (0%)	92 (0%)	74 (0%)	50 (0%)
Aug	16,597	0 (0%)	-17 (0%)	-15 (0%)	-9 (0%)
Sep	14,089	0 (0%)	-114 (-1%)	-112 (-1%)	-120 (-1%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A101: Monthly Average Simulated Flow in Sacramento River below Freeport for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	9,994	0(0%)	43 (0%)	32 (0%)	18 (0%)
Nov	13,181	0 (0%)	42 (0%)	26 (0%)	50 (0%)
Dec	14,909	0 (0%)	-37 (0%)	-35 (0%)	-32 (0%)
Jan	16,551	0 (0%)	4 (0%)	4 (0%)	4 (0%)
Feb	21,967	0 (0%)	-7 (0%)	7 (0%)	11 (0%)
Mar	19,398	0 (0%)	3 (0%)	4 (0%)	2 (0%)
Apr	13,509	0 (0%)	5 (0%)	16 (0%)	33 (0%)
May	11,355	0 (0%)	13 (0%)	20 (0%)	12 (0%)
Jun	12,340	0 (0%)	20 (0%)	10 (0%)	22 (0%)
Jul	16,607	0 (0%)	45 (0%)	44 (0%)	43 (0%)
Aug	12,724	0 (0%)	-53 (0%)	-68 (-1%)	-80 (-1%)
Sep	9,940	0 (0%)	-14 (0%)	-93 (-1%)	-103 (-1%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A102: Monthly Average Simulated Flow in Sacramento River below Freeport for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	9,111	0(0%)	-2 (0%)	-3 (0%)	-12 (0%)
Nov	10,001	0 (0%)	-23 (0%)	-22 (0%)	-3 (0%)
Dec	10,701	0(0%)	9 (0%)	7 (0%)	-7 (0%)
Jan	13,978	0 (0%)	-124 (-1%)	-102 (-1%)	-127 (-1%)
Feb	16,000	0 (0%)	15 (0%)	22 (0%)	30 (0%)
Mar	12,917	0 (0%)	44 (0%)	16 (0%)	51 (0%)
Apr	10,612	0 (0%)	12 (0%)	38 (0%)	70 (1%)
May	8,148	0 (0%)	-7 (0%)	-7 (0%)	-3 (0%)
Jun	9,233	0 (0%)	18 (0%)	3 (0%)	10 (0%)
Jul	10,647	0 (0%)	-6 (0%)	-32 (0%)	-32 (0%)
Aug	8,252	0 (0%)	-10 (0%)	-15 (0%)	-6 (0%)
Sep	7,268	0 (0%)	26 (0%)	12 (0%)	12 (0%)

Source: CalSim-II Simulation Output Parameter (C169)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A103: Monthly Average Simulated Flow in Yolo Bypass for All Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	198	0 (0%)	-2 (-1%)	-2 (-1%)	-3 (-1%)
Nov	473	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	3,718	0 (0%)	-7 (0%)	-8 (0%)	-9 (0%)
Jan	10,873	0 (0%)	1 (0%)	0 (0%)	-3 (0%)
Feb	14,227	0 (0%)	-7 (0%)	-8 (0%)	-10 (0%)
Mar	9,594	0 (0%)	-2 (0%)	0 (0%)	-2 (0%)
Apr	3,604	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
May	363	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	224	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	88	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	171	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A104: Monthly Average Simulated Flow in Yolo Bypass for Wet Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	274	0 (0%)	-7 (-2%)	-7 (-2%)	-9 (-3%)
Nov	1,106	0 (0%)	-1 (0%)	-1 (0%)	0 (0%)
Dec	9,498	0 (0%)	-16 (0%)	-19 (0%)	-26 (0%)
Jan	27,993	0 (0%)	3 (0%)	0 (0%)	-11 (0%)
Feb	33,588	0 (0%)	-37 (0%)	-38 (0%)	-45 (0%)
Mar	22,955	0 (0%)	-5 (0%)	-1 (0%)	-4 (0%)
Apr	8,935	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
May	729	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	349	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	121	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	173	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A105: Monthly Average Simulated Flow in Yolo Bypass for Above Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	132	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	210	0 (0%)	0 (0%)	1 (0%)	0 (0%)
Dec	1,907	0 (0%)	1 (0%)	-1 (0%)	-3 (0%)
Jan	8,437	0 (0%)	-2 (0%)	-1 (0%)	3 (0%)
Feb	13,656	0 (0%)	-10 (0%)	-14 (0%)	0 (0%)
Mar	10,046	0 (0%)	3 (0%)	7 (0%)	-7 (0%)
Apr	3,023	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	283	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	166	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	87	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	165	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A106: Monthly Average Simulated Flow in Yolo Bypass for Below Normal Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	133	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1,469	0 (0%)	-12 (-1%)	-12 (-1%)	-3 (0%)
Jan	2,518	0 (0%)	1 (0%)	1 (0%)	2 (0%)
Feb	4,727	0 (0%)	35 (1%)	34 (1%)	27 (1%)
Mar	2,020	0 (0%)	-3 (0%)	-2 (0%)	-1 (0%)
Apr	1,121	0 (0%)	-2 (0%)	-3 (0%)	-3 (0%)
May	167	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	166	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	99	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	185	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A107: Monthly Average Simulated Flow in Yolo Bypass for Dry Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	216	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	233	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	654	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1,057	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Feb	2,920	0 (0%)	-1 (0%)	-1 (0%)	0 (0%)
Mar	1,805	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	483	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	171	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	167	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	56	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	165	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A108: Monthly Average Simulated Flow in Yolo Bypass for Critical Years

