B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix A: Alternatives Development Report

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Alternatives Development Report
Draft

Prepared by
San Luis & Delta-Mendota Water Authority

United States Department of the Interior
Bureau of Reclamation
Interior Region 10 California-Great Basin

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Abbreviations and Acronyms

AF	acre-feet
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
COA	Coordinated Operations Agreement
CVOO	Reclamation Central Valley Operations Office
CVP	Central Valley Project
Delta	Sacramento-San Joaquin River Delta
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EIR	Environmental Impact Report
IPR	indirect potable reuse
M&I	municipal and industrial
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NVRRWP	North Valley Regional Recycled Water Program
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
ROC on LTO	Reinitiation of Consultation on the Coordinated Long-Term Operation of Central Valley Project and State Water Project
ROD	Record of Decision
SGMA	Sustainable Groundwater Management Act
SJRRP	San Joaquin River Restoration Program
SLDMWA	San Luis & Delta-Mendota Water Authority
SOD	Safety of Dams
SR	State Route
SEIS	Supplemental Environmental Impact Statement
SWP	State Water Project
TAF	thousand acre-feet
USFWS	U.S. Fish and Wildlife Service
Valley Water	Santa Clara Valley Water District
WIIN Act	Water Infrastructure Improvements for the Nation Act

Chapter 1 Introduction

This report describes the alternatives development process and proposed alternatives for the B.F. Sisk Dam Raise and Reservoir Expansion Feasibility Study and Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS).

1.1 Background

Hydrologic conditions, climatic variability, and regulatory operational requirements for water projects commonly affect water supply availability in California, making advance planning for water shortages necessary and routine. This variability can strain water supplies in areas that are dependent on delivery of Central Valley Project (CVP) and State Water Project (SWP) supplies to meet most, if not all, of the water demand.

The San Luis & Delta-Mendota Water Authority (SLDMWA) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are completing a joint EIR/SEIS to provide California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) compliance for the B.F. Sisk Dam Raise and Reservoir Expansion Project. SLDMWA is the Lead Agency under CEQA, and Reclamation is serving as the Lead Agency under NEPA. This report refers to SLDMWA and Reclamation jointly as the Lead Agencies.

The EIR/SEIS will evaluate increasing storage capacity in San Luis Reservoir to provide greater water supply reliability for South-of-Delta CVP and SWP water contractors. Increased capacity within San Luis Reservoir would only be used to help meet existing demands and would not serve any new demands.

Figure 1-1 presents a map of the study area, including:

- San Luis Reservoir, Merced County
- Sacramento-San Joaquin River Delta (Delta)
- California Aqueduct
- Delta-Mendota Canal (DMC)
- South-of-Delta CVP and SWP water contractors' service areas

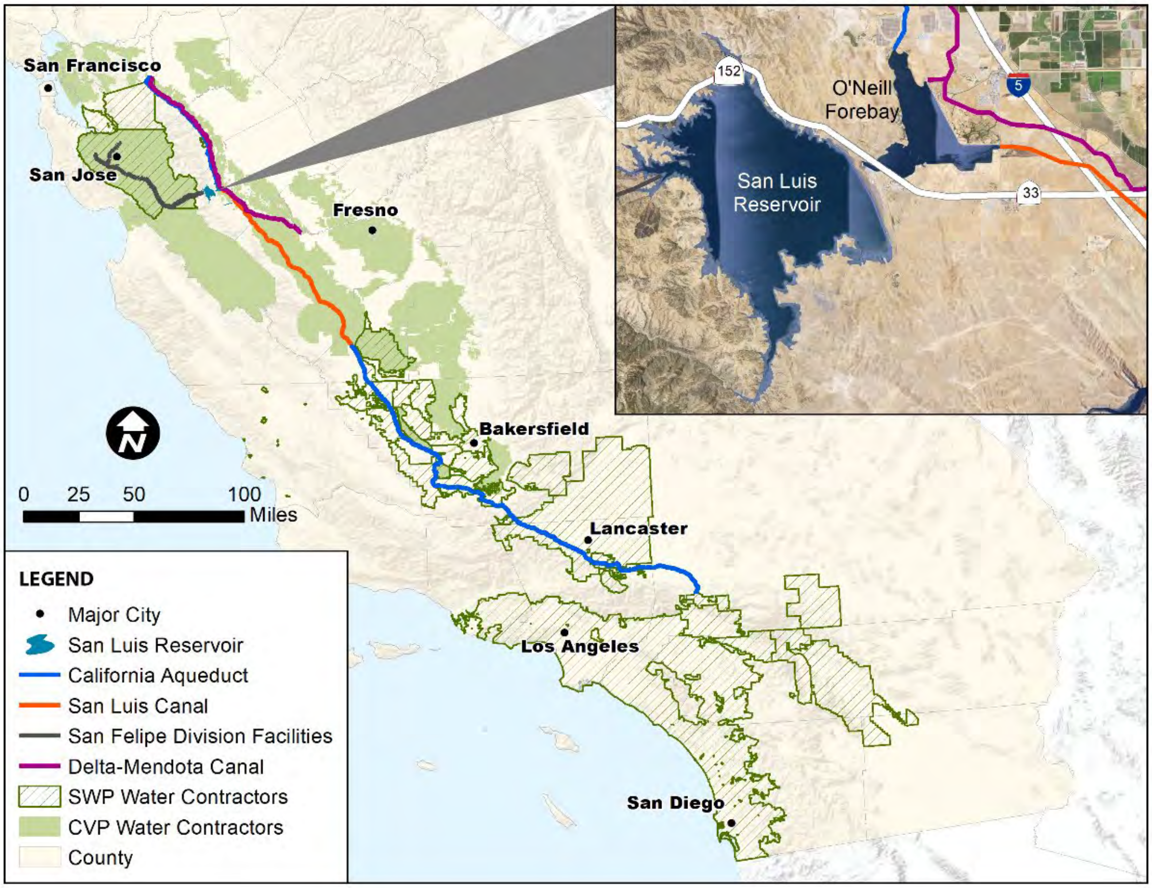

Figure 1-1. Study Area

1.1.1 History

B.F. Sisk Dam was constructed to create the off-stream San Luis Reservoir, which provides supplemental storage capacity for the CVP and SWP. Currently, the San Luis Reservoir provides 2,027,840 acre-feet (AF) of water storage for the CVP and SWP. The water stored in the reservoir is managed for state (52%) and federal (48%) uses as part of the SWP and CVP, respectively. Typically, during the winter and early spring, water is lifted from O'Neill Forebay into the San Luis Reservoir for storage using the pump-turbines in the Gianelli Pumping-Generating Plant. Later in the year, when demand in the CVP and SWP increases, water is released from the San Luis Reservoir through O'Neill Forebay and conveyed via the California Aqueduct (an SWP facility) or the DMC (a CVP facility) for use by municipal and agricultural (M&I) water users. As water is released back through the Gianelli Pumping-Generating Plant, the plant generates hydropower, which is used to offset the energy demand of the project operations. Water also is diverted from the west side of San Luis Reservoir at the Pacheco Pumping Plant to supply water to CVP contractors. In addition to storing and supplying water, the San Luis Reservoir provides recreation opportunities.

In 2006, Reclamation completed a risk analysis of B.F. Sisk Dam that evaluated dam stability in the event of seismic activity. The analysis concluded that significant to high seismic activity could result in dam failure and B.F. Sisk Dam did not meet the standards of Reclamation's Public Protection Guidelines (Reclamation 2011). Reclamation, in coordination with California Department of Water Resources (DWR), completed a Corrective Action Study in December 2019 regarding the potential for liquefaction of the B.F. Sisk Dam foundation and resulting potential for dam slumping and overtopping (Reclamation 2019). In addition to evaluating liquefaction potential, the Corrective Action Study also identified and evaluated potential dam modifications to reduce the potential for dam failure. Alternatives that were considered include a potential dam raise, construction of berms at locations along the dam toe requiring foundation support, and a reduction in maximum storage capacity. Given the planned raise of B.F. Sisk Dam to address dam safety issues under the B.F. Sisk Dam Safety of Dams (SOD) Modification Project and the opportunity to increase water supply reliability through increases to San Luis Reservoir capacity, Reclamation is preparing the B.F. Sisk Dam Raise and Reservoir Expansion Project EIS as a supplement to the B.F. Sisk Dam SOD Modification Project EIS developed by Reclamation and DWR (Reclamation 2019).

1.1.2 Purpose of the Report

This Alternatives Development Report documents the process to develop the EIR/SEIS alternatives. The Lead Agencies are using this structured planning process to delineate a reasonable range of alternatives for evaluation in the EIR/SEIS in compliance with CEQA and NEPA.

1.2 References

Bureau of Reclamation (Reclamation). 2011. Dam Safety Public Protection Guidelines. A Risk Framework to Support Dam Safety Decision-Making. August 2011.

———. 2019. B.F. Sisk Dam Safety of Dams Modification Project Final Environmental Impact Statement/Environmental Impact Report. August 2019. Accessed May 4, 2020, https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=39981

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Chapter 2 Alternatives Development Process

Both CEQA and NEPA require EIRs and EISs, respectively, to identify a reasonable range of alternatives. To identify and screen alternatives, a structured and documented process was developed to include internal and public scoping **(Figure 2-1).**

Figure 2-1. Alternatives Development and Screening Process

2.1 Problems and Needs, Opportunities, and Planning Objectives

This section is a critical part of the environmental review process because it helps to set the overall direction of an EIS/EIR, identify the range of reasonable alternatives, and focus the scope of analysis. The Lead Agencies developed the following project objectives (CEQA)/project purpose and need (NEPA).

2.1.1 Problems and Needs

The B.F. Sisk Dam Raise and Reservoir Expansion Feasibility Study is being developed to facilitate and approve the expansion of San Luis Reservoir's capacity to secure a more reliable water supply for South-of-Delta CVP and SWP water contractors and address water supply reliability problems across the CVP and SWP service areas.

Decreased water supply reliability affects the ability of CVP contractors to meet water demands. Stringent flow and water quality requirements in the Delta continue to restrict the amount of water that the CVP and SWP can pump. These limitations cause water supply reliability concerns for CVP and SWP contractors that receive Delta exports. Regulatory changes and project operations are expected to increase reliance on San Luis Reservoir supplies.

2.1.2 Opportunities

2.1.2.1 Operational Flexibility

Operational flexibility allows water agencies to efficiently manage water supplies by increasing supply and storage management options. Several of the options identified include new operational approaches to the expanded storage capacity in San Luis Reservoir.

2.1.2.2 Water Supply Reliability

When portions of a CVP contractor's allocation for water demand remain unused, contractors can choose to leave the unused water supply in San Luis Reservoir to be carried over for use in subsequent years. However, the carried over supply has the potential to be lost if the San Luis

Reservoir fills the next year and that supply is spilled. Implementing the B.F. Sisk Dam Raise and Reservoir Expansion Project could increase storage capacity and reduce the likelihood of this contractor supply being lost.

2.1.3 Project Objectives

As required by CEQA, a lead agency must identify the objectives sought by the proposed project. SLDMWA has developed objectives to optimize the water supply benefits of San Luis Reservoir while reducing additional risks to South-of-Delta water users by:

- Increasing long-term reliability and quantity of yearly allocations to South-of-Delta contractors dependent on San Luis Reservoir.
- Increasing the certainty of access to supplies stored by South-of-Delta contractors in San Luis Reservoir in subsequent water years.

2.1.4 Project Purpose and Need

As a potential funder for the B.F. Sisk Dam Raise and Reservoir Expansion Project under the Water Infrastructure Improvements for the Nation Act (WIIN Act), and in accordance with the amended SOD Act, Reclamation's preliminary purpose and need is to evaluate the feasibility report and determine if SLDMWA's request to increase storage capacity, resulting in a corresponding increase in water supply reliability across the CVP and SWP service areas, as an additional benefit in conjunction with the current B.F. Sisk Dam SOD Modification Project is consistent with Reclamation law, can support a Secretary of Interior's finding of feasibility, has federal benefits pursuant to the WIIN Act, and can be accomplished without negatively impacting the B.F. Sisk Dam SOD Modification Project.

The B.F. Sisk Dam Raise and Reservoir Expansion Project is a federally owned storage project, and according to Public Law 114-322, Title III, Subtitle J, Section 4007, Subsection (a)(1):

> *The Term "federally owned storage project" means any project involving a surface water storage facility in a Reclamation State-*
>
> > *(A) to which the United States holds title; and*
> >
> > *(B) that was authorized to be constructed, operated, and maintained pursuant to the reclamation laws.*

Further guidance is provided in Public Law 114-322, Section 4007 (b):

> *(1) Agreements- On the request of any State, any department, agency, or subdivision of a State, or any public agency organized pursuant to State law, the Secretary of the Interior may negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project in accordance with this section.*
>
> *(2) Federal Cost Share- Subject to the requirements of this subsection, the Secretary of the Interior may participate in a federally owned storage project in an amount equal to not more than 50 percent of the total cost of the federally owned storage project.*

(3) Commencement- The construction of a federally owned storage project that is the subject of an agreement under this subsection shall not commence until the Secretary of the Interior-

(A) determines that the proposed federally owned storage project is feasible in accordance with the reclamation laws:

(B) secures an agreement providing upfront funding as is necessary to pay the non-Federal share of the capital costs; and

(C) determines that, in return for the Federal cost-share investment in the federally owned storage project, at least a proportionate share of the project benefits are Federal benefits, including water supplies dedicated to specific purposed such as environmental enhancement and wildlife refuges.

(4) Environmental Laws- In participating in a federally owned storage project under this subsection, the Secretary of the Interior shall comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

Therefore, section 4007(b) allows the Secretary of the Interior to negotiate and enter into an agreement on behalf of the United States for the design, study, and construction or expansion of any federally owned storage project. The Secretary of the Interior can participate up to "an amount equal to not more than 50 percent of the total cost." Section 4007(b)(4) also states that "at least a proportional share of the project benefits must be Federal benefits, including water supplies dedicated to specific purposes such as environmental enhancement and wildlife refuges." Section 4007(i) states "this section shall apply only to federally owned storage projects and State-led storage projects that the Secretary of the Interior determines to be feasible before January 1, 2021."

2.2 Measure Identification

SLDMWA and its member agencies identified specific measures that support the conceptual alternatives to address the project objectives/project purpose and need. The list of initial measures is presented in **Table 2-1** (described in more detail in Chapter 3).

Table 2-1. Initial Measures

Measure	Measure Description
Agricultural Water Supply	Increase agricultural water supply delivered from expanded capacity in San Luis Reservoir
M&II Water Supply	Increase M&I water supply delivered from expanded capacity in San Luis Reservoir
Groundwater Stabilization	Increases in surface water deliveries could reduce seasonal reliance on groundwater supplies
Emergency Water Supply	In response to system outages, increased average storage volume in San Luis Reservoir available for use as an emergency supply

Measure	Measure Description
Refuge Water	Increases in Level 4 refuge water supply deliveries, avoidance of water supply delivery reductions, and potential support for implementation of proposals for adaptive management of Delta exports to support ecosystem health
Capture of Delta Surplus	Improve capacity to divert and store Delta surplus during periods when the existing San Luis Reservoir would have been full
Coordinated Operations Agreement (COA)	Increases in capacity available to store and carry-over additional Delta CVP exports pursuant to COA
Long-Term Storage of Carried-Over Water	Improved security for contractor carry-over in San Luis Reservoir regarding risk of potential spill or protection for year-to-year ownership of that carry-over
Transfer Water–CVP Sources	Increase available capacity for storage of potential carried over transfer water purchased by CVP contractors
Transfer Water–Non-CVP Sources	Increase available capacity for storage of potential carried over transfer water purchased by non-CVP contractors
Recycled Water	Increase available capacity for storage of potential carried over allocated CVP supply not used by contractors owing to the availability of recycled water, along with the potential storage of recycled water produced by the CVP contractors
SJRRP Recaptured Restoration Flows	Increase available capacity for storage of potential carried over recaptured restoration flows for future use by Friant contractors through recirculation or delivery to other water users via transfer
Temporary Storage of State Water Contractors Supply	Storage capacity made available to state water contractors for temporary storage or carryover
Delta-Mendota Canal Reverse Flow	Diversion from Mendota Pool to San Luis Reservoir during periods of surplus flows
Groundwater Pump-In Program	Increase available capacity for storage of potential carried over groundwater pumped by member agencies DMC for use by other member agencies
Shared CVP and SWP Ownership	Optional storage configuration to provide split ownership of the expanded storage capacity of San Luis Reservoir between CVP and SWP
Modifications to South-of-Delta CVP Operations	Adjustments to Reclamation’s operation of the South-of-Delta CVP, including potential modifications to annual allocations and the provision of carrying over CVP supply in San Luis Reservoir

2.3 Screening Methods

The Lead Agencies deemed the list of initial measures be screened and only carried forward if the measure had the potential to contribute to the project objectives and project purpose and need. The measures were screened against criteria developed and based, in part, on CEQA and NEPA guidance:

- CEQA Guidelines Section 15126.6(a) states, "An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project…" An EIR need not consider every conceivable alternative to a project or alternatives that are infeasible. State CEQA Guidelines Section 15364 defines feasible as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."

- NEPA requires that agencies will "rigorously explore and objectively evaluate all the reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated" (40 Code of Federal Regulations [CFR] Part 1502.14(a)). The Department of the Interior NEPA procedures (43 CFR Part 46.420(b)) defines reasonable alternatives as "alternatives that are technically and economically practical or feasible and meet the purpose and need of the proposed action."

Both CEQA and NEPA include provisions that measures meet (or meet most of) the project objectives/project purpose and need and be potentially feasible. Some measures do not fully meet the project objectives/project purpose and need but may be carried forward for additional analysis because they have the potential to minimize some types of environmental effects or help create a reasonable range of alternatives for consideration by decision-makers. The Lead Agencies determined that they would screen the measures based on:

- Ability to meet key elements of the project objectives that include increasing the reliability and quantity of yearly allocations to South-of-Delta contractors dependent on San Luis Reservoir and increasing the certainty of access to supplies stored by South-of-Delta contractors in San Luis Reservoir in subsequent water years.

- Ability to meet key elements of the project purpose and need that include:
    - Providing additional project benefits as a connected action to the B.F. Sisk Dam SOD Modification Project
    - Ability to provide federal benefits pursuant to the WIIN Act, including:
        - Feasibility of the project
        - Capacity to provide environmental enhancements and wildlife refuges benefits
        - Applicable with all environmental laws, including NEPA
    - Ensuring no adverse impacts to the B.F. Sisk Dam SOD Modification Project

Measures need to meet these criteria to move forward for further evaluation. Each alternative was rated on a scale of high (3), medium (2), or low (1) for each criteria.

2.4 Alternatives Development

The Lead Agencies screened the measures by applying the screening criteria to each measure based on available information and best professional judgment. The measures that will move forward for more detailed analysis in the EIR/SEIS are those that (a) align with one or more of the project objectives/project purpose and need, (b) minimize negative effects, (c) are feasible, and (d) represent a range of reasonable alternatives. Chapter 4 describes the screening results in more detail.

The Lead Agencies combined the remaining measures into alternatives. The remaining measures represent potential methods to expand capacity in San Luis Reservoir. The alternatives examine different combinations of water sources, with different operational procedures.

Chapter 3 Measures

This chapter describes measures identified for the alternatives development process. As described in Section 2.2, these measures were developed based on meetings with SLDMWA and its member agencies. Chapter 4 includes an evaluation of the measures relative to the project objectives/project purpose and need for the B.F. Sisk Dam Raise and Reservoir Expansion Project. These measures were identified as potential contributors to structural and nonstructural alternatives capable of addressing the project objectives/project purpose and need. As an action connected to the B.F. Sisk SOD Modification Project, the potential structural improvements these measures would rely on include an embankment raise at B.F. Sisk Dam to increase storage in San Luis Reservoir. This is consistent with the management measures presented in the San Luis Reservoir Expansion Draft Appraisal Report (Reclamation 2013).

3.1 Agricultural/Municipal and Industrial Water Supply

This measure would dedicate the new storage capacity in the federal share of San Luis Reservoir to increasing water supply delivery and reliability for agricultural and M&I purposes to help meet future water demands for SLDMWA's member agencies.

3.2 Groundwater Stabilization

During the irrigation season, many contractors use groundwater to help meet demands in response to limited surface water supply. This measure would dedicate water stored in the expanded San Luis Reservoir to offset seasonal reliance on groundwater by increasing surface water availability during periods when groundwater would otherwise be used.

3.3 Emergency Water Supply

This measure would dedicate the new storage capacity in San Luis Reservoir as available supply to be used in the event of an emergency interruption of CVP or SWP supplies. Emergency circumstances include:

- Delta export outage – No or limited pumping at CVP and SWP export facilities (owing to natural or other events) would significantly affect the ability of SLDMWA's member agencies to meet water demands.

- Imported water conveyance outage – Outages of conveyance facilities (e.g., tunnels, pipelines, canals, pump stations) owing to natural events, equipment failures, or other causes, would limit the ability of SLDMWA's member agencies to meet water demands.

- Other major event – Such as regional infrastructure failures or extended drought periods that may occur when water supplies are required to meet essential health and safety needs for drinking, hygiene and sanitation, fire protection, or to avoid permanent land subsidence as a result of groundwater depletion.

3.4 Refuge Water

There are numerous challenges to meeting wildlife refuge allocations, including availability of limited water supplies (especially during droughts), water pricing inflation and increasing conveyance costs (combined with static funding levels), the ability of Refuge managers to move and store water supply without losses, and water quality and groundwater impacts. These challenges will likely continue and even increase in the future because of foreseeable increases in competition for California's finite water resources. There is a need for reliable long-term water supplies and improvements to operational flexibility for unmet environmental water need. This measure would dedicate the new storage capacity in San Luis Reservoir to provide reliable, long-term Level 4 Refuge water supply, while allowing environmental water management programs to improve operational flexibility.

3.5 Capture of Delta Surplus

The increased capacity of San Luis Reservoir could be filled during times when there is surplus Delta outflow (Delta surplus) in excess of the required Delta outflow and the Delta outflow needed to meet Delta water quality standards. Delta surplus can only be exported when Delta export capacity is available, such as when the existing CVP or SWP portion of San Luis Reservoir is full under current conditions.

3.6 Coordinated Operations Agreement

The COA between the United States and the State of California defines how CVP and SWP share available in-river supplies and specifies their responsibility to meet environmental flow and water quality requirements obligated by regulatory agencies. The increase in CVP storage capacity in San Luis Reservoir would allow additional Delta CVP exports (pursuant to COA) to be stored and used in the CVP service area.

3.7 Long-Term Storage of Carried-Over Water

This measure would allow participating contractors, as a result of increased yield in the San Luis Reservoir during wet years versus during dry years, to store a portion of their allocation for future use. Although delivering water as soon as possible after it is stored in the San Luis Reservoir provides the highest average annual yield from the expanded capacity, the water tends to be delivered during wet years and increase allocation when it is likely already high. Carrying over water until allocations are very low tends to reduce the average annual yield but shifts the deliveries of water to drier years when the water may be needed more and is of higher value. The reduction in likelihood of lost supplies (due to conflicts with storage of CVP water) and the increase in protections to year over year ownership of supply improve security of contractor supplies in San Luis Reservoir carried over for use in subsequent years.

3.8 Transfer Water – CVP/Non-CVP Sources

Contractors may experience water shortages for CVP and SWP operations as a result of unpredictable hydrologic conditions, climatic variability, and regulatory requirements. This variability often strains available water supplies; as such, water agencies implement water transfers to supplement available water supplies to serve existing demands. This measure allows greater flexibility for South-of-Delta CVP and SWP water contractors to enter into transfer agreements with other CVP contractors or non-CVP contractors and improves the ability to store and potentially carry-over the purchased transfer or other non-CVP water via the increased capacity in the San Luis Reservoir.

3.9 Recycled Water

Water recycling creates new water supply through either the treatment of wastewater for non-potable uses or by recharging groundwater aquifers with advanced treated wastewater for future extraction for potable uses (indirect potable reuse). The process of recycling water requires a wastewater source, treatment, and distribution facilities.

This measure would provide recycled water for irrigation, landscaping, or other suitable uses. A new or expanded existing tertiary treatment plant would be needed to treat wastewater. This measure would also require construction of pipelines to convey recycled water to new users. Most of the urban member districts have existing wastewater treatment plants. Santa Clara Valley Water District (Valley Water) works with wastewater authorities that operate four wastewater treatment plants in Santa Clara County. Valley Water also expanded the use of recycled water, by working with the City of San Jose to build an advanced water treatment facility that produces up to 10 million gallons per day. Del Puerto Water District is a program partner in the North Valley Regional Recycled Water Program (NVRRWP), in which the Cities of Turlock and Modesto provide treated recycled water to the water district for distribution to agricultural users in its service area and South-of-Delta Central Valley Project Improvement Act (CVPIA)-designated refuges (NVRRWP 2016).

The increased storage capacity of San Luis Reservoir would allow greater flexibility for using recycled water by making capacity available to store and potentially carry-over allocated CVP supplies not used by contractors due to the availability of recycled water. The increased storage capacity also could allow for the potential storage of recycled water produced during periods of low irrigation demands.

3.10 San Joaquin River Restoration Program Recapture Restoration Flows

Restoration flows are required under the San Joaquin River Restoration Program (SJRRP), established in late 2006 to implement the Stipulation of Settlement in *Natural Resource Defense Council (NRDC), et al., v. Kirk Rodgers, et al.* The increased capacity within San Luis Reservoir would improve storage availability and could increase the amount of carry-over recaptured water from restoration flows to be used in the future by Friant contractors via recirculation or delivery to other water users through transfer.

3.11 Temporary Storage of State Water Contractors Supply

The expanded capacity within San Luis Reservoir would allow state water contractors to temporarily store some of their SWP supplies short term prior to being conveyed south.

3.12 Delta-Mendota Canal Reverse Flow

The addition of temporary pumping capacity along the DMC would allow for the water stored in San Luis Reservoir to be pumped north to CVP water contractors during periods when South-of-Delta exports are unable to meet demands (Reclamation 2015).

3.13 Groundwater Pump-In Program

The Groundwater Pump-in Program provides additional water supplies for various CVP contractors located along the DMC. The cumulative volume of groundwater introduced into the DMC under the Groundwater Pump-In Program is limited to 50,000 AF per year, which is annually allocated by SLDMWA among the participating districts based on need (Reclamation 2018). The Groundwater Pump-In Program is covered under separate environmental coverage, is currently occurring, and will continue to occur outside of the B.F. Sisk Dam Raise and Reservoir Expansion Project. Expanded capacity in San Luis Reservoir could increase the storage for carry-over and accumulated pumped-in groundwater.

3.14 Shared CVP and SWP Ownership

This measure would be an optional storage configuration to provide split ownership—between CVP and SWP—of the expanded storage capacity of San Luis Reservoir. Within this measure, there are four configuration options, described in Section 5.3.2.

3.15 Modifications to South-of-Delta CVP Operations

This measure would adjust Reclamation's operation of the South-of-Delta CVP, including potential modifications to annual allocations and the provision of carrying over CVP supply in San Luis Reservoir.

3.16 References

Bureau of Reclamation (Reclamation). 2013. San Luis Reservoir Expansion Draft Appraisal Report. December 2013. Accessed April 8, 2020, https://www.usbr.gov/mp/sllpp/docs/2013-11-19-draft-san-luis-expansion-appraisal-report.pdf

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———. 2018. Final Environmental Assessment Delta-Mendota Canal Groundwater Pump-In Program Revised Design Constraints. EA-18-007. Accessed January 8, 2020, https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=33261

North Valley Regional Recycled Water Program (NVRRWP). 2016. How it Works Webpage. Accessed January 8, 2020, http://www.nvr-recycledwater.org/description.asp

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Chapter 4 Measures Screening Evaluation

4.1 Screening Evaluation

The criteria developed to evaluate the measures include (1) the ability of the measure to address the project objectives (long-term reliability and quantity of yearly allocations and increasing the certainty of access to supplies for South-of-Delta contractors) and (2) the ability of the measure to address the project purpose and need (additional project benefits under the B.F. Sisk Dam SOD Modification Project federal benefits pursuant to the WIIN Act, and no adverse impacts to the B.F. Sisk Dam SOD Modification Project). Measures were scored for each of the screening criteria using the following metrics:

- **High (3)** ranking means the measure fully meets project objectives/project purpose and need
- **Medium (2)** ranking means the measure partially meets the project objectives/project purpose and need
- **Low (1)** ranking means the measure does not meet the project objectives/project purpose need

Measures were eliminated from further consideration if they would not contribute to project objectives/project purpose and need. Only those measures that scored highest moved forward to be incorporated into the alternatives. The following sections present the evaluation of each measure relative to the aforementioned screening criteria.

