San Luis Low Point Improvement Project

Draft Feasibility Report

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacifi c Region
Sacramento, California

Santa Clara Valley Water District
San Jose, California

April 2019

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Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

The San Luis Low Point Improvement Project (SLLPIP) Draft Feasibility Report is a joint study by the United States (U.S.) Department of the Interior Bureau of Reclamation (Reclamation), in cooperation with the Santa Clara Valley Water District (SCVWD). The purpose of the feasibility report is to determine the potential type and extent of Federal and regional interest in a potential project to address water supply reliability and schedule certainty issues for SCVWD associated with low water levels in San Luis Reservoir. The SLLPIP alternatives analyzed in this Draft Feasibility Report would help to maintain a high quality, reliable, and cost-effective water supply for SCVWD, and would ensure that they receive their annual Central Valley Project (CVP) contract allocations at the time needed to meet their existing water supply commitments.

ES.1 Background

Reclamation and the DWR jointly own and operate the San Luis Reservoir to provide seasonal storage for the CVP and the State Water Project (SWP). The San Luis Reservoir is connected to both the Delta-Mendota Canal and the California Aqueduct (see Figure ES-1), which enables the CVP and SWP to pump water into the reservoir during the wet season and release water into the conveyance facilities during the dry season when demands are higher. Deliveries from San Luis Reservoir also flow west through Pacheco Pumping Plant and Conduit to the San Felipe Division of the CVP, which includes SCVWD and the San Benito County Water District (SBCWD).

During the summer, high temperatures and declining water levels create conditions that foster algae growth. The thickness of the algae blooms varies, but typically average about 35 feet in depth. The water quality within the algal blooms is not suitable for municipal and industrial (M&I) water users relying on existing water treatment facilities in Santa Clara County.

Figure ES-2 shows the intake and outlet facilities associated with the reservoir. As water levels decline to the point that the algae are in the vicinity of the Upper Intake, that intake is no longer used. The low point problem occurs when the water levels decline to the point that the algae blooms are near the Lower Intake. Typically, this point occurs when water levels reach an elevation of 369 feet above mean sea level (MSL) or at 300 thousand acre-feet (TAF) capacity in the reservoir, when the water is approximately 35 feet above the top of the Lower Intake (334 feet above MSL or 110 TAF). The reservoir's minimum operating level is about 30 feet above the top of the Gianelli Intake; therefore, algae does not typically enter the Delta-Mendota Canal or California Aqueduct.

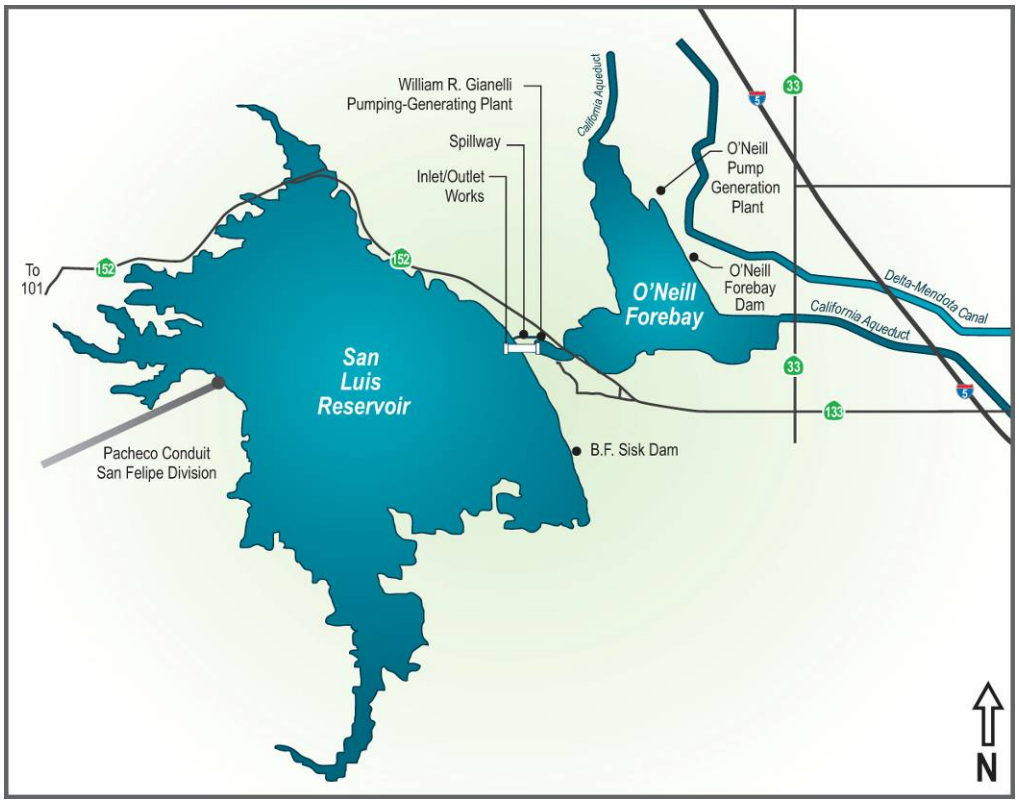

Figure ES-1. San Luis Reservoir and Associated Facilities

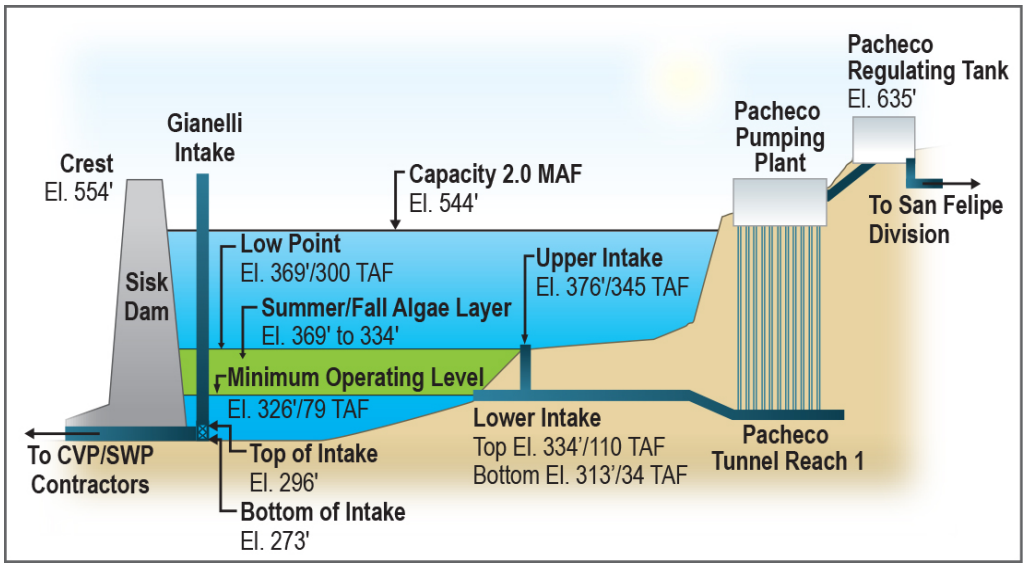

Figure ES-2. Reservoir Intake and Outlet Facilities

If water levels fall below 369 feet above MSL (300 TAF), SCVWD cannot receive water from San Luis Reservoir for M&I purposes because of water quality issues. San Luis Reservoir is the only delivery route for SCVWD's CVP supplies; therefore, SCVWD cannot access CVP supplies for M&I purposes during low-point events.

ES.2 SLLPIP Specific Planning Objectives

The primary and secondary planning objectives of the SLLPIP are intended to optimize the water supply benefits of San Luis Reservoir while reducing additional risks to south-of-Delta water users.

ES.2.1 Primary Objectives

- Avoiding supply interruptions when water is needed by increasing the certainty of meeting the requested delivery schedule throughout the year to south-of-Delta contractors, including SCVWD, dependent on San Luis Reservoir.

- Increasing the reliability and quantity of yearly allocations to south-of-Delta contractors, including SCVWD, dependent on San Luis Reservoir.

ES.2.2 Secondary Objective

- Provide opportunities for ecosystem enhancement.

ES.3 Plan Formulation Process

Reclamation and SCVWD implemented a multi-year plan formulation (Figure ES-3) and screening process to identify, evaluate, and develop alternatives.

Figure ES-3. Planning Process

The evaluation identified and screened 87 management measures and 26 initial alternatives relative to federal planning criteria. Reclamation developed an Initial Alternatives Information Report and a Plan Formulation Report to document the plan formulation process.

ES.4 Alternatives Evaluated in Feasibility Investigation

After completion of the plan formulation process, the following alternatives were carried forward to the feasibility investigation.

ES.4.1 No Action/No Project Alternative

The No Action or No Project Alternative presents the reasonably foreseeable future conditions in the absence of the alternative plan. The purpose of the No Action or No Project Alternative is to allow decision makers to compare the impacts of approving the project to the impacts of not approving the project. The No Action/No Project Alternative would leave the current operations at San Luis Reservoir unchanged. SCVWD would continue annual operations planning to anticipate curtailment of CVP supply, and would cope with its uses and sources of imported and local water supplies. CVP agricultural contractors would continue to rely on the current water supply allocation process.

ES.4.2 Lower San Felipe Intake Alternative Plan

The Lower San Felipe Intake Alternative Plan includes construction of a new, lower San Felipe Intake to allow reservoir drawdown to its minimum operating level without algae effects. Moving the San Felipe Intake to an elevation equal to that of the Gianelli Intake would allow operation of San Luis Reservoir below the 300 TAF level without creating the potential for a water supply interruption to SCVWD. A tunnel and a pipeline option were evaluated for this alternative. A tunnel would be constructed beneath the reservoir floor to convey water from the new intake to the existing intake. The tunnel would be about 20,000 feet long, 15 feet in diameter, and the liner would have an inner diameter of 13 feet. For the pipeline option, a new 13-foot diameter, reinforced concrete cylinder pipe would be laid along the bottom of San Luis Reservoir. The pipeline would be approximately 20,000 feet long.

The Lower San Felipe Intake Alternative Plan would provide an annual average of approximately 3,149 acre-feet (AF) of additional water M&I supply to the San Felipe Division compared to the No Action/No Project Alternative. Modeling results show that the Lower San Felipe Intake Alternative Plan would fully replace interrupted supplies in all 17 years with low point conditions (out of the 82 years modeled) low point years and fully address total demand shortages in 10 of those years.

ES.4.3 Treatment Alternative Plan

The Treatment Alternative Plan includes new technology retrofits at the SCVWD's Santa Teresa Water Treatment Plant (WTP). This WTP is supplied with water from San Luis Reservoir and cannot effectively treat the algae-laden water present during low point events. The Treatment Alternative Plan would add a raw water ozonation process to the treatment train at the Santa Teresa WTP. The additional water supply under the Treatment Alternative Plan would be the same as the Lower San Felipe Intake Alternative Plan. Results show that the Treatment Alternative Plan would fully replace interrupted supplies in all 17

years with low point conditions (out of the 82 years modeled) low point years and fully address total demand shortages in 10 of those years.

ES.4.4 San Luis Reservoir Expansion Plan

The San Luis Reservoir Expansion Alternative Plan would place additional fill material on the dam embankment to raise the dam crest to increase storage capacity. The alternative plan would build upon the dam embankment expansion and foundation modifications to address the seismic concerns that are currently in final design. The San Luis Reservoir Expansion Alternative would allocate the increased capacity to the CVP only. This expanded capacity would be operated in the same way as the current CVP portion of San Luis Reservoir, with the reservoir used for seasonal storage.

Results show that the San Luis Reservoir Expansion Alternative Plan would deliver additional water supplies in 8 of the 17 low point years, but would not in any year fully address the low point generated water supply shortages. The San Luis Reservoir Expansion Alternative has the potential to decrease SWP deliveries by reducing SWP exports from the Delta through Banks Pumping Plant. Banks Pumping Plant exports can be reduced as compared to the No Action/No Project Alternative because the additional CVP storage capacity under the alternative allows the CVP to export more of the water they are entitled to under the Coordinated Operations Agreement. Under the No Action/No Project Alternative, the SWP is able to export this water when the CVP portion of San Luis Reservoir fills and CVP south-of-Delta demands are being met.

The San Luis Reservoir Expansion Alternative Plan would provide a minimal increase to SCVWD M&I supply and would provide approximately 16,100 AF of additional south of Delta agricultural water supply on an average annual basis as compared to the No Action/No Project Alternative.

ES.4.5 Pacheco Reservoir Expansion Plan

The Pacheco Reservoir Expansion Alternative Plan includes construction of new dam, removal of existing dam, and expansion of the reservoir. The new dam and reservoir would be constructed on Pacheco Creek 0.5 mile upstream from the existing North Fork Dam and would inundate most of the existing Pacheco Reservoir.

The expanded Pacheco Reservoir would be primarily filled using natural inflows from the North and East Forks of Pacheco Creek. These inflows are typically realized from December through March. Supplemental flows to the expanded reservoir would arrive from SCVWD's share of contracted CVP pumped water from San Luis Reservoir. This would include allocated CVP water supplies that otherwise could not be delivered to or stored by SCVWD. Pacheco Reservoir would be operated by SCVWD to both improve habitat conditions for steelhead in Pacheco Creek and improve SCVWD water supply reliability, including during drought periods and emergencies.

The Pacheco Reservoir Expansion Alternative Plan would provide an annual average of approximately 2,800 AF of additional water M&I supply to the San Felipe Division compared to the No Action/No Project Alternative. Modeling results show that the Pacheco Reservoir Expansion Alternative Plan would fully replace interrupted supplies in 14 out of the 17 years with low point conditions (out of the 82 years modeled) low point years.

ES.4.6 Alternative Plan Cost Estimates

Table ES-1 summarizes preliminary construction and operations and maintenance (O&M) cost estimates for the alternatives. The total cost was amortized over the alternatives' assumed 100-year project life at the 2018 Federal discount rates of 2.875 percent and 2018 price level.

Table ES-1. Appraisal-Level Cost Estimates for the Alternatives, 2018 dollars

Alternative Plan	Total Construction Cost (Million $)	Interest and Amortization for Construction Costs, 2.875%, 100 yr (Million $)	Interest and Amortization for Replacement Costs, 2.875%, 100 yr (Million $)[1]	Average Annual O&M Cost (Million $)	Total Annual Cost (Million $)
Lower San Felipe Intake (Tunnel)	$968.00	$29.60	NA	$2.50	$32.10
Lower San Felipe Intake (Pipeline)	$885.00	$27.00	NA	$2.50	$29.50
Treatment[2]	$37.00	$1.10	$2.80	$0.30	$4.20
San Luis Reservoir Expansion	$490.00	$15.00	NA	$2.20	$17.10
Pacheco Reservoir Expansion	$1,127.00	$34.40	$3.80	$1.60	$39.90

Notes: [1] Treatment and Pacheco Reservoir Expansion Alternative Plans annual cost estimates include replacement costs (capital costs). [2]Treatment Alternative Plan cost estimates are at a feasibility level of design.

ES.5 Preliminary National Economic Development Evaluation

The objective of National Economic Development (NED) analysis is to determine the change in net value of the Nation's output of goods and services that would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and measured in terms of changes in national income among the No Action and various action alternatives. Benefits evaluated for the alternatives included M&I water supply, agricultural water supply, emergency water supply, and ecosystem benefits.

Table ES-2 summarizes the annual economic benefits and costs of the alternatives. The table also presents net annual benefits or costs and a benefit-cost ratio for each alternative. Based on this economic evaluation at the appraisal level, the Pacheco Reservoir Expansion Alternative Plan would have the only net benefits among the alternatives. The Pacheco Reservoir Expansion

Alternative Plan would have a benefit cost ratio of 1.2, based on the appraisal level cost estimate and preliminary benefits evaluation.

Table ES-2. Preliminary NED Benefit-Cost Summary, Annual Values, 2018 dollars

	Treatment	Lower San Felipe Intake (Pipe)	Lower San Felipe Intake (Tunnel)	San Luis Reservoir Expansion	Pacheco Reservoir Expansion
Annual M&I Water Supply Benefits (Million $)[1]	$2.30	$2.30	$2.30	($1.70)	$2.10
Annual Emergency Water Storage Benefits (Million $)	$1.60	$1.60	$1.60	$0.00	$23.70
Annual Agricultural Water Supply Benefits (Million $)[1]	($0.90)	($0.90)	($0.90)	$7.80	($0.90)
Annual Ecosystem Improvement - Pacheco Creek (Million $)[1]	NA	NA	NA	NA	$24.00
Annual San Joaquin Refuge Water Supply (Million $)[1]	NA	NA	NA	NA	$0.20
Total Annual Benefits (Million $)[1]	**$3.00**	**$3.00**	**$3.00**	**$6.10**	**$49.10**
Total Construction Cost (Million $)	$37.00	$885.00	$968.00	$490.00	$1,127.00
Annual Costs (Million $)[2]	**$4.20**	**$29.50**	**$32.10**	**$17.10**	**$39.90**
Net Annual Benefits or Costs (Million $)	**($1.20)**	**($26.50)**	**($29.10)**	**($11.00)**	**$9.20**
Benefit-Cost Ratio	**0.71**	**0.10**	**0.09**	**0.4**	**1.2**

Notes: [1] Benefits represent annual benefits estimated in the year 2030

[2] Annual costs include construction cost amortized over 100 years at 2.875% discount rate, annual O&M costs and the Treatment and Pacheco Reservoir Expansion Alternative Plans annual cost estimates include replacement costs (capital costs).

ES.6 Summary of Preliminary NED Plan

The Pacheco Reservoir Expansion Alternative Plan includes removal of the existing dam and construction and operation of a new dam and expanded reservoir, pump station, conveyance facilities, and related miscellaneous infrastructure. The new dam and expanded reservoir would be constructed on Pacheco Creek 0.5 mile upstream from the existing North Fork Dam and would inundate most of the existing Pacheco Reservoir. The proposed total storage for the expanded reservoir is 141,600 AF, with an active storage of 140,800 AF. The full pool elevation would be 694 feet and would inundate an additional 1,245 acres, for a total of 1,385 total acres inundated. Water would be collected in the expanded reservoir during the winter months from runoff from the local watershed area, and diversion of CVP supplies from the Pacheco Conduit. The expanded reservoir would be operated by SCVWD to both improve habitat conditions for steelhead in Pacheco Creek and improve SCVWD water supply reliability, including during drought periods and emergencies. In addition, SCVWD will transfer 2,000 AF of its CVP water contract (in below normal water years), directly or through transfer and exchanges, in perpetuity to Reclamation's Refuge Water Supply Program (RWSP), for use in the Incremental Level 4 (IL4) refuge water supply.

ES.6.1 Preliminary Costs and Benefits

The total construction cost of the preliminary NED Plan is estimated at an appraisal level to be $1,127.0 million. Annual costs including replacement and O&M would be $39.9 million over a 100 year period and at a 2.875% discount rate and 2018 price level.

The Preliminary NED Plan would provide increased water supplies to M&I users, to wildlife refuges, would release water to Pacheco Creek for ecosystem enhancement for South-Central California Coast (SCCC) steelhead, which are listed as threatened under the Federal Endangered Species Act (ESA), and would provide emergency water supplies. Water supplies provided would vary by year type.

- **Municipal and industrial supplies** provided to San Felipe Division CVP M&I deliveries would increase on average by 2,800 AF.
- **Emergency water storage**, estimated at 96,600 AF (long-term average), would be available in the event of a regional water supply disruption.
- **Ecosystem enhancement on Pacheco Creek**, by releasing 10 to 30 cfs in the creek to benefit federally threatened SCCC Steelhead.
- **Refuge water supplies** are estimated to be about 2,000 AF/year in below normal years.

The estimated annual monetary benefit is about $49.1 million. The net annual economic benefit is about $9.2 million.

ES.6.2 Feasibility

The preliminary NED plan is determined to be technically, environmentally, economically, and financially feasible at the appraisal level of detail.

ES.6.2.1 Technical Feasibility

At the appraisal level of design presented in this report, the Pacheco Reservoir Expansion Alternative Plan is projected to be technically feasible, constructible, and can be operated and maintained.

ES.6.2.2 Environmental Feasibility

Environmental analyses conducted to date suggest that the Pacheco Reservoir Expansion Alternative Plan would be environmentally feasible. Following the completion of construction, the expanded Pacheco Reservoir would support the storage of local inflow from the watershed that would be released for downstream ecosystem enhancements on Pacheco Creek for fishery benefits.

ES.6.2.3 Economic Feasibility

The Pacheco Reservoir Expansion Alternative Plan, at the appraisal level of design, is projected to be economically feasible, because the estimated benefits

exceed the estimated costs, resulting in positive net benefits of $9.2 million annually, and a benefit cost ratio of 1.2.

ES.6.2.4 Financial Feasibility

The beneficiaries of the NED Plan have been evaluated to have the ability to pay the non-Federal portion of project costs, based on a cost allocation and cost assignment analysis.

ES.6.3 Cost Allocation and Assignment

Costs allocated to each purpose are assigned to Federal taxpayers (non-reimbursable) and project beneficiaries (reimbursable) based on the specific project authorization, existing Federal law, existing cost sharing requirements, and laws and objectives of non-Federal entities, including states, counties, and non-profit organizations. Non-Federal partners are not seeking Federal upfront financing in the form of reimbursable Federal funding for the implementation of this project. Table ES-3 summarizes the initial cost allocation and assignment.

Table ES-3. Initial Cost Assignment for the Pacheco Reservoir Expansion Alternative Plan by Project Purpose

Cost		Emergency Water Storage	M&I Water Supply	Ecosystem Enhancement on Pacheco Creek	Refuge Water Supply
Construction	Non-Reimbursable Federal Costs	$0	$0	$270.40	$0
	Non-Federal Costs	$534.46	$47.24	$270.40	$4.51
Interest During Construction (IDC)	Non-Reimbursable Federal Costs	$0	$0	$20.35	$0
	Non-Federal Costs	$40.23	$3.56	$20.35	$0.34
OM&R	Non-Reimbursable Federal Costs	$0	$0	$0	$0.02
	Non-Federal Costs	$2.58	$0.23	$2.61	$0.01

The CWC approved conditional funding of approximately $485 million for the Pacheco Reservoir Expansion Project in May of 2018. Final award of this funding is contingent upon the Local Agency Partner completing the remaining Proposition 1 requirements including final permits, environmental documents, contracts for the administration of public benefits, and commitments for non-Proposition 1 funding. Once the Local Agency Partner has obtained all the necessary permits, documents and contracts, California Water Commission (CWC) will hold a final award hearing.

ES.6.4 Risk and Uncertainty

Certain assumptions were made for the Investigation based on engineering, economic, and scientific judgment and the availability of data/information. While this is effective in estimating relative outcomes, various risks and uncertainties could affect implementation of an authorized project.

- Potential climate variabilities could produce conditions that differ from today, affecting future CVP and SWP operations.

- Future water system operations and facilities may change, in addition to changing operational constraints, hydrology, demands, and regulatory conditions in California.

- Reservoir design is at an appraisal level of engineering design and there are uncertainties due to existing geotechnical and seismic conditions at the site. Additional engineering design is necessary.

- Construction cost estimates, at an appraisal-level, have inherent risks and uncertainties due to unknown future labor, market, and field conditions.

- The timing, source, and availability of funding will affect the construction schedule and cost estimates included in the Feasibility Report.

- In addition to construction funding, the Secretary of the Interior would request appropriations annually for the delivery and administration of Refuge water supplies. A delay in Federal, state or local funding would affect project operations.

- Various activities need to occur before Federal construction funding can be awarded. Among these, consultation under the ESA must be completed and a Record of Decision (ROD) signed. Delays in completing consultation and permitting activities could result in delays in construction funding.

- The estimation of the economic (monetized) benefits of potential project accomplishments is subject to uncertainties associated with valuation methods and assumptions.

- Non-Federal funding for a majority of the construction costs of a recommended plan would need to be identified and secured for the Secretary of the Interior to recommend funding for construction. A conditional funding award was made by the State of California that would cover a large portion of the non-Federal costs. Financing arrangements are being actively explored by SCVWD.

ES.7 Summary

Reclamation and SCVWD will continue to refine and evaluate the preliminary NED Plan, the Pacheco Reservoir Alternative Plan, to reflect potential changes to existing and likely future conditions. The public has been invited to

comment on this and other alternative plans and these comments will be taken into consideration. Refinement of the Pacheco Reservoir Expansion Alternative design from its current appraisal level to feasibility level, and future updates to operations modeling and economic studies to reevaluate the newly refined designs and cost estimates should be considered. It should be noted that conditions at San Luis Reservoir, in the SCVWD service area and in the Delta are also complex and subject to change.

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List of Acronyms

ACHP	Advisory Council on Historic Preservation
Act	Water Supply, Reliability, and Environmental Improvement Act
AF	acre-feet
APE	area of potential effects
BAAQMD	Bay Area Air Quality Management District
BDCP	Bay Delta Conservation Plan
BEPA	Bald Eagle Protection Act
BiOps	Biological Opinions
BON	basis of negotiation
CAAQS	California Ambient Air Quality Standards
CALFED	CALFED Bay-Delta Program
CARB	California Air Resources Board
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFP	California fully protected species
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
COA	Coordinated Operations Agreement
CSC	California Species of Concern
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWC	California Water Commission
DAF	Dissolved Air Floatation
Delta	Sacramento-San Joaquin Delta
DFG	Department of Fish and Game
DOC	Department of Conservation
DPS	Distinct Population Segment
DRMS	Delta Risk Management Strategy
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EIS/EIR	Environmental Impact Statement/ Environmental Impact Report

ESA	Endangered Species Act
ESU	evolutionary significant unit
EQ	Environmental Quality
FC	Candidate for Federal listing
FD	Federal Delisted
FE	Federally Endangered
FT	Federally Threatened
FPE	Proposed for Listing as Endangered
FPT	Proposed for Listing as Threatened
GCM	global climate model
GRCD	Grassland Resources Conservation District
hp	horsepower
I	Interstate
IAIR	Initial Alternatives Information Report
IDC	interest during construction
IL4	Incremental Level 4
IMPLAN	IMpact analysis for PLANning
IPCC	Intergovernmental Panel on Climate Change
ITA	Indian Trust Asset
kV	kilovolt
M&I	municipal and industrial
MAF	million acre-feet
MIG	Minnesota IMPLAN Group
MSL	mean sea level
MVA	megavolt amp
MWDSC	Metropolitan Water District of Southern California
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
No CC	No Climate Change
O&M	operations and maintenance
O_3	ozone
OM&R	operations, maintenance, and replacement
OSE	Other Social Effects
P&Gs	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies

PFR	Plan Formulation Report
PG&E	Pacific Gas and Electric Company
P.L.	Public Law
$PM_{2.5}$	fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns
PPWD	Pacheco Pass Water District
PR&G	Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies
PVWMA	Pajaro Valley Water Management Agency
Reclamation	United States Department of the Interior, Bureau of Reclamation
RED	Regional Economic Development
ROD	Record of Decision
RPAs	Reasonable and Prudent Alternatives
RWQCB	Regional Water Quality Control Boards
RWSP	Refuge Water Supply Program
SBA	South Bay Aqueduct
SBCWD	San Benito County Water District
SC	Candidate for State listing
SCC	South-Central California Coast
SCRB	Separable Cost-Remaining Benefits
SCVWD	Santa Clara Valley Water District
SE	State Endangered
SFBAAB	San Francisco Bay Area Air Basin
SFPUC	San Francisco Public Utilities Commission
SHPO	State Historic Preservation Officer
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SLDMWA	San Luis & Delta-Mendota Water Authority
SLLPIP	San Luis Low Point Improvement Project
SP	State Park
SR	State Route
SR	Listed as Rare by the State of California (plants only)
SRA	State Recreation Area
ST	State Threatened
SWE	Snow Water Equivalent
SWP	State Water Project
SWRCB	State Water Resources Control Board

TAF	thousand acre-feet
U.S.	United States
US 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
VTA	Valley Transportation Authority
WEAP	Water Evaluation and Planning
WEF	Water Education Foundation
WestMap	Western Climate Mapping Initiative
WIIN	Water Infrastructure for Improvements to the Nation
WSIP	Water Storage Investment Program
WTP	water treatment plant
YR	year

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Chapter 1
Introduction

The San Luis Low Point Improvement Project (SLLPIP) Draft Feasibility Report is a joint study by the United States (U.S.) Department of the Interior Bureau of Reclamation (Reclamation), in cooperation with the Santa Clara Valley Water District (SCVWD). The purpose of the feasibility report is to determine the potential type and extent of Federal and regional interest in a potential project to address water supply reliability and schedule certainty issues for SCVWD associated with low water levels in San Luis Reservoir. The SLLPIP alternatives analyzed in this Draft Feasibility Report would help to maintain a high quality, reliable, and cost-effective water supply for SCVWD, and would ensure that they receive their annual Central Valley Project (CVP) contract allocations at the time needed to meet their existing water supply commitments.

1.1 Draft Feasibility Report Purpose and Organization

The purpose of this Feasibility Report is to document the development, evaluation, and comparison of the alternatives established during the Federal planning process for the SLLPIP and identify the National Economic Development (NED) Plan. Figure 1-1 shows the planning process when each step was or will be completed. The Environmental Impact Statement/Environmental Impact Report (EIS/EIR) is a companion document to this Report and assesses the environmental effects of a range of alternatives including the No Action/No Project alternative.

Figure 1-1. Planning Process

This Draft Feasibility Report is the result of a multi-step, iterative screening process that further developed the alternatives initially identified in the Initial Alternatives Information Report (IAIR). This Report documents the preliminary NED Plan. The scope of this Report includes specifying problems and opportunities, inventory and forecast of conditions, formulation of alternative plans, evaluation of effects of alternative plans, comparison of alternative plans, and identification of the preliminary NED Plan. At this time, the alternative plans are developed to an appraisal level of engineering design.

This Draft Feasibility Report includes the following topics:

- Chapter 1 describes the study authorization; project background; problems, needs, and opportunities; and study planning objectives. The chapter also describes the study area and pertinent prior studies, projects, and programs.
- Chapter 2 describes the existing and likely future water resources and related conditions in the study area.
- Chapter 3 describes the plan formulation process, including the Initial Alternative Information Report, Plan Formulation Report (PFR), project modifications, and plan reformulation.
- Chapter 4 presents the No Action/No Project Alternative and alternative plans, including features and operations.
- Chapter 5 provides the evaluation and comparison of alternatives.
- Chapter 6 describes the preliminary NED Plan, including its major components and benefits, determination of feasibility, risk and uncertainties.
- Chapter 7 provides an overview of coordination and public involvement for the study, including stakeholder outreach, public involvement, and agency coordination and consultation.
- Chapter 8 summarizes findings of this Draft Feasibility Report.
- Chapter 9 includes the next steps.
- Chapter 10 contains the sources used to prepare this Draft Feasibility Report.

1.2 Study History and Authorization

The SLLPIP began when the August 2000 CALFED Bay-Delta Program (CALFED) Programmatic Record of Decision (ROD) included the SLLPIP as a complementary conveyance action. The ROD referred to a bypass canal to the San Felipe Unit at the San Luis Reservoir as one complementary action. In May 2001, SCVWD accepted a $14 million Proposition 13 grant from the California Department of Water Resources (DWR) to fund a feasibility study to address the low point problem. SCVWD moved forward to identify potential alternatives. During this time, SCVWD initiated a stakeholder involvement effort to help identify and assess alternatives and conducted public scoping in

2002 for the development of an Environmental Assessment under the California Environmental Quality Act (CEQA).

Reclamation became a project study partner when the SLLPIP Federal Feasibility Investigation was authorized under Public Law (P.L.) 108-361, Title 1, SEC. 101, CALFED Bay-Delta Authorization Act (October 25, 2004, 118 STAT. 1694), also known as the Water Supply, Reliability, and Environmental Improvement Act (Act). Section 103(f)(1)(A) of the Act authorized the Secretary of the Interior to expend funds "…for feasibility studies, evaluation, and implementation of the San Luis Reservoir lowpoint improvement project, except that Federal participation in any construction of an expanded Pacheco Reservoir shall be subject to future congressional authorization."

With Federal involvement, the feasibility investigation was conducted pursuant to the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*[1] (P&Gs) (U.S. Water Resources Council 1983). The P&Gs provide guidance to Federal agencies for planning and water resource-related projects. Reclamation and SCVWD worked to develop a joint feasibility investigation approach; identified Federal planning objectives, and formulated alternatives to address the low point problem. In 2008, Reclamation and SCVWD conducted public scoping meetings because the baseline conditions, project objectives, and alternatives had changed since the original scoping period completed by SCVWD in 2002. In 2016, the Water Infrastructure for Improvements to the Nation (WIIN) Act reaffirmed the feasibility study authority for SLLPIP.

In August 2017, SCVWD submitted an application to the State of California Water Commission (CWC) for funding an expansion of Pacheco Reservoir pursuant to the Water Storage Investment Program (WSIP). Proposition 1 of 2014 dedicated $2.7 billion for investments in water storage projects. The CWC is currently administering WSIP to fund the public benefits associated with eligible projects, including the Pacheco Reservoir Expansion Alternative included in this Report. In July 2018, SCVWD received a maximum conditional eligibility determination of $484.5 million from the CWC. Based on the public and non-public benefits identified from the evaluation conducted for the WSIP application and the stakeholder support for the project, SCVWD requested that Reclamation reevaluate the Pacheco Reservoir Expansion Alternative in the SLLPIP Feasibility Report.

[1] The SLLPIP Feasibility Study was initiated by Reclamation in 2004 and as such, has been developed consistent with the guidelines presented in the P&Gs. In 2015, the Department of the Interior released the *Department of Interior Agency Specific Procedures for implementing the Council on Environmental Quality's Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies (PR&G)* (United States Department of the Interior 2015). These new PR&Gs are being used to provide input on the SLLPIP Feasibility process but are not required.

1.3 Background

Reclamation and the DWR jointly own and operate the San Luis Reservoir to provide seasonal storage for the CVP and the State Water Project (SWP). The San Luis Reservoir is connected to both the Delta-Mendota Canal and the California Aqueduct (see Figure 1-2), which enables the CVP and SWP to pump water into the reservoir during the wet season and release water into the conveyance facilities during the dry season when demands are higher. Deliveries from San Luis Reservoir also flow west through Pacheco Pumping Plant and Conduit to the San Felipe Division of the CVP, which includes SCVWD and the San Benito County Water District (SBCWD).

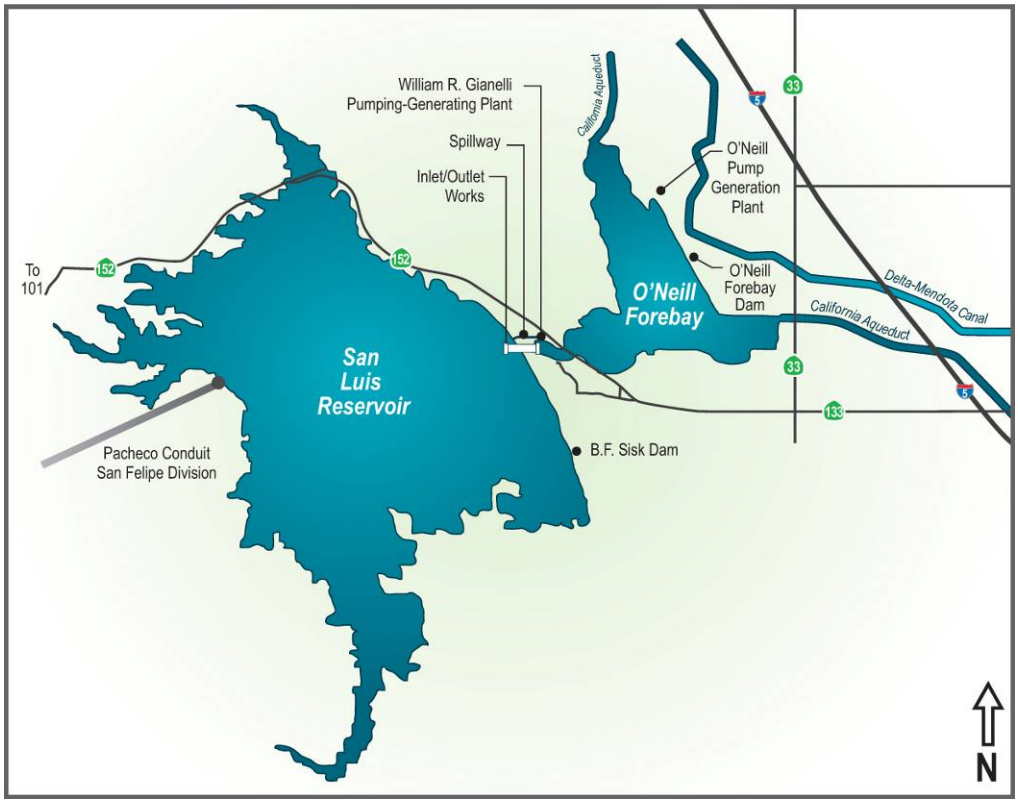

Figure 1-2. San Luis Reservoir and Associated Facilities

During the summer, high temperatures and declining water levels create conditions that foster algae growth. The thickness of the algae blooms vary, but typically average about 35 feet in depth. The water quality within the algal blooms is not suitable for municipal and industrial (M&I) water users relying on existing water treatment facilities in Santa Clara County.

Figure 1-3 shows the intake and outlet facilities associated with the reservoir. As water levels decline to the point that the algae is in the vicinity of the Upper Intake, that intake is no longer used. The low point problem occurs when the

water levels decline to the point that the algae blooms are near the Lower Intake. Typically, this point occurs when water levels reach an elevation of 369 feet above mean sea level (MSL) or at 300 thousand acre-feet (TAF) capacity in the reservoir, when the water is approximately 35 feet above the top of the Lower Intake (334 feet above MSL or 110 TAF). The reservoir's minimum operating level is about 30 feet above the top of the Gianelli Intake; therefore, algae does not typically enter the Delta-Mendota Canal or California Aqueduct.

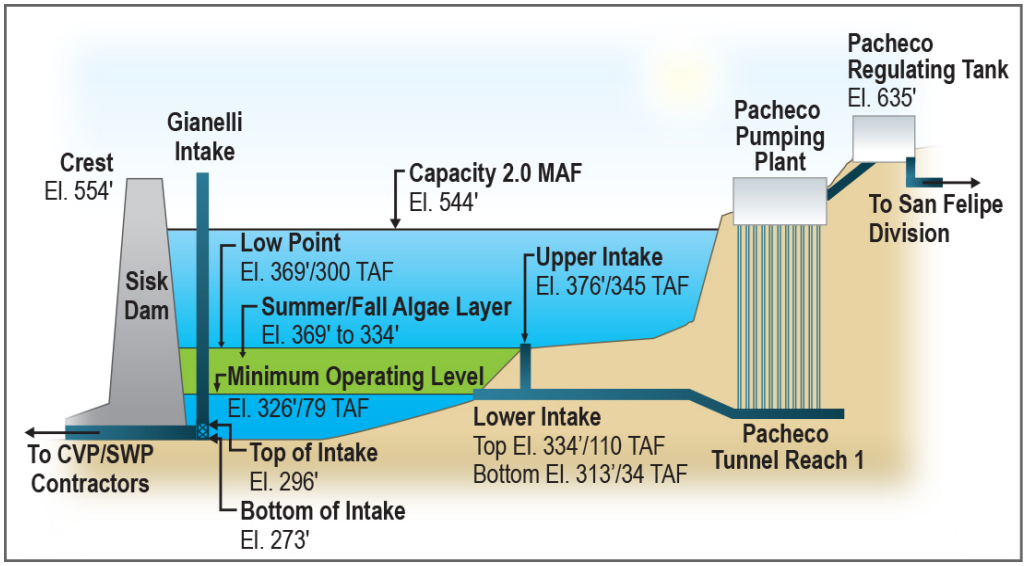

Figure 1-3. Reservoir Intake and Outlet Facilities

If water levels fall below 369 feet above MSL (300 TAF), SCVWD cannot receive water from San Luis Reservoir for M&I purposes because of water quality issues. San Luis Reservoir is the only delivery route for SCVWD's CVP supplies; therefore, SCVWD cannot access CVP supplies for M&I purposes during low-point events. The CVP operators allocate water based on the minimum operating level of 326 feet above MSL (79 TAF), and predict water levels below 369 feet above MSL (300 TAF) in most years. Even the prediction of a low point problem can cause water supply concerns for SCVWD because it must secure alternative water supplies in case disruptions occur, from sources including local groundwater supplies, District supplies stored in the Semitropic Water Storage District groundwater bank, and surface water transfers from willing sellers. In recent years, Reclamation has been implementing exchanges to deliver a portion of CVP supplies when there is a low point problem in San Luis Reservoir.

1.4 Problems, Needs, Opportunities, and Planning Objectives

1.4.1 Water and Related Resource Problems, Needs, and Opportunities

1.4.1.1 Problems and Needs

The SLLPIP is designed to address the water resource problem related to reduced certainty of meeting SCVWD delivery schedules during the year and reduced water supply reliability to SCVWD related to the frequency and duration of the low point problem.

1.4.1.1.1 Delivery Schedule Certainty

As discussed above, low water levels in San Luis Reservoir cause supply interruptions to SCVWD because of algae problems at the San Felipe Division intakes. SCVWD provides water supplies to approximately two million residents and commuters in 15 cities in Santa Clara County (SCVWD 2011), and an interruption in water supply can have far-reaching effects on residents and businesses.

Water demands are typically at their peak during the summer months, which is also the time that low point problems have the potential to interrupt water supplies (SCVWD 2015). Decreased water deliveries during the peak demands pose the greatest risks of potential economic and environmental losses associated with a water shortage.

SCVWD is not only affected by the water supply interruptions, but also by the prediction of water supply interruptions. CVP and SWP water is stored in San Luis Reservoir in order to meet demands of south-of-Delta contractors. Reclamation requests an annual delivery schedule from each contractor and then approves the appropriate schedules based on CVP water availability. The actual demand schedules are, however, subject to uncertainty during the summer months because of operational constraints, varying temperature conditions, changing cropping patterns, and water transfers. The uncertainty associated with San Luis Reservoir water supply deliveries affects SCVWD's overall water delivery operations to meet customer demands (SCVWD 2014). The frequency of low point forecasts and occurrences is projected to increase in the future and SCVWD's ability to adjust operations to mitigate water supply impacts associated with the low point problem will diminish over time as local supplies, currently reserved for use during drought events, are relied on to replace interrupted imported CVP supplies during non-drought years.