Month	No Action Alt (cfs)	Change from No Action (cfs)			
		Alt2	Alt3	Alt4	Alt5
Oct	141	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	119	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	224	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	687	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	896	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Mar	714	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	213	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	168	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	164	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	54	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	167	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (C157)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A109: Monthly Average Simulated End-of-Month Trinity Lake Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,346	0 (0%)	1 (0%)	0 (0%)	-2 (0%)
Nov	1,357	0 (0%)	1 (0%)	0 (0%)	-2 (0%)
Dec	1,407	0 (0%)	1 (0%)	0 (0%)	-2 (0%)
Jan	1,468	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Feb	1,576	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Mar	1,698	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Apr	1,848	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
May	1,841	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
Jun	1,800	0 (0%)	1 (0%)	0 (0%)	-2 (0%)
Jul	1,662	0 (0%)	1 (0%)	0 (0%)	-2 (0%)
Aug	1,527	0 (0%)	0 (0%)	0 (0%)	-4 (0%)
Sep	1,407	0 (0%)	1 (0%)	0 (0%)	-2 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A110: Monthly Average Simulated End-of-Month Trinity Lake Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,540	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Nov	1,570	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Dec	1,665	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Jan	1,776	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Feb	1,931	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Mar	2,065	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Apr	2,248	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
May	2,283	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jun	2,259	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jul	2,128	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	2,011	0 (0%)	-3 (0%)	-3 (0%)	-3 (0%)
Sep	1,860	0 (0%)	-2 (0%)	-2 (0%)	-2 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A111: Monthly Average Simulated End-of-Month Trinity Lake Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,378	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Nov	1,391	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Dec	1,464	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Jan	1,591	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Feb	1,746	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Mar	1,915	0 (0%)	3 (0%)	3 (0%)	-1 (0%)
Apr	2,084	0 (0%)	2 (0%)	1 (0%)	0 (0%)
May	2,089	0 (0%)	2 (0%)	1 (0%)	0 (0%)
Jun	2,057	0 (0%)	2 (0%)	1 (0%)	0 (0%)
Jul	1,940	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Aug	1,794	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Sep	1,649	0 (0%)	1 (0%)	1 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A112: Monthly Average Simulated End-of-Month Trinity Lake Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,274	0 (0%)	4 (0%)	3 (0%)	-4 (0%)
Nov	1,280	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Dec	1,299	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Jan	1,353	0 (0%)	4 (0%)	2 (0%)	-5 (0%)
Feb	1,427	0 (0%)	4 (0%)	2 (0%)	-5 (0%)
Mar	1,524	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Apr	1,697	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
May	1,680	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Jun	1,631	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Jul	1,502	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Aug	1,367	0 (0%)	4 (0%)	3 (0%)	-5 (0%)
Sep	1,262	0 (0%)	4 (0%)	3 (0%)	-5 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A113: Monthly Average Simulated End-of-Month Trinity Lake Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,307	0(0%)	-1 (0%)	-1 (0%)	-4 (0%)
Nov	1,311	0 (0%)	-2 (0%)	-1 (0%)	-4 (0%)
Dec	1,335	0 (0%)	-2 (0%)	-1 (0%)	-4 (0%)
Jan	1,347	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Feb	1,428	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Mar	1,557	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Apr	1,686	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
May	1,633	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Jun	1,563	0 (0%)	-1 (0%)	-2 (0%)	-4 (0%)
Jul	1,392	0 (0%)	-1 (0%)	-2 (0%)	-4 (0%)
Aug	1,239	0 (0%)	1 (0%)	1 (0%)	-3 (0%)
Sep	1,138	0 (0%)	1 (0%)	1 (0%)	-3 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A114: Monthly Average Simulated End-of-Month Trinity Lake Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,039	0(0%)	1 (0%)	1 (0%)	1 (0%)
Nov	1,017	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Dec	1,023	0(0%)	1 (0%)	1 (0%)	1 (0%)
Jan	990	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Feb	1,032	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Mar	1,102	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Apr	1,162	0 (0%)	1 (0%)	1 (0%)	0 (0%)
May	1,138	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Jun	1,099	0 (0%)	1 (0%)	0 (0%)	0 (0%)
Jul	967	0 (0%)	1 (0%)	0 (0%)	0 (0%)
Aug	832	0 (0%)	1 (0%)	0 (0%)	-6 (-1%)
Sep	755	0 (0%)	1 (0%)	1 (0%)	1 (0%)

Source: CalSim-II Simulation Output Parameter (S1)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A115: Monthly Average Simulated End-of-Month Shasta Lake Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,614	0 (0%)	1 (0%)	2 (0%)	1 (0%)
Nov	2,573	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Dec	2,752	0 (0%)	0 (0%)	1 (0%)	-1 (0%)
Jan	3,025	0 (0%)	1 (0%)	2 (0%)	1 (0%)
Feb	3,278	0 (0%)	1 (0%)	3 (0%)	1 (0%)
Mar	3,648	0 (0%)	1 (0%)	2 (0%)	0 (0%)
Apr	3,940	0 (0%)	1 (0%)	2 (0%)	0 (0%)
May	3,957	0 (0%)	1 (0%)	2 (0%)	0 (0%)
Jun	3,658	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Jul	3,200	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
Aug	2,887	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Sep	2,699	0 (0%)	0 (0%)	1 (0%)	-1 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A116: Monthly Average Simulated End-of-Month Shasta Lake Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,856	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Nov	2,864	0 (0%)	-2 (0%)	-2 (0%)	-3 (0%)
Dec	3,171	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Jan	3,427	0 (0%)	-2 (0%)	-2 (0%)	-2 (0%)
Feb	3,596	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	3,851	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	4,314	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4,474	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	4,292	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	3,883	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Aug	3,534	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Sep	3,137	0 (0%)	1 (0%)	0 (0%)	1 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A117: Monthly Average Simulated End-of-Month Shasta Lake Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,555	0 (0%)	3 (0%)	7 (0%)	8 (0%)
Nov	2,491	0 (0%)	2 (0%)	4 (0%)	5 (0%)
Dec	2,655	0 (0%)	2 (0%)	4 (0%)	5 (0%)
Jan	3,160	0 (0%)	2 (0%)	4 (0%)	5 (0%)
Feb	3,424	0 (0%)	3 (0%)	6 (0%)	6 (0%)
Mar	3,997	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	4,437	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
May	4,476	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
Jun	4,123	0 (0%)	1 (0%)	1 (0%)	-2 (0%)
Jul	3,541	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Aug	3,223	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Sep	3,032	0 (0%)	1 (0%)	1 (0%)	-2 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A118: Monthly Average Simulated End-of-Month Shasta Lake Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,655	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
Nov	2,583	0 (0%)	-2 (0%)	-4 (0%)	-5 (0%)
Dec	2,672	0 (0%)	-1 (0%)	-2 (0%)	-4 (0%)
Jan	3,003	0 (0%)	-1 (0%)	-1 (0%)	-4 (0%)
Feb	3,340	0 (0%)	-3 (0%)	-2 (0%)	-4 (0%)
Mar	3,739	0 (0%)	-3 (0%)	-2 (0%)	-4 (0%)
Apr	4,098	0 (0%)	-3 (0%)	-2 (0%)	-3 (0%)
May	4,106	0 (0%)	-3 (0%)	-2 (0%)	-4 (0%)
Jun	3,772	0 (0%)	-3 (0%)	-3 (0%)	-5 (0%)
Jul	3,256	0 (0%)	-6 (0%)	-5 (0%)	-7 (0%)
Aug	2,934	0 (0%)	-6 (0%)	-6 (0%)	-7 (0%)
Sep	2,863	0 (0%)	-4 (0%)	-4 (0%)	-6 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A119: Monthly Average Simulated End-of-Month Shasta Lake Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,547	0(0%)	1 (0%)	1 (0%)	1 (0%)
Nov	2,505	0 (0%)	-2 (0%)	-1 (0%)	-3 (0%)
Dec	2,665	0 (0%)	1 (0%)	1 (0%)	-1 (0%)
Jan	2,843	0 (0%)	-2 (0%)	-2 (0%)	-4 (0%)
Feb	3,208	0 (0%)	-1 (0%)	-1 (0%)	-3 (0%)
Mar	3,678	0 (0%)	0 (0%)	0 (0%)	-3 (0%)
Apr	3,809	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
May	3,701	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Jun	3,324	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Jul	2,880	0 (0%)	2 (0%)	2 (0%)	0 (0%)
Aug	2,581	0 (0%)	-2 (0%)	-2 (0%)	-2 (0%)
Sep	2,518	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A120: Monthly Average Simulated End-of-Month Shasta Lake Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2,204	0(0%)	3 (0%)	4 (0%)	2 (0%)
Nov	2,111	0 (0%)	5 (0%)	6 (0%)	2 (0%)
Dec	2,167	0(0%)	4 (0%)	5 (0%)	1 (0%)
Jan	2,316	0 (0%)	10 (0%)	16 (1%)	13 (1%)
Feb	2,475	0 (0%)	10 (0%)	16 (1%)	13 (1%)
Mar	2,706	0 (0%)	9 (0%)	15 (1%)	11 (0%)
Apr	2,645	0 (0%)	9 (0%)	14 (1%)	8 (0%)
May	2,529	0 (0%)	9 (0%)	13 (1%)	8 (0%)
Jun	2,186	0 (0%)	8 (0%)	11 (1%)	8 (0%)
Jul	1,792	0 (0%)	8 (0%)	10 (1%)	7 (0%)
Aug	1,553	0 (0%)	7 (0%)	9 (1%)	11 (1%)
Sep	1,495	0 (0%)	6 (0%)	9 (1%)	5 (0%)