4.2 Screening Results

4.2.1 Agricultural/M&I Water Supply

Dedication of water stored in the new expanded capacity in San Luis Reservoir for use as agricultural or M&I water supply would be expected to increase annual allocations in years when water is available for diversion and storage is available in that space. These measures would afford water users some certainty of access to carried-over water supply in subsequent water years by increasing storage capacity in San Luis Reservoir and reducing the frequency of years when the reservoir would fill and carried-over supply would be lost to the contractors.

These measures would result in no adverse impacts to the B.F. Sisk Dam SOD Modification Project and would provide additional project benefits by increasing the use of San Luis Reservoir. Although the measures would not provide environmental enhancements or wildlife refuge benefits, dedicating a portion of the new expanded capacity in San Luis Reservoir for use as agricultural or M&I water supply would provide federal benefits pursuant to the WIIN Act as they are feasible and would comply with all environmental laws.

While this measure does not fully address the project objectives/project purpose and need, it may be combined with a measure that does increase certainty of access as a combined alternative.

Table 4-1. Agricultural/M&I Water Supply Screening Result

	Project Objectives		Project Purpose and Need		
Measure	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Agricultural/ Supply	3	2	3	2	3
M&I Water Supply	3	2	3	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.2 Groundwater Stabilization

The exclusive dedication of water supply stored in the new expanded capacity in San Luis Reservoir for use by contractors who would have otherwise relied on groundwater to meet demands would be expected to provide some improvement in the reliability and quantity of yearly allocations by delivering additional surface water supplies. Similar to the agricultural/M&I water supply measures previously mentioned, this measure would afford water users some certainty of access to carried-over water supply in subsequent water years by reducing the frequency of years when the reservoir would fill and carried-over supply would be lost to the contractors.

Similar to the agricultural/M&I water supply measures, the groundwater stabilization measure would result in no adverse impacts to the B.F. Sisk Dam SOD Modification Project and would provide additional project benefits by increasing the use of San Luis Reservoir. Reducing the reliance on groundwater throughout the CVP and SWP service areas due to the increased capacity in San Luis Reservoir would provide some environmental enhancements as required under the WIIN Act. This measure is feasible and would comply with all environmental laws.

While this measure does not fully address the project objectives/project purpose and need, it may be combined with other measures that would improve its ability to address the project's criteria as a combined alternative.

Table 4-2. Groundwater Stabilization Screening Result

	Project Objectives		Project Purpose and Need		
Measure	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Groundwater Stabilization	2	2	3	3	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.3 Emergency Water Supply

The exclusive dedication of water supply stored in the new expanded capacity in San Luis Reservoir for use as an emergency supply would be expected to provide some improvement in the reliability and quantity of yearly allocations in years with emergency outages by delivering additional surface water supplies to offset limits on deliveries interrupted by the emergency. However, this measure would generate limited improvements in water years without emergency conditions, given the limits on the stored supplies use. The measure would offer water users limited improvements in certainty of access to carried-over water supply in subsequent water years because of the holding of water in storage for use in emergency outages and result in a higher likelihood of reservoir fill and loss of carried-over supplies.

Utilizing a portion of the expanded storage in San Luis Reservoir for use as emergency supply would provide additional use of San Luis Reservoir resulting in additional benefits to the B.F. Sisk Dam SOD Modification Project. No adverse impacts would be anticipated. The Emergency Water Supply measure would not provide environmental enhancements or wildlife refuge benefits, but the measure would provide some federal benefits pursuant to the WIIN Act as the measure is feasible and would comply with all environmental laws. As such, the measure partially meets the project purpose and need.

This measure does not address the project objective/project purpose and need and therefore will not be carried forward for consideration in the EIR/SEIS.

Table 4-3. Emergency Water Supply Screening Result

	Project Objectives		Project Purpose and Need		
Measure	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Emergency Water Supply	1	1	3	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.4 Refuge Water

The Refuge Water measure would dedicate a portion of the new storage capacity in San Luis Reservoir to provide reliable, long-term Level 4 refuge water supply, while allowing environmental water management programs to improve operational flexibility. This measure would afford improved refuge certainty regarding access to carried-over water supply in subsequent water years by increasing storage capacity in San Luis Reservoir and reducing the frequency of years when the reservoir would fill and carried-over supply would be lost to the refuges and associated contractors.

The Refuge Water measure would provide supplemental project benefits under the B.F. Sisk Dam SOD Modification Project by providing additional water supply to San Luis Reservoir, with no adverse impacts to the project. Providing reliable, long-term refuge water supply would provide wildlife refuge benefits as required under the WIIN Act. The measure would be feasible and comply with all environmental laws. As such, this measure meets the project objectives/project purpose and need and will be carried forward for consideration in the EIR/SEIS.

Table 4-4. Refuge Water Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Refuge Water	3	3	3	3	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.5 Capture of Delta Surplus

The Capture of Delta Surplus measure would allow the increased capacity of San Luis Reservoir to be filled during times when there is a surplus of required Delta outflow and Delta outflow needed to meet Delta water quality standards. This measure is expected to provide improvement in reliability and quantity of yearly allocations by increasing the ability to capture Delta surplus in San Luis Reservoir.

Storing Delta surplus in the expanded capacity of San Luis Reservoir would not result in adverse impacts to B.F. Sisk Dam SOD Modification Project but would allow for additional project benefits by increasing the use of San Luis Reservoir. The measure would provide additional federal benefits pursuant to the WIIN Act by providing environmental enhancements and wildlife refuge benefits , as well as being feasible and compliant with all environmental laws.

This measure, in combination with other measures that would increase the certainty of access to supplies, will be carried forward for consideration in the EIR/SEIS.

Table 4-5. Capture of Delta Surplus Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Capture of Delta Surplus	3	2	3	3	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.6 Coordinated Operations Agreement

The COA measure would dedicate a portion of storage capacity in San Luis Reservoir to additional Delta CVP exports pursuant to COA to be stored and used in the CVP service area. This measure would provide improvements in reliability and quantity of yearly allocations by improving the amount of Delta CVP exports stored in San Luis Reservoir.

Storing Delta CVP exports in the new expanded capacity would provide additional water supply for San Luis Reservoir and would be an additional project benefit under the B.F. Sisk SOD Modification Project with no anticipated adverse impacts. This measure would provide environmental enhancements or wildlife refuge benefits, as well as being feasible and applicable with all environmental laws, including NEPA.

Although this measure does not fully meet the project objectives/project purpose and need, it can be combined with other measures to more fully meet the criteria. As such, the COA measure will be carried forward for consideration in the EIR/SEIS.

Table 4-6. Coordinated Operations Agreement Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Coordinated Operations Agreement	3	2	3	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.7 Long-Term Storage of Carried-Over Water

Using carried-over water to fill a portion of storage within the expanded capacity of San Luis Reservoir would provide improvement in reliability and quantity of yearly allocations. Participating contractors could choose to store a portion of their allocation and other non-CVP water for potential use in future dry years. The reduced likelihood of lost supplies (resulting from conflicts with storage of CVP Project water) and increases in protections to year over year ownership of supply, would increase certainty of contractor access in San Luis Reservoir carried over for use in subsequent years.

This measure would result in no adverse impacts to the B.F. Sisk Dam SOD Modification Project and would provide additional project benefits by increasing the use of San Luis Reservoir. Storing carried-over in the expanded portion of San Luis Reservoir would provide federal benefits pursuant to the WIIN Act by providing environmental enhancements and wildlife refuge benefits, as well as being feasible and complying with all environmental laws.

This measure, combined with others, will be carried forward for evaluation in the EIR/SEIS.

Table 4-7. Long-Term Storage of Carried-Over Water Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Long-term Storage of Carried-Over Water	3	3	3	3	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.8 Transfer Water – CVP/Non-CVP Sources

Transfer water is not a reliable source in all water year types because of its reliance on favorable hydrologic conditions, dependence on willing sellers and buyers, adherence to changing regulatory settings, dependence on available excess capacity at the Delta pumps and its dependency on Delta conditions. The Transfer Water measures would not improve long-term reliability of allocations nor the certainty of access to supplies but could be combined with other measures that would improve its ability to address the project's criteria as a combined alternative.

Storing transfer water from CVP and non-CVP sources in the expanded capacity of San Luis Reservoir would provide some additional project benefits under the B.F. Sisk Dam SOD Modification Project by providing additional water supply to San Luis Reservoir. However, because of the nature of transfer water, this benefit would be unreliable and not consistent. These measures would not result in adverse impacts to the B.F. Sisk Dam SOD Modification Project. Federal benefits pursuant to the WIIN Act under these measures would be feasibility and applicability to all environmental laws.

These measures, in combination with other measures to fully meet project criteria, will move forward for consideration in the EIR/SEIS.

Table 4-8. Transfer Water – CVP Sources Screening Result

	Project Objectives		Project Purpose and Need		
Measure	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Transfer Water – CVP Sources	2	2	2	2	3
Transfer Water – Non-CVP Sources	2	2	2	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.9 Recycled Water

Using recycled water in lieu of CVP supply or carried-over water could allow for some improvement in reliability and quantity of yearly allocations and certainty of access by making capacity available to store and potentially carry-over allocated CVP supplies not used by contractors due to the availability of recycled water. However, this measure would require a wastewater source, treatment, and distribution facilities, requiring some participating contractors to build additional infrastructure.

Although storing recycled water in the expanded capacity would provide additional water supply for San Luis Reservoir, this measure would require construction of additional infrastructure, limiting the benefits to the B.F. Sisk Dam SOD Modification Project. As such, this measure is not as feasible as the other measures evaluated and would not provide environmental enhancements or wildlife refuge benefits.

Given this measure does not fully address the project objectives/project purpose and need and would be less cost-effective owing to the requirement of building additional infrastructure, this measure will not be carried forward for consideration in the EIR/SEIS.

Table 4-9. Recycled Water Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Recycled Water	1	1	2	1	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.10 San Joaquin River Restoration Program Recapture Restoration Flows

This measure would dedicate a portion of expanded capacity to recaptured restoration flows in San Luis Reservoir. The recapture and recirculation of restoration flows is currently completed under annual environmental compliance evaluations dependent on the restoration water year type and the availability of recapture capacity at the Patterson Irrigation District, West Stanislaus Irrigation District, Banta Carbona Irrigation District and Delta diversions. The project would primarily serve Friant contractors, not all CVP SOD contractors. Given the uncertainty of the annual size of this measure's contribution to storage in San Luis Reservoir, this measure would provide not meet project objectives and have limited benefits under the B.F. Sisk Dam SOD Modification Project.

This measure does not address the project objectives/project purpose and need and will not move forward for evaluation in the EIR/SEIS.

Table 4-10. San Joaquin River Restoration Program Recapture Restoration Flows Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
San Joaquin River Restoration Program Recapture Restoration Flows	1	1	1	1	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.11 Temporary Storage of State Water Contractors Supply

This measure would provide for the opportunity for State Water Contractors to temporarily store some of their SWP supplies short term prior to being conveyed south. This measure would reduce the potential for loss of SWP supplies during wet years when San Luis Reservoir spills, providing more reliability and quantity of yearly allocations and increasing certainty of access for contractors south of San Luis Reservoir.

Utilizing a portion of the expanded storage in San Luis Reservoir to provide SWP Contractors temporary storage of SWP supplies would provide additional use of San Luis Reservoir resulting in additional benefits to the B.F. Sisk Dam SOD Modification Project. No adverse impacts would be anticipated. This measure would not provide environmental enhancements or wildlife refuge benefits but would provide some federal benefits pursuant to the WIIN Act, as this measure is feasible and would comply with all environmental laws.

Although this measure does not fully address the project objectives/project purpose and need, it may be combined with other measures that would improve its ability to address the project's criteria as a combined alternative.

Table 4-11. Temporary Storage of State Water Contractors Supply Screening Result

	Project Objectives		Project Purpose and Need		
Measure	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Temporary Storage of State Water Contractors Supply	3	2	3	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.12 Delta-Mendota Canal Reverse Flow

The DMC Reserve Flow measure would—in extreme conditions—allow for water stored in San Luis Reservoir to be conveyed to water users unable to access supplies pumped at the Delta. This would increase these water users' certainty of access to supplies in severe drought years but would not change conditions in other year types. As such, this measure would have limited additional project benefits under the B.F. Sisk Dam SOD Modification Project and would not be feasible.

Given this measure does not fully address the project objectives/project purpose and need, this measure will not be carried forward for consideration in the EIR/SEIS.

Table 4-12. Delta-Mendota Canal Reverse Flow Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Delta-Mendota Canal Reverse Flow	1	2	1	1	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.13 Groundwater Pump-In Program

The Groundwater Pump-In Program measure would dedicate a portion of the expanded capacity in San Luis Reservoir to store and carry-over accumulated pumped-in groundwater. Given the requirements of the Sustainable Groundwater Management Act (SGMA) and the groundwater conditions in the San Joaquin Valley, this measure would not likely increase certainty of access to supplies and therefore does not fully address the project objectives. In addition, this measure would have limited additional project benefits to the B.F. Sisk Dam SOD Modification Project and would not be feasible, given the nature of groundwater conditions in the San Joaquin Valley. As such, this measure will not be carried forward for consideration in the EIR/SEIS.

Table 4-13. Groundwater Pump-In Program Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Groundwater Pump-In Program	1	1	1	1	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.14 Shared CVP and SWP Ownership

Under this measure, the storage configuration to provide split ownership—between CVP and SWP—of the expanded storage capacity of San Luis Reservoir would improve both the CVP's and SWP's ability to meet yearly allocations through the overall increase in storage at San Luis Reservoir. Splitting the increased storage between SWP and CVP would provide an increase in certainty of access for SWP and CVP contractors.

Although this measure would provide limited project benefits under the B.F. Sisk Dam SOD Modification Project as it does not provide additional water supply to San Luis Reservoir and only proposes operational modifications, this measure would result in no adverse impacts to the B.F. Sisk Dam SOD Modification Project. Relating to federal benefits pursuant to the WIIN Act, the measure is feasible and would comply with all environmental laws, including NEPA.

As such, this measure will move forward for evaluation in the EIR/SEIS.

Table 4-14. Shared CVP and SWP Ownership Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Shared CVP and SWP Ownership	3	3	1	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.2.15 Modifications to South-of-Delta CVP Operations

This measure would allow for adjustments to Reclamation's operation of the South-of-Delta CVP, including potential modifications to annual allocations and the provision of carrying over CVP supply in San Luis Reservoir. This measure would provide operational flexibility; however, there would be some reduction in reliability during dry water years when CVP allocations would be low. Additional project benefits under the B.F. Sisk Dam SOD Modification Project would be limited under this measure as it does not provide additional water supply in San Luis Reservoir; however, no adverse impacts to the B.F. Sisk Dam SOD Modification Project would be expected. Federal benefits pursuant to the WIIN Act under this measure would include feasibility and compliance with all environmental laws. As such, this measure is moving forward for evaluation in the EIR/SEIS.

Table 4-15. Modifications to South-of-Delta CVP Operations Screening Result

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Shared CVP and SWP Ownership	2	3	1	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.3 Screening Summary

Table 4-16 presents a summary of screening results against each of the screening criteria for all of the measures listed in Section 4.2.

Table 4-16. Measure Screening Matrix

Measure	Project Objectives		Project Purpose and Need		
	Long-Term Reliability and Quantity of Yearly Allocations	Increasing the Certainty of Access to Supplies	Additional Project Benefits under B.F. Sisk SOD Project	Federal Benefits pursuant to WIIN Act	No Adverse Impacts to B.F. Sisk SOD Project
Agricultural Water Supply	3	2	3	2	3
M&I Water Supply	3	2	3	2	3
Groundwater Stabilization	2	2	3	3	3
Emergency Water Supply	1	1	3	2	3
Refuge Water	3	3	3	3	3
Capture of Delta Surplus	3	2	3	3	3
Coordinated Operations Agreement (COA)	3	2	3	2	3
Long-Term Storage of Carried-Over Water	3	3	3	3	3
Transfer Water – CVP Sources	2	2	2	2	3
Transfer Water – Non-CVP Sources	2	2	2	2	3
Recycled Water	1	1	2	1	3
SJRRP Recaptured Restoration Flows	1	1	1	1	3
Temporary Storage of State Water Contractors Supply	3	2	3	2	3
Delta-Mendota Canal Reverse Flow	1	2	1	1	3
Groundwater Pump-In Program	1	1	1	1	3
Shared CVP and SWP Ownership	3	3	1	2	3
Modifications to South-of-Delta CVP Operations	1	3	1	2	3

Key: 3 – High, 2 – Medium, 1 – Low

4.4 Measures Carried Forward to Alternatives Formulation

The following measures fully met or partially met project objectives (as indicated in Section 4.2) and will be combined into alternatives to be analyzed in the EIR/SEIS:

- Agricultural Water Supply
- M&I Water Supply
- Groundwater Stabilization
- Refuge Water
- Capture of Delta Surplus
- Coordinated Operations Agreement
- Long-Term Storage of Carried-Over Water
- Transfer Water - CVP sources
- Transfer Water - non-CVP sources
- Temporary Storage of State Water Contractors Supply
- Shared CVP and SWP Ownership
- Modifications to South-of-Delta CVP Operations

Chapter 5 Alternatives

This chapter presents alternatives developed and based on the evaluation described in Chapter 4. Alternatives for the EIR/SEIS include different combinations of potential measures, a No Project/No Action Alternative, and a Non-structural Alternative (as required by the SOD Directive and Standard [Reclamation 2016]). All alternatives would be operated within the limits of the operating rules identified in the 2019 United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries Biological Opinions for the Reinitiation of Consultation on the Coordinated Operations of the CVP and SWP (USFWS 2019; NOAA Fisheries 2019).

5.1 Alternative 1 – No Project/No Action

The No Project Alternative (under CEQA) describes the future without the project and may include some reasonably foreseeable changes in existing conditions and changes that would reasonably be expected to occur in the foreseeable future if the project were not approved. The No Action Alternative (under NEPA) describes future circumstances without the proposed action and includes predictable actions by persons or entities, other than the federal agency involved in a project action, acting in accordance with current management direction or level of management intensity.

Under the No Project/No Action Alternative, crest raise actions from the B.F. Sisk Dam SOD Modification Project would be implemented, including increasing the dam crest by 12 feet to reduce safety concerns for the downstream public by reducing the likelihood of overtopping if slumping were to occur during a seismic event (Reclamation 2019). As discussed in the B.F. Sisk Dam SOD Modification Project Record of Decision (ROD), the Crest Raise Action includes implementation of several mitigation measures and environmental commitments to reduce environmental impacts. These mitigation measures and environmental commitments are evaluated as project actions under the No Project/No Action Alternative analysis in this EIR/SEIS.

The No Project/No Action Alternative includes current conditions in the study area at the time of the Lead Agencies' release of the Notice of Intent and Notice of Preparation for the EIS/EIR and will be analyzed consistently with the Reinitiation of Consultation on the Coordinated Long-Term Operation of Central Valley Project and State Water Project (ROC on LTO) and the 2018 Addendum to the Coordinated Operations Agreement Central Valley Project/State Water Project ROD that are assumed to also reasonably portray future anticipated operational conditions.

5.2 Alternative 2 – Non-Structural Alternative

Under Alternative 2, Non-Structural Alternative, operational measures would be used to meet project objective/project purpose and need. Alternative 2 would rely on a change in the current approach for annual CVP Project water supply allocations. San Luis Reservoir's maximum capacity is 2,027,840 AF, with a federal share of 966 thousand acre-feet (TAF) and state share of 1,062 TAF.

The annual allocation of CVP supplies is managed by Reclamation. Reclamation develops the annual allocation to fully utilize stored CVP supply in the reservoir to meet CVP contractors' contracts and the requirements of other authorized purposes, such as CVPIA refuge water supplies. Under the Non-Structural Alternative, Reclamation would change its annual allocation process to reserve up to 310 TAF of stored CVP supply in San Luis Reservoir at the end of wetter years. This water would be reserved in San Luis Reservoir for allocation in subsequent drier years to South-of-Delta CVP contractors. In these drier years, the 310 TAF in reserved supply would be allocated to South-of-Delta CVP water contractors consistent with the CVP's current allocation of water supply stored in San Luis Reservoir, but only if supply is sufficient to meet the demands of senior water rights contractors. Under Alternative 2, water supply reserved in wetter water years by Reclamation for delivery to South-of Delta CVP contractors in drier years could potentially be diverted for delivery to the Exchange Contractors in critical water year types.

Under this new operational configuration allocated water supply not used by CVP contractors could not be carried over for use in a subsequent year.

This change in San Luis Reservoir operations to increase water supply available in dry and critical years would adversely impact average water supply deliveries to CVP and SWP contractors. This alternative would not completely meet the project objectives/purpose and needs of the proposed action. However, the Non-Structural Alternative is analyzed in this EIR/SEIS as a nonstructural alternative that would not fully meet the project objectives as it would not increase annual allocations (see Appendix E for delivery modeling results under Alternative 2). The Non-Structural Alternative would not require any additional construction or maintenance actions.

Alternative 2 is an action connected to the approved B.F. Sisk Dam SOD Modification Project included under Alternative 1. Therefore, the analysis of effects completed for Alternative 2 in this EIR/SEIS considers the operational impacts of implementing Alternative 2.

5.3 Alternative 3 – Dam Raise Alternative

Alternative 3, Dam Raise Alternative, would be completed by placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk Dam SOD Modification Project. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. Under this alternative, three subalternatives evaluate different operational configurations, covering varying assignments and uses of the increased storage space, described in more detail below.

5.3.1 Elements Common to all Subalternatives

5.3.1.1 Construction of Dam Raise

All of the subalternatives under the Dam Raise Alternative would include the additional 10-foot raise of B.F. Sisk Dam across the entire dam crest, resulting in a new crest elevation of 576 feet, which would support a new maximum water surface elevation of 554 feet. In addition to the new dam height added by the reservoir enlargement, all subalternatives would include (1) installation of downstream stability berms and crack filters and (2) raising the existing outlet works intake towers, access bridge, and spillway intake by 10 feet.

The existing saddle dike, known as the East Dike, located approximately 1,300 feet north of the main embankment, would be modified by adding a downstream filter. With increased reservoir surface elevations, modifications would be made to the Dinosaur Point Boat Launch and the Goosehead Point Boat Launch to increase the ramp's operating elevation by 10 feet.

Construction of the additional 10-foot embankment and associated modifications would initiate during construction of the B.F. Sisk Dam SOD Modification Project currently scheduled to start in September 2020 and continue through December 2028.

5.3.1.2 State Route 152 Modifications

Under all subalternatives, the increase in storage levels will require modifications to a section of State Route (SR) 152 where it crosses over Cottonwood Creek. The current maximum water level at San Luis Reservoir is 544 feet. Under the Dam Raise subalternatives, the maximum water level would increase 10 feet. The current elevation of the road surface of SR 152 near Cottonwood Creek ranges in elevation from 555 to 558 feet and higher. With the lowest point of SR 152 approximately 1 foot above the proposed maximum water storage level, it is assumed that modifications will be needed to protect the roadway.

5.3.2 Operation of Dam Raise Alternative

SLDMWA and its member agencies, Reclamation, and DWR coordinated on the identification of several operational configurations of the Dam Raise Alternative. Those subalternatives have been further configured as "bookends" to capture the range of stakeholder-requested configurations and cover the high- and low-end of potential environmental effects. These effects include potential growth-inducing impacts from increases in M&I water supply reliability, and potential environmental impacts to aquatic resources in the Delta resulting from changes in water deliveries conveyed through the Delta.

5.3.2.1 CVP-Only Storage Subalternative

The additional storage in San Luis Reservoir would be Reclamation-owned CVP storage and would be operated consistent with current CVP operations. The new reservoir capacity would be used to store CVP Project water, carried-over water,[1] and non-Project water.[2] The maximum quantity of carried-over water would be the same as recent operations under the current rescheduling guidelines. Based on a review of historical rescheduling quantities and the most recent annual rescheduling guidelines (Reclamation 2020), an upper quantity of 180 TAF was used to estimate the aggregate total of rescheduled water in high-allocation water years. As an operational bookend, this upper limit was allocated 98% to agricultural and 2% to M&I South-of-Delta CVP water contractors. Storage

[1] Carried-over water refers to Rescheduled Water. Rescheduled Water is defined as allocated CVP water carried over to subsequent water year(s) by the water contractor pursuant to Reclamation's then-current Rescheduling Guidelines.. The water contractors, in storing this carried-over supply in San Luis Reservoir, take on a risk of potentially losing it if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

[2] Non-Project water includes transfer water acquired by existing South-of-Delta CVP contractors or other non-project water currently stored in San Luis Reservoir such as conserved water.. The water contractors can store non-Project water in San Luis Reservoir under a Warren Act Contract. Similar to carried-over water, the contractors take on a risk of potentially losing non-Project water if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

priority will follow current rescheduling guidelines with rescheduled water being subject to spill consistent with current operating criteria.

5.3.2.2 CVP/SWP Split Storage Subalternative

The additional storage would be split between CVP and SWP consistent with the current 45% CVP and 55% SWP split of the overall reservoir storage. The additional storage would follow current operating criteria and the storage priority will follow the current rescheduling guidelines.

5.3.2.3 Investor-Directed Storage Subalternative

Under this subalternative's four operational configurations, the use of the proposed storage (expanded capacity) would be primarily investor-directed. Remaining expanded capacity not in use by the investors, at any given time, would be available to Reclamation to store CVP Project water.

Investors could store allocated CVP Project water, carried-over water, and non-Project water in the new storage. Investors could forgo delivery of their allocated CVP Project water for delivery in subsequent year(s). This unused CVP Project water would be carried over to subsequent year(s) and continue to be stored in San Luis Reservoir until investor requests delivery of the water without the risk of "spill." Carried-over water in the expanded capacity would be subject to evaporation at the same rate as CVP Project water stored in San Luis Reservoir. Investors would have first priority in storing carried-over water and non-Project water in the expanded storage.

Configuration A – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 78% to agriculture, 7% to M&I, and 15% federal refuge water users.

Configuration B – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agricultural water users.

Configuration C – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 78% to agricultural, 7% to M&I, and 15 percent federal refuge water users.

Configuration D – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agricultural water users.

5.4 References

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix B: Background

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Appendix B Background

This appendix includes information on (1) No Project/ No Action and Proposed Action, and (2) federal and state regulations relevant to Proposed Action.

B.1 Alternatives

B.1.1 No Project/ No Action Alternative

The No Project Alternative (under California Environmental Quality Act [CEQA]) describes the future without the project and may include some reasonably foreseeable changes in existing conditions and changes that would reasonably be expected to occur in the foreseeable future if the project were not approved. The No Action Alternative (under National Environmental Policy Act [NEPA]) may be described as the future circumstances without the Proposed Action and can also include predictable actions by persons or entities, other than the federal agency, involved in a project action, acting in accordance with current management direction or level of management intensity.

Under the No Project/No Action Alternative, crest raise actions from the B.F. Sisk Dam Safety of Dams (SOD) Modification Project would be implemented. The crest raise action under the B.F. Sisk Dam SOD Modification Project includes increasing the dam crest by 12 feet to reduce safety concerns for the downstream public by reducing the likelihood of overtopping if slumping were to occur during a seismic event (Reclamation 2019). As discussed in the B.F. Sisk Dam SOD Modification Project Record of Decision (ROD), the crest raise action includes implementation of several mitigation measures to reduce environmental impacts. These mitigation measures (see Section 2.3 for the list of mitigation measures), are evaluated as project actions under the No Project/No Action analysis in this Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS).

The No Project/No Action Alternative includes current conditions in the study area at the time of the Lead Agencies' release of the Notice of Intent (NOI) and Notice of Preparation (NOP) for the EIR/SEIS and was analyzed consistently with the Reinitiation of Consultation on the Coordinated Long-Term Operation of Central Valley Project and State Water Project (ROC on LTO) and the 2018 Addendum to the Coordinated Operation Agreement Central Valley Project (CVP)/State Water Project (SWP) ROD (see Section B.2 for details).

B.1.1.1 B.F. Sisk Dam Safety of Dams Modification Project

Investigations conducted under Reclamation's SOD Program determined that several sections of B.F. Sisk Dam sit above liquefiable and soft soils. During a seismic event, sections of the dam could slump below the water line or allow cracking to develop through the embankment, which could lead to dam failure.

