FINAL

PLANNING STUDY REPORT

Pacheco Reservoir Expansion Project

November 2022

Valley Water

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PACHECO RESERVOIR EXPANSION PROJECT

PLANNING STUDY REPORT

PROJECT NO. 91954002

I have reviewed and concur with the alternatives analysis and recommendation presented in this Planning Study Report for the Pacheco Reservoir Expansion Project and recommend proceeding with design to implement the project as recommended.

DocuSigned by:
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12/6/2022

Ryan McCarter, PE
Assistant Officer
Dam Safety and Capital Delivery Division

Date

I have reviewed and approve with the alternatives analysis and recommendation presented in this Planning Study Report for the Pacheco Reservoir Expansion Project and approve proceeding with design to implement the project as recommended.

DocuSigned by:
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12/7/2022

Christopher Hakes, PE
Deputy Operating Officer
Dam Safety and Capital Delivery Division

Date

NOVEMBER 2022

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PACHECO RESERVOIR EXPANSION PROJECT

PLANNING STUDY REPORT

PROJECT NO. 91954002

Prepared By:
Robert Green, PE, GE (AECOM)
Mary Paasch, PE, PMP; Adam Witt, PhD, PE; Kevin Werbylo, PE; Paul Uncapher; Tori Thomas (Stantec)

The Planning Study Report has been prepared by the undersigned, who hereby certifies that he is a Registered Civil/Geotechnical Engineer in the State of California.

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NOVEMBER 2022

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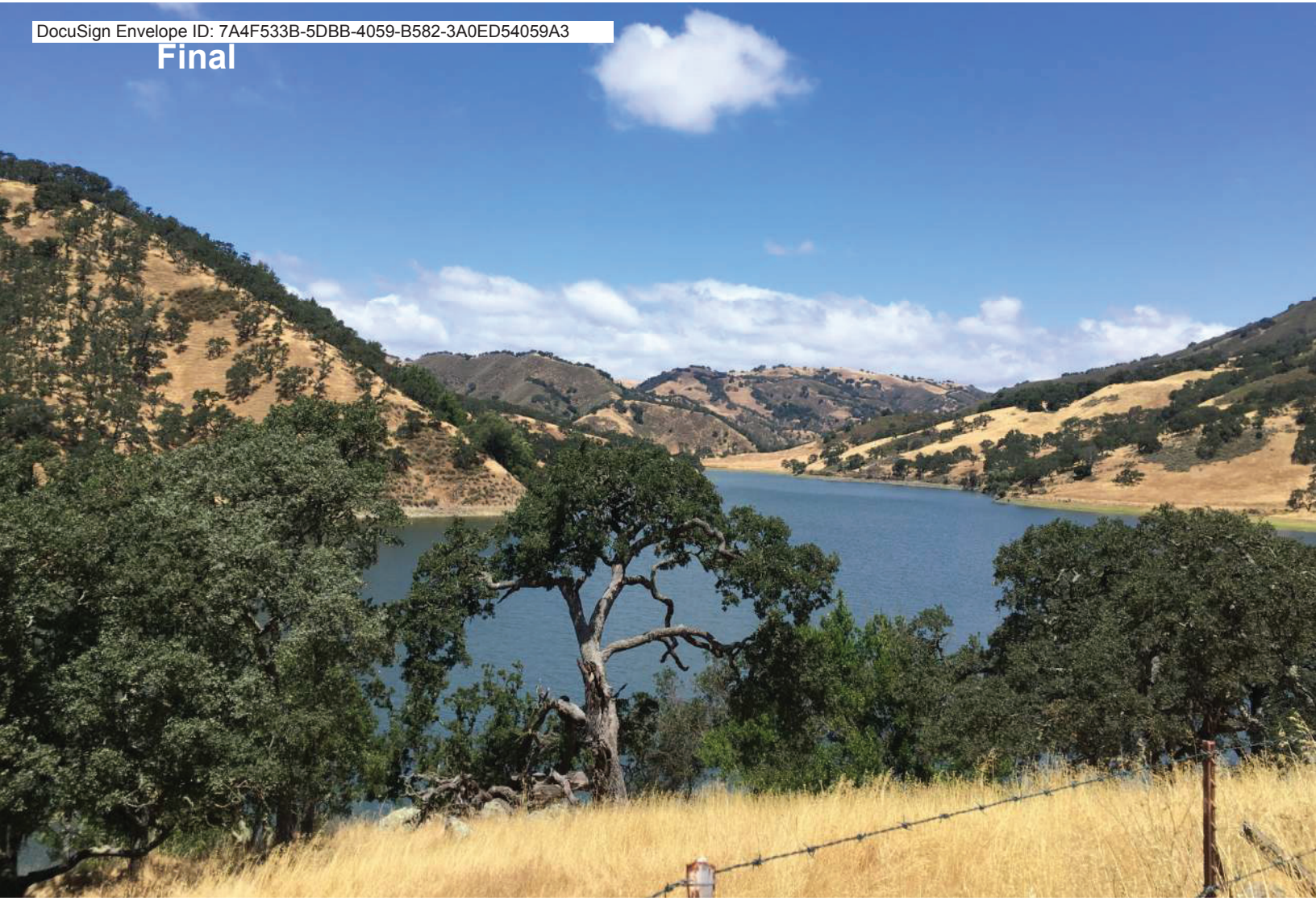
Final



Planning Study Report

Pacheco Reservoir Expansion Project

November 2022

Prepared by:

AECOM

Stantec GEI

Prepared for:

Valley Water

Valley Water Project Number: 91954002

Quality Information

Prepared By	Checked By	Verified By	Approved By
Neil Stewart, Tori Thomas, and Kevin Werbylo	Mary Paasch	Paul Uncapher	Mary Paasch

Revision History

Revision	Revision Date	Details	Authorized	Name	Position
0	October 17, 2022	Preliminary Draft	Yes	Neil Stewart Kevin Werbylo Tori Thomas	Water Resource Engineer Water Resource Engineer Water Resource Engineer-in-Training
1	November 3, 2022	Final	Yes	Neil Stewart Kevin Werbylo Tori Thomas	Water Resource Engineer Water Resource Engineer Water Resource Engineer-in-Training

Distribution List

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Acronyms and Abbreviations

BGP	Biogeographic Population Group
cfs	cubic feet per second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWC	California Water Commission
DSOD	California Department of Water Resources, Division of Safety of Dams
EIR	Environmental Impact Report
IL4	Incremental Level 4
kV	kilovolt
M&I	municipal and industrial
NED	National Economic Development
NMFS	National Marine Fisheries Service
PPWD	Pacheco Pass Water District
Project	Pacheco Reservoir Expansion Project
Reclamation	U.S. Department of Interior, Bureau of Reclamation
Recovery Plan	South-Central California Steelhead Recovery Plan
RWSP	Refuge Supply Water Program
SBCWD	San Benito County Water District
SCCC	South Central California Coast
SLLPIP	San Luis Low Point Improvement Project
SR 152	State Route 152
TM	Technical Memorandum
TRB	Technical Review Board
Valley Water	Santa Clara Valley Water District
WIFIA	Water Infrastructure Finance and Innovation Act
WSIP	Water Storage Investment Program

Executive Summary

Introduction

The Santa Clara Valley Water District (Valley Water), in partnership with San Benito County Water District (SBCWD) and Pacheco Pass Water District, is proposing the Pacheco Reservoir Expansion Project (Project) in the southeastern portion of Santa Clara County, California. The Project includes construction and operation of a new dam and expanded reservoir, conveyance facilities, and related miscellaneous infrastructure (e.g., access roads and electrical transmission lines), and decommissioning of the existing North Fork Dam and restoring portions of North Fork Pacheco Creek.

Water would be collected in the expanded reservoir during the winter months from local watershed area runoff and Central Valley Project (CVP) supplies from San Luis Reservoir via the Pacheco Conduit, as available. The proposed facilities and expanded reservoir would be operated by Valley Water to increase water supply reliability and system operational flexibility, help meet municipal and industrial (M&I) and agricultural water demands during drought periods and emergencies, increase suitable habitat for South Central California Coast (SCCC) steelhead in Pacheco Creek, and improve water quality and minimize water supply interruptions related to San Luis Reservoir operations. During below normal years, water supplies would also be supplied to the Central Valley Project Improvement Act (CVPIA) Refuge Water Supply Program (RWSP) in support of wetlands and wildlife habitat development and management.

Location

The existing Pacheco Reservoir is located in unincorporated Santa Clara County, approximately 17 miles northeast of the City of Gilroy and 0.4 miles north of State Route 152 (SR 152), as shown in Figure ES-1. Pacheco Reservoir is situated on the North Fork of Pacheco Creek. The headwaters of Pacheco Creek are in the Diablo Range, northeast of the City of Hollister. Downstream of Pacheco Reservoir, Pacheco Creek continues to flow west until it reaches San Felipe Lake, draining approximately 168 square miles in Santa Clara and San Benito Counties. San Felipe Lake is drained by Miller Canal, which joins the Pajaro River and flows southwest until it drains into Monterey Bay.

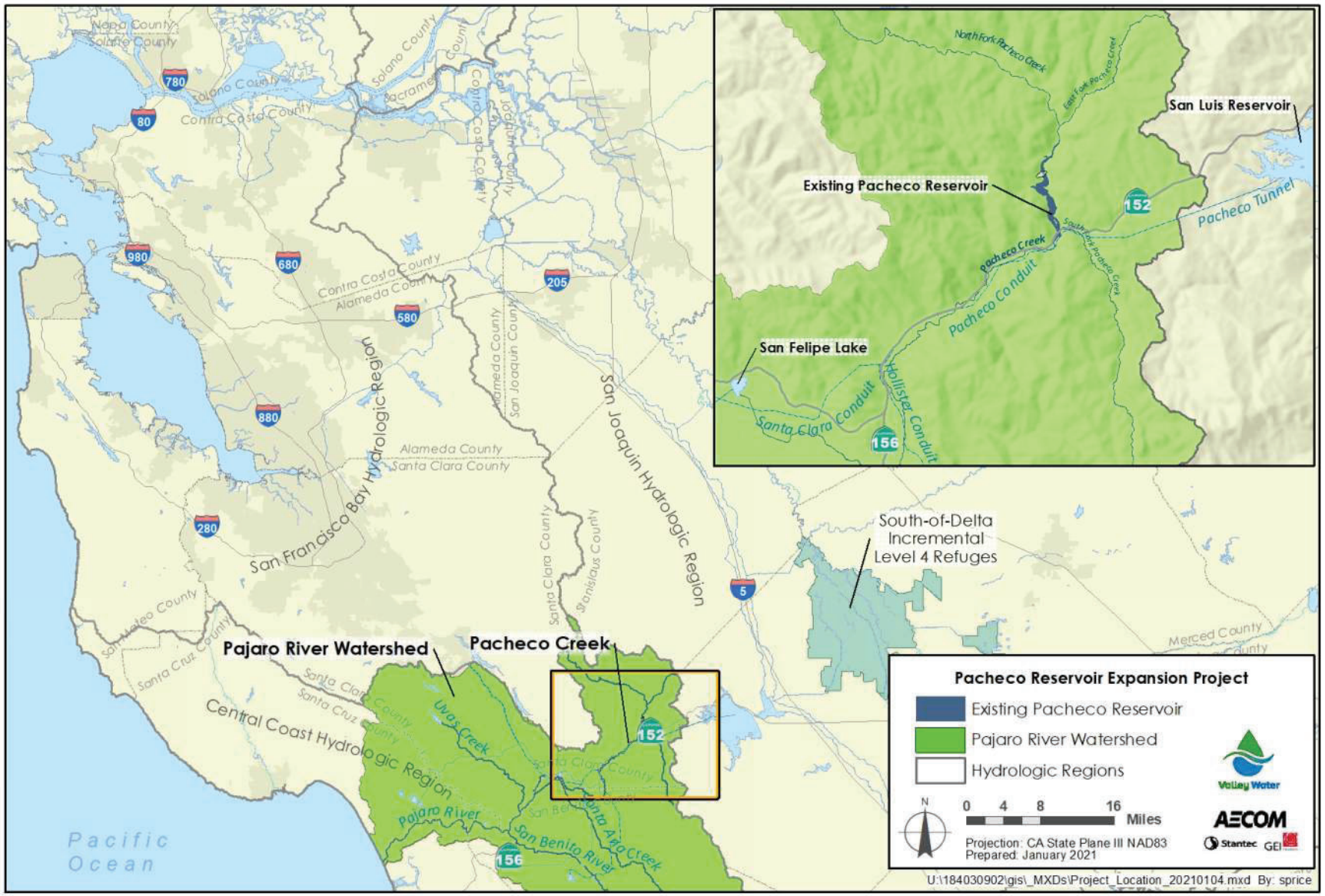


Figure ES-1. Pacheco Reservoir Expansion Project Location

Objectives

Primary objectives consider the basic needs the Project intends to satisfy. The primary and secondary Project objectives are to:

- Primary Objectives
  - Increase water supply reliability and system operational flexibility to help meet M&I and agricultural water demands in Santa Clara and San Benito Counties during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions.
  - Increase suitable habitat in Pacheco Creek for federally threatened SCCC steelhead through improved water temperature and flow conditions.
- Secondary Objectives
  - Improve water quality and minimize supply interruptions, when water is needed, for Santa Clara and San Benito Counties, to increase operational flexibility for south-of-Delta contractors dependent on San Luis Reservoir.
  - Develop water supplies for environmental water needs at Incremental Level 4 (IL4) wildlife refuges to support habitat management in the Delta watershed.