Source: CalSim-II Simulation Output Parameter (S4)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A121: Monthly Average Simulated End-of-Month Lake Oroville Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,593	0 (0%)	-2 (0%)	-2 (0%)	-4 (0%)
Nov	1,571	0 (0%)	-2 (0%)	-3 (0%)	-4 (0%)
Dec	1,705	0 (0%)	-1 (0%)	-2 (0%)	-3 (0%)
Jan	1,919	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
Feb	2,196	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
Mar	2,440	0 (0%)	0 (0%)	-1 (0%)	-2 (0%)
Apr	2,718	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
May	2,855	0 (0%)	-1 (0%)	-2 (0%)	-3 (0%)
Jun	2,747	0 (0%)	-1 (0%)	-2 (0%)	-3 (0%)
Jul	2,301	0 (0%)	-2 (0%)	-3 (0%)	-4 (0%)
Aug	2,010	0 (0%)	-1 (0%)	-3 (0%)	-4 (0%)
Sep	1,711	0 (0%)	-2 (0%)	-2 (0%)	-3 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A122: Monthly Average Simulated End-of-Month Lake Oroville Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,854	0 (0%)	-3 (0%)	-4 (0%)	-7 (0%)
Nov	1,870	0 (0%)	-3 (0%)	-4 (0%)	-6 (0%)
Dec	2,226	0 (0%)	-2 (0%)	-2 (0%)	-4 (0%)
Jan	2,505	0 (0%)	-1 (0%)	-2 (0%)	-3 (0%)
Feb	2,823	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Mar	2,939	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	3,304	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	3,508	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	3,481	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jul	3,116	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Aug	2,901	0 (0%)	-2 (0%)	-3 (0%)	-6 (0%)
Sep	2,400	0 (0%)	-2 (0%)	-3 (0%)	-7 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A123: Monthly Average Simulated End-of-Month Lake Oroville Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,512	0 (0%)	-2 (0%)	-1 (0%)	-2 (0%)
Nov	1,526	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Dec	1,633	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jan	2,041	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Feb	2,450	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Mar	2,906	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	3,268	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	3,481	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jun	3,375	0 (0%)	-1 (0%)	-2 (0%)	-3 (0%)
Jul	2,808	0 (0%)	-1 (0%)	-3 (0%)	-3 (0%)
Aug	2,382	0 (0%)	-1 (0%)	-3 (0%)	-3 (0%)
Sep	1,926	0 (0%)	-1 (0%)	-3 (0%)	-3 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A124: Monthly Average Simulated End-of-Month Lake Oroville Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,622	0 (0%)	-2 (0%)	-3 (0%)	-3 (0%)
Nov	1,562	0 (0%)	-3 (0%)	-3 (0%)	-4 (0%)
Dec	1,578	0 (0%)	-2 (0%)	-3 (0%)	-4 (0%)
Jan	1,787	0 (0%)	-2 (0%)	-3 (0%)	-4 (0%)
Feb	2,094	0 (0%)	-3 (0%)	-3 (0%)	-4 (0%)
Mar	2,386	0 (0%)	-3 (0%)	-3 (0%)	-4 (0%)
Apr	2,765	0 (0%)	-3 (0%)	-3 (0%)	-4 (0%)
May	2,975	0 (0%)	-4 (0%)	-5 (0%)	-6 (0%)
Jun	2,855	0 (0%)	1 (0%)	0 (0%)	-1 (0%)
Jul	2,267	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Aug	1,793	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Sep	1,511	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A125: Monthly Average Simulated End-of-Month Lake Oroville Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,416	0(0%)	-1 (0%)	-3 (0%)	-4 (0%)
Nov	1,375	0 (0%)	-2 (0%)	-5 (0%)	-6 (0%)
Dec	1,394	0 (0%)	-2 (0%)	-5 (0%)	-5 (0%)
Jan	1,492	0 (0%)	-2 (0%)	-3 (0%)	-3 (0%)
Feb	1,717	0 (0%)	-2 (0%)	-6 (0%)	-6 (0%)
Mar	2,037	0 (0%)	-2 (0%)	-6 (0%)	-6 (0%)
Apr	2,232	0 (0%)	-2 (0%)	-7 (0%)	-7 (0%)
May	2,274	0 (0%)	-2 (0%)	-7 (0%)	-7 (0%)
Jun	2,071	0 (0%)	-3 (0%)	-7 (0%)	-7 (0%)
Jul	1,579	0 (0%)	-8 (-1%)	-13 (-1%)	-12 (-1%)
Aug	1,306	0 (0%)	-3 (0%)	-8 (-1%)	-8 (-1%)
Sep	1,221	0 (0%)	-4 (0%)	-3 (0%)	-3 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A126: Monthly Average Simulated End-of-Month Lake Oroville Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1,340	0(0%)	2 (0%)	2 (0%)	1 (0%)
Nov	1,271	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Dec	1,264	0(0%)	2 (0%)	2 (0%)	1 (0%)
Jan	1,319	0 (0%)	3 (0%)	3 (0%)	3 (0%)
Feb	1,420	0 (0%)	4 (0%)	3 (0%)	3 (0%)
Mar	1,564	0 (0%)	3 (0%)	2 (0%)	1 (0%)
Apr	1,571	0 (0%)	2 (0%)	2 (0%)	1 (0%)
May	1,548	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Jun	1,418	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jul	1,153	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Aug	1,019	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Sep	969	0 (0%)	1 (0%)	1 (0%)	-1 (0%)