The San Luis Reservoir is an important CVP and SWP facility and a key component of California's water supply system. Therefore, proper functioning of the reservoir is critical to maintaining water distribution for federal, state, and local uses. The United States Department of Interior, Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) are implementing the B.F. Sisk Dam SOD Modification Project to reduce safety concerns for the downstream public by increasing dam height to reduce the likelihood of overtopping if slumping were to occur during a seismic event. This B.F. Sisk Dam SOD Modification Project would also address dam failure as a result of earthquake-induced cracking. This measure maintains water supply deliveries to state and federal contractors through the CVP and SWP because it allows the reservoir to operate at its current maximum storage elevation.

As part of the B.F. Sisk Dam SOD Modification Project, the dam crest would be raised by adding additional embankment material (see Figure 2) in conjunction with the addition of stability berms and downstream crack filters. The foundation that the dam is built on can be divided into sections: the right abutment, the left abutment, the north valley section (NVS), and the south valley section (SVS) (See Figure 1).

The B.F. Sisk Dam SOD Modification Project would raise the dam crest an additional 12 feet to a new crest elevation of 566 feet along the majority of the embankment, tapering at a 2 percent slope to the existing crest elevation at the abutments. Any work that would reduce the reservoir embankment strength would be timed seasonally and would occur during periods of the year when the reservoir is drawn down to lower elevations. This work would also be scheduled for completion each year prior to San Luis Reservoir being refilled back above safe levels to protect embankment stability. This could result in delays to refill if the construction schedule is delayed, but the division of specific modification actions scheduled to occur in one drawdown season would be structured to minimize this risk. This reduction in surface elevation would reduce storage capacity in the reservoir and could limit CVP and SWP deliveries during this construction period.

Findings Some resource areas, including Water Supply, Greenhouse Gases (GHG), Air Quality, Flood Protection, Noise, Traffic and Transportation, Hazards and Hazardous Materials, Fisheries, Recreation, and Cultural Resources, were found to have significant impacts due to implementation of the B.F. Sisk Dam SOD Modification Project. The below mitigation measures, were implemented to reduce the severity of these impacts.

Mitigation Measure AQ-1. Reduce emissions from off-road construction equipment by using Tier 4 construction equipment Impacts on air quality from construction activities will be reduced by using construction equipment compliant with the Tier 4 emission standards for off-road diesel engines instead of the fleet average for the San Joaquin Valley Air Basin. Records will be maintained by the construction contractor that demonstrate that actual emissions would not exceed the San Joaquin Valley Air Pollution Control District's (SJVAPCD) significance criteria and would be submitted to Reclamation monthly.

If Nitrogen oxide (NOx) emissions are forecasted to exceed thresholds, then changes will be made so that the threshold is not exceeded, or work will be stopped.

Mitigation Measure AQ-2. Reduce exhaust emissions from on-road trucks All haul trucks, vendor trucks, or other vehicles operating onsite with on-road engines will meet model year 2015 or better emission standards.

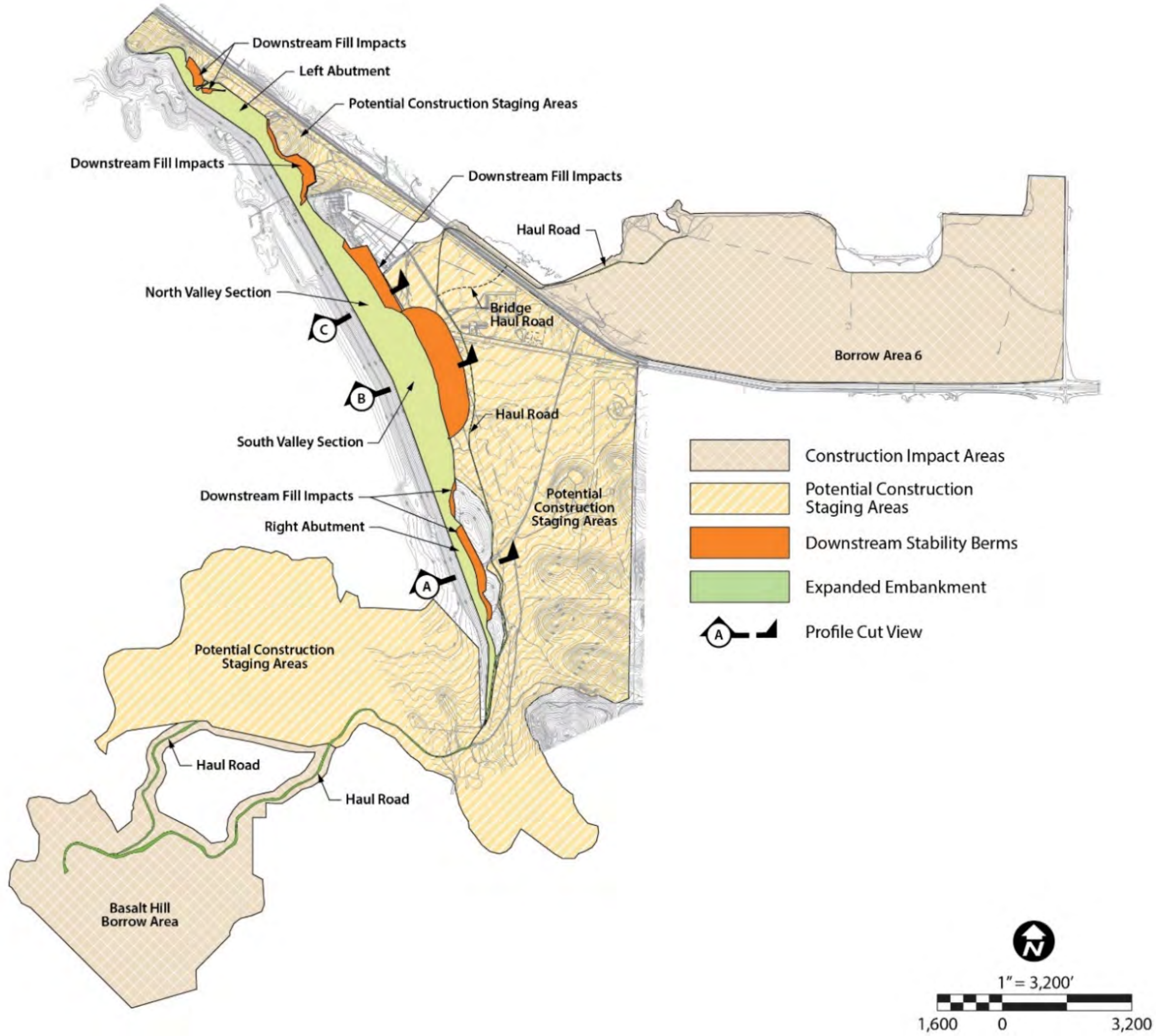

Figure 1. B.F. Sisk Safety of Dam Project Crest Raise Construction and Staging Areas

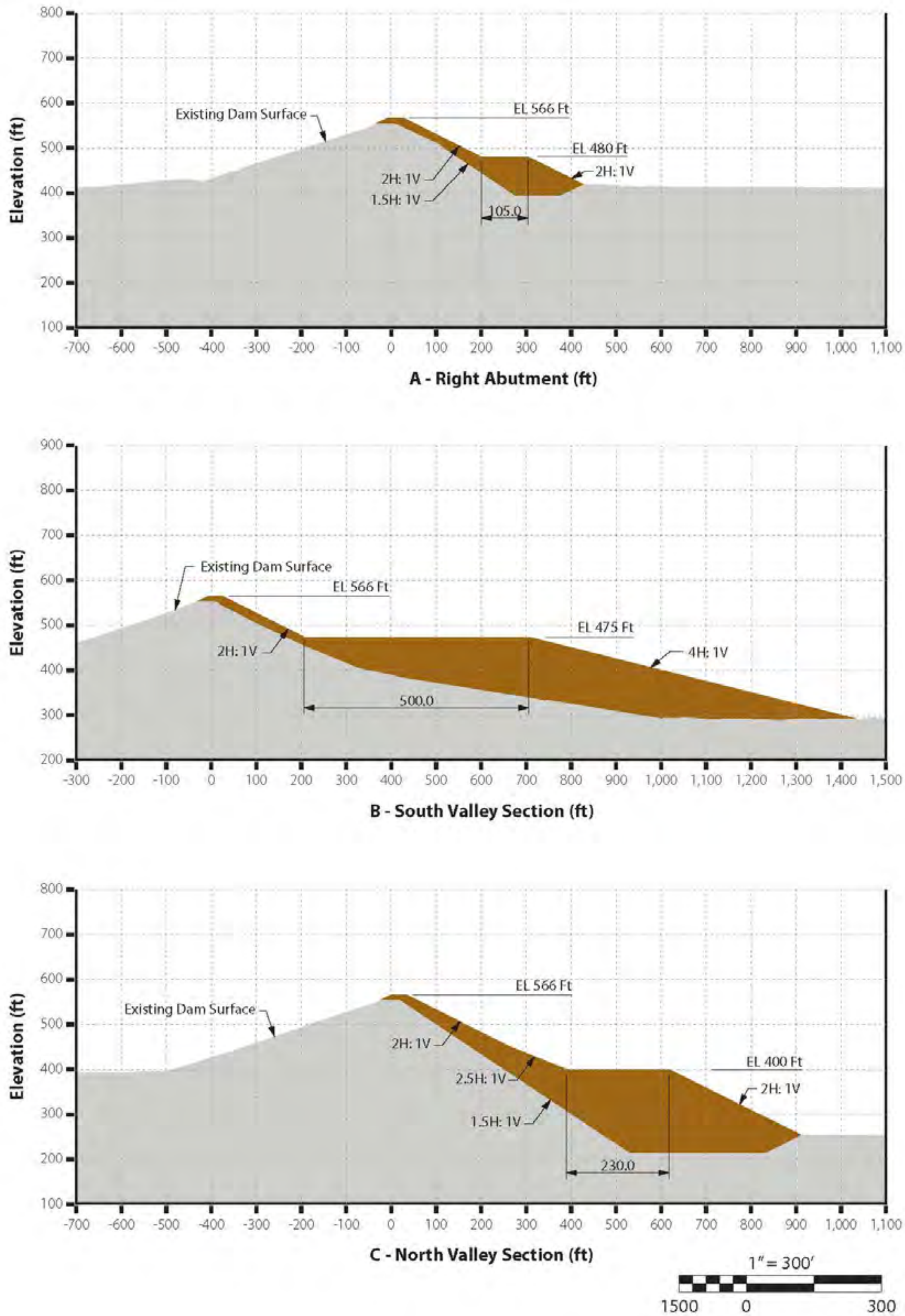

Figure 2. B.F. Sisk Safety of Dam Project Crest Raise Profiles

Mitigation Measure AQ-3. Implement Best Available Mitigation Measures for Construction Phase As required by the SJVAPCD, the project must apply the following best available mitigation measures for the construction phase:

- All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilize of dust emission using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover.
- All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut & fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
- With the demolition of buildings up to six stories in height, all exterior surfaces of the building shall be wetted during demolition.
- When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained.
- All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions.) (Use of blower devices is expressly forbidden.)
- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant.
- Within urban areas, trackout shall be immediately removed when it extends 50 or more feet from the site and at the end of each workday.
- An owner/operator of any site with 150 or more vehicle trips per day, or 20 or more vehicles trips per day by vehicles with three or more axles shall implement mitigation measures to prevent carryout and trackout.

Mitigation Measure GHG-1 Reclamation will require the contractor to purchase carbon offsets before construction activities commence in an amount sufficient to reduce GHG emissions to less than significant levels using DWR significance thresholds; a minimum of 120,575 metric tons carbon dioxide equivalent (MTCO2e) would be required to reduce emissions below the project-level significance threshold. Only emission offsets generated as part of California Air Resources Board's (CARB's) Compliance Offset Protocols (developed for the Assembly Bill 32 cap-and-trade program) may be used to reduce GHG emissions. These protocols assure that offsets are real, permanent, quantifiable, verifiable, enforceable, and additional (Health and Safety Code Section 38562(d)). Registries selling approved offsets include the American Carbon Registry, the Climate Action Reserve, and the Verified Carbon Standard.

Mitigation Measure VIS-1 To reduce visual intrusion from light sources, Reclamation shall require the contractors to implement measures to reduce light and glare while meeting minimum safety and security standards. Light reduction measures must include: directing lighting downward to prevent spillover onto nearby areas, utilization of lighting fixtures with directional shielding to focus on areas being lit, and a construction requirement that all lighting in areas not under active construction be shut off. To reduce the amount of glare, building finishes shall be subdued and earth-toned. Onsite mechanical equipment roofing materials, and any exposed vents or flashings must be constructed of non-glare finishes that minimizes reflectivity.

Mitigation Measure NOI-1 A Noise Control Plan (NCP) will be developed by the construction contractor prior to the start of any construction activities to address increased noise levels as a result of the proposed project and alternatives. The NCP will identify the procedures for predicting construction noise levels at sensitive receptors and will describe the reduction measures required to minimize construction noise. The noise mitigation measures in the NCP will include, but are not limited to:

- Appropriate level of sound attenuation will be used or constructed to minimize noise levels by at least 3 A-weighted decibels (dBA). Potential sound attenuation measures could include, but are not limited to stationary equipment and stockpiles, or otherwise placed between the source(s) of construction noise and noise-sensitive receptors, as appropriate. The feasible measures will be determined by the construction contractor based on an initial evaluation of each construction site.

- Contractor will be responsible for maintaining equipment in best possible working condition and outfitting construction equipment with the most effective locally available commercial mufflers or other noise attenuation devices;

- When feasible, the loudest construction activities will be conducted during Merced County construction noise exempt hours, between 7:00 a.m. and 6:00 p.m.;

- Operation of construction equipment between the hours between 6 p.m. and 10 p.m. will be prohibited within 9,100 feet of the Subdivision off State Route (SR) 152. During the hours between 10:00 p.m. and 6:00 a.m. the operation of construction equipment will be prohibited within 9,550 feet of the Subdivision off SR 152.

- Shutting down equipment that are queued or not in use for 5 minutes or more;

- Pre-construction meeting with contractors and project managers to confirm that noise mitigation procedures are in place;

- Signs shall be posted at the construction sites that include permitted construction days and hours, a day and evening contact number for the job site, and a contact number in the event of problems;

- The public will be kept informed of the construction hours and days;

- List contact information for complaints and respond to noise complaints; and

- An on-site complaint and enforcement manager shall respond to and track complaints and questions related to noise.

Mitigation Measure NOI-2 A Blasting Plan for construction shall be prepared and followed that includes the following:

- Identification of blast officer;
- Scaled drawings of blast locations, and neighboring buildings, streets, or other locations which could be inhabited;
- Blasting notification procedures, lead times, and list of those notified. Public notification to potentially affected vibration and nuisance noise receptors describing the expected extent and duration of the blasting;
- Description of means for transportation and on-site storage and security of explosives in accordance with local, State and Federal regulations;
- Minimum acceptable weather conditions for blasting and safety provisions for potential stray current (if electric detonation);
- Traffic control standards and traffic safety measures (if applicable);
- Required personal protective equipment;
- Minimum standoff distances and description of blast impact zones and procedures for clearing and controlling access to blast danger;
- Procedures for handling, setting, wiring, and firing explosives; and procedures for handling misfires per Federal code;
- Type and quantity of explosives and description of detonation device.
- Methods of matting or covering of blast area to prevent flyrock and excessive air blast pressure;
- Description of blast vibration and air blast monitoring programs;
- Dust control measures in compliance with applicable air pollution control regulations (to interface with general construction dust control plan);
- Emergency Action Plan to provide emergency telephone numbers and directions to medical facilities. Procedures for action in the event of injury;
- Material Safety Data Sheets for each explosive or other hazardous materials to be used;
- Evidence of licensing, experience, qualifications of blasters, and description of insurance for the blasting work

- A sound attenuation plan shall be prepared outlining sound control measures that would include the use of blasting mats or sound walls;

- If vibration results in damage to any nearby structures or utilities, or scenic rock faces, blasting shall immediately cease. The stability of segmental retaining walls, existing slopes, creek canals, etc. shall be monitored and any evidence of instability due to blasting operations shall result in immediate termination of blasting;

- Explosive materials shall be delivered in specially built vehicles marked with United Nations (UN) hazardous materials placards. Explosives and detonators shall be delivered in separate vehicles or be separated in compartments meeting Department of Transportation rules within the same vehicle. Vehicles shall have at least two ten-pound Class-A fire extinguishers and all sides of the vehicles display placards displaying the UN Standard hazard code for the onboard explosive materials. Drivers shall have commercial driver licenses with Hazmat endorsements, and drivers shall carry bill-of-lading papers detailing the exact quantities and code dates of transported explosives or detonators;

- The contractor must comply with United States Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) table-of-distance requirements (Code of Federal Regulations (CFR) 27, United States Department of Justice, Alcohol, Tobacco, Firearms and Explosives Division Part 555) that restrict explosive quantities based on distance from occupied buildings and public roadways. Employees must also comply with the security requirements of the Safe Explosives Act (Title XI, Subtitle C of Public Law 107-296, Interim Final Rule), implemented in March 2003. These requirements require background checks for all persons that use, handle or have access to explosive materials; and responsible persons on a now required Federal explosives license must submit photographs and fingerprints with the application to ATF.

Mitigation Measure NOI-3. A pre-construction noise survey will be completed during daytime and nighttime periods at multiple locations across the project area, including identified sensitive receptors, to establish background noise levels at those times. During construction, noise will be periodically monitored at these locations to assess any increases in noise levels that exceed the local noise ordinances. If noise levels are recorded exceeding the background noise level by 10 dBA between 6:00 p.m. and 10:00 p.m. or by 5 dBA between 10:00 p.m. and 7:00 a.m. or if noise complaints are received, an investigation will be conducted to determine the source of the noise. After the investigation, noise will be reduced using all feasible measures, including mitigation at the receiver impacted by the noise. Potential mitigation at the receiver would include building envelope improvements and acoustical window treatments.

All mitigation requirements will be included in bid documents and construction contracts.

Mitigation Measure TR-1. The following construction management actions will be documented in a temporary traffic control plan developed by the contractor as a requirement that will be included in its construction contract. The temporary traffic control plan will be submitted for California Department of Transportation review and approval during the Encroachment Permit process. Construction contractors shall install signage at intersections identified as dangerous in accordance with the California Manual on Uniform Traffic Control Devices guidelines warning motorists of slow moving construction traffic and lane closures, including SR 152, Basalt Road, and the Romero

Visitor Center access road. Signage shall also be posted at these intersections one month in advance to allow motorists time to plan for delays or alternate routes. Construction contractors shall implement dust abatement and perform proper construction traffic management actions, including signage warning motorists of construction activity and traffic controls like flaggers or temporary traffic lights where construction equipment will be entering roadways, to reduce conflicts during periods of high traffic volume in and around each construction site and to avoid conflicts with emergency responders entering and existing the area during an emergency.

In addition to the temporary traffic control plan, prior to the initiation of any construction actions, construction contractors shall develop and adhere to a health and safety plan outlining all applicable Occupational Safety and Health Administration requirements, important traffic safety plans including identification of emergency access routes in and through construction areas that would will need to be kept clear at all times during construction. The health and safety plan shall include coordination with emergency service personnel to ensure adequate mitigation for all impacts.

Mitigation Measure HAZ-1. The construction contractor in coordination with the Lead Agencies shall work with the California Department of Parks and Recreation (CDPR) and the Central Valley Regional Water Quality Control Board (RWQCB) to review existing monitoring data of the San Luis Reservoir State Recreation Area (SRA) Leaking Underground Storage Tank Cleanup Site (LUST) to evaluate the potential for interacting with hazardous soil contamination during construction. If the construction contractor and the Lead Agencies (as the responsible party for this potential disturbance) determine that interaction with contaminated soil cannot be avoided and these construction actions could generate a release of this soil to nearby water bodies or elsewhere offsite, the construction contractor shall prepare a Contaminated Soil/Groundwater Remediation Plan. This remediation plan will detail the nature of the contaminants on site, measures required to avoid interaction with these contaminants including if necessary a pre-construction cleanup of the site, and a response action plan in the event of an inadvertent release of contaminated soils from the construction site. This plan will be submitted to the CDPR and the Central Valley RWQCB for review and approval prior to any construction taking place.

In addition, the construction contractor shall also prepare a Spill Prevention and Response Plan for preventing spills and responding to chemical or hazardous substance spills. This plan will include spill prevention management, including employee training, hazardous substance inventory, and spill response equipment. The plan will also include a spill response plan, including evacuation procedures, spill containment and cleanup, and reporting a release.

Finally, the construction contractor shall prepare a Fire Prevention Plan to prevent a fire from occurring. The plan must include (Occupational Safety and Health Administration 2018):

- A list of all major fire hazards, proper handling and storage procedures for hazardous materials, potential ignition sources and their control, and the type of fire protection equipment necessary to control each major hazard.
- Procedures to control accumulations of flammable and combustible waste materials.
- Procedures for regular maintenance of safeguards installed on heat-producing equipment to prevent the accidental ignition of combustible materials.

- The name or job title of employees responsible for maintaining equipment to prevent or control sources of ignition or fires.
- The name or job title of employees responsible for the control of fuel source hazards

Mitigation Measure HAZ-2. Construction contracts will include requirements for the contractor to prepare a construction safety plan prior to any construction activities in collaboration with seaplane base personnel to coordinate construction activities including: a schedule, coordination of personnel with aviation radios, and notice requirements. Also, consistent with Mitigation Measure TR-1, the contractor shall coordinate with emergency service personnel to ensure adequate mitigation for all impacts.

Mitigation Measure HAZ-3. The construction contractor in coordination with the Lead Agencies shall notify the San Luis Seaplane Base administrator when a Notice to Airmen is required to be issued prior to the commencement of construction activities within the seaplane base and when high profile equipment will be used within safety zones.

Mitigation Measure HAZ-4. The Lead Agencies will include requirements in all construction contracts requiring the use of spark arrestors on all construction equipment. The contract shall also include requirements for the contractor to educate all construction workers about the risk of starting a wildfire and how to avoid it and who to contact in case a wildfire is started. In addition, restrictions shall be placed on smoking and campfires for any personnel utilizing Basalt Campground.

Mitigation Measure TERR-1. Special-status Plant Species and Special-Status Natural Communities Surveys of the project area for special-status plant species will be conducted during the identifiable blooming period prior to commencement of work. Special-status plants include: Arcuate bush-mallow (blooms April through September), big-scale balsamroot (blooms March through June), California alkali grass (blooms March through May), chaparral harebell (blooms May through June), Congdon's tarplant (blooms May through October), Hall's bush-mallow (blooms May through September), Hispid bird's beak (blooms June through September), Hospital Canyon larkspur (blooms March through June), Lemmon's jewelflower (blooms February through May), Lime Ridge navarretia (blooms May through June), round-leaved filaree (blooms March through May), shining navarretia (blooms April through July), and spiny-sepaled button-celery (bloom April through June).

A qualified DWR biologist (qualified biologist) will be present prior to and during construction to ensure avoidance of impacts on special-status plant species and special-status natural communities by implementing one, or more, of the following, as appropriate, per the biologist's recommendation:

- Flag the population or natural community areas to be protected;
- Allow adequate buffers; and/or,
- Time construction or other activities during dormant and/or non-critical life cycle periods.

For unavoidable impacts to special-status plant species, compensatory mitigation may be required based on recommendations of the qualified biologist. If any impacts occur to listed plant species, consultation with United States Fish and Wildlife Service (USFWS) and/or California Department of Fish and Wildlife (CDFW) will be initiated. If deemed necessary based on the type and extent of special-status plant populations affected, compensatory mitigation will entail:

- The protection, through land acquisition or a conservation easement, of a population of equal or greater size and health. Or,

- If it is not feasible to acquire and preserve a known population of a special-status plant to be impacted, suitable unoccupied habitat capable of supporting the species will be acquired, and used to create a new population. For population creation, the following considerations will also be met:

- Prior to unavoidable and permanent disturbance to a population of a special-status plant species, propagules shall be collected from the population to be disturbed. This may include seed collection or cuttings, and these propagules will be used to establish a new population on suitable, unoccupied habitat as described above. Transplantation may be attempted but will not be used as the primary means of plant salvage and new population creation.

- Creation of new populations will require identifying suitable locations and researching and determining appropriate and viable propagation or planting techniques for the species. It will also require field and literature research to determine the appropriate seed sampling techniques and harvest numbers for acquisition of seed from existing populations.

- A minimum ten-year monitoring plan with adaptive management will be implemented to document the success of creating new plant populations. Adequate funding for compensatory mitigation will be provided on an agreed-to schedule, following a discussion with the appropriate regulatory agencies, to ensure long-term protection and management of lands acquired or placed under conservation easement.

Mitigation Measure TERR-2. Valley Elderberry Longhorn Beetle Prior to construction, the known stand of more than 25 elderberry shrubs and surrounding areas with suitable elderberry habitat would be surveyed to determine the current number of elderberry shrubs present, their stem diameters, and, if feasible, the presence and number of exit holes formed by valley elderberry longhorn beetle (VELB) as they exit the branch. Surveys are valid for two years.

A 100-foot buffer around construction areas would also be surveyed for elderberry shrubs that could be affected by dust from construction. Areas containing elderberry shrubs with stems greater than 1-inch in diameter would be assumed to provide VELB habitat, protected with fencing, and avoided to the extent possible. Consultation with the USFWS through the Section 7 process may be required if shrubs cannot be avoided during construction. If shrubs cannot be avoided, removal measures would be implemented, including transplanting shrubs to a USFWS-approved conservation area, compensating for habitat loss at a ratio ranging from 1:1 to 8:1 depending on the diameter of the impacted elderberry stems and habitat type that they were removed from (riparian or non-riparian), under an Elderberry Mitigation Plan approved by USFWS, or purchasing credits at a USFWS-approved mitigation bank for VELB.

Mitigation Measure TERR-3. Special-Status Amphibians Before and during construction:

- The Proponent shall submit the name and credentials of a DWR biologist qualified to act as construction monitor to USFWS and CDFW for approval at least 15 days before construction work begins. General minimum qualifications are a 4-year degree in biological sciences and experience in surveying, identifying, and handling California tiger salamanders and California red-legged frogs. The qualified biologist shall be present at all times during construction. Consultation with the USFWS through the Section 7 process may be required to determine avoidance, conservation, and mitigation measures.

- The USFWS and CDFW-approved biologist, under the appropriate Federal and State authorities (e.g. permitting and consultation), shall survey the work sites 2 weeks before the onset of construction. If California tiger salamanders or California red-legged frogs (or their tadpoles or eggs) are found, the approved biologist shall contact USFWS and CDFW to determine whether moving any of these life-stages is appropriate. If USFWS and CDFW approve moving the animals, the biologist shall be allowed sufficient time to move frogs and/or salamanders from the work sites before work begins. If these species are not identified, construction can proceed at these sites. The biologist shall use professional judgment to determine whether (and if so, when) the California tiger salamanders and/or frogs are to be moved. The biologist shall immediately inform the construction manager that work shall be halted, if necessary, to avert avoidable take of listed species.

- The known location of California red-legged frogs and Willow Spring, the water source for the perennial frog pond, near the borrow area will be avoided during construction with a buffer of 250 feet to avoid modifying aquatic habitat that supports the frog population; or as otherwise approved by the resource agencies.

- Areas impacted by construction will be monitored during construction to identify, capture, and relocate special-status amphibians, if present.

- Areas beneath construction equipment and vehicles shall be inspected daily, prior to operation, for presence of special-status amphibians under tracks/tires and within machinery. If special-status amphibians are found a qualified biologist will capture and relocate animals from work sites.

- Appropriate State and Federal permits for handling of special-status species will be acquired

- If necessary, a detailed amphibian relocation plan will be prepared at least 3 weeks before the start of groundbreaking and submitted to CDFW and USFWS for review. The purpose of the plan is to standardize amphibian relocation methods and relocation sites.

- A USFWS and CDFW-approved biologist shall be present at the active work sites until special-status amphibians have been removed, and habitat disturbance has been completed. Thereafter, the contractor shall designate a person to monitor onsite compliance with all minimization measures. A CDFW and USFWS-approved biologist shall ensure that this individual receives training consistent with USFWS requirements.

- The project proponent and its contractors shall install frog-exclusion fencing (i.e., silt fences) around all construction areas that are within 100 feet of any identified ponds that provide potential special-status amphibian aquatic breeding habitat. During and after rain events, an approved biologist will monitor work areas for the presence of special-status amphibians.