Alternatives Development and Evaluation

Alternatives were formulated and evaluated to allow for the direct comparison of the physical benefits, tradeoffs and costs of the various dam site, dam type, and reservoir capacity combinations. To support the evaluation of the alternatives, four major criteria categories were developed, with two or more detailed criterion developed for each major criteria category. Each alternative evaluation criterion was assessed either quantitatively or qualitatively and specific metrics were used to assign a score. As a result of this process, the alternative with the highest weighted score was an earthfill dam at an upstream dam site with a 140,000 acre-foot reservoir. This was selected as the Staff Recommended Alternative.

Staff Recommended Alternative

Under the Staff Recommended Alternative, Valley Water proposes to construct a new earthfill dam and other associated facilities as presented in Figure ES-2. The new earthfill dam would be located 2.2 miles upstream from the confluence of North Fork Pacheco Creek and South Fork Pacheco Creek. Valley Water would operate these facilities and the expanded 140,000-acre-foot reservoir to increase emergency storage/emergency water supply, improve water supply reliability, increase SCCC steelhead habitat suitability, increase IL4 refuge water supplies, and reduce impaired water quality deliveries from San Luis Reservoir.

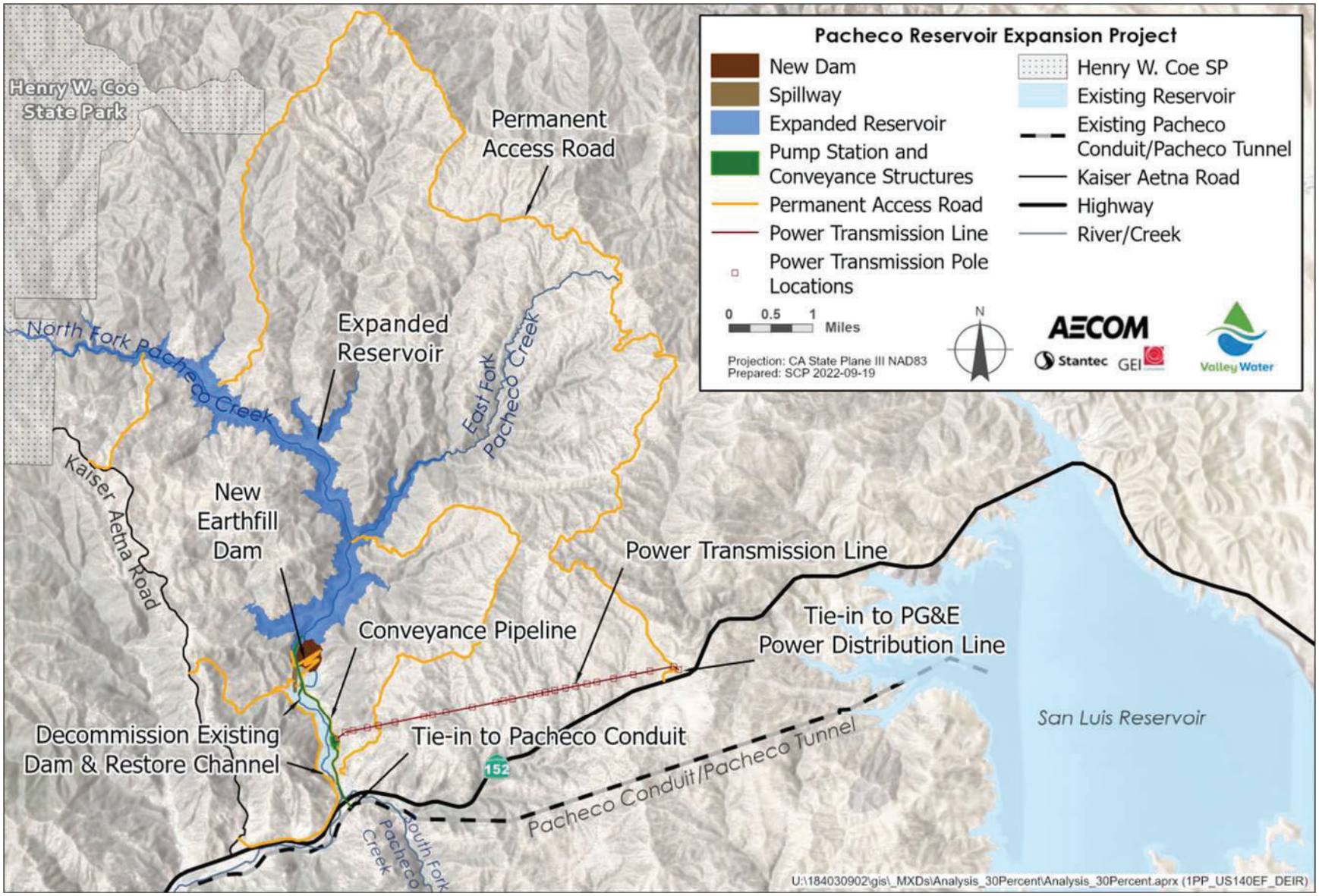


Figure ES-2. Permanent Facilities and Expanded Reservoir for Staff Recommended Alternative

The facilities of the Staff Recommended Alternative would include a new dam and appurtenant facilities[1], new water conveyance to and from the Pacheco Conduit, utility modifications, vehicular access improvements, and other minor improvements. A new earthfill dam with spillway and inlet/outlet works facility would be constructed at a site 2.2 miles upstream from the confluence of North Fork Pacheco Creek and South Fork Pacheco Creek. The Staff Recommended Alternative would include a pipeline and pump station to allow for the bi-directional conveyance of water between the expanded reservoir and Pacheco Conduit. To provide power to the dam and water conveyance facilities, a new 70 kilovolt (kV)/4.16 kV electrical substation and 4.1 miles of new, single overhead 70 kV transmission line would be constructed. A combination of new permanent and temporary roads and improvements to existing access routes would be required to allow primary and auxiliary access to the new dam and facilities, nearby properties of existing landowners, and construction areas. Primary vehicular access to the dam site and appurtenant facilities during construction would be provided by a new temporary overcrossing bridge located west of the existing SR 152 and Kaiser-Aetna Road intersection.

Construction of the Staff Recommended Alternative is estimated to require 7.2 years. The temporary overcrossing bridge located west of SR 152 and Kaiser-Aetna Road, and permanent and temporary access roads would be completed early in the construction period to facilitate access for construction crews and equipment to the dam site. In year two of construction, the existing Pacheco Reservoir would be drained, and the existing North Fork Dam and appurtenant facilities would be decommissioned. Following decommissioning of the existing dam, flows in both North Fork Pacheco Creek and Pacheco Creek would follow a natural hydrograph until the new dam is completed. Construction of the earthfill dam with spillway and inlet/outlet works facility, conveyance facilities, utilities, and other improvements would occur concurrently until completion.

Under the Staff Recommended Alternative, Valley Water would operate the expanded reservoir to optimize Valley Water's and SBCWD's available water supplies, meet M&I demands during drought periods and emergencies, increase suitable habitat for SCCC steelhead in Pacheco Creek, improve M&I water quality, and increase refuge water supplies. Valley Water and SBCWD would be allocated 90 percent and 10 percent, respectively, of the operating storage capacity of the reservoir. Except during emergencies, reservoir operations would prioritize releases to North Fork Pacheco Creek, and the expanded reservoir would release flows into North Fork Pacheco Creek from a multi-level inlet/outlet structure based on a Variable Flow Schedule. Mean monthly baseflows and pulse flow targets would vary based on a Pacheco Reservoir hydrologic water year type. Instream flows would support the maintenance of suitable habitat for SCCC steelhead. When needed, water supply withdrawals would be made out of the expanded reservoir into Pacheco Conduit for delivery to Valley Water and SBCWD. In below normal water years, Valley Water and SBCWD would provide 1,800 acre-feet and 200 acre-feet, respectively, of their CVP contract allocation to the CVPIA RWSP for use as IL4 refuge water supply.

Ability to Meet Project Objectives

The Staff Recommended Alternative would address both of the primary Project objectives and both of the secondary Project objectives. Table ES-1 illustrates the ability of the Staff Recommended Alternative to meet Project objectives by quantifying net benefits (i.e., Staff

[1] Supplementary or ancillary features of a dam such as inlet/outlet structures, spillways, tunnels, etc.

Recommended Alternative in comparison to existing and future baseline conditions[2]). The Staff Recommended Alternative's ability to meet Project objectives is summarized below:

- **Emergency Response: Emergency Storage/Emergency Water Supplies** Since SWP and CVP water supplies comprise approximately 45 percent of Valley Water's water supply portfolio, a Delta levee failure event could substantially impact Valley Water's ability to meet M&I water supply needs within its service area. The Staff Recommended Alternative would provide Valley Water and SBCWD with a dedicated local emergency water supply and would avoid undesirable results caused by long-term reliance on groundwater during emergencies. In an emergency, the Staff Recommended Alternative could deliver—either directly or by exchange—water to Valley Water and SBCWD.

- **Water Supply: Long-Term Water Supply Reliability.** The Staff Recommended Alternative would improve M&I water-supply reliability and increase available supplies under existing and future conditions for Valley Water and SBCWD. The Staff Recommended Alternative would improve M&I water supplies through an increased ability to fully utilize CVP allocations, development of local water supplies from the Pacheco Creek watershed, and improved system flexibility.

- **Ecosystem Improvement – Pacheco Creek: SCCC Steelhead Habitat Suitability.** The Pajaro River watershed has experienced more than a 90 percent decline in SCCC steelhead adult run size (i.e., number of adults per run) (NMFS 2013). Without serious intervention, a majority (possibly all) of SCCC steelhead populations are likely to be extinct within the next 50 years (Moyle et al. 2008). The Staff Recommended Alternative would provide substantive beneficial improvements to SCCC steelhead habitat conditions in Pacheco Creek through improved flow and temperature conditions. As shown in Table ES-1, the Steelhead Cohort Score, an index of Pacheco Creek's ability to support SCCC steelhead through all life stage based on the 14-month period in which a cohort is expected to remain in the creek (i.e., from adult migration through juvenile outmigration), would substantially increase under the Staff Recommended Alternative in comparison to baseline conditions in all water year types. In addition, the Staff Recommended Alternative would provide for pulse flows for adult steelhead attraction.

- **Ecosystem Improvement – San Joaquin River Watershed: IL4 Refuge Deliveries.** The Staff Recommended Alternative would allow Valley Water and SBCWD to provide a firm, 2,000 acre-feet supply of water in below normal water years to RWSP, for use in the IL4 Refuge Water Supply Pool—which is managed by Reclamation and USFWS. The increased supply would provide habitat and food for migratory birds of the Pacific Flyway, resident bird species, and many wildlife species.

[2] The exiting condition baseline represents conditions in 2017 without implementation of the Staff Recommended Alternative, and reflects land use, water demands, and institutional and regulatory conditions in 2017 and incorporates historical climate conditions. The future condition baseline represents conditions in 2030 without implementation of the Staff Recommended Alternative, and reflects projected land use, water demands, and institutional and regulatory conditions in 2030 and incorporates projected climate conditions (i.e., includes climate change projections).