1.4.1.1.2 Water Supply Reliability

Decreased water supply reliability affects CVP contractors' ability to meet water demands. More stringent flow and water quality requirements in the Sacramento-San Joaquin River Delta (Delta) have restricted the amount of water that the CVP and SWP can pump. These limitations are causing water supply reliability concerns for SCVWD and other CVP and SWP contractors that receive Delta exports. Regulatory changes, project operations, and growth

in water demand is expected to increase reliance on San Luis Reservoir supplies. Full exercise of the storage in San Luis Reservoir would cause reservoir levels to fall below 300 TAF more frequently than has occurred in the past, which interrupts deliveries to SCVWD and reduces water supply reliability.

1.4.1.2 Opportunities

1.4.1.2.1 Avoidance of Interruption to SCVWD M&I Water Deliveries
Reclamation operates San Luis Reservoir to meet contract allocations and/or regulatory requirements. Reclamation operates the reservoir to reach the minimum operating pool of 79 TAF. In the past, water levels did not always decrease below 300 TAF because of historical SWP operations where contractors are storing carryover water in San Luis Reservoir, which prevented the low point problem. If Reclamation operated the reservoir down to 79 TAF, SCVWD would request that the reservoir be maintained above 300 TAF to avoid supply interruptions to SCVWD's M&I water users. Implementing the SLLPIP could improve SCVWD's utilization of CVP supplies.

1.4.1.2.2 Operational Flexibility
Operational flexibility allows water agencies to manage water supplies efficiently by increasing supply and storage options. Several SLLPIP measures would include new local storage facilities or alternate water supplies within SCVWD's area. In years that the low point is not an issue, the local agency could use the local water projects to provide additional supplies, which would allow the agency to maximize use of surface and groundwater to meet both current and future water demands.

1.4.1.2.3 Ecosystem Enhancement
SCVWD is proposing to donate part of their CVP allocation to south-of-Delta National Wildlife Refuges as a part of Reclamation's obligation under the Central Valley Project Improvement Act (CVPIA) Incremental Level 4 (IL4) refuge water supply. The 1992 CVPIA, Section 3406(d), includes provisions for refuge water supplies for 19 specified Central Valley refuges under the refuge water supply section of the Act. The CVPIA refuges are managed by United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and the landowners of privately owned/ managed wetlands in the Grasslands Conservation District. Each year, Reclamation strives to provide as much IL4 water as possible. However, full IL4 deliveries have only been achieved during wettest years, and only to refuges without conveyance constraints.

Developing a new water resource project outside of San Luis Reservoir could produce ecosystem enhancement benefits through improvements to refuge habitat quality and values.

1.4.2 SLLPIP Specific Planning Objectives

The primary and secondary planning objectives, developed based on the above-stated problems and opportunities, of the SLLPIP are intended to optimize the water supply benefits of San Luis Reservoir while reducing additional risks to south-of-Delta water users. Primary project objectives are those which specific alternatives are formulated to address. The two primary objectives are considered to have coequal priority, with each pursued to the maximum extent practicable without adversely affecting the other. Secondary objectives are considered to the extent possible through pursuit of the primary objectives.

1.4.2.1 Primary Objectives

- Avoiding supply interruptions when water is needed by increasing the certainty of meeting the requested delivery schedule throughout the year to south-of-Delta contractors, including SCVWD, dependent on San Luis Reservoir.

- Increasing the reliability and quantity of yearly allocations to south-of-Delta contractors, including SCVWD, dependent on San Luis Reservoir.

1.4.2.2 Secondary Objective

- Provide opportunities for ecosystem enhancement.

The objectives distinguish between certainty of meeting delivery schedules and the reliability of supplies. More specifically, the first objective is related to predictably meeting contractors' delivery schedules throughout the year as opposed to the second objective, which improves reliability to increase yearly allocations to more closely match the contractual terms.

These issues are relevant to south-of-Delta contractors dependent on San Luis Reservoir. San Luis Reservoir serves as a storage facility to increase the annual reliability of deliveries to CVP and SWP contractors in the Central Valley. CVP contractors rely on both exports from the C.W. "Bill" Jones Pumping Plant and San Luis Reservoir to meet summer demands. Full exercise of the reservoir helps to maximize CVP supplies, but the low point constraint in the release of water from San Luis Reservoir could limit M&I supplies. The C.W. "Bill" Jones Pumping Plant does not have enough pumping capacity to fully meet demands alone and CVP operators store additional water in San Luis Reservoir during the winter, when demands are low, to help meet summertime needs.

SCVWD is more impacted by conditions in San Luis Reservoir due to its position between the Delta and the San Felipe Unit. When SCVWD is unable to treat its CVP supply due to algae, then it must rely on other sources of water for M&I purposes which may not be reliable each year. In the future, increased demand and the potential for further regulatory constraints on availability of supplies may cause CVP and SWP contractors to maximize use of their water

stored in San Luis Reservoir, increasing the frequency of the low point problem and the risk of supply interruptions to SCVWD.

SCVWD water supply interruptions have historically been avoided because SWP contractors have left water in storage, thus maintaining water levels in San Luis Reservoir above 300 TAF. However, in 2008 San Luis Reservoir was drawn down below 300 TAF which created treatment performance issues at SCVWD water treatment plants (WTPs) and resulted in an interruption of deliveries from San Luis Reservoir. Future CVP water supply reliability for SCVWD requires the full use of the CVP water from San Luis Reservoir; therefore, SCVWD desires a solution that resolves the low point problem in San Luis Reservoir that can impair the Districts ability to utilize contractual supplies.

1.5 Study Area

The study area, shown in Figure 1-4, includes the Delta, San Luis Reservoir and its related infrastructure, SCVWD's service area in Santa Clara County, Pacheco Reservoir, Pacheco Creek downstream of the Pacheco Dam, and San Felipe Lake. The study area also includes service areas of south of Delta CVP and SWP contractors and wildlife refuges.

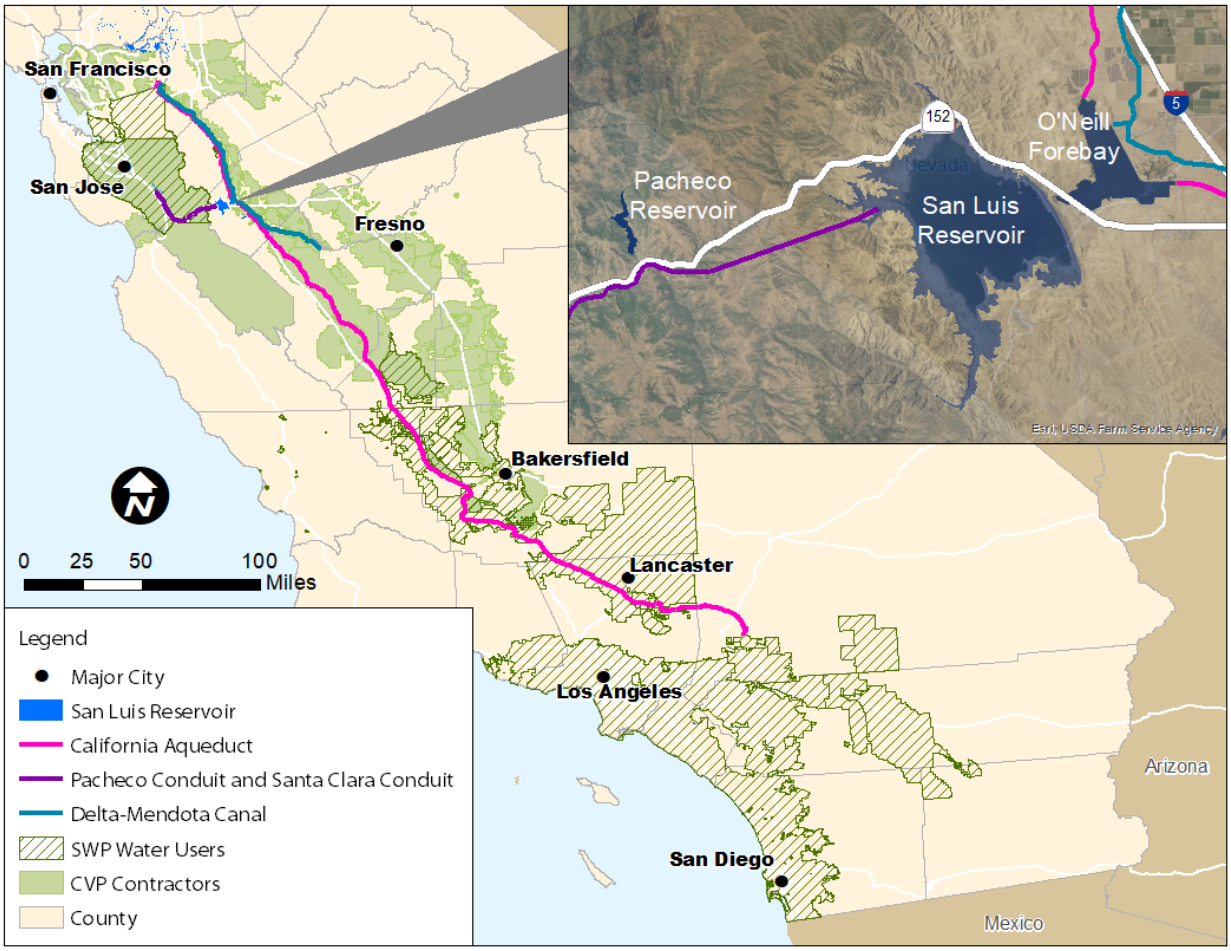

Figure 1-4. Study Area

1.6 Related Studies, Projects, and Programs

Federal, State, and local agencies are participating throughout California in a wide range of other projects and programs that have the potential to influence water supply conditions for both San Luis Reservoir and SCVWD. The projects and programs listed below are in the study area and potentially relevant to the study.

1.6.1 Federal

Federal studies, projects, programs, and plans relevant to the Feasibility Report are described below.

1.6.1.1 San Luis Drainage Feature Re-evaluation Project

The purpose of the San Luis Drainage Feature Re-evaluation Project is to identify a plan to provide agricultural drainage service to the CVP's San Luis Unit in accordance with the Ninth District Circuit Court decision that Reclamation must provide drainage service to the San Luis Unit. The San Luis

Drainage Feature Re-evaluation Project could affect operations of the San Luis Reservoir by altering the schedule for water deliveries.

Drainage service has been defined as managing the regional shallow groundwater table by collecting and disposing shallow groundwater from the root zone of drainage-impaired lands and/or reducing contributions of water to the shallow groundwater table through land retirement. The related ROD, signed in March 2007, selected the In-Valley/Water Needs Alternative for implementation. This alternative includes collection systems, reuse areas, treatment, and disposal facilities, as well as the retirement of 184,000 acres of farmland in the Westlands Water District and 10,000 acres in the Broadview Water District. The In-Valley/Water Needs Alternative would retire enough lands to balance the internal water demand of the San Luis Unit with the expected available supply. Reclamation has finalized the estimate of project costs and determined that Congressional action is needed to implement the In-Valley/Water Needs Alternative.

1.6.1.2 B.F. Sisk Dam (San Luis Reservoir) Safety of Dams Corrective Action Study

Reclamation in coordination with DWR is completing a Corrective Action Study on the potential for liquefaction of the B.F. Sisk Dam foundation and resulting potential for dam slumping and overtopping. In addition to evaluating liquefaction potential, the Corrective Action Study is also identifying and evaluating potential dam modifications to reduce the potential for dam failure. A public scoping meeting in 2009 included a presentation on the project and the preliminary alternatives under consideration. Alternatives presented at that meeting and currently under consideration include a potential dam raise, construction of berms at locations along the dam toe requiring foundation support, and a reduction in maximum storage capacity. The Corrective Action Study is scheduled for completion in 2019. The dam embankment expansion and foundation modifications investigated in the ongoing Corrective Action Study have been incorporated into San Luis Reservoir Expansion Alternative evaluated in this Feasibility Report.

1.6.1.3 Central Valley Project Improvement Act

Implementation of the CVPIA[2] changed the management of the CVP by making fish and wildlife protection a project purpose, equal to water supply for agricultural and urban uses. The CVPIA affects exports of water from the Delta to San Luis Reservoir and increases operational pressures on the reservoir to meet south-of-Delta water demands. CVPIA Section 3406 (b)(2) authorized and directed the Secretary of the Interior, among other actions, to dedicate and manage 800 TAF of CVP yield annually for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized in CVPIA, to assist the State in its efforts to protect the waters of the

[2] Title 34 of P.L. 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992, signed October 30, 1992.

San Francisco Bay-Delta Estuary, and to help meet obligations legally imposed on the CVP under State or Federal law following the date of enactment of the CVPIA.

CVPIA Section 3406(d)(1) required that the Secretary immediately provide specific quantities of water to the refuges referred to as "Level 2" supplies. The CVPIA requires delivery of the Level 2 water in all year types except critically dry water year conditions, when it can be reduced by 25 percent. Section 3406(d)(2) of the CVPIA refers to incremental "Level 4" refuge water supplies, which are the quantities required for optimum habitat management of the existing refuge lands. IL4 water supplies amount to about 163 TAF above Level 2 water supplies. The availability of IL4 refuge water supplies are influenced by the availability of water for transfer from willing sellers.

1.6.1.4 California WaterFix

The Bay Delta Conservation Plan (BDCP), now referred to as California WaterFix, is being prepared by Reclamation and DWR, along with Kern County Water Agency, Metropolitan Water District of Southern California, San Luis and Delta-Mendota Water Authority, SCVWD, State and Federal Water Contractors Agency, Westlands Water District, and Zone 7 Water Agency (referred to as Potential Authorized Entities).

California WaterFix is a comprehensive conservation strategy for the Delta designed to restore and protect ecosystem health, water supply, and water quality. The original Draft EIR/EIS for the BDCP, published in December 2013, included an ambitious and comprehensive plan under Section 10 of the Endangered Species Act (ESA) and California's Natural Community Conservation Planning Act, to include new water conveyance facilities and sought to secure water supplies and contribute to the recovery of listed species under a single regulatory package. The BDCP was anticipated to result in a permit decision concerning long-term regulatory authorizations under State and Federal ESA for the operations of the SWP and CVP. After receiving public comment on the Draft EIR/EIS, rather than pursuing the project as a Habitat Conservation Plan, under Section 10 of the ESA, and a Natural Community Conservation Plan, under the state's Natural Community Conservation Planning Act, DWR and Reclamation jointly decided to study additional alternatives to achieve the dual goals through implementation of new water conveyance facilities built in compliance with Section 7 of the ESA and Section 2018(b) of the California ESA. The State now proposes to restore more than 30,000 acres of Delta habitat separately through another venture called California EcoRestore.

In July 2015, DWR and Reclamation released the Partially Recirculated Draft EIR/Supplemental Draft EIS on the BDCP, proposing the California WaterFix as the preferred alternative. California WaterFix is proposed to fix California's aging water delivery system to help protect the state's economy and public safety. This project covers five main areas: water security; climate change

adaptation; environmental protection; seismic safety; and affordability (DWR and Reclamation 2015). Primary goals of the alternative include the protection of the state's water supplies from climate change through water system upgrades, improvements of river flows for threatened fish species, and ecosystem restoration and protection.

The Final EIS/EIR that identified the California WaterFix for implementation was released in December 2016 (DWR and Reclamation 2016). Biological Opinions (BiOps) for the California WaterFix were release in June 2017 and a Notice of Determination was filed in July 2017. On July 17, 2018, DWR published the California WaterFix Draft Supplemental EIR/EIS evaluating the proposed changes to the conveyance facilities in compliance with CEQA. Reclamation issued the California WaterFix Draft Supplemental EIR/EIS in compliance with National Environmental Policy Act (NEPA). Public review of Reclamation's California WaterFix Draft Supplemental EIR/EIS began on September 21, 2018 when the U.S. Environmental Protection Agency (USEPA) posted its notice of availability in the Federal Register. Public comment on the draft supplemental document closed on November 5, 2018 (DWR and Reclamation 2018).

1.6.1.5 CVPIA Contract Renewals

The CVP has more than 100 water service contracts. Reclamation has negotiated renewals of long-term water service contracts for all CVP contractors, including those within the SLLPIP study area, as required by CVPIA Section 3404(c). As mandated by Section 3404(c), irrigation contracts have a term not exceeding 25 years and M&I contracts have a term not exceeding 40 years. Most contracts have been renewed; those contracts not yet renewed will be executed upon completion of the re-initiated consultation on the Coordinated Long-term Operations of the CVP and SWP. All water service contracts contain terms and conditions for the delivery and use of CVP water, for the repayment of applicable capital construction costs, and for the reimbursement of annual operations and maintenance (O&M) expenditures. Contracts may be converted to permanent repayment contracts under the WIIN Act, regardless of the Biological Opinion completion date.

Reclamation recognizes that hydrologic, regulatory, and operational uncertainties constrain its ability to deliver CVP water and that such uncertainties may increase in importance as future water demands increase. Because of uncertainties, competing demands, variable supplies, and stated shortage provisions in service contracts, Reclamation and its contractors recognize that delivery of full contract quantities is not guaranteed and that deliveries may be equal to or less than historical deliveries. The SLLPIP may increase Reclamation's ability to deliver greater quantities of water. Furthermore, improved operations of San Luis Reservoir may provide a more reliable water supply for CVP contractors.

1.6.2 Federal-State

Programs and plans relevant to the Study that were developed or are being developed as collaborations between Federal and State agencies are described below.

1.6.2.1 Los Vaqueros Expansion Phase 2

Contra Costa Water District (CCWD), Reclamation, and DWR have jointly undertaken a series of studies to analyze the feasibility of expanding Los Vaqueros Reservoir while adhering to reservoir expansion principles established by CCWD. The project had two primary objectives and one secondary objective.

1.6.2.1.1 Primary Objectives:

- Develop water supplies for environmental water management that supports fish protection, habitat management, and other environmental water needs.

- Increase water supply reliability for water providers within the San Francisco Bay Area, to help meet M&I water demands during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions.

1.6.2.1.2 Secondary Objective:

- Improve the quality of water deliveries to M&I customers in the San Francisco Bay Area, without impairing the project's ability to meet the environmental and water supply reliability objectives stated above.

CCWD approved the Final EIR/EIS and an expansion of the reservoir from 100 TAF to 160 TAF in March 2010, and construction was completed in 2012 (CCWD undated). A further expansion of the reservoir to 275 TAF, as analyzed in the EIR/EIS is being investigated by Reclamation and CCWD. Reclamation and CCWD released a draft supplement to the Final EIR/EIR on July 3, 2017 and a Draft Feasibility Report on February 2, 2018. On July 24, 2018, the CWC announced that $459 million of Proposition 1 funding will be slated for expanding Los Vaqueros Reservoir (CCWD 2018).

1.6.2.2 Biological Opinions on the Long-term Operations of the CVP and SWP

The Long-term Operation of the CVP and SWP is currently subject to the terms and conditions of BiOps issued by the USFWS (2008) and National Marine Fisheries Service (NMFS) (2009) pursuant to Section 7 of the Federal ESA. These BiOps control operation of the CVP and SWP Delta pumps and consequently storage levels in San Luis Reservoir and deliveries to CVP and SWP contractors. The BiOps requires maximum transfer volume to be limited to 600 TAF for critical and dry years and to 360 TAF for all other year types.

In 2011, these BiOps were remanded by court order to the Federal fish and wildlife agencies for revision, these decisions were appealed to the Ninth Circuit Court of Appeals and in 2014 the orders to rewrite the BiOps were reversed (Congressional Research Service 2014). The Ninth Circuit decision affirmed the requirement that Reclamation complete an EIS on implementing the BiOps by December 1, 2015 (Congressional Research Service 2014). The Final EIS was published on November 23, 2015 and the ROD was signed on January 11, 2016 (Reclamation 2016a). On August 2, 2016, Reclamation requested reinitiation of ESA Section 7 consultation with USFWS and NMFS on the Long-Term Operations. Several factors resulted in Reclamation requesting reinitiation of consultation under the ESA, including the apparent decline in the status of several listed species, new information related to recent multiple years of drought, and the evolution of best available science. On December 29, 2017, Reclamation issued a Notice of Intent to prepare a programmatic EIS for analyzing potential modifications to the continued long-term operation of the CVP, for its authorized purposes, in a coordinated manner with SWP, for its authorized purposes.

1.6.2.3 Coordinated Operating Agreement Addendum

Reclamation and DWR developed and signed a detailed operations agreement, the "Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project" (Agreement) in 1986 (Reclamation and DWR 1986). The United States Congress enacted Public Law 99-546, which authorized Reclamation to execute the Agreement. Under this Agreement, Reclamation and DWR established the terms by which they would use their respective water rights to ensure certain contractual and regulatory responsibilities were met, while maximizing Reclamation's and DWR's ability to operate the CVP and SWP to meet water right and contract obligations upstream of the Delta, Delta water quality and flow objectives, joint Delta water right requirements issued by the State Water Resources Control Board (SWRCB), and CVP and SWP water right and contract obligations that depend upon diversions from the Delta. In 2018, Reclamation and DWR amended four key elements of the Agreement to reflect the evolved manner in which the Projects have been operated since the Agreement was originally authorized and signed: Article 6(c) in-basin uses; Article 10(b) CVP use of Harvey O. Banks ("Banks") Pumping Plant; Article 10(i) export restrictions; and Article 14(a) the periodic review.

1.6.3 Regional and Local

Regional and local programs and plans relevant to the study are described below.

1.6.3.1 Rinconada Water Treatment Plant Reliability Improvements Project

SCVWD is also conducting the Rinconada Water Treatment Plant Reliability Improvements Project to address the WTP's capacity to treat for taste-and-odor causing compounds common in the source water supply. The WTP upgrade also improves the disinfection capability and provides flexibility to treat

contaminants of emerging concern, and provides reliable capacity to meet peak demands. As a part of these upgrades, SCVWD is constructing a new treatment train.

1.6.3.2 Water Supply and Infrastructure Master Plan

The SCVWD Water Supply and Infrastructure Master Plan identifies the District's strategy to continue investments to meet the county's future water supply needs through at least 2035. The plan outlines steps for developing indirect potable reuse and optimizing existing supplies in the form of additional groundwater recharge and increased local conveyance flexibility through a new pipeline connecting Lexington Reservoir to the SCVWD raw water distribution system. The Water Supply and Infrastructure Master Plan assumes that the low point problem at San Luis Reservoir will be resolved in the future and will not limit imported supplies.

1.6.3.3 Water Storage Investment Program Pacheco Reservoir Expansion Project

SCVWD received conditional funding from CWC's WSIP under Proposition 1 for the Pacheco Reservoir Expansion Project. The project is a multi-agency effort led by SCVWD that is expected to provide local, regional and statewide environmental, water supply reliability, and water quality benefits. The objectives of the project are: (1) increase suitable habitat in Pacheco Creek for the federally threatened South-Central California Coast (SCCC) steelhead (i.e., provide ecosystem improvement benefits); (2) increase water supply reliability to help meet municipal and industrial water demands in the Santa Clara County during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions (i.e., provide emergency response and M&I benefits); (3) develop water supplies for environmental water needs at IL4 wildlife refuges to support habitat management in the Delta watershed (i.e., provide ecosystem improvement benefits in the Delta watershed); (4) improve water quality and minimize supply interruptions, when water is needed, for Central Valley Project San Felipe Division contractors, and increase operational flexibility for south-of-Delta contractors dependent on San Luis Reservoir (i.e., provide M&I water quality benefits); (5) reduce flood risk along Pacheco Creek and downstream areas, including disadvantaged communities (i.e., provide flood control benefits) (SCVWD 2017a).

The WSIP application documents for the Expanded Pacheco Reservoir Plan provided technical details and analyses for the Pacheco Reservoir Expansion Alternative evaluated in this report (SCVWD 2017a).

Chapter 2
Water Resources and Related Conditions

The plan formulation process completed for this Feasibility Report relied on an early inventory, forecast, and analysis of existing and likely future conditions in the study area. This section describes these steps.

2.1 Existing and Likely Future Resource Conditions in Study Area

An important element of any water resources evaluation is defining existing resource conditions in the affected environment, and how these conditions may change in the future. The magnitude of change not only influences the scope of the problems, needs, and opportunities, but the extent of related resources that could be influenced by possible actions taken to address them. Defining the existing and likely future conditions is critical in establishing the basis for comparing potential alternative plans consistent with the P&Gs, NEPA, and CEQA guidance. The following section briefly discusses existing conditions in the study area, including existing infrastructure, the physical environment, biological environment, cultural resources, and socioeconomic resources.

2.1.1 Existing Condition Summary

This section describes existing conditions in the study area. These are described in more detail in the EIS/EIR.

2.1.1.1 Physical Infrastructure

Physical infrastructure in the study area includes facilities for San Luis Reservoir and its related water infrastructure. This consists of the San Felipe Division's water intakes and associated infrastructure, associated recreational facilities a part of the San Luis Reservoir State Recreation Area (SRA), the California Aqueduct, and the South Bay Aqueduct (SBA). Additional physical infrastructure in the SCVWD service area includes Anderson Reservoir, the Santa Teresa WTP in San Jose, the Campbell Well Field and San Tomas Injection well in Campbell, and the existing Pacheco Reservoir.

2.1.1.1.1 San Luis Reservoir

The San Luis Reservoir is a part of the San Luis Unit of the CVP and SWP. Reclamation and the State of California jointly maintain and operate this joint use facility including, the O'Neil Dam and Forebay, B.F. Sisk San Luis Dam, San Luis Reservoir, William R. Gianelli Pumping-Generating Plant, Dos Amigos Pumping Plant, Los Banos and Little Panoche reservoirs, the San Luis Canal, and associated switchyards. The primary purpose of the San Luis Unit is

to provide approximately 1.25 million acre-feet (AF) of supplemental irrigation water supply to western counties such as Fresno, Kings, and Merced.

San Luis Reservoir serves as a major storage reservoir for the CVP and SWP. The reservoir is an artificial lake on San Luis Creek in the eastern slopes of the Diablo Range of Merced County. The reservoir stores water taken from the San Joaquin-Sacramento River Delta that would otherwise discharge into the Pacific Ocean. Water is then pumped uphill into the reservoir from the O'Neil Forebay which is fed by the California Aqueduct and then released back into the forebay to continue downstream primarily for agricultural irrigation. The reservoir has an approximate depth of 270 feet, length of 9 miles, a surface area of 19.84 square miles, and a surface elevation of 544 feet (Reclamation 2013).

The San Luis Reservoir is also a part of the San Luis Reservoir SRA, owned and operated by the California Department of Parks and Recreation (CDPR). The SRA includes four campgrounds surrounding the reservoir including the Basalt, San Luis Creek, Medeiros, and Los Banos Creek, in addition to several day-use sites. The SRA affords for various recreation activities including boating, fishing, camping, hiking, equestrian, picnicking, swimming, wind surfing, and off-highway vehicles (CDPR 2016).

2.1.1.1.2 California Aqueduct

The California Aqueduct is a primary part of the SWP and carries water from the Delta to the San Joaquin Valley and Southern California. The concrete, open aqueduct has a width of 12 to 85 feet and an average depth of 30 feet. The aqueduct helps deliver SWP water to San Joaquin Valley farms and cities (Water Education Foundation [WEF] 2016a).

2.1.1.1.3 South Bay Aqueduct

The SBA was the first conveyance facility constructed as part of the SWP. The aqueduct conveys water from the Sacramento-San Joaquin Delta through over 40 miles of pipeline and canals to Alameda County Water District, Alameda County Flood Control and Water Conservation District, and the SCVWD. The aqueduct has a capacity of 300 cubic feet per second (cfs) (WEF 2016b).

2.1.1.1.4 Anderson Reservoir

Anderson Reservoir is the largest of 10 SCVWD reservoirs and provides a reliable supply of water to Santa Clara County. It has a total storage capacity of 89,073 AF. The reservoir is located three miles east of U.S. Highway 101 (US 101) in Morgan Hill. The SCVWD is currently conducting seismic retrofits to the dam and reservoir and have placed restrictions limiting maximum storage to approximately 52% of the reservoir's total capacity for public safety purposes (SCVWD 2018a). These storage restrictions challenge SCVWD's ability to meet instream flow requirements on Coyote Creek while maintaining adequate water storage for use later in the year for its primary purpose as an emergency supply reserved by SCVWD for use in response to system outages. The current schedule for completion of a seismic retrofit

project at the dam has construction commencing in 2022 with an anticipated duration of 5 years (SCVWD 2018a).

A part of Anderson Lake County Park, Anderson Reservoir is a seven mile long lake with a 1,250 acre surface at full capacity and provides various recreation opportunities such as power and non-power boating, fishing, and picnicking (Santa Clara County Parks 2011).

2.1.1.1.5 Santa Teresa Water Treatment Plant

The Santa Teresa WTP is the largest of three WTPs in the SCVWD. The WTP produces safe drinking water to South San Jose – Almaden Valley, Blossom Valley, and Santa Teresa for residential and commercial users. Santa Teresa WTP treats and delivers up to 100 million gallons of water per day and primarily imports water from the San Luis Reservoir, in addition to the district's local supplies at Anderson and Calero reservoirs (SCVWD 2016a).

2.1.1.1.6 Existing Pacheco Reservoir

Pacheco Reservoir is located on North Fork Pacheco Creek, and it was established in 1939 through construction of the North Fork Dam. This existing earthen dam is owned and operated by Pacheco Pass Water District (PPWD), and operated for groundwater recharge via releases to Pacheco Creek in spring and early summer. The design capacity of Pacheco Reservoir is 6,000 AF with an operational capacity of 5,500 AF. The earthen dam is 100-feet tall and collects rainfall from a 75-square-mile watershed. The North Fork Dam is currently under restricted-operation criteria through an April 5, 2017 order of the DWR Division of Safety of Dams (DSOD), due to existing spillway deficiencies. PPWD is coordinating with the Federal Emergency Management Agency and DSOD on short-term and long-term repairs. The DSOD has stated that if satisfactory progress is not made to address spillway deficiencies, additional remedies would be invoked, a step that would reduce, among other things, existing fisheries habitat (SCVWD 2017a).

2.1.1.2 Physical Environment

Elements of the physical environment related to the Project study area are described in this section, and include geology and soils, water quality, groundwater resources, air quality, greenhouse gases and noise.

2.1.1.2.1 Geology, Seismicity and Soils

San Luis Reservoir

The four geologic formations in the area around San Luis Reservoir include: (1) the Franciscan formation composed of a thick assemblage of sedimentary (sandstone, shale, chert and conglomerate), igneous, and metamorphic rock; (2) the Panoche formation composed of an arenaceous shale and thinly bedded sandstone, a sedimentary sequence of lenses of coarse-grained conglomerate of porphyritic and granite boulders, cobbles, and pebbles; (3) the Tulare formation composed of nonmarine gravel, sand, and silt derived from the Franciscan

formation; and (4) the Tertiary Volcanic formation including small scattered deposits of volcanic rocks.

There are several soil associations that occur around the San Luis Reservoir, including Denverton, Kettleman, and Altamont clay associations which occupy 2,650 acres of the lands surrounding the reservoir (Reclamation and CDPR 2013). Rough stony land is the second most common soil type in the reservoir area, occupying approximately 2,000 acres mostly on the western side of the reservoir (Reclamation and CDPR 2013). The majority of developed lands in the vicinity of the reservoir, including most recreation areas, have slight or moderate erosion potential. Many of the undeveloped areas along the western, northern, and southern shorelines are categorized as having severe erosion hazard.

Soil types on the reservoir floor were characterized in geologic borings conducted by Reclamation in 1962. In the deeper areas of eastern San Luis Reservoir, reservoir bottom soils consist primarily of lean clay to sandy clay/clayey sand with trace peat/fat clay, overlying silty sand and gravel (Reclamation 1962 as cited in Reclamation and SCVWD 2013). In the western part of the reservoir, starting from approximately half way between the proposed new intake structure and the connection to the existing intake structure, the soil types transition from lean clay deposits to sandier sediments, sandy silt, silty sand beds, sandy clay beds, and gravels (Reclamation and SCVWD 2013).

San Luis Reservoir is in a seismically active area and is close to several faults and fault systems. The Ortigalita fault passes under the reservoir in two locations, one is along the western shore of the reservoir crossing over Lone Oak Bay to the east and the other runs from Cottonwood Bay close to the eastern shore of the reservoir on the eastern side of Basalt Hill (Reclamation and CDPR 2013 and United States Geological Survey [USGS] 2011). The O'Neill Fault System runs south and east of O'Neill Forebay and south of San Luis Reservoir (USGS 2011). The Calaveras and San Andreas faults are 23 and 28 miles away, respectively (Reclamation and CDPR 2013). These faults can cause earthquakes at or near San Luis Reservoir given that fault offsets can take place either along a single, or multiple fault planes. During a seismic event, secondary fault rupture and displacements can take place on neighboring faults, which had been considered to be less than active.

Landslides are common within the Coast Ranges, specifically, the west side of Merced County due to steep slopes, unstable terrain and proximity to earthquake faults (Merced County 1990). The eastern portion of San Luis Reservoir including O'Neill Forebay is in a low potential landslide zone while the western portion of the reservoir is in a medium potential landslide zone (Merced County 1990).

SCVWD Service Area

Sediments within the Santa Clara Subbasin include Holocene to Pliocene age continental deposits composed of unconsolidated to semi-consolidated gravels, sands, silts, and clays. These sediments have generally been classified as either alluvium, including unconsolidated gravels, sand, silts, and clays, or as the Santa Clara Formation, including poorly sorted deposits ranging from boulders to silt (Reclamation and SCVWD 2013).

The San Francisco Bay region is one of the most seismically active regions in the United States. There are three major faults that run across Santa Clara County: the San Andreas, Calaveras, and Hayward Faults.

The section of the San Andreas Fault directly west of San Luis Reservoir is the Santa Cruz Mountains section; this section is in Santa Clara and San Benito Counties. The San Andreas Fault has had historic earthquake activity within the past 150 years with recorded surface deformation taking place during the San Francisco earthquake in 1906 (USGS, Department of Conservation [DOC], and California Geological Survey [CGS] 2011; Bryant and Lundberg 2002). The Calaveras Fault zone has four sections with the central Calaveras Fault section running west of the project area in the vicinity of Anderson Lake and Coyote Lake (USGS, DOC and CGS 2011 and Bryant and Cluett 1999a). Portions of the central section as well as the southern section of the fault are reported as having historic earthquake activity within the past 150 years, such as the Coyote Lake earthquake of August 1979 (Bryant and Cluett 1999b). The Hayward Fault Zone is located along the eastern side of San Francisco Bay and forms the western boundary of the East Bay Hills. The fault zone has three sections, two of which are near the area of analysis: the southern section and the southeast extension section (Bryant and Cluett 2000a and 2000b). Neither section has experienced historic surface rupturing; the most recent prehistoric surface rupture for both sections was less than 15,000 years ago (Bryant and Cluett 2000a and 2000b).

Areas most prone to landslides include areas in the mountainous regions surrounding Santa Clara Valley. There are a couple sites within the area of analysis that have been designated as prone to landslides; these include two areas south of the City of San Jose located between State Route (SR) 87 and US 101. The area of the county in the Santa Cruz Mountains, west of SR 85 is also classified as a high landslide hazard area (Santa Clara County 2006). These sites are outside of the area for proposed groundwater wells and the proposed groundwater recharge pond.

The Pacheco Reservoir site is located within the Diablo Range portion of the Coast Ranges Geomorphic Province. The Diablo Range is a broad anticlinorium with a core comprised largely of Franciscan Assemblage subduction sequence sedimentary rocks that have been folded, sheared and mildly metamorphosed. The overall fabric of the Coast Ranges is a reflection of the greater San Andreas fault system (SCVWD 2017a).

2.1.1.2.2 Water Quality

San Luis Reservoir
San Luis Reservoir stores runoff water from the Delta, with a storage capacity of over two million AF. The water arrives through the California Aqueduct and Delta-Mendota Canal, and is pumped from the O'Neill Forebay into the main reservoir during the winter and spring.

San Luis Reservoir and the surrounding area tend to be windy and are characterized by wet, cool winters and warm, dry summers. During the summer months, when water levels are low, water quality in the San Luis Reservoir deteriorates due to a combination of higher warmer temperatures, wind-induced nutrient mixing, and algal blooms near the reservoir surface. Presently, when San Luis Reservoir approaches its late summer/early fall low point, algal growth may begin to degrade water quality for contractors that utilize the water. If the algal layer is significantly thick, when the lake storage volume is reduced to approximately 300,000 AF, algae may begin to enter the Lower San Felipe Intake. The water quality within the algal blooms is not suitable for agricultural water users with drip irrigation systems in San Benito County or for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County.

San Luis Reservoir and O'Neill Forebay were designated in 2010 as impaired on the Central Valley Regional Water Quality Control Board 303(d) List. The reservoir and forebay were listed for mercury impairment. Potential sources of the impairment are listed as unknown.

Delta Region and South-of-Delta CVP and SWP Facilities
San Luis Reservoir provides off-stream storage, and the primary source of that water is Delta exports. The Delta Region forms the low-lying outlet of the Central Valley, between the bordering Sacramento River to the north and the San Joaquin River to the south. Water quality in the Delta Region is governed in part by Delta hydrodynamics, which are highly complex. The principal factors affecting Delta hydrodynamic conditions are: 1) river inflows from the San Joaquin and Sacramento River systems; 2) daily tidal inflows and outflows through the San Francisco Bay; and 3) export pumping from the south Delta through the Harvey O. Banks Pumping Plant and Jones Pumping Plant.

The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.

Santa Clara County Region
The San Felipe Division provides supplemental water to 63,500 acres of land with up to 132,400 AF of water delivered annually for municipal and industrial use, subject to availability. Water is transported to the service area from the San

Luis Reservoir via the Pacheco Tunnel to users in the SCVWD Service Area or stored in Anderson reservoir for later use (Reclamation 2011). Water is also imported from the SWP through the SBA.

Anderson Reservoir is the largest surface storage facility in SCVWD that was constructed in 1950. The reservoir is listed on California's 303(d) List for impairment due to mercury and polychlorinated biphenyl.

The SBA is a 44.7 mile SWP delivery system that conveys water to Zone 7 Water Agency of the Alameda County Water Conservation and Flood Control District, Alameda County Water District, and the SCVWD. The majority of SBA water originates from the Delta. Sanitary surveys and drinking water source assessments have identified water quality constituents as contaminants of concern. These contaminants include: bacteria and protozoa with possible sources being stormwater runoff, livestock grazing, and/or wastewater treatment facilities; bromide with a possible source of seawater contributions from Delta water; total organic carbon which may be derived from stormwater runoff, septic leaching, and/or wastewater treatment facilities; total solids introduced by stormwater runoff, agricultural activities, or by grazing; and nutrients with possible sources being sewage spills, stormwater flows, and/or agricultural activities (Alameda County Water District 2008).

Beneficial uses at Pacheco Reservoir include municipal and domestic supply, agricultural supply, groundwater recharge, water contact and non-contact water recreation, wildlife habitat, cold and warm freshwater habitat, fish spawning, preservation of rare and endangered species, freshwater replenishment, navigation and commercial and sport fishing. Beneficial Uses designated for Pacheco Creek include municipal and domestic supply, agricultural supply, groundwater recharge, water contact and non-contact water recreation, wildlife habitat, cold and warm freshwater habitat, fish migration, fish spawning, preservation of biological habitats, preservation of rare and endangered species, freshwater replenishment, and commercial and sport fishing. The Pacheco Reservoir releases are not known to contribute to the identified impairments to Beneficial Use. However, Beneficial Uses at Pacheco Creek are identified as impaired under the Clean Water Act (CWA) Section 303(d) due to high concentrations of fecal coliforms, low dissolved oxygen and turbidity sourced from agriculture, natural and grazing-related sources, as well as from storm drainage discharges, animal discharges, and sewer spills and leaks (SCVWD 2017a).

2.1.1.2.3 Groundwater Resources

San Joaquin Valley Groundwater Basin

The San Joaquin Valley Groundwater Basin, including the Tracy, Delta-Mendota, and Westside subbasins, extends over the southern two-thirds of the Central Valley regional aquifer system and has an area of approximately 13,500 square miles. The San Joaquin Valley Groundwater Basin, extends from just

north of Stockton in San Joaquin County to Kern County. DWR has prioritized Tracy subbasins as medium priority based on degraded water quality throughout the subbasin (DWR 2014). The north western portion of the subbasin does not have designated groundwater sustainability agency at the time of writing this report. DWR has prioritized the Delta-Mendota subbasin as high priority based on overdraft concerns in the subbasin (DWR 2014). DWR has prioritized the Westside subbasin as high priority based on overdraft, land subsidence and water quality concerns in the subbasin (DWR 2014).

Santa Clara Valley Groundwater Basin and Gilroy- Hollister Groundwater Basin

Groundwater is an important water supply source for Santa Clara County and its preservation was the goal that spurred the formation of the SCVWD. SCVWD manages two groundwater subbasins: the Santa Clara Plain and Coyote Valley in the Santa Clara Valley Subbasin and the Llagas Subbasin in the Gilroy-Hollister Groundwater Basin. SCVWD's management of groundwater in these two subbasins includes replenishment with local and imported surface water, reductions in demand on groundwater through the use of treated surface water deliveries, water conservation, and water recycling, and ongoing monitoring of groundwater levels and quality across the subbasins (SCVWD 2018b).

DWR has prioritized the Santa Clara Valley subbasin as medium priority based on groundwater quality concerns in some wells across the subbasin (DWR 2014). Llagas Area subbasin was prioritized as high priority based on groundwater quality concerns over a significant number of wells across the subbasin (DWR 2014).

Pacheco Reservoir is currently operated for groundwater recharge through releases to Pacheco Creek. Pacheco Creek flows through the Gilroy-Hollister groundwater basin.

2.1.1.2.4 Air Quality

San Luis Reservoir

San Luis Reservoir is located within the San Joaquin Valley Air Basin (SJVAB). The region is highly susceptible to pollutant accumulation over time because of the mountains that surround the valley. Marine air flows towards the east through gaps in the Coast Range at the Golden Gate and Carquinez Strait.

Low wind speeds contribute to high concentrations of air pollutants in the winter time. During the summer, winds typically originate from the north end of the basin and flow in a south-southeast direction though the valley. These conditions contribute to persistent summer inversions that prevent the vertical dispersion of air pollutants. Summer time inversions occur when a layer of cool, marine air is trapped below a mass of warmer air above.

The SJVAB is currently designated by the USEPA as nonattainment for the ozone (O_3) and fine particulate matter ($PM_{2.5}$) national and California ambient air quality standards (NAAQS and CAAQS), nonattainment for the inhalable particulate matter (PM_{10}) CAAQS, and maintenance for the PM_{10} NAAQS (California Air Resources Board [CARB] 2015; USEPA 2016; 40 Code of Federal Regulations [CFR] 81.305).

Santa Clara Valley Water District Service Area and Pacheco Reservoir
Santa Clara County is in the San Francisco Bay Area Air Basin (SFBAAB). The basin is mostly covered on the east and south by the Diablo Range, on the west by the Pacific Ocean and on the north by the Coast Ranges. The basin is characterized by complex terrain consisting of inland valleys, coastal mountain ranges, and the San Francisco Bay.