- Reclamation shall provide compensation for permanent and temporary impacts on California tiger salamander and California red-legged frog aquatic habitat. Compensatory mitigation shall be provided for the loss of aquatic breeding sites that will be filled or otherwise directly affected by the project, as well as mitigate for any impacts on associated California red-legged frog upland habitat through compensatory mitigation. If possible, compensatory mitigation areas shall be located within a California red-legged Frog Recovery Area, as identified in the 2002 California Red-legged Frog Recovery Plan (USFWS 2002).

- The total area, size and number of California red-legged frog or California tiger salamander mitigation ponds to be created will be based on a comparable loss of breeding sites (e.g., a minimum 1:1 replacement ratio) as a result of the project. These ponds shall concurrently satisfy wetland mitigation requirements identified in Mitigation Measure TERR-2. To the degree possible, new mitigation ponds that are created for California red-legged frog and California tiger salamander shall be hydrologically self-sustaining and shall not require a supplemental water supply.

Mitigation Measure TERR-4. Western Pond Turtle Before construction activities begin, a qualified biologist shall conduct western pond turtle surveys within creeks and in other ponded areas affected by the project. Adjacent upland areas shall also be examined for evidence of nests as well as individual turtles. The project biologist shall be responsible for the survey and for the relocation of pond turtles, if found. Construction shall not proceed until a reasonable effort has been made to capture and relocate as many western pond turtles as possible to minimize take. However, some individuals may be undetected or enter sites after surveys and would be subject to injury or mortality. If a nest is observed, a biologist with the appropriate permits and prior approval from CDFW shall move eggs to a suitable location or facility for incubation, and release hatchlings into the creek system the following autumn.

Mitigation Measure TERR-5. San Joaquin Whipsnake Before construction activities begin a qualified biologist shall conduct San Joaquin whipsnake surveys 2 weeks prior to construction activities within work sites and within 100 feet of disturbance areas. A qualified biologist shall relocate any San Joaquin whipsnakes to suitable habitat outside of areas of disturbance. There is possibility of snakes to move into the work sites after pre-construction surveys have checked the area and some individuals could be subject to mortality. If San Joaquin whipsnakes are detected in work sites during construction, activities and equipment travel shall cease in the immediate area of detection until the snake has left work site or has been relocated out of the area by a qualified biologist.

Mitigation Measure TERR-6. Nesting Bird Surveys A qualified biologist would conduct nesting bird surveys prior to construction and supervise avoidance of nests during construction. The generally accepted nesting season extends from February 1 through September 15. If an active nest of a special-status bird is found, construction within 300 feet of the nest (500 feet for raptor nests, excluding Swainson's hawk) would be postponed until the nest is no longer active.

Mitigation Measure TERR-7. Swainson's Hawk Prior to construction, surveys for active Swainson's hawk nests will be conducted in and around all potential nest trees within 0.5 mile of construction areas. If known or active nests are identified through preconstruction surveys or other means, a 0.5 mile no-disturbance buffer shall be established around all active nest sites if construction cannot be limited to occur outside the nesting season (February 15 through September 15). Buffer sizes may be reduced if approved by CDFW and active nest sites are monitored during construction by a qualified biologist.

Permanent foraging habitat losses (i.e. grasslands) within one mile of active Swainson's hawk nests shall be compensated by preserving in perpetuity suitable foraging habitat at a ratio of 1:1. This includes permanently disturbed construction sites. The CDFW shall approve the location and types of habitats preserved.

Mitigation Measure TERR-8. Bald and Golden Eagles, and California Condor The following measures address potential impacts on nesting eagles in the San Luis Reservoir vicinity. Prior to the initiation of construction, an Eagle Conservation Plan will need to be developed that details eagle protection guidelines specific to the San Luis Reservoir construction area. These protections will include, the initiation of pre-construction surveys by a USFWS-approved biologist for golden eagles and bald eagles initiating approximately two years prior to construction continuing through the construction period. These surveys will be completed across an area at a 5-mile radius from where impacts from the project occur, including construction areas. Any nesting sites identified during these surveys would be mapped and monitored for up to ten years, depending on the monitoring specifications identified within the plan. Whenever feasible, construction near recently active nest sites shall start outside the active nesting season. The nesting period for golden eagles is between January 15 and August 15 and bald eagles nest between January 1 and August 15. If groundbreaking activities begin during the nesting period, a qualified biologist shall perform a preconstruction survey 14 to 30 days before the start of each new construction phase to search for eagle nest sites within two miles of proposed activities. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented.

- For golden and bald eagles, construction contractors shall observe CDFW and USFWS avoidance guidelines, which stipulate a minimum 660 foot to 0.5-mile buffer zone depending upon the visibility and severity of the activity (e.g., earth-moving versus blasting) (USFWS 2007). Buffer zones shall remain until young have fledged. A qualified biologist will monitor the nest daily for one week to determine whether construction activities are disturbing nest behavior. If nest behavior appears normal, then weekly monitoring will continue until the nest is no longer active. If the nest appears disturbed, the biological monitor will increase the no-work buffer at their discretion to ensure normal nesting behavior. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the eagle nest(s) to monitor eagle reactions to activities. If activities are deemed to have a negative effect on nesting eagles, the biologist shall immediately inform the construction manager that work should be halted, and CDFW and USFWS will be consulted.

- CDFW and USFWS often allow construction activities that are initiated outside the nesting season to continue without cessation even if raptors such as eagles choose to nest within 500 feet of work activities. Thus, work at the dam construction site may continue if approved by CDFW and USFWS and a qualified biologist monitors the nest site during construction.

- To compensate for the loss of grassland, which provides suitable foraging habitat for golden eagles and California condors, grasslands shall be enhanced or restored at a minimum ratio of 1:1. Restoration or enhancement of grassland habitat shall be conducted under a USFWS and

CDFW-approved restoration/enhancement plan, and may be conducted on lands also used for mitigation for Swainson's hawk and/or San Joaquin kit fox.

Mitigation Measure TERR-9. Burrowing Owl Prior to construction, surveys for burrowing owls would be conducted in areas supporting potentially suitable habitat. Any occupied burrows shall not be disturbed during the breeding season (February 1 through August 31). A minimum 160-foot-wide buffer shall be placed around occupied burrows during the nonbreeding season (September 1 through January 31), and a 250-foot-wide buffer shall be placed around occupied burrows during the breeding season. Ground- disturbing activities shall not occur within the designated buffers.

The project proponent shall implement the measures listed below for grassland habitats to avoid incidental take of burrowing owls. In advance of construction, a qualified biologist shall follow the current CDFW burrowing owl survey guidance to evaluate burrowing owl use. Measures shall apply to all construction activities near active nests or within potential burrowing owl nesting habitat, to avoid, minimize, or mitigate impacts on burrowing owls.

Breeding season surveys shall be performed to determine the presence of burrowing owls for the purposes of inventory, monitoring, avoidance of take, and determining appropriate mitigation. In California the breeding season begins as early as February 1 and continues through August 31. Under the Burrowing Owl Consortium's multi-phase survey methodology, for areas within 500 feet of construction boundaries, a biologist shall: 1) perform a habitat assessment to identify essential components of burrowing owl habitat, including artificial nest features; 2) perform intensive burrow surveys in areas that are identified to provide suitable burrowing owl habitat, and; 3) perform at least four appropriately-timed breeding season surveys (four survey visits spread evenly [roughly every 3 weeks] during the peak of the breeding season, from April 15 to July 15) to document habitat use.

Pre-construction surveys shall be used to assess the owl presence before site modification is scheduled to begin. Generally, initial pre-construction surveys should be conducted within 7 days, but no more than 30 days prior to ground-disturbing activities. Additional surveys may be required when the initial disturbance is followed by periods of inactivity or the development is phased spatially and/or temporally over the project area. Up to four or more survey visits performed on separate days may be required to assure with a high degree of certainty that site modification and grading will not take owls. The full extent of the pre-construction survey effort shall be described and mapped in detail (e.g., dates, time periods, area[s] covered, and methods employed) in a biological report that will provided for review to CDFW.

In addition to the above survey requirements, the following measures shall be implemented to reduce project impacts to burrowing owls:

- Construction exclusion areas (e.g., orange exclusion fence or signage) shall be established around occupied burrows, where no disturbance shall be allowed. During the nonbreeding season (September 1 through January 31), the exclusion zone shall extend at least 160 feet around occupied burrows. During the breeding season (February 1 through August 31), exclusion areas shall extend 250 feet around occupied burrows (or farther if warranted to avoid nest abandonment).

- If work or exclusion areas conflict with owl burrows, passive relocation of onsite owls could be implemented as an alternative, but only during the nonbreeding season and only with

CDFW approval. The approach to owl relocation and burrow closure will vary depending on the number of occupied burrows. Passive relocation shall be accomplished by installing one-way doors on the entrances of burrows within 160 feet of the project area. The one-way doors shall be left in place for 48 hours to ensure the owls have left the burrow. The burrows shall then be excavated with a qualified biologist present. Construction shall not proceed until the project area is deemed free of owls.

- Unoccupied burrows within the immediate construction area shall be excavated using hand tools, and then filled to prevent reoccupation. The qualified biologist will be present during construction to continue examination of burrows. If any burrowing owls are discovered during the excavation, the excavation shall cease and the owl shall be allowed to escape. Excavation would be completed when the biological monitor confirms the burrow is empty.
- Artificial nesting burrows will be provided as a temporary measure when natural burrows are lacking. To compensate for lost nest burrows, artificial burrows shall be provided outside the 160-foot buffer zone. The alternate burrows shall be monitored daily for 7 days to confirm that the owls have moved in and acclimated to the new burrow.

Mitigation Measure TERR-10. Tricolored Blackbird Prior to construction, appropriately timed surveys for tricolored blackbirds would be conducted in areas supporting potentially suitable habitat within 0.25 mile of construction areas. Habitat within 0.25 mile of tricolored blackbird colonies will be avoided during nesting season, which can begin as early as mid-March and extend through August. If colonies cannot be avoided, CDFW shall be consulted to potentially reduce buffer distances with active monitoring during construction by a qualified biologist.

Mitigation Measure TERR-11. Special-Status Bats Impacts to special-status bats shall be minimized by performing preconstruction surveys and creating no-disturbance buffers around active bat roosting sites.

Before construction activities (i.e., ground clearing and grading, including trees or shrub removal) within 200 feet of trees that could support special-status bats, a qualified bat biologist shall survey for special-status bats. If no evidence of bats (i.e., direct observation, guano, staining, or strong odors) is observed, no further mitigation shall be required.

If evidence of bats is observed, the following measures shall be implemented to avoid potential impacts on breeding populations:

A no-disturbance buffer of 200 feet shall be created around active bat roosts during the breeding season (April 15 through August 15). Bat roosts initiated during construction are presumed to be unaffected by the indirect effects of noise and construction disturbances. However, the direct take of individuals will be prohibited.

Removal of trees showing evidence of active bat activity shall occur during the period least likely to affect bats, as determined and monitored by a qualified bat biologist (generally between February 15 and October 15 for winter hibernacula, and between August 15 and April 15 for maternity roosts). If the exclusion of bats from potential roost sites is necessary to prevent indirect impacts due to construction noise and human activity adjacent, bat exclusion activities (e.g., installation of netting to block roost entrances) shall also be conducted during these periods. If special-status bats are identified in the dam or special allowances must be made to relocate bats, DWR will coordinate the effort in advance with CDFW.

Mitigation Measure TERR-12. San Joaquin Kit Fox San Joaquin kit fox would be affected by construction activities if animals are harmed or killed by equipment, their movement is blocked or their dens or other habitat is altered or destroyed. Consultation with the USFWS through the Section 7 process may be required to determine avoidance, conservation, and mitigation measures. Prior to construction, a qualified biologist will conduct surveys to identify potential dens more than 4 inches in diameter. A habitat assessment in 2010 found 195 potential kit fox dens in the San Luis Reservoir work area (Reclamation 2010). If dens are located within the proposed work area, and cannot be avoided during construction activities, a USFWS- and CDFW-approved biologist will determine if the dens are occupied. If occupied dens are present within the proposed work, their disturbance and destruction shall be avoided. Exclusion zones will be implemented following the latest USFWS procedures (USFWS 2011).

The Proponent shall implement San Joaquin kit fox protection measures. The following measures, which are intended to reduce direct and indirect project impacts on San Joaquin kit foxes, are derived from the San Joaquin Kit Fox Survey Protocol for the Northern Range (USFWS 1999a) and the Standardized Recommendations for Protection of the San Joaquin Kit Fox (USFWS 1999b). The following measures shall be implemented for construction areas at San Luis Reservoir:

Preconstruction surveys shall be conducted within 200 feet of work areas to identify potential San Joaquin kit fox dens or other refugia in and surrounding workstations. A qualified biologist shall conduct the survey for potential kit fox dens 14 to 30 days before construction begins. All identified potential dens shall be monitored for evidence of kit fox use by placing an inert tracking medium at den entrances and monitoring for at least 3 consecutive nights. If no activity is detected at these den sites, they shall be closed following guidance established in the USFWS Standardized Recommendations report (USFWS 1999b).

If kit fox occupancy is determined at a given site during the pre-construction surveys or during the construction period, the construction manager should be immediately informed that work should be halted within 200 feet of the den and the USFWS contacted. Depending on the den type, reasonable and prudent measures to avoid effects to kit foxes could include seasonal limitations on project construction at the site (i.e., restricting the construction period to avoid spring-summer pupping season), and/or establishing a construction exclusion zone around the identified site, or resurveying the den a week later to determine species presence or absence.

Off-road vehicle and equipment movement will be limited to the project footprint.

To compensate for permanent impacts to grassland, which provides habitat for San Joaquin kit fox, lands shall be acquired and covered by conservation easements or mitigation credits shall be purchased at a 2:1 mitigation ration, or other compensation ratios approved by the USFWS and the CDFW.

Mitigation Measure TERR-13. American Badger Impacts on badgers within annual grasslands and oak woodland at San Luis Reservoir will be minimized through a combination of worker training, preconstruction surveys, and passively or actively relocating animals. Concurrent with other required surveys, during winter/spring months before new project activities, and concurrent with other preconstruction surveys (e.g., kit fox and burrowing owl), a qualified biologist shall perform a survey to identify the presence of active or inactive American badger dens. If this species is not found, no further mitigation shall be required. If badger dens are identified within the construction footprint during the surveys or afterwards, they shall be inspected and closed using the following methodology:

- When unoccupied dens are encountered outside of work areas but within 100 feet of proposed activities, vacated dens shall be inspected to ensure they are empty and temporarily covered using plywood sheets or similar materials.
- If badger occupancy is determined at a given site within the work area, work activities at that site should be halted. Depending on the den type, reasonable and prudent measures to avoid harming badgers will be implemented and may include seasonal limitations on project construction near the site (i.e., restricting the construction period to avoid spring-summer pupping season), and/or establishing a construction exclusion zone around the identified site, or resurveying the den at a later time to determine species presence or absence.
- Badgers may be passively relocated using burrow exclusion (e.g., installing one-way doors on burrows) or similar CDFW-approved exclusion methods. In unique situations it might be necessary to actively relocate badgers (e.g., using live traps) to protect individuals from potentially harmful situations. Such relocation would be performed with advance CDFW coordination and concurrence.

Mitigation Measure TERR-14. Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp While project design is planned to avoid fill of seasonal wetlands and pools identified as suitable habitat for vernal pool crustaceans, if any vernal pool fairy shrimp or vernal pool tadpole shrimp habitat will be impacted, the project proponent may assume presence of the species. Consultation with the USFWS through the Section 7 process may be required to determine avoidance, conservation, and mitigation measures. Measures may include, but are not limited to, compensating for impacts at a 2:1 ratio for preservation and at a 1:1 ratio for creation.

Mitigation Measure TERR-15. Contractor Environmental Awareness Training and Site Protection Measures. All construction personnel working in biologically sensitive areas shall attend an environmental education program delivered by a qualified biologist prior to starting work. The training shall include an explanation as how to best avoid the accidental take of special-status plants and wildlife. The field meeting shall include species identification, life history, descriptions, and habitat requirements. The program shall include an explanation of Federal and State laws protecting endangered species, and avoidance and minimization methods being implemented to protect these species. A qualified biologist will be present on the site at all times during construction.

The contractor shall provide closed garbage containers for the disposal of all trash items (e.g., wrappers, cans, bottles, food scraps). Work sites shall be cleaned of litter before closure each day, and placed in wildlife-proof garbage receptacles. Construction personnel shall not feed or otherwise attract any wildlife. No pets, excluding service animals, shall be allowed onsite or in construction areas.

Nighttime vehicle traffic shall be kept to a minimum on non-maintained roads with a maximum speed of 15 miles per hour.

To minimize disturbance to wildlife, temporary and permanent exterior lighting shall be installed such that:

a. lamps and reflectors are not visible from beyond the project site,
b. reflective glare will be minimized to the extent feasible;
c. illumination of the project and its immediate vicinity is minimized;
d. lighting shall incorporate fixture hoods/shielding, with light directed downward or toward the area to be illuminated;
e. all lighting shall be of minimum necessary brightness consistent with operational safety and security;
f. lights in areas not occupied on a continuous basis (such as maintenance areas) shall have (in addition to hoods) switches, timer switches, or motion detectors so that the lights operate only when the area is occupied, and
g. the plan complies with local policies and ordinances.

Mitigation Measure TERR-16. Mitigation measures for special-status communities, including jurisdictional wetlands or waters, and streambeds and banks regulated by the CDFW, RWQCB, and United States Army Corps of Engineers (USACE), and native grassland.

Mitigation Measure TERR -16a. Final project design shall avoid and minimize the fill of wetlands and other waters to the greatest practicable extent. The following actions shall be performed to protect jurisdictional wetlands:

1. The distribution of Federal and State jurisdictional wetlands and waters; streambeds and banks regulated by CDFW; and sensitive habitat regulated by CDFW, shall be defined and avoided to the greatest possible extent.
2. Prior to construction, a qualified biologist shall delineate the extent of jurisdictional areas to be avoided in the field. Reclamation will designate areas to be avoided as "Restricted Areas" and protect them using highly visible fencing, rope, or flagging, as appropriate based on site conditions. No construction activities or disturbance will occur within restricted areas that are designated to protect wetlands.
3. Minimize the removal of riparian and wetland vegetation. Avoid disturbance of riparian and aquatic habitat north of the access road to the dam.
4. Minimize the removal or damage to purple needlegrass grassland. Avoid impacts to native grasslands in the staging area.

Mitigation Measure TERR-16b. Where jurisdictional wetlands and other waters cannot be avoided, to offset temporary and permanent impacts that would occur as a result of the project, restoration and compensatory mitigation shall be provided as described below.

A wetland mitigation and monitoring plan shall be developed in coordination with CDFW, USACE, and/or the RWQCB that details mitigation and monitoring obligations for temporary and permanent impacts to wetlands and other waters as a result of construction activities; and other CDFW jurisdictional areas. The plan shall quantify the total acreage affected; provide for mitigation as described below to wetland or riparian habitat; annual success criteria; mitigation sites; monitoring and reporting requirements; and site-specific plans to compensate for wetland losses resulting from the project.

Prior to construction, the aquatic structure of wetland and riparian areas to be disturbed will be photo-documented, and measurements of width, length, and depth will be recorded. DWR will recontour and revegetate disturbed portions of jurisdictional areas in areas temporarily affected by construction prior to demobilization by the contractor at the end of project construction. Creek banks will be recontoured to a more stable condition if necessary.

Revegetation will include a palette of species native to the watershed area according to a revegetation plan to be developed by Reclamation and submitted to the USACE, CDFW, and RWQCB for approval. Following removal, woody trees habitat acreage would be replanted at a minimum 1:1 ratio, or as determined and agreed upon by the permitting agencies. Interim vegetation or other measures will be implemented as necessary to control erosion in disturbed areas prior to final revegetation.

Wetland and other waters impact in the construction area shall be compensated at a ratio of 2:1 or at a ratio agreed upon by the wetland permitting agencies. Compensatory mitigation shall be conducted by creating or restoring wetland and aquatic habitat at an agency-approved location on nearby lands or through purchasing mitigation credits at a USACE and/or CDFW-approved mitigation bank (depending on the resource). If mitigation is conducted on- or off-site, a five-year wetland mitigation and monitoring program for onsite and offsite mitigation shall be developed. Appropriate performance standards may include, but are not limited to: a 75 percent survival rate of restoration plantings; absence of invasive plant species; and a viable, self-sustaining creek or wetland system at the end of five years.

A weed control plan for the project to limit the spread of noxious or invasive weeds shall also be developed. This plan would be consistent with current Integrated Pest Management Plans that are already in practice on lands surrounding the reservoir. Noxious or invasive weeds include those rated as "high" in invasiveness by the California Invasive Plant Council. The plan will include a baseline survey to identify the location and extent of invasive weeds in the project area prior to ground-disturbing activity, a plan to destroy existing invasive weeds in the construction area prior to initiation of ground-disturbing activity, weed-containment measures while the project is in progress, and monitoring and control of weeds following completion of construction.

Mitigation Measure REC-1. Campsite and Facilities Replacement. Campsites closed at San Luis Reservoir during construction of the Crest Raise Alternative will be replaced at a 1:1 ratio at the San Luis Creek Use Area and then as necessary at the Los Banos Creek Use Area, including six American with Disabilities Act (ADA) accessible campsites and Recreational Vehicle (RV) accommodations. These new replacement campsites would be developed consistent with the new facilities considered in the San Luis Reservoir SRA Resource Management Plan/General Plan (RMP/GP) and will not exceed the quantities of new facilities considered in the RMP/GP at each Use Area. The new campsites would be constructed concurrent to the crest construction period during a period of low precipitation in order to reduce the risk of accidental leaks or spills, potential for soil contamination and to minimize erosion of loose materials in construction areas, as per Goal RES-WQ4 in the San Luis Reservoir SRA RMP/GP (Reclamation and CDPR 2013):

- Design, construct, and maintain buildings, roads, trails, campsites, boat launches and marinas, and associated infrastructure to minimize stormwater runoff, promote groundwater recharge, and prevent soil erosion.

The new campsites would be constructed within the San Luis Creek use area at the SRA on O'Neill Forebay. Reclamation will include this mitigation requirement in bid documents and construction contracts.

In addition, Reclamation will work with CDPR to implement the following measure. The boat launch at the San Luis Creek and Dinosaur Point use areas would be expanded by addition of a launch lane and a boarding float at each area. In addition, a fish cleaning station, public storage lockers, and shower facilities would be developed at San Luis Creek Use Area.

Mitigation Measure CR-1. Implement a formal agreement document to govern National Historic Preservation Act (NHPA) Section 106 compliance and resolve any adverse effects/significant impacts to cultural resources

The Reservoir Restriction Alternative fails to meet one of three critical objectives under the Proposed Action because it would result in a reduction in San Luis Reservoir storage capacity that would adversely impact water supply deliveries to Central Valley Project and State Water Project contractors. The Crest Raise Alternative, which is the preferred alternative, meets each of the Proposed Action objectives. As efforts to identify historic properties are unable to be fully completed, and effects on historic properties cannot be fully determined prior to the approval of the Project, an agreement document was negotiated to satisfy NHPA Section 106 compliance. Additional surveys are needed to identify potential historic properties within the area of potential effects. These surveys will be managed under the agreement document. Due to the need for additional surveys, potential adverse effects/significant impacts to historic properties are not fully known.

Reclamation negotiated a programmatic agreement with the State Historic Preservation Officer, which was executed on September 12, 2019. Reclamation will complete the additional historic property identification and evaluation efforts under the negotiated programmatic agreement, and any adverse effects to historic properties will be "resolved" through the completion of the Section 106 process, which will satisfy Federal lead agency requirements with respect to National Environmental Policy Act (NEPA). A process to avoid, minimize impacts to, and/or mitigate adverse effects to historic properties was formalized in the programmatic agreement document in compliance with 36 CFR Part 800.6(c). DWR will be a party to this agreement document.

Water Quality Environmental Commitments In compliance with the Clean Water Act, projects involving construction activities (e.g., clearing, grading, or excavation) involving land disturbance greater than one acre must file a (NOI with the applicable RWQCB to indicate their intent to comply with the State General Permit for Stormwater Discharges Associated with Construction Activity (General Permit). The State General Permit specifies Best Management Practices (BMPs), to achieve compliance as well as numeric action levels in order to achieve Federal standards to minimize sediment and pollutant loadings. The General Permit requires preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) as well as a Rain Event Action Plan (REAP) prior to construction. The SWPPP and REAP are intended to help identify the sources of sediment and other pollutants and assess the effectiveness of BMPs in preventing or reducing pollutants in storm water discharges and authorized non-storm water discharges. Common SWPPP objectives include the following (U.S. Environmental Protection Agency 2007):

1. *Stabilize the site as soon as possible.* Get your site to final grade and either permanently or temporarily stabilize all bare soil areas as soon as possible
2. *Protect slopes and channels.* Convey concentrated stormwater runoff around the top of slopes and stabilize slopes as soon as possible. This can be accomplished using pipe slope drains or earthen berms that will convey runoff around the exposed slope.
3. *Reduce impervious surfaces and promote infiltration.* Reducing impervious surfaces will ultimately reduce the amount of runoff leaving your site. Also, divert runoff from rooftops and other impervious surfaces to vegetated areas when possible to promote infiltration.
4. *Control the perimeter of your site.* Divert stormwater coming on to your site by conveying it safely around through, or under your site. Avoid allowing run-on to contact disturbed areas of the construction site
5. *Protect receiving waters adjacent to your site.* Erosion and sediment controls are used around the entire site, but operators should consider additional controls on areas that are adjacent to receiving waters or other environmentally sensitive areas.
6. *Follow pollution prevention measures.* Provide proper containers for waste and garbage at your site. Store hazardous materials and chemicals so that they are not exposed to stormwater.
7. *Minimize the area and duration of exposed soils.* Clearing only land that will be under construction in the near future, a practice known as construction phasing, can reduce off-site sediment loads.

Air Quality Environmental Commitments The following dust control measures will be implemented during construction of the Crest Raise Alternative to avoid impacts on air quality. These measures are identified in the SJVAPCD's Regulation VIII and are referenced in the Guide for Assessing and Mitigating Air Quality Impacts (SJVAPCD 2015).

1. Apply water to unpaved surfaces and areas.
2. Use non-toxic chemical or organic dust suppressants on unpaved roads and traffic areas.
3. Limited or reduce vehicle speed on unpaved roads and traffic areas. (Assumed for this analysis, 15 miles per hour would be the maximum vehicle speed.)
4. Maintain areas in a stabilized condition by restricting vehicle access.
5. Install wind barriers.
6. Keep bulk materials sufficiently wet when handling.
7. Store and handle materials in a three-sided structure.
8. When storing bulk materials, apply water to the surface or cover the storage pile with a tarp.
9. Do not overload trucks. Overloaded trucks are likely to spill bulk materials.
10. Cover haul trucks with a tarp or other suitable cover. Or, wet the top of the load enough to limit visible dust emissions.
11. Clean the interior of cargo compartments on emptied haul trucks prior to leaving a site.

12. Prevent trackout by installing a trackout control device.
13. Clean up trackout at least once a day. If along a busy road or highway, clean up trackout immediately.
14. Monitor dust-generating activities and implement appropriate measures for maximum dust control.

Terrestrial Resources Environmental Commitments The final project design shall avoid and minimize the fill of wetlands and other waters to the greatest practicable extent. Where jurisdictional wetlands and other waters cannot be avoided, to offset temporary and permanent impacts that would occur as a result of the project, restoration and compensatory mitigation shall be provided as described below.

A wetland mitigation and monitoring plan shall be developed by a qualified biologist in coordination with CDFW, USACE, and/or RWQCB that details mitigation and monitoring obligations for temporary and permanent impacts to wetlands and other waters as a result of construction activities; and other CDFW jurisdictional areas. The plan shall quantify the total acreage affected; describe mitigation ratios for impacted habitat (described below); annual success criteria; mitigation sites; monitoring and reporting requirements; and site specific plans to compensate for wetland losses resulting from the project.

Prior to construction, the aquatic structure of wetland and riparian areas to be disturbed will be photo-documented, and measurements of width, length, and depth will be recorded. Reclamation will recontour and revegetate disturbed portions of jurisdictional areas in areas temporarily affected by construction prior to demobilization by the contractor at the end of project construction. Creek banks will be recontoured to a more stable condition if necessary. Revegetation will include a palette of species native to the watershed area according to a revegetation plan to be developed by Reclamation and submitted to the USACE, CDFW, and RWQCB for approval. Following removal, woody trees would be replanted at a minimum 1:1 ratio, or as determined and agreed upon by the appropriate wetland permitting agencies. Interim vegetation or other measures will be implemented as necessary to control erosion in disturbed areas prior to final revegetation.