Table ES-1. Ability of the Staff Recommended Alternative to Address Project Objectives and Summary of the Net Benefits

Benefit	Objective Addressed	Indicators	Existing Conditions (2017)[9]	Future Conditions (2030)[9]
Emergency Response	Primary Objective: Increase water supply reliability and system operational flexibility to help meet M&I and agricultural water demands in Santa Clara and San Benito Counties during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions	Net increase in regional surface storage (Pacheco Reservoir and Valley Water's surface reservoirs) and groundwater storage (North County Santa Clara Subbasin)[1, 2, 9]	117,480 AF	107,160 AF
Water Supply		Net increase in baseline supplies available to Valley Water and SBCWD; average all years and critical years only[3, 7, 8]	5,130 AF/ 8,830 AF	3,600 AF/ 8,350 AF
Ecosystem Improvement – Pacheco Creek	Primary Objective: Increase suitable habitat in Pacheco Creek for federally threatened SCCC steelhead through improved water temperature and flow conditions	Percent increase in Steelhead Cohort Score[4, 9]	157%	146%
		Provides adult attraction pulse flows for SCCC steelhead	Yes	
		Length of new stream channel habitat[5]	1.3 miles	
Ecosystem Improvement – San Joaquin River Watershed	Secondary Objective: Develop water supplies for environmental water needs at IL4 wildlife refuges to support habitat management in the Sacramento-San Joaquin Delta watershed	Net increase in Incremental Level 4 water deliveries to San Joaquin River watershed refuges in below normal years[6, 7, 9]	2,000 AF	2,000 AF
M&I Water Quality	Secondary Objective: Improve water quality and minimize supply interruptions, when water is needed, for Santa Clara and San Benito Counties, to increase operational flexibility for south-of-Delta contractors dependent on San Luis Reservoir	Number of months of avoided impaired water quality deliveries from San Luis Reservoir over 82-year simulation period[8, 9]	96 months out of 102 months (94% reduction)	63 months out of 65 months (97% reduction)

Notes:

[1] Values were derived from CalSim II and Valley Water's WEAP model.

[2] Under existing conditions, water stored in Pacheco Reservoir would not be available for emergency response due to lack of connection to the Valley Water or SBCWD water systems. Under the Staff Recommended Alternative, an expanded Pacheco Reservoir would be connected to Valley Water and SBCWD water systems via the Pacheco Conduit.

[3] Values were derived from Valley Water's WEAP model.

[4] Values were derived from Pacheco Creek Steelhead Habitat Suitability Model. The Steelhead Cohort Score provides an index of the ability of Pacheco Creek to support South-Central California Coast steelhead through all life stages.

[5] Reflects length of historic North Fork Pacheco Creek stream channel that is currently inundated by the existing Pacheco Reservoir and would be restored between the spillway of the new dam and the existing North Fork Dam that would be decommissioned.

[6] Values were derived from CalSim II and reflect refuge deliveries in the San Joaquin River watershed. Value reflects total quantity of water Valley Water, and SBCWD for the Staff Recommended Alternative, would transfer of their current CVP contract allocation, directly or through exchanges, to the Refuge Water Supply Program.

[7] Water year types based on the Sacramento Valley water year hydrologic classification.

[8] Values were derived from CalSim II and Valley Water's WEAP model.

[9] Existing conditions (2017) reflect the level of water supply demand and regulatory requirements in 2017, patterns of land use in 2017, and the water-related facilities assumed to be in place in 2017. Future conditions (2030) reflect the projected level of water supply demand and regulatory requirements in 2030, projected climate conditions centered around 2030, projected patterns of land use in 2030, and the additional water-related facilities assumed to be in place by 2030.

Key:
AF = acre-feet
M&I = municipal and industrial
SBCWD = San Benito County Water District
SCCC = South Central Coastal California
Valley Water = Santa Clara Valley Water District
WEAP = Water Evaluation and Planning

Costs

The total cost of the Staff Recommended Alternative, excluding escalation, is an estimated $1,996.4 million (April 2022 dollars). The total cost of the Staff Recommended Alternative, inclusive of escalation for construction and non-contract costs, is an estimated $2,358.4 million (April 2022 dollars).

Chapter 1. Introduction

1.1 Background and Location

The Santa Clara Valley Water District (Valley Water), in partnership with San Benito County Water District (SBCWD) and Pacheco Pass Water District (PPWD), is proposing the Pacheco Reservoir Expansion Project (Project) in the southeastern portion of Santa Clara County, California. The Project includes construction and operation of a new dam and expanded reservoir, conveyance facilities, and related miscellaneous infrastructure (e.g., access roads, electrical transmission lines), and decommissioning of the existing North Fork Dam and restoring portions of North Fork Pacheco Creek. The new dam and expanded reservoir would be located on North Fork Pacheco Creek upstream from the existing North Fork Dam and would inundate the upstream portion of the existing Pacheco Reservoir.

Water would be collected in the expanded reservoir during the winter months from local watershed area runoff and, as available, through Central Valley Project (CVP) supplies from San Luis Reservoir via the Pacheco Conduit. The proposed facilities and expanded reservoir would be operated by Valley Water to increase water supply reliability and system operational flexibility, help meet municipal and industrial (M&I) and agricultural water demands during drought periods and emergencies, increase suitable habitat for South Central California Coast (SCCC) steelhead in Pacheco Creek, and improve water quality and minimize water supply interruptions related to San Luis Reservoir operations. During below normal years, water supplies would also be supplied to the Central Valley Project Improvement Act (CVPIA) Refuge Water Supply Program (RWSP) in support of wetlands and wildlife habitat development and management.

The existing North Fork Dam is a 100-foot-tall earthen embankment dam on North Fork Pacheco Creek that impounds Pacheco Reservoir. The existing Pacheco Reservoir and North Fork Dam were constructed in 1939 by PPWD to provide irrigation and domestic water supply. These facilities are owned and operated by PPWD and are located in unincorporated Santa Clara County, approximately 17 miles northeast of the City of Gilroy and 0.4 miles north of State Route 152 (SR 152), as shown in Figure 1-1. Pacheco Reservoir is situated on the North Fork of Pacheco Creek. The headwaters of Pacheco Creek are in the Diablo Range, northeast of the City of Hollister. Downstream of Pacheco Reservoir, Pacheco Creek continues to flow west until it reaches San Felipe Lake, draining approximately 168 square miles in Santa Clara and San Benito Counties. San Felipe Lake is drained by Miller Canal, which joins the Pajaro River and flows southwest until it drains into Monterey Bay.

The San Luis Low Point Improvement Project (SLLPIP) feasibility studies were initiated in 2000 to determine how to improve water quality coming from San Luis Reservoir during periods when warm temperatures and declining water levels cause algae blooms near the San Felipe Division water supply intake. Pacheco Reservoir expansion has been considered a viable alternative for improving water quality conditions, as it would enable Valley Water to move high-quality water out of San Luis Reservoir and into Pacheco Reservoir before or after algae blooms—increasing water supply reliability and avoiding supply interruptions. The SLLPIP 2019 Draft Feasibility Report included the Pacheco Reservoir Expansion Alternative Plan and identified this plan as the preliminary National Economic Development (NED) Plan, as it was 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 (Reclamation 2019).

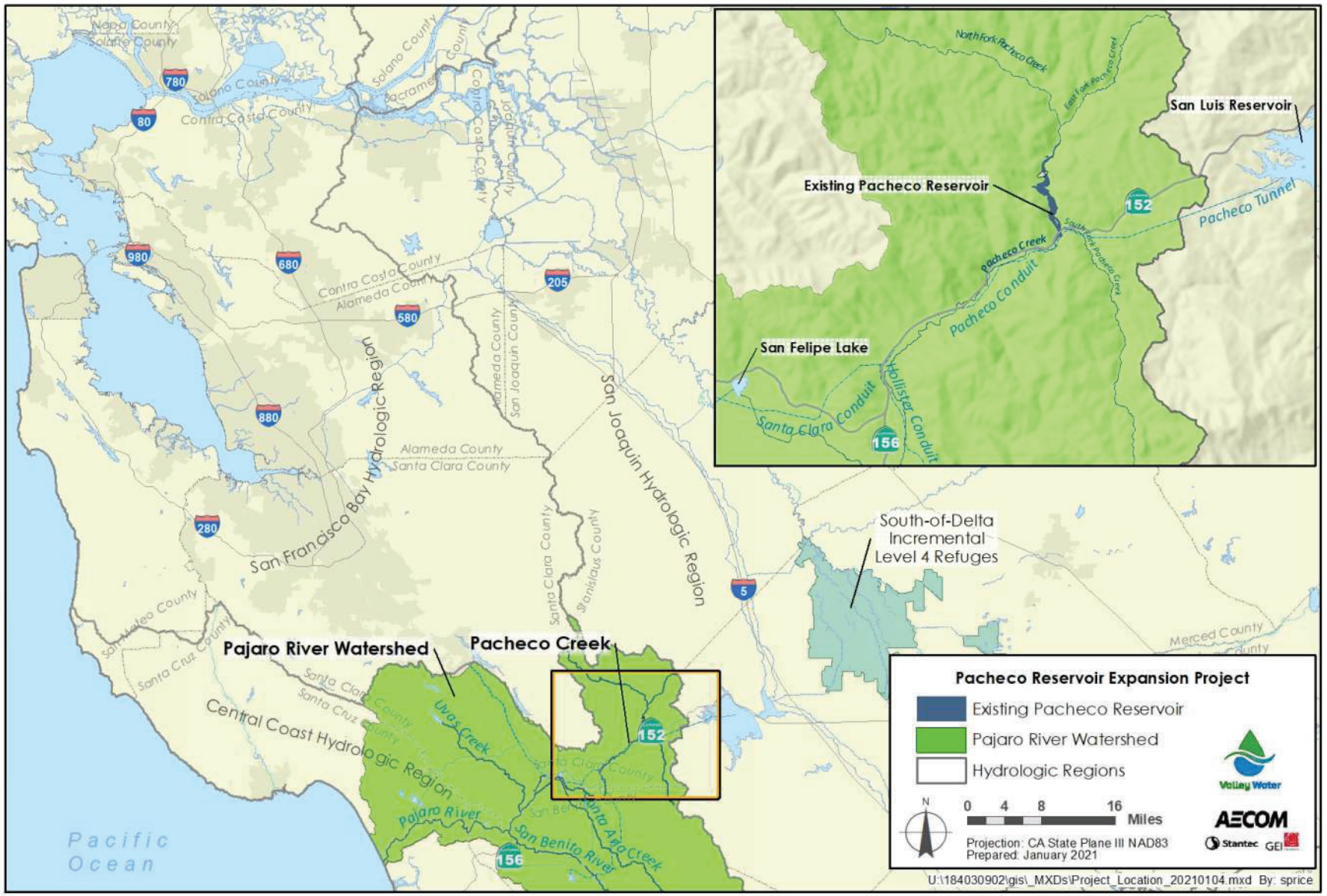


Figure 1-1. Pacheco Reservoir Expansion Project Location

Proposition 1, passed by California voters in 2014, dedicated $2.7 billion for investments in water storage projects in California. The California Water Commission (CWC) is administering the Water Storage Investment Program (WSIP) to fund the public benefits (e.g., emergency response, ecosystem enhancement, flood control, water quality) associated with water storage projects. The CWC selected the Project as the top-ranked of eight selected projects based on the public benefits the respective projects would provide. Valley Water has secured up to $496.7 million in WSIP funding for public benefits associated with ecosystem enhancement and emergency response for the Project. In December of 2022, the CWC reviewed and approved the Final Pacheco Reservoir Expansion Project WSIP Feasibility Documentation (Valley Water 2021d), and found that the Project is feasible and will advance the long-term objectives of restoring ecological health and improving water management for beneficial uses of the Sacramento-San Joaquin Delta.

The U.S. Environmental Protection Agency's Water Infrastructure Finance and Innovation Act (WIFIA) Program accelerates investment in our nation's water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects. Through the U.S. Environmental Protection Agency's competitive selection process, the Project was selected and formally invited to apply for a WIFIA loan for up to $1.2 billion; this is one of the largest funding awards in the WIFIA program's history. Valley Water is pursuing incremental loans for the Project through the WIFIA. Valley Water submitted an initial loan application in April of 2022.