The basin's climate is mostly determined by a high-pressure system regularly present over the eastern Pacific Ocean off the West Coast of North America. This high-pressure system shifts to the south during the winter allowing storms to pass through the region. During the summer, abundant sunshine along with the region's topography and subsidence inversion creates conditions that favor the formation of pollutants such as ozone.

The SFBAAB is currently designated by the USEPA as nonattainment for the O_3 and $PM_{2.5}$ NAAQS and CAAQS, nonattainment for the PM_{10} CAAQS, and maintenance for the carbon monoxide NAAQS. (CARB 2015; USEPA 2016; 40 CFR 81.305).

2.1.1.2.5 Noise
Noise sources currently existing in the area of analysis are of three general types: agricultural noise, general stationary noise, and general mobile noise. The counties in the area of analysis vary from rural to urban environments, and include farming, industrial, residential, and commercial noise sources. On the whole, no major long-term sources of vibration are known to exist in the area of analysis.

2.1.1.3 Biological Environment
Elements of the aquatic and terrestrial biological environment in the SLLPIP study area are described in this section. The discussion focuses on habitat and species, including special-status species.

2.1.1.3.1 Aquatic Resources
The following sections describe the existing aquatic resource conditions within the different regions of the area of analysis.

San Luis Reservoir
San Luis Reservoir contains warm water fish, and recreational fishing is an important use of the reservoir. The reservoir is an artificial environment and does not support a naturally evolved aquatic community. Although a few

species native to San Luis Creek that the reservoir impounds may still be present, the vast majority of fish species in the reservoir have either been directly introduced or transported into the reservoir via the California Aqueduct and Delta-Mendota Canal. Although there are fish screens at the CVP and SWP pumps, fish eggs, larvae, small juveniles, and invertebrates can pass through the screens and be transported to San Luis Reservoir. Striped bass are the predominant species in the reservoir. Other species found in the reservoir include threadfin shad (*Dorosoma petenense*), Sacramento sucker, carp (*Cyprinus carpio*), Sacramento blackfish (*Orthodon microlepidotus*), hitch (*Lavinia exilicauda*), hardhead, white catfish, channel catfish, yellow bullhead (*Ictalurus natalis*), brown bullhead (*Ictalurus nebulosus*), black bullhead (*Ictalurus melas*), mosquitofish (*Gambusia affinis*), Sacramento perch (*Archoplites interruptus*), black crappie (*Pomoxis migromaculatus*), largemouth bass, warmouth (*Lepomis gulosus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), and red-eared sunfish (*Lepomis microlophus*).

SCVWD Service Area

The SCVWD Service Area includes 10 dams and surface storage reservoirs, 3 water treatment plants, 400 acres of groundwater recharge ponds, and 275 miles of streams (SCVWD 2011). Waterbodies within the service area include, but are not limited to the Guadalupe River, Anderson Reservoir, Calero Reservoir, Almaden Reservoir, Coyote Creek, and Stevens Creek.

Fish-bearing watercourses in the SCVWD Service Area include the Guadalupe River and Coyote, Stevens, Calabasas, San Tomas Aquino creeks, all of which drain into the south San Francisco Bay. Chinook salmon and Central California Coast Distinct Population Segment (DPS) steelhead (*Oncorhynchus mykiss*) are the two fish species of primary management concern in this region. NMFS has designated critical habitat for steelhead in the SCVWD Service Area (NMFS 2007) in the Guadalupe River from its mouth upstream to its confluence with Los Gatos Creek, Coyote Creek, and Penitencia Creek.

Other native fish species known to occur in the SCVWD Service Area include Pacific lamprey (*Entosphenus tridentatus*), California roach (*Hesperoleucus symmetricus),* hitch, Sacramento blackfish, Sacramento pikeminnow, Sacramento sucker, threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), and tule perch (*Hysterocarpus traski*).

Pacheco Reservoir and Pacheco Creek

The existing North Fork Pacheco Reservoir is operated by the Pacheco Water District to supply agricultural irrigation water through streambed percolation. Rearing and migratory habitat for SCCC steelhead in Pacheco Creek downstream of the dam is almost completely dependent upon releases from North Fork Pacheco Reservoir. Prior field studies have identified intermittent populations of SCCC steelhead in Pacheco Creek, with opportunistic migration to the creek when flows allow upstream movement. However, fish present in

any life stages are at high-risk to death when flows decrease to a point of either resulting in warm water temperatures, or to the point of drying up the streambed. Therefore, having consistent and contiguous flow at a suitable temperature is vital to the survival of SCCC steelhead in Pacheco Creek.

Threatened, Endangered and Special-Status Species
Several native anadromous and resident species have been listed as threatened or endangered under the Federal ESA or California ESA (CESA) or are candidates for listing. Seven fish species listed under Federal ESA or CESA have the potential to occur in the watercourses in the area of analysis including Central Valley Steelhead, Central California Coast and SCCC steelhead, Central Valley spring-run Chinook Salmon, Sacramento River winter-run Chinook salmon, Green sturgeon, Delta smelt, and longfin smelt. Additionally, Central Valley Chinook salmon (fall/late fall-run), California/San Joaquin Roach, and Sacramento perch have the potential to occur in the watercourses in the area of analysis that are listed as either federal or State species of concern (CDFW 2016; Moyle 2002).

SCCC steelhead were formally listed by NMFS as a threatened evolutionarily significant unit (ESU) on August 18, 1998 (62 FR 43937), with the ESU boundary from the Pajaro River south to (but not including) the Santa Maria River. NMFS subsequently adopted a DPS for steelhead, replacing the ESU designation (71 FR 834). Under the final listing, the SCCC steelhead DPS includes all naturally spawned steelhead that occur below impassible barriers, and which exhibit an anadromous life history. NMFS designated critical habitat for SCCC, which includes Pacheco Creek of the Pajaro River watershed, on September 2, 2005 (70 FR 52488).

2.1.1.3.2 Terrestrial Resources
The following section describes the existing terrestrial resource conditions within the area of analysis.

San Luis Reservoir
Dominant vegetation communities within the San Luis Reservoir Region include riparian woodland, woodland, coast live oak woodland, scrub/chaparral, grassland, mesic herbaceous (wetland), ruderal, and developed (Reclamation and CDPR 2013).

Riparian woodland support common wildlife species including: amphibians such as Sierran treefrog (*Pseudacris sierra*), California newt (*Taricha torosa*), and California slender salamander (*Batrachoseps attenuatus*); birds including Wilson's warbler (*Wilsonia pusilla*), Swainson's thrush (*Catharus ustulatus*), yellow warbler (*Dendroica petechia brewsteri*), green heron (*Butorides striatus*), and red-shouldered hawk (*Buteo lineatus*); and mammals including San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), gray fox (*Urocyon cinereoargenteus*), and mountain lion (*Puma concolor*) (Santa Clara County 2012a).

Scrub/chaparral provides cover for wildlife including desert cottontail (*Sylvilagus audubonii*), western rattlesnake (*Crotalus viridis*) and coyote.

Grassland habitats support many species of migratory birds and raptors including western meadowlark (*Sturnella neglecta*), savannah sparrow (*Passerculus sandwichensis*), and red-tailed hawk (*Buteo jamaicensis*). Reptiles including western fence lizard (*Sceloporus occidentalis*) and common garter snake (*Thamnophis sirtalis*) and mammals including California ground squirrel (*Otospermophilis beecheyi*), bobcat (*Felis rufus*), and coyote (*Canis latrans*) inhabit grassland.

Wetlands are important for foraging and breeding habitat for many species of water birds including: wading birds such as great egret (*Ardea alba*); waterfowl including green-winged teal (*Anas crecca*), mallard, and American coot; shorebirds including killdeer, black-necked stilt (Himanto*pus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and American avocet (*Recurvirostra americana);* and passerines including Brewer's blackbird (*Euphagus cyanocephalus*), red-winged blackbird, brown-headed cowbird (*Molothrus ater*), and American pipit (*Anthus rubescens*) (Santa Clara County 2012a).

Developed areas provide limited habitat for wildlife because of their built environment. However, typical bird species that are found in developed areas include American robin (*Turdus migratorius*), mockingbird (*Mimus polyglottos*), American crow (*Corvus brachyrhynchos*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and rock pigeon (*Columba livia*). Other wildlife adapted to living in developed areas include Norway rat (*Rattus norvegicus*), western gray squirrel (*Sciurus niger*), opossum (*Didelphis virginiana*), and raccoon.

Santa Clara Valley Water District Service Area

Major vegetation communities found in the SCVWD Service Area include grassland, chaparral and coastal scrub, oak woodland, riparian forest and scrub, and wetland and open water (Santa Clara County 2012a). The Santa Teresa WTP is located within a developed area; hhowever, grassland, oak woodland, and riparian forest and scrub vegetation communities do occur nearby. These vegetation communities are described in more detail below.

Pacheco Reservoir and Pacheco Creek

The area surrounding the Pacheco Reservoir is principally undeveloped. Oak woodland comprises the majority of land cover in the vicinity of the reservoir including: foothill-pine oak woodland, mixed oak woodland and forest, blue oak woodland, and valley oak woodland. Other habitat types in the area include northern riparian forest and woodland, annual grassland, and chaparral.

Given similarities in vegetation communities, many of the wildlife species that occur in the SCVWD Service Area are similar to those found in the San Luis Reservoir Region, such as grassland, riparian, and wetlands, as described above.

Common wildlife associated with the vegetation communities not found in the San Luis Reservoir Region, including chaparral.

Chaparral communities in the SCVWD Service Area support many species of birds including Anna's hummingbird (*Calypte anna*), western scrub-jay (*Aphelocoma californica*), Bewick's wren (*Thryomanes bewickii*), California towhee (*Pipilo crissalis*), and California quail (*Callipepla californica*). Reptiles that utilize chaparral include gopher snake (*Pituophis melanoleucus*) and western rattlesnake (*Crotalus oreganus*). Mammals that utilize chaparral include California pocket mouse (*Perognathus californicus*), California ground squirrel, bobcat, and coyote.

Threatened, Endangered and Special-Status Species
Special-status plant and wildlife species that have the potential to occur within the San Luis Reservoir region or in the SCVWD Service Area based on local sightings and/or the potential presence of suitable habitat are provided in Table 2-1.

Table 2-1. Federal and State Threatened, Endangered and Special-Status Species and Species of Note

Common Name	Scientific Name	Status
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT
Zayante band-winged grasshopper	*Trimerotropis infantilis*	FE
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
California tiger salamander	*Ambystoma californiense*	FT, ST
Foothill yellow-legged frog	*Rana boylii*	CSC
California red-legged frog	*Rana draytonii*	FT, CSC
Western pond turtle	*Actinemys marmorata*	CSC
Blunt-nosed leopard lizard	*Gambelia sila*	FE, SE
Coast horned lizard	*Phrynosoma blainvillii*	CSC
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT, ST
San Joaquin whipsnake	*Masticophis flagellum ruddocki*	CSC
American peregrine falcon	*Falco peregrinus anatum*	CFP
Bald eagle	*Haliaeetus leucocephalus*	BGEPA, SE, CFP
Black swift	*Cypseloides niger*	CSC
Golden eagle	*Aquila chrysaetos*	BGEPA
Northern harrier	*Circus cyaneus*	CSC
Purple martin	*Progne subis*	CSC
Swainson's hawk	*Buteo swainsoni*	ST
Tricolored blackbird	*Agelaius tricolor*	SC
Western burrowing owl	*Athene cunicularia*	CSC
White-tailed kite	*Elanus leucurus*	CFP
American badger	*Taxidea taxus*	CSC
Greater western mastiff bat	*Eumops perotis californicus*	CSC
Pallid bat	*Antrozous pallidus*	CSC
Ringtail	*Bassariscus astutus*	CFP
San Joaquin kit fox	*Vulpes macrotis mutica*	FE, ST

Common Name	Scientific Name	Status
Townsend's big-eared bat	*Corynorhinus townsendii*	CSC
Tule elk	*Cervus elaphus nannodes*	Managed as Big Game Mammal
Arburua Ranch jewelflower	*Streptanthus insignis* ssp. *lyonii*	CRPR 1B.2
Arcuate bush-mallow	*Malacothamnus arcuatus*	CRPR 1B.2
Big-scale balsamroot	*Balsamorhiza macrolepis* var. *macrolepis*	CRPR 1B.2
California alkali grass	*Puccinellia simplex*	CRPR 1B.2
Chaparral harebell	*Campanula exigua*	CRPR 1B.2
Congdon's tarplant	*Centromadia parryi ssp. congdonii*	CRPR 1B.2
Contra Costa goldfields	*Lasthenia conjugens*	FE, CRPR 1B.1
Coyote ceanothus	*Ceanothus ferrisiae*	FE, CRPR 1B.1
Fragrant fritillary	*Fritillaria liliacea*	CRPR 1B.2
Hairless popcorn-flower	*Plagiobothrys glaber*	CRPR 1A
Hall's bush-mallow	*Malacothamnus hallii*	CRPR1B.2
Hispid bird's-beak	*Chloropyron mollis* ssp. *hispidum*	CRPR 1B.1
Hospital Canyon larkspur	*Delphinium californicum ssp. interius*	CRPR 1B.2
Lemmon's jewel-flower	*Caulanthus lemmonii*	CRPR 1B.2
Lime Ridge navarretia	*Navarretia gowenii*	CRPR 1B.1
Loma Prieta hoita	*Hoita strobilina*	CRPR 1B.1
Maple-leaved checkerbloom	*Sidalcea malachroides*	CRPR 4.2
Most beautiful jewel-flower	*Streptanthus albidus* ssp. *peramoenus*	CRPR 1B.2
Mt. Hamilton fountain thistle	*Cirsium fontinale* var. *campylon*	CRPR 1B.2
Mt. Hamilton jewel-flower	*Streptanthus callistus*	CRPR 1B.3
Pink creamsacs	*Castilleja rubicundula* ssp. *rubicundula*	CRPR 1B.2
Robust spineflower	*Chorizanthe robusta* var. *robusta*	FE, CRPR 1B.1
Round-leaved filaree	*California macrophyllum*	CRPR 1B.1
Saline clover	*Trifolium hydrophilum*	CRPR 1B.2
San Francisco collinsia	*Collinsia multicolor*	CRPR 1B.2
Santa Clara Valley dudleya	*Dudleya abramsii* ssp. *setchellii*	FE, CRPR 1B.1
Santa Cruz Mountains beardtongue	*Penstemon rattanii* var. *kleei*	CRPR 1B.2
Santa Cruz Mountains pussypaws	*Calyptridium parryi* var. *hesseae*	CRPR 1B.1
Shining navarretia	*Navarretia nigelliformis ssp. radians*	CRPR 1B.2
Smooth lessingia	*Lessingia micradenia var. glabrata*	CRPR 1B.2
Spiny-sepaled button-celery	*Eryngium spinosepalum*	CRPR 1B.2
Tiburon paintbrush	*Castilleja affinis* ssp. *neglecta*	FE, ST, CRPR 1B.2
Woodland woollythreads	*Monolopia gracilens*	CRPR 1B.2

Source: CDFW 2016, Reclamation and CDPR 2013.

Key:

Federal (USFWS):

BEPA = Bald Eagle Protection Act
FE = Listed as Endangered by the Federal Government
FT = Listed as Threatened by the Federal Government
FPE = Proposed for Listing as Endangered
FPT = Proposed for Listing as Threatened
FD = Federal Delisted Species
FC = Candidate for Federal listing

State (California Department of Fish and Wildlife):

SE = Listed as Endangered by the State of California
ST = Listed as Threatened by the State of California
SC = Candidate for State listing
SR = Listed as Rare by the State of California (plants only)
CSC = California species of special concern
CFP = California fully protected species

California Rare Plant Rank:

CRPR 1A – Species considered extinct in California
CRPR 1B – Rare and endangered in California and elsewhere
CRPR 2 – Species considered rare and endangered in California but more common elsewhere
0.1 – Seriously threatened
0.2 – Fairly threatened in California
0.3 – Not very threatened in California

2.1.1.4 Cultural Resources

The cultural resources area of analysis also includes a buffer surrounding the area of potential effects (APE) for each alternative. The APE for the four action alternative plans is as follows: (1) the Lower San Felipe Intake Alternative APE, which encompasses a proposed aeration facility, the Basalt Point use area, the Dinosaur Point area, Dinosaur Point Road, an intake or dredging area surrounding the proposed pipeline or tunnel, and Gate Shaft Island; (2) the Treatment Alternative APE, which includes the full extents of the existing Santa Teresa WTP; (3) the San Luis Reservoir Expansion Alternative APE, which spans B.F. Sisk Dam, the Basalt Hill borrow area and Borrow Area 6, the Cottonwood Bay levee modification and levee raise areas, the Dinosaur Point boat launch modification area, downstream fill impact areas, haul road and SR 152 impact areas, potential construction staging areas, and the San Luis Reservoir shoreline; and (4) the Pacheco Reservoir Expansion Alternative APE, which includes the existing North Fork Dam, a proposed dam and reservoir, new pipelines and tunnels, inlet/outlet facilities, a pump station, borrow areas, temporary haul roads, and a new transmission line. The alternatives plans span the Central Coast and Central Valley regions, which were inhabited by Native Americans beginning at least 10,000 years ago. The Ohlone and the Northern Valley Yokuts, the two major Native groups who would have been encountered by early Euro-Americans, left behind a rich material culture evident in archaeological sites throughout both regions. These groups were followed by Spanish, Mexican, and American explorers, missionaries, soldiers, and settlers who later altered the landscape in distinct ways. While much of what is known of Native Californian prehistory comes from archaeological evidence, Native Americans lifeways during the later prehistoric and historic periods also may be understood through the ethnographic record. That record includes written accounts and oral histories from European and American missionaries, soldiers, and settlers who made observations about the aboriginal cultures they encountered; it also includes observations from 18th and 19th century anthropologists who attempted to document the languages and practices of Native Americans even as they were being radically transformed. As documented through the ethnographic record, the study area is located in the western territorial boundary for the Northern Valley Yokuts (Wallace 1978; Kroeber 1925), and the traditional territory of the Coastanoan/Ohlone.

Archival and record searches of known cultural resource locations and prior cultural resource studies were carried out in 2009, 2012, 2016, and 2018 at the Central California Information Center and the Northwest Information Center of the California Historical Resources Information System for the cultural resources area of analysis associated with each proposed action alternative. Pedestrian inventory surveys within the APE for alternatives were conducted, as access was available. The EIS/EIR provides information on resources discovered during record searches and pedestrian surveys.

2.1.1.5 Socioeconomic Resources

2.1.1.5.1 Population and Employment

San Joaquin Valley Region
The CVP and SWP water service contractors within the San Joaquin Valley have service areas within Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties. In 2014, the total population in the 8-county region was 4.1 million (Minnesota IMPLAN Group (MIG), Inc. 2016). The region is largely rural with some large population centers in the cities of Stockton, Merced, Fresno, and Bakersfield. Much of the region's land is in agricultural production. CVP contractors in this region deliver both irrigation and M&I water supplies with the majority of the CVP water used in the region for agriculture.

Bay Area Region
CVP contractors in the Bay Area Region deliver both irrigation and M&I water supplies with Alameda, Contra Costa, and Santa Clara counties more reliant on M&I deliveries and San Benito County more reliant on irrigation deliveries. SWP contractors in this region deliver M&I water within Santa Clara County.

In 2014, the total population in the 4-county region was approximately 4.7 million (MIG 2016). Alameda, Contra Costa, and Santa Clara counties have the largest urban areas in the Bay Area Region, supporting the most employment and industry. These counties include residential suburbs of San Francisco, but are also home to important business services and retail businesses. California's Silicon Valley, the center of the region high-tech businesses, is in Santa Clara County.

2.1.1.5.2 Land Use

San Luis Reservoir
The majority of land within Merced County is designated as Agricultural and Foothill Pasture Land and lies outside of existing cities, Rural Centers, Urban Communities, and Highway Interchange Centers (Merced County 2013).

Land surrounding the San Luis Reservoir and the SRA include a variety of uses. The unincorporated community of Santa Nella, located northeast of O'Neill Forebay, includes residential and commercial uses (Reclamation and CDPR 2013). Grazing land is the primary land use surrounding the reservoir. Lands to the southeast of the reservoir include privately owned ranchlands, agricultural lands, public utility uses, and other scattered nonresidential uses (Reclamation and CDPR 2013).

SCVWD Area
Santa Clara County encompasses 1,300 square miles at the southern end of the San Francisco Bay (Santa Clara County 1994). The eastern and southern

portions of the county are rural and designated as Ranchlands, Other Public Open Lands, and Regional Parks, with the exception of the lands immediately surrounding and in the cities of Morgan Hill and Gilroy (Santa Clara County 2013). San Jose is the largest city in Santa Clara County and Northern California. Residential development in the city tends to be low density, single-family detached housing (City of San Jose 2011). Pacheco Reservoir is located in the sphere of influence of unincorporated Santa Clara County. A majority of the area surrounding Pacheco Reservoir is rural, pastoral landscape of open space. Two single-family residences are located one mile south of the existing North Fork Dam. Several small ranching facilities are located along the North Fork of Pacheco Creek (SCVWD 2017a).

2.1.1.5.3 Traffic

San Luis Reservoir

Regional access routes to the San Luis Reservoir SRA include Interstate 5 (I-5), US 101, SR 152, and SR 33. Local access routes in the vicinity of the San Luis SRA include Fifield Road, a two-land rural non-freeway road located west of the San Luis Reservoir running in the east/west direction connecting SR 152 with the San Luis Reservoir SRA; Dinosaur Point Road, a two-lane east-west rural non-freeway road that connects SR 152 with Fifield Road and the Dinosaur Point parking lot within the San Luis Reservoir SRA; and, Basalt Road, a two-lane rural road non-freeway road that runs along the edge of the San Luis Reservoir on the southeast side providing direct access from SR 152 to the Basal Recreation Area.

Public transit near San Luis Reservoir area includes the Merced Area Regional Transit System and Greyhound-Trailways bus lines. These two transit services do not stop at San Luis Reservoir.

The San Luis Reservoir SRA Resource Management Plan/General Plan identified parking shortages at the San Luis Creek and Los Banos Creek Use Areas during peak visitation periods (Reclamation and CDPR 2013).

SCVWD Service Area

Regional and local access routes to the area where construction for the treatment technology upgrades at the Santa Teresa WTP would be involved include I-280, SR 87, and SR 85.

Throughout Santa Clara County and the incorporated cities and towns, public transportation is provided by Caltrain, light rail, rapid bus transit, Bay Area Rapid Transit, Santa Clara Valley Transit Authority (VTA) buses, and local shuttles. In addition to bus service, the VTA directly provides light rail, rail shuttles, and paratransit services to Santa Clara residents, workers, and visitors. The City of San Jose also provides bus and rail service throughout the region.

Vehicle access to Pacheco Reservoir site would occur from SR 152, also known as the Pacheco Pass Highway. Vehicles would access Pacheco Reservoir via the existing access road adjacent to SR 152.

2.1.1.5.4 Recreation

San Luis Reservoir
Recreation facilities potentially affected within the San Luis Reservoir study area include the San Luis Reservoir SRA and Pacheco State Park (SP).

San Luis Reservoir State Recreation Area
The San Luis Reservoir SRA was developed beginning with an agreement in 1969 and initiation of general plan development in 1971 (Reclamation and CDPR 2013). The San Luis Reservoir SRA is divided into five main use areas[1] (Basalt, Dinosaur Point, Los Banos Creek, Medeiros, and San Luis Creek), and one minor use area for off-highway vehicle use. There are two additional areas designated for wildlife; both allow for hunting and hiking in undeveloped areas, along with nature study activities. The primary activities at each main use area vary but, collectively, the San Luis Reservoir SRA provides opportunities for boating, swimming, windsurfing, camping, and fishing (Reclamation and CDPR 2013).

Pacheco Pass
The Pacheco SP lies directly west of the San Luis Reservoir SRA. Part of the park is open to the public for day use recreation. The remainder of the park is used as a horse and cattle ranch, in addition to a wind turbine farm that generates clean energy for 3,500 homes. The public park component is most notable for its rich historic heritage and public education opportunities (CDPR 2011).

SCVWD Service Area
Recreational facilities potentially affected in the SCVWD study area include Anderson Lake County Park. The Henry W. Coe State Park boundary is located 2,100 feet from the Pacheco Reservoir site (SCVWD 2017a). Land in the area of Pacheco Reservoir are primarily privately held and devoted to open space and ranchlands. Pacheco Reservoir itself does not support any recreational activities.

Anderson Lake County Park
Anderson Park encompasses Anderson Reservoir which has a storage capacity of 89,073 AF (SCVWD 2016b). In addition, the park includes portions of the Coyote Creek Parkway trail system, the Jackson Ranch historic site, the Moses L. Rosendin Park, and the Burnett Park area. The combination of recreation resources provides a variety of recreation opportunities to the public including

[1] Main use areas refer to the designated major public recreation facilities within the San Luis Reservoir SRA (Reclamation and CDPR 2013).

boating, picnicking, fishing, hiking, bicycling, and equestrian use (Santa Clara County Parks 2011).

2.1.1.5.5 Visual Resources

San Luis Reservoir

Overall, the area around San Luis Reservoir offers open scenic vistas of undeveloped land and open water. These scenic qualities are enhanced by the surrounding undeveloped landscape consisting of "open grassland, expansive vistas of the rolling terrain and the adjacent Diablo range" (Reclamation and CDPR 2013). Most shoreline areas allow for uninterrupted views of the open water from the three nearby reservoirs (San Luis Reservoir, O'Neill Forebay, and Los Banos Reservoir). The views from the north and south plateaus at the Los Banos Reservoir provide a vista opportunity of the water and adjacent landscape. The San Luis SRA Regional Management Plan/General Plan notes that future plans for facilities and landscape features should consider the open, uninterrupted nature of the landscape (Reclamation and CDPR 2013). While there are developed areas around the reservoir, the overall layout and configuration of the built structures is "clustered in succinct areas, reducing the sense of sprawl and visual clutter" (Reclamation and CDPR 2013). Additionally, many of the engineered built structures contribute to the understanding of the site as a water storage and distribution facility in those areas.

SCVWD Service Area

The SCVWD Service Area extends across Santa Clara County. The Santa Clara Valley generally runs through the center of the county and is flanked by rolling hills leading to the Santa Cruz Mountains to the west and the Diablo Range to the east. Pacheco Reservoir is in this area of rolling hills and small valleys. The environment surrounding the Reservoir is relatively undeveloped, consisting of a few private ranches and residences, the North Fork Dam facilities, and telephone and electricity transmission lines. Santa Clara County encompasses 15 cities and most of the urban development is located within the incorporated cities (Santa Clara County 1994). Scenic characteristics of the area include largely undeveloped hillsides which are visible from the more developed valley floor. However, unobstructed views in urban areas are generally only possible from elevated viewpoints. Resource conservation areas such as public open lands, regional parks and ranch lands surround the urban areas to the west, south and east. Waterways are a contributing visual feature in the area and include Guadalupe River, Los Gatos Creek, Coyote Creek, and various tributaries.

2.1.1.5.6 Indian Trust Assets

Indian Trust Assets (ITAs) are defined as legal interests in property held in trust by the U.S. government for Indian tribes or individuals, or property protected under U.S. law for Indian tribes or individuals. There are no ITAs within or adjacent to Merced County and Santa Clara County, the area of analysis for

ITAs. The ITAs in closest proximity to the area of analysis are northeast and slightly southeast of Merced County in Madera and Tuolumne counties.

2.1.1.6 Climate Variability

2.1.1.6.1 Historical Climate

The historical climate of the Central Valley is characterized by hot and dry summers and cool and damp winters. Average daytime temperatures are 95 degrees Fahrenheit (°F) in the summer and 55°F in the winter. Over the course of the 20th century, average mean-annual temperature has increased by approximately 2°F, although not steadily. The increases occurred primarily during the early part of the 20th century between 1915 and 1935 and began again in the mid-1970s through the present (Western Climate Mapping Initiative [WestMap] 2010).

Precipitation in the Central Valley falls primarily from mid-autumn to mid-spring. While snowfall is rare in the valley, temperatures below freezing may occur in the winter. The variability of annual precipitation has increased in the latter part of the 20th century. These extremes in wet and dry years have been especially frequent since the 1980s (WestMap 2010).

2.1.1.6.2 Historical Hydrology

Streamflow in the Sacramento River and San Joaquin River basins has historically varied considerably from year to year. Runoff can also vary geographically; during any particular year, some portions of the basin may experience relatively greater runoff than other areas. On a monthly to seasonal basis, runoff is generally greater during the winter to early summer months (December to June), with winter runoff generally originating from rainfall-runoff events and spring to early summer runoff generally supported by snowmelt from the Cascade Mountains and Sierra Nevada.

Runoff is also greater during the winter to early summer than the rest of the year. Winter runoff events are the consequence of rainfall while the spring and early summer events are more from snowmelt. Snowpack is measured as Snow Water Equivalent (SWE). Studies have shown a decreasing trend in the latter half of the 20th century, as measured by April 1st (Mote et al. 2005). The research by Knowles et al (2007) supported these findings using SWE measurements from 1948 through 2001 at 173 stations. Another study reported decreasing spring SWE trends as much as 50 percent (Regonda et al. 2005).

Despite a slight increase or unchanged annual precipitation in the area, annual runoff increases did not occur in the Sacramento and San Joaquin rivers (Dettinger and Cayan 1995). However, the seasonal timing of runoff has shifted in the Sacramento River Basin. Between April and July, a 10 percent decrease in total runoff has been observed throughout the course of the 20th century (Roos 1991). This is supported by similar results from Dettinger and Cayan (1995) for the combined Sacramento River and San Joaquin River runoff. This

is a contrast to increases in winter runoff, such as the Peterson et al. (2008) study, which found earlier runoff trends for 18 Sierra Nevada river basins. Cayan et al. (2001) consider that the primary cause of the shift in runoff timing is due primarily from increasing spring temperatures and not increased winter precipitation.

2.1.2 Likely Future Without Project Conditions Summary

Identification of the magnitude of potential water resources and related problems, needs, and opportunities in the study area is based not only on the existing conditions highlighted above but also on an estimate of how these conditions may change in the future. Predicting future conditions is complicated by a variety of factors, including uncertainty regarding future regulatory requirements and ongoing programs and projects affecting the study area.

This section describes the changes in the environment expected in the study area assuming that no Federal (or State) actions are implemented to address the low point issues. The likely future condition includes actions reasonably expected to occur in the future. This includes projects and actions that are currently authorized, funded, and permitted[2].

2.1.2.1 Physical Environment

Physical conditions in the study area are expected to remain relatively unchanged in the future. No changes to area topography, geology, or soils are foreseen.

2.1.2.2 Biological Environment

Biological conditions at San Luis Reservoir are expected to remain relatively unchanged in the future. Without any action to improve the low point problem, there would be no related impacts on special-status fish species or their habitat and no foreseeable impacts on sensitive habitats such as watercourses and riparian communities. There would be no impacts on fish migration corridors, and no conflicts with habitat conservation plans or other local plans or policies.

In addition, efforts are underway by numerous agencies and groups to restore various biological conditions in the SCVWD service area. Accordingly, major areas of wildlife habitat, including wetlands and riparian vegetation areas, are expected to be protected and restored. However, as population and urban growth continues and land uses are converted to urban centers, wildlife and plants dependent on native habitat types may be adversely affected.

2.1.2.3 Cultural Resources

At San Luis Reservoir, any paleontological, archaeological, historic, or ethnographic resources currently affected by erosion due to reservoir fluctuations or recreational use of the reservoir and shoreline would continue to

[2] A full listing of these currently authorized, funded, and permitted projects and actions are detailed in the SLLPIP EIS/EIR cumulative effects analysis.

be affected. Fossils and artifacts located around the perimeter of the existing reservoir will continue to be subject to potential inadvertent impacts from recreationalists. Similarly, existing conditions related to the cultural resources in the SCVWD service area unlikely to change significantly.

2.1.2.4 Socioeconomic Resources

The State's population is estimated to increase from approximately 37 million in 2010 to about 44 million by 2030, and to approximately 49 million by 2050 (California Department of Finance 2018). Between 2018 and 2050, Merced and Santa Clara counties are expected to continue their historic growth trends. According to the California Department of Finance (2018), Merced County's population is expected to increase by 46 percent by 2050 to a total of approximately 410,000 residents. Santa Clara County's population is expected to increase by 33 percent by 2050 to a total of approximately 2,634,000 residents.

To support these expected increases in population, some conversion of agricultural and other rural land to urban uses, along with the densification of existing urbanized areas is anticipated. These trends are similar to the current trends under existing conditions.

Increases in population would increase demands for electric, natural gas, and wastewater utilities; public services such as fire, police protection, and emergency services; and water-related and communication infrastructure. Cities would continue to evaluate demands and respond to changing needs similar to existing conditions.

2.1.2.5 Climate Variability

Project changes in climate conditions with global climate variability are expected to result in a wide variety of impacts in the state of California, San Francisco Bay, and the Central Valley. Reclamation has actively pursued analysis and understanding of the potential effects of uncertainties related to climate variability and socioeconomic conditions through several recent studies, including the Sacramento and San Joaquin Basins Climate Impact Assessment (Reclamation 2014b), Central Valley Project Integrated Resource Plan (Reclamation 2014c), and the Sacramento and San Joaquin Rivers Basin Study (Reclamation 2016b). These studies were used to develop the information summarized below.

The modeling approach and analysis tools for the Basins Study were developed as part of the CVP Integrated Resource Plan (Reclamation 2014c) and the Sacramento and San Joaquin Basin's Climate Risk Assessment Report (Reclamation 2014b) and further improved for the Basins Study. During these studies, Reclamation evaluated future uncertainties related to climate and socioeconomic changes. Uncertainties in future climates primarily surround changes in temperature and precipitation. Changes in both temperature and precipitation then drive changes in runoff, snowpack, and sea level rise assumptions that can affect water supplies and the operations of the CVP/SWP

system. Additionally, changes in temperature and precipitation can also affect water needs for agriculture, urban, and the environment.

The Basins Study developed five representative climate futures using results from recent global climate model (GCM) simulations (Intergovernmental Panel on Climate Change [IPCC] 2013) that had been further refined for use in climate studies such as the Basins Study. Three of these climate futures were then evaluated in detail to capture a wide range of potential future climate conditions as they relate to water supply and the operations of the CVP and SWP. These three climate futures were Central Tendency, Warm-Wet, and Hot-Dry.

Under these climate variability futures average annual runoff from 2015 through 2019 in the Sacramento River basin was forecast to vary from nearly 18 million acre-feet (MAF) under the Hot-Dry scenario to 27 MAF under the Warm-Wet scenario. Average annual runoff in the Sacramento River system under the Hot-Dry scenario shows a decrease of approximately 4 MAF compared to the "No Climate Change" (No CC) scenario. Average annual runoff under the Warm-Wet scenario shows an increase of approximately 5 MAF from the No CC scenario. Average annual runoff in the San Joaquin basin are similar to those seen in the Sacramento basin. The Hot-Dry scenario has the lowest runoff at just less than 5 MAF, a reduction of approximately 1.2 MAF compared to the No CC scenario. The Warm-Wet scenario shows the highest runoff of over 8 MAF, an increase of approximately 2 MAF from the No CC scenario.

Under the Central Tendency scenario, Delta outflow is higher by approximately 1.2 MAF per year than under the No CC scenario. The majority of the increase in Delta outflow occurs from November through January, in part due to the shift in the timing of runoff in the Central Tendency scenario. During the months of March, April, May, and August, Delta outflow is reduced under the Central Tendency scenario. Total Delta exports decrease by nearly 150 TAF under the Central Tendency scenario as compared to the No CC scenario. In some months, the river flows are greater and in other months they are lower under Central Tendency as compared to the No CC scenario. River flows in the Sacramento basin show consistent average monthly increases from November through January. Average monthly flow of the San Joaquin River at Vernalis increases from November through March. Overall, on an average annual basis, Sacramento River flows and San Joaquin River flows increase by approximately 300 cfs under Central Tendency scenario as compared to the No CC scenario.

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Chapter 3
Plan Formulation

This chapter provides the formulation and screening process that Reclamation and SCVWD used to identify, evaluate, and develop alternatives. This chapter also documents all phases of the planning process, which include the IAIR and PFR. Both of these phases resulted in interim reports that are posted on Reclamation's SLLPIP website[1].

3.1 Initial Alternatives Information Report

The first step in the development of the initial alternatives, described in the IAIR, was the identification of potential management measures, which could include programs, projects, or policies that would help achieve the project objectives. These management measures were then screened according to their technical and institutional viability and the degree to which their implementation would achieve the project objectives.

3.1.1 Management Measure Development

Management measures were identified based on Reclamation and SCVWD's past work on the project, other water resources studies, and the team's technical understanding of the project's problems, opportunities, and objectives. SCVWD's previous efforts included an extensive public outreach effort, which resulted in the inclusion of management measures suggested by stakeholders and the general public. The initial list of management measures in the IAIR was not constrained in any way.

The 87 management measures identified in the IAIR were grouped into six categories: Institutional Agreements; Source Water Quality Control; Water Treatment; Conveyance; Local Reservoir Storage; and Alternate Water Supplies.

[1] Reclamation's SLLPIP website can be found at - https://www.usbr.gov/mp/sllpp/

3.1.2 Management Measure Screening

The screening process (presented in the IAIR) evaluated management measures based on technical viability, institutional viability, and the ability to meet the project objectives. This screening did not evaluate management measures in detail, but rather looked for fatal flaws that would make a measure nonviable. Further analysis during the plan formulation phase of the Federal Planning process in some instances showed that a particular management measure that was carried forward was actually nonviable. If management measures did not pass the technical and institutional viability criteria, they were dropped from further analysis. Management measures that passed both technical and institutional viability criteria were evaluated against the project objectives using defined rating scales.

The technical and institutional viability criteria take into account essential factors that the management measures were required to meet. Technical viability addresses the general engineering viability of the management measures. This criterion asks the question: can the measure be constructed or implemented to address the low point problem effectively? For example, some source water quality control management measures might not be viable because they could not be implemented at the scale required, given the large size of the reservoir. The institutional viability criterion considers the institutional aspects of a measure, including regulatory and environmental compliance and public acceptance. For example, some surface storage management measures that include expansion of existing reservoirs were in some instances nonviable given their projected inundation of existing communities adjacent to the reservoirs and the associated public opposition to the measure.

Potentially viable management measures were evaluated according to the project objectives. The IAIR included definitions for the criteria used to rank the alternatives relative to the project objectives. Management measures that were technically and institutionally viable and that received at least one "performs moderately" rating related to a project objective were carried forward for further evaluation. The institutional agreement management measures carried forward were banking, exchanges, and operating agreements and procedures. The source water quality control management measures carried forward were algae harvesting, algaecides/herbicides, and managed stratification. The water treatment management measures carried forward were dissolved air flotation (DAF) near San Felipe Intake, DAF at Coyote Pumping Plant, DAF at Santa Teresa and Rinconada WTPs, add ozone to raw water as it enters water treatment facilities, add potassium permanganate to raw water along the Santa Clara Conduit. The conveyance management measures carried forward were Holladay Aqueduct, Northerly Bypass Corridor, Southerly Bypass Corridor, extend/lower San Felipe Intake, San Felipe Division conveyance modifications. The local reservoir storage management measures carried forward were Anderson, Chesbro, Lower Pacheco, Pacheco A, raise San Luis Reservoir, San Benito, Del Puerto Reservoir, Ingram Canyon Reservoir, and Quinto Creek Reservoir. The alternative water supply management measures

carried forward were desalination, enlarged SBA/Los Vaqueros expansion, Los Vaqueros expansion, more storage in SCVWD groundwater basin, options from SBCWD Basin Management Plan, options from Pajaro Valley Water Management Agency (PVWMA) Basin Management Plan, recycling in SCVWD, re-operation of Anderson Reservoir, and San Francisco Public Utilities Commission (SFPUC) intertie. These retained management measures could help to meet the objectives and could be combined with other viable management measures to form preliminary alternatives. Appendix A provides detailed evaluation results and also notes why the eliminated management measures were not carried forward.

3.1.3 Initial Alternative Formulation and Screening

Initial alternatives were developed using the measures that were carried forward after management measure screening. In some cases, the initial alternatives were composed of multiple management measures, in combinations that performed better according to the project objectives than individual measures. These initial alternatives were screened for how well they would meet the Federal planning criteria from the PR&Gs: completeness; effectiveness; acceptability; and efficiency.

The retained management measures were combined into 26 initial alternatives. These alternatives included either one measure or a combination of measures to achieve good performance relative to the project objectives: avoiding supply interruptions; increasing reliability and quantity of deliveries; and announcing higher allocations earlier in the year[2]. Each management measure that remained after the initial screening was included in one or more initial alternatives.

The initial alternatives were screened based on how well they met the Federal screening criteria using the rating scales. Appendix A presents the performance of initial alternatives according to the Federal screening criteria and the ratings for each initial alternative.

At least one alternative from each category was selected to carry forward for the next phase of analysis, maintaining a reasonable range of alternative types. The selected alternatives achieve the most benefits for the least cost relative to other alternatives within the same category. This comparison was qualitative because a full analysis of net benefits (benefits minus costs) was not completed for the initial alternatives. If at least one alternative did not stand out within a category because of higher benefits or lower costs, then multiple alternatives from that category were retained. Table 3-1 shows the 17 alternatives that the IAIR identified to move forward to the plan formulation phase for further analysis.

[2] At this point in the Study process, the objectives included "announcing higher allocations earlier in the year," which was removed as an objective in the Feasibility Phase. The reasons for this change are discussed below in more detail.

Table 3-1. Initial Alternatives Retained after IAIR Evaluation

Category	Alternative	Included Management Measures
Institutional	Institutional Alternative	Groundwater banking, exchanges, and operating agreements and procedures.
Source Water Quality Control	Algaecide Alternative	Algaecides, banking, exchanges, and groundwater storage.
Treatment	Treatment at San Felipe Intake Alternative	DAF at San Felipe Intake, treatment at Rinconada, and exchanges.
	Treatment at Water Treatment Plants Alternative	DAF at WTPs, treatment at Rinconada, and exchanges
	Treatment at Pumping Plant Alternative	DAF at Coyote Pumping Plant, treatment at Rinconada, and exchanges.
Conveyance	Lower San Felipe Intake Alternative	Extend/Lower San Felipe Intake to Gianelli Inlet/Outlet Level and banking.
	Southerly Bypass Corridor Alternative	Southerly Bypass Corridor and exchanges.
Storage	Anderson Reservoir Expansion Alternative	Anderson expansion and exchanges.
	Chesbro Reservoir Expansion Alternative	Chesbro expansion and exchanges.
	Lower Pacheco Reservoir Alternative	Lower Pacheco (Pacheco Lake Reservoir) and exchanges.
	Pacheco A Reservoir Alternative	Pacheco A Reservoir and exchanges.
	San Benito Canyon Reservoir Alternative	San Benito Reservoir and exchanges.
	Del Puerto Canyon Reservoir Alternative	Del Puerto Canyon Reservoir, banking, groundwater storage, and exchanges.
	Ingram Canyon Reservoir Alternative	Ingram Canyon Reservoir.
	Quinto Creek Reservoir Alternative	Quinto Creek Reservoir.
Alternate Water Supplies	Los Vaqueros Expansion Alternative	Los Vaqueros Expansion, Anderson re-operation, SFPUC intertie, San Benito groundwater desalination, and exchanges.
Combination	San Felipe Division Combination Alternative	San Felipe Division conveyance modification, groundwater storage, recycling, and exchanges.