Source: CalSim-II Simulation Output Parameter (S6)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A127: Monthly Average Simulated End-of-Month Folsom Lake Storage for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	459	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	432	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	457	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	473	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Feb	493	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Mar	592	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Apr	720	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
May	838	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Jun	805	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Jul	673	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Aug	593	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	507	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A128: Monthly Average Simulated End-of-Month Folsom Lake Storage for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	496	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	472	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	528	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	525	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	515	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	631	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	787	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	959	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	956	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	867	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Aug	759	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	593	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A129: Monthly Average Simulated End-of-Month Folsom Lake Storage for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	446	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Nov	411	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Dec	428	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Jan	508	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	531	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	642	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	787	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	955	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	922	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	731	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	658	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	538	0 (0%)	0 (0%)	0 (0%)	-1 (0%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A130: Monthly Average Simulated End-of-Month Folsom Lake Storage for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	470	0 (0%)	-2 (0%)	-1 (0%)	-1 (0%)
Nov	438	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Dec	445	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Jan	493	0 (0%)	-2 (0%)	-1 (0%)	-2 (0%)
Feb	541	0 (0%)	-1 (0%)	-1 (0%)	-2 (0%)
Mar	627	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Apr	780	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	913	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jun	881	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jul	695	0 (0%)	-4 (-1%)	-3 (0%)	-2 (0%)
Aug	616	0 (0%)	-3 (0%)	-2 (0%)	-2 (0%)
Sep	576	0 (0%)	0 (0%)	1 (0%)	1 (0%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A131: Monthly Average Simulated End-of-Month Folsom Lake Storage for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	440	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	425	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	447	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	442	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	482	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	583	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	698	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
May	769	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jun	697	0 (0%)	0 (0%)	0 (0%)	-2 (0%)
Jul	547	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Aug	470	0 (0%)	2 (0%)	2 (0%)	1 (0%)
Sep	449	0 (0%)	1 (0%)	1 (0%)	1 (0%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A132: Monthly Average Simulated End-of-Month Folsom Lake Storage for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	408	0(0%)	1 (0%)	0 (0%)	-2 (0%)
Nov	371	0 (0%)	2 (0%)	0 (0%)	-1 (0%)
Dec	362	0(0%)	2 (0%)	0 (0%)	0 (0%)
Jan	347	0 (0%)	2 (0%)	-5 (-2%)	-5 (-1%)
Feb	369	0 (0%)	2 (0%)	-5 (-1%)	-6 (-2%)
Mar	429	0 (0%)	0 (0%)	-5 (-1%)	-5 (-1%)
Apr	468	0 (0%)	0 (0%)	-6 (-1%)	-6 (-1%)
May	477	0 (0%)	0 (0%)	-5 (-1%)	-6 (-1%)
Jun	432	0 (0%)	1 (0%)	-3 (-1%)	-5 (-1%)
Jul	360	0 (0%)	1 (0%)	-1 (0%)	-4 (-1%)
Aug	323	0 (0%)	1 (0%)	0 (0%)	-2 (-1%)
Sep	298	0 (0%)	1 (0%)	0 (0%)	-3 (-1%)