1.2 Valley Water Planning Process

The alternatives formulation and evaluation methodology for the Project includes the following sequential processes:

1. **Define Problems and Objectives**: Problems with the existing system were clearly defined. The objectives indicate how each defined problem was targeted for improvement. These two activities are described in the *Problem Definition Report* (Valley Water 2021b) and *Project Objectives Technical Memorandum* (TM) (Valley Water 2020).

2. **Develop and Screen Conceptual Measures**: Based on the defined problems and objectives, a set of all potential conceptual measures that could address the problems and achieve the Project objectives were developed. These conceptual measures were either retained for further consideration or deleted, based on screening criteria. This process and its results are summarized in the *Conceptual Measures Assessment TM* (Valley Water 2021c).

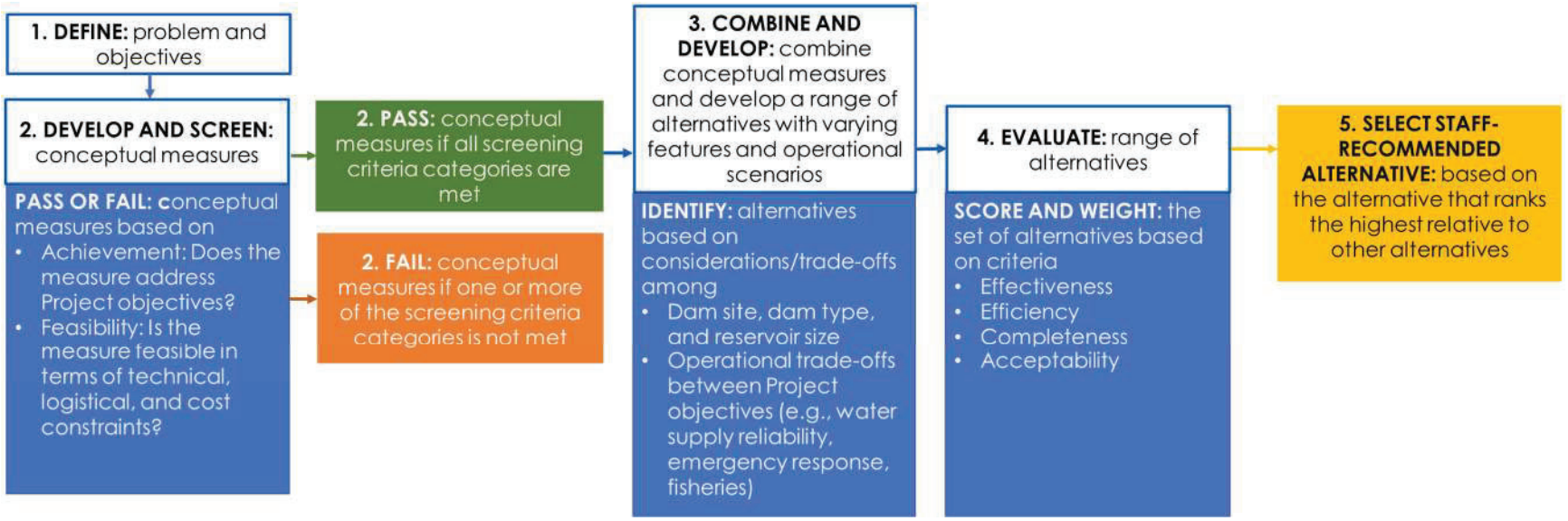
3. **Combine Conceptual Measures and Develop Alternatives**: Retained conceptual measures were combined to develop a range of alternatives that address the objectives. This process is summarized in the *Revised Final Project Alternatives Assessment TM* (Valley Water 2022a).

4. **Define Evaluation Criteria for Alternatives***:* Alternative evaluation criteria were developed and defined based on four major categories: effectiveness, efficiency, completeness, and acceptability. This process is summarized in the *Revised Final Project Alternatives Assessment TM* (Valley Water 2022a).

5. **Apply Evaluation Criteria to Alternatives**: Defined evaluation criteria were used to evaluate and rank the alternatives. This process and its results are summarized in the *Revised Final Project Alternatives Assessment TM* (Valley Water 2022a).

6. **Recommend Alternative**: A Staff-Recommended Alternative was identified based on how well the alternative meets the evaluation criteria. The Staff Recommended Alternative is summarized in the *Staff Recommended Alternative/Alternatives Formulation Report* (Valley Water 2022b).

Figure 1-2 highlights the alternatives formulation and evaluation methodology to support selection of the Staff-Recommended Alternative.



Note: In consideration of the California Department of Water Resources, Division of Safety of Dams letter received in November 2021 that identified concerns related to the viability/acceptability of the hardfill dam and refined modeling and analyses developed for the Draft Environmental Impact Report released in November 2021, a re-evaluation of the alternatives was conducted in 2022 based on this updated information.

Figure 1-2. Alternatives Formulation and Evaluation Process

1.3 Stakeholder Engagement

Concurrent with the Project's planning process, Valley Water engaged with various potential funding partners, regulatory agencies, tribes, and other stakeholders and industry experts on a wide range of alternatives development and Project implementation considerations. These considerations included Project facility needs and requirements, construction period and long-term reservoir operations, Project benefits and funding, and means to avoid and/or reduce Project-related environmental impacts. Valley Water continues to engage with a broad range of Project stakeholders, including those listed in Table 1-1.

Table 1-1. Entities Engaged with During Alternatives Development Process

Type	Entity
Federal Agencies	National Marine Fisheries Service/NOAA Fisheries U.S. Army Corps of Engineers U.S. Environmental Protection Agency U.S. Fish and Wildlife Service U.S. Department of Interior, Bureau of Reclamation
State Agencies	California Department of Fish and Wildlife California Department of Transportation California Department of Water Resources (including Division of Safety of Dams) California Water Commission California State Parks State Water Resources Control Board Regional Water Quality Control Board, Central Coast
Regional/Local Agencies	Pacheco Pass Water District Power and Water Resources Pooling Authority San Benito County Water District Santa Clara County Santa Clara Valley Habitat Agency
Tribal[1]	Amah Mutsun Tribal Band Indian Canyon Mutsun Band of Costanoan Ohlone Indian Tribe
Other Entities	Pacific Gas and Electric Private Landowners

Notes:
[1] As part of the AB 52 tribal consultation process, Valley Water contacted ten (10) tribes identified by the Native American Heritage Commission. Three tribes requested consultation under AB 52; these tribes are listed by name.

Key:
AB = Assembly Bill
NOAA = National Oceanic and Atmospheric Administration

Input from two key stakeholder groups most influential during the Project alternatives development and evaluation process included: 1) the California Department of Water Resources, Division of Safety of Dams (DSOD) and the Project Technical Review Board (TRB), and 2) the WSIP funding agencies (i.e., CWC, California Department of Fish and Wildlife), regulatory agencies (e.g., National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service, State Water Resources Control Board), and other Project stakeholders (e.g., U.S. Department of Interior, Bureau of Reclamation (Reclamation), Santa Clara Valley Habitat Agency). In 2019, Valley Water initiated coordination with DSOD due to their role in reviewing and approving the designs of the dam and appurtenant structures. In 2019, Valley Water also established the TRB of five recognized industry leaders and experts in dam siting, design, and

construction to evaluate and provide feedback on the dam alternatives. The second stakeholder group (i.e., WSIP funding partners, regulatory agencies, and other Project stakeholders) was engaged via a series of 17 workshops between 2019 and 2021. A broad range of topics were addressed during workshops including SCCC steelhead production in Pacheco Creek, analytical tools to assess beneficial and adverse impacts of reservoir operations, and other topics. Many workshops focused on long-term reservoir operations and resulted in the development of a reservoir release schedule based on water year type that would benefit SCCC steelhead and other aquatic and riparian species in Pacheco Creek. Valley water will continue to engage with these key Project stakeholder groups moving forward.

1.4 Document Organization

This Planning Study Report is organized as follows:

- **Chapter 1 Introduction** Provides background information on the Project.
- **Chapter 2 Purpose and Project Objectives** Defines the objectives and purpose of the Project
- **Chapter 3 Alternatives Development and Evaluation** Describes the alternatives evaluated and the evaluation methodology and results used to identify the Staff Recommended Alternative.
- **Chapter 4 Staff Recommended Alternative** Documents the facilities, construction, construction schedule, operations and maintenance, benefits, and costs of the Staff Recommended Alternative.

Chapter 2. Purpose and Project Objectives

2.1 Objectives

Primary objectives consider the basic needs the Project intends to satisfy. The primary objectives are considered to have equal priority. Secondary planning objectives are considered to the extent possible through pursuit of the primary planning objectives.

The primary and secondary Project objectives are to:

- Primary Objectives
  - Increase water supply reliability and system operational flexibility to help meet M&I and agricultural water demands in Santa Clara and San Benito Counties during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions.
  - Increase suitable habitat in Pacheco Creek for federally threatened SCCC steelhead through improved water temperature and flow conditions.
- Secondary Objectives
  - Improve water quality and minimize supply interruptions, when water is needed, for Santa Clara and San Benito Counties, to increase operational flexibility for south-of-Delta contractors dependent on San Luis Reservoir.
  - Develop water supplies for environmental water needs at Incremental Level 4 (IL4) wildlife refuges to support habitat management in the Delta watershed

2.2 Project Purpose

Following is a description of identified major water resources problems or deficiencies. These problems or deficiencies identify the purpose for the expansion of Pacheco Reservoir.

2.2.1 Decreasing Water Supply Reliability and System Flexibility

Despite significant physical improvements in water resources systems and system management over the past few decades, California still faces unreliable water supplies due to uncertainty surrounding future climate change, seismic events, and hydrologic conditions. In response to these challenges, Bay Area water agencies have diversified their respective water supply portfolios (DWR 2019; DWR 2014). Valley Water's diversified water supply portfolio includes imported and local surface supplies and groundwater, conservation, water-banking operations, and water recycling. This portfolio provides flexibility in responding to droughts, but Valley Water customers still receive more than 45 percent of their supply from Delta exports under CVP and SWP contracts. During dry years, Valley Water and SBCWD may have water allocations much less than their contract amounts and during wet years CVP and SWP allocations often are greater than expected. Unfortunately, Valley Water and SBCWD are unable to take advantage of a portion of higher wet year allocations in some years due to insufficient local storage capacity. The anticipated effects of climate change could contribute to reduced water supply space in existing reservoirs due to increased needs for additional flood management space, more extreme heat and drought events, and saltwater intrusion due to sea-level rise.

The state's water operations, including the reliability of SWP and CVP water supplies, rely on a fragile Delta levee system that faces increasing risks from floods, earthquakes, and climate change. A Delta levee-failure event could substantially impact Valley Water's ability to meet M&I water supply needs within its service area. Multiple levee failures, or a failure when Delta inflows are low, could cause saltwater intrusion as far inland as the SWP and CVP pumping facilities in the south Delta. This could result in a long-term disruption of SWP and CVP exports to south-of-Delta water contractors. Since SWP and CVP water supplies comprise approximately 45 percent of Valley Water's water supply portfolio, a Delta levee failure event could substantially impact Valley Water's ability to meet M&I water supply needs within its service area. A Delta levee failure would also substantially impact the SBCWD's M&I customers, as SBCWD's water supply portfolio includes approximately 42 percent from CVP water supplies.

As strain continues to build up on Bay Area faults, increasing the annual risk of seismic activity, aging levees are increasingly vulnerable to earthquake-induced failure. Numerous earthquake faults running through or near the Delta also pose a threat to levee stability and therefore, the reliability of Valley Water's SWP and CVP water supplies and the SBCWD's CVP water supplies. Valley Water's Climate Change Action Plan identifies the need to support state efforts to develop emergency preparedness plans to respond to large Delta levee failure events that threaten imported water supplies (Valley Water 2021a).

Multiple challenges are presented when maintaining and ensuring groundwater sustainability, including increasing uncertainty about the future availability of imported water, particularly with climate variability and competing demands from overdrafted basins elsewhere. During the 2012 to 2016 drought, locally observed groundwater levels dropped due to extreme dry conditions (Valley Water 2019). Lack of imported water during dry years, groundwater overdraft, and drought presents risks to long-term water supply reliability. Groundwater overdraft presents further threats to groundwater supply reliability, such as land subsidence and sea-water intrusion. Future climate change impacts to hydrologic conditions may place new challenges and constraints on managing the region's groundwater resources.