Key:
DAF = Dissolved Air Flotation
WTPs = water treatment plants
SFPUC = San Francisco Public Utilities Commission

3.2 Plan Formulation Report

The plan formulation phase, documented in the PFR, developed new information and analysis to further evaluate, refine, and compare initial alternatives from the IAIR.

3.2.1 Alternative Re-Evaluation

In the plan formulation report, alternatives carried forward from the IAIR were re-evaluated for their capacity to meet the four Federal screening criteria. The goal of this re-evaluation was to use updated information and data to identify and screen out alternatives that would not meet the Federal screening criteria prior to refining the alternatives in the PFR. As a result of the re-evaluation, summarized in Table 3-2, 14 alternatives were screened out, eliminating them from further consideration.

Table 3-2. Alternatives Eliminated after Re-Evaluation during Plan Formulation

Category	Alternative	Reasons for Elimination
Institutional	Institutional Alternative	Completeness criterion: institutional measures would not provide a reliable long term water supply to meet the SLLPIP project objective of avoiding supply interruptions
Source Water Quality Control	Algaecide Alternative	Effectiveness and acceptability criteria: algaecides would not be effective in the large reservoir area on algae at 30-foot depths and could have adverse effects on fish in the reservoir
Treatment	Treatment at San Felipe Intake Alternative	Acceptability criterion: SCVWD determined that the DAF treatment alternatives would likely not be an acceptable remedy to the low point issue and as a local sponsor SCVWD would be unwilling to participate in any cost sharing agreement
	Treatment at Water Treatment Plants Alternative	
	Treatment at Pumping Plant Alternative	
Conveyance	Southerly Bypass Corridor Alternative	Efficiency criterion: The Southerly Bypass Corridor Alternative would have higher costs than the Lower San Felipe Intake Alternative, which would offer similar benefits
Storage	Anderson Reservoir Expansion Alternative	Efficiency criterion: new information was developed on physical, geotechnical, geological, and hydraulic conditions as well as forecasting potential land development issues and social impacts associated with each storage alternative. This information and earthwork costs identified the Pacheco Reservoir Alternatives as the most efficient storage alternatives and the others were screened out
	Chesbro Reservoir Expansion Alternative	
	Lower Pacheco Reservoir Alternative	
	San Benito Canyon Reservoir Alternative	
	Del Puerto Canyon Reservoir Alternative	
	Ingram Canyon Reservoir Alternative	
	Quinto Creek Reservoir Alternative	
Alternate Water Supplies	Los Vaqueros Expansion Alternative[1]	Completeness criterion: uncertainties in the planning process and the inability to investigate whether changes made to the Los Vaqueros facility could help to achieve the SLLPIP project objectives made the utility of this alternative uncertain

Key:
DAF = Dissolved Air Filtration
SBA = South Bay Aqueduct
WTPs = water treatment plants
SFPUC = San Francisco Public Utilities Commission

Notes:
[1] The IAIR and PFR evaluated the potential participation in the first Los Vaqueros Reservoir expansion as an alternative for the SLLPIP. This option was screened under the completeness criterion. The issues driving that determination were reevaluated early in the feasibility phase for the new Phase 2 configuration of Los Vaqueros Reservoir under investigation and found to still apply.

3.2.2 Alternative Development and Evaluation

The alternatives that remained after the initial PFR screening for further refinement and development included:

- Lower San Felipe Intake Alternative Plan;
- Pacheco Reservoir Alternative Plan; and
- Combination Alternative Plan.

These alternatives were refined using results from economic evaluation, hydrologic modeling using CalSim II, engineering analysis, and preliminary cost estimation. This refinement effort sought to maximize alternative performance in terms of the potential benefits provided.

Similar to the effort in the IAIR, each alternative was compared to a set of performance measures and rating scales to evaluate how well it addressed the Federal planning screening criteria. This effort included additional information that allowed several measures to be evaluated in greater depth. Appendix A shows the performance measures and rating scales and the full results of the evaluation. This evaluation provided the basis for the analysis in this Draft Feasibility Report.

3.3 Feasibility Report

This Report is the culmination of numerous technical studies leading to documentation that will aid Federal decision-makers after consideration of public input.

3.3.1 Project Modifications

At each stage of the feasibility study, the key features of the study are revisited, such as the need for the project and whether conditions have changed to allow any alternatives previously eliminated to be re-introduced. Several project changes occurred during this feasibility investigation.

3.3.1.1 Project Objectives

During the IAIR and the PFR, the objectives contained three key elements: avoiding supply interruptions; increasing reliability and quantity of deliveries; and announcing higher allocations earlier in the year. The third objective was eliminated after plan formulation due to the fact that solving the low point problem did not provide the opportunity for earlier CVP allocation announcements. As a result, the institutional measures related to earlier higher allocations were removed from all alternatives because they were not required to meet the remaining objectives.

3.3.1.2 New Alternatives

During the PFR development, SCVWD was concerned about DAF as a method for drinking water treatment. The alternative to modify SCVWD's treatment plants with DAF was eliminated from further consideration based on the acceptability criterion. Subsequent analysis, however, found that other treatment methods (i.e., ballasted flocculation or raw water ozonation) may allow efficient treatment of algae-laden water without adversely affecting water treatment options during the non-low point periods. Additional studies on potential treatment options determined that water treatment should be reconsidered as an alternative.

The IAIR considered but eliminated the Expansion of San Luis Reservoir Alternative given its higher cost and similar benefits to the other storage alternatives that were identified in the IAIR. Potential dam safety issues at B.F. Sisk Dam have been under review in a Federal Corrective Action Study being prepared by Reclamation at the same time the SLLPIP Feasibility Investigation was underway. While geologic studies and engineering design of structural alternatives to raise the dam embankment and adding abutments were underway to support development of the Corrective Action Study, Reclamation completed the San Luis Reservoir Expansion Draft Appraisal Report (Reclamation 2013). The Report evaluated the potential water supply benefits generated by a reservoir expansion completed in coordination with the dam safety improvements. Results from the 2013 appraisal study indicated that inclusion of the Expansion of San Luis Reservoir Alternative in the SLLPIP Feasibility Report and EIS/EIR was warranted (Reclamation 2013).

The feasibility investigation considered multiple operational scenarios for an expanded San Luis Reservoir. These scenarios evaluated the potential water supply benefits of different dedications of the additional water stored in the reservoir – a CVP only storage configuration, a split CVP and SWP storage configuration, and a configuration that would allow CVP operators to carryover supply in this expanded space for delivery to CVP contractors in subsequent years. Table 3-3 presents the results of potential water supply benefit evaluations that were completed for these optional configurations. The CVP only dedication of the expanded 120 TAF was selected to move forward in the feasibility process for further evaluation.

Table 3-3. Changes in San Felipe Division and CVP/M&I Water Supply Benefits with San Luis Reservoir Expansion

Alternative[1]	Average Annual Change in San Felipe Division M&I Deliveries in years with Low Point Interruptions (AF)[2]	Average Annual Change in San Felipe Division M&I Deliveries in years without Low Point Interruptions (AF)	Average Annual Change in CVP Deliveries (AF)	Average Annual Change in SWP Deliveries (AF)[3]
CVP Reservoir Expansion	200	700	16,700	-5,600
Shared CVP and SWP Reservoir Expansion	100	370	8,400	1,200
Increased San Luis Reservoir Carryover Storage	700	>100	10,300	0

Notes:

[1] All reservoir expansion configurations considered 120 TAF of additional storage capacity in San Luis Reservoir consistent with the 10-foot embankment raise under consideration.

[2] CalSim II and post processing modeling analysis of the Future No Action condition identified 17 years out of the 82-year model record with the potential for low point generated water supply interruptions

[3] Includes changes in SWP Table, Article 21, and Article 56 deliveries

3.3.1.3 Changes to Participating Parties

During the PFR, the key parties involved in the Study included Reclamation, SCVWD, San Luis and Delta-Mendota Water Authority (SLDMWA), and SBCWD. Currently, SLDMWA participation in the overall study shifted to an interested party and is no longer a regular member of the study team. The SBCWD shifted to an interested party due to lack of continued interest in the project.

3.3.2 Plan Reformulation

Reclamation and SCVWD were concerned about high costs of the alternatives and revisited them to determine if there was a more cost-effective way to achieve the objectives. Before moving forward, the team considered each alternative plan to determine if it should be reformulated.

After publication of the SLLPIP PFR, Reclamation and SCVWD reconsidered the alternatives recommended for consideration. The PFR considered but eliminated the Treatment Alternatives; however, new treatment methods suggested that this alternative should be re-considered in the Feasibility Report and EIS/EIR. In addition, actions taken by SCVWD resulted in completion of upgrades at the Rinconada WTP that improved its capacity to address the low point problem and has resulted in the narrowing of the Treatment Alternative to focus on upgrades to the Santa Teresa WTP only. Based on preliminary results of early drafts of the Feasibility Report, Reclamation completed a feasibility level of analysis, including design details, of the Treatment Alternative Plan. In this report, the design details of the Treatment Alternative Plan are shown at a feasibility level.

The PFR also recommended consideration of the Combination Alternative; however, detailed review of the alternative by SCVWD during development of

the Draft Feasibility Report and the EIS/EIR identified issues with the feasibility of the alternative's Anderson Reservoir reoperation component and its groundwater extraction and recharge components. These issues included concerns over the potential for future changes to operating rules for releases to Coyote Creek under the Fisheries and Aquatic Habitat Collaborative Effort Settlement Agreement between SCVWD, the Guadalupe Coyote Resource Conservation District, and the resource agencies—CDFW; USFWS; and NMFS (SCVWD 2017b). These changes in conditions are anticipated with implementation of the Anderson Dam Seismic Retrofit Project currently under design (SCVWD 2017b). SCVWD also determined that the operation of the groundwater extraction and recharge components of the Combination Alternative that were originally formulated by SCVWD during development of an Infrastructure Reliability Plan would be infeasible given issues identified with conflicts to operation of existing wells by SCVWD contractors during completion of the Infrastructure Reliability Plan (SCVWD 2017b). Without these major components, the Combination Alternative would be unable to adequately address the low point problem and water supply interruptions in Santa Clara County (SCVWD 2017b).

SCVWD continued evaluation of the feasibility of a Pacheco Reservoir expansion, refining some project features, and submitted the project for California Proposition 1 funding under WSIP. The CWC awarded funding to SCVWD for this alternative. SCVWD requested that the refined Pacheco Reservoir expansion be included in this Federal Feasibility Report for reevaluation. Reclamation and SCVWD have added the Pacheco Reservoir expansion configuration into this investigation for further evaluation.

Table 3-4 displays the alternatives screened and refined in the IAIR and PFR processes, the reason that they were screened, and the alternatives to be considered in this Feasibility Report.

Table 3-4. Alternative Screening Results

Category	IAIR Screening		PFR Screening		Feasibility Report
	Alternative	Screening Result	Alternative	Screening Result	
Institutional	Institutional Alternative	Retained	Institutional Alternative	Screened out as a standalone plan under the completeness criterion	--
Source Water Quality Control	Algae Harvesting Alternative	Eliminated because it had similar benefits to algaecide and was economically infeasible when compared to algaecide	--	--	--

Category	IAIR Screening		PFR Screening		Feasibility Report
	Alternative	**Screening Result**	**Alternative**	**Screening Result**	
	Algaecide Alternative	Retained	Algaecide Alternative	Screened out under the effectiveness and acceptability criteria given concerns over potential capacity to treat SLR algae and the difficulty permitting the application of algaecide on a drinking water reservoir at this scale	--
	Managed Stratification Alternative	Eliminated because it had similar benefits to algaecide and was economically infeasible when compared to algaecide	--	--	--
Treatment	Treatment at San Felipe Intake Alternative	Retained	Treatment at San Felipe Intake Alternative	Screened out under the acceptability criterion given SCVWD's determination that DAF treatment is not an acceptable remedy to the low point issue because evaluation during previous WTP upgrades indicated DAF is less effective and more difficult to operate than current treatment methods	--
	Treatment at WTPs Alternative	Retained	Treatment at WTPs Alternative		Treatment Alternative – carried forward following further analysis of ballasted flocculation at the Santa Teresa WTP
	Treatment at Pumping Plant Alternative	Retained	Treatment at Pumping Plant Alternative		--
Conveyance	Lower San Felipe Intake Alternative	Retained	Lower San Felipe Intake Alternative	Retained	Lower San Felipe Intake
	Holladay Aqueduct Alternative	Eliminated because it had similar benefits to the Lower San Felipe Intake and Southerly Bypass Alternatives and was economically infeasible when compared to those options	--	--	--
	Northerly Bypass Corridor Alternative	Eliminated because it had similar benefits to the Lower San Felipe Intake and Southerly Bypass Alternatives and was economically infeasible when compared to those options	--	--	--
	Southerly Bypass Corridor Alternative	Retained	Southerly Bypass Corridor Alternative	Screened out under the efficiency criterion given the alternative's economic infeasibility when compared to the Lower San Felipe Intake Alternative	--

Category	IAIR Screening		PFR Screening		Feasibility Report
	Alternative	**Screening Result**	**Alternative**	**Screening Result**	
Storage	Anderson Reservoir Expansion Alternative	Retained	Anderson Reservoir Expansion Alternative	Screened out under the efficiency criterion given the alternative's economic infeasibility when compared to the Pacheco B Alternative	--
	Chesbro Reservoir Expansion Alternative	Retained	Chesbro Reservoir Expansion Alternative	Screened out because of increased risk of landslides and inundation of existing residences.	--
	Lower Pacheco Reservoir Alternative	Retained	Lower Pacheco Reservoir Alternative	Screened out because additional engineering showed a weak foundation.	--
	Pacheco A Reservoir Alternative	Retained	Pacheco A Reservoir Alternative	Alternatives include partial demolition of existing dam. Screening determined that an alternative with an alternative dam site would meet storage and geological needs better than Pacheco A and Pacheco B. Alternatives retained with the need for a site visit and further investigation.	Pacheco Reservoir Expansion Alternative – construction and operation of a new alternative dam site further downstream of A and B and an expanded reservoir, pump station, conveyance facilities, and miscellaneous infrastructure. Information is provided from the SCVWD WSIP application.
	Pacheco B Reservoir Alternative	Retained	Pacheco B Reservoir Alternative		
	San Benito Canyon Reservoir Alternative	Retained	San Benito Canyon Reservoir Alternative	Screened out because small size made reservoir less efficient than other options	--
	San Luis Reservoir Expansion Alternative	Eliminated because it had similar benefits to the other storage alternatives and was economically infeasible when compared to those options			San Luis Reservoir Expansion Alternative - multiple configurations of a reservoir expansion alternative considered by analysis of the potential combination with the connected Corrective Action Study action. CVP only option was selected to move forward.
	Del Puerto Canyon Reservoir Alternative	Retained	Del Puerto Canyon Reservoir Alternative	Screened out under the efficiency criterion given the alternative's economic infeasibility when compared to the Pacheco Alternative	--
	Ingram Canyon Reservoir Alternative	Retained	Ingram Canyon Reservoir Alternative		--
	Quinto Creek Reservoir Alternative	Retained	Quinto Creek Reservoir Alternative		--

Category	IAIR Screening		PFR Screening		Feasibility Report
	Alternative	Screening Result	Alternative	Screening Result	
Alternate Water Supplies	Monterey Bay Desalination Alternative	Eliminated because it was economically infeasible when compared to any of the other alternatives under consideration in the IAIR	--	--	--
	San Francisco Bay Desalination Alternative	Eliminated because it was economically infeasible when compared to any of the other alternatives under consideration in the IAIR	--	--	--
	Combined Desalination Alternative	Eliminated because it was economically infeasible when compared to any of the other alternatives under consideration in the IAIR	--	--	--
	Enlarged SBA/Los Vaqueros Expansion Alternative	Expansion of the SBA was screened out but enlarging Los Vaqueros Reservoir was retained	Los Vaqueros Expansion Alternative	Screened out under the completeness criterion given the ongoing development of the project in the Los Vaqueros Expansion Project Feasibility Study	--
	Los Vaqueros Expansion Alternative	Retained			--
Combination	Combination Alternative	Retained	Combination Alternative	Retained	Eliminated related to the acceptability criterion given the identification of issues with the feasibility of the Anderson Reservoir reoperation and groundwater components.

3.3.3 Alternative Refinement and Evaluation

This Report refines the alternatives to the following:

- Lower San Felipe Intake Alternative Plan;
- Treatment Alternative Plan;
- San Luis Reservoir Expansion Alternative Plan; and
- Pacheco Reservoir Expansion Alternative Plan.

Reclamation and SCVWD completed appraisal-level engineering design on each alternative to better understand project features and develop costs (see design summary in Appendix C), except, as described above, the Treatment Alternative Plan design is at a feasibility level. The refinement and evaluation process for the remaining alternatives included detailed hydrologic modeling using CalSim II to assess system operations and SCVWD's Water Evaluation

and Planning (WEAP) system model to simulate local operational changes and M&I water supply benefits (see Appendix B). In addition, a sensitivity analysis was completed to evaluate the potential resilience of the potential water supply benefits generated by these alternatives to future climate change (see Appendix D).

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Chapter 4
Descriptions of Alternatives

This chapter describes the No Action/No Project Alternative, also referred to as the No Action Alternative, and the four alternative plans evaluated at the appraisal-level for feasibility in this Draft Feasibility Report. Appendix C includes descriptions of the appraisal-level designs for these alternative plans.

4.1 No Action/No Project Alternative

The No Action/No Project Alternative would leave the current operations at San Luis Reservoir unchanged. SCVWD would continue annual operations in anticipation of curtailment of CVP supply and would manage its uses and sources of imported and local water supplies. A low point supply interruption—and even the threat of an interruption—could result in the immediate reduction of the amount of treated water available for delivery, because it requires the re-operation of SCVWD's surface and groundwater systems and requires the use of alternative water supplies that would otherwise be dedicated to other uses. The effects resulting from delivery reductions and/or curtailments due to a low point event pose a significant threat to SCVWD's short- and long-term water supply reliability.

4.2 Lower San Felipe Intake Alternative Plan

The Lower San Felipe Intake Alternative Plan includes construction of a new, lower San Felipe Intake to allow reservoir drawdown to its minimum operating level without algae effects. Moving the San Felipe Intake to an elevation equal to that of the Gianelli Intake would allow operation of San Luis Reservoir below the 300 TAF level without creating the potential for a water supply interruption to SCVWD.

As part of this alternative plan, a new intake would be constructed and connected to the existing San Felipe Division Intake via approximately 20,000 feet of new pipeline or tunnel. Lowering the San Felipe Intake would require an extension of the intake for the Pacheco Pumping Plant because the reservoir is higher on the west side than at the site of the Gianelli Intake. The conveyance structure from the new intake to the existing intake would be either a submerged pipeline along the bottom of the reservoir or a tunnel beneath the bottom of the reservoir (see Figure 4-1).

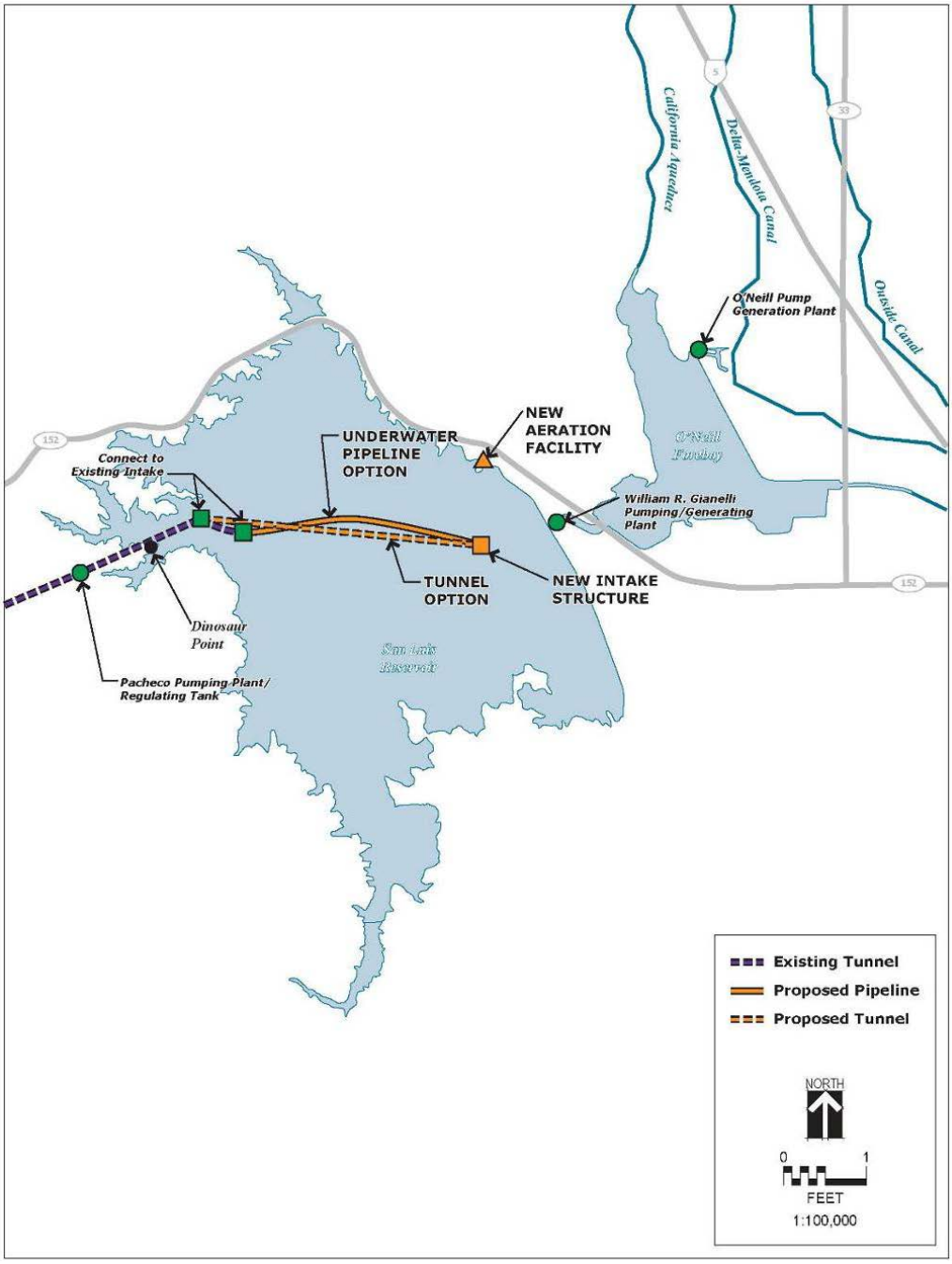

Figure 4-1. Pipeline and Tunnel Alignment for the Lower San Felipe Intake Alternative Plan

4.2.1 Tunnel Option

A tunnel would be constructed beneath the reservoir floor to convey water from the new intake to the existing intake. The tunnel option includes a new vertical shaft on Gate Shaft Island to tie into the existing intake and serve as a beginning point to launch the tunnel boring equipment. The tunnel would be about 20,000 feet long, 15 feet in diameter, and the liner would have an inner diameter of 13 feet. Figure 4-2 shows the tunnel profile.

4.2.2 Pipeline Option

For the pipeline option, a new 13-foot diameter, reinforced concrete cylinder pipe would be laid along the bottom of San Luis Reservoir. The pipeline would be approximately 20,000 feet long. The pipe would have a constant slope upward from the new intake and tie into the invert of the existing lower intake at elevation 313 feet. An existing intake channel is graded along the bottom of the reservoir. To reduce the amount of dredging required, the pipeline's alignment would match the alignment of the existing intake channel. Construction would need to occur underwater because the water levels in San Luis Reservoir could not be affected by construction. Figure 4-3 shows the pipeline profile.

4.2.3 Hypolimnetic Aeration System

A hypolimnetic aeration facility would also be constructed to oxygenate the reservoir and prevent stratification that occurs during low water levels and warm weather. The aeration system (shown on Figure 4-1) would consist of a new facility near Romero Visitor Center. A liquid oxygen tank and vaporizers or a compressed air system would be used for the aeration facility. Either system would require a structure of approximately 1,200 square feet. A 3-inch air supply line would connect to approximately 6,000 feet of submerged high density polyethylene air diffuser piping within the reservoir.

4.2.4 Operation

The Lower San Felipe Intake Alternative Plan would provide an annual average of approximately 3,149 AF of additional water M&I supply to the San Felipe Division compared to the No Action/No Project Alternative. Figure 4-4 shows how the Lower San Felipe Intake Alternative Plan addresses the San Felipe Division supply interruptions and demand shortages in the No Action/No Project Alternative. Modeling results show that the Lower San Felipe Intake Alternative Plan would fully replace interrupted supplies in all 17 years with low point conditions (out of the 82 years modeled) low point years and fully address total demand shortages in 10 of those years. Appendix B includes more information about the hydrologic modeling methods and results.

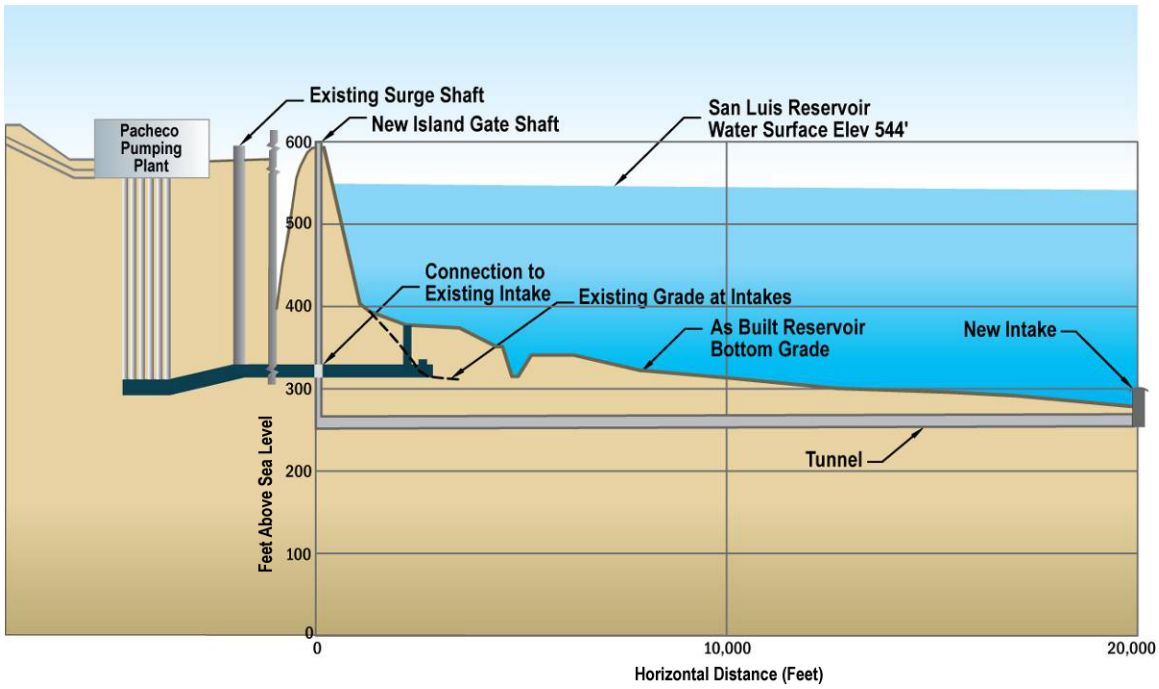

Figure 4-2. Lower San Felipe Intake Alternative Plan Tunnel Profile

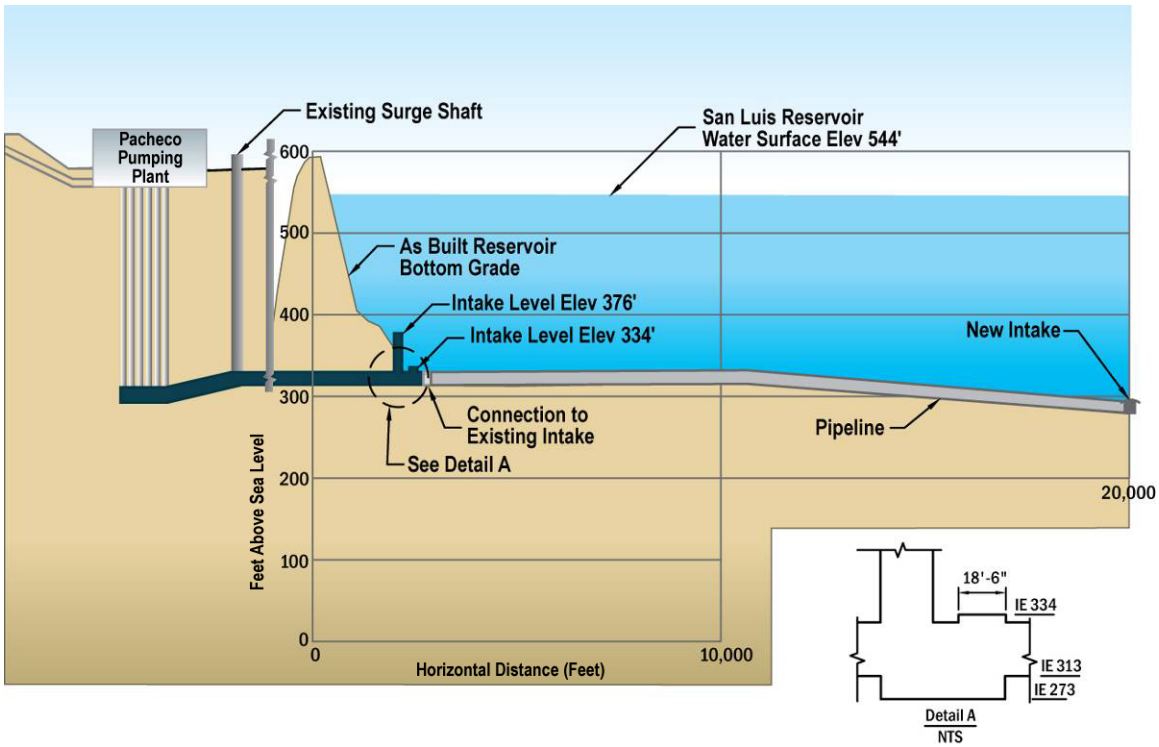

Figure 4-3. Lower San Felipe Intake Alternative Plan Pipeline Profile

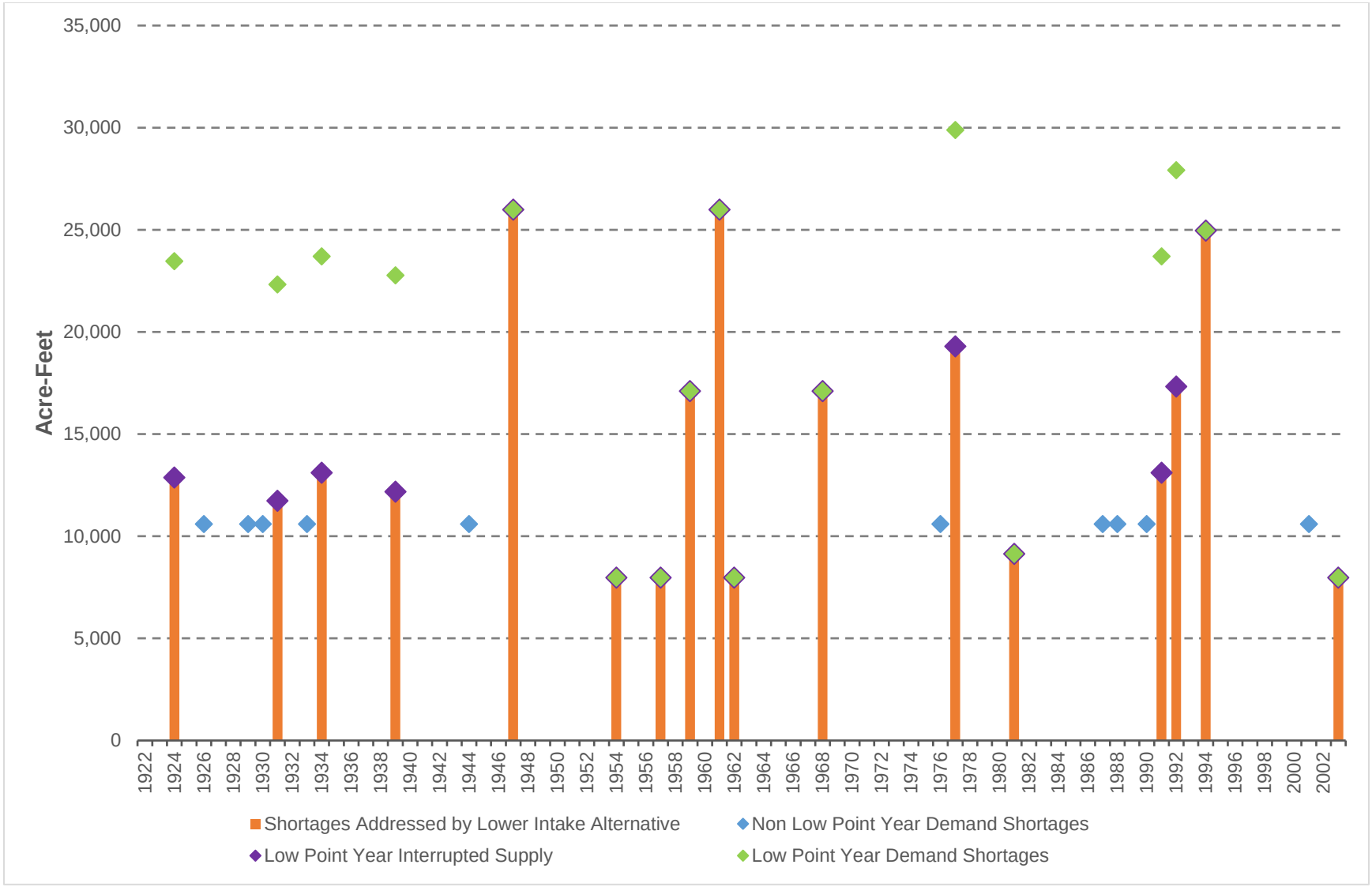

Figure 4-4. Annual San Felipe Division Shortages Addressed by the Lower San Felipe Intake Alternative Plan

4.2.5 Costs

The costs of the tunnel and pipeline options are similar. Table 4-1 shows appraisal-level cost estimates for the Lower San Felipe Intake Alternative Plan.

Table 4-1. Lower San Felipe Intake Alternative Plan Preliminary Costs

	Tunnel Option	Pipeline Option
Total Project Construction Costs	$968 million	$885 million
Annual Operation and Maintenance Costs	$2.5 million	$2.5 million

4.3 Treatment Alternative Plan

The Treatment Alternative Plan includes new technology retrofits at the SCVWD's Santa Teresa WTP. This WTP is supplied with water from San Luis Reservoir and cannot effectively treat the algae-laden water present during low point events.

4.3.1 Santa Teresa WTP

The existing Santa Teresa WTP process includes chemical coagulation, conventional clarification, settled water ozonation, granular media filtration, and disinfection. Solids handling facilities include washwater recovery basins and sludge drying beds. The recovered washwater is returned to the headworks of the plant. The recovered decant water from the sludge drying beds is returned to the washwater recovery basins, and the dried sludge is disposed of in a landfill.

The Treatment Alternative Plan would add a raw water ozonation process to the treatment train at the Santa Teresa WTP. A site plan of the Santa Teresa WTP with the raw water ozonation process is shown in Figure 4-5.

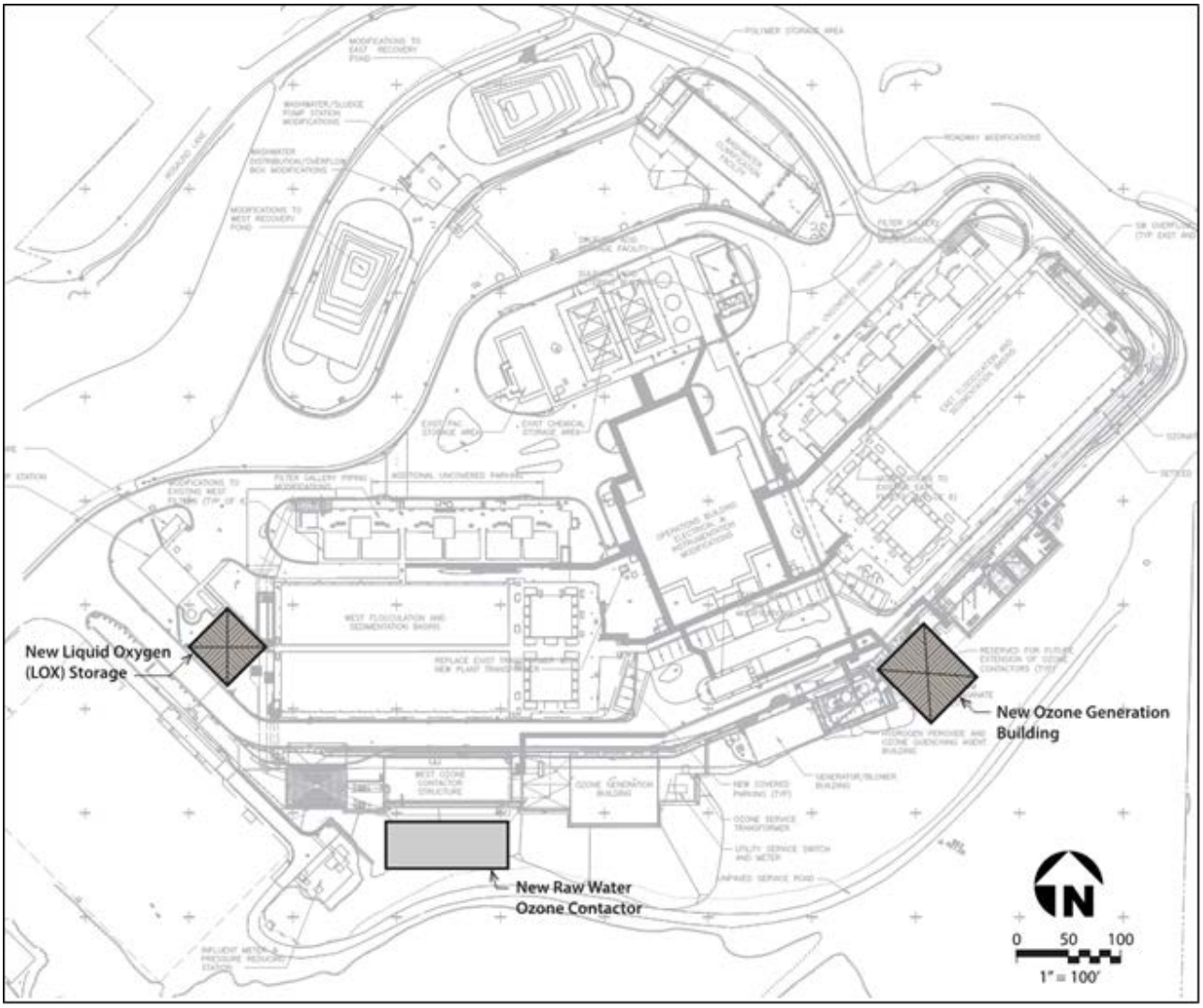

Figure 4-5. Santa Teresa WTP Conceptual Site Plan – Raw Water Ozonation

In a raw water ozonation process, ozone is added to the raw water entering the treatment plant before the water is treated by any other processes. Ozone oxidizes taste and odor causing compounds and other dissolved organic material released by algae. Ozone also improves clarification and filtration processes when used as a pre-oxidant. Implementation of a raw water ozonation process at the Santa Teresa WTP would require installation of a new ozone contactor, new ozone generation equipment housed in a new building, and new liquid oxygen storage facilities.

4.3.2 Operation

The Treatment Alternative Plan would provide additional water supply to meet SCVWD treated water demands. The additional water supply under the Treatment Alternative Plan would be the same as the Lower San Felipe Intake Alternative Plan. The Treatment Alternative Plan would address the shortages

in the No Action/No Project Alternative in the same manner as the Lower San Felipe Intake Alternative Plan, shown in Figure 4-4. Results show that the Treatment Alternative Plan would fully replace interrupted supplies in all 17 years with low point conditions (out of the 82 years modeled) low point years and fully address total demand shortages in 10 of those years.

4.3.3 Costs

Table 4-2 shows appraisal-level cost estimates for the Treatment Alternative Plan.

Table 4-2. Treatment Alternative Plan Preliminary Costs

	Santa Teresa Improvements
Total Project Construction Costs	$37 million
Annual Operation and Maintenance Costs	$0.25 million

4.4 San Luis Reservoir Expansion Alternative Plan

The San Luis Reservoir Expansion Alternative Plan would place additional fill material on the dam embankment to raise the dam crest to increase storage capacity. The alternative plan would build upon the dam embankment expansion and foundation modifications to address the seismic concerns that are currently in final design. The seismic modifications to B.F. Sisk Dam currently under Reclamation's Safety of Dams (SOD) Act, as amended, that the San Luis Reservoir Expansion Alternative Plan would build on are included in this alternative plan as connected actions as defined under NEPA. The San Luis Reservoir Expansion Alternative would allocate the increased capacity to the CVP only. This expanded capacity would be operated in the same way as the current CVP portion of San Luis Reservoir, with the reservoir used for seasonal storage.

The San Luis Reservoir Expansion Alternative Plan is evaluated alongside other alternative plans in this report primarily for its ability to help avoid water supply interruptions during low point conditions. The evaluation of a San Luis Reservoir Expansion Alternative Plan considering a broader set of objectives could potentially change the performance of this alternative in comparison to the results presented in this investigation.

Increasing storage capacity in San Luis Reservoir would potentially increase the yield of the CVP in years that surplus supplies in excess of the reservoir's existing storage capacity are available. This increased yield could increase SCVWD's capacity to access their CVP supply prior to the reservoir being drawn below the 300 TAF level and allow the District to avoid the potential for a water supply interruption from low point conditions.