Source: CalSim-II Simulation Output Parameter (S8)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A133: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	67	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	271	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	292	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	409	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	411	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	302	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	76	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A134: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	64	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	16	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	242	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	291	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	416	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	418	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	307	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A135: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	63	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	262	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	286	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	423	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	419	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	305	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	77	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A136: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	70	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	283	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	309	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	412	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	418	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	306	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	75	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A137: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	70	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	290	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	300	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	414	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	413	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	305	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	73	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A138: Monthly Average Deliveries to Sacramento Valley Settlement Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	68	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	10	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	299	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	267	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	367	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	375	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	277	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	70	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PSC_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A139: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	17	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	34	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	46	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	55	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	44	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A140: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	5	0 (0%)	0 (1%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	82	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	66	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	30	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A141: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0 (0%)	0 (1%)	0 (1%)	0 (0%)
Apr	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	46	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	67	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	79	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	62	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A142: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	6	0 (0%)	0 (0%)	0 (0%)	0 (-1%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0 (0%)	0 (2%)	0 (2%)	0 (0%)
Mar	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	35	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	43	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	53	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	42	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A143: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	5	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (-1%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	14	0 (0%)	0 (0%)	0 (0%)	0 (-1%)
May	22	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Jun	29	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Jul	34	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Aug	27	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Sep	11	0 (0%)	0 (-1%)	0 (0%)	0 (-1%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A144: Monthly Average Deliveries to Sacramento Valley Water Service Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	3	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (-3%)	0 (-2%)	0 (-1%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	5	0 (0%)	0 (1%)	0 (1%)	0 (0%)
May	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A145: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	124	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	145	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	142	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	92	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A146: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	60	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	70	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	96	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	127	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	149	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	146	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	95	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A147: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	58	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	70	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	96	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	127	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	149	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	146	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	95	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A148: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	96	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	127	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	149	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	146	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	95	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A149: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	59	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	95	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	125	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	147	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	144	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A150: Monthly Average Deliveries to San Joaquin Valley Exchange Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	57	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	9	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	81	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	107	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	126	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	123	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PEX_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A151: Monthly Average Deliveries to South-of-Delta Water Service Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	57	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	40	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	89	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	143	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	178	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	128	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A152: Monthly Average Deliveries to South-of-Delta Water Service Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	34	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	36	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	64	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	73	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	65	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	142	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	230	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	286	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	206	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	65	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A153: Monthly Average Deliveries to South-of-Delta Water Service Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	23	0 (0%)	0 (0%)	0 (0%)	0 (1%)
Nov	17	0 (0%)	0 (0%)	0 (0%)	0 (1%)
Dec	24	0 (0%)	0 (0%)	0 (0%)	0 (1%)
Jan	43	0 (0%)	0 (0%)	0 (0%)	0 (1%)
Feb	49	0 (0%)	0 (0%)	0 (0%)	0 (1%)
Mar	49	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	73	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	108	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	175	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	217	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Aug	156	0 (0%)	-1 (0%)	-1 (-1%)	0 (0%)
Sep	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A154: Monthly Average Deliveries to South-of-Delta Water Service Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	30	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Nov	22	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Dec	32	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Jan	55	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Feb	63	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	38	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	58	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	86	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	138	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Jul	172	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Aug	124	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	39	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A155: Monthly Average Deliveries to South-of-Delta Water Service Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	24	0(0%)	0 (-1%)	0 (-1%)	0 (-1%)
Nov	18	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Dec	25	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Jan	44	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Feb	51	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	36	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
May	54	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-1%)
Jun	88	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-1%)
Jul	109	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-1%)
Aug	79	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-1%)
Sep	25	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A156: Monthly Average Deliveries to South-of-Delta Water Service Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	16	0(0%)	0 (-1%)	0 (-1%)	0 (-1%)
Nov	12	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Dec	17	0(0%)	0 (-1%)	0 (-1%)	0 (-1%)
Jan	29	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Feb	33	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	5	0 (0%)	0 (0%)	0 (-2%)	0 (-1%)
Apr	6	0 (0%)	0 (0%)	0 (-2%)	0 (-2%)
May	8	0 (0%)	0 (-3%)	0 (-4%)	0 (-4%)
Jun	13	0 (0%)	0 (-3%)	-1 (-4%)	-1 (-4%)
Jul	16	0 (0%)	0 (-3%)	-1 (-4%)	-1 (-4%)
Aug	12	0 (0%)	0 (-3%)	0 (-4%)	-1 (-4%)
Sep	4	0 (0%)	0 (-3%)	0 (-4%)	0 (-4%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PAG_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A157: Monthly Average Deliveries to North-of-Delta Refuges for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A158: Monthly Average Deliveries to North-of-Delta Refuges for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A159: Monthly Average Deliveries to North-of-Delta Refuges for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A160: Monthly Average Deliveries to North-of-Delta Refuges for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A161: Monthly Average Deliveries to North-of-Delta Refuges for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	11	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A162: Monthly Average Deliveries to North-of-Delta Refuges for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A163: Monthly Average Deliveries to South-of-Delta Refuges for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	64	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	40	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A164: Monthly Average Deliveries to South-of-Delta Refuges for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	65	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A165: Monthly Average Deliveries to South-of-Delta Refuges for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	63	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	39	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A166: Monthly Average Deliveries to South-of-Delta Refuges for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	65	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	40	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A167: Monthly Average Deliveries to South-of-Delta Refuges for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	64	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	40	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	49	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A168: Monthly Average Deliveries to South-of-Delta Refuges for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	62	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	38	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	18	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PRF_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A169: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	10	0 (0%)	0 (0%)	0 (1%)	0 (1%)
Mar	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A170: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	29	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	30	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A171: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	28	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	30	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A172: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (-2%)	0 (0%)	0 (0%)
Dec	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	27	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	19	0 (0%)	0 (1%)	0 (1%)	0 (1%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A173: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	11	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	10	0 (0%)	0 (0%)	0 (3%)	0 (3%)
Mar	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A174: Monthly Average Deliveries to CVP North-of-Delta M&I Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	7	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	17	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	18	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	20	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	16	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A175: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	11	0 (0%)	0 (0%)	0 (1%)	0 (1%)
Sep	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A176: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A177: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	11	0 (0%)	0 (1%)	1 (8%)	1 (8%)
Sep	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A178: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	12	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A179: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	8	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A180: Monthly Average Deliveries to CVP South-of-Delta M&I Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	7	0(0%)	0 (-1%)	0 (0%)	0 (0%)
Nov	10	0 (0%)	0 (-1%)	0 (0%)	0 (0%)
Dec	10	0(0%)	0 (-1%)	0 (0%)	0 (0%)
Jan	7	0 (0%)	0 (-1%)	0 (0%)	0 (0%)
Feb	3	0 (0%)	0 (-1%)	0 (0%)	0 (0%)
Mar	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	9	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_PMI_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A181: Monthly Average Deliveries to SWP Table A Contractors for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	246	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	207	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	203	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	26	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	37	0 (0%)	0 (0%)	0 (-1%)	0 (-1%)
Mar	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	137	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	215	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	294	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	338	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	350	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	285	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A182: Monthly Average Deliveries to SWP Table A Contractors for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	289	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Nov	248	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Dec	239	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Jan	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	78	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	165	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Apr	210	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	304	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jun	377	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	403	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	423	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	342	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A183: Monthly Average Deliveries to SWP Table A Contractors for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	233	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Nov	189	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	201	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	41	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Mar	99	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	164	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	246	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	330	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	377	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	397	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	324	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A184: Monthly Average Deliveries to SWP Table A Contractors for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	255	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Nov	218	0 (0%)	-3 (-1%)	-3 (-1%)	-2 (-1%)
Dec	212	0 (0%)	-4 (-2%)	-4 (-2%)	-3 (-2%)
Jan	15	0 (0%)	0 (1%)	0 (0%)	0 (-1%)
Feb	19	0 (0%)	-1 (-3%)	-1 (-3%)	-1 (-3%)
Mar	44	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	145	0 (0%)	2 (1%)	2 (1%)	2 (2%)
May	223	0 (0%)	3 (1%)	2 (1%)	2 (1%)
Jun	317	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Jul	374	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Aug	393	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Sep	321	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A185: Monthly Average Deliveries to SWP Table A Contractors for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	225	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	187	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	181	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	6	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Feb	10	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	17	0 (0%)	0 (-2%)	0 (-2%)	0 (-2%)
Apr	84	0 (0%)	-3 (-3%)	-2 (-2%)	-2 (-2%)
May	149	0 (0%)	0 (0%)	-1 (-1%)	-1 (0%)
Jun	238	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (0%)
Jul	302	0 (0%)	-2 (-1%)	-2 (-1%)	-1 (0%)
Aug	308	0 (0%)	-4 (-1%)	-3 (-1%)	-3 (-1%)
Sep	253	0 (0%)	-3 (-1%)	-3 (-1%)	-2 (-1%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A186: Monthly Average Deliveries to SWP Table A Contractors for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	189	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	153	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	147	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	7	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	11	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	21	0 (0%)	0 (1%)	0 (1%)	0 (1%)
May	80	0 (0%)	0 (0%)	0 (0%)	1 (1%)
Jun	132	0 (0%)	0 (0%)	1 (0%)	1 (1%)
Jul	168	0 (0%)	0 (0%)	1 (0%)	1 (1%)
Aug	158	0 (0%)	0 (0%)	1 (0%)	1 (1%)
Sep	128	0 (0%)	0 (0%)	1 (0%)	1 (1%)