Wetland and other waters impacts in the construction area shall be compensated at a ratio of 1:1 or at a ratio agreed upon by the wetland permitting agencies. Compensatory mitigation shall be conducted by creating or restoring wetland and aquatic habitat at an agency-approved location on nearby lands or through purchasing mitigation credits at a USACE and/or CDFW-approved mitigation bank (depending on the resource). If mitigation is conducted on- or off-site, a five-year wetland mitigation and monitoring program for onsite and offsite mitigation shall be developed. Appropriate performance standards may include, but are not limited to: a 75 percent survival rate of restoration plantings; absence of invasive plant species; and a viable, self-sustaining creek or wetland system at the end of five years.

A weed control plan for the project to limit the spread of noxious or invasive weeds shall also be developed. This plan would be consistent with current Integrated Pest Management Plans that are already in practice on lands surrounding the reservoir. Noxious or invasive weeds include those rated as "high" in invasiveness by the California Invasive Plant Council. The plan will include a baseline survey to identify the location and extent of invasive weeds in the project area prior to ground-disturbing activity, a plan to destroy existing invasive weeds in the construction area prior to initiation of ground-disturbing activity, weed-containment measures while the project is in progress, and monitoring and control of weeds following completion of construction.

Reclamation shall make every effort to avoid removing or damaging native blue oak woodland tree species. If any tree species need to be removed, Reclamation will make every effort to conduct any tree and shrub removal activities outside of the migratory bird and raptor breeding season (March 1 through August 31). For construction activities that will occur between March 1 and August 31 of any given year, Reclamation shall conduct preconstruction surveys in suitable nesting habitat within 500 feet of the project site for nesting birds. Surveys shall be conducted by a qualified biologist.

If nesting raptors are detected, the applicant will consult with a qualified biologist to develop suitable measures to avoid impacting breeding effort. If active nests for non-raptor breeding birds are found during the survey, Reclamation shall implement appropriate measures to ensure that the species will not be adversely affected, which will include establishing a 150-foot no-work buffer zone around the active nest, until a qualified biologist determines that juveniles have fledged the nest(s).

B.1.2 Non-Structural Alternative

Under Alternative 2, Non-Structural Alternative, operational measures would be used to meet project objective/project purpose and need. Alternative 2 would rely on a change in the current approach for annual CVP Project water supply allocations. San Luis Reservoir's maximum capacity is 2,027,840 AF, with a federal share of 966 thousand acre-feet (TAF) and state share of 1,062 TAF. The annual allocation of CVP supplies is managed by Reclamation. Reclamation develops the annual allocation to fully utilize stored CVP supply in the reservoir to meet CVP contractors' contracts and the requirements of other authorized purposes, such as CVPIA refuge water supplies. Under the Non-Structural Alternative, Reclamation would change its annual allocation process to reserve up to 310 TAF of stored CVP supply in San Luis Reservoir at the end of wetter years. This water would be reserved in San Luis Reservoir for allocation in subsequent drier years to South-of-Delta CVP contractors. In these drier years, the 310 TAF in reserved supply would be allocated to South-of-Delta CVP water contractors consistent with the CVP's current allocation of water supply stored in San Luis Reservoir, but only if supply is sufficient to meet the demands of senior water rights contractors. Under Alternative 2, water supply reserved in wetter water years by Reclamation for delivery to South-of Delta CVP contractors in drier years could potentially be diverted for delivery to the Exchange Contractors in critical water year types.

Under this new operational configuration allocated water supply not used by CVP contractors could not be carried over for use in a subsequent year.

This change in San Luis Reservoir operations to increase water supply available in dry and critical years would adversely impact average water supply deliveries to CVP and SWP contractors. This alternative would not completely meet the project objectives/purpose and needs of the proposed action. However, the Non-Structural Alternative is analyzed in this EIR/SEIS as a nonstructural alternative that would not fully meet the project objectives as it would not increase annual allocations (see Appendix E for delivery modeling results under Alternative 2). The Non-Structural Alternative would not require any additional construction or maintenance actions.

Alternative 2 is an action connected to the approved B.F. Sisk Dam SOD Modification Project included under Alternative 1. Therefore, the analysis of effects completed for Alternative 2 in this EIR/SEIS considers the operational impacts of implementing Alternative 2.

B.1.3 Dam Raise Alternative (Proposed Action)

The Dam Raise Alternative would be completed by placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk Dam SOD Modification Project. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. The 10-foot increase in San Luis Reservoir's maximum surface elevation would inundate 445 acres of new land around the shore of the reservoir when the reservoir is full. The newly inundated lands are public lands and would not require additional land acquisitions.

Alternative 3 is an action connected to the approved B.F. Sisk Dam SOD Modification Project included under Alternative 1. Therefore, the analysis of effects completed for Alternative 3 in this EIR/SEIS considers the incremental impacts of raising the dam an additional 10 feet above the approved B.F. Sisk Dam SOD Modification Project.

As part of this alternative, the dam crest would be raised by adding additional embankment material (see Figures 4 and 6), and downstream stability berms and crack filters would be installed. Also included in this alternative are construction of foundation shear keys at slope-wash sections in the abutments and the NVS, and a filter around the downstream portion of the existing spillway conduit. The existing saddle dike located north of the main embankment would be modified by adding a downstream filter.

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. SR 152 embankment would be raised by 10 feet to allow adequate freeboard to protect against wave action (see Figure 7). Modifications to the Dinosaur Point Boat Launch and the Goosehead Point Boat Launch would be made to increase the ramp's operating elevation by 10 feet. The existing berm developed during construction of the Pacheco Pumping Plant would be reconstruction with a higher crest elevation to protect the plant at high storage levels (see Figure 6).

B.1.3.1 Project Facilities

Proposed Action would expand storage in San Luis Reservoir to increase the yield of the CVP by supporting, in some years when conditions permit, increases in South-of-Delta exports. Three operation subalternatives are evaluated under the Dam Raise Alternative (see Section B.1.3.5 for details). Implementation of the CVP/SWP split storage alternative could result in increased yield for CVP and SWP. This section outlines the physical modifications that would be developed under this alternative.

B.F. Sisk Dam B.F. Sisk Dam is a zoned earthfill structure with a maximum structural height of 382 feet, a crest length of 18,600 feet, a crest width of 30 feet, and a crest elevation of 556 feet. The dam embankment was constructed of five materials in seven zones, with the central zone consisting primarily of low-plasticity clays (see Figure 4). The downstream face of the dam is covered by a 2-foot-thick cobble blanket, and the upstream face is covered by a 3-foot-thick layer of riprap. Both thickness measurements are normal to the dam slope. A saddle dike, known as the East Dike, is present along the north rim of the reservoir, approximately 1,300 feet from the dam.

The foundation that the dam is built on can be divided into sections: the right abutment, the left abutment, the NVS, and the SVS (See Figures 3 and 5). The NVS and SVS are the alluvial channels of San Luis Creek and Cottonwood Creek that B.F. Sisk Dam impounds and consist of deposits of sands and gravels with clayey or silty fines. The abutments are primarily founded on bedrock (sandstone, shale, and conglomerate), which is covered by clayey slope wash in some locations. In addition, the East Dike is also partially founded on slope wash.

The Dam Raise Alternative would build on the B.F. Sisk Dam SOD Modification Project 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 130 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.

San Luis Reservoir seasonally operates (in most years) with an approximate 6-month period when CVP and SWP supplies are pumped into the reservoir followed by an approximate 6-month period when the reservoir is drawn down as those stored supplies are delivered to water users. Any work that would reduce the reservoir embankment strength, such as foundation or embankment excavation, would be timed seasonally and would occur during periods of the year when the reservoir is drawn down to lower elevations. As the reservoir is drawn down as a part of regular operations, construction would start after the reservoir is drawn below an elevation sufficient to ensure slope stability during any work that would impact embankment strength. This work would also be scheduled for completion each year prior to San Luis Reservoir being refilled back above safe level to protect embankment stability. Scheduling work during regular periods of drawdown would allow for uninterrupted water supply deliveries. Delays to refill could potentially occur if the construction schedule is delayed, but the division of specific modification actions scheduled to occur in one drawdown season would be structured to minimize this risk. In addition, contract requirements would require use of the second construction shift on this particular component of the overall project in the event that work becomes delayed.

Cottonwood Bay/State Route 152 Sections of SR 152 near and at Cottonwood Bay could potentially be impacted by the 10-foot increase in water surface elevation, and would 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 7).

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 approximate 500-foot-wide dike east of the pumping plant. This dike would be replaced with a new dike 20 feet taller than the existing structure to protect the pumping plant from the enlarged reservoir.

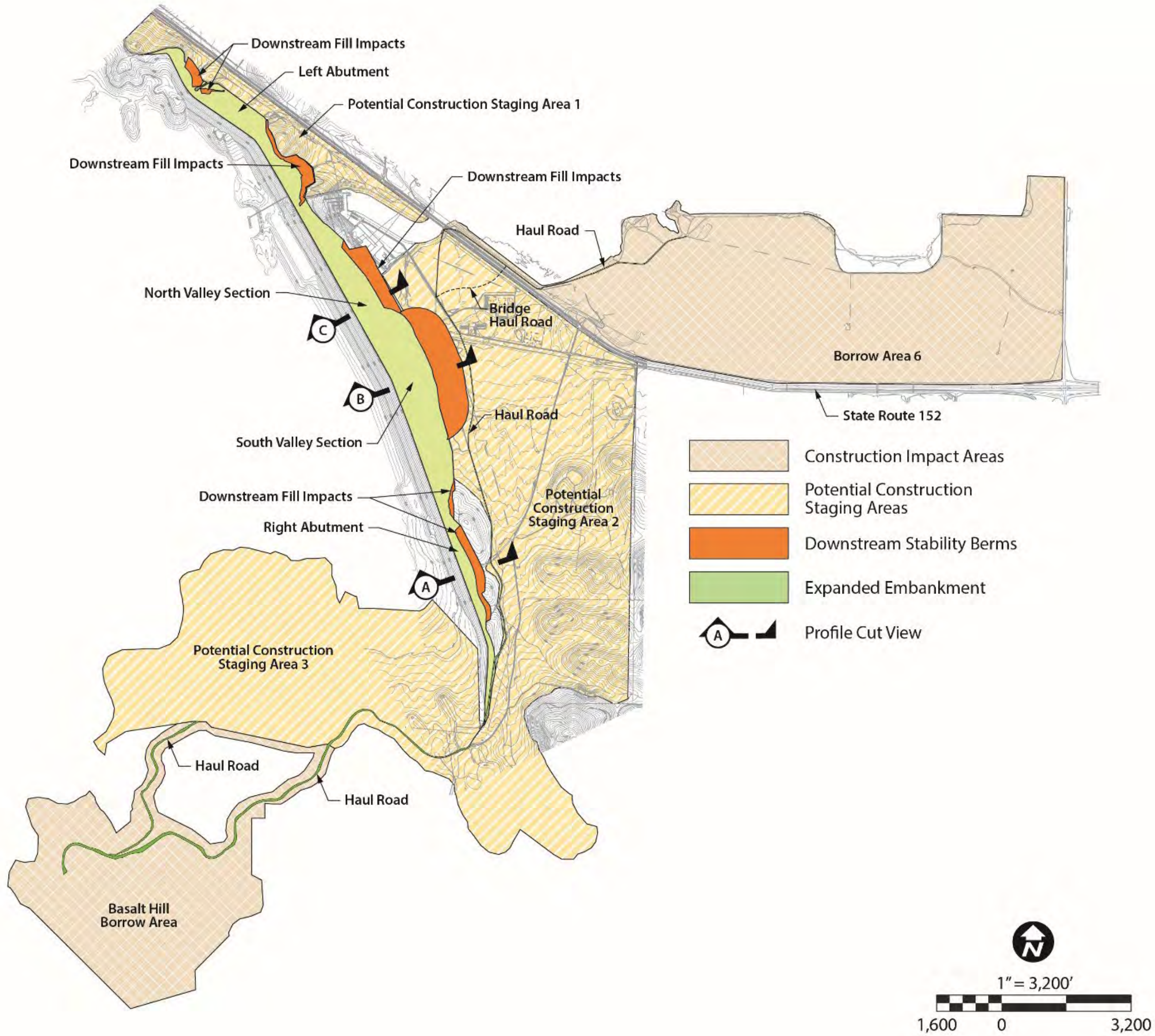

Figure 3. Proposed Action Construction and Staging Areas

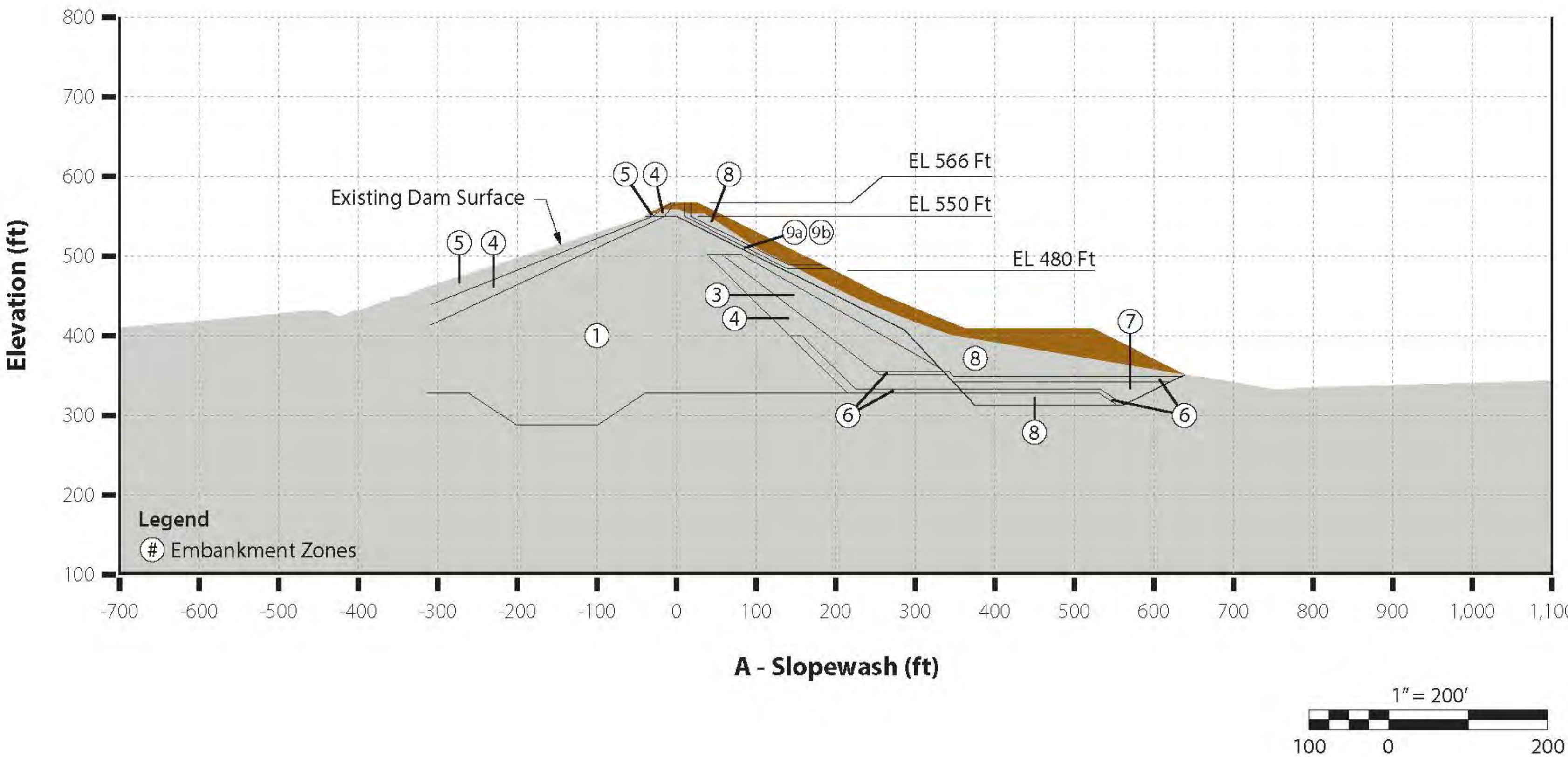

Figure 4. Dam Raise Typical Cross-Section, Embankment Materials and Zones

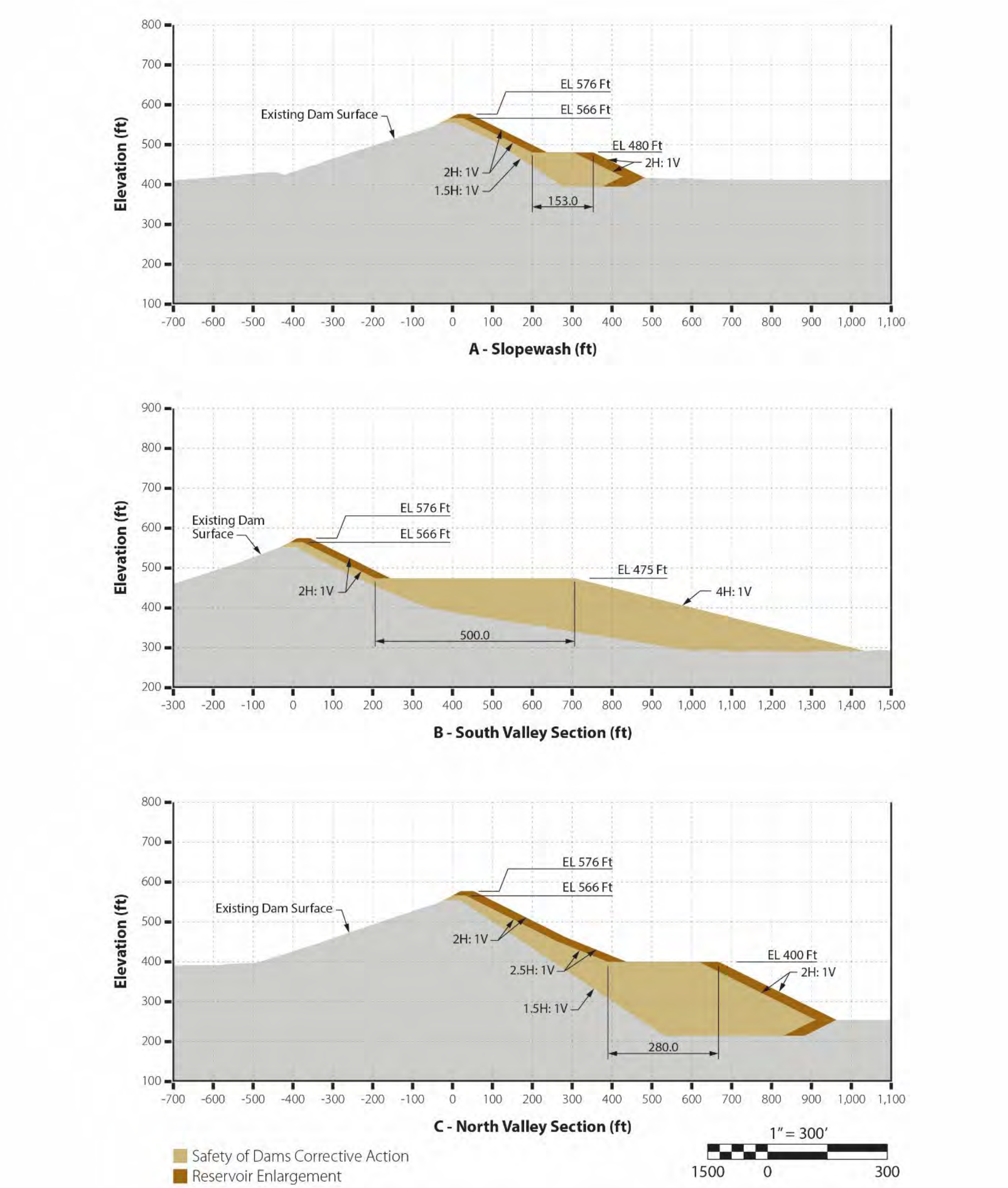

Figure 5. Dam Raise Embankment Profiles

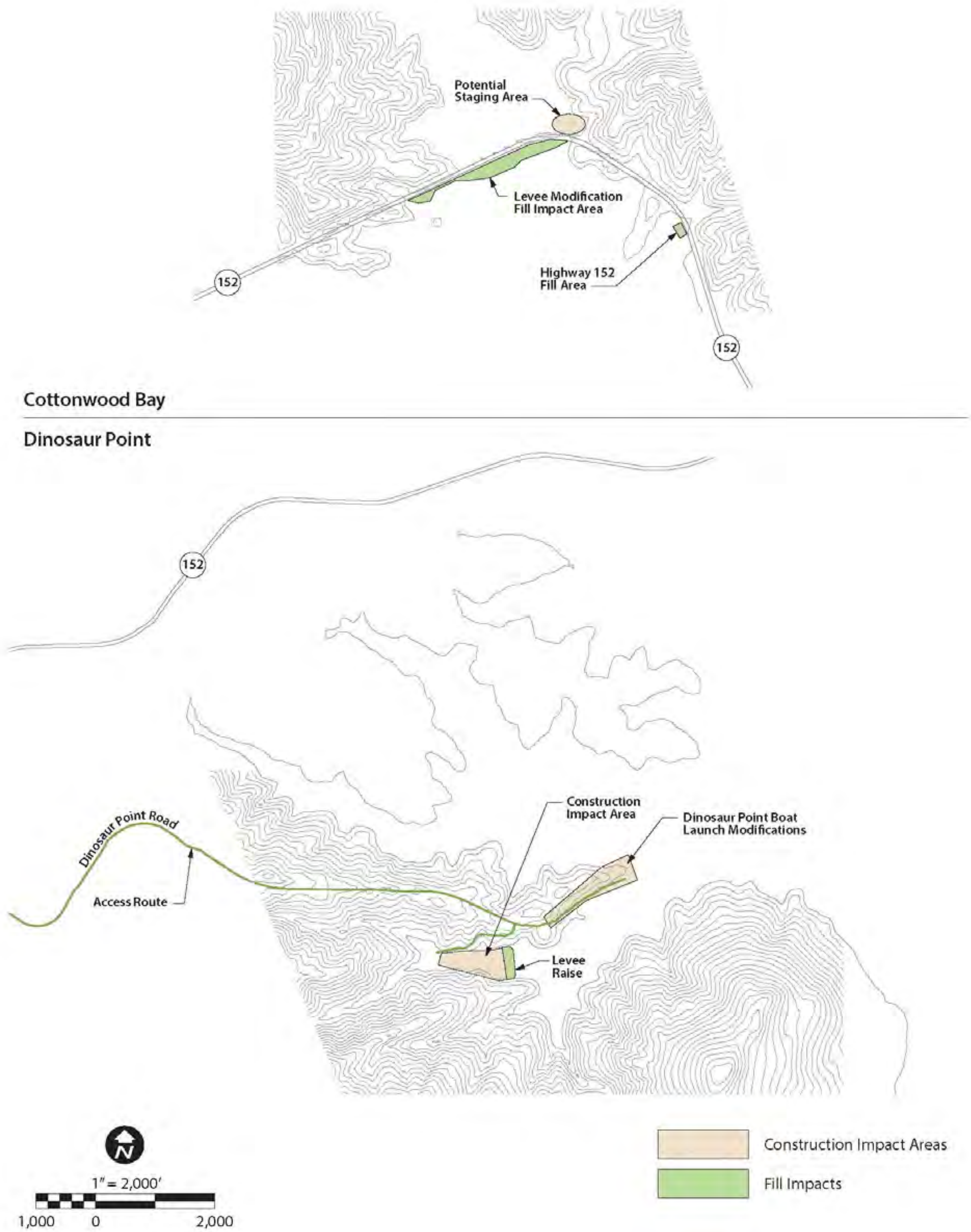

Figure 6. Reservoir Expansion Actions along State Route 152 and at Pacheco Pumping Plant

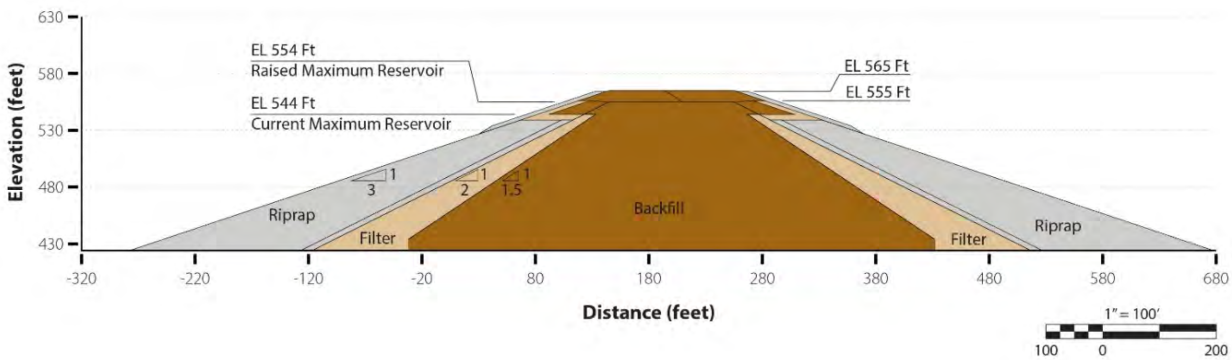

Figure 7. State Route 152 Embankment Modification Profiles

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, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

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, thus requiring modifications to the facility to maintain launching functions during periods when the enlarged reservoir is at capacity.

B.1.3.2 Construction Methods

The NVS shear key and downstream stability berms would be constructed by first excavating the existing liquefiable and soft foundation soils down to bedrock up to a depth of 80 feet in the NVS alluvium and up to a depth of 50 feet in the sections of the abutments developed on the clayey slope wash. During the shear key excavations, dewatering and unwatering measures would be employed to remove groundwater from the excavation and maintain a dry excavation. The rock blanket or slope protection would also be removed to the top elevation of the embankment and stockpiled downstream of the toe. Next, the existing toe drain would be removed by excavation. These two operations would expose the existing blanket drain and surrounding filter materials in the downstream face of the dam. Above the blanket drain, the existing Zone 3 shell would be exposed.

After completion of the excavations, the existing filters/drains located at the downstream toe would be re-established and a new toe drain seepage collection system would be installed, similar to the one currently in place. Stronger material would then be placed as backfill and compacted. Placement of shell material (Zone 8) and the rock blanket would continue up the downstream side of the embankment until it reaches an elevation of 480 feet. At 480 feet, construction of the two-stage downstream crack filter begins and the filter material along with shell material (Zone 8) continues up to the new dam crest elevation. Above an elevation of 550 feet, the raised crest is developed by simultaneously placing riprap and bedding (Zones 5 and 4), core (Zone 1), a two-stage chimney filter (Zones 9A and 9B), and the downstream shell (Zone 8), as shown in Figure 4. Materials used would be stockpiled downstream of the toe and in Borrow Area 6. After fill placement is completed, road base and paving of the dam crest complete the overlay raise.

The dam raise action would elevate the B.F. Sisk Dam embankment to an elevation of 576 feet from approximate dam station 30+00 to the left abutment with a transition back to the existing crest elevation at the right abutment. The raise would be constructed by initially excavating approximately 8 feet from the top of the dam. This excavation would remove portions of existing Zones 1, 4, and 5. Removing this portion of the dam exposes an approximately 40- to 50-foot-wide surface of the existing low-plasticity clay core (Zone 1) material and provides a working surface for connecting the new zones of the dam overlay to the existing embankment. The 2-foot-thick rock blanket on the downstream slope of the dam would be removed in all areas to be covered by the overlay. For sections of the embankment not also receiving a stability berm, no further excavation would be needed.

An estimated 15 million cubic yard of fill materials for the new enlarged dam embankment would be sourced from two borrow sites—Basalt Hill and Borrow Area 6 (See Figure 3). The Basalt Hill Borrow area was used to support construction of the original B.F. Sisk Dam and would again be used to supply rock materials, including gravel, riprap, and cobble slope protection. These materials would be produced on-site from source material present at Basalt Hill. Borrow Area 6 was used to support construction of embankment modifications made in the 1980s and would be again used to supply material for the expansion of the Zone 1 core along with the materials for downstream berms. The only fill materials that would be imported from off-site are the filter sands needed for Zone 9a. It is estimated that approximately 1 million cubic yards of material would need to be sourced from commercial sources in the area.