As part of this alternative plan, the dam crest would be raised by adding additional embankment material (see Figure 4-6 for a schematic and Figure 4-7 for profile views). In addition, downstream stability berms and crack filters would be installed. Construction of foundation shear keys at slopewash sections in the abutments and the north valley section (NVS), and a filter around the downstream portion of the existing spillway conduit are also included in this alternative plan. The existing saddle dike located north of the main embankment would be modified by adding a downstream filter. In addition to these modifications, development of a foundation shear key at the south valley section (SVS) is under consideration as an optional additional feature of this alternative plan. With increased reservoir surface elevations, modifications would also be made at multiple locations along SR 152 to prevent inundation of the roadway when the enlarged reservoir is filled to capacity, and modifications to the Dinosaur Point Boat Launch and the Goosehead Point Boat Launch would be made to increase the ramps operating elevation by 10 feet. The existing berm developed during construction of the Pacheco Pumping Plant would be reconstructed with a higher crest elevation to protect the plant at high storage levels (see Figure 4-8). Key components are described below.

B.F. Sisk Dam

Studies completed during the Corrective Action Study (CAS) have identified the potential for significant deformation (crest settlement) of the dam in the sections built on the alluvium and clayey slopewash during a seismic event (Reclamation 2013). The SOD seismic modification will address this deformation potential with the placement of downstream stability berms anchored to bedrock and placement of additional embankment materials on the downstream slope of the dam to increase the crest elevation 10 feet, increasing the distance between the water surface and the dam crest (freeboard) to prevent reservoir overtopping and failure in the event of earthquake-induced deformations (Reclamation 2013).

In addition to dam crest deformation, seismic shaking can cause cracks in the dam embankment susceptible to erosion that can lead to dam failure. Downstream crack filters restrict the migration of soil materials through these cracks mitigating the potential for post seismic cracks to induce internal erosion within the dam embankment. The SOD modification will address this seismic crack induced erosion risk by installing downstream filters along the upper portion of the embankment across the entire length of the dam.

The San Luis Reservoir Expansion Alternative Plan would build on the physical SOD modifications currently under final design and raise the dam crest an additional 10 feet to a new crest elevation of 576 feet. This additional 10 feet in embankment height would support a new water surface elevation of 554 feet and an additional 120 TAF in storage capacity. In addition to the new embankment height added by the reservoir enlargement, the existing outlet works intake towers, access bridge, and spillway intake would need to be raised by 10 feet.

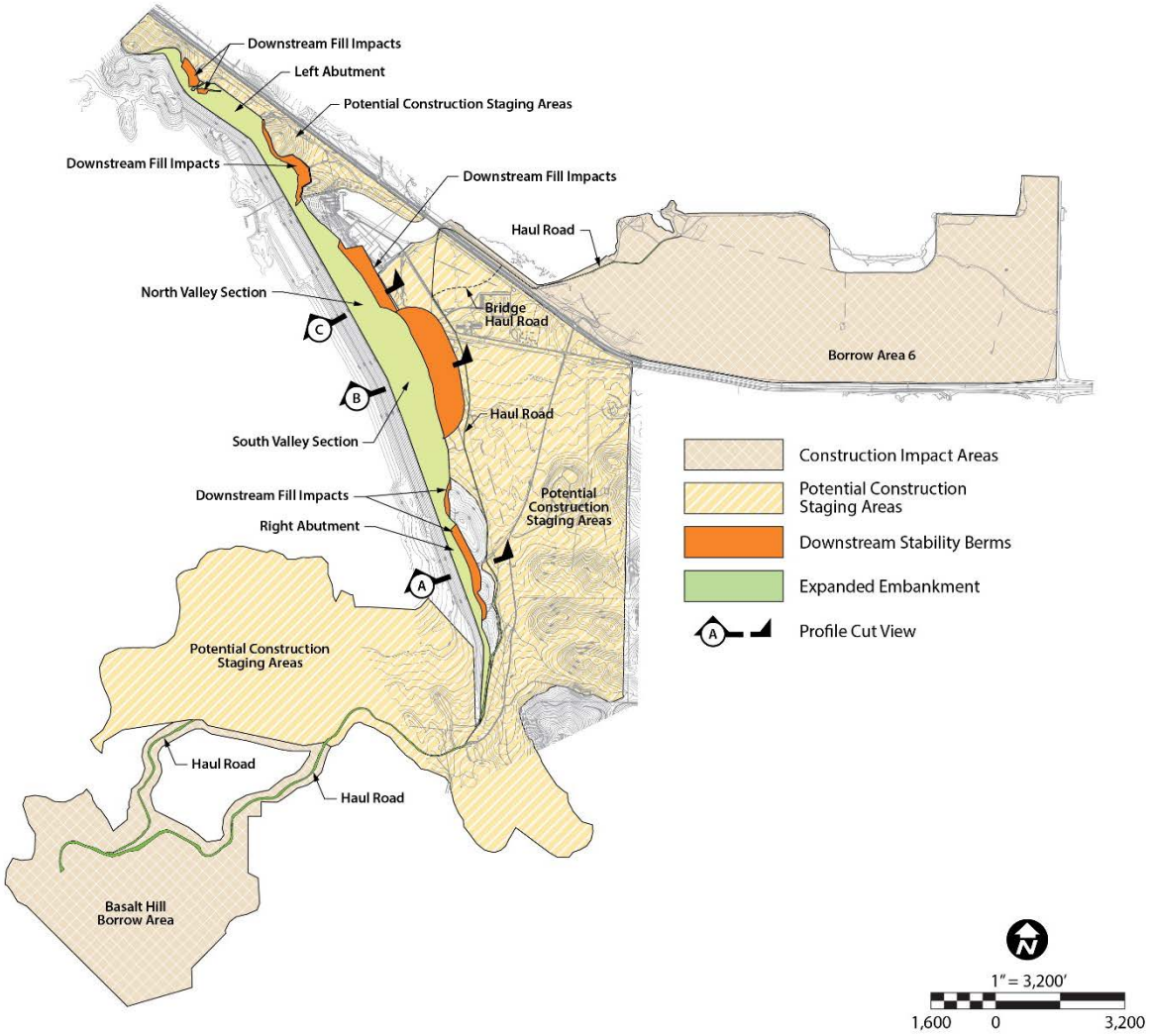

Figure 4-6. Reservoir Enlargement Construction and Staging Areas

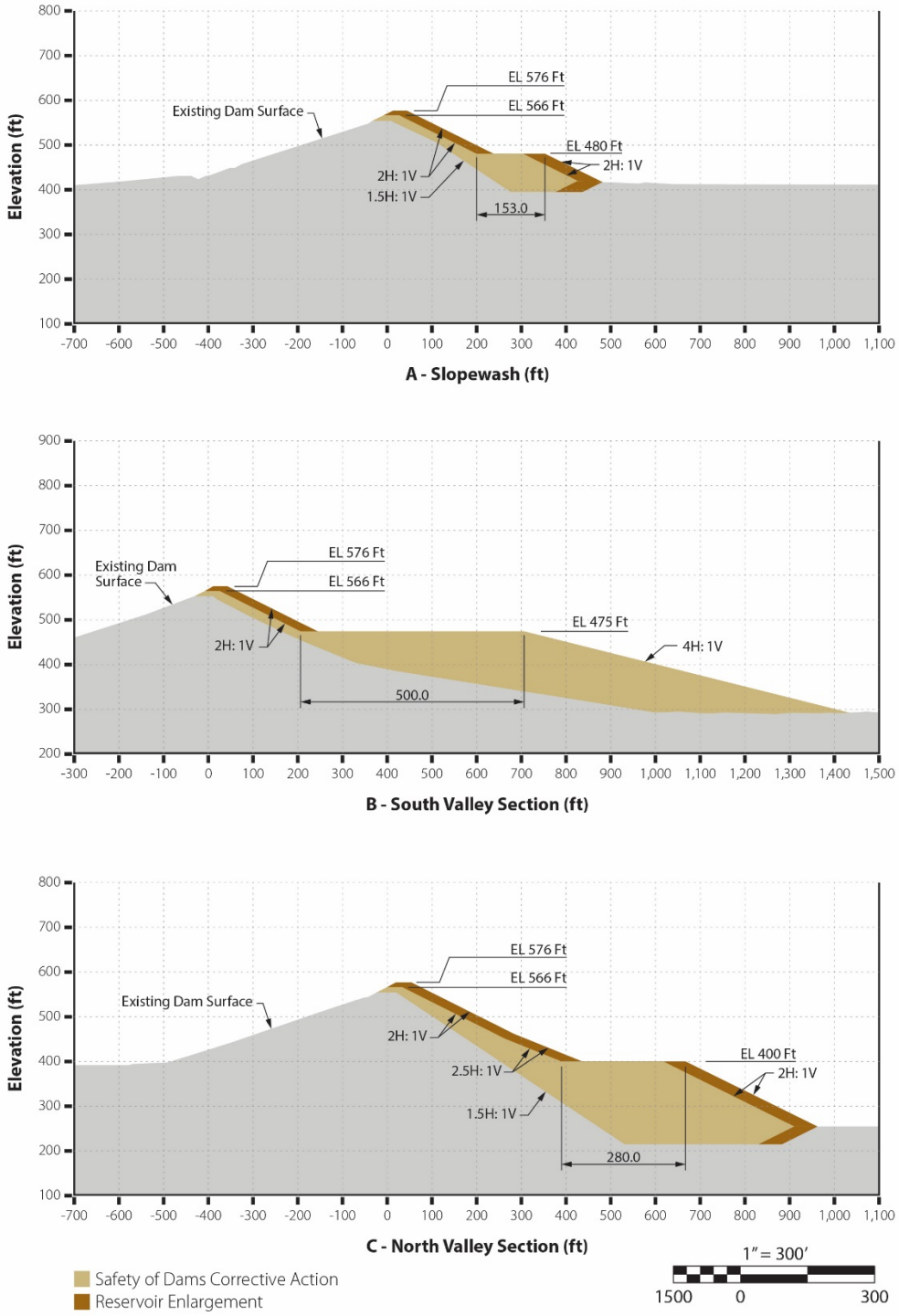

Figure 4-7. Reservoir Enlargement Profiles

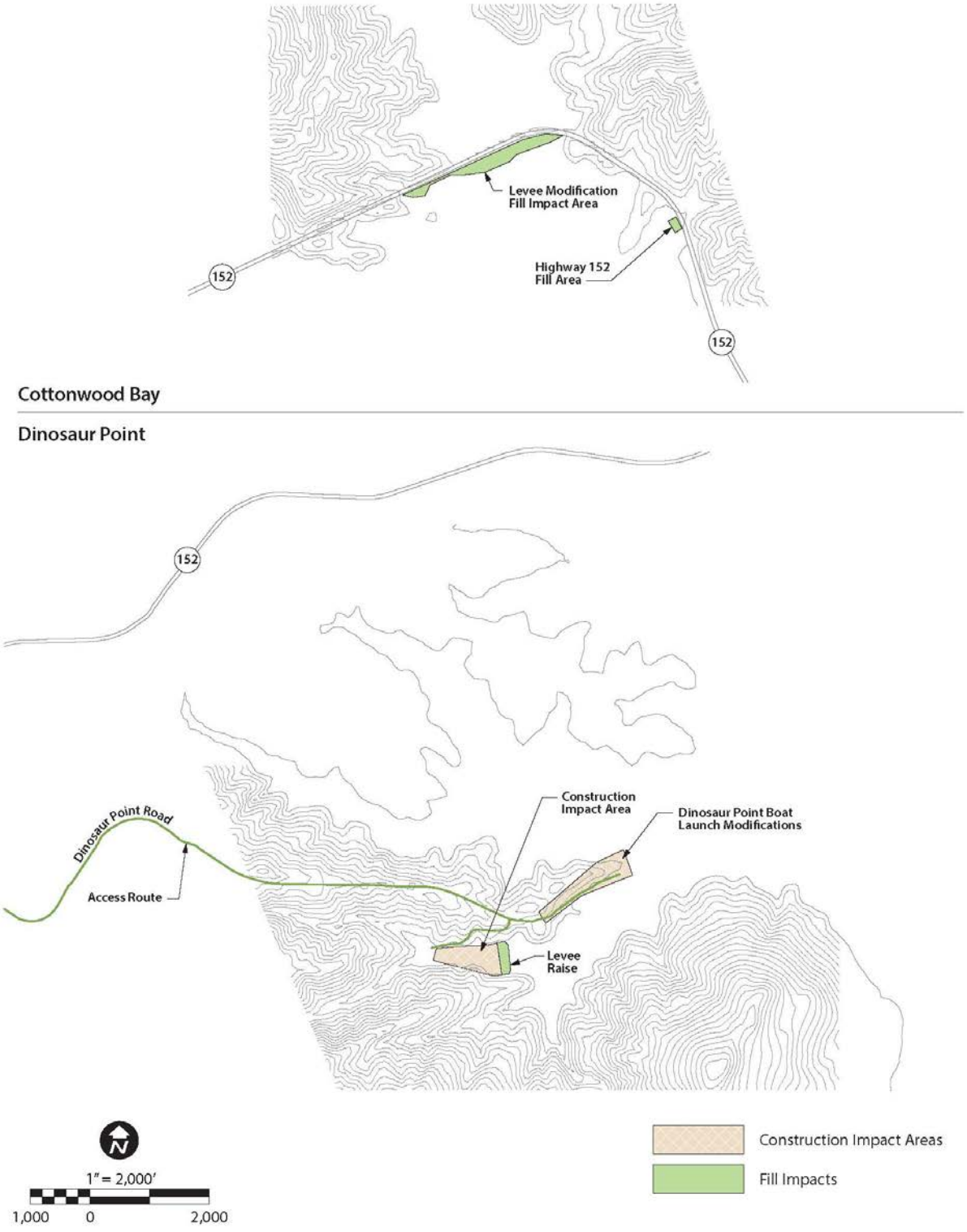

Figure 4-8. Reservoir Enlargement Actions along State Route 152 and at Pacheco Pumping Plant

Cottonwood Bay/State Route 152
Sections of SR 152 near and at Cottonwood Bay could potentially be affected by the 10-foot increase in water surface elevation, and will be protected by the development of berms separating the reservoir from the roadway in periods when storage in the enlarged reservoir is full (see Figure 4-8).

Pacheco Pumping Plant West Dike
The Pacheco Pumping Plant is located on the western side of San Luis Reservoir. The pumping plant is separated from San Luis Reservoir by an approximately 500-foot wide dike east of the pumping plant (see Figure 4-8). This dike will be replaced with a new dike 20 feet taller than the existing structure to protect the pumping plant from the enlarged reservoir.

Dinosaur Point Boat Launch
The Dinosaur Point Boat Launch is located on the western side of San Luis Reservoir close to the Pacheco Pumping Plant. The boat ramp and portions of the parking lot at Dinosaur Point would be inundated with the 10-foot increase in surface elevation requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity (see Figure 4-8).

Goosehead Point Boat Launch
The Goosehead Point Boat Launch is located on the southern side of San Luis Reservoir close to Basalt Hill. The boat ramp and parking lot at Goosehead Point would be inundated with the 10-foot increase in reservoir surface elevation requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

4.4.1 Operation

Figure 4-9 shows how the San Luis Reservoir Expansion Alternative Plan addresses SCVWD low point water supply interruptions in the No Action/No Project Alternative. Results show that the San Luis Reservoir Expansion Alternative Plan would deliver additional water supplies in 8 of the 17 low point years, but would not in any year fully address the low point generated water supply shortages.

The San Luis Reservoir Expansion Alternative has the potential to decrease SWP deliveries by reducing SWP exports from the Delta through Banks Pumping Plant. Banks Pumping Plant exports can be reduced as compared to the No Action/No Project Alternative because the additional CVP storage capacity under the alternative allows the CVP to export more of the water they are entitled to under the Coordinated Operations Agreement. Under the No Action/No Project Alternative, the SWP is able to export this water when the CVP portion of San Luis Reservoir fills and CVP SOD demands are being met.

The San Luis Reservoir Expansion Alternative Plan would provide minimal increase to SCVWD M&I supply and would provide approximately 16,100 AF of additional south of Delta agricultural water supply on an average annual basis as compared to the No Action/No Project Alternative.

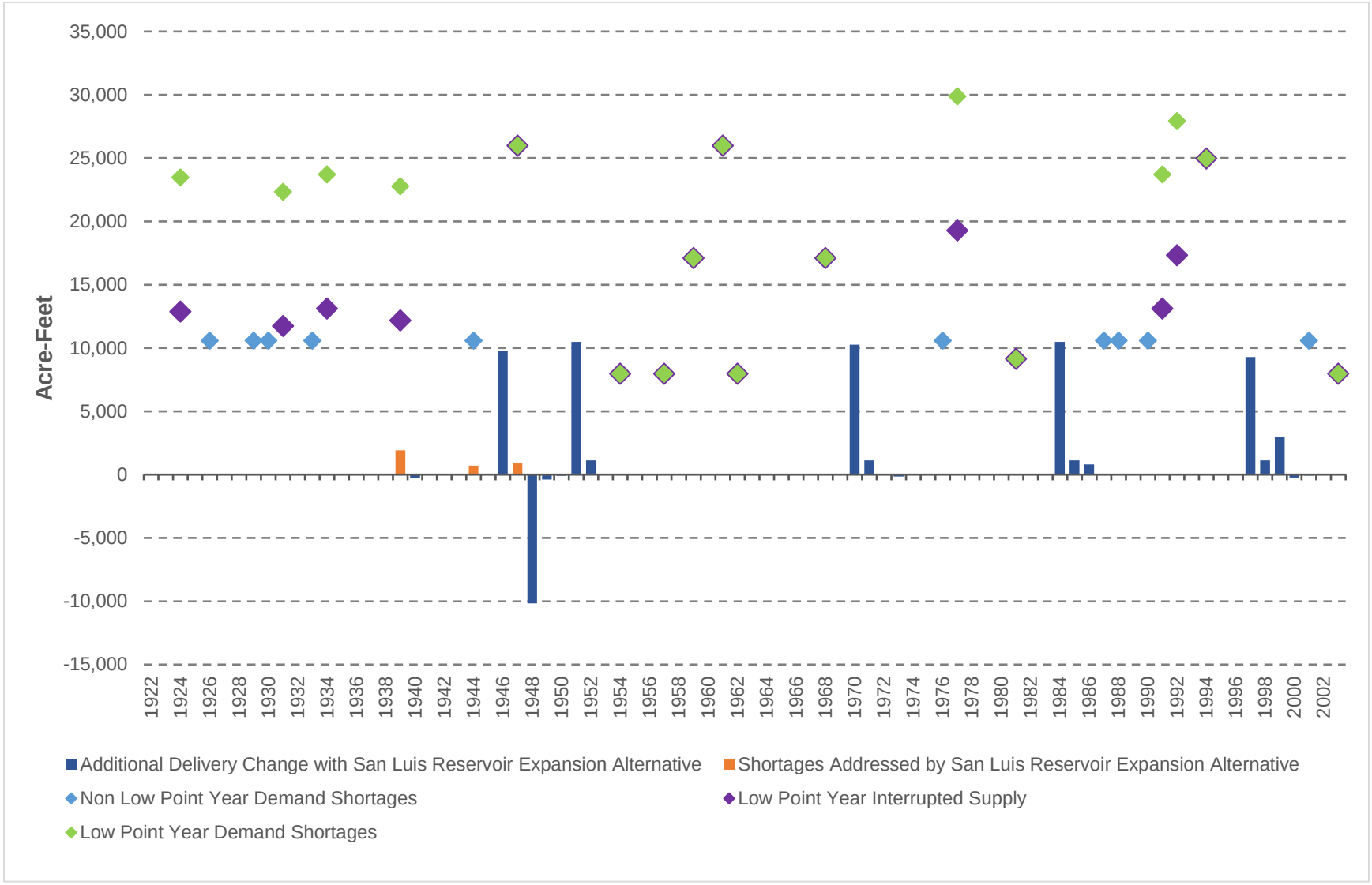

Figure 4-9. Annual San Felipe Division Shortages addressed by the San Luis Reservoir Expansion Alternative Plan

4.4.2 Costs

Table 4-3 shows appraisal-level cost estimates for the San Luis Reservoir Expansion Alternative Plan.

Table 4-3. Reservoir Expansion Alternative Plan Preliminary Costs

	Reservoir Expansion
Total Project Construction Costs	$490 million
Annual Operation and Maintenance Costs	$2.2 million[1]

Notes:
[1] O&M costs reflect increased pumping costs at the Gianelli Pumping Plant with increased capacity. This is an average annual estimate.

4.5 Pacheco Reservoir Expansion Alternative Plan

The Pacheco Reservoir Expansion Alternative Plan includes construction of new dam, removal of existing dam, and expansion of the reservoir. The new dam and reservoir would be constructed on Pacheco Creek 0.5 mile upstream from the existing North Fork Dam and would inundate most of the existing Pacheco Reservoir. Figure 4-10 and 4-11 shows the expanded Pacheco Reservoir footprint. The following are major components of the alternative plan.

4.5.1 Pacheco Reservoir Expansion Project Facilities

4.5.1.1 Dam and Spillway

The new embankment dam would be a zoned earthfill structure consisting of an impervious core, flanked by an outer shell of compatible fill (see Exhibit 4 in Attachment A of Appendix C). A system of filters and drains would be provided to control seepage through the dam and foundation. A downstream sand chimney filter would protect the impervious core. A gravel chimney drain located downstream of the chimney filter would convey drainage to a gravel blanket beneath the downstream compatible fill zone. The gravel blanket drain would convey seepage from the impervious core and overlie form the foundation beneath the downstream compatible fill zone to the downstream toe of the dam. Sand filter zones would be placed above and beneath the gravel blanket drain to protect the gravel drain from contamination of the overlying compatible fill and underlying foundation materials. The upstream slope of dam would be protected from reservoir wave action by a 3-foot thick riprap layer.

An uncontrolled side channel spillway with a trapezoidal cross section would be located adjacent to the right (west) abutment of the proposed dam. Due to the relatively steep topography at the dam site, a side channel spillway would reduce the amount of excavation required in order to accommodate the spillway control weir. The spillway features include an approach channel, discharge

chute and stilling basin, all of reinforced concrete and founded on bedrock. The side channel spillway entrance would include an ogee weir. A flip bucket located at the end of the stilling basin would dissipate the remaining energy in the basin during high discharge events. After leaving the deflector bucket, spillway discharges would be conveyed through a riprap lined outlet channel into the restored Pacheco Creek channel. Exhibit 5 in Attachment A of Appendix C shows the profile view of the spillway.

4.5.1.2 Inlet/Outlet Facilities

The inlet/outlet facilities would consist of a sloping intake/outlet structure and a low-level inlet/outlet designed to provide deliveries to the reservoir from Pacheco Conduit and withdrawals from the reservoir to the conduit and Pacheco Creek. However, these facilities would not be operated to facilitate these flows at the same time. For withdrawals from the reservoir, under normal operating conditions, this inlet/outlet facility would need to simultaneously convey up 490 cfs to Pacheco Conduit and release up to 35 cfs to Pacheco Creek. The inlet/outlet conveyance facilities have been sized to accommodate up to 1,350 cfs under emergency drawdown conditions. During emergency conditions, the outlet works would serve as an evacuation outlet for reservoir draw down.

A sloping intake structure would be located north of the left (east) abutment and would consist of a single 132-inch diameter reinforced-concrete structure, with approximately 10 ports located at various elevations for drawing from the reservoir. A low-level reservoir inlet would also be constructed, with an inlet elevation of 450 feet, for reservoir drainage. A hydraulically operated gate valve structure would be located upstream of the reinforced-concrete sloping intake to allow for switching between reservoir delivery (through the tunnel) and withdrawal operations (through the outlet structure).

A 2,300-foot long conveyance tunnel would be constructed under the dam abutment to connect the intake structures and the pump station. The conveyance tunnel would be excavated through the bedrock on the left abutment of the dam. A profile of the tunnel is shown on Exhibit 6 in Attachment A of Appendix C. The control gatehouse structure would be used to regulate outlet flows from the reservoir to the pump station, for normal releases, and the discharge channel for stream augmentation and emergency releases.

To connect the new outlet works to Pacheco Creek, the historical Pacheco Creek channel would be restored between the new dam and the existing dam through the existing Pacheco Reservoir. Restoration of the channel would include excavating a new 1,500-feet long, 1.7-feet deep, one-foot wide, low-flow channel, and a 6-feet deep, 20-feet wide overbank channel to facilitate riparian restoration. The channel would be designed to reduce streambank erosion (e.g., using bank stabilizing materials), and riparian vegetation would be planted to initiate growth of a new riparian forest along the restored channel.

4.5.1.3 Pacheco Reservoir Pump Station

The Pacheco Reservoir Pump Station would serve as a two-way pump station that both delivers water to and withdraws water from the Pacheco Reservoir. The water surface elevation of the new reservoir would have an operating range of 450 feet to 694 feet; however, at the connection point to the Pacheco Conduit the total hydraulic head would be 610 feet. This requires a "two-way" system operating both by gravity and through a booster pump station.

The conveyance system would contain 10 feet of dynamic head loss. Isolation valves would enable the pump station to deliver water to, or pump water from, the reservoir. Pressure-reducing sleeve valves are necessary to reduce excess pressure head under certain gravity-flow conditions. These valves would be used only when needed and bypassed at all other times. Additionally, a pressure relief air chamber and discharge structures would be required to prevent over-pressurization of the existing Pacheco Conduit.

The pump station would be below the new dam. To provide security and minimize noise levels in the surrounding area, the pumps would be housed in a building. Space has been identified for other facilities on site, including intake, access, parking, surge tanks, power substation, yard piping, and construction staging. The site footprint and conceptual layout for the pump station is shown in Exhibit 9 in Attachment A of Appendix C.

The new pump station would need to meet a wide range of lift (0 to 160 feet static plus 10 feet dynamic) and high flow (490 cfs). A single pump station with multiple pump ranges has been proposed to meet these requirements—while preventing pump station horsepower (hp) duplication—limiting the amount of head burned by pump control valves and minimizing cost. A total of 11 pumps (10 duty plus 1 standby) are planned, however the pump configuration may be refined during future design studies. The pump motors would be sized for the first operating range (higher lift) at 1,250 hp each (13,750 total hp).

The 14 megavolt amp (MVA) substation for the new reservoir pump station is located in the Pacific Gas and Electric Company (PG&E) service area, with no other nearby service sources. PG&E has a 70 kilovolt (kV) transmission line that cannot support the additional 14 MVA connected load, and it would need to be upgraded to support the increased load. The existing 70 kV transmission line would be upgraded to two circuits, for use by the double-ended substation arrangement for this alternative plan.

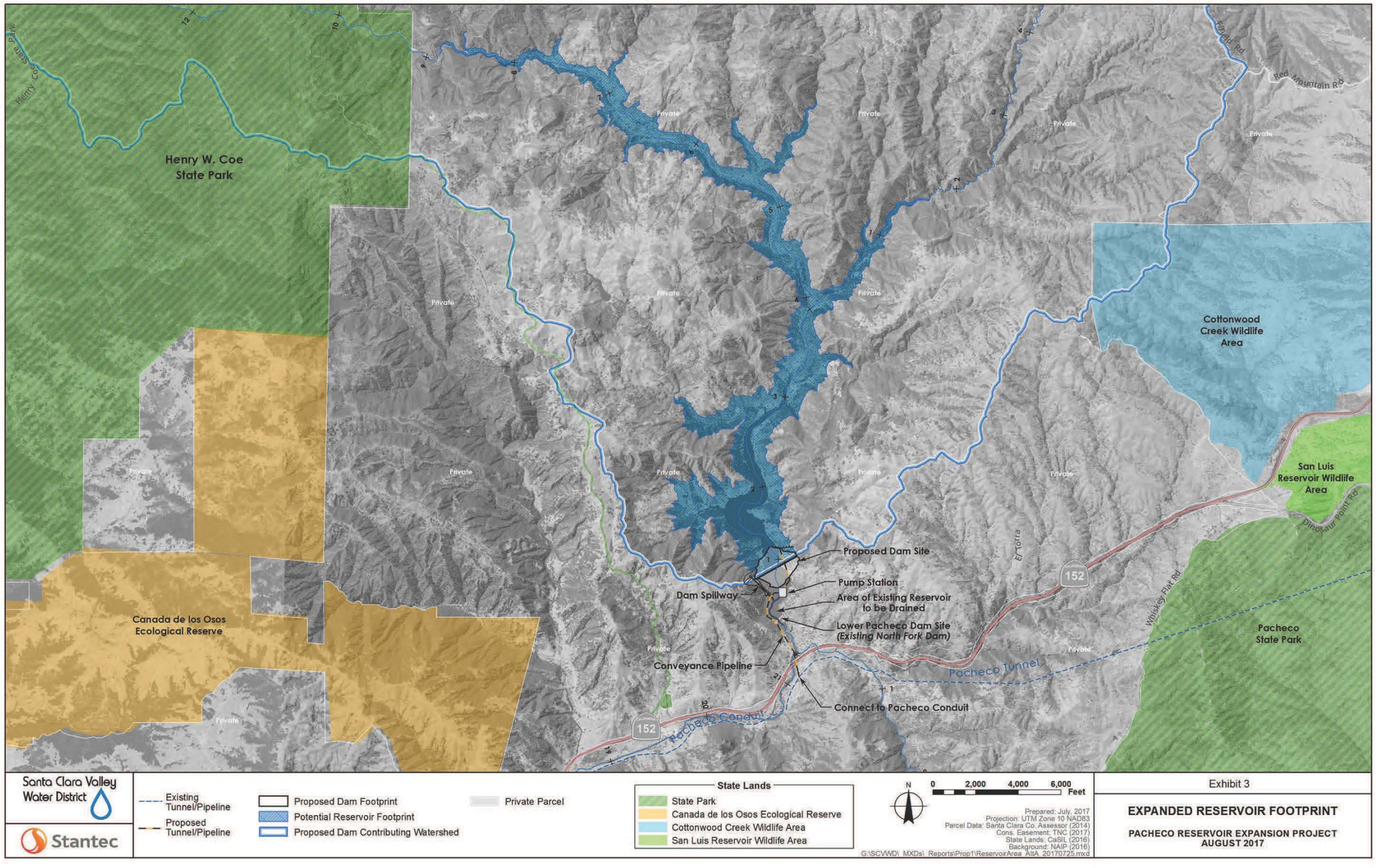

Figure 4-10. Pacheco Reservoir Expansion Footprint

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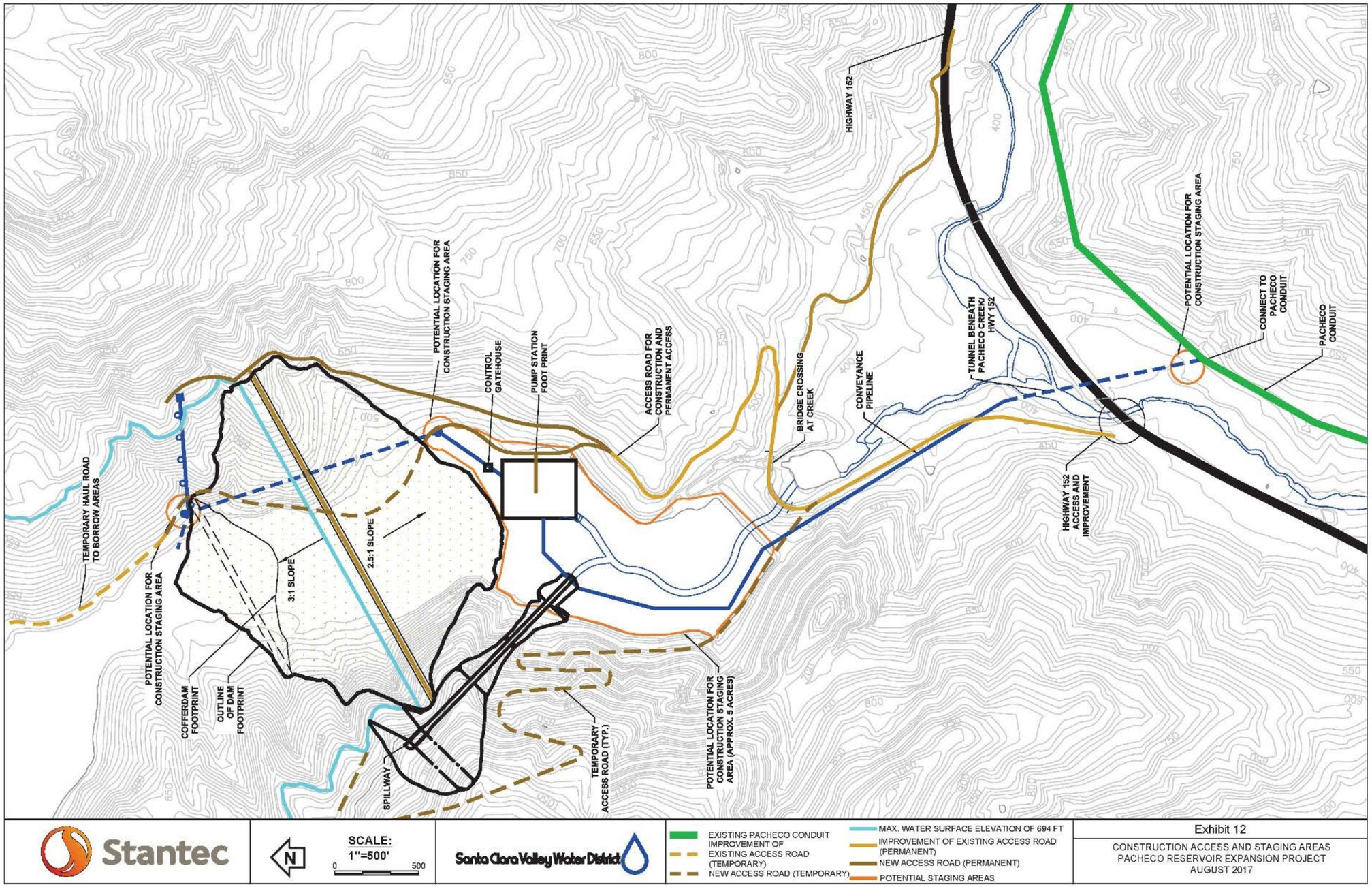

Figure 4-11. Pacheco Reservoir Construction Access and Staging Areas

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4.5.1.4 Conveyance from Pacheco Reservoir Pump Station to Pacheco Conduit

A pipeline would be constructed to connect the new pump station located immediately downstream of the new dam and the existing Pacheco Conduit. The proposed pipeline would be 9 feet in diameter and about 4,700 feet long, with a design capacity of 490 cfs. This pipeline would allow for delivery of imported water from the Pacheco Conduit to the proposed reservoir for future release and would also provide for reservoir releases to the Pacheco Conduit.

Construction would be by conventional excavation, open trench, and backfill except for the length of pipe located under SR 152. The length of pipe that would be located under SR 152 and Pacheco Creek would be installed using bore and jack techniques (i.e., tunneling techniques), to minimize impacts during construction. Spoils would be hauled off and disposed of at a suitable location. The tunnel, when completed, would be a 132-inch casing containing a 108-inch carrier pipe. There would also be permanent structures for appurtenances, such as air/vacuum valves, vaults, drains and blowoffs for the conveyance line.

The connection of the pipeline to the existing Pacheco Conduit would be southeast of the existing North Fork Dam. The connection would be with a tee in the Pacheco Conduit, with an isolation valve for the turnout (inlet and outlet) for the new reservoir.

4.5.1.5 New Regulating Tank at Existing Pacheco Pumping Plant

Controls to turn pumps on or off remotely would be based on the water level within the expanded Pacheco Reservoir and regulating tanks at the existing Pacheco Pumping Plant site near San Luis Reservoir. A second regulating tank at the existing Pacheco Pumping Plant site would be added adjacent to the existing regulating tank to provide additional control buffer and surge control for the new Pacheco Reservoir Pump Station. The new regulating tank would match the elevation, diameter, and materials of the existing tank. This would add a second 3 million gallon, 150-feet diameter reservoir, as shown in Exhibit 10 in Attachment A of Appendix C. Additional piping, valving, and controls would be required.

4.5.2 Operation

The expanded Pacheco Reservoir would be primarily filled using natural inflows from the North and East Forks of Pacheco Creek. These inflows are typically realized from December through March. Supplemental flows to the expanded reservoir would arrive from SCVWD's share of contracted CVP pumped water from San Luis Reservoir. This would include allocated CVP water supplies that otherwise could not be delivered to or stored by SCVWD. This CVP water supply would be pumped from the Pacheco Conduit up to the expanded Pacheco Reservoir earlier in the year prior to the summer months when the San Luis Reservoir is typically drawn down to the 300 TAF level. The rate at which these transfers are made between San Luis Reservoir and

Pacheco Reservoir would depend upon water rights, supply allocations, water demands, availability of other water supplies, and conveyance limitations of Pacheco Conduit. Conveyance and storage of these CVP supplies is anticipated to occur primarily in wet years. CVP water stored in Pacheco Reservoir could then be released through the summer while supplies from San Luis Reservoir would be inaccessible to SCVWD. The expanded Pacheco Reservoir could also limit the frequency of and impact from harmful cyanobacteria blooms that occur in the existing Pacheco Reservoir. Under existing conditions, cyanobacteria blooms can occur during low water levels during the fall that are toxic to fish downstream (Smith 2007). Increased reservoir storage capacity and water releases downstream in Pacheco Creek may limit the presence of cyanobacteria blooms or dilute their impact. The import of CVP supplies from San Luis Reservoir is not anticipated to further contribute to these algae conditions given small proportion of these supplies in comparison to the natural inflow to the reservoir.

The Pacheco Reservoir Expansion Alternative Plan would be operated to optimize the public and non-public benefits, including ecosystem enhancement and IL4 refuge water supply, emergency response, flood control, M&I water supply, and M&I water quality. Operations focus on (1) capturing and storing water during wetter periods from natural inflows for release during dry periods, both annually (i.e., capture winter flows for summer release and use), and across multiple years (i.e., capturing and storing water during wetter years for release and use during drier years and/or emergencies); and (2) integration with SCVWD's water system operations to optimize use of all available supplies, including CVP/SWP Delta supplies, other imported supplies, other local surface supplies, and conjunctive use/groundwater recharge.

Pacheco Reservoir would be operated by SCVWD to both improve habitat conditions for steelhead in Pacheco Creek and improve SCVWD water supply reliability, including during drought periods and emergencies. Table 4-4 summarizes the average monthly release targets to Pacheco Creek from the expanded Pacheco Reservoir. Operation of the expanded Pacheco Reservoir would not change the existing operations of the CVP.

Table 4-4. Average Monthly Release Targets to Pacheco Creek from Expanded Pacheco Reservoir

Month	Average Monthly Release Targets to Pacheco Creek (cfs)[1,2]
January	10
February	10
March	20
April	20
May	12
June	13
July	14
August	14
September	14
October	14
November	10
December	10

Note:
[1] Releases from Pacheco Reservoir may be adjusted based on high flows in the south fork of Pacheco Creek.
[2] SCVWD water through their water rights.
Key: cfs = cubic feet per second

The average monthly release targets shown in Table 4-4 incorporate the biological needs of the SCCC steelhead, which are listed as threatened under the Federal ESA, for higher flows in March and April for outmigration. The winter releases listed in Table 4-4 may be reduced depending on flows in the South Fork of Pacheco Creek. In addition, during heavy precipitation events, releases from the expanded reservoir would be reduced to minimize flooding risks along Pacheco Creek and the Pajaro River. Releases to Pacheco Conduit, to meet SCVWD water demands, may be reduced or discontinued when storage levels in the expanded Reservoir fall below 55 TAF. This would ensure that flow and water temperatures in Pacheco Creek (below the new dam) are maintained in consecutive dry years.

SCVWD would transfer 2,000 AF of its CVP water contract (in below normal water years), directly or through transfer and exchanges, in perpetuity to Reclamation's Refuge Water Supply Program (RWSP), for use in the IL4 refuge water supply. This long-term voluntary reallocation of CVP yield by SCVWD would be secured by an agreement between the USFWS and SCVWD detailing its operation, a contract between and DWR and SCVWD for the provision of grant funding through the WSIP that would require the provision of these supplies in perpetuity, and an integrated operations agreement between Reclamation and SCVWD for Pacheco Reservoir that would include the requirements for this transfer. While Reclamation sets priorities for IL4 distribution, SCVWD has expressed its desire that the transferred water be designated to refuges supported by Grassland Resources Conservation District (GRCD). The water would be used to flood wetlands, directly benefiting wetland-dependent wildlife populations. The delivery schedule of this water would be flexible, but could be delivered as early as March or April. This water

could be stored in San Luis Reservoir, providing Reclamation's RWSP greater flexibility in making late season deliveries to refuges. For deliveries to GRCD, deliveries would be made to Los Banos through the Delta-Mendota Canal.

SCVWD would use the reservoir for operational storage within their system as well as for emergency supply. SCVWD accesses its CVP contract water through the Pacheco Conduit. This alternative plan includes construction of an inlet/outlet facility connecting to the conduit that takes water from Pacheco Conduit to Pacheco Reservoir as well as from the reservoir to Pacheco Conduit. During years when SCVWD water supplies exceed the water demands in the SCVWD service areas and excess storage capacity is available in the expanded reservoir, SCVWD would convey CVP supplies from San Luis Reservoir through Pacheco Conduit and into the expanded Pacheco Reservoir. Conveyance and storage of these CVP supplies is anticipated to occur primarily in wet years. The rate at which these transfers are made between San Luis Reservoir and Pacheco Reservoir would depend on supply allocations, water demands, and availability of other water supplies.

The Pacheco Reservoir Expansion Alternative Plan would provide an annual average of approximately 2,800 AF of additional water M&I supply to the San Felipe Division compared to the No Action/No Project Alternative. Figure 4-12 shows how the Pacheco Reservoir Expansion Alternative Plan addresses SCVWD low point water supply interruptions along with treated water demand shortages in the No Action Alternative. Modeling results show that the Lower San Felipe Intake Alternative Plan would fully replace interrupted supplies in 14 out of the 17 years with low point conditions (out of the 82 years modeled) low point years.