2.2.2 Insufficient Habitat for SCCC Steelhead

The Pajaro River watershed is considered severely degraded, and it has experienced more than a 90 percent decline in SCCC steelhead adult run size (i.e., number of adults per run) (NMFS 2013). Without serious intervention, a majority (possibly all) of SCCC steelhead populations are likely to be extinct within the next 50 years (Moyle et al. 2008). In the early to mid-1960's, the Pajaro River watershed supported up to 2,000 spawning adults (McEwan and Jackson 1996), only to have the population plummet to less than 500 adults by 1996 (NMFS. 2005). Over the years, the three watersheds most likely supporting the largest runs of steelhead (Pajaro, Salinas, and Carmel) have experienced more than 90 percent declines in adult run size (NMFS 2013).

NMFS developed the South-Central California Steelhead Recovery Plan (Recovery Plan) in 2013 for the SCCC steelhead. The Recovery Plan describes the importance of the Interior Coast Range Biogeographic Population Group (BGP), which includes the Pajaro River and its tributaries. The Recovery Plan states that the SCCC steelhead require the recovery of a minimum number of viable populations within each BGP in order to conserve natural diversity, spatial distribution, and abundance. The Interior Coast Range BGP consists mostly of long alluvial valleys, historically moderate-to-low migration reliability (based on unmanaged flow regimes prior to European settlement), and many intermittent streams. Because the mainstems cross alluvial valleys, steelhead adults and smolts often encounter problems migrating, particularly in dry years. As a result, the number of viable populations in this BGP have

decreased over the years. In the Pajaro River watershed, there are only two consistent populations – Corralitos Creek near the estuary, and Uvas Creek. Llagas Creek and Pacheco Creek only have sporadic steelhead activity due to the intermittent nature of the streams. Therefore, the Pajaro River steelhead are at a higher risk of extirpation because of the limited number of populations. Improving conditions in Pacheco Creek to support SCCC steelhead is extremely important to the establishment of a functionally independent SCCC population in the Pajaro River watershed.

The SCCC steelhead population is severely impacted by insufficient flow, unsuitable water temperatures, and climate change. These steelhead have adapted to live in flashy streams along the California and Oregon coastlines, which provides a high-risk, high-reward strategy for survival because the fish are exposed to extended dry periods with limited to no channel flows. This increases the risk of single-year population extirpation (local eradication). Pacheco Creek is subject to significant streambed percolation into the aquifers, with stream reaches that tend to go dry in many years.

Insufficient flows in Pacheco Creek and its tributaries, particularly South Fork Pacheco Creek and Cedar Creek, impact both adult and juvenile steelhead survival by impeding fish passage, stranding redds (spawning nests) or juveniles, and impairing habitat by reducing riparian vegetation cover—which exacerbates increased water temperatures. Dry tributaries to Pacheco Creek negatively impact juvenile habitat and juveniles have become dependent on North Fork Pacheco Reservoir releases designed to match the timing of agricultural use downstream. Low stream flows and high water temperatures severely impact steelhead fry and juvenile survival in many years during late spring before Pacheco Reservoir releases begin. Low flows result in dry creek beds and shallow riffles which impede fish movement throughout Pacheco Creek, and its tributaries as well as during the outmigration period.

Pacheco Creek in the dry season.

Pacheco Creek with 10 cfs flow.

Field studies indicate that, under current conditions (low flows and high water temperature), only the 10 miles of Pacheco Creek downstream from the existing confluence of North Fork and South Fork Pacheco Creeks may provide suitable habitat for steelhead egg incubation and fry rearing in some years (Smith pers. Com 2017). Therefore, having consistent and continuous flow at a suitable temperature is essential to the survival of SCCC steelhead in Pacheco Creek. Pacheco Creek is noted to have warmer water temperatures because of factors including low flows, restricted connection to the aquifer, and limited riparian cover. Water temperatures in Pacheco Creek are likely suitable immediately downstream from North Fork Dam during the wet, cooler months of January through April when upstream and downstream migration, spawning, and egg incubation occur. Several creek miles downstream from the dam, water temperatures become increasingly warmer and more variable in late summer due to diurnal heating and cooling and without enough flow, these temperatures can be lethal.

2.2.3 Degraded Quality of Drinking Water

Valley Water and SBCWD Intake Within San Luis Reservoir

When water levels are low at San Luis Reservoir—a main component of the CVP San Felipe Division—water quality declines and can interrupt the supply of healthy, clean drinking water for Santa Clara and San Benito Counties. San Luis Reservoir, located approximately 11.5 miles east of Pacheco Reservoir, is owned and jointly operated by Reclamation and California Department of Water Resources to provide seasonal storage for SWP and CVP. A portion of deliveries from San Luis Reservoir flow west—through the Upper and Lower Pacheco Intakes, Pacheco Tunnel, Pacheco Pumping Plant, and Pacheco Conduit—to the San Felipe Division of the CVP, which includes Valley Water and SBCWD.

Algae Growth Within San Luis Reservoir

High temperatures, combined with declining water levels, foster growth of an algae layer extending as much as 35 feet below San Luis Reservoir's surface. As the water levels decline to the point that the algae are in the vicinity of the Upper Pacheco Intake, that intake is no longer used. Typically, this occurs when water levels reach an elevation of 369 feet above mean sea level (msl), or at 300,000 acre-feet capacity in the reservoir. If water levels fall below 369 feet above msl, Valley Water blends water from San Luis Reservoir with local supply sources to minimize water quality issues for M&I customers. San Luis Reservoir is the only delivery route for Valley Water's CVP supplies; therefore, Valley Water cannot receive its normal CVP supplies for M&I purposes during low-point events (Reclamation and Valley Water 2019).

2.2.4 Insufficient Water Supply for Refuges

Pursuant to the CVPIA RWSP, IL4 water supplies are deliveries meant to support wetlands and wildlife habitat development and management. Historically, these deliveries to wildlife refuges have been less than 50 percent of demand. Reclamation is required to provide full Level 2 water supplies annually, while Level 4 water supply is considered the total amount of water identified for optimum wetlands and wildlife habitat development and management. IL4 water supplies are the difference between the defined Level 2 and full Level 4 water supplies. The CVPIA requires that Reclamation provide full Level 2 supplies annually, with allowable reductions of up to 25 percent during some years. However, the CVPIA stipulates that IL4 water supplies are to be acquired in cooperation and cost-sharing with the State of California through voluntary measures, such as purchase, lease, donation, conservation, and conjunctive use.

Each year, the RWSP strives to provide as much IL4 water as possible. However, full IL4 deliveries have been achieved only during wet years and only to refuges without conveyance constraints. From 2002 to 2014, average annual IL4 refuge water supply deliveries were less than 50 percent of total IL4 demands (Reclamation 2016). This deficit is due in large part to state and federal budget shortages, conveyance constraints at certain refuges that prevent the transmission of surface water deliveries, inconsistency in the timing of water deliveries, decreased water supply availability due to in-stream flow requirements and the Delta export restrictions, and increases in the cost of water made available annually from willing sellers on the open market (CVJV 2006).

Chapter 3. Alternatives Development

This chapter describes Valley Water's alternatives development process that was outlined in Section 1.2.

3.1 Conceptual Measures and Screening Criteria

Once the Project objectives were developed and the Project purposes were identified to address problems and deficiencies, the next major step in formulating alternatives was to identify and evaluate potential conceptual measures. A conceptual measure is any operational modification or construction change that could address one or more of the Project objectives consistent with Valley Water's Quality and Environmental Management System, the following categories were used to evaluate the conceptual measures during the screening process.

1. Achievement: Ability to address the respective primary or secondary Project objectives independently
2. Feasibility: Practicability in terms of technical, logistical, and cost constraints

Over 50 conceptual measures were developed and evaluated to address the primary and secondary objectives. The conceptual measures for each of the primary and secondary objectives were categorized by project type. Each conceptual measure was evaluated, receiving either a pass or fail, for two categories: 1) achievement (i.e., ability to address the respective primary or secondary Project objectives independently) and 2) feasibility (i.e., practicability in terms of technical, logistical, and cost constraints). Conceptual measures retained for potential incorporation into alternatives received a pass for both achievement and feasibility categories.

All conceptual measures that addressed the primary objectives and received a pass for all screening categories were retained for inclusion into initial action alternatives. Conceptual measures that addressed the secondary objectives, received a pass for all screening categories, and were not being pursued under an independent study or project were retained for inclusion into initial action alternatives. These retained conceptual measures were combined and a set of initial action alternatives was formulated.

3.2 Alternatives Evaluation

3.2.1 Initial Alternatives Evaluation

Initial alternatives were formulated to allow for the direct comparison of the physical benefits, tradeoffs, and costs of the various dam site, dam type, and reservoir capacity combinations. Considered were an upstream and downstream dam site location, hardfill and earthfill dam type, and a larger (140,000 acre-feet) and smaller (96,000 acre-feet) reservoir capacity. All initial alternatives had common operational priorities (e.g., fixed reservoir release schedules, no partner participation in operations) because coordination among the WSIP funding partners, regulatory agencies, and other stakeholders was ongoing and because physical benefits (e.g., M&I water supply quantities, amount of suitable habitat for SCCC steelhead) did not vary considerably based on dam site location or dam type. Ultimately, five alternatives were evaluated based on criteria related to effectiveness, efficiency, completeness, and acceptability by regulatory agencies and other stakeholders. The highest-ranking alternative was a reservoir expansion of 140,000 acre-feet with a hardfill dam at the upstream location. Although uncertainty related to DSOD acceptability of constructing a hardfill dam was recognized during

this initial evaluation and ranking process, the upstream, hardfill dam alternative was the highest-ranking alternative due to the substantial cost savings, improved constructability, and minimized construction-related environmental impacts when compared to the other alternatives.

3.2.2 Alternatives Refinement

Following the initial alternatives evaluation and ranking and in consideration of stakeholder input, the initial alternatives were refined for inclusion in the Draft Environmental Impact Report (EIR). Refinements to the initial alternatives included updated designs for additional facilities (e.g., property owner access roads, power transmission lines, SR 152 access improvements), construction methods (e.g., water handling during construction at new dam site, water sources during construction), and operational analyses (e.g., variable Pacheco Creek flow targets informed by agency coordination, level of SBCWD participation). Based on coordination with California Department of Transportation, options for access improvements at SR 152 and Kaiser-Aetna Road were developed and incorporated into the alternatives, ranging from a permanent interchange/overpass option to a temporary at-grade interchange with a lane widening. Based on coordination with WSIP funding agencies, regulatory agencies and other stakeholders, a variable Pacheco Creek flow release schedule was developed to consider hydrologic conditions (e.g., based on water year type) and incorporate pulse flows for adult steelhead attraction. In addition, 10 percent participation by SBCWD was incorporated into selected alternatives. As a result of these refinements, alternatives evaluated in the Draft EIR included 1) either an upstream or downstream dam site location, 2) either a hardfill or earthfill dam type, 3) either a larger (140,000 acre-feet) or a smaller (96,000 acre-feet) reservoir capacity, 4) either a fixed flow release schedule or a variable (by water year type) flow release schedule and 5) either no participation by SBCWD or 10 percent participation by SBCWD.

3.2.3 Revised Alternatives Evaluation

After continued coordination and engagement between Valley Water, the Project's TRB, and DSOD, and after the TRB strongly supported the continued advancement of the initial highest-ranking Project alternative with the hardfill dam type, the DSOD transmitted a letter raising concerns with the viability/acceptability of the hardfill dam. This, in combination with refined modeling and analyses in the Draft EIR, resulted in the need to update the alternatives evaluation based on new information.

3.2.3.1 Description of Revised Alternatives

Similar to the initial alternatives evaluation, the alternatives in the revised evaluation considered an upstream and downstream dam site location, hardfill and earthfill dam types, and a larger (140,000 acre-feet) and smaller (96,000 acre-feet) reservoir capacity. Furthermore, each alternative had the same operational priorities. As the physical benefits (e.g., M&I water supply quantities, amount of suitable habitat for SCCC steelhead) would not vary considerably based on dam site location or dam type, all of the alternatives listed in Table 3-1 had common operational priorities consistent with those presented for the Proposed Project in the Draft EIR (Valley Water 2021). For the revised alternatives evaluation, all alternatives incorporated Pacheco Creek flow targets that were variable across water year types and assumed 10 percent participation by SBCWD. A summary of the combination of facilities and operations of the revised alternatives is shown in Table 3-1.