Source: CalSim-II Simulation Output Parameter (SWP_TA_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A187: Monthly Average SWP Article 56 Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	39	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Feb	33	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Mar	10	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Apr	0	0 (0%)	0 (-4%)	0 (-7%)	0 (-100%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A188: Monthly Average SWP Article 56 Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	52	0 (0%)	1 (2%)	1 (2%)	1 (2%)
Feb	42	0 (0%)	1 (2%)	1 (2%)	1 (2%)
Mar	13	0 (0%)	0 (2%)	0 (2%)	0 (2%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A189: Monthly Average SWP Article 56 Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	29	0 (0%)	0 (-1%)	0 (-1%)	0 (-2%)
Feb	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A190: Monthly Average SWP Article 56 Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	44	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	38	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	13	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A191: Monthly Average SWP Article 56 Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	36	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Feb	31	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	11	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A192: Monthly Average SWP Article 56 Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0(0%)	0(0%)	0(0%)
Nov	0	0(0%)	0(0%)	0(0%)	0(0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	20	0 (0%)	0 (1%)	1 (3%)	0 (2%)
Feb	17	0 (0%)	0 (1%)	0 (3%)	0 (2%)
Mar	5	0 (0%)	0 (1%)	0 (3%)	0 (2%)
Apr	0	0 (0%)	0 (-4%)	0 (-7%)	0 (-100%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_CO_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A193: Monthly Average Interruptible SWP Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0 (0%)	0 (9%)	0 (9%)	0 (9%)
Nov	2	0 (0%)	0 (0%)	0 (0%)	0 (2%)
Dec	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	7	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Feb	17	0 (0%)	0 (1%)	0 (0%)	0 (0%)
Mar	25	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Apr	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (7%)	0 (7%)	0 (7%)
Jul	1	0 (0%)	0 (-1%)	0 (0%)	0 (1%)
Aug	1	0 (0%)	0 (-2%)	0 (-1%)	0 (1%)
Sep	0	0 (0%)	0 (-15%)	0 (-16%)	0 (1%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A194: Monthly Average Interruptible SWP Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	22	0 (0%)	0 (1%)	0 (0%)	0 (0%)
Mar	35	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Apr	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	1	0 (0%)	0 (0%)	0 (5%)	0 (5%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A195: Monthly Average Interruptible SWP Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	21	0 (0%)	0 (2%)	1 (3%)	0 (2%)
Feb	35	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Mar	37	0 (0%)	0 (-1%)	0 (-1%)	-1 (-3%)
Apr	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (8%)	0 (8%)	0 (8%)
Jul	2	0 (0%)	0 (0%)	0 (0%)	0 (2%)
Aug	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A196: Monthly Average Interruptible SWP Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0 (0%)	0 (100%)	0 (100%)	0 (100%)
Nov	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	38	0 (0%)	1 (2%)	1 (2%)	1 (2%)
Apr	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (32%)	0 (32%)	0 (32%)
Jul	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	0	0 (0%)	0 (2%)	0 (-3%)	0 (-8%)
Sep	0	0 (0%)	0 (-16%)	0 (-16%)	0 (1%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A197: Monthly Average Interruptible SWP Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	0	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	8	0 (0%)	1 (10%)	0 (4%)	1 (9%)
Apr	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	2	0 (0%)	0 (-5%)	0 (-5%)	0 (1%)
Sep	0	0 (0%)	0 (34%)	0 (7%)	0 (19%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A198: Monthly Average Interruptible SWP Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	1	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	0	0 (0%)	0 (0%)	0 (0%)	0 (100%)
Dec	1	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	0	0 (0%)	0 (-23%)	0 (7%)	0 (8%)
Aug	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (SWP_IN_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A199: Monthly Average Total SWP Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	341	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Nov	305	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	268	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	51	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	40	0 (0%)	0 (0%)	0 (0%)	0 (-1%)
Mar	86	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	242	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	353	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	454	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	499	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	478	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	379	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A200: Monthly Average Total SWP Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	387	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Nov	353	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Dec	305	0 (0%)	1 (0%)	1 (0%)	1 (0%)
Jan	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	80	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	170	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Apr	304	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	449	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Jun	546	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	574	0 (0%)	1 (0%)	0 (0%)	0 (0%)
Aug	558	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	447	0 (0%)	0 (0%)	1 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A201: Monthly Average Total SWP Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	316	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Nov	279	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	262	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	41	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	44	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Mar	102	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	267	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	389	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	501	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	547	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	531	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	426	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A202: Monthly Average Total SWP Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	355	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Nov	315	0 (0%)	-3 (-1%)	-3 (-1%)	-2 (-1%)
Dec	278	0 (0%)	-4 (-1%)	-4 (-1%)	-3 (-1%)
Jan	43	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	22	0 (0%)	-1 (-2%)	-1 (-3%)	-1 (-3%)
Mar	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	256	0 (0%)	2 (1%)	2 (1%)	2 (1%)
May	370	0 (0%)	3 (1%)	3 (1%)	2 (1%)
Jun	482	0 (0%)	1 (0%)	2 (0%)	1 (0%)
Jul	540	0 (0%)	1 (0%)	1 (0%)	0 (0%)
Aug	524	0 (0%)	1 (0%)	2 (0%)	1 (0%)
Sep	421	0 (0%)	0 (0%)	1 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A203: Monthly Average Total SWP Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	317	0(0%)	0 (0%)	2 (0%)	1 (0%)
Nov	280	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Dec	246	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Jan	33	0 (0%)	0 (0%)	1 (2%)	1 (2%)
Feb	13	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Mar	24	0 (0%)	0 (-1%)	0 (-1%)	0 (-1%)
Apr	199	0 (0%)	-3 (-1%)	-2 (-1%)	-2 (-1%)
May	294	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Jun	405	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jul	468	0 (0%)	-2 (0%)	-2 (0%)	-1 (0%)
Aug	439	0 (0%)	-4 (-1%)	-3 (-1%)	-3 (-1%)
Sep	349	0 (0%)	-3 (-1%)	-3 (-1%)	-2 (-1%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A204: Monthly Average Total SWP Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	283	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	253	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	214	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	35	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	10	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	131	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	181	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Jun	248	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Jul	291	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Aug	252	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Sep	184	0 (0%)	2 (1%)	2 (1%)	2 (1%)