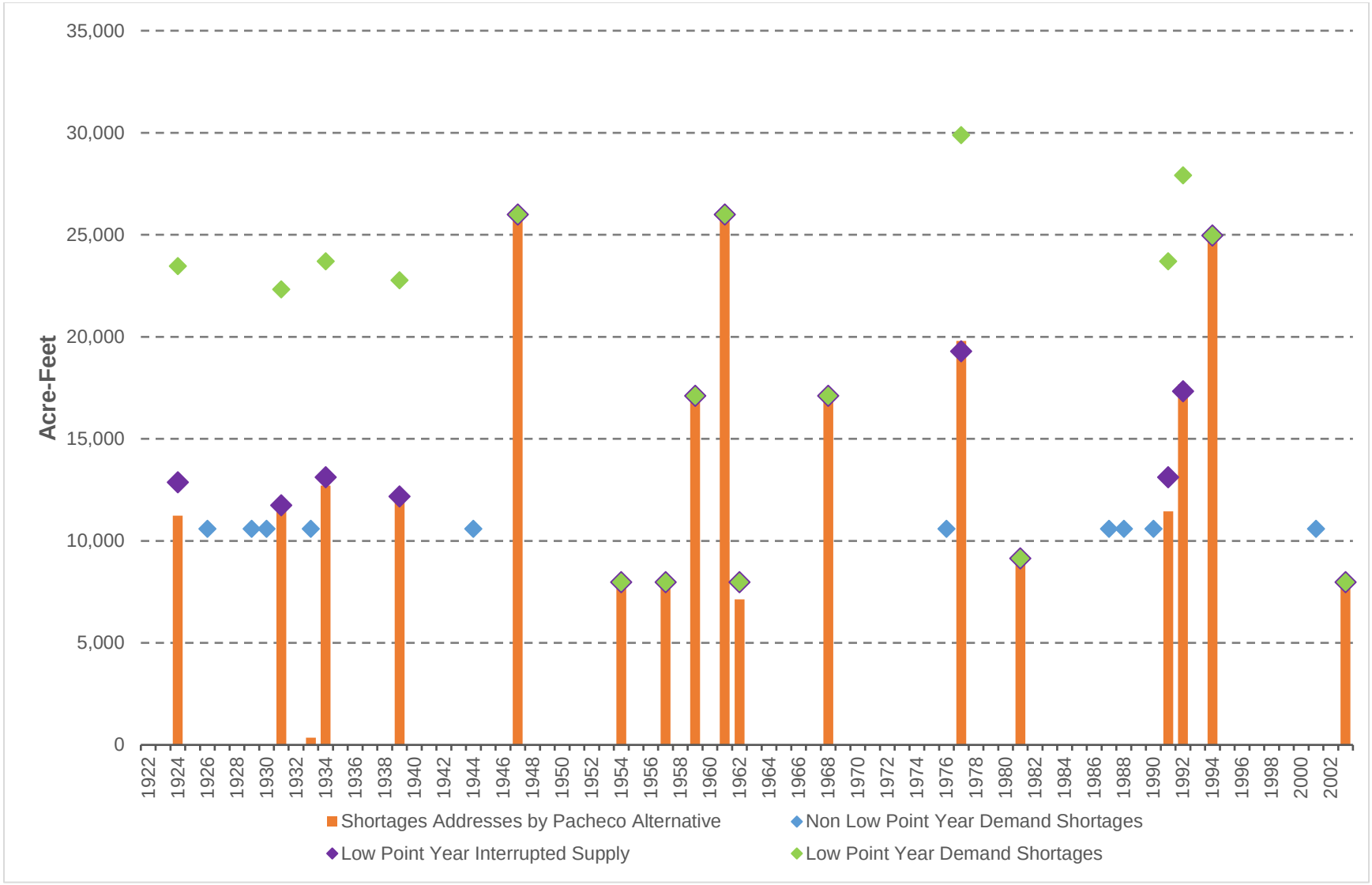

Figure 4-12. Annual San Felipe Division Shortages addressed by the Pacheco Reservoir Expansion Alternative Plan

4.5.3 Costs

Table 4-5 shows appraisal-level cost estimates for the Pacheco Reservoir Expansion Alternative Plan.

Table 4-5. Pacheco Reservoir Expansion Alternative Plan Preliminary Costs

	Pacheco Reservoir Expansion
Total Project Construction Costs	$1,127 million
Annual Operation and Maintenance Costs	$1.6 million

Chapter 5
Plan Evaluation and Comparison

A critically important element of Federal planning is the evaluation and comparison of alternative plans. This chapter presents results of this evaluation and comparison of the No Action/No Project Alternative (No Action Alternative) and the alternative plans described in Chapter 4. This chapter also documents the consistency of the alternative plans with other water management programs and regulations.

5.1 Alternative Plan Evaluation

Under the feasibility planning process, four accounts are established to display, and facilitate evaluation of, the effects of alternative plans: National Economic Development (NED); environmental quality (EQ); regional economic development (RED); and other social effects (OSE). These four accounts encompass public benefits that include environmental, economic, and social goals. The beneficial and adverse effects of each alternative plan are evaluated through comparison to the No Action Alternative and the plan that maximizes net public benefits should be identified.

5.1.1 National Economic Development

The objective of NED analysis is to determine the change in net value of the Nation's output of goods and services that would result from implementing each project alternative. Beneficial and adverse effects are evaluated in monetary terms and measured in terms of changes in national income among the No Action and various action alternatives. The NED account describes the part of the human environment that identifies beneficial and adverse effects on the economy. Beneficial effects in the NED account are (1) increases in the economic value of the national output of goods and services from an alternative, (2) the value of output resulting from external economies caused by an alternative, and (3) the value associated with the use of otherwise unemployed or underemployed labor resources. Adverse effects in the NED account are the opportunity costs of resources used in implementing an alternative. These adverse effects include (1) implementation outlays, (2) associated costs, and (3) other direct costs. The NED account may include benefits to the following categories: irrigation water supply for agriculture; M&I water supply; urban flood damage reduction; power (hydropower); transportation (inland navigation and deep draft navigation); recreation; commercial fishing; unemployed or underemployed labor resources; and other direct benefits. In this analysis, other

direct benefits include emergency water supplies in the event of a disruption in supply from San Luis Reservoir due to a Delta outage. Environmental benefits, including fisheries and ecosystem resources, are typically included in the EQ account if monetary units cannot be attributed to these benefits. However, for this analysis, ecosystem benefits were developed as monetary units and are included in the NED account.

5.1.1.1 M&I Water Supply Benefits

The incremental change in annual M&I water supply under the alternatives relative to the No Action Alternative is the basis for M&I water supply benefits. The hydrologic model results (detailed in Appendix B) provide the quantity of water available under the No Action and action alternatives. The alternative plans would provide additional water to reduce shortages under the No Action Alternative, which is an economic benefit. Table 5-1 shows the average annual incremental differences in water quantity delivered to M&I contractors under the No Action and action alternatives. In addition, a sensitivity analysis of climate change's potential effect on the alternatives' potential water supply benefits is presented in Appendix D.

The San Luis Reservoir Expansion Alternative would result in a net reduction of M&I waters supply because of decreases in SWP deliveries by reducing SWP exports from the Delta through Banks Pumping Plant. Banks Pumping Plant exports can be reduced as compared to the No Action Alternative because the additional CVP storage capacity under the alternative allows the CVP to export more of the water they are entitled to under the Coordinated Operations Agreement. Under the No Action Alternative, the SWP is able to export this water when the CVP portion of San Luis Reservoir fills and CVP South of Delta demands are being met.

Table 5-1. Average Annual Change in M&I Water Supply Summary

Alternative Plan	Average Annual Additional Water Deliveries Relative to No Action Alternative (TAF)
Lower San Felipe Intake (Pipeline and Tunnel)	3.1
Treatment	3.1
San Luis Reservoir Expansion	-2.6
Pacheco Reservoir Expansion	2.8

In this analysis, the benefits to M&I water users are measured according to the cost of the most likely alternative water supply that would be pursued in the absence of development of the SLLPIP alternative plans. For water supply reliability benefits, the cost of the most likely alternative represents the next unit of water supply the water user would purchase, or develop, if the project under consideration were not in place. The cost of the most likely alternative assumes

that if the preferred alternative is not implemented, the alternative action most likely to take place provides a relevant comparison. The valuation approach relies upon the costs associated with observed market transactions for water. The data include single-year transactions from 1990 through 2016 of surface water supplies originating in California's Central Valley. The dataset includes 204 transactions for municipal uses, 367 for agricultural uses, and 152 purchases by environmental users. The water transfer price model projects water prices to 2030 by geographic region and hydrologic condition.

Combined water market prices, carriage losses, and conveyance costs for SWP contractors are provided in Table 5-2. The values reflect the total cost of water (water price + conveyance losses + wheeling charges) by year type in 2030. These values are applied to water deliveries by year type to estimate total M&I water supply reliability benefits.

Table 5-2. Estimated 2030 Municipal and Industrial Water Cost by Year Type

Water Year Type[2]	2030 ($/acre-foot)[1]
Wet	$526
Above Normal	$572
Below Normal	$729
Dry	$779
Critical	$1,060

Note:
[1] April 2018 price levels.
[2] Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types.
Key:
Above Normal = Total SWP and CVP deliveries are 83% of contracted volume.
Below Normal = Total SWP and CVP deliveries are 64% of contracted volume.
Critical = Total SWP and CVP deliveries are 45% of contracted volume.
Dry = Total SWP and CVP deliveries are 61% of contracted volume.
Wet = Total SWP and CVP deliveries is 89% of contracted volume.

Table 5-3 presents the estimated annual M&I water supply reliability benefits for each alternative plan based on the water supplies delivered and the water unit values. The values represent 2030 estimates and are presented in 2018 dollars. Benefits are based on the water supplies presented in Table 5-1.

Table 5-3. Average Annual M&I Water Supply Economic Benefits

Alternative Plan	*NED M&I Water Supply Annual Benefits (million $)*
Lower San Felipe Intake (Pipeline and Tunnel)	$2.3
Treatment	$2.3
San Luis Reservoir Expansion	($1.7)
Pacheco Reservoir Expansion	$2.1

5.1.1.2 Emergency Water Storage Benefits

The alternative plans would provide storage for emergency response actions during Delta outages. This analysis incorporates methods and assumptions from the WSIP evaluation that was refined during review with the CWC (SCVWD 2017a).

Water supply could be reduced or interrupted after an emergency such as a flood or earthquake. Conveyance of water supply through the Delta could be interrupted or reduced in the event of Delta levee failures if seawater intruded into the Delta to an extent that would make it too saline for human consumption. In such cases, the additional water available in surface and groundwater storage, the physical interconnections between groundwater and surface water system, and the operational integration would help to mitigate the impacts of the emergency. The alternative plans would provide varying levels emergency response benefits to SCVWD. The SCVWD WEAP model was used to estimate storage conditions (both surface storage and groundwater storage) in the SCVWD system for the No Action and alternative plans under 2030 future conditions. CalSim II CVP and SWP allocations were used as inputs into the WEAP model.

The alternative plans would change storage in San Luis Reservoir that could also be used for emergency response during a Delta outage by south of Delta CVP and SWP contractors. The San Luis Reservoir Expansion Alternative Plan would increase storage by expanding capacity in the reservoir. The Lower Intake, Treatment, and Pacheco Reservoir Expansion Alternative Plans would decrease emergency response storage in San Luis Reservoir for south of Delta CVP and SWP contractors because the reservoir could be drawn down further by increased San Felipe Division deliveries relative to the No Action Alternative, which would decrease available storage in the reservoir for south of Delta contractors. For the San Luis Reservoir emergency response benefits or losses, CalSim II was used to estimate changes in storage to south of Delta M&I CVP and SWP contractors.

This analysis applies a willingness to pay approach to estimate the economic benefits associated with emergency storage for SCVWD. Key considerations in estimating the economic cost of water supply disruptions include the probability that a supply disruption would occur, level of water supply shortage, and duration and timing of the supply disruption to urban water agencies.

This analysis assumes a constant price elasticity of demand over the changes in water delivery considered. The demand function is calibrated to 2030 water demand levels by adjusting 2017 prices and quantities according to water demand projections. The demand function applied in this analysis is described in detail in Appendix E.

The estimation method detailed in Appendix E, was used to generate an estimate of the economic losses associated with a 12-month Delta outage to develop a dollar per acre-foot benefit for emergency water supplies. The average value was then multiplied by the volume of emergency supplies available from the Alternatives, and the expected annual benefit is calculated by multiplying by the probability of a Delta water export disruption. The estimation method described above was used to generate an estimate of the economic losses associated with a 28 percent shortage level in 2030 to develop a dollar per acre-foot benefit for emergency water supplies. The average value was then multiplied by the volume of emergency supplies available from the alternatives, and the expected annual benefit is calculated by multiplying by the probability of a Delta water export disruption. The expected annual emergency water supply benefit is then reduced by the avoided marginal cost of emergency water delivery and treatment to M&I customers (*c*). This analysis applies a fixed per unit cost of $270/AF/year (DWR 2013b). Table 5-4 summarizes the parameters applied in this analysis.

Table 5-4. Summary of Key Assumptions and Parameters

Variable	Value	Description	Source
P_{2017}	$1,796/ acre-foot	Weighted average service rate (2017 dollars)[1] for water providers in Santa Clara County	M. Cubed (2016)
D_{2017}	294,328 acre-feet	Estimated 2017 annual M&I water demand for North County Santa Clara Subbasin	SCVWD WEAP model
D_{2030}	298,382 acre-feet	Forecast 2030 annual M&I water demand in North County Santa Clara Subbasin	SCVWD WEAP model
Q_E	95 acre-feet (San Luis Expansion) 2,354 acre-feet (Intake/Treatment) 102,016 acre-feet (Pacheco Expansion)	Average emergency water supply yield in 2030 under each alternative plan	SCVWD WEAP model
η	-0.189	Short-term price elasticity of demand	Bay Delta Conservation Plan (DWR 2013b)
Shortage Level	28%	Level of shortage to M&I users as a percent of 2030 water demand	SCVWD WEAP model
Shortage Duration	12 months	Duration of the Delta water supply disruption	DRMS Phase 1 Summary Report (2007)

Variable	Value	Description	Source
Probability	0.042	Annual probability of a Delta water supply export disruption during the planning period[1]	DRMS (DWR, USACE, and DFW 2009)
c	$270/ acre-foot	Marginal cost of delivery	Bay Delta Conservation Plan (DWR 2013b)

Notes:

[1]The annual probability of a Delta water supply export disruption applied in this analysis is the average annual all hazards probabilities for the 20 and 30 "island-breach" scenarios identified for the Delta Risk Management Strategy (DWR, USACE, and DFG, 2009).

Table 5-5 shows the values for groundwater and surface water outage supplies for the SCVWD. The total was then multiplied by the annual probability of occurrence to obtain the expected annual benefit for each alternative. The San Luis Reservoir Expansion Alternative would not provide emergency water supply benefits to SCVWD or south of Delta contractors.

Key:

Delta = Sacramento-San Joaquin Delta

DFG = Department of Fish and Wildlife

DRMS = Delta Risk Management Strategy

M&I = municipal & industrial

SCVWD = Santa Clara Valley Water District

USACE = U.S. Army Corps of Engineers

WEAP = Water Evaluation and Planning

Table 5-5. Average Annual NED Benefits for Emergency Water Storage: Delta Outage for 2030 Future Conditions

Alternative	Outage Supply	Volume (acre-feet)	Value[1] ($)	Benefit ($ million)	Total NED Benefit ($ million)
Lower San Felipe Intake (Pipeline and Tunnel)	Groundwater	0	$1,019[2]	$0.0	$38.4
	Surface Water	2,354	$16, 329	$38.4	
Treatment	Groundwater	0	$1,019[2]	$0.0	$38.4
	Surface Water	2,354	$16, 329	$38.4	
Pacheco Reservoir Expansion	Groundwater	18,137	$1,019[2]	$18.5	$565.4
	Surface Water	83,878	$6,526	$546.8	

Notes:

[1]Based on 2018 price levels.

[2]Reflects 2018 groundwater charges for SCVWD Zone 5 of $1,289 (https://www.valleywater.org/your-water/current-water-charges) less $270/acre-foot.

For south of Delta contractors, the alternatives would decrease emergency storage for South of Delta contractors by 1.4 TAF. It is assumed that local groundwater supplies would be used to meet demands during a Delta outage. Therefore, the emergency response benefit to south of Delta contractors was monetized using Metropolitan Water District of Southern California's (MWDSC) forecasted Tier 2 water rates (MWDSC 2016). These forecasted rates took into consideration willingness to pay for water during Delta outages. Fixed water conveyance charges (e.g., Delta water charge, transportation charge capital cost component) are not included. Table 5-6 shows the key parameters used to estimate south of Delta emergency water rates.

Table 5-6. Summary of Key Assumptions and Parameters for South-of-Delta Emergency Water Storage Benefits

Variable	Value	Description	Source
P_{2026}	$1,066/ acre-foot	MWDSC forecasted Tier 2 water rates	MWDSC (2016)
Probability	0.042	Annual probability of a Delta water supply export disruption during the planning period[1]	DRMS (DWR, USACE, and DFG 2009)
C	$270/ acre-foot	Marginal cost of delivery	Bay Delta Conservation Plan (DWR 2013b)

Notes:

[1] The annual probability of a Delta water supply export disruption applied in this analysis is the average annual all hazards probabilities for the 20 and 30 "island-breach" scenarios identified for the Delta Risk Management Strategy (DWR, USACE, and DFG, 2009).

Key:

Delta = Sacramento-San Joaquin Delta

DRMS = Delta Risk Management Strategy

MWDSC = Metropolitan Water District of Southern California

Table 5-7 shows the estimated NED benefits for emergency water storage under 2030 future conditions. The total groundwater and surface water volumes were multiplied by the annual probability of occurrence (0.042) and value to obtain the expected total and annual benefit for each alternative plan.

Table 5-7. Estimated NED Benefits for Emergency Water Storage

Alternative Plan	Total Monetized change to SCVWD Water Storage (million $)	Total Monetized Emergency Response to South-of-Delta Contractors (million $)	Total NED Emergency Response Benefit (million $)1	NED Emergency Response Annual Benefits (million $)2
Lower San Felipe Intake (Pipeline and Tunnel)	$38.4	-$1.1	$37.3	$1.6
Treatment	$38.4	-$1.1	$37.3	$1.6
Pacheco Reservoir Expansion	$565.4	-$1.1	$564.3	$23.7

Total might not add up due to rounding.

[1] Total NED Emergency Response Benefit= Total Emergency Response Benefit to SCVWD (Includes change to local surface water storage and change to north county groundwater storage)+ Total Emergency Response Benefit to South-of-Delta Contractors

[2] Total economic losses were multiplied by the annual probability of occurrence of 0.042 to obtain the emergency response annual benefits.

5.1.1.3 Agricultural Water Supply Benefits

The incremental change in annual agricultural water supply under the alternatives relative to the No Action Alternative is the basis for agricultural water supply benefits. The hydrologic model results provide the quantity of water available under the No Action and action alternatives. Table 5-8 shows the average annual incremental differences in water quantity delivered to

agricultural contractors under the No Action and action alternatives. Only the San Luis Reservoir Expansion Alternative Plan would increase agricultural water supplies.

Table 5-8. Average Annual Agricultural Water Supply Summary

Alternative Plan	Average Annual Additional Water Quantity Relative to No Action Alternative (TAF)
Lower San Felipe Intake (Pipeline and Tunnel)	-1.6
Treatment	-1.6
San Luis Reservoir Expansion	16.1
Pacheco Reservoir Expansion	-1.6

The water transfer pricing model described for M&I water supply benefits is applied to estimate the benefits of improved agricultural water supply. As previously described, the economic model consists of a statistical analysis of documented spot market water transactions in California. The model seeks to explain the factors that influence California water market prices and is used to forecast 2030 prices under a variety of conditions including seller and buyer location, buyer type, and hydrologic conditions.

In addition to the market price for water, agricultural buyers incur conveyance costs that vary with location and infrastructure. This analysis assumes that the purchased water is conveyed to CVP south of Delta agricultural users at a cost of approximately $20/AF. Combined water market prices, carriage losses, and conveyance costs for agricultural water supplies are provided in Table 5-9. The values reflect the total cost of water (water price + conveyance losses + power charges) to agricultural water users by location and year type in 2030.

Table 5-9. Estimated 2030 Agricultural Water Supply Costs by Year Type

Water Year Type[1]	Water Cost [2] ($/acre-feet/year)
Wet	$422
Above Normal	$464
Below Normal	$606
Dry	$651
Critical	$905

Note:
[1] Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index used to define water year types.
[2] Losses and conveyance losses not included in the price.

These values are applied to water deliveries by location and year type to estimate total agricultural water supply reliability benefits. Table 5-10 provides a summary of the estimated benefits for the alternatives.

Table 5-10. Average Annual Agricultural Water Supply Economic Benefits

Alternative Plan	NED Agricultural Water Supply Annual Benefits (million $)
Lower San Felipe Intake (Pipeline and Tunnel)	-$0.9
Treatment	-$0.9
San Luis Reservoir Expansion	$2.4
Pacheco Reservoir Expansion	-$0.9

5.1.1.4 Ecosystem Enhancement Benefits

The Pacheco Reservoir Expansion Alternative Plan would be operated to provide water for ecosystem enhancement on Pacheco Creek (and the San Joaquin River Watershed.) The other alternative plans would not be operated to provide ecosystem benefits.

5.1.1.4.1 Pacheco Creek

The Pacheco Reservoir Expansion Alternative Plan would be operated to improve habitat conditions for SCCC steelhead, which are listed as threatened under the Federal ESA, in Pacheco Creek. These operations include year-round releases to Pacheco Creek, targeting average monthly creek flows ranging from 10 cfs to 30 cfs, depending on steelhead life stage requirements. To ensure that flows and water temperatures in Pacheco Creek are maintained in consecutive dry years, releases to Pacheco Conduit—to meet SCVWD water demands—would be discontinued in the event that reservoir storage volumes fall below 55,000 AF.

The approach to estimate the SCCC steelhead ecosystem enhancement benefit considers a least-cost means of providing, at minimum, the same amount of physical benefit as the most likely alternative, in the absence of the proposed Pacheco Reservoir expansion. This method is consistent with the alternative cost method. Because improved flows and reduced water temperatures during critical periods (provided by additional surface storage) would be essential to achieving a viable steelhead population, the most likely alternative means of providing that benefit would be a single-purpose reservoir at the same location as the proposed Pacheco Reservoir expansion. A conservative estimated single purpose reservoir size was selected, a 96,000 AF reservoir for 2030 future conditions. To quantify the monetary benefits, capital cost estimates were developed for the 96,000 AF reservoir. Total capital cost for the single purpose reservoir for ecosystem enhancement was estimated to be $720.0 million and the annualized cost was $23.0 million.

5.1.1.4.2 San Joaquin River Watershed

The Pacheco Reservoir Expansion Alternative Plan would allow SCVWD to provide 2 TAF of firm water supplies from its CVP allocation (in below normal water years) to Reclamation's RWSP under the Accelerated Water Transfer Program. The potential supply resources for allocation to the IL4 refuge supply pool would be provided through transfer of SCVWD's CVP long-term water supply contract supplies, or through transfer or exchanges with other water

districts. Delivering water through transfer or exchange afforded by SCVWD is intended to assist Reclamation's RWSP obligation to provide IL4 supply at refuges.

The approach to estimate ecosystem enhancement benefits considers the estimated short-term price to purchase water supplies on the open market, the most likely alternative in the absence of a firm water supply from the Pacheco Reservoir expansion. This method is consistent with the least cost alternative method. To monetize these ecosystem benefits for San Joaquin River watershed refuges, the cost associated with acquiring 2 TAF in below normal water years was determined for 2030 future conditions. The analysis relies on values estimated through application of a water-transfer pricing model, with consideration of the costs associated with conveying the water to the refuges being served. Average annual environmental water-supply reliability benefits are $0.2 million per year, under 2030 future conditions.

Table 5-11 presents the estimated annual ecosystem benefits for each alternative plan. The values represent 2030 estimates and are presented in 2018 dollars.

Table 5-11. Average Annual Ecosystem Improvement Economic Benefits Relative to No Action Alternative

Alternative Plan	NED Ecosystem Improvement Annual Benefits relative to No Action Alternative (million $)
Lower San Felipe Intake (Pipeline and Tunnel)	0
Treatment	0
San Luis Reservoir Expansion	0
Pacheco Reservoir Expansion	$24.2[1]

[1] Total Pacheco Reservoir Expansion benefits include annual $24.0 million from ecosystem enhancement benefits for Pacheco Creek and annual $0.2 million from ecosystems benefits to wildlife refuges.

5.1.1.5 Preliminary Cost Estimates

Table 5-12 summarizes preliminary construction and O&M cost estimates for the alternatives. The total cost was amortized over the alternatives' assumed 100-year project life at the 2018 Federal discount rates of 2.875 percent. The Treatment Alternative Plan assumes a 3-year construction schedule, the Lower Intake alternative plans assume a 4-year construction schedule, and the San Luis Reservoir Expansion Alternative assumes an 8 to 12-year construction schedule. The Pacheco Reservoir Expansion Alternative Plan assumes a 5-year construction schedule. Annual O&M costs would begin after construction is complete.

Table 5-12. Appraisal-Level Cost Estimates for the Alternatives, 2018 dollars

Alternative Plan	Total Construction Cost (Million $)	Interest and Amortization for Construction Costs, 2.875%, 100 yr (Million $)	Interest and Amortization for Replacement Costs, 2.875%, 100 yr (Million $)[1]	Average Annual O&M Cost (Million $)	Total Annual Cost (Million $)
Lower San Felipe Intake (Tunnel)	$968.00	$29.60	NA	$2.50	$32.10
Lower San Felipe Intake (Pipeline)	$885.00	$27.00	NA	$2.50	$29.50
Treatment	$37.00	$1.10	$2.80	$0.30	$4.20
San Luis Reservoir Expansion	$490.00	$15.00	NA	$2.20	$17.10
Pacheco Reservoir Expansion	$1,127.00	$34.40	$3.80	$1.60	$39.90

Notes: [1] Treatment and Pacheco Reservoir Expansion Alternative Plans annual cost estimates include replacement costs (capital costs).

5.1.1.6 Preliminary NED Results

Table 5-13 summarizes the annual economic benefits and costs of the alternatives. The table also presents net annual benefits or costs and a benefit-cost ratio for each alternative. Based on this economic evaluation at the appraisal level, the Pacheco Reservoir Expansion Alternative Plan would have the only net benefits among the alternatives. The Pacheco Reservoir Expansion Alternative Plan would have a benefit cost ratio of 1.2, based on the appraisal level cost estimate and preliminary benefits evaluation.

Table 5-13. Preliminary NED Benefit-Cost Summary, Annual Values, 2018 dollars

	Treatment	Lower San Felipe Intake (Pipe)	Lower San Felipe Intake (Tunnel)	San Luis Reservoir Expansion	Pacheco Reservoir Expansion
Annual M&I Water Supply Benefits (Million $)[1]	$2.30	$2.30	$2.30	($1.70)	$2.10
Annual Emergency Water Storage Benefits (Million $)	$1.60	$1.60	$1.60	$0.00	$23.70
Annual Agricultural Water Supply Benefits (Million $)[1]	($0.90)	($0.90)	($0.90)	$7.80	($0.90)
Annual Ecosystem Improvement - Pacheco Creek (Million $)[1]	NA	NA	NA	NA	$24.00
Annual San Joaquin Refuge Water Supply (Million $)[1]	NA	NA	NA	NA	$0.20
Total Annual Benefits (Million $)[1]	**$3.00**	**$3.00**	**$3.00**	**$6.10**	**$49.10**
Total Construction Cost (Million $)	$37.00	$885.00	$968.00	$490.00	$1,127.00
Annual Costs (Million $)[2]	**$4.20**	**$29.50**	**$32.10**	**$17.10**	**$39.90**
Net Annual Benefits or Costs (Million $)	**($1.20)**	**($26.50)**	**($29.10)**	**($11.00)**	**$9.20**
Benefit-Cost Ratio	**0.71**	**0.10**	**0.09**	**0.4**	**1.2**

Notes: [1] Benefits represent annual benefits estimated in the year 2030

[2] Annual costs include construction cost amortized over 100 years at 2.875% discount rate, annual O&M costs and the Treatment and Pacheco Reservoir Expansion Alternative Plans annual cost estimates include replacement costs (capital costs).

5.1.2 Environmental Quality

The EQ account is a means of integrating information about the EQ resource and NEPA human environment effects (as defined in 40 CFR 1507.14) of alternatives into water resources planning. A thorough evaluation of the EQ accounts was performed as part of the NEPA and CEQA environmental documentation process. Table 5-14 summarizes key effects for all resource categories for the EQ account.

5.1.3 Regional Economic Development

Regional economic effects would occur as a result of construction, O&M, and repair and replacement expenditures associated with the alternatives. The IMPLAN (IMpact analysis for PLANning) modeling package used to assess the regional economic impacts from the expenditures. IMPLAN is a commonly used, industry accepted economic input-output modeling system that estimates the effects of economic changes in a defined study area. The 2017 IMPLAN data was used for the analysis. This analysis assumes that direct effects would occur from construction expenditures. The facilities would also require periodic repair and replacement, which would also generate employment, income, and output during the repairs and replacement period. The project life of facilities included in the alternatives range from approximately 20-50 years with full replacement of capital assumed to occur after 50 years, depending on the facility; therefore, RED effects of repair and replacement would not occur for many years after the initial construction period. RED effects of replacement expenditures are not quantified.

Construction expenditures would temporarily increase employment, output, and labor income in the economic region during the construction period.
Tables 5-13 and 5-14 summarize direct, indirect, induced, and total employment and output effects of construction expenditures for the alternatives.

Table 5-14. Summary of EQ Effects

Resource	Treatment Alternative Plan	Lower San Felipe Intake Alternative Plan	San Luis Reservoir Expansion Alternative Plan	Pacheco Reservoir Expansion Alternative Plan
Terrestrial and Aquatic Species	Short-term minor adverse effect from construction, but construction area is in disturbed water treatment plant.	Potential adverse effects to sensitive species during construction; effects reduced by implementation of mitigation measures.	Potential adverse effects to sensitive species surrounding San Luis Reservoir during construction; effects reduced by implementation of mitigation measures.	Potential adverse effects to sensitive species during construction; effects reduced by implementation of mitigation measures. Long-term operations would generate substantial benefits for Pacheco Creek fisheries including federally threatened SCCC steelhead.
Cultural Resources	No resources identified at treatment plant and all technological retrofits would be made within the existing footprint of the WTP.	Adverse effects from construction on known and potential unknown cultural resources in and around San Luis Reservoir; effects reduced by implementation of mitigation measures.	Adverse effects from construction on known and potential unknown cultural resources in and around San Luis Reservoir; effects reduced by implementation of mitigation measures.	Adverse effects from construction on known and potential unknown cultural resources in and around Pacheco Reservoir site; effects reduced by implementation of mitigation measures.
Noise	Adverse effect from noise to neighboring communities during construction; effects reduced by implementation of mitigation measures.	Adverse effect from noise to recreational users and visitor center during construction; effects reduced by implementation of mitigation measures.	Adverse effect from noise to recreational users and visitor center during construction nearby San Luis Reservoir; effects reduced by implementation of mitigation measures.	Adverse effect from noise and vibration to neighboring communities during construction; effects reduced by implementation of mitigation measures.
Traffic and Transportation	Short-term minor adverse effect from construction-related traffic.	Short-term minor adverse effect from construction-related traffic.	Short-term minor adverse effect from construction-related traffic.	Short-term minor adverse effect from construction-related traffic.
Recreation	No effect on recreation.	Short-term adverse effects from closing two recreation areas during construction; effects reduced by implementation of mitigation measures.	Short-term adverse effects from closing two recreation areas during construction; effects reduced by implementation of mitigation measures.	No effect on recreation.

Resource	Treatment Alternative Plan	Lower San Felipe Intake Alternative Plan	San Luis Reservoir Expansion Alternative Plan	Pacheco Reservoir Expansion Alternative Plan
Hazardous Waste	No effect because water treatment plant does not have any active or inactive remediation sites.	No effect because construction is not near any active or inactive remediation sites.	No effect because construction is not near any active or inactive remediation sites.	No effect because construction is not near any active or inactive remediation sites.
Water Quality	Short-term adverse effect from construction runoff; effect reduced by implementation of mitigation measures.	Short-term adverse effect from construction of pipeline on San Luis Reservoir water quality; short-term effects from construction runoff reduced by implementation of mitigation measures.	Short-term adverse effect from construction at Sisk Dam and Gianelli Intake on San Luis Reservoir water quality; short-term effects from construction runoff reduced by implementation of mitigation measures.	Short-term adverse effect from construction runoff; effect reduced by implementation of mitigation measures.
Greenhouse Gas Emissions	Minor adverse construction generated increase in greenhouse gas production.	Significant adverse construction generated increase in greenhouse gas production; effects reduced by implementation of mitigation measures.	Significant adverse construction generated increase in greenhouse gas production; effects reduced by implementation of mitigation measures.	Significant adverse construction generated increase in greenhouse gas production; effects reduced by implementation of mitigation measures.

Table 5-15. Direct, Indirect, Induced Employment Effects of Construction Expenditures (# jobs)

	Treatment	Lower San Felipe Intake Tunnel	Lower San Felipe Intake Pipeline	San Luis Reservoir Expansion	Pacheco Reservoir Expansion
Construction Duration	3 years	4 years	4 years	8 to 12 years	5 years
Direct Effect	192	3,457	3,196	3,868	6,116
Indirect Effect	41	1,294	1,185	707	1,291
Induced Effect	42	1,027	940	571	1,437
Total Effect	275	5,778	5,322	5,145	8,844

Table 5-16. Direct, Indirect, Induced Output Effects of Construction Expenditures, 2018 $ (million $)

	Treatment	Lower San Felipe Intake Tunnel	Lower San Felipe Intake Pipeline	San Luis Reservoir Expansion	Pacheco Reservoir Expansion
Direct Effect	$29.0	$924.9	$843.5	$466.3	$1,051.4
Indirect Effect	$15.5	$442.2	$275.5	$89.5	$232.8
Induced Effect	$14.5	$234.5	$198.6	$80.3	$257.8
Total Effect	$58.9	$1,601.7	$1,317.7	$636.0	$1,542.1

Annual O&M of the alternatives would have minor regional economic benefits and are not quantified. The RED effects of O&M would be long-term and occur each year during project operation. Direct effects would occur in the water, sewage, and other treatment and delivery systems sector. Some O&M would be pumping costs and would not generate RED effect. There would be minor increases in employment due to O&M; in some instances, existing staff could be able to provide services and new employment would not be generated.

The San Luis Reservoir Expansion Alternative would provide water supplies to agricultural users in the CVP service area in the San Joaquin Valley. The increased surface water supply would likely substitute groundwater pumping. This would increase farm revenues by decreasing input costs but would not increase amount of land in production. There would be minor regional economic impacts related to increase water supplies. The Lower Intake, Treatment, and Pacheco Reservoir Expansion Alternative Plans would decrease agricultural water deliveries by about 1.6 TAF on an average annual basis. These decreases would likely result in increased groundwater pumping and decreased farm revenues. A small amount of acreage may be fallow due to the decreased supply. The regional economic effects would be adverse, but minor.

5.1.4 Other Social Effects

The OSE account measures effects to the social well being of a community from implementing an alternative. This OSE analysis uses a series of criteria to assist in identifying relevant social effects. These criteria take into account social well being factors, including health and safety, economic vitality, social connectedness and identity, social vulnerability, public participation, and leisure and recreation. The OSE evaluation is qualitative and describes potential social effects related to increase water supplies under the alternatives relative to the No Action Alternative. Table 5-17 summarizes OSE evaluation for all alternatives. The alternatives would have similar effects relative to one another. Table 5-17 notes any differences between alternatives for the OSE account.

Table 5-17. OSE Summary

OSE Criteria	Alternative Evaluation
Health and Safety	The alternative plans would increase water supply reliability for SCVWD customers or additional south-of-Delta contractors and reduce potential water shortages, which would improve long-term health and safety. All alternatives would provide social health and safety benefits relative to the No Action Alternative. The San Luis Reservoir Expansion Alternative Plan and the Pacheco Reservoir Expansion Alternative Plan would provide emergency response to natural hazards.
Economic Vitality	Economic vitality relates to employment opportunities, business development, and population growth. The alternatives would provide a local, more reliable water supply for businesses, which would support employment and economic activity. A reliable water supply would also support projected increase in population and long-term economic vitality in Santa Clara County. Water provided for agricultural uses under the San Luis Reservoir Expansion Alternative Plan would also support the agricultural economy in the Central Valley, including jobs.
Social Connectedness and Identity	Social connectedness and identity consider how residents connect to and view their community. The 2012 Quality of Life Survey Report for Santa Clara County, California, revealed that 59 percent of residents feel that they experience a strong sense of community (Santa Clara County 2012b). The alternatives would not affect Santa Clara County residents' view of their community. In Merced County, San Luis Reservoir is one of the top 3 community assets (Merced County 2007). The Lower Intake Alternative Plan and the San Luis Reservoir Expansion Alternative Plan would affect recreation at San Luis Reservoir for 3 or between 8 and 12 years, respectively. Effects could affect Merced County residents' social connectedness with the reservoir.
Social Vulnerability	Social vulnerability refers to the capacity for being adversely affected by hazards or other impacts and disproportionate effects to vulnerable populations in the ability to prepare for and respond to impacts. The alternatives would rely on imported CVP supplies from San Luis Reservoir, which could have reliability issues in case of a natural disaster if infrastructure or conveyance is damaged. Additional water supply under all alternatives could help alleviate effects of climate change, such as extreme heat or increased wildfires. Water supplies would be delivered within all areas and to all customers within a contractor service area; therefore, there would be no disproportionate effects on vulnerable populations.

OSE Criteria	Alternative Evaluation
Leisure and Recreation	The Treatment and Pacheco Reservoir Expansion Alternative Plan would not affect leisure and recreation relative to the No Action Alternative. The Lower San Felipe Intake Alternative Plan and the San Luis Reservoir Expansion Alternative Plan could adversely affect recreation opportunities at San Luis Reservoir in Merced County during the construction period. Two main use areas, Basalt and Dinosaur Point, would be closed to the public because of construction activities.
Participation	Participation means being able to interact with others to influence social outcomes. Reclamation and SCVWD are pursuing this project in an open and transparent process allowing participation by all stakeholder groups. Reclamation and SCVWD have and will provide opportunities for public participation throughout the planning process. All affected stakeholder groups would have the same opportunities to participate in this process. All alternatives would have the same opportunities for participation.

5.2 Alternative Plan Comparison

Consistent with the standards for formulating and evaluating alternatives for planning and water resource-related projects outlined in the P&Gs, the evaluation and comparison of alternatives in this Feasibility Report relies on the federal planning criteria of completeness, effectiveness, acceptability, and efficiency. This evaluation presents the relative performance of the alternatives as they are defined in this stage of the study process. This section further describes the federal criteria and their application in the evaluation and comparison process, and the preliminary results of this comparison.

Figure 5-1 presents the criteria, performance measures, and the rating scales used for the comparison of the alternative plans. Each scale has either three or four levels. To facilitate visual review of a comparison summary, levels are depicted with colors. In all cases, a dark green rating indicates that the alternative would meet the criterion fully and a purple rating indicates that the alternative would not meet the criterion.

5.2.1 Completeness

The completeness criterion addresses whether the alternative would account for all investments or other actions necessary to realize the planned effects. This criterion considers how well the alternative plan would achieve the planning objectives. Three performance measures (Full Spectrum of Objectives, Reliability, and Physical Implementability) were developed for the completeness criterion to characterize the degree to which each alternative would provide for the realization of the SLLPIP's planned effects.

5.2.1.1 Full Spectrum of Objectives

This performance measure indicates each alternative's capacity to satisfy the two primary planning objectives and the secondary objective by the degree to which implementation of each alternative would:

- Predictably meet delivery schedules throughout the year;
- Increase deliveries to more closely match the contractual entitlements; and
- Provide opportunities for ecosystem enhancement.

Screening Criteria		
Planning Criterion	Performance Measures	Rating Scales
Completeness	Full spectrum of objectives	*Fully meets the project objectives*
		Fully meets one project objective, and partially meets the other
		Partially meets the project objectives
	Reliability	*Provides long-term reliability improvements without increasing operations and maintenance*
		Provides long-term reliability improvements with increases to operations and maintenance
		Provides reliability improvements without increasing operations and maintenance
		Provides reliability improvements with increases to operations and maintenance
	Physical implementability	*Requires little new construction*
		Requires new construction with non-complex construction techniques
		Requires new construction with complex construction techniques
Effectiveness	Decreased supply interruptions from the low point issue	*Fully eliminates interruptions*
		Eliminates interruptions
		Partially eliminates interruptions
	Increased delivery quantities at other times	*Provides substantial increase in supply outside of low point events*
		Provides small or moderate increase in supply outside of low point events
		Does not provide additional supply
Acceptability	Biological resource impacts	*Benefits biological resources*
		Creates no impact or temporary or minor, but mitigable, adverse impacts to biological resources
		Creates moderate, but mitigable, impacts to biological resources
		Creates unmitigable impacts to biological resources
	Physical resource impacts	*Benefits physical resources*
		Creates no impact or temporary or minor, but mitigable, adverse impacts to physical resources
		Creates moderate, but mitigable impacts to physical resources
		Creates unmitigable impacts to physical resources
	Social resource impacts	*Benefits social resources*
		Creates no impact or temporary or minor, but mitigable, adverse impacts to social resources
		Creates moderate, but mitigable, impacts to social resources
		Creates unmitigable impacts to social resources
Efficiency	Net benefit	*Has a benefit-cost ratio greater than 1*
		Has a benefit-cost ratio between 0.1 and 1
		Has a benefit-cost ratio below 0.1

Figure 5-1. Screening Criteria

The rating scales correspond to the number of study objectives that the alternative would meet, and to what extent those objectives would be met. An alternative scoring a dark green rating would fully satisfy the three objectives. Alternatives scoring light green would fully satisfy at least one of the objectives and an alternative scoring a yellow ranking would only partially satisfy the two study objectives. Table 5-18 shows the rating for each alternative with a brief explanation.

Table 5-18. Alternative Ratings for Meeting the Project Objectives

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Light Green	Lowering the San Felipe Intake would reduce low point related water supply delivery interruptions to SCVWD by avoiding the summer algae blooms. Results show that the Lower San Felipe Intake Alternative Plan would fully replace interrupted M&I supply in all low point years. However, the San Felipe Intake Alternatives would not fully meet project objectives as it does not provide opportunities for ecosystem enhancement.
	Tunnel	Light Green	
Treatment		Light Green	Modifications to the Santa Teresa WTP to address the negative impacts associated with increased algae during low points would prevent supply interruptions during low point events. Results show that the Treatment Alternative Plan would fully replace interrupted M&I supply in all low point years. However, the Treatment Alternative would not fully meet project objectives as it does not provide opportunities for ecosystem enhancement.
San Luis Reservoir Expansion		Light Green	The San Luis Reservoir Expansion Alternative would increase storage in San Luis Reservoir and provide some additional delivery of CVP supplies to SCVWD during low point years. However, the San Luis Reservoir Expansion Alternative would not fully meet project objectives as it does not provide opportunities for ecosystem enhancement.
Pacheco Reservoir Expansion		Dark Green	The expanded reservoir would increase SCVWD's ability to fully utilize CVP allocations, with largest increases in dry and critical years, and would develop new local water supplies from Pacheco Creek watershed. Results show that the Pacheco Reservoir Expansion Alternative Plan would fully replace interrupted M&I supply in all but three low point years. The Pacheco Reservoir Expansion Alternative Plan would also provide ecosystem benefits on Pacheco Creek downstream of the new dam and via Level 4 refuge water supply deliveries.