Table 3-1. Summary of Combination of Facility and Operations of Revised Alternatives

Revised Alternative[1]	Facilities			Operations	
	Dam Site	Expanded Reservoir Capacity (TAF)	Dam Type	Pacheco Creek Flow Target	San Benito County Water District Participation
1a	Downstream	140	Earthfill	Variable flow targets[2]	10%
1b	Downstream	140	Hardfill	Variable flow targets[2]	10%
5a	Upstream	140	Earthfill	Variable flow targets[2]	10%
5b	Upstream	140	Hardfill	Variable flow targets[2]	10%
6	Upstream	96	Earthfill	Variable flow targets[2]	10%

Notes:

[1] Numbering based upon facilities incorporated into alternatives evaluated during Alternatives Analysis Workshop on May 12, 2020. As the physical benefits would not vary considerably based on dam site location or dam type, the revised alternatives evaluated incorporated common operational priorities.

[2] Releases to North Fork Pacheco Creek from the expanded reservoir vary depending on water year type and reflect input received from regulatory agencies and Water Storage Investment Program funding agencies (Valley Water 2021b, Valley Water 2021c)

Key:

% = percent

TAF = thousand acre-feet

3.2.3.2 Revised Alternatives Evaluation Methodology and Results

Specific Project objectives were used to guide the alternatives evaluation. To support the evaluation of the alternatives, four major criteria categories were developed, with two or more detailed criterion developed for each major criteria category, as shown in Table 3-2. Each alternative evaluation criterion was assessed either quantitatively or qualitatively and specific metrics were used to assign a score. Evaluation criteria that were assessed using quantitative metrics were assigned a score on a scale of 0 to 10. Evaluation criteria that were assessed using qualitative metrics were assigned *very high*, *high*, *medium*, *low*, or *very low* and a corresponding numerical score. All corresponding numerical scores assigned are whole integers.

Table 3-2. Criteria for Each Major Alternatives Evaluation Criteria Category

Criteria Category	Criterion
Effectiveness: the extent to which an alternative alleviates problems and addresses the Project objectives.	Improve water supply reliability
	Increase emergency response water supplies
	Improve SCCC steelhead habitat suitability
	Ability to address secondary Project objectives
Cost Efficiency: The extent to which an alternative addresses the Project objectives at the least cost, based on capital and operations and maintenance costs.	Benefit/Cost ratio
	Capital cost
Completeness: The extent to which an alternative has the necessary components to be implemented while also accounting for constructability and maintainability.	Constructability
	Maintainability
Acceptability: The viability of the alternative with respect to environmental impacts and regulatory and public/stakeholder acceptance.	Regulatory acceptability
	Environmental impacts
	Public/stakeholder acceptability

Key:
SCCC = South-Central California Coast

A summary of the weighting factor and scoring results from both the quantitative and qualitative criterion for each of the action alternatives is provided in Table 3-3. The higher the weighted score, the greater the importance of the given criterion. The alternative with the highest weighted score is Alternative 5a, which includes an earthfilll dam at the upstream dam site with a 140,000-acre-foot reservoir.

Table 3-3. Summary of Weighting Factor and Scoring Results for Each of the Criterion

Criterion		Weighting Factor	Alternatives Score									
			Alternative 1a		Alternative 1b		Alternative 5a		Alternative 5b		Alternative 6	
			Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Effectiveness	Improve Long-Term Water Supply Reliability	14	10	140	10	140	10	140	10	140	8	112
	Increase Emergency Response Water Supplies	17	10	170	10	170	10	170	10	170	7	119
	Improve SCCC Steelhead Habitat Suitability	9	10	90	10	90	10	90	10	90	10	90
	Ability to Address Secondary Project Objectives	1	9	9	9	9	9	9	9	9	9	9
Cost	Benefit/Cost Ratio	15	8	120	10	150	9	135	10	150	9	135
	Capital Cost	12	3	36	7	84	7	84	9	108	10	120
Completeness	Constructability	11	4	44	8	88	6	66	10	110	7	77
	Maintainability	4	2	8	9	36	6	24	10	40	7	28
Acceptability	Regulatory Acceptability	13	8	104	2	26	10	130	2	26	10	130
	Environmental Impacts	3	8	10	10	30	8	24	8	24	8	24
	Public/Stakeholder Acceptability	6	8	48	8	48	6	36	6	36	8	48
			Total	**793**	**Total**	**871**	**Total**	**908**	**Total**	**903**	**Total**	**892**

Key:
SCCC = South Central California Coast

3.3 Staff Recommended Alternative and Next Steps

Chapter 4 provides a description of the Staff Recommended Alternative. Facility components and construction program components for the Staff Recommended Alternative are based on the 30 percent designs for the upstream, earthfill dam that provides for an expanded reservoir of 140,000 acre-feet and have been refined since the revised alternatives evaluation. The operations of the Staff Recommended Alternative are consistent with those presented for the Proposed Project in the Draft EIR (Valley Water 2021).

Chapter 4. Staff Recommended Alternative

4.1 Overview

The Staff Recommended Alternative includes a new earthfill dam and other associated facilities as presented in Figure 4-1. Valley Water would operate these facilities and the expanded 140,000-acre-foot reservoir to increase emergency storage/emergency water supply, improve water supply reliability, increase SCCC steelhead habitat suitability, increase IL 4 refuge water supplies, and reduce impaired water quality deliveries from San Luis Reservoir. Major facilities of the Staff Recommended Alternative include:

- a new earthfill dam, spillway, and inlet/outlet works at the upstream dam site;
- an expanded reservoir with a total active storage capacity of 140,000 acre-feet;
- new water conveyance facilities (pipelines, tunnel, and pump station) connecting the expanded reservoir to the Pacheco Conduit;
- decommissioning the existing North Fork dam and restoring segments of the North Fork Pacheco Creek channel;
- utility modifications including a new electrical substation and power transmission lines; and
- new permanent access roads and temporary vehicular access improvements on SR 152 and Kaiser-Aetna Road (i.e., temporary overcrossing bridge).

Figure 4-2 presents the facilities at or near the earthfill dam site. The new earthfill dam would be located 2.2 miles upstream from the confluence of North Fork Pacheco Creek and South Fork Pacheco Creek. At full pool, the surface area of the expanded reservoir would be approximately 1,367 acres and the water surface elevation would be 741 feet above msl. Facilities included as part of the Staff Recommended Alternative, construction efforts required to construct these facilities, and operations and maintenance of the Staff Recommended Alternative are summarized below.

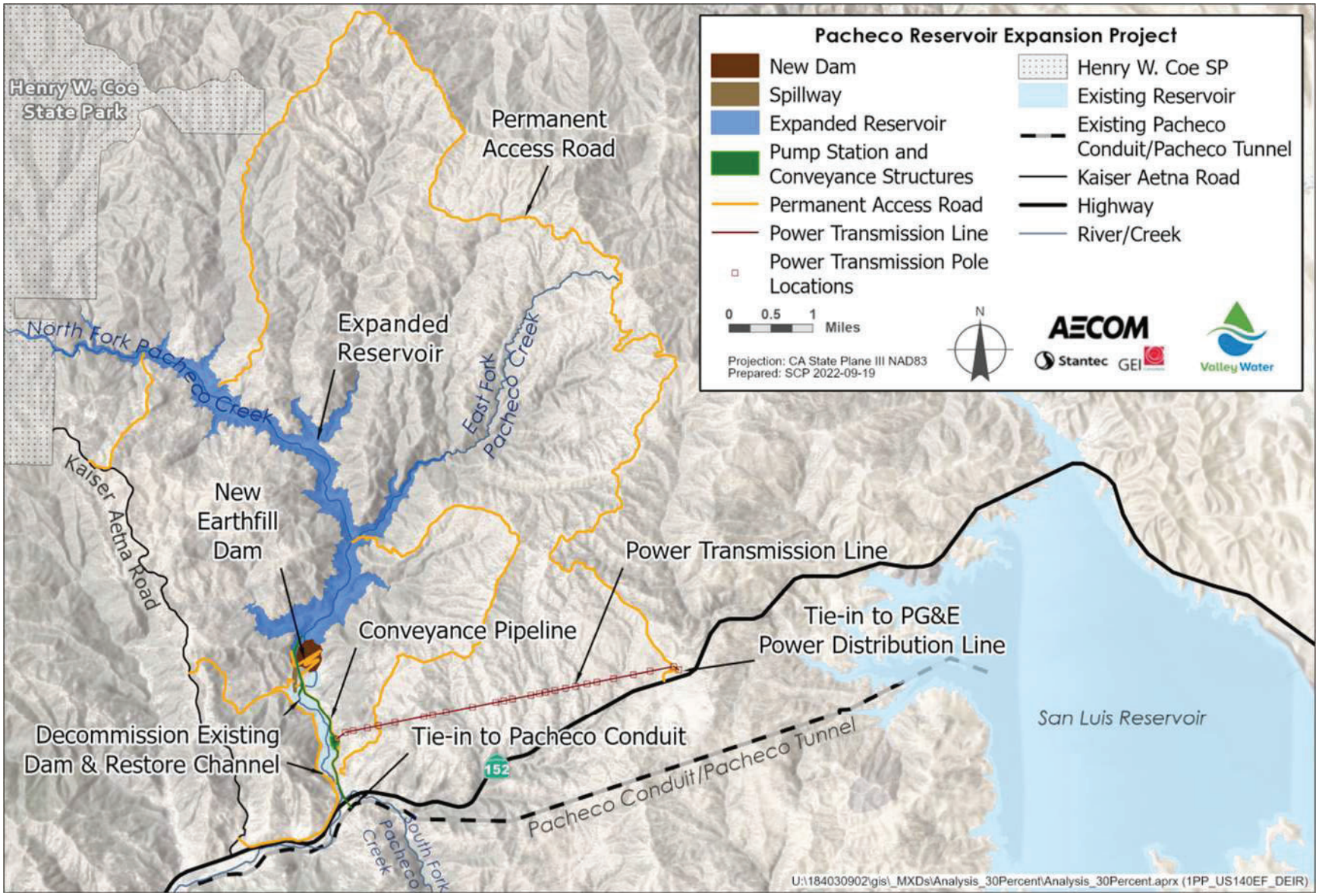
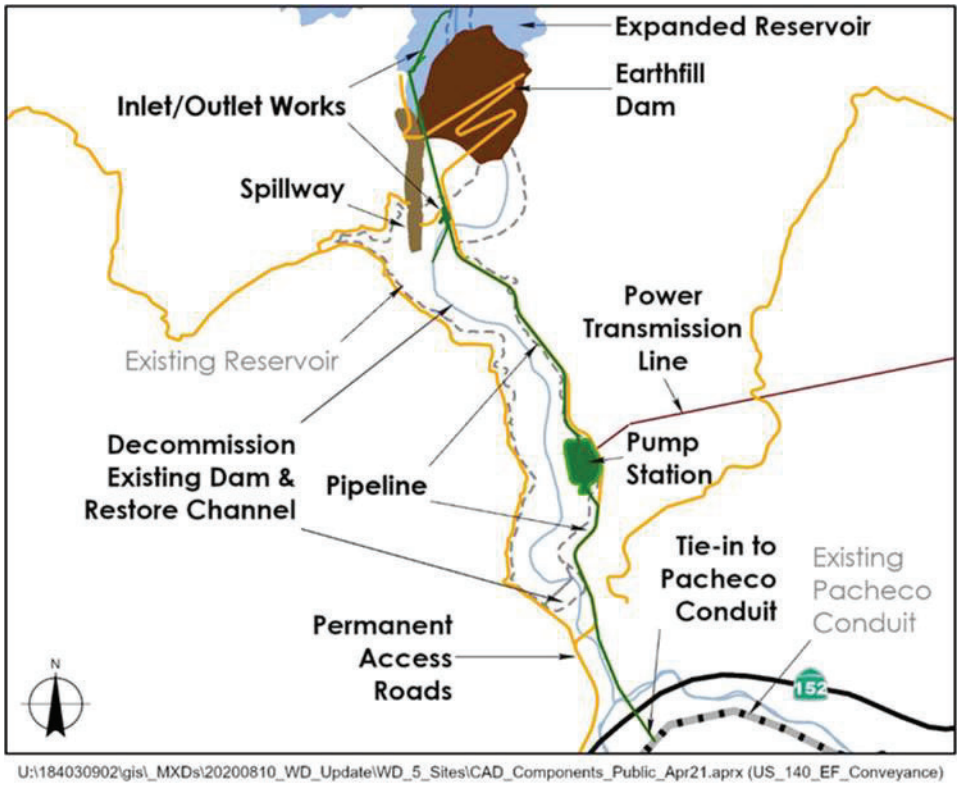