Source: CalSim-II Simulation Output Parameter (DEL_SWP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A205: Monthly Average Total CVP South of Delta Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	165	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	95	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	73	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	82	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	100	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	134	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	162	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	236	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	333	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	375	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Aug	322	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	205	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A206: Monthly Average Total CVP South of Delta Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	176	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	103	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	82	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	97	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	117	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	164	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	201	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	295	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	425	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	489	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	406	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	236	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A207: Monthly Average Total CVP South of Delta Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	159	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	91	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	68	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	74	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	91	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	147	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	179	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	260	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	369	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	419	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Aug	354	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	219	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A208: Monthly Average Total CVP South of Delta Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	170	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	99	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	77	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	88	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	107	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	135	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	160	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	237	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	333	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Jul	373	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Aug	322	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	207	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A209: Monthly Average Total CVP South of Delta Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	162	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	93	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	69	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	76	0 (0%)	0 (0%)	0 (-1%)	0 (0%)
Feb	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	115	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	139	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	203	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jun	279	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jul	307	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Aug	274	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Sep	190	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A210: Monthly Average Total CVP South of Delta Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	149	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	84	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	58	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	59	0 (0%)	0 (-1%)	0 (-1%)	0 (0%)
Feb	75	0 (0%)	0 (-1%)	0 (-1%)	0 (0%)
Mar	87	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	96	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	137	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	180	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Jul	190	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Aug	182	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Sep	145	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_S)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A211: Monthly Average Total CVP North of Delta Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	44	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	22	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	309	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	353	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	486	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	501	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	381	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	127	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A212: Monthly Average Total CVP North of Delta Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	93	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	42	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	24	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	19	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	284	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	369	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	519	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	539	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	412	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	145	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A213: Monthly Average Total CVP North of Delta Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	88	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	43	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	16	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	308	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	362	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	524	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	537	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	406	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	142	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A214: Monthly Average Total CVP North of Delta Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	100	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	45	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	324	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	372	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	487	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	506	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	384	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	126	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A215: Monthly Average Total CVP North of Delta Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	97	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	45	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	25	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	15	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	14	0 (0%)	0 (0%)	0 (2%)	0 (2%)
Mar	21	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	323	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	348	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	472	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	480	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	365	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	113	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A216: Monthly Average Total CVP North of Delta Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	89	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	44	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	25	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	14	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	32	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	322	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	294	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	399	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	410	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	307	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	96	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL_N)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A217: Monthly Average Total CVP Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	259	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	139	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	97	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	97	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	114	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	156	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	471	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	589	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	820	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	876	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Aug	703	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	332	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A218: Monthly Average Total CVP Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	268	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	145	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	112	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	131	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	183	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	486	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	664	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	945	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	1,027	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aug	818	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	381	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A219: Monthly Average Total CVP Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	248	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	135	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	92	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	88	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	105	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	163	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	487	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	622	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	893	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	956	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
Aug	760	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	361	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A220: Monthly Average Total CVP Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	270	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	144	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	102	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	103	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	120	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	158	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	484	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	608	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	819	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Jul	879	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Aug	706	0 (0%)	0 (0%)	0 (0%)	1 (0%)
Sep	333	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A221: Monthly Average Total CVP Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	259	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	138	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	94	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	92	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	108	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	136	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	462	0 (0%)	0 (0%)	-1 (0%)	0 (0%)
May	550	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jun	751	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Jul	787	0 (0%)	-1 (0%)	-2 (0%)	-2 (0%)
Aug	638	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Sep	303	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A222: Monthly Average Total CVP Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	238	0(0%)	0 (0%)	0 (0%)	0 (0%)
Nov	128	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	83	0(0%)	0 (0%)	0 (0%)	0 (0%)
Jan	73	0 (0%)	0 (-1%)	0 (-1%)	0 (0%)
Feb	89	0 (0%)	0 (-1%)	0 (0%)	0 (0%)
Mar	118	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	417	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	431	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	579	0 (0%)	0 (0%)	-1 (0%)	-1 (0%)
Jul	601	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)
Aug	489	0 (0%)	0 (0%)	0 (0%)	-1 (0%)
Sep	241	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: CalSim-II Simulation Output Parameter (DEL_CVP_TOTAL)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A223: Monthly Average Cross valley Canal Deliveries for All Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	7	0 (0%)	0 (-2%)	0 (-2%)	0 (-2%)
Nov	34	0 (0%)	0 (1%)	0 (1%)	0 (1%)
Dec	0	0 (0%)	0 (0%)	0 (2%)	0 (2%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	6	0 (0%)	0 (-1%)	0 (-1%)	0 (1%)
Aug	5	0 (0%)	0 (1%)	0 (1%)	0 (-1%)
Sep	3	0 (0%)	0 (-10%)	0 (-11%)	0 (-11%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A224: Monthly Average Cross valley Canal Deliveries for Wet Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	2	0 (0%)	0 (-19%)	0 (-19%)	0 (-19%)
Nov	39	0 (0%)	1 (1%)	1 (1%)	1 (2%)
Dec	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	4	0 (0%)	0 (2%)	0 (2%)	0 (1%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0 (0%)	0 (-25%)	0 (-50%)	0 (-50%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A225: Monthly Average Cross valley Canal Deliveries for Above Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0 (0%)	-1 (-8%)	-1 (-8%)	-1 (-8%)
Nov	35	0 (0%)	1 (2%)	1 (2%)	1 (2%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	0	0(0%)	0(0%)	0(0%)	0(0%)
Aug	0	0(0%)	0(0%)	0(0%)	0(0%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A226: Monthly Average Cross valley Canal Deliveries for Below Normal Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	12	0 (0%)	1 (10%)	1 (10%)	1 (10%)
Nov	43	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	1	0 (0%)	0 (12%)	0 (10%)	0 (10%)
Aug	6	0 (0%)	0 (6%)	0 (6%)	0 (8%)
Sep	13	0 (0%)	-2 (-14%)	-2 (-14%)	-2 (-14%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A227: Monthly Average Cross valley Canal Deliveries for Dry Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	9	0(0%)	0 (-3%)	0 (-3%)	0 (-2%)
Nov	32	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	1	0 (0%)	0 (0%)	0 (4%)	0 (4%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	17	0 (0%)	0 (-2%)	0 (-2%)	0 (1%)
Aug	16	0 (0%)	0 (-1%)	0 (-1%)	-1 (-3%)
Sep	4	0 (0%)	0 (0%)	0 (-2%)	0 (-2%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A228: Monthly Average Cross valley Canal Deliveries for Critical Years

Month	No Action Alt (1,000 AF)	Change from No Action (1,000 AF)			
		Alt2	Alt3	Alt4	Alt5
Oct	6	0(0%)	0 (-3%)	0 (-3%)	0 (-3%)
Nov	17	0 (0%)	0 (0%)	0 (1%)	0 (1%)
Dec	0	0(0%)	0(0%)	0(0%)	0(0%)
Jan	0	0(0%)	0(0%)	0(0%)	0(0%)
Feb	0	0(0%)	0(0%)	0(0%)	0(0%)
Mar	0	0(0%)	0(0%)	0(0%)	0(0%)
Apr	0	0(0%)	0(0%)	0(0%)	0(0%)
May	0	0(0%)	0(0%)	0(0%)	0(0%)
Jun	0	0(0%)	0(0%)	0(0%)	0(0%)
Jul	2	0 (0%)	0 (-11%)	0 (-12%)	0 (-12%)
Aug	3	0 (0%)	0 (3%)	0 (2%)	0 (2%)
Sep	0	0(0%)	0(0%)	0(0%)	0(0%)

Source: CalSim-II Simulation Output Parameter (D855)
Simulation period: 1922–2003
Key:
cfs = Cubic Feet Per Second; TAF= Thousands Acre-Foot
Alt=Alternative
Based on Sacramento Valley Year Type
Change as measured from Future No Action Alternative
Values in paranthesis indicate percentage change. Calculated as
(Alt X minus No Action Alt)/No Action Alt

Table A229: Modeling Assumptions

	Period of Simulation: 82 years (1922-2003)
	Future Level Study
HYDROLOGY	
Level of Development	2020 Level, *DWR Bulletin 160-98*[1]
CVP	Land use based, full build-out of contract amounts
SWP (FRSA)	Land use based, limited by full contract
Non-Project	Land use based
Antioch	Pre-1914 water right
CVP Refuges	Firm Level 2 water needs
Water rights	2020 Level
CVP	2020 Level, full contracts including Freeport Regional Water Project and Sacramento River Water Reliability Project
Friant Unit	Limited by contract amounts, based on current allocation policy
Lower Basin	Land use based with district level operations and constraints
Stanislaus River Basin[2]	Land use based, with New Melones Interim Operations Plan and NMFS biological opinion (June 2009), Actions 3.1.2 and 3.1.3[5]
CVP	Full contract
Contra Costa Water District	195 taf/yr
SWP (with North Bay Aqueduct)	4.1 maf/yr
SWP Article 21 Demand	Metropolitan Water District of Southern California up to 200 taf/month (Dec-Mar), KCWA demand up to 180 taf/month and others up to 34 taf/month
FACILITIES	
Red Bluff Diversion Dam	Fish Passage Improvement Project in place with 2500 cfs capacity
Freeport Regional Water Project	Included with diversions to EBMUD
Banks Pumping Capacity	Physical capacity is 10,300 cfs, 6,680 cfs permitted capacity up to 8,500 cfs (Dec 15th–Mar 15th) depending on Vernalis flow conditions[3]; additional capacity of 500 cfs (up to 7,180 cfs) allowed for Jul–Sep for reducing impact of NMFS biological opinion on SWP (Jun 2009), Action 4.2.1[5]
Jones Pumping Capacity	Exports up to 4,600 cfs permit capacity in all months
Delta-Mendota Canal-California Aqueduct Intertie	Included with 400 cfs capacity
Los Vaqueros Reservoir Capacity	160 taf