5.2.1.2 Reliability

This performance measure indicates each alternative's capacity to provide long term water supply reliability improvements and also considers the degree to which they generate new O&M responsibilities for the study partners.

An alternative scoring a dark green rating would provide long-term reliability improvements without substantially increasing O&M requirements. Alternatives scoring light green would provide long-term reliability improvements with notable increases to O&M requirements and an alternative scoring yellow would provide short-term reliability improvements with notable increases in O&M requirements. An alternative scoring a purple ranking would not increase water supply reliability. Table 5-19 shows the rating for each alternative with a brief explanation. All the alternatives are designed to provide water supply reliability to SCVWD.

Table 5-19. Alternative Ratings for Providing Reliability Benefits

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Dark Green	Lowering the San Felipe Intake would provide SCVWD improved water supply reliability and would not generate a major increase in operations and maintenance responsibilities because of the new infrastructure's direct interface with the existing system. These improvements would also be resilient to any increases in low point occurrence potentially generated by future climate change given the new intake's capacity to avoid algae related water quality issues when the reservoir exercised below low point.
	Tunnel	Dark Green	
Treatment		Light Green	Under this alternative, improved SCVWD water supply reliability would occur through modifications at the Santa Teresa WTP. These modifications and improvements would increase operations and maintenance responsibilities for plant operators. These improvements would also be resilient to any increases in low point occurrence potentially generated by future climate change given the upgraded treatment plant's capacity to address algae related water quality issues when the reservoir exercised below low point.
San Luis Reservoir Expansion		Light Green	Under this alternative, improved CVP water supply reliability would occur through increases in storage at San Luis Reservoir. The alternative would generate increases in operational expenses from increased pumping power demands to fill a larger San Luis Reservoir. In some years, water supply benefits generated by an expanded San Luis Reservoir are forecast to increase slightly under the future climate change scenarios by providing increased capacity to store winter runoff.
Pacheco Reservoir Expansion		Dark Green	Under this alternative, improved SCVWD water supply reliability would occur through increases in storage at Pacheco Reservoir. The alternative would generate small increases in operational expenses from increased pumping power demands to pump water to Pacheco Reservoir. In some years, water supply benefits generated by Pacheco Reservoir are forecast to increase slightly under the future climate change scenarios by providing increased capacity to store winter runoff.

5.2.1.3 Physical Implementability

This performance measure indicates the relative complexity associated with designing and constructing each alternative.

The rating scales correspond to the amount of new construction that would be required and the relative complexity of necessary design and construction. An alternative scoring a dark green rating would require little new construction and would instead rely on changes in the operations of existing facilities. Alternatives that score light green would require new construction with non-complex design and construction techniques. Alternatives scoring a purple rating would require new construction with complex design and construction techniques. For the purpose of this evaluation, non-complex design and construction techniques were considered to be those that would use proven technologies and approaches for which there is a proven track record at the scale proposed by each alternative. Table 5-20 shows the rating for each alternative with a brief explanation.

Table 5-20. Alternative Ratings for Physical Implementability

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Light Green	Lowering the San Felipe Intake would require new construction to extend and lower the existing San Felipe Division Intake in San Luis Reservoir. The design and construction approaches that would be used are well proven at the scale proposed for this alternative.
	Tunnel	Light Green	
Treatment		Dark Green	The Treatment Alternative Plan would construct modifications and improvements at the WTP. The design and construction approaches that would be used are well proven at the scale proposed for this alternative.
San Luis Reservoir Expansion		Light Green	The San Luis Reservoir Expansion Alternative Plan would require substantial construction; however, the majority of construction effort would occur under the dam safety action and the reservoir expansion would be an incremental effort using the same equipment and construction methods.
Pacheco Reservoir Expansion		Light Green	An expanded reservoir would require substantial construction for new facilities; however, the actions would be similar to the dam safety and San Luis Reservoir Expansion Alternative construction actions.

5.2.2 Effectiveness

The effectiveness criterion addresses how well an alternative would alleviate problems and achieve opportunities. Four performance measures were developed for this criterion to compare the extent to which each alternative satisfies this criterion.

5.2.2.1 Decreased Supply Interruptions from the Low Point Problem

This performance measure indicates each alternative's capacity to prevent San Luis Reservoir summer algae blooms which limits SCVWD's ability to treat

CVP supplies. The rating scales examine whether the alternatives would fully address future low point supply interruptions by avoiding summer algae blooms. An alternative scoring a dark green rating would fully eliminate water supply interruptions and alternatives scoring light green would eliminate most water supply interruptions. An alternative scoring a purple rating would only partially eliminate water supply interruptions, leaving a substantial amount of unmet demand during low point events. Table 5-21 shows the rating for each alternative with a brief explanation.

5.2.2.2 Increased Delivery Quantities at Other Times

This performance measure indicates each alternative's capacity to increase water supplies to SCVWD and other CVP or SWP contractors during non-low point events and during an emergency, such as a Delta outage. The rating scales examine to what degree the alternatives could provide secondary benefits by increasing supplies when the low point problem is not a concern. An alternative scoring a dark green rating would provide substantial supply and storage increases to SCVWD and/or other CVP or SWP contractors in addition to addressing the low point concerns. Alternatives scoring light green would provide low to moderate supply increases, and an alternative scoring yellow would provide no additional deliveries. There is no purple rating for this criterion because this is an added benefit for some alternatives, but it is not a required benefit to meet the project objectives. Table 5-22 shows the rating for each alternative with a brief explanation.

Table 5-21. Alternative Ratings for San Felipe Division Supply Interruptions

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Dark Green	Results show that the Lower Intake Alternative Plan would fully replace interrupted M&I supply in all low point years.
	Tunnel	Dark Green	
Treatment		Dark Green	Results show that the Treatment Alternative Plan would fully replace interrupted M&I supply in all low point years.
San Luis Reservoir Expansion		Yellow	Results show that the San Luis Reservoir Expansion Alternative Plan would deliver additional water supplies during some low point years but would not in any year fully address the low point generated water supply shortages.
Pacheco Reservoir Expansion		Dark Green	Results show that the Pacheco Reservoir Expansion Alternative Plan would replace interrupted M&I supply in all but three low point years where it is able to deliver most of the interrupted supply.

Table 5-22. Alternative Ratings for Increased Delivery Quantities to SCVWD and other CVP and SWP contractors during Non-Low Point Period and Emergency Response Supplies

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Light Green	Lowering the San Felipe Intake would allow for the full exercise of San Luis Reservoir without triggering water quality concerns for SCVWD, and would allow small increases in deliveries at in response to emergency outages.
	Tunnel	Light Green	
Treatment		Light Green	The Treatment Alternative Plan would allow for the full exercise of San Luis Reservoir without triggering water quality concerns for SCVWD, and would allow small increases in deliveries at in response to emergency outages.
San Luis Reservoir Expansion		Dark Green	The San Luis Reservoir Expansion Alternative Plan would increase water supply to south-of-Delta CVP contractors. This alternative would provide emergency response storage in San Luis Reservoir for south-of-Delta contractors.
Pacheco Reservoir Expansion		Dark Green	This alternative would not increase deliveries to south-of-Delta contractors but would provide access to substantial emergency response surface and groundwater storage for SCVWD. Storage within Pacheco Reservoir is not specifically reserved for emergency response purposes.

5.2.3 Acceptability

The acceptability criterion addresses the viability of an alternative with respect to acceptance by State and local entities and compatibility with existing laws. The performance measures for the acceptability criterion focus on potential environmental effects, which are further described in the accompanying EIS/EIR that satisfies CEQA and NEPA. The performance measures for this criterion consider the alternatives' potential environmental impacts to biological, physical, and social resources in the study area.

The acceptability planning criterion has three performance measures: impacts to biological resources, impacts to physical resources, and impacts to social resources. The rating scales measure the severity of these impacts and whether they are mitigable. An alternative scoring a dark green rating would be expected to provide benefits related to the resource. An alternative scoring a light green rating would create no impact or would create temporary or minor mitigable impacts. An alternative scoring a yellow rating would create a moderate but mitigable impact, and an alternative scoring a purple rating would create unmitigable impacts. Table 5-23 shows the rating for each alternative with a brief explanation.

Table 5-23. Alternative Ratings for Acceptability

Alternative Plan	Layout	Biological Impacts[1]	Physical Impacts[2]	Social Impacts[3]	Explanation
Lower San Felipe Intake	Pipeline	Yellow	Yellow	Purple	Dredging to extend and lower the San Felipe Intake would have temporary construction generated effects on aquatic species in the reservoir and terrestrial species near the reservoir, and could impact affect air quality, water quality, recreation, and noise conditions. Water quality impacts under the pipeline would likely be larger than the tunnel option due to the disturbance and introduction of sediments in the water column that would be isolated to the area in the reservoir immediately around the disturbance. Air quality impacts would also likely be greater than the tunnel due to the use of multiple on reservoir barges. Recreation impacts would be significant and unavoidable because of the closure of the facilities. Mitigation would also be implemented to address adverse impacts to cultural resources.
	Tunnel	Light Green	Light Green	Purple	Tunneling to construct a new intake would have temporary noise, air quality, recreation, and traffic effects. Recreation impacts would be significant and unavoidable because of the closure of the facilities. Similar to the Pipeline Option, water quality impacts, such as increase in turbidity, could occur.
Treatment		Light Green	Light Green	Light Green	The Treatment Alternative Plan would increase the SCVWD WTP's ability to treat CVP water from San Luis Reservoir during low point events when high algae levels have historically made the water untreatable with existing infrastructure. Construction of the new water treatment facilities would generate short-term mitigable air quality, noise, and traffic impacts and operation of the new facilities would slightly increase the amount of treatment media that would be needed to be disposed of in local landfills.
San Luis Reservoir Expansion		Yellow	Purple	Purple	Construction of the San Luis Reservoir Expansion Alternative Plan would have significant and unavoidable impacts to visual resources, noise and recreation. Significant impacts to terrestrial resources, water quality, air quality, climate change, and traffic could be mitigated to a less than significant level, and mitigation would also be implemented to address adverse impacts to cultural resources.

Alternative Plan	Layout	Biological Impacts[1]	Physical Impacts[2]	Social Impacts[3]	Explanation
Pacheco Reservoir Expansion		Yellow	Purple	Yellow	Construction of the Pacheco Reservoir Expansion Alternative Plan would have significant and unavoidable impacts to air quality and noise. Significant impacts to terrestrial resources, water quality, climate change, and traffic could be mitigated to a less than significant level, and mitigation would also be implemented to address adverse impacts to cultural resources. Operation of the expanded Pacheco Reservoir would generate substantial long-term benefits in habitat quality for the federally threatened SCCC steelhead on Pacheco Creek downstream of the new dam with increased flows in periods when the creek is often dry under existing conditions, increased flood control with reductions in flood flows, and improved groundwater recharge along Pacheco Creek benefiting the underlying aquifer relied on by agricultural water users. The introduction of Delta water into Pacheco Creek and the Pajaro River Watershed downstream has the potential to introduce invasive aquatic species not currently present into Pacheco Creek or the Pajaro River, and potentially impact the imprinting behavior of steelhead. However, introductions of Delta species that are adapted to tidally-influenced, large river channels and sloughs may not be able to successfully colonize the small, coastal river systems of Pacheco Creek or Pajaro River, limiting the impact of Delta water introductions. Similarly, the potential impact to steelhead imprinting is anticipated to be limited given that the reservoir primarily filled with natural inflows from the Pacheco Creek Watershed, with CVP inputs only occurring in years when there is excess there is excess CVP allocation that SCVWD would otherwise be unable to use or place in local storage. As was noted above the changes in creek flows downstream of the expanded reservoir are anticipated to substantially benefit habitat quality and outweigh the limited potential for adverse impacts from the introduction of Delta water to the watershed

Notes:

[1] Biological Resources include aquatic and terrestrial resources.

[2] Physical Resources include geology and soils, land use, water quality, groundwater, air quality, noise, climate change, and visual resources

[3] Social Resources include cultural resources, socioeconomics, hazardous materials, traffic, and recreation.

5.2.4 Efficiency

The efficiency criterion addresses how well an alternative would deliver economic benefits from a project cost standpoint, in comparison to the performance measures associated with the completeness and effectiveness criteria, which address each alternative's benefits qualitatively. The performance measure for the efficiency criterion is defined as the alternatives' net benefits.

5.2.4.1 Net Benefits

This performance measure compares each alternative's benefits to its costs to quantify the efficiency of each alternative at securing benefits. An alternative scoring a dark green rating would provide net benefits based on preliminary benefit and cost estimates, resulting in a benefit-cost ratio over 1. Alternatives scoring a yellow rating would generate benefit values that may be nearly equal to, but lower than costs, resulting in a benefit-cost ratio between 1 and 0.1. Alternatives receiving a purple rating have a benefit-cost ratio of less than 0.1.

Table 5-24 shows the rating for each alternative with a brief explanation. The Pacheco Reservoir Expansion Alternative Plan is the only alternative with net benefits.

Table 5-24. Alternative Ratings for Efficiency

Alternative Plan	Layout	Rating	Explanation
Lower San Felipe Intake	Pipeline	Yellow	The Lower San Felipe Intake Alternative pipeline option would generate the same water supply benefit to SCVWD as the tunnel option. Both options, however, have significant net costs and a benefit-cost ratio of 0.1.
	Tunnel	Yellow	
Treatment		Yellow	Construction costs are estimated to be the least expensive compared with the other alternatives. The Treatment Alternative has annualized net costs are $1.4 million and the benefit-cost ratio is 0.7.
San Luis Reservoir Expansion		Yellow	The San Luis Reservoir Expansion Alternative Plan has net costs of $11.0 million and a benefit-cost ratio of 0.4.
Pacheco Reservoir Expansion		Green	The Pacheco Reservoir Expansion Alternative Plan has the highest construction costs of all alternatives. The alternative is also the only alternative to have net benefits. The resulting annualized benefits would be $9.2 million and a benefit cost ratio of 1.2.

5.3 Summary of Comparisons

Figure 5-2 shows a summary of the alternative plan evaluation and comparison. Potential issues associated with each alternative will require further investigation as the study proceeds.

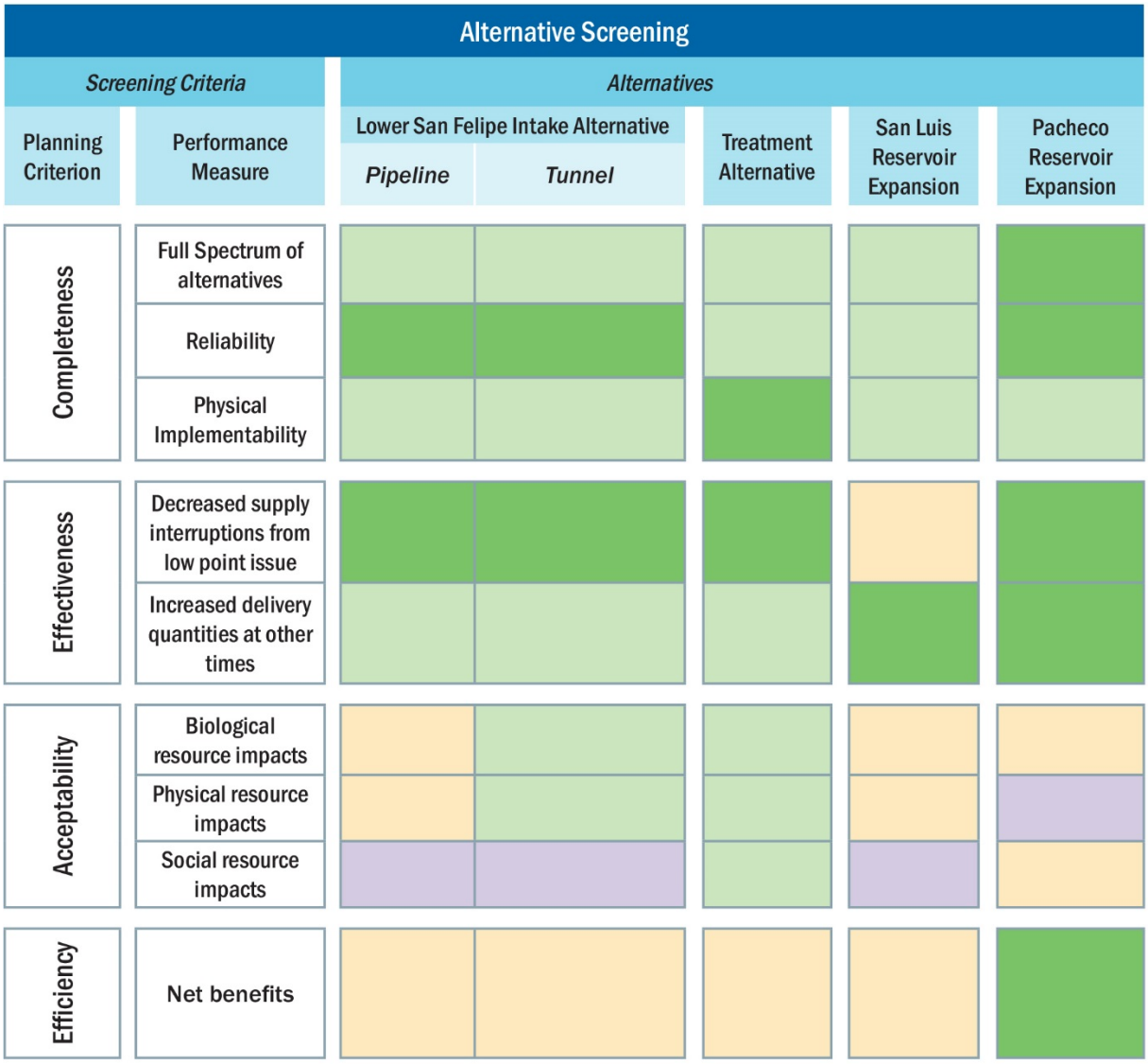

Figure 5-2. Alternative Plan Screening

5.4 Consistency of Alternative Plans with Other Programs

Alternative plans were evaluated on their consistency with the overall goals and objectives of the CALFED Programmatic ROD. CALFED, a coordinated Federal and State program, was established after the Bay-Delta Accord to address water supply reliability, conveyance, water quality, ecosystem quality, and Delta levee system integrity. CALFED provides a programmatic framework to develop and implement a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system.

The SLLPIP began when the August 2000 CALFED Bay-Delta Program's Programmatic ROD included the SLLPIP as a complementary conveyance action. The CALFED Bay-Delta Program (CALFED 2000) developed the following program goal for conveyance actions:

- Identify and implement conveyance modifications that will improve water supply reliability for in-Delta and export users, support continuous improvement in drinking water quality, and complement ecosystem restoration. More specifically for export and environmental purposes, conveyance improvements are needed to improve the pumping capabilities of SWP export facilities to: (1) restore water project reliability and operational flexibility; (2) allow the environmental acquisition programs to transfer and store water; (3) allow a reliable water transfer market to function; (4) allow SWP facilities to convey larger amounts of water during periods of high quality water in the Delta to improve water quality for urban use; and (5) provide greater capability for SWP facilities to be used to improve the reliability of CVP supplies for both its water users and wildlife refuges.

The alternative plans could potentially contribute towards this goal by:

- Restoring Water Project Reliability and Operational Flexibility – All of the alternative plans evaluated in this Feasibility Report provide improvements to water supply reliability for the SCVWD by helping to address the low point problem. The Lower San Felipe Intake, Treatment, Pacheco Reservoir Expansion alternative plans fully avoid the low point problem. The San Luis Reservoir Expansion Alternative Plan would create new storage capacity in San Luis Reservoir to capture surplus flows and improve water supply reliability for south-of-Delta CVP contractors. The Pacheco Reservoir Expansion Alternative Plan would develop a local water supply for SCVWD, provide emergency water supply, provide ecosystem benefits to Pacheco Creek, and provide water to wildlife refuges in the CVP service area.

Table 5-25 qualitatively compares anticipated contributions of the individual alternative plans relative to the CALFED conveyance goal.

Table 5-25. Comparison of Alternative Plans Relative to CALFED Goal

Alternative Plan	Lower San Felipe Intake	Treatment	San Luis Reservoir Expansion	Pacheco Reservoir Expansion
CALFED Bay-Delta Program Goals[1]				
Conveyance: Identify and implement conveyance modifications that will improve water supply reliability for in-Delta and export users, support continuous improvement in drinking water quality, and complement ecosystem restoration	+	+	+	+

Notes:
[1] *Source: CALFED Bay-Delta Program Programmatic Record of Decision (CALFED 2000)*
Key:
+ = net positive effect (benefit)
0 = no anticipated effect
CALFED = CALFED Bay-Delta Program

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Chapter 6
Preliminary NED Plan

This chapter further describes the Pacheco Reservoir Expansion Alternative Plan as the preliminary NED Plan. Pursuant to Reclamation Directives and Standards (FAC 09-03), Reclamation has provided appraisal level cost estimates as a resource for use in discussions among interested parties evaluating specific alternatives. Presentation of this estimate does not in and of itself imply Reclamation's support for moving forward with the effort. Where appropriate, Reclamation will articulate support for further action in a report containing recommendations to the Secretary of the Interior and Congress.

6.1 Description of the Preliminary NED Plan

Based on the preliminary plan evaluation and comparison in Chapter 5, the Pacheco Reservoir Expansion Alternative Plan has the greatest total net benefits and is the preliminary NED Plan.

6.1.1 Major Components

The Pacheco Reservoir Expansion Alternative Plan includes removal of the existing dam and construction and operation of a new dam and reservoir, pump station, conveyance facilities, and related miscellaneous infrastructure. Table 6-1 list features of major components of the Pacheco Reservoir Expansion Alternative Plan. The plan is developed to an appraisal level design.

Table 6-1. Physical Features of Major Expanded Pacheco Reservoir Components

Component	Physical Features
New Dam and Reservoir	
Total Storage Volume	141.6 TAF
Active Storage Volume	140.8 TAF
Surface Area at Full Pool	1,385 acres
Dam Crest Elevation	719 feet msl
Full Pool Elevation	694 feet msl
Dead Pool Elevation	450 feet msl
Embankment Height	319 feet
Dam Crest Length	2,212 feet
Dam Embankment Volume	12,475,688 cy

Component	Physical Features
New Pump Station	
Pump Station Capacity	490 cfs
Pump Station Lift	170 feet
Pump Station Total Horsepower	13,750 hp
Number of Pumps	11
Pipeline/Tunnels	
Diameter	108 inches
Length	4,700 feet
Pacheco Pumping Plant New Regulating Tank	
Capacity	3 million gallons
Diameter	150 feet
Hydraulic Head at Conduit Connection	610 feet
Access Improvements	
40-feet wide permanent roads	2.7 miles
25-feet wide temporary access road to spillway	1.2 miles
25-feet wide temporary haul road to borrow sites	5.7 miles
Electrical transmission line	16 miles

Key:
cfs = cubic feet per second
cy = cubic yard
hp = horsepower
msl = mean sea level
TAF = thousand acre feet

6.1.2 Operations

The expanded Pacheco Reservoir would be primarily filled using natural inflows from the North and East Forks of Pacheco Creek. These inflows are typically realized from December through March. Supplemental flows to the expanded reservoir would arrive from SCVWD's share of contracted CVP Delta export water from San Luis Reservoir. The deliveries would include allocated CVP water supplies that otherwise could not be delivered to or stored by SCVWD. CVP water would be pumped from the Pacheco Conduit up to the expanded Pacheco Reservoir earlier in the year prior to the summer months when the San Luis Reservoir is typically drawn down to the 300 TAF level. The rate at which these transfers are made between San Luis Reservoir and Pacheco Reservoir would depend upon water rights, supply allocations, water demands, availability of other water supplies, and conveyance limitations of Pacheco Conduit[1]. Conveyance and storage of these CVP supplies is anticipated to occur primarily in wet years. CVP water stored in Pacheco Reservoir could then be released through the summer while supplies from San Luis Reservoir would be inaccessible to SCVWD. The expanded Pacheco Reservoir could also limit the frequency of and impact from harmful cyanobacteria blooms that occur in the existing Pacheco Reservoir. Under existing conditions, cyanobacteria blooms can occur during low water levels during the fall that are toxic to fish downstream (Smith 2007). Increased

[1] Storage of water in Pacheco Reservoir previously diverted from the Delta and stored in San Luis Reservoir under the existing CVP water right would require the addition of a point of re-diversion to permit.

reservoir storage capacity and water releases downstream in Pacheco Creek may limit the presence of cyanobacteria blooms or dilute their impact. The import of CVP supplies from San Luis Reservoir is not anticipated to further contribute to these algae conditions given small proportion of these supplies in comparison to the natural inflow to the reservoir.

The Pacheco Reservoir Alternative Plan would be operated by SCVWD to improve habitat conditions for steelhead in Pacheco Creek, improve SCVWD water supply reliability, including during drought periods and emergencies, and meet the groundwater recharge objectives of PPWD. Average monthly target flows ranging from 10 to 30 cfs in Pacheco Creek would support the biological needs of SCCC steelhead, which are listed as threatened under the Federal ESA, for higher flows for outmigration. The average monthly release targets are shown in Table 6-2[2]. During heavy precipitation events, releases from the expanded reservoir will be reduced to minimize flooding risks along Pacheco Creek and the Pajaro River. The winter releases indicated in Table 6-2 could be reduced if South Fork Pacheco Creek flows fully meet steelhead habitat needs.

To ensure that flows and water temperatures in Pacheco Creek are maintained in consecutive dry years, releases to Pacheco Conduit—to meet SCVWD water demands—would be discontinued in the event that reservoir storage volumes fall below 55,000 AF. This flow regime may however be altered in the event of an emergency declaration by SCVWD for health and safety purposes. Habitat flows would be secured by operations requirements expected in the ESA biological opinion(s) that would be required for the expanded Pacheco Reservoir, as well as the contract by and between DWR and SCVWD for the provision of grant funding through the WSIP, and in a potential future integrated operations agreement by and between Reclamation and SCVWD for Pacheco Reservoir.

Table 6-2. Average Monthly Release Targets to Pacheco Creek from Expanded Pacheco Reservoir

Month	Average Monthly Release Targets to Pacheco Creek (cfs)[1]	Inflow into Pacheco Reservoir Needed to Discontinue Releases under With-Project Operation (cfs)
January	10	11.2
February	10	11.2
March	20	22.4
April	20	22.4
May	12	13.4
June	13	NA

[2] The average monthly release targets shown in Table 6-2 incorporate the biological needs of the SCCC steelhead and include a 15-day pulse flow of 30 cfs, followed by a 15-day release schedule of 10 cfs. This pulse flow is anticipated to occur in March and April for outmigration.

Month	Average Monthly Release Targets to Pacheco Creek (cfs)[1]	Inflow into Pacheco Reservoir Needed to Discontinue Releases under With-Project Operation (cfs)
July	14	NA
August	14	NA
September	14	NA
October	14	NA
November	10	11.2
December	10	11.2

Notes:
[1] Releases from Pacheco Reservoir are reduced during high flows in the south fork of Pacheco Creek.
Key:
CFS = cubic feet per second

In addition, SCVWD would transfer 2,000 AF of its CVP water contract allocation (in below normal water years), directly or through transfer and exchanges, in perpetuity to Reclamation's RWSP, for IL4 water supply to wildlife refuges. This long-term voluntary reallocation of CVP yield by SCVWD would be secured by an agreement between the USFWS and SCVWD detailing its operation, a contract between and DWR and SCVWD for the provision of grant funding through the WSIP that would require the provision of these supplies in perpetuity, and an integrated operations agreement between Reclamation and SCVWD for Pacheco Reservoir that would include the requirements for this transfer.

6.1.3 Potential Benefits

The following are the benefits of the Pacheco Reservoir Expansion Alternative Plan.

- Groundwater Recharge and M&I Water Supply: The Pacheco Reservoir Expansion Alternative Plan would provide additional groundwater recharge to aquifers fed by Pacheco Creek, thereby benefiting agricultural customers of two Project partners, SBCWD and PPWD. It would also improve SCVWD M&I water supplies through an increased ability to fully utilize CVP allocations, and through development of local water supplies from the Pacheco Creek watershed. The expanded reservoir would be integrated into regional system operations and the partners' water supply portfolios.

- Emergency Response: The Pacheco Reservoir Expansion Alternative Plan would be operated to provide water supplies to SCVWD M&I water users during emergencies. If a supply interruption poses an imminent risk to essential public health and safety, SCVWD may proceed with an emergency drawdown of Pacheco Reservoir below 55,000 acre-feet to meet M&I water demands. Such emergency circumstances could include Delta export outages, imported water

conveyance outages, regional infrastructure failures, or extended drought periods when waters supplies are required to meet essential health and safety needs for drinking, hygiene, sanitation, fire protection and/or to avoid permanent land subsidence due to groundwater depletion.

- Ecosystem Enhancement – Pacheco Creek: The Pacheco Reservoir Expansion Alternative Plan would be operated to improve habitat conditions for federally threatened SCCC steelhead in Pacheco Creek. These operations include year-round releases to Pacheco Creek, targeting average monthly creek flows ranging from 10 cfs to 30 cfs, depending on steelhead life stage requirements. To ensure that flows and water temperatures in Pacheco Creek are maintained in consecutive dry years, releases to Pacheco Conduit—to meet M&I and agricultural water demands—would be discontinued in the event that reservoir storage volumes fall below 55,000 acre-feet.

- Central Valley Ecosystem Enhancement San Joaquin River Watershed: Through capture of equivalent local water supplies from the North Fork Pacheco Creek to meet SCVWD needs, the Pacheco Reservoir Expansion Alternative Plan would provide 2,000 acre-feet in below normal years for IL4 refuge water supply. More specifically, the alternative plan would allow SCVWD to provide 2,000 acre-feet of firm water supplies (in below normal water years) to the RWSP. The supply resources for allocation to the IL4 refuge water supply would be provided through transfer of SCVWD's CVP long-term water supply contract supplies, or through transfer or exchanges with other water districts. Delivering water through transfer or exchange afforded by SCVWD is intended to assist the RWSP address IL4 supply obligations at refuges with constrained surface water delivery infrastructure.

- Flood Control: The Pacheco Reservoir Expansion Alternative Plan does not specifically dedicate flood space in the expanded reservoir. However, the reservoir would provide flood control benefits, including to disadvantages communities, by reducing flows in Pacheco Creek and downstream waterways during flood events through incidental available storage and proposed project facility design (i.e., spillway configuration).

- M&I Water Quality: During the summer, high temperatures and declining water levels create conditions that foster algae growth in San Luis Reservoir. Treated CVP water in these periods has significant taste and odor problems for SCVWD customers and generates numerous complaints to SCVWD. During such periods, the expanded reservoir would be operated to avoid delivery of CVP water supplies when San Luis Reservoir levels are low. This would be accomplished by taking delivery of SCVWD supplies earlier or later in the season, storing these

supplies in the expanded Pacheco Reservoir and using additional local supplies developed through the expanded reservoir.

6.1.4 Economic Benefits Summary

The Pacheco Reservoir Expansion Alternative Plan would provide the following economic benefits. Benefits were estimated under 2030 conditions.

- M&I Water Supply: The reservoir would improve M&I water supply reliability for SCVWD. The benefits associated with improved M&I water supply reliability were quantified using an alternative cost approach estimating the total cost associated with purchasing water on the spot market from willing sellers. The annual M&I water supply reliability benefits were estimated to be $2.1 million.

- Emergency Water Storage: Emergency storage benefits are increased supplies stored surface reservoirs and underlying groundwater basins that can be delivered in the event of a major levee failure in the Delta that would significantly degrade water quality, or a major earthquake that would disrupt the ability of SCVWD to import water into their service area. Benefits associated with emergency water supplies were estimated using willingness to pay approach to avoid interruptions in water deliveries. Willingness to pay was estimated by applying a short-run price elasticity to a constant elasticity demand function calibrated to observed price and quantity information from Santa Clara County water providers. A probability of a Delta outage was applied to the calculated willingness to pay value. The annual value of emergency water supply benefits was estimated at $23.7 million.

- Ecosystem Improvement on Pacheco Creek: The expanded reservoir would contribute to improved anadromous fish (SCCC steelhead) habitat by altering seasonal water flows and temperatures in the Pacheco Creek downstream from new Pacheco Dam. To quantify the monetary benefits, capital cost estimates were developed for a 96,000 acre-foot single purpose reservoir. The annualized costs for the 96,000 acre-foot reservoirs represent the alternative cost for 2030 future conditions and the average annual net monetary benefits for ecosystem improvement on Pacheco Creek under 2030 future conditions. The annualized benefits were estimated to be $24.0 million.

- Ecosystem Improvement to San Joaquin Valley Refuges: The expanded reservoir would increase deliveries of Incremental Level 4 water supplies to Reclamation's RWSP. The Pacheco Reservoir Expansion Alternative Plan would transfer 2,000 AF of SCVWD's CVP water supply, during below normal water years, to the Incremental Level 4 Refuge Water Supply Pool. The quantification of refuge water supply benefits considers the estimated short-term water market purchase price

as the most likely alternative in the absence of firm water supply from Pacheco Reservoir. The estimated annual benefits are approximately $0.2 million.

6.1.5 Implementation Schedule

The environmental compliance, design, permitting, land acquisition, and financial and institutional arrangements are anticipated to be completed in 2023. Construction is anticipated to take approximately five years from 2024 to 2028 with commissioning of system completed in late 2028. Miscellaneous improvements, such as road repairs, would continue through 2029.

6.1.6 Initial Cost Allocation

The objective of cost allocations is to equitably distribute the costs of a multipurpose project among the purposes served. Reclamation law and policy require an allocation of costs to project purposes to test financial feasibility of reimbursable purposes and establish and measure compliance with project financial requirements. Basic steps of cost allocation include the following: (1) allocating costs to project purposes, (2) assigning reimbursable and nonreimbursable costs for each identified project purpose, (3) identifying potential project beneficiaries, and (4) determining project beneficiaries' potential ability to pay their allocated and assigned costs, including capital and long-term operations, maintenance, and replacement (OM&R) costs. This process informs the Federal decision maker of the appropriateness of the investment in individual components and the overall project. Appendix G further describes the initial cost allocation.

6.1.6.1 Allocating Costs to Project Purposes

Reclamation law and policy require an initial and final allocation of costs to project purposes. The initial allocation of costs is conducted to test financial feasibility of reimbursable costs during the planning phase, by comparing estimated project costs with anticipated benefits. When construction of the project is determined to be substantially complete, the final allocation of costs is conducted to determine actual reimbursable and nonreimbursable costs and is the basis for assignment of costs to beneficiaries.

The primary purpose of cost allocation is to determine the assignment of costs to beneficiaries for repayment. As reimbursement requirements differ by law among the purposes served by a project, a systematic and impartial cost allocation process is required to determine and allocate those costs that are clearly attributable to a single purpose, and to equitably allocate the remaining joint costs serving two or more purposes. Costs to be allocated include construction costs, interest during construction, annual O&M costs, and replacement costs.

Table 6-3 provides the estimated costs to be allocated for the Pacheco Reservoir Expansion Alternative Plan.

Table 6-3. Pacheco Reservoir Expansion Alternative Plan Preliminary Costs to be Allocated (million $)

	Cost
Capital Cost	
Construction Cost	$1,127.0
Interest During Construction (IDC)	$84.8
Total Capital	$1,211.8
Annual Cost	
Interest & Amortization	$34.4
OM&R	$5.4
Total Annual	$39.9

The Alternative Justifiable Expenditure method is a modified separable costs remaining benefits (SCRB) method used in situations when derivation of the separable costs is not feasible. Cost allocation under the Alternative Justifiable Expenditure method is the same as under the SCRB method, except that specific costs (i.e., costs for project components that contribute to a single purpose and exclude the costs of a change in project design due to inclusion) replace separable costs. The remaining (joint) costs are apportioned among project purposes based on their total benefits. However, if no specific or separable costs can be identified, cost allocation can be directly carried out based on the distribution of benefits between project purposes. This method was applied to the Pacheco Reservoir Expansion Alternative Plan.

Table 6-4 displays a step-by-step process for determining the construction cost to be allocated to each project purpose. The initial allocation assumes that the estimated benefits would be less than the single purpose alternative costs; therefore, the benefits would be the justifiable expenditure. At this time, the single purpose alternative costs have not been estimated for this preliminary cost allocation. Further, the allocation assumes that all costs are joint costs and there are not specific costs. This will be revisited in subsequent drafts, but at this time, specific costs for each purpose are not estimated.

Table 6-4. Initial Total Cost Allocation Summary for the Pacheco Reservoir Expansion Alternative Plan ($ millions)

	Emergency Water Storage	M&I Water Supply	Ecosystem Improvement on Pacheco Creek	Refuge Water Supply	Total
Item					
Annual Costs to be allocated	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$39.9**
Total Construction Costs	$0.0	$0.0	$0.0	$0.0	$1,127.0
Total IDC	$0.0	$0.0	$0.0	$0.0	$84.8
Amortization of Construction and IDC (annual)	$0.0	$0.0	$0.0	$0.0	$34.4
Annual OM&R	$0.0	$0.0	$0.0	$0.0	$5.4
Average Annual Benefits[1]	$23.7	$2.1	$24.0	$0.2	$50.0
Justifiable Expenditure	**$23.7**	**$2.1**	**$23.0**	**$0.2**	**$49.0**
Specific Costs[2]	$0.0	$0.0	$0.0	$0.0	$0.0
Construction Costs	$0.0	$0.0	$0.0	$0.0	$0.0
IDC	$0.0	$0.0	$0.0	$0.0	$0.0
Average Annual OM&R	$0.0	$0.0	$0.0	$0.0	$0.0
Remaining Justifiable Expenditure[3]	$23.7	$2.1	$23.0	$0.2	$49.0
Percent Distribution[4]	48.4%	4.3%	46.9%	0.4%	100.0%
Remaining Joint Costs (annual)	**$18.9**	**$1.7**	**$19.1**	**$0.2**	**$39.9**
Construction Costs	$534.5	$47.2	$540.8	$4.5	$1,127.0
IDC	$40.2	$3.6	$40.7	$0.3	$84.8
Average Annual OM&R	$2.6	$0.2	$2.6	$0.0	$5.4
Total Allocation (annual)	**$18.9**	**$1.7**	**$19.1**	**$0.2**	**$39.9**
Construction Costs	$534.5	$47.2	$540.8	$4.5	$1,127.0
IDC	$40.2	$3.6	$40.7	$0.3	$84.8
Average Annual OM&R	$2.6	$0.2	$2.6	$0.0	$5.4

[1] The cost allocation assumes that benefits are less than single purpose alternative costs and that benefits are used as the justifiable expenditure.

[2] Specific costs have not been identified for this preliminary cost allocation.

[3] Remaining justifiable expenditure is justifiable expenditure less specific costs. See note 2, specific costs are assumed to be zero for this initial cost allocation.

[4] Percent distribution is based on proportion of benefits for each project purpose.

6.1.6.2 Authorities for Federal Financial Participation

Costs allocated to each purpose are assigned to Federal taxpayers (nonreimbursable) and project beneficiaries (reimbursable) based on the specific project authorization, existing Federal law, existing cost sharing requirements, and laws and objectives of non-Federal entities, including states, counties, and non-profit organizations. Non-Federal partners are not seeking Federal upfront financing in the form of reimbursable Federal funding for the implementation of this project. Table 6-5 summarizes the federal authorities that inform the cost allocation.

Table 6-5. Existing Authorities for Federal Financial Participation for Monetized Benefit Categories

Purpose	Pertinent Federal Legislation	Description
Federal Cost Share for a State-Led Project (Fish Habitat Enhancement and Incremental Level 4 Refuge)	Water Infrastructure Improvements for the Nation Act, 2015-2016 (Public Law 114-322)	Provides authorization for Federal funding in surface storage projects led by public agencies organized pursuant to State law and limits Federal participation to not more than 25% of the total cost of a State-led storage project.[2]
M&I Water Supply (Including Emergency Water Supply)[1]	Reclamation Act of 1939, as amended	Provides for up-front Federal financing of M&I water supply purposes, with 100% repayment of capital costs (including interest during construction and interest over the repayment period); 100% of OM&R costs are non-Federal.
Refuge Water Supply[2]	Central Valley Project Improvement Act (Public Law 102-575)	Provides Federal non-reimbursable share of up to 75% and 25% non-Federal share (State of California) for voluntary acquisition of Incremental Level 4 supplies to meet full Level 4 obligations.
Pacheco Creek Ecosystem Improvement[3]	Federal Water Project Recreation Act of 1965 (Public Law 89-72), as amended	Public Law 89-72 provides Federal non-reimbursable share of up to 75% and non-Federal share of at least 25% for fish and wildlife enhancements, including planning, design, and IDC. In addition, 50% of the annual OM&R costs would be a non-Federal responsibility.

Notes:

[1] The Investigation is not pursuing Federal funding for M&I Water Supply and M&I Emergency Water Supply project benefit categories. The authorities listed for these project benefit categories were considered during initial determinations of Federal interest in the Investigation. Construction under these authorities would need to be authorized by a specific act of Congress.

[2] Applies to annual O&M costs for Incremental Level 4 Refuge Water Supply

[3] The Investigation is not pursuing Federal funding for Pacheco Creek Fish Habitat Enhancement under this authority. The authority listed for this project benefit category was considered during initial determinations of Federal interest in the Investigation. Construction under this authority would need to be authorized by a specific act of Congress.

6.1.6.3 Initial Cost Assignment

The assignment percentages used as the basis for assigning costs are based on existing Federal authorities and are summarized in Table 6-6.

Table 6-6. Initial Cost Assignment Percentages

Cost Type	Cost Category	Emergency Water Storage	M&I Water Supply	Ecosystem Improvement on Pacheco Creek	Refuge Water Supply
Construction	Federal Non-Reimbursable Costs	0%	0%	50%	0%
	Non-Federal Costs	100%	100%	50%	100%
Interest During Construction	Federal Non-Reimbursable Costs	0%	0%	50%	0%
	Non-Federal Costs	100%	100%	50%	100%
OM&R	Federal Non-Reimbursable Costs	0%	0%	0%	75%
	Non-Federal Costs	100%	100%	100%	25%

Table 6-7 shows an estimate of costs assigned to beneficiaries for each project purpose for the Pacheco Reservoir Expansion Alternative Plan. Non-Federal partners are not seeking Federal upfront financing in the form of reimbursable Federal funding for the implementation of this project.