Figure 4-1. Permanent Facilities and Expanded Reservoir for Staff Recommended Alternative



Note: Not to scale

Figure 4-2. Schematic of Permanent Facilities at or Near the Dam Site of the Staff Recommended Alternative

4.2 Facilities

The Staff Recommended Alternative facilities would include a new dam and appurtenant facilities[3], new water conveyance to and from the Pacheco Conduit, utility modifications, vehicular access improvements, and other minor improvements. A new earthfill dam with spillway and inlet/outlet works would be constructed 1.8 miles upstream from the existing North Fork Dam. The height of the earthfill dam would be approximately 315 feet and the width of the dam at the crest would be approximately 1,900 feet. The new dam would require approximately 11.5 million cubic yards of earthfill. At full pool, the surface area of the expanded reservoir would be approximately 1,367 acres with 35.2 miles of shoreline. The inlet/outlet works would consist of three adits[4] on an intake shaft built separate of the body of the dam; a bypass intake and pipeline; an outlet conduit installed under the east abutment of the dam; and an outlet/bifurcation structure. The inlet/outlet works would convey up to 490 cubic feet per second (cfs) to/from Pacheco Conduit and simultaneously release up to 100 cfs to North Fork Pacheco Creek and allow for 2,680 cfs emergency releases. The existing North Fork Dam and appurtenant facilities would be decommissioned and approximately 1.3 miles of North Fork Pacheco Creek would be restored to provide spawning and rearing habitat for SCCC steelhead.

The Staff Recommended Alternative would include a pipeline and pump station to allow for the bi-directional conveyance of water between the expanded reservoir and Pacheco Conduit. The conveyance pipeline would be 8,700 feet long and 114-inch-internal-diameter with a capacity of

[3] Supplementary or ancillary features of a dam such as inlet/outlet structures, spillways, tunnels, etc.
[4] For earthfill dams, these are the welded steel pipes within tunnels with openings to intake water from the reservoir (also for release of water from Pacheco Conduit into expanded reservoir).

490 cfs. To tie-in the new pipeline into the existing Pacheco Conduit, approximately 1,000 feet of the existing Pacheco Conduit would be removed and replaced. To provide power to the dam and water conveyance facilities, a new 70 kilovolt (kV)/4.16 kV electrical substation and 4.1 miles of new, single overhead 70 kV transmission line would be constructed.

A combination of new permanent and temporary roads and improvements to existing access routes would be required to allow primary and auxiliary access to the new dam and facilities, nearby properties of existing landowners, and construction areas. Permanent access roads would include a 1.6-mile frontage road, 6.6 miles of dam and auxiliary access roads, and 29.9 miles of property owner access roads. In addition, 3.0 miles of temporary construction roads would be required during construction. Primary vehicular access to the dam site and appurtenant facilities during construction would be provided by temporary overcrossing bridge located west of the existing SR 152 and Kaiser-Aetna Road intersection that would connect to a new permanent frontage road accessed from Kaiser-Aetna Road.

4.3 Construction

Construction of the Staff Recommended Alternative would be initiated in mid-2027, with an estimated duration of 7.2 years. The temporary overcrossing bridge located west of SR 152 and Kaiser-Aetna Road, and permanent and temporary access roads would be completed early in the construction period to facilitate access for construction crews and equipment to the dam site. In year two of construction, the existing Pacheco Reservoir would be drained, and the existing North Fork Dam and ancillary facilities would be decommissioned. Following decommissioning of the existing dam, flows would follow a natural hydrograph until the new dam is completed. Construction of the earthfill dam with spillway and inlet/outlet works, conveyance facilities, utilities, and other improvements would occur concurrently until completion.

The Staff Recommended Alternative would include 11 construction staging areas totaling 55.6 acres, 5 on-site material borrow areas totaling 176.8 acres, and 5 disposal areas totaling 168.1 acres, as shown in Figure 4-3. To allow for material mixing on site during construction the Staff Recommended Alternative would include the development of a concrete batch plant, located in one of the identified staging areas. A mix of equipment would be on-site during construction to support earthmoving, grading, tunneling, concrete mixing, paving, vegetation clearing, aerial transportation (e.g., helicopters for power transmission lines), and similar activities. During the peak of construction, the construction labor force would consist of multiple crews plus construction management personnel (up to 625 workers per day).

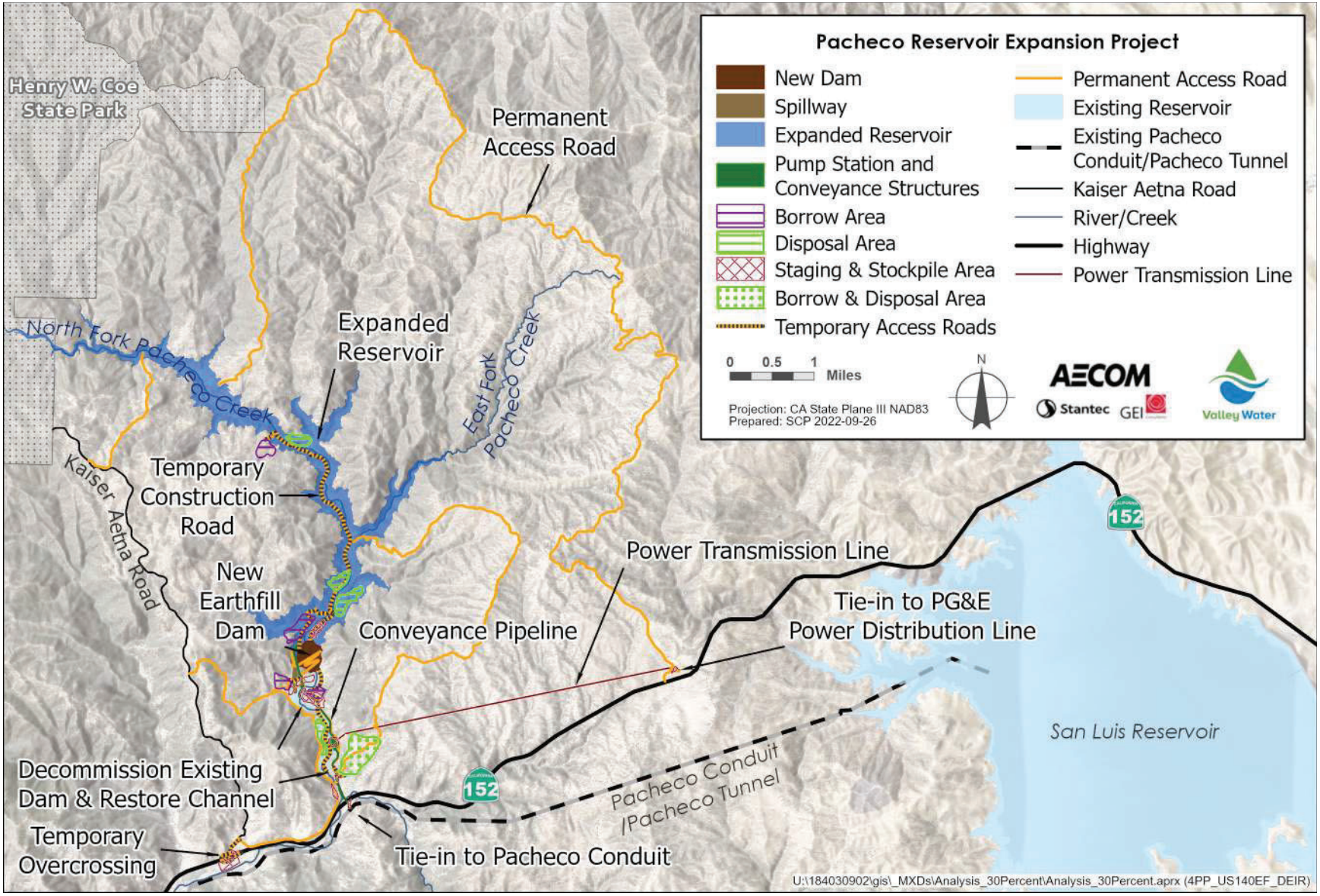


Figure 4-3. Temporary Roads and Borrow, Disposal, Staging, and Stockpiling Areas for the Staff Recommended Alternative

4.4 Operation and Maintenance

Under the Staff Recommended Alternative, Valley Water would operate the expanded reservoir to optimize Valley Water's and SBCWD's available water supplies, meet M&I demands during drought periods and emergencies, increase suitable habitat for SCCC steelhead in Pacheco Creek, improve M&I water quality, and increase refuge water supplies. Valley Water and SBCWD would be allocated 90 percent and 10 percent, respectively, of the operating storage capacity of the reservoir. Inflow operations would prioritize capturing and storing local inflow and, when available, pumping Valley Water CVP water supplies and SBCWD CVP water supplies into the expanded reservoir from Pacheco Conduit. Outflow operations would prioritize releases to North Fork Pacheco Creek and, when needed, pumping water supply withdrawals out of the expanded reservoir into Pacheco Conduit for delivery to Valley Water and SBCWD. In below normal water years, Valley Water and SBCWD would provide 1,800 acre-feet and 200 acre-feet, respectively, of their CVP contract allocation to the CVPIA RWSP for use as IL4 refuge water supply.

Under the Staff Recommended Alternative, the expanded reservoir would release flows into North Fork Pacheco Creek from a multi-level inlet/outlet structure based on a Variable Flow Schedule, as shown in Table 4-1. Instream flows would support the maintenance of suitable habitat for SCCC steelhead. Mean monthly baseflows and pulse flow targets would vary based on a Pacheco Reservoir hydrologic water year type. Baseflows would be released continuously in all months, adult attraction pulse flows would be made in January, February, and March, and smolt (i.e., juvenile steelhead) outmigration pulse flows would be made in April and May. To conserve water for releases during summer and drier years, the scheduled pulse flow would not be released from the new dam if during that month a spill event occurred in excess of the scheduled pulse flow, or if the pulse flow target magnitude and duration were exceeded at U.S. Geological Survey streamgage 11153000 in Pacheco Creek. In certain years, summer baseflows would be reduced in June through October to promote sycamore alluvial woodland deeper root growth, promote a reduction in willow growth, and reduce non-native aquatic predatory species and plant species. Water supplies developed during these years would be released in subsequent years as a high magnitude short duration environmental pulse flow to support geomorphic processes and other ecological purposes.

A 35,000-acre-foot habitat storage reserve would be maintained to provide suitable flows and water temperatures for SCCC steelhead in the North Fork and mainstem Pacheco Creek during multi-year droughts. Once the expanded reservoir drops below 35,000 acre-feet, the reserve would be managed independent of water supply to provide releases according to the Variable Flow Schedule unless an emergency declaration is made for health and safety purposes.

Valley Water would rely on instrumentation at the expanded reservoir and in Pacheco Creek to support essential monitoring efforts to implement and verify the Variable Flow Schedule. Valley Water would develop and implement adaptive management plans for three public benefits in cooperation with appropriate regulatory agencies to be consistent with WSIP and regulatory requirements: ecosystem improvement in Pacheco Creek, ecosystem improvement in the San Joaquin watershed, and emergency response.

The expanded reservoir and associated facilities would be unstaffed and operated/monitored via telemetry remotely. Valley Water would perform maintenance activities for all proposed facilities except for power transmission lines. Maintenance activities would generally include facility and equipment inspections, preventive maintenance, and repairs. Power and Water Resources Pooling Authority, Western Area Power Administration, or Pacific Gas and Electric Company would perform maintenance activities on power transmission lines.