The preferred method to transport materials to and from the construction site and Borrow Area 6 would be either a conveyor belt system or low-profile trucks passing below SR 152 under the existing bridge that crosses O'Neill Forebay. A temporary platform or roadbed would be developed below the bridge by placing clean riprap and rockfill-sized cobbles and boulders in the water between the second bridge column and the south abutment (approximately 60 feet) and topped with clean gravel to construct a clean (no fine materials) roadway underneath the bridge. This temporary construction road would be used to allow for transportation of materials without impacting traffic on SR 152. The riprap and rockfill-sized cobbles and boulders would be removed and the area would be returned to preconstruction conditions upon completion of the work.

Under this configuration a tunnel would be bored under SR 152 to allow for installation of 15-foot-high by 30-foot-wide concrete box culverts. The culverts would allow for conveyor system equipment to be installed through the culverts and allow the transportation of materials without impacting traffic. The location of this tunnel corresponds to the potential route of another routing option to develop either a temporary construction bridge over SR 152 or use of an at-grade road crossing with signalized traffic control.

The last routing option for any materials developed in the construction site that require temporary stockpiling in Borrow Area 6 would utilize Gonzaga Road and the Santa Nella Boulevard underpass to access Borrow Area 6. Haul and access roads would be constructed consistent with the 2009 Reclamation Safety and Health Standards, as amended. New roads would be cleared and existing roads would be improved and would be either paved or treated to prevent dust. Roads would be approximately 30 feet wide with approximately 100 feet of clearance.

Other material imports to the site would include pipe for new toe drains that would be installed beneath new berms, asphalt pavement for road replacement at the top of the new dam crest, and steel and other materials needed for construction of new transmission towers adjacent to Gianelli Pumping-Generating Plant. Off-site material disposal at area landfills and regional hazardous waste landfills would include steel and other materials from the removed transmission towers, and asbestos-wrapped corrugated metal pipe (CMP) where existing toe drains are removed.

Construction actions that would impact dam strength, such as embankment excavation, would be scheduled for completion during times in the water year that San Luis Reservoir is typically drawn down to lower levels to avoid any adverse impact on storage capacity and water supply. This would be accomplished by not initiating any excavation actions until the reservoir is drawn below safe levels and scheduling construction to complete prior to the annual reservoir refill cycle bringing storage levels above safe levels. Temporary in-reservoir construction roads would be constructed on the upstream side of the embankment when the reservoir is lowered during normal operations and then removed prior to reservoir filling the following year.

Construction Methods for SR 152 Modifications

Construction of the SR 152 modification would initiate during construction of the B.F. Sisk Dam SOD Modification Project and the dam raise construction activities described above. SR 152 modification would include raising the embankment by 11 feet and slope protection of the East Overlook Parking Area located approximately half a mile southeast from the SR 152 site. The SR 152 modification construction is scheduled to last for 18–24 months, starting in summer 2027.

Construction of the SR 152 modification would be sequenced to occur in eight steps: (1) rough excavation and site grading; (2) mobilization and assembly of the barge system to move material from the borrow sites to the construction site and the conveyor system to move material from the San Luis Reservoir side to the Cottonwood Bay side; (3) stockpiling rip rap and fill material on San Luis Reservoir and Cottonwood Bay side; (4) placement of riprap on both sides slopes in wet; (5) placement of additional filter material and riprap on both side slopes in dry; (6) placement of backfill and riprap armor to raise the embankment height on the San Luis Reservoir side; (7) placement of backfill and riprap armor to raise embankment height on the Cottonwood Bay side; (8) construction of the new roadway pavement.

Construction of the steps 1 through 5 can occur without lane closures along SR 152. During construction of steps 6 through 8, traffic would be reduced to two-way traffic using two of the existing four lanes along SR 152. Traffic reductions from lane closure would occur for approximately 8–12 months during the scheduled period of construction.

Construction on the Cottonwood Bay side of SR 152 would occur in the dry by dewatering a portion of the bay. Dewatering of the Cottonwood Bay would be facilitated by plugging the 24- and 66-inch existing submerged pipes and installing a cofferdam. An estimated 1.1 million cubic yard of fill materials for SR 152 embankment modification would be sourced from two borrow sites—Basalt Hill and Borrow Area 6—and stockpiled on the embankment slopes and roadway. Stockpiling of materials could result in minor changes to drainage patterns during the period of construction. Large deliveries or waste material transports off-site per day could be expected, along with the transport and disposal of material to local landfills and the regular commuting of construction personnel. Approximately 87,000 cubic yards of waste is expected to be generated from removal of existing riprap and filter material at the site. Roadway pavement material would be sourced from a local asphalt plant.

B.1.3.3 Equipment and Staging

Equipment in the staging areas would include trailers, equipment to be used, and stockpiled materials. Construction staging and stockpile areas would include:

- Area south of Gianelli Pumping Plant off of Basalt Road for the staging of construction equipment, fill materials transported from the borrow sites, embankment materials excavated and stored for later use, and materials transported from off-site. The area proposed for use consists of approximately 1,000 acres.

- Area north of Gianelli Pumping Plant off of Gonzaga Road for the staging of construction equipment, fill materials transported from the borrow sites, embankment materials excavated and stored for later use, and materials transported form off-site. The area proposed for use consists of approximately 120 acres.

- Dinosaur Point for the staging of construction equipment for both the Pacheco Pumping Plant West Dike replacement and Dinosaur Point Boat Launch modifications. The area proposed for use consists of approximately 28 acres.

- Embankment slopes around SR 152 between milepost MER R5.239 and MER R5.806.

The access route to the two main staging areas would be SR 152 to Basalt Road. Most of the traffic to the site would come from the east. Construction-related traffic would likely begin one to two months after notice to proceed. Temporary traffic signals would be installed at the current left turn crossing on SR 152 at Basalt Road and at the access road to Romero Visitor Center for the duration of the project. Up to 240 large deliveries or waste material transports off-site per day could be expected, as well as the transport and disposal of material to local landfills, along with the regular commuting of construction personnel.

Aside from areas dedicated to construction staging and transportation, all remaining available space at the areas next to B.F. Sisk Dam would be needed for stockpiling materials. These areas around the dam would be used as a staging area of the full duration of construction. These areas would be returned to preconstruction condition after the project is completed.

Equipment used to construct the dam raise action would include:

3 Excavators	2 Scrapers
4 Bulldozers	5 Loaders (2 small, 3 large)
5 Cranes/Lifts	13 Dump trucks
5 Compactors	5 Water trucks
1 Graders	1 Barge
4 Flatbed Trucks	2 Wheel Trenchers
2 Concrete Saw Cutters	2 Concrete Pumpers

Equipment used to construction the SR 152 modification would include:

27 Cranes	4 Pavers	9 Tractors/Loaders/Backhoes	18 Plate Compactors
8 Crawler Tractors	9 Rollers	9 Dump Truck	1 Rollers
8 Excavators	5 Rough Terrain Forklifts	2 Flatbed Truck	1 Pumps
4 Graders	5 Rubber Tired Loaders	7 Haul Truck	2 Welders
5 Off-Highway Trucks	1 Skid Steer Loaders	2 Concrete/Industrial Saws	7 Generators
9 Water Truck	16 Barges (8 aggregate, 4 conveyor, 4 crane)		

B.1.3.4 Construction Schedule

Recreational activities would be suspended for safety reasons during the entire construction schedule at Basalt Use Area and Medeiros Use Area, and during active construction at Dinosaur Point Use Area (approximately 1 year). Recreational use for boating would be suspended for the full year that both the Basalt and Dinosaur Point use areas are closed and would be limited to areas away from B.F. Sisk Dam for the full construction schedule. The closed Basalt Campground would be used as a temporary camping area for construction workers.

Final design of the dam raise and SR 152 embankment modification would include the development of a construction schedule that times the completion work in the direct path of potential flood flows or on infrastructure specifically designed to direct flood flows to occur in periods of the year when rain is unlikely and reservoir levels are lower. In addition, the contractor would be required to develop a health and safety plan as an environmental commitment that includes a response plan to flood forecasts that would require the suspension of construction activities and the movement of construction equipment to higher ground.

Construction of the dam raise action is expected to last approximately 8 years. Construction duration is based on 130 anticipated workers on-site during the day shift and 87 workers on-site during the night shift. Work would be performed 24 hours per day, 7 days per week, 12 months per year. The 24-hour work day would consist of two 10-hour work shifts, with a half-hour for lunch each shift, plus a 3-hour maintenance period. Blasting operations at Basalt Hill would be limited to the hours between 6:00 a.m. and 6:00 p.m. It is assumed, for the purpose of this EIR/SEIS, that construction would start in September 2025.

SR 152 Modification construction is expected to last approximately 18–24 months from summer 2027. The construction duration is based on approximately 75–130 workers on-site. Work would be performed from 6:00 a.m. to 6:00 p.m., 7 days per week, 12 months per year. A smaller crew of 10–20 people would be active at the site performing equipment maintenance, repair activities, crushing operations at Basalt Hill, and borrow operations in Borrow Area 6 from 6:00 p.m. to 6:00 a.m.

B.1.3.5 Operation of the Reservoir Expansion Alternative

SLDMWA and its member agencies, Reclamation, and DWR coordinated on the identification of several operational configurations of the Dam Raise Alternative. Those subalternatives have been further configured as "bookends" to capture the range of stakeholder-requested configurations and cover the high- and low-end of potential environmental effects. These effects include potential growth-inducing impacts from increases in municipal and industrial (M&I) water supply reliability and potential environmental impacts to aquatic resources in the Delta resulting from changes in water deliveries conveyed through the Delta.

CVP-Only Storage Subalternative The additional storage in San Luis Reservoir would be Reclamation-owned CVP storage and would be operated consistent with current CVP operations. The new reservoir capacity would be used to store CVP Project water, carried-over water,[1] and non-Project water.[2] The maximum quantity of carried-over water would be the same as recent operations under the current rescheduling guidelines. Based on a review of historical rescheduling quantities and the most recent annual rescheduling guidelines, an upper quantity of 180 TAF was used to estimate the aggregate total of carried-over water in high-allocation water years. As an operational bookend, this upper limit was allocated 98% to agricultural and 2% to M&I South-of-Delta CVP water contractors.

Storage priority will follow current rescheduling guidelines with carried-over water and non-Project water being subject to spill consistent with current operating criteria.

(see details in Section B.2).

CVP/SWP Split Storage Subalternative The additional storage would be split between CVP and SWP, consistent with the current 45 % CVP and 55 % SWP split of the overall reservoir storage. The additional storage would follow current operating criteria and the storage priority will follow the current rescheduling guidelines.

Investor-Directed Storage Subalternative Under this subalternative's four operational configurations, the use of the proposed storage (expanded capacity) would be primarily investor-directed. Remaining expanded capacity not in use by the investors, at any given time, would be available to Reclamation to store CVP Project water.

Investors could store allocated CVP Project water carried-over water, and non-Project water in the expanded capacity. Investors could forgo delivery of their allocated CVP Project water for delivery in subsequent year(s). This unused CVP Project water would be carried over to subsequent year(s) and continue to be stored in San Luis Reservoir until investor requests delivery of the water without the risk of "spill". Carried-over water in the expanded capacity would be subject to evaporation at the same rate as CVP Project water stored in San Luis Reservoir. Investors would have first priority in storing carried-over water and non-Project water in the expanded capacity without the risk of "spill."

Configuration A – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally

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[1] Carried-over water refers to Rescheduled Water. Rescheduled Water is defined as allocated CVP water carried over to subsequent water year(s) by the water contractor. pursuant to Reclamation's then-current Rescheduling Guidelines. The water contractors, in storing this carried-over supply in San Luis Reservoir, take on a risk of potentially losing it if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

[2] Non-Project water includes transfer water acquired by existing South-of-Delta CVP contractors. or other non-Project water currently stored in San Luis Reservoir such as conserved water. The water contractors can store non-Project water in San Luis Reservoir under a Warren Act Contract. Similar to carried-over water, the contractors take on a risk of potentially losing non-Project water if San Luis Reservoir fills the next year and that supply is "spilled" (converted to CVP supplies for following year's allocation).

among the SLDMWA investor group at 78% to agriculture, 7% to M&I, and 15% federal refuge water users.

Configuration B – The upper target quantity of carried-over water in San Luis Reservoir would be 180 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agriculture water contractors.

Configuration C – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 78% to agriculture, 7% to M&I, and 15% federal refuge water contractors.

Configuration D – The upper target quantity of carried over water in San Luis Reservoir would be 310 TAF. The delivery of the carried-over water and CVP Project water was allocated proportionally among the SLDMWA investor group at 90% to M&I and 10% to agriculture water contractors.

B.2 Federal and State Regulations Governing Operation of Proposed Action

This section discusses federal and state regulations relevant to operations of Alternative 3 – Dam Raise Alternative.

B.2.1 Federal Regulations

B.2.1.1 CVP Water Contracts

Over time, as the units and divisions of the CVP became operational, Reclamation entered into long-term contracts with various water districts, irrigation districts, and others for delivery of CVP water. Throughout the CVP, approximately 250 contracts provide for varying amounts of water. The nature of the contracts varies, as some of the contracts were entered into with entities which claim water rights senior to the CVP, while other contracts are for water service. Some of the contracts, including the Sacramento River Settlement contracts, the San Joaquin Exchange Contracts, and certain refuge contracts, have defined minimum deliveries. The overall operation of the CVP incorporates Reclamation's obligations and priorities for delivery under these different types of contracts. Although the proposed project may develop new CVP yield or may allow for additional seasonal storage of water, implementation of the proposed project would not change Reclamation's other CVP contractual obligations and priorities.

B.2.1.2 Rescheduling Guidelines for the Federal Share of Storage in San Luis Reservoir

Reclamation developed guidelines that apply to the annual rescheduling of CVP (Project) water in the San Luis Reservoir. These guidelines may change from year to year to ensure that rescheduling will not interfere with CVP operations and annual changes may include changes to dates, water rates, and other policy considerations. Rescheduled water is the first water scheduled and delivered to individual contractors.

Under current guidelines, development of new CVP water supplies, including supplies for Central Valley Project Improvement Act (CVPIA) acquired/allocated Contract Year water for refuge and wildlife habitat restoration (Level II Refuge Water) has first priority of storage in the Federal share of San Luis Reservoir. The complete schedule of storage priorities for the federal share of San Luis Reservoir is as follows:

1. Upcoming Contract Year CVP Project water including Level II Refuge Water
2. Upcoming Contract Year Incremental Level IV Refuge Water
3. Rescheduled Project Water:
    a. Irrigation water
    b. M&I Water
4. Cross Valley Canal contractor water
5. Non-Project and Non-allocated water supplies acquired by existing South-of-Delta CVP Project contractors and developed Incremental Level 4 Refuge Water
6. San Joaquin River Restoration Settlement flow water in the Federal share of San Luis Reservoir
7. All other non-Project water

The Rescheduling Guidelines (Reclamation 2020) set procedures and provide guidance on approval and scheduling of rescheduled water. Below is a summary of the procedures and guidance:

1. **Request** – Contractors must identify the estimated total quantity of rescheduled water and acquired non-Project water the contractor desires to reschedule/store by February 15. A final quantity of rescheduled Project water and acquired non-Project project water request must be submitted no later than March 10.

    The maximum quantity of current Contract Year Project water that can be rescheduled is limited to any unused portion of the respective contractor's current Contract Year's Project water allocation or 10 % of their CVP Contract Total, whichever is less.

    The total quantity of water that may be cumulatively rescheduled or stored by all contractors cannot exceed the quantity of stored water in the federal share of San Luis Reservoir on February 28/29th. If the cumulative rescheduling and storage requests exceed the physical quantity of water in San Luis Reservoir storage, Reclamation will reduce the maximum quantity limitation identified previously in this Section to an amount necessary to make certain the total amount of rescheduled Project water, rescheduled or stored non-allocated water supplies, and stored non-Project water is less than or equal to the quantity of water stored in the federal share of San Luis Reservoir on February 28/29th.
2. **Limitation on M&I Water** – Rescheduled irrigation water will have priority over rescheduled M&I water.
3. **Schedule** – Once contractors receive written approval from South-Central California Area Office (SCCAO) of the contractor's rescheduling/storage request(s), the contractor must submit a delivery schedule, which will subsequently be approved by Reclamation.
4. **First Water Evacuated** – All rescheduled Project water and acquired non-Project water is subject to available conveyance and storage capacity. If there is insufficient storage space in the federal share of San Luis Reservoir to store these supplies, such water must be evacuated

as soon as possible upon notice from Reclamation. Additional categories of water will be evacuated consistent with the storage priority presented above.

5. **Transfers/Exchanges, and/or Banking of Rescheduled Water** – Rescheduled Project water may be eligible for transfers, exchanges, and/or banking during the upcoming Contract Year.
6. **Loss Criteria**– Rescheduled Project water will not interfere with the upcoming Contract Year Project operations. If Reclamation's share of San Luis Reservoir does not fill prior to a sustained drawdown, the rescheduled Project water and acquired non-Project water will be deemed as having no impact on the upcoming Contract Year Project supplies and must be the first Project water scheduled and used in the upcoming Contract Year.

   If Reclamation's share is deemed full prior to or on March 1, Reclamation will maintain a record of foregone pumping from the time the Federal share of San Luis Reservoir filled until the conclusion of the sustained drawdown and the loss of rescheduled water.

   Starting April 1st of the upcoming Contract Year, Reclamation will assess a loss factor of 1 % per month to account for evaporation and system losses to help ensure no impacts to the upcoming Contract Year Project operations.
7. **Section 215 Water** – Contractors may enter temporary contracts with Reclamation for non-storable or unmanageable flood flows of short duration (Section 215 water).

The Business Practice Guideline No.8, developed by Reclamation and issued with the Rescheduling Guidelines, provides guidance for developing rates, identifying contractor obligations and payment requirements, and applying revenue for rescheduled Project water (Reclamation 2014).

B.2.1.3 Cooperated Operations Agreement

Reclamation and the DWR would continue to operate their respective facilities in accordance with the Agreement between the United States and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project executed in 1986 (Coordinated Operations Agreement, hereinafter referred to as COA). The COA defines the project facilities and their water supplies, sets forth procedures for coordinating operations, and identifies formulas for sharing joint responsibilities for meeting Delta standards and other legal uses of water. COA further identifies how unstored flow is shared, sets up a framework for exchange of water and services between the projects, and provides for periodic review of the agreement.

Implementation of the COA principles has evolved since 1986, as changes have occurred to CVP and SWP facilities, operating criteria, and overall physical and regulatory environment. For example, updated water quality and flow standards adopted by the State Water Resource Control Board (SWRCB), CVPIA, and Endangered Species Act (ESA) responsibilities have affected both CVP and SWP operations. The 1986, COA incorporated the SWRCB Water Right Decision 1485 (D-1485) provisions regarding Delta salinity, outflow, and export restrictions. D-1485 included implementation provisions for the Bay-Delta Water Quality Control Plan (WQCP) that was current at the time, but has since been updated with Water Right Decision 1641 (D-1641). COA envisioned and provided a methodology to incorporate future regulatory changes, such as Delta salinity requirements, but did not explicitly envision or address sharing of export restrictions. D-1641 and the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009

National Marine Fisheries Service (NMFS) BO included various export restrictions not explicitly addressed in the 1986 COA. However, the available export capacity as a result of these export restrictions was shared between the CVP and the SWP in absence of a formal update to the COA.

In 2018, Reclamation and DWR amended four key elements of the COA to address changes since the COA was signed: (1) in-basin uses, (2) export restrictions, (3) CVP use of Banks Pumping Plant up to 195,000 acre-feet per year (AFY), and (4) periodic review. The COA sharing percentages for meeting Sacramento Valley in-basin uses now vary from 80 percent responsibility of the United States and 20 percent responsibility of the state of California in wet year types to 60 percent responsibility of the United States and 40 percent responsibility of the state of California in critical year types. In a dry or critical year following two dry or critical years, the United States and state of California will meet to discuss additional changes to the percentage sharing of responsibility to meet in-basin uses. When exports are constrained and the Delta is in balanced conditions, Reclamation may pump up to 65 percent of the allowable total exports with DWR pumping the remaining capacity. In excess conditions, these percentages change to 60/40. The COA defines balanced conditions as periods when it is agreed that releases from upstream reservoirs plus unregulated flow approximately equal the water supply needed to meet Sacramento Valley in-basin uses, plus exports. The COA defines excess conditions as periods when it is agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses, plus exports.

B.2.1.4 Central Valley Project Improvement Act (CVPIA) of 1992

The CVPIA[3] is multipurpose water legislation that was signed into law October 30, 1992. CVPIA comprises 10 areas of legislation, including long-term water supply contracts/agreements with the California Department of Fish and Game, Grasslands Water District (SLDMWA representing the Grassland Resource Conservation District).

Reclamation established the Refuge Water Supply Program (RWSP) to implement Section 3406(d) of the CVPIA. The RWSP is administered by Reclamation and includes a USFWS representative. Through the RWSP, Reclamation acquires water supplies in the Central Valley of California to meet its obligation under Section 3406(d)(2) of the CVPIA.

Section 3406(d)(l) of the CVPIA requires the Secretary of the Interior (Secretary) to provide firm Level 2 water supplies to the various CVPIA refuges' habitat areas identified in Reclamation's "Report on Refuge Water Supply Investigations" (Reclamation 1989) and the "San Joaquin Basin Action Plan/Kesterson Mitigation Plan" (Reclamation, USFWS, and California Department of Fish and Game 1989). These reports describe water needs and delivery requirements for each wetland habitat area to accomplish stated refuges management objectives. In the Report on Refuge Water Supply Investigations "Dependable Water Supply Needs" tables, "Level 2" is defined as "current average annual water deliveries" and is afterwards frequently referred to as the historical annual average water received by those identified CVPIA refuges over a specific 10-year period. "Level 4" of the Dependable Water Needs tables is defined as "optimum management," identifying the quantity of water needed to achieve optimum habitat management. CVPIA defines Level 2 for those

[3] Title 34 of Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992, signed October 30, 1992.

CVPIA refuges identified in the San Joaquin Basin Action Plan/Kesterson Mitigation Plan as "two-thirds of the water supply needed for full habitat development."

Section 3406(d)(2) of the CVPIA further directs the Secretary to provide additional water supplies to the CVPIA refuges to be in accordance with Level 4 of the Dependable Water Supply Needs tables in the Report on Refuge Water Supply Investigations, and the full water supply needed for full habitat development for those CVPIA refuges identified in the San Joaquin Basin Action Plan/Kesterson Mitigation Plan. The additional quantities of water required to supplement the quantities provided under 3406(d)(1) are to be acquired by Reclamation through voluntary measures, including acquisition of water from willing sellers. The incremental difference between Level 2 and Level 4 quantities is referred to as "Incremental Level 4" (IL4) water supplies. Reclamation must also acquire additional IL4 water supplies above the quantity identified for CVPIA refuges to cover conveyance losses—water lost through seepage and evapotranspiration during the conveyance of refuge water supplies.

The intent of CVPIA is to provide firm Level 4 water supplies to all 19 CVPIA refuges. To date, Reclamation has acquired the IL4 water supplies on both an annual and permanent basis while continuing to plan for long-term acquisition actions.

B.2.1.5 Biological Opinions on the Coordinated Operations of the CVP and SWP

On October 21, 2019, USFWS and NOAA Fisheries released biological opinions on the effects of coordinated long-term operations of the CVP and SWP (USFWS 2019; NOAA Fisheries 2019). In the 2019 biological opinion, USFWS concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" the continued existence of delta smelt and its critical habitat (USFWS 2019).

Similar to the USFWS biological opinion on delta smelt, NOAA Fisheries concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" continued existence of Sacramento River winter run Chinook salmon, Central Valley spring run Chinook salmon, Central Valley steelhead, and the southern Distinct Population Segment of North American green sturgeon or destroy or adversely modify their designated or proposed critical habitat (NOAA Fisheries 2019).

On November 21, 2019, the California Natural Resources Agency announced litigation challenging the 2019 USFWS and NOAA Fisheries Biological Opinions and the "not likely to jeopardize" determinations.

The ROD for the Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the CVP and SWP was released on February 19, 2020.

B.2.2 State Regulations

B.2.2.1 CVP Water Rights

Federal law provides that Reclamation obtain water rights for its projects and administer its projects pursuant to State law relating to the control, appropriation, use, or distribution of water used in irrigation, unless the State law is inconsistent with clear Congressional directives. See 43 United States Code (U.S.C.) §383; California v. United States, 438 U.S. 645, 678 (1978); appeal on remand, 694 F.2d 117 (1982). Reclamation operates the CVP in a manner that does not impair senior or prior water rights.

Reclamation was issued water rights by the SWRCB to appropriate water for the CVP. Many of the rights for the CVP were issued pursuant to SWRCB Decision (D)-990, adopted in February 1961. Several other decisions and SWRCB actions cover the remaining rights for the CVP. These rights contain terms and conditions that must be complied with in the operation of the CVP. Over time, SWRCB has issued further decisions that modify the terms and conditions of CVP water rights. In August 1978, SWRCB adopted the WQCP for the Delta and Suisun Marsh, which established revised water quality objectives for flow and salinity in the Delta and Suisun Marsh. In D-1485, also adopted in August 1978, SWRCB required Reclamation and DWR to operate the CVP and SWP to meet all of the 1978 WQCP objectives, except some of the salinity objectives in the southern Delta. In addition, SWRCB, issued D-1594 in November 1983, and Order WR 84-2 in February 1984, defining Standard Permit Term 91 to protect CVP and SWP stored water from diversion by others. In 1995, SWRCB adopted a WQCP for the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) Estuary (1995 Bay-Delta Plan). The 1995 Bay-Delta Plan superseded both the 1978 and 1991 plans. On December 29, 1999, SWRCB adopted (and then revised on March 15, 2000) D-1641, amending certain terms and conditions of the water rights of the SWP and CVP.

B.2.2.2 State Water Resources Control Board Decision 1641

As part of the combined CVP and SWP water rights, the SWRCB imposes constraints upon the Delta operations of the CVP and SWP. With Water Rights D-1641, the SWRCB implements the objectives set forth in the SWRCB 1995 Bay-Delta WQCP and imposes flow and water quality objectives upon the Projects to assure protection of beneficial uses in the Delta. The SWRCB also grants conditional changes to points of diversion for each project with D-1641.

The various flow objectives and export restraints are designed to protect fisheries. These objectives include specific outflow requirements throughout the year, specific export restraints in the spring, and export limits based on a percentage of estuary inflow throughout the year. The water quality objectives are designed to protect agricultural, municipal and industrial, and fishery uses, and they vary throughout the year and by the wetness of the year.

B.2.2.3 Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta

In March 2020, CDFW issued an Incidental Take Permit (ITP) to DWR for long-term operations of the SWP. The permit covers four species protected under the CEQA: Delta smelt, longfin smelt, winter-run Chinook salmon and spring-run Chinook salmon. The ITP covers the following proposed long-term operation of SWP:

- Provide strong and clear criteria to protect Delta smelt, longfin smelt, winter-run Chinook salmon and spring-run Chinook salmon.
- Dedicated “block” of water for summer or fall Delta outflow as well as additional spring maintenance flows that would be provided on a flexible basis.
- Improve habitat conditions in Suisun Marsh for Delta smelt.
- Implementation of CDFW’s operational decision if a joint DWR and CDFW decision cannot be reached on real time SWP operations.
- Installation and operation of behavioral modification barriers for migrating salmon at Georgiana Slough and Sacramento River.

- Clear direction on when Delta pumping can be increased during storm events and caps the amount that exports can be increased in those events.
- Funding to implement a comprehensive Adaptive Management Plan (AMP) to collect, analyze, and inform management actions over the ITP permit period (March 31, 2020 to March 31, 2030).
- From December through June of most years, SWP exports would be similar to conditions under the Biological Opinions on the Coordinated Operations of the CVP and SWP (USFWS 2008; NOAA Fisheries 2009). Modeling for the ITP shows there would be increases in modeled entrainment at SWP facilities during April and May, attributed to CVP operations. The SWP may also increase pumping in wetter years, when Delta inflow is over 44,500 cubic feet per second and in those years, some increases in entrainment can be attributed to both the SWP and the CVP.

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix C: Regulatory Settings

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Appendix C Regulatory Settings

Federal and State of California (state) laws, rules and regulations, Executive Orders (EOs), and compliance requirements for implementation of the alternatives are described in the following sections. Descriptions are organized by federal, state, and local requirements.