Table 6-7. Initial Cost Assignment for the Pacheco Reservoir Expansion Alternative Plan by Project Purpose

Cost		Emergency Water Storage	M&I Water Supply	Ecosystem Improvement on Pacheco Creek	Refuge Water Supply
Construction	Non-Reimbursable Federal Costs	$0	$0	$270.40	$0
	Non-Federal Costs	$534.46	$47.24	$270.40	$4.51
IDC	Non-Reimbursable Federal Costs	$0	$0	$20.35	$0
	Non-Federal Costs	$40.23	$3.56	$20.35	$0.34
OM&R	Non-Reimbursable Federal Costs	$0	$0	$0	$0.02
	Non-Federal Costs	$2.58	$0.23	$2.61	$0.01

6.1.6.4 Ability to Pay

The financial feasibility analysis for M&I water supply benefits assesses how much water users can afford to pay for water supply improvements (i.e., payment capacity) and provides the basis to determine if their payment capacity is sufficient to pay for the allocated project costs.

For municipal water supply beneficiaries, ability to pay and payment capacity of potential beneficiaries is estimated with an "affordability threshold" represented as a percent of median household income. This analysis applies the affordability threshold established by the USEPA. In 1980, the USEPA Office of Drinking Water completed a study to assess the costs of complying with new drinking water regulations. The study determined that costs of water service exceeding 2.5 percent of household income were not affordable (Reclamation 2014d). For this analysis, the USEPA affordability threshold of 2.5 percent of median income is applied to estimate payment capacity. The NED Plan could provide water supply reliability and emergency benefits to Santa Clara County, which is the SCVWD service area.

In this analysis, the number of households (U.S. Census Bureau 2017) within Santa Clara County is used to estimate payment capacity. Table 6-5 provides the average payment capacity analysis results for SCVWD. As described above, payment capacity is estimated as 2.5 percent of median household income. To account for existing water payments, an average annual water charge for Santa Clara County residential customers of $656 (obtained from

Raftelis Financial Consultants, Inc. and American Water Works Association 2013) is subtracted from the estimate to arrive at the estimated additional payments that are available to support new water projects. As shown in Table 6-8, the estimated annual unused payment capacity in the SCVWD service area is approximately $1.3 billion.

Table 6-8. Santa Clara Valley Water District Payment Capacity Results

Households, 2013-2017[1]	Median Household Income, 2013-2017[1]	Estimated Current Water Rates, 2013[2] ($1/hhld/yr)	Household Payment Capacity ($1/hhld/yr)	Estimated Total Payment Capacity ($/yr)
630,451	$106,761	$656	$2,013	$1.3 billion

Key: hhld = household; yr = year
Source: [1]U.S. Census Bureau 2017; [2] Raftelis Financial Consultants, Inc. and American Water Works Association 2013

6.2 Determination of Feasibility of the NED Plan

The feasibility of the Pacheco Reservoir Expansion Alternative Plan can be described with four key considerations:

- Technical Feasibility: it is possible to design, construct, and operate the alternative using existing, proven technologies and construction techniques;
- Environmental Feasibility: it is possible to complete environmental compliance and permitting activities;
- Economic Feasibility: the alternative would result in benefits that are greater than the costs; and
- Financial Feasibility: the beneficiaries have the ability to pay for the costs of the alternative.

6.2.1 Technical Feasibility

At the appraisal level of design presented in this report, the Pacheco Reservoir Expansion Alternative Plan is projected to be technically feasible, constructible, and can be operated and maintained.

6.2.2 Environmental Feasibility

Environmental analyses conducted to date suggest that the Pacheco Reservoir Expansion Alternative Plan would be environmentally feasible. The alternative would implement a major construction action over multiple years in an area approximately six miles west of San Luis Reservoir, with the potential to impact the water quality, air quality, greenhouse gas emissions, traffic conditions, terrestrial resources, and cultural resources. The Pacheco Reservoir Expansion Alternative Plan would implement the mitigation actions to help reduce the severity of those impacts.

If constructed, the expanded Pacheco Reservoir would support the storage of local inflow from the watershed that would be released for downstream ecosystem benefits on Pacheco Creek for fishery benefits.

6.2.3 Economic Feasibility

The Pacheco Reservoir Expansion Alternative Plan, at the appraisal level of design, is projected to be economically feasible, because the estimated annual benefits exceed the estimated annual costs, resulting in positive net benefits of $9.2 million annually, and a benefit cost ratio of 1.2. The Pacheco Reservoir Expansion Alternative Plan has the highest net benefits of the alternatives evaluated in this Draft Feasibility Report and is the only alternative plan with positive net benefits.

6.2.4 Financial Feasibility

Financial feasibility was determined by comparing the plan beneficiaries' payment capacity with the annualized costs. The estimated average annual ability to pay of M&I users is large in comparison to the estimated total annual M&I water supply cost, which indicates that the potential M&I partners that would benefit from the NED Plan will be able to repay their allocated annualized costs.

6.3 Risk and Uncertainty

The Pacheco Reservoir Expansion Alternative Plan evaluation is still at an appraisal level of detail, and incorporates assumptions where information is not yet available. These assumptions are based on the currently available information and result in valuable information for the feasibility and environmental analysis. Key areas of remaining risk and uncertainties are described below.

6.3.1 Hydrology and Climate Change

Future climate change scenarios indicate that a wide variety of changes are possible to California's precipitation and hydrology. Potential changes include decreased snowpack and sea level rise. Rising air temperatures could further increase the current imbalance between water supply and demands through changes to seasonal runoff, increased reservoir evaporation rates and rising sea levels reducing flexibility in Sacramento-San Joaquin Delta operations. These changes will affect the availability of CVP, SWP, and local water supplies and could reduce the amount of water exported from the Delta. Reclamation developed the Sacramento and San Joaquin Rivers Basin Study in 2016 to evaluate the potential effect of climate and socioeconomic change on future water demands. The study found that sea level is expected to rise but the range of potential increase is uncertain. Any change in sea level could increase the difficulty of conveying water through the Sacramento-San Joaquin Delta with rising water surface elevation changing the flow-salinity dynamics of the Delta, which would require more Delta outflow to meet water quality standards and other regulatory requirements. Also, the study reported that temperatures are projected increase in both the Sacramento and San Joaquin River basins. Increased temperatures across the CVP and SWP service areas are likely to increase demand for both M&I and agricultural water supply while simultaneously accelerating evaporation from surface water reservoirs across the basins. Precipitation may increase in the areas north of the Sacramento-San Joaquin Delta, with very little change projected in the Tulare Lake Basin, where some of the greatest agricultural demands exist; and snowpack will decline with warming temperatures, particularly in the lower elevations of the mountains surrounding California's Central Valley (Reclamation 2016b).

These changes, including increases in surface water demands, are likely to increase the frequency of low point occurrences and impact the effectiveness of the Pacheco Reservoir Expansion Alternative Plan by reducing the overall availability of CVP supplies for import into the SCVWD from San Luis Reservoir. The increased frequency of low point occurrences in San Luis Reservoir will likely increase the importance of the increased storage capacity at the expanded Pacheco Reservoir. A sensitivity analysis of climate change's potential effect on the alternatives evaluated in this Draft Feasibility Report is presented in Appendix D. In that sensitivity analysis the frequency of low point occurrence increased under both the central tendency (4% increase) and hot-dry (21% increase) climate futures, but was reduced in the warm-wet climate future (5% decrease).

6.3.2 System Operations

The CalSim II system operations model was used to simulate existing and future operations of the CVP and SWP with and without the alternatives. CalSim II is a tool that provides valuable information, but it is not perfect in its predictions of how the system would work. The version of CalSim II used for the analysis includes the best available inputs and assumptions at the time that the modeling

was completed, including those regarding implementation of the USFWS 2008 and NMFS 2009 BiOps on the Long-term Operations of the CVP and SWP. These operational constraints are subject to continued uncertainty. Ongoing consultation processes for the 2008 USFWS and 2009 NMFS BiOps have resulted in some uncertainty in future CVP and SWP operational constraints. In response to lawsuits challenging the 2008 and 2009 BiOps, the District Court remanded the BiOps to USFWS and NMFS in 2010 and 2011, respectively, and subsequently ordered consultation to be reinitiated and preparation of new BiOps. These legal challenges may result in changes to CVP and SWP operational constraints if the revised USFWS and NMFS BiOps contain new or amended Reasonable and Prudent Alternatives (RPAs). Changes in Delta exports as a result of shifts in these factors could also influence future water operations. In addition, changes in hydrology could produce conditions that are different than current water operations were designed for and the modeling results utilized in this Draft Feasibility Report could change.

6.3.3 Project Design and Cost Estimates

Project features for the expanded Pacheco Reservoir are not designed to a feasibility-level; the design is currently at an appraisal level. Additional design work is planned to bring all features to feasibility-level, including geotechnical surveys and analysis to inform the civil design and reduce current uncertainties with the cost estimates during a future phase. The more detailed design level will reduce the risk and uncertainty associated with the current cost estimates.

All cost estimates have inherent risks and uncertainties, including labor costs, materials availability, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, and changing regulatory environments. Of primary consideration, varying uncertainties are associated with the material and unit costs used to develop the estimates. Unknowns include the price of construction materials and labor costs. In particular, the construction market has experienced extreme price volatility in the last several years. While future inflation trends are difficult to predict, new market forces (e.g., higher material commodity pricing, energy costs, lack of competition) will likely continue to have significant impacts on heavy civil infrastructure construction costs for the foreseeable future. Because of uncertainty and variability among the short-term regressions, a longer view of the market is preferred. Consequently, while forward cost trends are always difficult to predict, there is some basis to believe that cost escalation is normalizing back to historical levels at approximately 3 percent per year.

6.3.4 Project Schedule

The pre-construction and construction schedule and associated costs for the preliminary proposed alternative are based on receiving appropriations consistent with the schedule. Partial or no appropriations would extend the

construction schedule. This would result in increased costs, both construction field costs and non-contracts costs.

The current schedule estimates that a period of about 4 years should be considered for pre-construction activities, considering remaining environmental compliance and permitting, data collection and design, land acquisition, and project contracting. The duration of additional surveying and geotechnical investigations are highly variable, and would be dependent on available drilling equipment, work schedule, and labor. Environmental compliance and permitting is also highly variable and would be dependent on cooperating agencies' input and approval, along with completion of mitigation requirements and construction.

The current schedule estimates about a 5-year construction period. An extended construction schedule would likely result in increased costs, both construction field costs and non-contracts costs. The 5-year period could potentially be reduced through measures such as optimizing contract packaging, selective use of design-build for certain facilities, and requiring shorter, more aggressive contract durations employing multiple shift work. Implementing measures to accelerate the schedule could potentially reduce schedule risk, raising the confidence in the overall 5-year construction period.

6.3.5 Activities Needed to Secure Construction Funding

In addition to Federal funding, non-Federal funding for a majority of the construction costs of a recommended plan would need to be identified and secured for the Secretary of the Interior to recommend funding for construction. Financing arrangements are being actively explored by SCVWD for the remainder of non-Federal costs. At this time, WSIP funding has conditionally identified $485 million for the Pacheco Reservoir expansion.

6.3.6 Monetizing Project Benefits

Estimating economic (monetized) benefits of potential project accomplishments is critical to establishing economic feasibility and identifying a corresponding NED plan. Valuation methods for each NED benefit category are presented in Appendix E and summarized in Chapter 5. As described, varying uncertainties are associated with each valuation method. Appendix E presents a sensitivity analysis on emergency water storage and response benefits that varies the probability of a Delta outage.

6.4 Unresolved Issues and Special Considerations

The following subject areas are issues that Reclamation will continue to address if a project is authorized by U.S. Congress.

6.4.1 Water Rights

SCVWD, with project partners, will need to seek either amendments of existing PPWD or new water rights for the diversion and storage of additional flows on Pacheco Creek. Storage of water in Pacheco Reservoir previously diverted from the Delta and stored in San Luis Reservoir under the existing CVP water right would require the addition of a point of re-diversion.

Changes to water rights occur through petitions to the State Water Resources Control Board in accordance with California Water Code requirements.

6.4.2 Environmental Impacts and Mitigation Requirements

Biological and cultural resource surveys were completed in support of the feasibility analysis presented in this Draft Feasibility Report and the environmental impact assessments presented in the EIS/EIR. Some of the results of these analyses are documented in this report. The assessment of potential impacts of alternative plans on environmental resources, along with proposed mitigation measures, are documented in the Draft EIS/EIR. Mitigation measures presented in the EIS/EIR include monitoring and response to discovery requirements that would be implemented during construction of an alternative. Discovery of previously unidentified resources could, depending on their nature, result in modifications to an alternative's configuration. Additional surveys also would be required and conducted when an SLLPIP alternative is authorized by Congress for construction.

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Chapter 7
Coordination and Public Involvement

Reclamation and SCVWD have reached out to interested parties throughout the SLLPIP feasibility process; these efforts are described in this chapter.

7.1 Stakeholder and Public Outreach

Stakeholder and public outreach began at study inception following the CALFED ROD (as discussed in Chapter 1). SCVWD initiated the SLLPIP in 2001 and organized a public involvement program to support the identification of project alternatives. The SCVWD-led public involvement program utilized a Stakeholder Committee, a Regulatory Compliance Work Group, special interest breakout groups, and public meetings to seek input from the public. Elected officials were kept informed throughout the process. When the SLLPIP Federal feasibility study was authorized in 2004, the SLLPIP study transitioned to a stronger partnership with Reclamation and the initiation of the Federal feasibility report. The SCVWD's public involvement efforts temporarily paused while Reclamation and SCVWD developed the plan of study for the Federal feasibility report and EIS/EIR.

In August 2002, SCVWD conducted two public scoping meetings for the EIR for the SLLPIP. SCVWD prepared the "Low Point Improvement Project Scoping Summary Report" (October 2002), which summarized the comments received. The comments received and issues raised during the SCVWD's scoping efforts have been carried forward and are being considered in this Feasibility Report.

Reclamation and SCVWD held additional public scoping meetings in September 2008 to reinitiate public involvement activities and seek input from the public on the alternatives being carried forward into the Feasibility Report and EIS/EIR. The results were included in the "San Luis Low Point Improvement Project Environmental Scoping Report" (December 2008).

Reclamation maintains a project website that provides information to interested parties about the status of the SLLPIP[1]. The documents from each study milestone (IAIR, PFR, Scoping Reports) are available on Reclamation's

[1] Reclamation's SLLPIP website can be found at http://www.usbr.gov/mp/sllpp/

website. SCWVD also maintains a Pacheco Reservoir Expansion Project website[2].

7.2 Agency Coordination

The development of the SLLPIP requires coordination with a variety of Federal, State, and local agencies. The following sections describe these agencies and their roles in the process. The agencies will receive a draft of the Feasibility Report and EIS/EIR for review or appropriate compliance documents.

7.2.1 U.S. Fish and Wildlife Service and National Marines Fisheries Service

Reclamation and SCVWD have been coordinating with the USFWS and NMFS to ensure compliance with ESA, Fish and Wildlife Coordination Act, and the Bald and Gold Eagle Protection Act. Depending on the potential to affect ESA-listed species, Reclamation will either submit a letter documenting no effect or a biological assessment for compliance with ESA.

7.2.2 California Department of Water Resources

The SLLPIP alternatives would all change to varying degrees operations at San Luis Reservoir. San Luis Reservoir is jointly managed by Reclamation and DWR. DWR will be coordinated with on potential changes to San Luis Reservoir operations.

DWR has administered grant funding to SCVWD for their participation in the SLLPIP and will file with the SWRCB for the water rights change necessary to expand the SWP place of use to include the south-of-Delta CVP service area. SCVWD will be signing a contract with DWR to provide emergency response benefits for WSIP funding.

The DSOD will evaluate and approve dam designs for the Pacheco Reservoir Expansion alternative. SCVWD will obtain a DSOD Dam Construction Permit before geotechnical borings are conducted at the Project site. An Operational License will be issued after the new dam, expanded Pacheco Reservoir, and appurtenant facilities are constructed.

7.2.3 U.S. Army Corps of Engineers

SCVWD is coordinating with the U.S. Army Corps of Engineers (USACE) and developing technical studies in support of the CWA 404 permit application.

[2] SCVWD's proposed Pacheco Reservoir website can be found at https://www.valleywater.org/project-updates/dam-reservoir-projects/pacheco-reservoir-expansion-project-proposed.

7.2.4 State Water Resources Control Board

The SWRCB administers water rights law in California. This includes the consideration of petitions for changes to water rights. SCVWD is also coordinating with SWRCB on the CWA Section 401 Water Quality Certification process that will be conducted concurrent with the CWA Section 404 permitting process.

7.2.5 California Department of Parks and Recreation

The CDPR manages the lands surrounding San Luis Reservoir. If an alternative moves forward with some potential to affect these areas, Reclamation will coordinate with CDPR to discuss potential impacts to recreation.

7.2.6 Office of Historic Preservation

Title 54 United States Code Section 306108, commonly known as Section 106 of the National Historic Preservation Act (NHPA), requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment with regard to such undertakings. The implementing regulations at 36 CFR Part 800 identify the steps that must be followed to comply with Section 106 of the NHPA. These steps include consultation with the State Historic Preservation Officer (SHPO).

The Section 106 regulations allow federal agencies to conduct "nondestructive project planning activities before completing compliance with Section 106" (36 CFR 800.1[c]), provided any subsequent consideration of alternatives to avoid, minimize or mitigate adverse effects is not restricted during the planning process. Feasibility studies, and environmental studies conducted in support of such studies, are considered planning activities that do not require completion of the Section 106 process. Reclamation must complete the Section 106 process prior to the approval of the expenditure of Federal funds for the SLLPIP.

7.2.7 San Francisco Regional Water Quality Control Board

The SLLPIP could require several permits from the San Francisco and Central Valley Regional Water Quality Control Boards (RWQCBs), including a dewatering permit and a National Pollutant Discharge Elimination System permit for General Construction. Reclamation will be consulting with the relevant RWQCB to determine the correct permits and their requirements. SCVWD and the construction contractor will obtain these permits prior to construction.

7.2.8 San Joaquin Air Pollution Control District and Bay Area Air Quality Management District

The SLLPIP has the potential to impact air quality in Merced County and Santa Clara County. SCVWD will coordinate with the San Joaquin Valley Air Pollution District (SJVAPD) regarding potential air quality impacts in Merced County and with the Bay Area Air Quality Management District (BAAQMD) regarding potential air quality impacts in Santa Clara County.

7.2.9 California Department of Fish and Wildlife

The SLLPIP has the potential to affect species covered under the California Endangered Species Act. SCVWD will consult with CDFW to ensure compliance with the California ESA. A Lake or Streambed Alteration Agreement from the CDFW will be required before project construction activities commence. SCVWD will be signing a contract with CDFW to provide ecosystem benefits for WSIP funding (refuge water supply and Pacheco Creek fisheries).

7.2.10 Santa Clara County

The Santa Clara County Department of Planning and Development may require Encroachment and Building permits before construction activities commence. In addition, the SCVWD will need to obtain an Excavation Permit from the County for use in the proposed project's borrow sites.

7.3 Public and Agency Review and Comment

Many of the comments received during the scoping process for the EIS/EIR focused on the potential for environmental effects and detailed feedback on how to assess those effects; those comments are more specifically related to the EIS/EIR and are not repeated here. The comments described below are related to the overall feasibility study process and alternative formulation and were considered during development of the alternative plans. All additional comments on the project received during the public review of the EIS/EIR will be addressed in the Final EIS/EIR. In addition, any comments that are received at the EIS/EIR hearings on the feasibility study process and alternative formulation will also be considered during completion of the Final Feasibility Report.

7.3.1 Planning Process

7.3.1.1 Agency Roles and Planning

Public commenters thought that the Federal interest in the project should be better defined. They also asked if Reclamation was responsible for water quality.

7.3.1.2 Planning Process

Members of the public questioned the appropriateness of the alternatives under consideration in the EIS/EIR, requested that a broader range of alternatives be considered as a part of the project, and suggested a number of additional alternatives that should be considered as a part of the project, as outlined in Section 7.3.2.

7.3.2 Alternative Descriptions

7.3.2.1 Pacheco Reservoir

Public commenters asked questions about Pacheco Reservoir, including who would own the expanded Pacheco Reservoir, how current maintenance issues at the existing dam on Pacheco Creek would be addressed by this project, how the reservoir would be operated, and how the Pacheco Creek watershed will be factored into the EIS/EIR.

7.3.2.2 Pacheco Inundation Area

Commenters asked if the Pacheco Reservoir expansion could inundate portions of Henry Coe State Park.

7.3.2.3 Algae Treatment Alternatives

Commenters would like to include an alternative that would treat CVP water before it enters San Luis Reservoir to prevent algae blooms.

7.3.2.4 Institutional Measures

Members of the public asked about the institutional measures that were included in each alternative to increase the accuracy of early allocations. Questions included how the program would work and who would bear the costs of institutional backstops. Commenters expressed concern that higher earlier allocations would increase risk of water supply shortages for south-of-Delta contractors, and that the institutional measures that were previously considered were not reliable enough to provide a backstop for more aggressive allocations.

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Chapter 8
Findings and Considerations

Reclamation and SCVWD have completed a multi-year study process that has led to the identification of the Pacheco Reservoir Expansion Alternative Plan as the preliminary NED Plan. The plan is currently designed, with cost estimates, to an appraisal design level of detail. This section summarizes the preliminary NED plan and describes key findings and considerations.

8.1 Need for the Project

Reclamation and SCVWD have identified an existing need to improve the certainty of meeting the requested delivery schedule throughout the year to south-of-Delta contractors, including SCVWD, dependent on San Luis Reservoir; and to increase the reliability and quantity of yearly allocations to the same south-of-Delta contractors. Reclamation and SCVWD also identified the need to support ecosystem enhancement opportunities. Demands for water in the Central Valley and elsewhere in the State exceed available supplies, especially in dry years and during extended drought, and this condition is expected to become more pronounced in the future. Developing projects to increase the reliability of water supplies for M&I, agricultural, and environmental purposes is necessary to meet demands, and is consistent with the CALFED Programmatic ROD, the CVPIA, and other Federal and State laws and initiatives.

8.2 Summary of the Preliminary NED Plan

The Pacheco Reservoir Expansion Alternative Plan is identified as the preliminary NED Plan and is also the Locally Preferred Plan by the non-Federal sponsor, SCVWD. Pacheco Reservoir Expansion Alternative Plan is the alternative that would achieve the highest net NED benefits while protecting the environment and was found to be technically, environmentally, economically, and financially feasible. The alternative has been designed at the appraisal level and needs feasibility level of design. Risk and uncertainty of appraisal level of design are addressed in Section 8.2.3.

8.2.1 Preliminary Costs and Benefits

Table 8-1 summarizes the benefit-cost analysis for the Pacheco Reservoir Expansion Alternative Plan. The Pacheco Reservoir Expansion Alternative Plan provides additional water supply to SCVWD in years with and without low-point conditions, supports improvements in the predictability of water

supply deliveries to SCVWD by providing an estimated 96,000 AF (long-term average) of supply available in the event of a regional water supply disruption (emergency water supply). Finally, the plan provides opportunities for the improvement of ecosystem quality on Pacheco Creek downstream of the new dam and through IL4 refuge water supply deliveries of 2,000 AF in below normal water years.

Table 8-1. Pacheco Reservoir Expansion Alternative Plan Annual Benefit-Cost Summary

	Pacheco Reservoir Expansion
Annual M&I Water Supply Benefits (Million $)	$2.1
Annual Emergency Water Storage Benefits (Million $)	$23.7
Annual Agricultural Water Supply Benefits (Million $)	($0.9)
Annual Ecosystem Enhancement - Pacheco Creek (Million $)	$24.0
Annual San Joaquin Refuges Water Supply (Million $)	$0.2
Total Annual Benefits (Million $)	**$49.1**
Total Construction Cost (Million $)	$1,127.0
Average Annual O&M Cost (Million $)	$1.6
Annual Costs, 100 years, 2.75% (Million $)[1]	**$39.9**
Net Annual Benefits or Costs (Million $)	**$9.2**
Benefit-Cost Ratio	**1.2**

[1] Includes construction and replacement costs amortized at 100 years at 2.875% discount rate.

8.2.2 Feasibility

The preliminary NED plan is determined to be technically, environmentally, economically, and financially feasible at the appraisal level of detail.

8.2.2.1 Technical Feasibility

At the appraisal level of design presented in this report, the Pacheco Reservoir Expansion Alternative Plan is projected to be technically feasible, constructible, and can be operated and maintained.

8.2.2.2 Environmental Feasibility

Environmental analyses conducted to date suggest that the Pacheco Reservoir Expansion Alternative Plan would be environmentally feasible. Following the completion of construction, the expanded Pacheco Reservoir would support the storage of local inflow from the watershed that would be released for downstream ecosystem enhancement on Pacheco Creek for fishery benefits.

8.2.2.3 Economic Feasibility

The Pacheco Reservoir Expansion Alternative Plan, at the appraisal level of design, is projected to be economically feasible, because the estimated benefits exceed the estimated costs, resulting in positive net benefits of $9.2 million annually, and a benefit cost ratio of 1.2.

8.2.2.4 Financial Feasibility

The beneficiaries of the NED Plan have been evaluated to have the ability to pay the non-Federal portion of project costs, based on a cost allocation and cost assignment analysis.

8.2.3 Risk and Uncertainty

Certain assumptions were made for the Investigation based on engineering, economic, and scientific judgment and the availability of data/information. While this is effective in estimating relative outcomes, various risks and uncertainties could affect implementation of an authorized project. These risks and uncertainties are described in Chapter 6 and summarized below.

- Potential climate variabilities could produce conditions that differ from today, affecting future CVP and SWP operations.
- Future water system operations and facilities may change, in addition to changing operational constraints, hydrology, demands, and regulatory conditions in California.
- Reservoir design is at an appraisal level of engineering design and there are uncertainties due to existing geotechnical and seismic conditions at the site. Additional engineering design is necessary.
- Construction cost estimates, at an appraisal-level, have inherent risks and uncertainties due to unknown future labor, market, and field conditions.
- The timing, source, and availability of funding will affect the construction schedule and cost estimates included in the Feasibility Report.
- In addition to construction funding, the Secretary of the Interior would request appropriations annually for the delivery and administration of Refuge water supplies. A delay in Federal, state or local funding would affect project operations.
- Various activities need to occur before Federal construction funding can be awarded. Among these, consultation under the ESA must be completed and a ROD signed. Delays in completing consultation and permitting activities could result in delays in construction funding.
- The estimation of the economic (monetized) benefits of potential project accomplishments is subject to uncertainties associated with valuation methods and assumptions.
- Non-Federal funding for a majority of the construction costs of a recommended plan would need to be identified and secured for the

Secretary of the Interior to recommend funding for construction. A conditional funding award was made by the State of California that would cover a large portion of the non-Federal costs. Financing arrangements are being actively explored by SCVWD.

8.2.4 Federal Interest

For an action to be implementable, there must be Federal interest in the action and it must be technically, environmentally, economically, and financially feasible, as defined by the P&Gs. The Pacheco Reservoir Expansion Alternative Plan provides positive NED benefits for M&I, agricultural, and environmental purposes. Reclamation's interest in the action is based upon the agency's mission "to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." Implementing any of the plans would improve water supply reliability for M&I and environmental uses, and operational flexibility for the CVP overall. The economic benefits of implementing the Pacheco Reservoir Expansion Alternative Plan exceed the cost when evaluated at the National level. Federal interest is also emphasized through the existing authorities described in preceding sections, including CVPIA, which establishes Federal obligations in providing water supplies to Central Valley refuges and wildlife habitat areas.

8.2.5 Environmental Review and Regulatory Requirements

Environmental review is documented in the Draft EIS/EIR. In summary, the Pacheco Reservoir Expansion Alternative Plan would, similar to other alternatives, implement a major construction action over multiple years, with similar water quality, air quality, greenhouse gas emissions, traffic condition, terrestrial resource, and cultural resource impacts. These impacts would occur in an area approximately six miles west of San Luis Reservoir at Pacheco Reservoir. The Draft EIS/EIR identifies mitigation actions to help reduce the severity of these impacts.

Federal, State, and local agencies with permitting or approval authority are expected to use the EIS/EIR to make decisions and/or issue permits for an authorized project. Permits and consultations would be required with the USACE, NMFS, USFWS, SHPO, DWR, CDFW, SWRCB, California Department of Parks and Recreation, and local Bay Area Air Quality Management District.

8.3 Implementation Framework

In recognition of the complexity of the feasibility analysis, much work has been done on the physical, technical, and financial aspects of the project. The ancillary benefits indicate that there is potential for the project to provide opportunities for M&I and emergency water supply and ecosystem improvements. However, in order to further determine how this project could

be integrated with the CVP/SWP system and be implemented, administrative actions are needed before moving to the construction phase. Reclamation's Federal administrative actions include the consideration of the need for amending of Reclamation's water rights, defining contractual terms for water service, power and Warren Act contracts, and review and revisions to the coordination of CVP and SWP operations to incorporate changes with a new integrated facility.

8.3.1 Governance

A governance structure on the partnership agreements is needed to illustrate all coordination aspects for the implementation actions and decisions needed to add new storage integrated with the CVP/SWP system. The partnership relationships would be between proponents of new facilities and Reclamation and DWR to support the coordination of operations. The governance structure would also support integration of principles to address water right permit conditions and draft contracts, working to ensure that the new facilities and the CVP/SWP system are functionally aligned and that the policy issues have been coordinated. Water rights, contractual agreements and the coordination of operations are the basis and foundation for implementation of new storage within the CVP/SWP system.

8.3.2 Water Rights Relationships

Water rights are an integral part of the implementation process. Reclamation and DWR must be in partnership with the proponents of new facilities in the water rights application process of the SWRCB and fully clarify how this partnership integrates all water right considerations of diversion (Warren Act contracts/water rights for the new facility, and contractual relationships) and the application of water to common CVP/SWP service areas.

In developing and determining the water right permits for a new facility, details are needed regarding project operations, how the benefits are generated, and how the requirements of SWRCB would be met, including in particular no injury to prior water rights and no unreasonable harm to fish and wildlife resources, diversion of water, place of use, purpose of use, filling, restorage, any instream flow dedication, and priority. The intention of the partnership agreements is to reach future agreement on the water rights permit terms and conditions of the new facility in conjunction with the CVP/SWP that are acceptable to Reclamation and DWR.

8.3.3 Contractual Relationships

Reclamation and DWR must be partners with the proponents of new facilities for both water right considerations and contracts. Contracts tie water right conditions together and water in stored in new facilities has to be acknowledged in both the water rights basis and the contracts as the source of water being applied to CVP/SWP service areas.

8.3.4 Review of the Coordinated Operations Agreement

Reclamation and DWR operate the CVP and SWP to divert, store, and convey CVP and SWP (project) water consistent with applicable law and contractual obligations. The CVP and SWP are two major inter-basin water storage and delivery systems that share a common water supply to divert and re-divert water from the southern portion of the Sacramento-San Joaquin Delta. The projects are permitted by the SWRCB, and both projects operate pursuant to water right permits and licenses issued by the SWRCB to appropriate water by diverting water for direct delivery to water users or to storage for release and use later in the year. As conditions of SWRCB water right permits and licenses, the SWRCB requires the CVP and SWP to meet specific water quality, quantity, and operational criteria within the Delta to protect the beneficial uses of water within the Sacramento Valley and the Sacramento-San Joaquin Delta. Reclamation and DWR closely coordinate the CVP and SWP operations, respectively to meet these conditions.

Reclamation and DWR signed the Coordinated Operations Agreement (COA) in November 1986. The COA describes the rights and responsibilities of the CVP and SWP with respect to in-basin water needs and provides a mechanism to account for those rights and responsibilities and to meet common goals. The COA is the foundation that defines the CVP and SWP facilities and water supplies, sets forth procedures for the coordination of operations, identifies formulas for sharing joint and un-separable responsibilities for meeting Delta standards, identifies how unstored flow will be shared, and sets up a framework for exchange of water and services between the two projects, as well as periodic review of the operations of the projects on their water supply performance in meeting common goals. The COA states that “It is in the best interest to use the water rights permits as set forth in the COA rather than litigate such uses as between Reclamation and DWR and potentially all other water users in the Central Valley”. The COA provided for the use of facilities to provide ‘maximum benefits’ to the people of California and the Nation through coordination, communication, and cooperation. The COA provides the basis for the contractual policies and lands served.

The COA laid the foundation for adding new facilities subject to periodic review of the COA to address each project’s water supply performance. New facilities have their own unique geographical location, hydrology and objectives. Numerous studies (investigative, feasibility level, environmental studies) have been completed on these potential projects, and an implementation strategy on how these projects could be integrated with California’s water system following the COA framework will be developed.

8.3.5 Basis of Negotiation

A basis of negotiation (BON) is the governance piece that creates functional governance terms. A BON is a crosscheck for Reclamation to ensure that all policy inputs (integration principles, water right relationships, contractual relationships, coordination of operations) have been considered for new facility integration with the CVP/SWP system. It should adequately describe the positions of the various parties to find solutions. A BON helps develop key questions and policy paths for Reclamation to follow and terms and conditions and boundaries of activities to help with negotiating integration principles of new facilities. In addressing policy questions, there are two approaches: the top down approach in which management provides guidance on dealing with new facility integration; and the bottom up approach in which terms and conditions for an integrated approach are developed. The BON provides guidance for Reclamation and project proponents to work in partnership.

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Chapter 9
Next Steps

This chapter presents next steps based on the results of the feasibility investigation to date.

9.1 Summary of Preliminary NED Plan

The Pacheco Reservoir Expansion Alternative Plan includes removal of the existing dam and construction and operation of a new dam and expanded reservoir, pump station, conveyance facilities, and related miscellaneous infrastructure. The new dam and expanded reservoir would be constructed on Pacheco Creek 0.5 mile upstream from the existing North Fork Dam and would inundate most of the existing Pacheco Reservoir. The proposed total storage for the expanded reservoir is 141,600 AF, with an active storage of 140,800 AF. The full pool elevation would be 694 feet and would inundate an additional 1,245 acres, for a total of 1,385 total acres inundated. Water would be collected in the expanded reservoir during the winter months from runoff from the local watershed area, and diversion of CVP supplies from the Pacheco Conduit. The expanded reservoir would be operated by SCVWD to both improve habitat conditions for steelhead in Pacheco Creek and improve SCVWD water supply reliability, including during drought periods and emergencies. In addition, SCVWD will transfer 2,000 AF of its CVP water contract (in below normal water years), directly or through transfer and exchanges, in perpetuity to Reclamation's RWSP, for use in the IL4 refuge water supply.

9.1.2 Preliminary Costs and Benefits

The total construction cost of the preliminary NED Plan is estimated to be $1,127.0 million. Annual costs including replacement and O&M would be $39.9 million over a 100 year period at a 2.875% discount rate and 2018 price level.

The Preliminary NED Plan would provide increased water supplies to M&I users, to wildlife refuges, would release water to Pacheco Creek for ecosystem enhancement for SCCC steelhead, which are listed as threatened under the Federal ESA, and would provide emergency water supplies. Water supplies provided would vary by year type.

- **Municipal and industrial supplies** provided to San Felipe Division CVP M&I deliveries would increase on average by 2,800 AF.

- **Emergency water storage**, estimated at 96,600 AF (long-term average), would be available in the event of a regional water supply disruption.

- **Ecosystem enhancement on Pacheco Creek**, by releasing 10 to 30 cfs in the creek to benefit federally threatened SCCC Steelhead.

- **Refuge water supplies** are estimated to be about 2,000 AF/year in below normal years.

The estimated annual monetary benefit is about $49.1 million. The net annual economic benefit is about $9.2 million.

9.1.3 Cost Allocation and Assignment

Costs allocated to each purpose are assigned to Federal taxpayers (non-reimbursable) and project beneficiaries (reimbursable) based on the specific project authorization, existing Federal law, existing cost sharing requirements, and laws and objectives of non-Federal entities, including states, counties, and non-profit organizations. Non-Federal partners are not seeking Federal upfront financing in the form of reimbursable Federal funding for the implementation of this project. Table 9-1 summarizes the initial cost allocation and assignment.

Table 9-1. Initial Cost Assignment for the Pacheco Reservoir Expansion Alternative Plan by Project Purpose

Cost		Emergency Water Storage	M&I Water Supply	Ecosystem Enhancement on Pacheco Creek	Refuge Water Supply
Construction	Non-Reimbursable Federal Costs	$0	$0	$270.40	$0
	Non-Federal Costs	$534.46	$47.24	$270.40	$4.51
IDC	Non-Reimbursable Federal Costs	$0	$0	$20.35	$0
	Non-Federal Costs	$40.23	$3.56	$20.35	$0.34
OM&R	Non-Reimbursable Federal Costs	$0	$0	$0	$0.02
	Non-Federal Costs	$2.58	$0.23	$2.61	$0.01

9.1.4 Non-Federal Cost-Share Partner

SCVWD is the non-Federal cost-share partners for preparation of this Feasibility Report. SCVWD is also working with SBVWD and PPWD to obtain funding support for a portion of the non-Federal cost share through the WSIP processes administered by the CWC. In July 2018, SCVWD was granted conditional funding for the Pacheco Reservoir Expansion Alternative by the CWC.

9.1.5 Funding

The SLLPIP was authorized for both study and implementation (except for Federal participation in construction of Pacheco Reservoir) in Title I of Public Law 108-361, CALFED Bay-Delta Authorization Act (October 25, 2004, 118 Stat. 1694), also known as the Water Supply, Reliability, and Environmental Improvement Act.

The WIIN Act, Public Law 114-322, Section 4007 provides authority for the Secretary of the Interior to (1) participate in State-led storage projects, and (2) provide financial assistance to carry out project, subject to a set of requirements.

The CWC approved conditional funding of approximately $485 million for the Pacheco Reservoir Expansion Project in May of 2018. Final award of this funding is contingent upon the Local Agency Partner completing the remaining Proposition 1 requirements including final permits, environmental documents, contracts for the administration of public benefits, and commitments for non-Proposition 1 funding. Once the Local Agency Partner has obtained all the necessary permits, documents and contracts, CWC will hold a final award hearing.

9.1.6 Approval

When developed, the subsequent Final Feasibility Report will be submitted by the Commissioner of Reclamation to the Secretary of the Interior. The Secretary may accept or revise the Final Feasibility Report. After review by the Office of Management and Budget, in accordance with Executive Order 12322, the Secretary would transmit a Final Feasibility Report and Final EIS/EIR to the U.S. Congress to determine the type and extent of Federal interest in the project. The Secretary may recommend any of the alternatives considered, including the No Action Alternative.

9.1.6.1 Preconstruction Phase

Feasibility level and detailed design is needed for the Pacheco Reservoir Expansion Alternative Plan. Key activities include geotechnical investigations and surveys; advanced planning studies and design activities; execution of agreements with key partners and stakeholders regarding advanced planning, design, and construction activities; funding agreements with beneficiaries; operations and maintenance plans and agreements; acquisition of lands, easements, and rights of ways; and water rights modifications, if required by the State Water Resources Control Board.

Preconstruction activities include:

- A post-authorization report
- Scoping and project setup
- Operations plan development
- Water rights licensing and permitting

- Project partnership cooperation agreement
- Environmental compliance and permitting
- Data collection, design, and cost estimating
- Land and rights acquisition plan development
- Construction contracting and acquisition
- Mitigation planning
- Coordination and outreach

9.1.6.2 Construction Phase

Construction and operation of the authorized plan would be subject to the requirements of Federal, state, and local laws, policies, and environmental regulations. Reclamation and/or SCVWD would need to obtain various Federal, state, and local permits and regulatory authorizations before project construction would begin. A list of potential permits and approvals is included in the Draft EIS/EIR. Reclamation would also have to make the determination that the proposed project partnerships would not injure Reclamation water rights.

9.2 Federal Implementation Requirements

Under the Preliminary NED Plan, the Federal Government would have the following roles and responsibilities:

- Work with SCVWD to complete Final Feasibility Report.
- Process the Final EIS/EIR, complete all Federal permitting, and prepare a ROD.
- Negotiate and enter into an Integrated Operations Plan and other required agreements.
- Complete a post-authorization report.
- Enter into a pre-construction cost-share agreement with SCVWD and subsequent construction cost estimates.
- Modify Reclamation water rights, as needed.

9.3 Non-Federal Implementation Requirements

SCVWD would take a lead role in final design and construction of project facilities, in coordination with Reclamation. SCVWD would own completed project facilities and operations. SCVWD would have the following roles and responsibilities:

- Complete feasibility level of design.

- As the lead for CEQA compliance, process and certify a Final EIS/EIR.
- Adopt CEQA Findings and approve the project.
- Complete investigation and 100% design of all project facilities, including mitigation requirements.
- Modify SCVWD and Local Agency Partner water rights, as described herein.
- Acquire real estate.
- Construct the new project facilities, including mitigation.
- Own, operate, and maintain the completed facilities.

9.4 Summary

Reclamation and SCVWD will continue to refine and evaluate the preliminary NED Plan, the Pacheco Reservoir Alternative Plan, to reflect potential changes to existing and likely future conditions. The public has been invited to comment on this and other alternative plans and these comments will be taken into consideration. Refinement of the Pacheco Reservoir Expansion Alternative design from its current appraisal level to feasibility level, and future updates to operations modeling and economic studies to reevaluate the newly refined designs and cost estimates should be considered. It should be noted that conditions at San Luis Reservoir, in the SCVWD service area and in the Delta are also complex and subject to change.

9.5 Draft Feasibility Report Summary

As next steps, Reclamation will continue to evaluate and refine alternative plans and address unresolved issues and concerns. Based on the findings of the Draft Feasibility Report to date, the following items comprise the next steps.

9.5.1 Solicit Input on Draft Feasibility Report

Reclamation and SCVWD will solicit public input on this Report.

9.5.2 Alternative Plan Refinement

Reclamation and SCVWD will continue to refine and evaluate alternative plans and address public comments. Additional refinement of alternative plans is expected based on public and stakeholder input on the Draft Feasibility Report and Draft EIS/EIR. Refinement of the Pacheco Reservoir Expansion Alternative design from its current appraisal level, and future updates to operations modeling and economic studies to reevaluate refined designs and cost estimates. It should be noted that conditions at San Luis Reservoir, in the SCVWD service area, and in the Delta are also complex and subject to change.

9.5.3 Continued Coordination and Evaluations

Reclamation and SCVWD will continue to coordinate with stakeholders and other agencies to address and resolve issues related to water rights, Native American and cultural resources, biological investigations and mitigation.

Chapter 10
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