Table 4-1. Average Monthly Flow Targets in Pacheco Creek Under the Staff Recommended Alternative (Variable Flow Schedule)

Month	Baseflow					Pulse Flow									
	Continuous Releases from New Dam Outlet (cfs)					Pulse Flow Target Magnitude at New Dam Outlet[1,4] (cfs)					Pulse Flow Duration[1,4] (days)				
PRII Water Year	W	AN	BN	D	C	W	AN	BN	D	C	W	AN	BN	D	C
January	8	8	8	8	8	30	30	35	35	0	5	5	5	5	0
February	8	8	8	8	8	30	30	45	45	30	5	5	5	5	5
March	8	8	8	8	8	30	30	50	45	35	8	8	8	8	8
April	8	8	8	8	8	25	25	25	25	25	14[2]	14[2]	14[2]	14[2]	14[2]
May	10	10	10	10	8	25	25	25	25	25	7	7	7	7	7
June	11	11	11	10	8[3]	--	--	--	--	--	--	--	--	--	--
July	13	13	13	10	8[3]	--	--	--	--	--	--	--	--	--	--
August	13	13	13	10	8[3]	--	--	--	--	--	--	--	--	--	--
September	13	13	13	10	8[3]	--	--	--	--	--	--	--	--	--	--
October	13	13	13	10	8[3]	--	--	--	--	--	--	--	--	--	--
November	11	11	11	9	8	--	--	--	--	--	--	--	--	--	--
December	9	9	9	9	8	--	--	--	--	--	--	--	--	--	--

Notes:

[1] The scheduled pulse flow would not be released in a given month if the target pulse flow magnitude and duration were exceeded at USGS streamgage 11153000 in Pacheco Creek.

[2] 14-day total duration reflects two separate 7-day duration pulses.

[3] Baseflow releases may be reduced to induce dryback in drought periods (may occur in Critical inflow years).

[4] Pulse flows during January, February, and March would support adult SCCC Steelhead attraction. Pulse flows during April and May would support SCCC Steelhead smolt outmigration.

Key:
-- = Not applicable
AN = Above Normal
BN = Below Normal
C = Critical
cfs = cubic feet per second
D = Dry
PRII = Pacheco Reservoir Inflow Index
SCCC = South-Central California Coast
USGS = U.S. Geological Survey
W = Wet

4.5 Ability to Meet Project Objectives

The Staff Recommended Alternative would address both of the primary Project objectives and both of the secondary Project objectives. Table 4-2 illustrates the ability of the Staff Recommended Alternative to meet Project objectives by quantifying net benefits (i.e., Staff Recommended Alternative in comparison to existing and future baseline conditions[5]). The Staff Recommended Alternative's ability to meet Project objectives is summarized below:

[5] The exiting condition baseline represents conditions in 2017 without implementation of the Staff Recommended Alternative or Alternatives A through D, and reflects land use, water demands, and institutional and regulatory conditions in 2017 and incorporates historical climate conditions. The future condition baseline represents conditions in 2030 without implementation of the Staff

- **Emergency Response: Emergency Storage/Emergency Water Supplies** Since SWP and CVP water supplies comprise approximately 45 percent of Valley Water's water supply portfolio, a Delta levee failure event could substantially impact Valley Water's ability to meet M&I water supply needs within its service area. The Staff Recommended Alternative would provide Valley Water and SBCWD with a dedicated local emergency water supply and would avoid undesirable results caused by long-term reliance on groundwater during emergencies. In an emergency, the Staff Recommended Alternative could deliver—either directly or by exchange—water to Valley Water and SBCWD.

- **Water Supply: Long-Term Water Supply Reliability.** The Staff Recommended Alternative would improve M&I water-supply reliability and increase available supplies under existing and future conditions for Valley Water and SBCWD. The Staff Recommended Alternative would improve M&I water supplies through an increased ability to fully utilize CVP allocations, development of local water supplies from the Pacheco Creek watershed, and improved system flexibility.

- **Ecosystem Improvement – Pacheco Creek: SCCC Steelhead Habitat Suitability.** The Pajaro River watershed has experienced more than a 90 percent decline in SCCC steelhead adult run size (i.e., number of adults per run) (NMFS 2013). Without serious intervention, a majority (possibly all) of SCCC steelhead populations are likely to be extinct within the next 50 years (Moyle et al. 2008). The Staff Recommended Alternative would provide substantive beneficial improvements to SCCC steelhead habitat conditions in Pacheco Creek through improved flow and temperature conditions. As shown in Table 4-2, the Steelhead Cohort Score, an index of Pacheco Creek's ability to support SCCC steelhead through all life stage based on the 14-month period in which a cohort is expected to remain in the creek (i.e., from adult migration through juvenile outmigration), would substantially increase under the Staff Recommended Alternative in comparison to baseline conditions in all water year types. In addition, the Staff Recommended Alternative would provide for pulse flows for adult steelhead attraction.

- **Ecosystem Improvement – San Joaquin River Watershed: IL4 Refuge Deliveries.** The Staff Recommended Alternative would allow Valley Water and SBCWD to provide a firm, 2,000 acre-feet supply of water in below normal water years to RWSP, for use in the IL4 Refuge Water Supply Pool—which is managed by Reclamation and USFWS. The increased supply would provide habitat and food for migratory birds of the Pacific Flyway, resident bird species, and many wildlife species.

Recommended Alternative or Alternatives A through D, and reflects projected land use, water demands, and institutional and regulatory conditions in 2030 and incorporates projected climate conditions (i.e., includes climate change projections).

Table 4-2. Ability of the Staff Recommended Alternative to Address Project Objectives and Summary of the Net Benefits

Benefit	Objective Addressed	Indicators	Existing Conditions (2017)[10]	Future Conditions (2030)[10]
Emergency Response	Primary Objective: Increase water supply reliability and system operational flexibility to help meet M&I and agricultural water demands in Santa Clara and San Benito Counties during drought periods and emergencies, or to address shortages due to regulatory and environmental restrictions	Net increase in regional surface storage (Pacheco Reservoir and Valley Water's surface reservoirs) and groundwater storage (North County Santa Clara Subbasin)[1, 2, 9]	117,480 AF	107,160 AF
Water Supply		Net increase in baseline supplies available to Valley Water and SBCWD; average all years and critical years only[3, 7, 8]	5,130 AF/ 8,830 AF	3,600 AF/ 8,350 AF
Ecosystem Improvement – Pacheco Creek	Primary Objective: Increase suitable habitat in Pacheco Creek for federally threatened SCCC steelhead through improved water temperature and flow conditions	Percent increase in Steelhead Cohort Score[4, 9]	157%	146%
		Provides adult attraction pulse flows for SCCC steelhead	Yes	
		Length of new stream channel habitat[5]	1.3 miles	
Ecosystem Improvement – San Joaquin River Watershed	Secondary Objective: Develop water supplies for environmental water needs at IL4 wildlife refuges to support habitat management in the Delta watershed	Net increase in Incremental Level 4 water deliveries to San Joaquin River watershed refuges in below normal years[6, 7, 9]	2,000 AF	2,000 AF
M&I Water Quality	Secondary Objective: Improve water quality and minimize supply interruptions, when water is needed, for Santa Clara and San Benito Counties, to increase operational flexibility for south-of-Delta contractors dependent on San Luis Reservoir	Number of months of avoided impaired water quality deliveries from San Luis Reservoir over 82-year simulation period[8, 9]	96 months out of 102 months (94% reduction)	63 months out of 65 months (97% reduction)

Notes:

[1] Values were derived from CalSim II and Valley Water's WEAP model.

[2] Under existing conditions, water stored in Pacheco Reservoir would not be available for emergency response due to lack of connection to the Valley Water or SBCWD water systems. Under the Staff Recommended Alternative, an expanded Pacheco Reservoir would be connected to Valley Water and SBCWD water systems via the Pacheco Conduit.

[3] Values were derived from Valley Water's WEAP model.

[4] Values were derived from Pacheco Creek Steelhead Habitat Suitability Model. The Steelhead Cohort Score provides an index of the ability of Pacheco Creek to support South-Central California Coast steelhead through all life stages.

[5] Reflects length of historic North Fork Pacheco Creek stream channel that is currently inundated by the existing Pacheco Reservoir and would be restored between the spillway of the new dam and the existing North Fork Dam that would be decommissioned.

[6] Values were derived from CalSim II and reflect refuge deliveries in the San Joaquin River watershed. Value reflects total quantity of water Valley Water, and SBCWD for the Staff Recommended Alternative, would transfer of their current CVP contract allocation, directly or through exchanges, to the Refuge Water Supply Program.

[7] Water year types based on the Sacramento Valley water year hydrologic classification.

[8] Values were derived from CalSim II and Valley Water's WEAP model.

[10] Existing conditions (2017) reflect the level of water supply demand and regulatory requirements in 2017, patterns of land use in 2017, and the water-related facilities assumed to be in place in 2017. Future conditions (2030) reflect the projected level of water supply demand and regulatory requirements in 2030, projected climate conditions centered around 2030, projected patterns of land use in 2030, and the additional water-related facilities assumed to be in place by 2030.

Table 4-2. Ability of the Staff Recommended Alternative to Address Project Objectives and Summary of the Net Benefits (contd.)

Key:
AF = acre-feet
Delta = Sacramento-San Joaquin Delta
M&I = municipal and industrial
SBCWD = San Benito County Water District
SCCC = South Central Coastal California
Valley Water = Santa Clara Valley Water District

4.6 Costs

Table 4-3 presents costs for the Staff Recommended Alternative. The total cost of the Staff Recommended Alternative, excluding escalation, is $1,996.4 million (April 2022 dollars). The total cost of the Staff Recommended Alternative, inclusive of escalation for construction and non-contract costs, is $2,358.4 million (April 2022 dollars).

Table 4-3. Summary of Staff Recommended Alternative Costs

Item[1]	Total Cost[2, 3] ($ millions)
Construction Costs	
Field Costs	
1: Decommission Existing Dam	$6.5
2: Temporary Works	$41.3
3: Earthfill Dam	$312.3
4: Inlet/Outlet Works	$99.2
5: Spillway	$88.1
6: Pump Station	$88.9
7: Conveyance	$81.0
8: Electrical	$50.7
9: Roads and Bridges	$72.4
10: Channel Restoration	$16.3
11: Construction Allowances	$0.3
12: Startup/Commission/Owner Training	$5.7
Subtotal (Direct Construction Cost)	*$862.6*
Construction and Materials Testing	$17.3
Mobilization	$44.0
General Contractor Markups	$390.6
Design & Estimating Contingencies	$236.6
Subtotal (Contract Cost)	*$1,551.0*
Construction Contingencies	$232.7
Subtotal (Field Costs without Escalation)	***$1,783.7***
Escalation[4]	$299.5
Subtotal (Field Costs with Escalation)	***$2,083.2***
Non-Contract Costs[5]	
Project Management, Construction Management & Regulatory Compliance and Monitoring During Construction Phase[6]	$200.9
Land Acquisition	$11.8
Subtotal (Non-Contract Costs without Escalation)	***$212.7***
Escalation[4]	$62.4
Subtotal (Non-Contract Costs with Escalation)	***$275.2***
Total Costs (Construction Costs + Non-Contract Costs without Escalation)	**$1,996.4**
Total Costs (Construction Costs + Non-Contract Costs with Escalation)	**$2,358.4**

Table 4-3. Summary of Staff Recommended Alternative Costs (cont.)

Notes:

[1] Facility and construction program components for the Staff Recommended Alternative are based on the 30 percent designs for the upstream, earthfill dam that provides for an expanded reservoir of 140,000 acre-feet.

[2] Dollar values for direct construction costs, contract costs, construction management & engineering services during construction costs, and land acquisition costs are expressed in April 2022 price levels.

[3] All numbers are rounded for display purposes, and therefore line items may not sum to totals.

[4] Escalation value accounts for inflation as well as related contingency. Inflation value estimated by Santa Clara Valley Water District's Financial Planning and Management Services Division.

[5] As requirements for mitigation are under development through environmental compliance (e.g., California Environmental Compliance Act) and permitting efforts (e.g., Endangered Species Act, Clean Water Act), costs for implementation of required mitigation are not included.

[6] Reflects future non-contract costs associated with construction phase activities associated with project management; construction management/inspection; and regulatory compliance and monitoring.

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