C.1 Federal Requirements

C.1.1 Bald and Golden Eagle Protection Act

Administered by the United States Fish and Wildlife Service (USFWS), the Bald and Golden Eagle Protection Act (BGEPA) provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*) by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The BGEPA prohibits unregulated take and makes it illegal to kill, wound, pursue, shoot, shoot at, poison, capture, trap, collect, molest, or disturb bald or golden eagles. Surveys are required to determine whether nests will be disturbed and, if so, a buffer area with a specified radius around the nest must be established so that no disturbance or intrusion is allowed until the young have fledged and left the nest. Coordination with the USFWS is recommended for establishing an appropriate buffer.

C.1.2 Central Valley Project Improvement Act

On October 30, 1992, Public Law (P.L.) 102-575 was signed into law. This law included Title 34, the Central Valley Project Improvement Act (CVPIA), which amended previous authorizations of the Central Valley Project (CVP). The CVPIA mandated changes in management of the CVP, requiring fish and wildlife protection, restoration, and mitigation as project purposes equal to that of agricultural irrigation, municipal and industrial (M&I) supplies, and power generation. The CVPIA also authorized the Accelerated Water Transfer Program, which allows voluntary water transfers under an accelerated process between CVP contractors through multi-year, programmatic environmental documentation.

C.1.3 Clean Air Act

The United States Environmental Protection Agency (EPA) is responsible for implementation of the federal Clean Air Act (CAA). The CAA was enacted in 1955 and was amended in 1963, 1965, 1967, 1970, 1977, 1990, and 1997. Under authority of CAA, EPA established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2).

CAA requires States to classify air basins (or portions thereof) as either “attainment” or “nonattainment” with respect to criteria air pollutants, based on whether the NAAQS have been achieved, and to prepare State Implementation Plans (SIPs) containing emission reduction strategies to maintain the NAAQS for those areas designated as attainment and to attain the NAAQS for those areas designated as nonattainment.

C.1.3.1 General Conformity

Section 176 (c) of the CAA (42 United States Code [USC 7506] [c]) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the federal CAA (42 USC 7410[a]) before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action proposed that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. This project is subject to the General Conformity Rule because it involves a federal agency (United States Department of the Interior, Bureau of Reclamation [Reclamation]).

The general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct[1] and indirect[2] emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain *de minimis* amounts, thus requiring the federal agency to make a determination of general conformity. A federal agency can indirectly control emissions by placing conditions on federal approval or federal funding.

Table 1 presents the *de minimis* amounts for nonattainment areas. The *de minimis* threshold for all maintenance areas is 100 tons per year (tpy), except for Pb, which has a *de minimis* threshold of 25 tpy.

Table 1. General Conformity *De Minimis* Thresholds

Pollutant	Classification of Emissions Type	De Minimis Threshold (tpy)
O_3 (VOCs or NOx)	Serious NAA	50
O_3 (VOCs or NOx)	Severe NAA	25
O_3 (VOCs or NOx)	Extreme NAA	10
O_3 (VOCs or NOx)	Other NAA	100
CO	n/a	100
SO_2	n/a	100
NO_2	n/a	100
PM_{10}	Moderate NAA	100
PM_{10}	Serious NAA	70
$PM_{2.5}$	Direct emissions	100
$PM_{2.5}$	SO_2 precursor	100

[1] Direct emissions are those that are caused or initiated by the federal action and occur at the same time and place as the federal action.
[2] Indirect emissions are reasonably foreseeable emissions that are further removed from the federal action in time and/or distance and can be practicably controlled by the federal agency on a continuing basis (40 CFR 93.152).

Pollutant	Classification of Emissions Type	De Minimis Threshold (tpy)
$PM_{2.5}$	NOx precursor	100
$PM_{2.5}$	VOC or ammonia precursor[1]	100
Pb	n/a	25

Source: 40 CFR 93.153.

[1] Pollutant not subject to *de minimis* threshold if the State does not determine it to be a significant precursor to $PM_{2.5}$ emissions.

CO = carbon monoxide; n/a = not applicable; NAA = nonattainment area; NO_2 = nitrogen dioxide; NOx = nitrogen oxides; O_3 = ozone; Pb = lead; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

If the regulating federal agency determines that the general conformity regulations do not apply to the proposed action (meaning the project emissions do not exceed the *de minimis* thresholds in a nonattainment or maintenance area), no further analysis or documentation is required.

C.1.4 Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act (CWA).

The CWA implemented requirements to set water quality standards for all known contaminants in surface waters. Section 303(d) of the 1972 CWA requires States, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The Section 303(d) list includes water bodies that do not meet water quality standards for the specified beneficial uses of that waterway, even after point sources (e.g., wastewater treatment plant discharges) of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water bodies on their Section 303(d) lists and implement a process, called Total Maximum Daily Loads (TMDLs), to meet water quality standards (EPA 2018).

TMDLs are intended to address all significant stressors that cause, or threaten to cause, water body beneficial use impairments, including point sources, nonpoint sources (e.g., runoff from fields, streets, range, or forest land), and naturally occurring sources (e.g., runoff from undisturbed lands). The TMDL process is a tool for implementing water quality standards and is based on the relationship between point source pollution and its deleterious effects on ambient in-stream conditions. The TMDL establishes the maximum allowable loadings of a pollutant that can be assimilated[3] by a water body while still meeting applicable water quality standards. The TMDL provides the basis for the establishment of water quality-based controls. These controls should provide the pollution reduction necessary for a water body to meet water quality standards. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDLs allocation calculation for each water body must include a margin of safety to ensure that the water body can be used for the beneficial uses the state has designated. Additionally, the calculation also must account for seasonal variation in water quality (EPA 2018).

[3] As known as assimilative capacity: the ability of a body of water to cleanse itself; to receive waste waters or toxic substances without deleterious effects and without damage to aquatic life or humans who consume the water.

For example, pollutant loads might be greater during winter months with higher flows, however, the rivers may have more assimilative capacity for such pollutants.

TMDLs may be based on readily available information and studies. In some cases, complex studies or models are needed to understand how stressors are causing water body impairment. In many cases, simple analytical efforts provide an adequate basis for stressor assessment and implementation planning. TMDLs are developed to provide an analytical basis for planning and implementing pollution controls, land management practices, and restoration projects needed to protect water quality. States are required to include approved TMDLs and associated implementation measures in State water quality management plans. Within California, TMDLs implementation is regulated through regional Basin Plans.

Water quality of waters of the United States (U.S.) subjected to a discharge of dredged or fill material is regulated under Section 404 of the CWA. These actions must not violate federal or state water quality standards. Specifically, in the State of California, the applicable Regional Water Quality Control Board (RWQCB) administers Section 401 and either issues or denies water quality certifications depending upon whether the proposed discharge or fill material complies with applicable state and federal laws. The CWA also requires that a permit be obtained from EPA and the United States Army Corps of Engineers (USACE) when discharge of dredged or fill material into wetlands and waters of the U.S. occurs. Section 404 of the CWA requires EPA and USACE to issue individual and general permits for these activities.

In addition to complying with state and federal water quality standards, all point sources that discharge into waters of the U.S. must obtain a National Pollutant Discharge Elimination System (NPDES) permit under provisions of Section 402 of the CWA. In California, the State Water Resources Control Board (SWRCB) and RWQCBs are responsible for the implementation of the NPDES permitting process at the state and regional levels, respectively. The NPDES permit process also provides a regulatory mechanism for the control of non-point source pollution created by runoff from construction and industrial activities, and general and urban land use, including runoff from streets. To prevent polluted stormwater runoff from being washed into municipal separate storm sewer systems (MS4s), certain operators are required to obtain NPDES permits. The 1990 Phase I regulation requires medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. The 1999 Phase II regulation requires small MS4s in U.S. Census Bureau defined urbanized areas to obtain NPDES permit coverage for their stormwater discharges. Phase II also includes non-traditional MS4s such as public universities, departments of transportation, hospitals and prisons. There are approximately 855 Phase 1 MS4s and 6,695 Phase II MS4s (EPA 2020).

Projects involving construction activities (e.g., clearing, grading, or excavation) involving land disturbance greater than one acre must file a Notice of Intent (NOI) with the applicable RWQCB to indicate their intent to comply with the State General Permit for Stormwater Discharges Associated with Construction Activity (General Permit). The State General Permit specifies Best Management Practices (BMPs), to achieve compliance as well as numeric action levels (NALs) in order to achieve federal standards to minimize sediment and pollutant loadings. The General Permit requires preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) as well as a Rain Event Action Plan (REAP) prior to construction. The SWPPP and REAP are intended to help identify the sources of sediment and other pollutants, and assess the effectiveness of BMPs in preventing or reducing pollutants in storm water discharges and authorized non-storm water discharges.

The General Permit only applies to individuals, public agencies, private businesses, and other legal entities that have submitted a complete NOI (Central Valley RWQCB 2016).

C.1.5 Earthquake Hazard Reduction Act of 1977

The Earthquake Hazard Reduction Act of 1977 established a national goal of reducing the risks of life and property from future earthquakes in the U.S. through the establishment and maintenance of an earthquake program including prediction and hazard assessment research, seismic monitoring and information dissemination. The Act established the Earthquake Hazard Reduction Program to promote the adoption of earthquake hazard reduction measures by federal, state, and local governments. Section 8 of the Act calls for the adoption of standards for assessing and enhancing the seismic safety of buildings constructed for or leased by the federal government (42 USC 7701 et. seq.).

C.1.6 Executive Order 11990, Protection of Wetlands

EO 11990 requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This requirement extends to actions involved with construction activities or increased storage in existing reservoirs which would affect wetlands. Federal agencies must provide opportunities for early public review of any plans or proposals for new construction in wetlands.

C.1.7 Executive Order 13783 – Promoting Energy Independence and Economic Growth

Section 3 of EO 13783 rescinds certain energy and climate-related presidential and regulatory actions. Actions that were revoked include EO 13653, Preparing the United States for the Impacts of Climate Change, and Council on Environmental Quality (CEQ) guidance entitled "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews."

C.1.8 Endangered Species Act

Under Endangered Species Act (ESA), the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (USC, Title 16, Section 1533[c]). ESA prohibits the "take" of endangered or threatened fish and wildlife species, the take of endangered or threatened plants in areas under federal jurisdiction or in violation of state law, or adverse modifications to their critical habitat. Under ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." USFWS and National Marine Fisheries Service (NMFS) also interpret the definition of "harm" to include significant habitat modification that could result in the take of a species.

If an activity would result in the take of a federally-listed species, one of the following is required: an incidental take permit under Section 10(a) of ESA or an incidental take statement issued pursuant to federal interagency consultation under Section 7 of ESA. Such authorization typically requires various measures to avoid and minimize species take, and to protect the species and avoid jeopardy to the species' continued existence.

Pursuant to the requirements of Section 7 of ESA, a federal agency reviewing a proposed project which it may authorize, fund, or carry out must determine whether any federally-listed threatened or endangered species, or species proposed for federal listing, may be present in the project area and determine whether implementation of the proposed project is likely to affect the species. In addition, the federal agency is required to determine whether a proposed project is likely to jeopardize the continued existence of a listed species or any species proposed to be listed under ESA or result in the destruction or adverse modification of critical habitat proposed or designated for such species (16 USC 1536[3], [4]).

NMFS administers ESA for marine and anadromous fish species, including California Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), Sacramento River winter-run and Central Valley spring-run Chinook salmon (*O. tshawytscha*) evolutionarily significant unit (ESU), and southern DPS of North American green sturgeon (*Acipenser medirostris*). USFWS administers ESA for non-anadromous and non-marine fish species such as delta smelt (*Hypomesus transpacificus*), and longfin smelt (*Spirinchus thaleichthys*), which has been recently proposed for listing and warrants consideration for protection under ESA. In 2012, USFWS acknowledged that the San Francisco Bay-Delta DPS of the longfin smelt warrants listing but was precluded from listing at that time because of other higher priorities and consequently will be treated as a candidate species. Projects for which a federally-listed species is present and likely to be affected by an existing or proposed project must receive authorization from USFWS and/or NMFS. Authorization may involve a letter of concurrence that the project will not result in the potential take of a listed species, or may result in the issuance of a Biological Opinion (BO) that describes measures that must be undertaken to minimize the likelihood of an incidental take of a listed species. NMFS and USFWS will issue a Reasonable and Prudent Alternative (RPA) in the BO when a project that is determined to jeopardize the continued existence of a listed species.

Where a federal agency is not authorizing, funding, or carrying out a project, take that is incidental to the lawful operation of a project may be permitted pursuant to Section 10(a) of ESA through approval of a habitat conservation plan (HCP).

ESA requires the federal government to designate "critical habitat" for any species it lists under the ESA. "Critical habitat" is defined as: 1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection; and 2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

C.1.8.1 Biological Opinions

As described above, BOs are prepared through formal consultation under Section 7 of the ESA by either NMFS or USFWS in response to a federal action affecting a listed species.

On October 21, 2019, USFWS and NOAA Fisheries released biological opinions on the effects of coordinated long-term operations of the CVP and SWP (USFWS 2019; NOAA Fisheries 2019). In the 2019 biological opinion, USFWS concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" the continued existence of delta smelt and its critical habitat (USFWS 2019).

Similar to the USFWS biological opinion on delta smelt, NOAA Fisheries concluded that continued long-term operations of the CVP and SWP are "not likely to jeopardize" continued existence of Sacramento River winter run Chinook salmon, Central Valley spring run Chinook salmon, Central Valley steelhead, and the southern Distinct Population Segment of North American green sturgeon or destroy or adversely modify their designated or proposed critical habitat (NOAA Fisheries 2019).

On November 21, 2019, the California Natural Resources Agency announced litigation challenging the 2019 USFWS and NOAA Fisheries Biological Opinions and the "not likely to jeopardize" determinations.

The ROD for the Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the CVP and SWP was released on February 19, 2020.

C.1.9 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for USFWS involvement in evaluating impacts on fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires federal agencies that construct, license or permit water resource development projects, to consult with the USFWS, NMFS, and State fish and wildlife agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts before project implementation. Under the FWCA, the USFWS coordinates with other agencies (e.g., NMFS and California Department of Fish and Wildlife [CDFW]) to ensure that the recommendations in the FWCA report reflect a more inclusive report that includes an evaluation of impacts on fish and wildlife from the project, recommended mitigation measures, and other recommendations to address these impacts (Reclamation 2017a).

C.1.10 Magnuson-Stevens Fishery Conservation and Management Act

The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (Magnuson-Stevens Act) (P.L. 94-256 or 10 USC 1801 et seq.) require heightened consideration of habitat for commercial fish species in resource management decisions. EFH is defined in the Magnuson-Stevens Act as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical, and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. The Magnuson-Stevens Act and its implementing regulations (50 CFR § 600.92[j]) require that before a federal agency may authorize, fund, or carry out any action that may adversely affect EFH, it must consult with NMFS. The purpose of the consultation is to develop conservation recommendations that address reasonably foreseeable adverse effects on EFH. Freshwater EFH for Pacific salmonids includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically, accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers, and long-standing impassable natural barriers.

C.1.11 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) decrees that all migratory birds and their parts (including eggs, nests and feathers) are fully protected. The MBTA protects nearly all native North American bird species. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Under the

MBTA, surveys are required to determine whether nests will be disturbed and, if so, a buffer area with a specified radius around the nest must be established so that no disturbance or intrusion is allowed until the young have fledged and left the nest. The size of the buffer area would vary depending on species and local conditions (e.g., presence of busy roads) and the professional judgment of the project biologist. Coordination with the USFWS is recommended for establishing an appropriate buffer.

C.1.12 National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966 (54 USC Section 300101 et seq.) requires federal agencies to consider the preservation of prehistoric and historic period resources. The NHPA authorizes the Secretary of the Interior to expand and maintain the National Register of Historic Places (NRHP), and it establishes the Advisory Council on Historic Preservation (ACHP) as an independent federal entity. Section 106 of the Act (54 USC Section 300108) requires federal agencies to take into account the effects of their undertakings on historic properties and affords the ACHP an opportunity to comment on the undertaking prior to the licensing or approval of the expenditure of funds on any undertaking that may affect properties listed, or eligible for listing, in the NRHP. 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).

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. If and when Congress authorizes a project, that undertaking will be subject to NHPA Section 106 compliance and willinclude consultation with the SHPO and other Section 106 consulting parties as required. Section 106 of the NHPA requires federal agencies to consider the effects of the undertaking on historic properties and to afford the ACHP and the SHPO a reasonable opportunity to comment on any undertaking that would adversely affect properties listed or eligible for listing in the NRHP. Section 302706(a) of the NHPA allows properties of traditional religious and cultural importance to Indian tribes to be determined eligible for inclusion in the NRHP. Under the NHPA, a "historic property" or significant cultural resource is one that meets the following NRHP criteria (36 CFR Part 60.4):

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history, or
B. That are associated with the lives of persons significant in our past, or
C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, or
D. That have yielded, or may be likely to yield, information important in prehistory or history.

The federal review of projects is typically referred to as the Section 106 process. Section 106 review normally involves a four-step procedure that is detailed in the implementing regulations (36 CFR Part 800):

1. *Establish undertaking.* Determine whether the proposed federal action is an undertaking;
2. *Identification of historic properties.* Determine scope of identification efforts, phased identification and evaluation, evaluate historic significance, results of identification and evaluation;
3. *Assessment of adverse effects.* Apply criteria of adverse effect, finding of no adverse effect, consulting party review, results of assessment;
4. *Resolution of adverse effects.* Continue consultation, resolve adverse effects, memorandum of agreement.

Once cultural resources are identified in the project area of potential effects (APE), they must be evaluated under the four NRHP criteria found at 36 CFR Part 60.4 pursuant to 36 CFR Part 800.4(c). If the agency determines historic properties are within the APE, then the effect of the undertaking on historic properties is assessed as outlined in 36 CFR 800.5. The effect can be either no adverse effect or adverse effect. Adverse effects must be resolved in consultation with and through the execution of an agreement document among the responsible federal agency or agencies, the SHPO, and other Section 106 consulting parties pursuant to 36 CFR Part 800.6.

C.1.13 Principles and Requirements for Federal Investments in Water Resources

Furthermore, Reclamation is subject to *Principles and Requirements for Federal Investments in Water Resources* (CEQ 2013). This document requires areas of risk and uncertainty to be identified, described, and considered when analyzing potential investments in water resources. It specifically requires climate change impacts to be accounted for and addressed.

C.1.14 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) of 1976, administered by the EPA, governs the disposal of solid and hazardous waste. Under RCRA, EPA was given authority of "cradle-to-grave" control of hazardous waste and this is the current approach for hazardous waste management. Three programs were established under RCRA including the solid waste program, hazardous waste program, and underground storage tank (UST) program. Under the law, controls for the generation, transport, treatment, storage, and disposal of hazardous waste are strictly mandated. Only active and future facilities are controlled under RCRA (EPA 2019). There have been three amendments to RCRA, including the Hazardous and Solid Waste Amendments of 1984, the Federal Facility Compliance Act of 1992, and the Land Disposal Program Flexibility Act of 1996 (EPA 2019).

C.1.15 San Luis Act (Public Law 86-488)

In 1960 the San Luis Act (P.L. 86-488) authorized the construction and operation of the San Luis Unit, which is jointly operated by Reclamation and DWR. The principal purpose of the San Luis Unit is irrigation water supply for almost 1 million acres of prime farmland in central California. The San Luis Unit joint-use facilities include O'Neill Dam and Forebay, B.F. Sisk Dam, San Luis Reservoir, and San Luis Canal.

C.1.16 Safe Drinking Water Act

The Federal Safe Drinking Water Act (SDWA) was enacted in 1974 to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA authorized the EPA to establish safe standards of purity for specified contaminants and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which assume this power from the EPA, also encourage attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the EPA through primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the EPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants.

C.1.17 United States Department of the Interior, Bureau of Reclamation National Environmental Policy Act Handbook

The Reclamation *National Environmental Policy Act (NEPA) Handbook* (Reclamation 2012) recommends that climate change be considered, as applicable, in every NEPA analysis. The *NEPA Handbook* acknowledges that there are two interpretations of climate change in regards to Reclamation actions: 1) Reclamation's action is a potentially significant contributor to climate change and 2) climate change could affect a Reclamation proposed action. The *NEPA Handbook* recommends considering different aspects of climate change (e.g., relevance of climate change to the proposed action, timeframe for analysis, and relevant regional/local projections of climate change) to determine the extent to which it should be discussed under NEPA.

C.1.18 United States Department of the Interior, Bureau of Reclamation Safety of Dams Act

The SOD Act of 1978 as amended gives Reclamation authority to modify dams and other actions to reduce the risk related to dam failure (Reclamation 2017b). Reclamation's SOD Program ensures regular monitoring, examination and evaluation of dam performance to identify potential risks to the public, property or the environment. The evaluation considers loading conditions and the consequences of structural dam failure. Unreasonable risks require corrective actions to be developed and implemented. The SOD Process entails a four-phased approach including: comprehensive and periodic inspections and reviews every 8 and 4 years respectively; issues evaluation which may include additional studies; Corrective Action Study (CAS) as recommended by the issues evaluation; and design/modification as recommended in the CAS (Reclamation 2019).

C.1.19 United States Department of the Interior Secretarial Order No. 3360

In 2017, Department of the Interior (DOI) issued a Secretarial Order that continues the implementation of EO 13783 by rescinding documents inconsistent with EO 13783. The order rescinds Departmental Manual Part 523, Chapter 1: Climate Change Policy, and directs each bureau and office to review all existing regulations, orders, guidance documents, policies, instructions, notices, and implementing actions that are inconsistent with EO 13783 and initiate a process to suspend, revise, or rescind any such actions (DOI 2017).

C.1.20 Water Project Recreation Act

The Federal Water Project Recreation Act requires federal agencies with authority to approve water projects to include recreation development as a condition of approving permits. Recreation development must be considered along with any navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project. The act states "consideration should be given to opportunities for outdoor recreation and fish and wildlife enhancement whenever any such project can reasonably serve either or both purposes consistently" (Reclamation 2017a).

C.2 State Requirements

C.2.1 Alquist-Priolo Earthquake Fault Zoning Act

The 1972 Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code [PRC] Section 2621 *et seq*.) requires local agencies to regulate development within earthquake fault zones to reduce the hazards associated with surface fault ruptures. It also regulates construction in earthquake fault zones.

C.2.2 California Building Code

Minimum standards for structural design and construction are outlined in the California Building Standards Code (CBSC) (Title 24, California Code of Regulations). The CBSC is based on the Uniform Building Code (UBC), which is widely used throughout the U.S. and has been modified for California conditions with numerous, more detailed and/or more stringent regulations.

C.2.2.1 Geology, Seismicity, and Soils

The CBSC requires that "classification of the soil at each building site…be determined when required by the building official" and that "the classification be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity shall be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including but not limited to excavation, grading, and earthwork construction; fill placement and embankment construction; construction on expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, project design and construction would be required to comply with provisions of the CBSC.

C.2.2.2 Noise and Vibration

The Code provides acoustical regulations for both exterior-to-interior sound insulation, as well as sound and impact isolation between adjacent spaces of various occupied units. Title 24 regulations generally state that interior noise levels generated by exterior noise sources shall not exceed 45 A-weighted decibels (dBA) L_{dn}/ Community Noise Equivalent Level (CNEL), with windows closed, in any habitable room for general residential uses.

C.2.3 California Clean Air Act

The California Clean Air Act (CCAA) substantially added to the authority and responsibilities of the State's air pollution control districts. The CCAA establishes an air quality management process that generally parallels the federal process. The CCAA, however, focuses on attainment of the California

Ambient Air Quality Standards (CAAQS) that, for certain pollutants and averaging periods, are typically more stringent than the comparable NAAQS. The CCAA requires that the CAAQS be met as expeditiously as practicable, but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The air quality attainment plan requirements established by the CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind air pollution control districts are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts.

The California Air Resources Board (CARB) is responsible for developing emission standards for on-road motor vehicles and some off-road equipment in the State. In addition, CARB develops guidelines for the local districts to use in establishing air quality permit and emission control requirements for stationary sources subject to the local air district regulations.

C.2.4 California Department of Fish and Wildlife Species Designations

CDFW maintains an informal list of species called "species of special concern." These are broadly defined as plant and wildlife species that are of concern to CDFW because of population declines and restricted distributions and/or because they are associated with habitats that are declining in California. These species are inventoried in the California Natural Diversity Database regardless of their legal status. Impacts on species of special concern may be considered significant.

C.2.5 California Department of Transportation Guide for the Preparation of Traffic Impact Studies

Traffic analysis in the State of California is guided by standards set at the state level by the California Department of Transportation (Caltrans), and by local jurisdictions. State highways fall under the jurisdiction of Caltrans. Other roadways fall under the local jurisdiction, either city or county, in which they are located.

Each jurisdiction has adopted standards regarding the desired performance level of traffic conditions on the circulation system within its jurisdiction. A performance measure called "Level of Service" (LOS) is used to characterize traffic operating conditions of a circulation element. Progressively worsening traffic operating conditions are given the letter grades "A" through "F". Traffic operating conditions associated with each LOS designation, the LOS criteria for freeways using average densities, and the LOS criteria for roadways using daily traffic volumes are included in Appendix H.

While most motorists consider LOS A, B, and C as satisfactory travel conditions, LOS D is considered marginally acceptable. Congestion and delay are considered unacceptable to most motorists and are given the LOS E or F ratings. Table 2 presents local and regional LOS standards established by each jurisdiction within the study area.

Table 2. LOS Standards of Significance

Regulatory Agency	LOS Standards
Merced County[1]	LOS D for freeways and urban roadways, LOS C for other rural roadways
City of Los Banos[2]	LOS C for roadway segments
City of Gustine[3]	LOS D for major roadways

[1] Source: Merced County 2013,
[2] Source: City of Los Banos 2009,
[3] Source: City of Gustine 2002

C.2.6 California Department of Water Resources, Division of Safety of Dams

At the state level, the responsibility for the supervision of dams and reservoirs is assigned to the DWR and delegated to the Division of SOD. California Water Code Division 3 regulates alterations; repairs and maintenance; operation; and, removal of dams and reservoirs.

C.2.7 California Department of Water Resources Non-Project Water Acceptance Criteria

Acceptance criteria has been developed by DWR to govern the water quality of non-Project water that may be conveyed through the California Aqueduct. These criteria require DWR to consult with SWP contractors and the California Department of Public Health on drinking water quality issues relating to non-Project water as needed to assure the protection of SWP water quality. DWR uses a two-tier approach for accepting non-Project water pumped into the California Aqueduct. Tier 1 programs have "no adverse impact" criteria and are tied to historical water quality levels in the California Aqueduct. Programs meeting all Tier 1 criteria are approved by DWR.

Tier 2 programs have water quality levels that exceed the historical water quality levels in the California Aqueduct and have potential to cause adverse effects to SWP contractors. Tier 2 programs are referred to a state water contract facilitation group for review. The facilitation group reviews the program and, if needed, makes recommendations to DWR during consideration of the project.

C.2.8 California Endangered Species Act

CDFW is responsible for administration of the California Endangered Species Act (CESA). For projects that affect a species that is both state and federal listed, compliance with the Federal Endangered Species Act will satisfy the CESA if CDFW determines that the federal incidental take authorization is "consistent" with the CESA. Projects that result in a "take" of a state-listed species may require an incidental take permit under the CESA. The state act also lends protection to species that are considered rare enough by the scientific community and trustee agencies to warrant special consideration, particularly with regard to protection of isolated populations, nesting or den locations, communal roosts, and other essential habitat. The area of analysis is known to support species listed under the CESA.

Fully Protected Species under California Fish and Game Code – Protection of fully protected species is described in four sections of the California Fish and Game Code that list 37 fully protected species (California Fish and Game Code Sections 3511, 4700, 5050, and 5515). These statutes prohibit take or possession at any time of fully protected species.

C.2.9 California Environmental Protection Agency Unified Program

The California Environmental Protection Agency (CalEPA) Unified Program was developed to protect Californians from hazardous waste and materials. CalEPA has certified 81 local government agencies as California Unified Program Agencies (CUPAs), including Merced County Department of Public Health, which is responsible for implementing the hazardous waste and materials standards for five different state agencies including: CalEPA, California Department of Toxic Substances Control (DTSC), Governor's Office of Emergency Services (CalOES), California Department of Forestry and Fire Protection and the SWRCB (CalEPA 2020a). Under the Unified Program, the administration, permit, inspection and enforcement activities are consolidated for the following environmental and emergency management programs (CalEPA 2020b).

- Aboveground Petroleum Storage Act (APSA) Program
- Area Plans for Hazardous Materials Emergencies
- California Accidental Release Prevention (CalARP) Program
- Hazardous Materials Release Response Plans and Inventories (Business Plans)
- Hazardous Material Management Plan and Hazardous Material Inventory Statements (California Fire Code)
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs
- UST Program

A more in-depth discussion of some of these programs that have applicability are described below.