	Period of Simulation: 82 years (1922-2003)
	Future Level Study
South Bay Aqueduct	SBA rehabilitation, 430 cfs capacity from junction with California Aqueduct to Alameda County FC&WSD Zone 7 diversion point
REGULATORY STANDARDS	
Minimum Flow below Lewiston Dam	Trinity EIS Preferred Alternative (369-815 taf/yr)
Trinity Reservoir End-of-September Minimum Storage	Trinity EIS Preferred Alternative (600 taf as able)
Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 Reclamation Proposal to USFWS and NPS, predetermined Central Valley Project Improvement Act 3406(b)(2) flows and NMFS biological opinion (June 2009) Action I.1.1[5]
Shasta Lake End-of-September Minimum Storage	NMFS 2004 Winter-run biological opinion (1900 taf), predetermined Central Valley Project Improvement Act 3406(b)(2) flows, and NMFS biological opinion (Jun 2009) Action I.2.1[5]
Minimum Flow below Thermalito Diversion Dam	2006 Settlement Agreement (700/800 cfs)
Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (750-1700 cfs)
Minimum flow below Daguerre Point Dam	D-1644 Operations (Lower Yuba River Accord)[4]
Minimum Flow below Nimbus Dam	American River Flow Management as required by NMFS biological opinion (Jun 2009), Action 2.1[5]
Minimum Flow at H Street Bridge	SWRCB D-893
Minimum Flow near Rio Vista	SWRCB D-1641
Minimum Flow below Camanche Dam	Federal Energy Regulatory Commission 2916-029, 1996 Joint Settlement Agreement (100 – 325 cfs)
Minimum Flow below Woodbridge Diversion Dam	Federal Energy Regulatory Commission 2916-029, 1996 Joint Settlement Agreement (25 – 300 cfs)
Minimum Flow below Goodwin Dam	1987 Reclamation, DFG agreement, and flows required for NMFS biological opinion (Jun 2009) Actions III.1.2 and III.1.3[5]

	Period of Simulation: 82 years (1922-2003)
	Future Level Study
Minimum Dissolved Oxygen	SWRCB D-1422
REGULATORY STANDARDS	
Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 cfs, Nov – Mar) and Cowell Agreement
Minimum Flow at Shaffer Bridge	Federal Energy Regulatory Commission 2179 (25-100 cfs)
Minimum Flow at Lagrange Bridge	Federal Energy Regulatory Commission 2299-024, 1995 Settlement Agreement (94-301 taf/yr)
San Joaquin River Restoration	Full flows
Maximum Salinity near Vernalis	SWRCB D-1641
Minimum Flow near Vernalis	SWRCB D-1641, NMFS biological opinion (Jun 2009), Action 4.2.1[5]
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641, USFWS biological opinion (Dec 2008), Action 4[5]
Delta Cross Channel Gates	SWRCB D-1641, NMFS biological opinion (Jun 2009) Action 4.1.2[5]
Delta Exports	SWRCB D-1641, NMFS biological opinion (Jun 2009) Action 4.2.1[5]
Combined Flow in Old and Middle River	USFWS biological opinion (Dec 2008), Actions 1–3 and NMFS biological opinion (Jun 2009), Action 4.2.3[5]
OPERATIONS CRITERIA	
Subsystem	
Flow Objective for Navigation (Wilkins Slough)	NMFS biological opinion (Jun 2009) Action I.4[5]; 3,500 – 5,000 cfs based on CVP water supply condition
Folsom Dam Flood Control	Variable 400/670 without outlet modifications
Flow at Mouth	Maintain DFG/DWR flow target above Verona or 2800 cfs Apr-Sep, dependent on Oroville inflow and FRSA allocation
System-wide	
CVP Settlement and Exchange	100% (75% in Shasta Critical years)
CVP Refuges	100% (75% in Shasta Critical years)
CVP Agriculture	100% - 0% based on supply; additionally limited due to D-1641, USFWS biological opinion (Dec 2008) and NMFS biological opinion (Jun 2009) export restrictions[5]
CVP Municipal & Industrial	100% - 0% based on supply; additionally limited due to D-1641, USFWS biological opinion (Dec 2008) and NMFS biological opinion (Jun 2009) export restrictions[5]

	Period of Simulation: 82 years (1922-2003)
	Future Level Study
OPERATIONS CRITERIA	
SWP Water Allocation	
North of Delta (FRSA)	Contract specific
South of Delta	Based on supply, Monterey Agreement; allocations limited due to D-1641, USFWS biological opinion (Dec2008) and NMFS biological opinion (Jun 2009) export restrictions[5]
Sharing of Responsibility for In Basin Use	1986 Coordinated Operations Agreement
Sharing of Surplus Flows	1986 Coordinated Operations Agreement
Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641, USFWS biological opinion
	(Dec 2008) and NMFS biological opinion (Jun 2009) export restrictions[5]
Lower Yuba River Accord7	Yuba River acquisitions for reducing impact of NMFS biological opinion export restrictions on SWP
Phase 8	None

[1] The Sacramento Valley hydrology used in the Future Conditions CalSim II model reflects 2020 land-use assumptions associated with Bulletin 160-98. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation. Development of future-level projected land-use assumptions are being coordinated with the California Water Plan Update for future models.

[2] The CalSim II model representation for the Stanislaus River does not necessarily represent Reclamation's current or future operational policies. A suitable plan for supporting flows has not been developed for NMFS biological opinion (Jun 2009), Action 3.1.3.

[3] Current US Army Corps of Engineers permit for Harvey O. Banks Pumping Plant allows for an average diversion rate of 6,680 cfs in all months. Diversion rate can increase up to 1/3 of the rate of San Joaquin River flow at Vernalis during Dec 15th–Mar 15th up to a maximum diversion of 8,500 cfs, if Vernalis flow exceeds 1,000 cfs.

[4] D-1644 and the Lower Yuba River Accord are assumed to be implemented for Existing and Future Conditions. The Yuba River is not dynamically modeled in CalSim II. Yuba River hydrology and availability of water acquisitions under the Lower Yuba River Accord are based on modeling performed and provided by the Lower Yuba River Accord EIS/EIR study team.

[5] In cooperation with USBR, NMFS, USFWS, and DGF, the DWR has developed assumptions for implementation of the USFWS biological opinion (December 15, 2008) and NMFS biological opinion (June 4, 2009) in CalSim II.

[6] Acquisitions of Component 1 water under the Lower Yuba River Accord, and use of 500 cfs dedicated capacity at Banks Pumping Plant during Jul–Sep, are assumed to be used to reduce as much of the effect of the April–May Delta export actions on SWP contractors as possible.