C.2.9.1 Hazardous Material Management Plan and Hazardous Material Inventory Statements

The Hazardous Material Business Plans program mandates the creation of a planning document by businesses and other entities who handle hazardous materials of certain quantities. The Business Plan shall include, among other things, an inventory of hazardous materials, a site location map, emergency plan and training program for their employees. These plans are to be submitted electronically to the California Environmental Reporting System. The local CUPA agency may be contacted for assistance with preparation of Business Plans. The CUPA will verify this information and provide it to "local emergency responders such as firefighters, health officials, planners, public safety officers, health care providers, regulatory agencies and other interested" parties. This information is prepared in response to federal community right-to-know laws (CalOES 2020a).

C.2.9.2 California Accidental Release Prevention Program

The CalARP program was developed to assist with prevention of harmful substances releases which could seriously harm the public and/or the environment. Businesses that handle certain quantities of regulated substances are required to prepare a Risk Management Plan that includes an engineering analysis of potential accident scenarios with mitigation measures. The mitigation measures, when implemented, would reduce the accident potential at a business. CalARP is implemented at the local government level (CUPA) who work directly with the regulated business (CalOES 2020b):

C.2.9.3 California Area Plan Program

The Area Plan Program requires CUPAs to prepare a plan utilizing information from CalARP and HMBP. The Area Plan includes emergency response procedures to minimize impacts from a hazardous material release or threatened release. Provisions for multi-agency coordination and notification during emergency responses are also to be addressed in the Area Plan (CalOES 2020c).

C.2.10 California Environmental Quality Act Guidelines

C.2.10.1 Greenhouse Gas Emissions

On March 18, 2010, the California Natural Resources Agency (CNRA) adopted amendments to the California Environmental Quality Act (CEQA) Guidelines to include provisions for evaluating the significance of greenhouse gas (GHG) emissions. The amended guidelines give the Lead Agency leeway in determining whether GHG emissions should be evaluated quantitatively or qualitatively but requires that the following factors be considered when assessing the significance of impacts from GHG emissions (Section 15064.4):

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting
- Whether the project emissions exceed a threshold of significance that the lead agency determines apply to the project
- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions

The amended guidelines also specify that Lead Agencies must analyze potentially significant impacts associated with placing projects in locations susceptible to hazardous conditions (e.g., floodplains, coastlines, and wildfire risk areas), including those that could be affected by climate change (Section 15126.2(a)).

Furthermore, the guidelines also suggest measures to mitigate GHG emissions, including implementing project features to reduce emissions, obtaining carbon offsets to reduce emissions, or sequestering GHG.

C.2.10.2 Cultural Resources

CEQA is the central law governing cultural resources at the state level. CEQA Guidelines Section 15064.5 states that a project may have a significant impact on the environment if it causes a substantial adverse change in the significance of a historical resource. Pursuant to Section 15064.5(a)(3), a historical resource is a resource that is included in, or eligible for inclusion in, the California Register of Historical Resources (CRHR); a resource listed in a local register of historical resources, as defined in PRC Section 5020.1(k) or identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be significant. Resources automatically listed in the CRHR are those formally determined eligible for, or listed in, the NRHP; State Historical Landmarks numbered 770 or higher, and California Points of Historical Interest. If a lead agency determines that a cultural resource constitutes a historical resource, the provisions of PRC Section 21084.1 and CEQA Guidelines Section 15064.5 would apply. If a cultural resource does not meet the criteria for a historical resource, it may yet be regarded as a "unique" archaeological resource (PRC Section 21083.2). CEQA Guidelines Section 15064.5(c)(4) notes that if a resource is neither a unique archaeological resource nor a historical resource, the effects of a project on that resource shall not be considered a significant effect on the environment. Human remains, including those interred outside formal cemeteries, are protected under several state laws, including PRC Section 5097.98 and Health and Safety Code Section 7050.5.

Signed in 2014, Assembly Bill (AB) 52 amends CEQA and creates a new category of environmental resource: "tribal cultural resources." These resources are defined as any site, feature, place, cultural landscape, sacred place, or object that has cultural value to a California Native American tribe. The bill further establishes a consultation process with all California Native American tribes listed by the Native American Heritage Commission, regardless of their federal recognition status.

C.2.11 California Executive Order S-3-05

On June 1, 2005, former California Governor Arnold Schwarzenegger signed EO S-03-05. This EO established the following GHG emission reduction targets for California:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80% below 1990 levels.

The order also requires the Secretary of the CalEPA to report to the Governor and the State Legislature biannually on progress made toward meeting the GHG emission targets, commencing in January 2006. The Secretary of the CalEPA is also required to report about impacts on water supply, public health, agriculture, the coastline, and forestry. Mitigation and adaptation plans to combat these impacts must also be developed.

California GHG emissions were estimated to be 446.06 million tonnes (metric tons) of CO_2 (carbon dioxide) equivalent (CO_2e) in 2010, compared to 467.19 million tonnes of CO_2e in 2000 (CARB 2019). The GHG emissions inventory indicates that emissions decreased by over 21 million tonnes of CO_2e over the decade, representing a 4% decrease in statewide emissions. Thus, the state was successful in meeting the first milestone of S-3-05.

C.2.12 California Executive Order B-30-15 and Senate Bill 32

California Governor Edmund G. Brown issued EO B-30-15 to reduce California GHG emissions to 40% below 1990 levels by 2030. The order aligns California's GHG reduction targets with the United Nations Climate Change Conference in Paris. In 2016, Senate Bill 32 codified the EO B-30-15 target and directed state regulatory agencies to develop rules and regulations to meet the 2030 state target.

C.2.13 California Fish and Game Code Section 1600, Streambed Alterations

Section 1600 et seq. of the California Fish and Game Code, as administered by CDFW, mandates that "it is unlawful for any person to substantively divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by the department, or use any material from the streambeds, without first notifying the department of such activity." Streambed alteration must be permitted by CDFW through a Streambed Alteration Agreement. CDFW defines streambeds as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life" and lakes as "natural lakes and man-made reservoirs." CDFW jurisdiction includes ephemeral, intermittent, and perennial watercourses, and can extend to habitats adjacent to watercourses, including flood plains. Wetlands near watercourses would also be considered "habitats adjacent to watercourses." A Lake and Streambed Alteration Agreement application may need to be submitted for construction actions disturbing the bed and bank of rivers or reservoirs.

C.2.14 California Fish and Game Code Sections 3500 - 3705, Migratory Bird Protection

Sections 3500 through 3705 of the California Fish and Game Code regulate the taking of migratory birds and their nests. These codes prohibit the taking of nesting birds, their nests, eggs, or any portion thereof during the nesting season. Typically, the breeding/nesting season is from March 1 through August 30. Depending on each year's seasonal factors, the breeding season can start earlier and/or end later. Several species of migratory birds are known to occur in the area of analysis.

C.2.15 California Global Warming Solutions Act of 2006 (Assembly Bill 32)

California AB 32, the Global Warming Solutions Act of 2006, codifies the state's GHG emissions targets by requiring the state's global warming emissions to be reduced to 1990 levels by 2020 and directs CARB to enforce the statewide cap that began to phase in during 2012. In 2007, CARB recommended and adopted a 1990 GHG emissions level and 2020 emissions limit of 427 million metric tons CO_2e ($MMTCO_2e$); however, this limit has subsequently been updated to 431 $MMTCO_2e$ using the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report global warming potentials (CARB 2020). The limit is a statewide limit and does not require individual sectors or facilities to reduce emissions equally.

Key AB 32 milestones are as follows (CARB 2014):

- January 1, 2009 – Scoping Plan adopted indicating how emissions will be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions.
- During 2009 – CARB staff drafted rule language to implement its plan and held a series of public workshops on each measure (including market mechanisms).
- January 1, 2010 – Early action measures took effect.
- During 2010 – CARB conducted series of rulemakings, after workshops and public hearings, to adopt GHG regulations, including rules governing market mechanisms.
- January 1, 2011 – Completion of major rulemakings for reducing GHGs, including market mechanisms.
- January 1, 2012 – GHG rules and market mechanisms adopted by CARB and are legally enforceable.
- November 14, 2012 – CARB held first quarterly auction of GHG emissions allowances as part of the cap-and-trade program.
- January 1, 2013 – Cap-and-trade program began with a GHG emissions cap that declines over time.
- September 17, 2013 – CARB issued first carbon offset credits as part of the cap-and-trade program.
- May 22, 2014 – CARB approved First Update to the Climate Change Scoping Plan.

- December 31, 2020 – Deadline for achieving 2020 GHG emissions cap.

CARB has been proactive in its implementation of AB 32 and has met each of the milestones identified above that have already passed and is on track to meet the last milestone.

C.2.16 California Natural Resources Agency

Under EO B-10-11 it is policy that every state agency and Department subject to executive control to implement effective government-to-government consultation with California Indian Tribes. The purpose of CNRA Tribal Consultation Policy is to ensure effective government-to-government consultation between the Natural Resources Agency, its Departments of the Natural Resources Agency and Indian tribes and tribal communities. It is only by engaging in open, inclusive and regular communication efforts that the interests of California's Tribes and tribal communities will be recognized and understood in the larger context of complex decision-making. The goal of the policy is to engage in the timely and active process of respectfully seeking, discussing and considering the views of California Indian Tribes, Tribal communities and Tribal Consortia in an effort to resolve concerns of as many parties as possible.

C.2.17 California Occupational Safety and Health Administration Standards

The California Occupational Safety and Health Administration (CalOSHA) enforces laws and regulations related to the safety and health of workers in the workplace. Laws and regulations enforced by CalOSHA include regulations related to construction and handling of carcinogens and asbestos (CalOSHA 2020).

C.2.18 California Office of Historic Preservation

The California Office of Historic Preservation (OHP) implements the policies of the NHPA on a statewide level and maintains the State Historic Resources Inventory database. The SHPO is responsible for the operation and management of the OHP and implements historic preservation programs within the state's jurisdiction while serving as a consulting party in the federal process described above.

C.2.19 California Porter-Cologne Water Quality Control Act

The California Porter-Cologne Water Quality Act (Porter-Cologne Act) was enacted in 1969 and established the SWRCB. The Porter-Cologne Act defines water quality objectives as the limits or levels of water constituents that are established for reasonable protection of beneficial uses, described in detail in Appendix D. Unlike the CWA, the Porter-Cologne Act applies to both surface and groundwater. The Porter-Cologne Act requires that each of nine semi-autonomous RWQCB establish water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, per Federal CWA regulations. Therefore, the regional plans provide the regulatory framework for meeting state and federal requirements for water quality control. Changes in water quality are only allowed if the change is consistent with the most restrictive beneficial use designation identified by the state, does not unreasonably affect the present or anticipated beneficial uses, and does not result in water quality less than that prescribed in the Regional Water Quality Control Plans (Basin Plans) (SWRCB 2019).

C.2.19.1 State Water Resources Control Board Decision 1641

SWRCB Decision-1641 presents the current water right requirements to implement the Delta flow-dependent objectives. In SWRCB Decision-1641, the SWRCB assigned responsibilities to Reclamation and DWR for meeting these requirements. These responsibilities require that the CVP and the SWP be operated to protect water quality, and that DWR and/or Reclamation will ensure that the flow dependent water quality objectives are met in the Delta (SWRCB 2000).

C.2.20 California State Parks Guidelines

The California State Parks system does not have regulations regarding noise impacts on campgrounds. For CEQA purposes, the park system defines significant adverse noise impacts as an increase above background that would be clearly discernible and objectionable to park users (California Department of Parks and Recreation [CDPR] 2006).

C.2.21 California Water Code Section 13240, Regional Water Quality Control Plans

The California Water Code (Section 13240) requires the preparation and adoption of Water Quality Control Plans (WQCPs) (Basin Plans), and the Federal CWA (Section 303) supports this requirement. According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and an implementation program needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code, beginning with Section 13000, and any state policy for water quality control. The Basin Plans are regulatory references for meeting the state and federal requirements for water quality control (40 Code Federal Regulations 131.20). One significant difference between the state and Federal programs is that California's basin plans also establish standards for groundwater in addition to surface water (Central Valley RWQCB 1998).

Basin Plans complement other WQCPs adopted by the SWRCB, such as the WQCP for Temperature Control and Ocean Waters. The SWRCB and the regional water boards maintain each Basin Plan in an updated and readily available edition that reflects the current water quality control programs.

Three different Water Quality Control Plans govern water bodies within the B.F. Sisk Dam Raise and Reservoir Expansion Project area of analysis.

- The *Central Valley Region Basin Plan* covers the drainage areas of the entire Sacramento and San Joaquin river basins, involving an area bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in this WQCP extends some 400 miles, from the California – Oregon border to the headwaters of the San Joaquin River.

- *San Francisco Bay/Sacramento-San Joaquin Delta Estuary Plan* establishes water quality objectives for water bodies within the region in order to protect beneficial uses. The WQCP includes beneficial uses to be protected, water quality objectives, and a program to help achieve the water quality objectives. This plan supplements other water quality control plans, by the SWRCB and RWQCBs, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to adversely affect beneficial uses or cause nuisance conditions (SWRCB 2018a).

- *Water Quality Control Plan for the Tulare Lake Basin* covers the drainage area of the San Joaquin Valley south of the San Joaquin River. The Basin encompasses approximately 10.5 million acres, of which approximately 3.25 million acres are in federal ownership (SWRCB 2018b). The WQCP includes existing and potential beneficial uses, water quality objectives, and an implementation plan.

C.2.22 California Water Code, Water Rights

The California Water Code establishes state policy, laws, statutes, and definitions for water rights. The Water Code established the SWRCB, delegating adjudicatory and regulatory functions of the state to the SWRCB in the field of water resources. Regulations pertaining to water law are found in Title 23, Sections 640 to 1024. After the enactment of the State Water Commission Act in 1914, the state required any person or agency seeking to use surface water, without an existing riparian right, to apply for and receive approval for such use from the SWRCB. Water rights permits granted by the SWRCB include detailed descriptions of the amounts, conditions, and construction timetables under which the proposed water project must comply. Prior to permit issuance, the SWRCB must take into account all prior rights and the availability of water in the basin. The SWRCB must also consider the flows needed to preserve instream uses such as recreation and fish and wildlife habitat. The SWRCB may impose additional conditions to ensure that these criteria are satisfied and it may use its continuing authority to enforce and revise the conditions of water right permits over time. The SWRCB is also empowered to revoke a permit or issue cease and desist orders if conditions of the permit are not being met.

C.2.23 Hazardous Waste Control Act

The Hazardous Waste Control Act was passed in 1972 by the State Legislature. The Hazardous Waste Control Law (Health and Safety Code sections 25100 et seq.) mandates regulatory standards for the generation, handling, processing, storage, transportation, and disposal of hazardous wastes through a “cradle to grave” system. The DTSC and local CUPAs are responsible for administration of the California Hazardous Waste Control Program (DTSC 2018).

C.2.24 Pacheco State Park General Plan

The Pacheco State Park (SP) is owned and managed by CDPR. The CDPR approved the *Pacheco SP General Plan (GP)* on May 12, 2006 (CDPR 2006). Goals listed within the GP that are relevant are:

- Goal VIS-F1 - Provide visitor facilities that enhance enjoyment of the site’s history and character and avoid resource degradation.
- Goal VIS-T1 - Ensure that trails are designed and used to preserve natural resources and provide optimum visitor experience.
- Goal VIS-T2 - Provide a variety of trail experiences for a variety of trail users.
- Goal VIS-T3 - Provide an appropriate amount of trails in a variety of locations throughout the park.
- Goal REG-D1 - Incorporate visitor use data and regional population and demographic information in planning and construction projects at the Park.

C.2.25 Noise Element Guidelines (Health and Safety Code §46050.1)

The State of California provides guidance for the preparation of GPs and noise ordinances. In 1976, the State Department of Health Services (now the Department of Public Health) issued *Noise Element Guidelines* (Health and Safety Code §46050.1). In 1977, the State Office of Noise Control (ONC) published a model noise ordinance and mandated that each county develop a noise element as part of its GP (Section 65203[f] of the California Government Code). The purpose of this element is to identify and appraise noise problems in the community. The ONC's model ordinance recommends limits on temporary construction noise levels and operational noise levels in residential, commercial, and industrial areas.

The State's *General Plan Guidelines* recommend that local governments "'analyze and quantify' noise levels and the extent of noise exposure through actual measurement and the use of noise modeling." In addition to other requirements, the guidelines state that "technical data relating to mobile and point sources must be collected and synthesized into a set of noise control policies and programs that 'minimizes the exposure of community residents to excessive noise'" (California Governor's Office of Planning and Research [OPR] 2017).

As part of the county-level planning process, analysis of existing conditions and community tolerance for noise are used to dictate the normally acceptable community noise exposure. Measured in dBA, a normally acceptable community noise exposure is used by the state to signify satisfactory land use in relation to noise exposure. Other terms used by the state to analyze community noise exposure are:

- **Normally Acceptable -** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

- **Conditionally Acceptable -** New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

- **Normally Unacceptable -** New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

- **Clearly Unacceptable -** New construction or development should generally not be undertaken.

Table 3 displays land use categories and community noise exposure levels.

Table 3. Noise Compatible Land Use Planning

Land Use	Normally Acceptable L_{dn} or CNEL (dBA) [1]	Conditionally Acceptable L_{dn} or CNEL (dBA) [1]	Normally Unacceptable L_{dn} or CNEL (dBA) [1]	Clearly Unacceptable L_{dn} or CNEL (dBA) [1]
Residential – Low Density Single Family, Duplex, Mobile Homes	50-60	55-70	70-75	75+
Residential – Multi Family	50-65	60-70	70-75	75+
Transient Lodging – Motels, Hotels	50-65	60-70	70-80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-70	60-70	70-80	80+
Auditoriums, Concert Halls, Amphitheaters	N/A	50-70	N/A	65+
Sports Arena, Outdoor Spectator Sports	N/A	50-75	N/A	70+
Playgrounds, Neighborhood Parks	50-70	N/A	67-75	72+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75	N/A	70-80	80+
Office Buildings, Business Commercial and Professional	50-70	67-77	75+	N/A
Industrial, Manufacturing, Utilities, Agriculture	50-75	70-80	75+	N/A

Source: OPR 2017

[1] Ranges in the community noise exposure levels (and any subsequent overlaps in the different categories) reflect the differing noise goals of a community, the community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution (OPR 2017).

L_{dn} = day-night average level; CNEL = Community Noise Equivalent Level; dBA = A-weighted decibel scale; N/A – = Not Applicable

C.2.26 San Luis Reservoir State Recreation Area Resource Management Plan/ General Plan

Through an agreement between Reclamation and CDPR, a Resource Management Plan (RMP)/GP was prepared for the San Luis Reservoir State Recreation Area (SRA) and adjoining Reclamation land (Reclamation and CDPR 2013). These areas are managed by State agencies including CDPR, DWR, CDFW, and Reclamation.

C.2.26.1 Visual Resources

Elements of the plan include limiting areas of future development and avoiding environmentally sensitive areas. The aesthetic resource goals of the plan include:

- Goal RES-S1: Preserve scenic vistas that overlook open land and water through the identification and definition of significant vista points and viewsheds.
- Goal RES-S1: Maintain large expanses of open space free of visual and physical interruptions.
- Goal RES-S1: Make new structures architecturally compatible with their use as recreation facilities and distinguishable from the water operations structures but in keeping with overall site character.

- Goal RES-S1: Identify a common and unified set of site-related details and materials (signage, gates, surface materials, fences, etc.) so that new facilities and infrastructure are compatible with the character of the site and are distinctive for recreation facilities.
- Goal RES-S1: Prevent aesthetic and environmental damage from duration and intensity of lighting and fixtures.

C.2.26.2 Terrestrial Resources

The San Luis Reservoir SRA RMP/GP sets forth the following goals for the protection, management, and restoration of vegetation and wildlife:

- Goal RES-V1: Protect, maintain, and, where appropriate, restore the site's locally and regionally important native plant communities.
- Goal RES-V2: Document and protect special-status plants and communities and manage for their perpetuation and enhancement.
- Goal RES-V3: Control invasive and non-native species.
- Goal RES-V4: Restore the project area's native grasslands through the use of BMPs.
- Goal RES-W1: Maintain, protect, and enhance wildlife habitat for common, sensitive, and special-status wildlife species.

C.2.26.3 Recreation

The SRA RMP/GP identifies a series of policies in the form of goals and guidelines. Goals and guidelines related to recreation include:

- Goal VIS-F1 - Maintain and provide new visitor facilities and uses that enhance recreational enjoyment of the site's history and character while avoiding resource degradation.

  - Plan for recreational opportunities within a regional context and in coordination with other plans (e.g., the Millerton Lake RMP, Pacheco SP, Hollister Hills State Vehicular Recreation Area, and Merced County and Santa Clara County parks) so that facilities are balanced within the region and are compatible with the location and resources.

  - Provide for a variety of day-use activities and overnight camping facilities that accommodate visitors of varying abilities.

- Goal VIS-F2 - Provide adequate shoreline and upland support facilities and management at each reservoir and use area to address current and future demand for permitted recreational uses, consistent with management zones and natural and cultural resource goals and guidelines.

  - Ensure that campground and day use additions and improvements respond to and are prioritized based on user demand.

- Goal VIS-F3 - Manage water surfaces and use areas to accommodate a variety of different user groups and minimize resource degradation and conflicts among users.

  - Resolve water surface use conflicts using a variety of methods, such as but not limited to seasonal and time-of-day restrictions and "no wake" or "reduced speed" zones.

  - Optimize and coordinate water and land based recreational uses by development of a boating management plan.

- Goal VIS-T1 - Provide an appropriate amount and variety of trails in a range of locations throughout the Plan Area as well as improved connectivity from existing trails.

  - Maintain a system of multi-use trails to meet visitor demand.

- Goal VIS-T2 - Balance the optimum visitor experience while avoiding habitat fragmentation or other site degradation.

  - Use BMPs to maintain trails and minimize erosion.

C.2.27 Seismic Hazards Mapping Act

The 1990 Seismic Hazards Mapping Act (PRC Section 2690-2699.6) was enacted to minimize loss of life and property from strong ground shaking, liquefaction, landslides, or other ground failures as a result of earthquakes. The Act requires the California Geological Survey to identify and map areas with the potential for liquefaction, landslides, or ground shaking. These maps are used by cities and counties in their land use permitting process and to adequately prepare the safety element of their general plans (California Department of Conservation [DOC] 2019). Permits for development projects are not issued until geologic investigations have been completed and mitigation has been developed to address any seismic hazard issues.

C.2.28 State Scenic Highway Program

California's Scenic Highway Program was created by the Legislature in 1963. Applicable state regulations protecting visual resources stem from the protection of state scenic highways running through or near the project area. There are two officially designated state scenic highway, State Route (SR) 152 and Interstate 5 from SR 152 to SR 205 near the City of Tracy, in the area of analysis (Caltrans 2019). Caltrans has full control and possession of all state highways, and the Scenic Highway Program is under their stewardship as well. Scenic highway legislation establishes the state's responsibility to protect and enhance California's scenic beauty by identifying portions of the state highway system and adjacent scenic corridors, which require special conservation treatment. The legislation also assigns responsibility for regulating land use and development along scenic highways to the appropriate local governmental agencies (Caltrans 2008).

C.2.29 State Water Resource Control Board Hazardous Waste Programs

The California SWRCB is responsible for several programs related to cleanup and management of hazardous waste sites in California including: the Site Cleanup Program, UST Program, Department of Defense Program, and Land Disposal (SWRCB 2017). All of these programs are administered by the Central Valley RWQCB in Merced County (SWRCB 2013). The Cleanup Program regulates unauthorized releases to soils and groundwater, and in some cases surface waters or sediments. The purpose of the UST Program is to "protect public health and safety and the environment from releases of petroleum and other hazardous substances from tanks." The Land Disposal program regulates the discharge of waste "to land for treatment, storage and disposal" (SWRCB 2017).

C.2.30 Surface Mining and Reclamation Act of 1975

The Surface Mining and Reclamation Act (SMARA) of 1975 (Public Resources Code, Division 2, Chapter 9, § 2710 et. seq.) addresses surface mining and requires mitigation to reduce adverse impacts to public health, property, and the environment. Through the law, the State Geologist instated mineral land classifications to help identify and protect mineral resources in the state that may be subject to urban development pressures or other "irreversible land uses" which would inhibit mineral extraction (California DOC, State Mining and Geology Board [SMGB] and Division of Mines and Geology Nd.). Following classification by the State Geologist, the SMGB designates lands containing mineral deposits as being of regional or statewide significance (California DOC, SMGB and Division of Mines and Geology Nd.).

The SMARA applies to anyone (including a government agency) that disturbs more than one acre or removes more than 1,000 cubic yards of material through surface mining activities, even if activities occur on federally managed lands (California DOC, Division of Mine Reclamation [DMC] 2007). Local city and county Lead Agencies are required to develop ordinances for permitting that provide the regulatory framework for mining and reclamation activities. The SMGB reviews Lead Agency ordinances to ensure they comply with SMARA (California DOC, DMC 2007).

The SMARA regulations, Article 2, describes areas designated as having regional significance due to the presence of mineral resources. Construction aggregate resources in the South San Francisco Bay Region are identified in Article 2 (§3550.10). There are no areas designated as having regional mineral significance within the area where construction of the alternative would take place; the closest area is located northeast of Lexington Reservoir, located south of Los Gatos (California DOC, Division of Mines and Geology 1987). There are no areas in the vicinity of San Luis Reservoir that are mined for aggregate mineral resources or that have been determined to contain minerals of regional, statewide, or multi-community significance (Clinkenbeard and Gius 2018).

C.3 Local/Regional Requirements

C.3.1 Guide to Building Permits and Inspections in Merced County (Unincorporated Areas)

The Merced County Public Works Department regulates building and building safety within the unincorporated county. The Building and Safety Division and the Planning and Community Development Department are responsible for assessing proposed building projects and issuing building permits (Merced County 2011). Merced County does not have a grading ordinance and does not require permits for proposed grading.

C.3.2 Merced County Code

C.3.2.1 Noise

The Merced County Code (Section 10.60.030) sets sound level limitations for the county. General limitations state that no sound source should exceed the background sound level at the receiving property line by 10 dBA or more during the daytime hours (7:00 a.m. to 10:00 p.m.) and by 5 dBA or more during the nighttime hours (10:00 p.m. to 7:00 a.m.). The maximum permissible sound levels for residential property are 65 dBA L_{dn} or 75 dBA $L_{max.}$ The maximum permissible sound levels for property other than residential property are 70 dBA L_{dn} or 80 dBA L_{max} (Merced County 2009).

The County's ordinance exempts construction activities, "provided that all construction in or adjacent to urban areas shall be limited to the daytime hours between 7:00 a.m. and 6:00 p.m., and all construction equipment shall be properly muffled and maintained." Operation of construction equipment outside of these daytime hours or at any time on a weekend day or legal holiday is prohibited (Merced County 2009).

C.3.2.2 Vibration

Section 18.41.090 of the Merced County Code states that no use shall create any disturbing ground vibration based on typical human reaction beyond the boundaries of the site (Merced County 2019).

C.3.2.3 Geology, Seismicity, and Soils

The Merced County Code Title 16, Chapter 16.16 requires construction projects within the county's jurisdiction to follow the International Building Code standards and California State Amendments to the code (Ord. 1856 § 2, 2009). Among other important specifications, the International Building Code includes requirements and standards for geotechnical investigations (Section 1803); excavation, grading, and fill (Section 1804); structural design (Chapter 16); and, earthquake loads (Section 1613).

Chapter 18.43 establishes the county's surface mining and reclamation ordinance. Merced's ordinance was certified in 1997. The purpose of the county's ordinance is to regulate surface mining and reclamation operations consistent with the county general plan and the SMARA at the state level. The county's SMARA ordinance was certified by the SMGB in 1997.

Chapter 18.41 of the county code sets performance standards to ensure compatibility between land uses by limiting such things as fumes, odor, noise, and dust. Section 030 covers dust mitigation from construction activities including clearing, grading, earth moving and other site preparation activities. The ordinance requires the application of water to prevent dust from leaving the project site.

C.3.3 Merced County General Plan

As required by state law, counties have developed their own general plans. At a minimum, these documents must address the topics of land use, transportation, housing, conservation, open space, noise, and safety. These documents serve as statements of county goals, policies, standards, and implementation programs for the physical development of a county.

The following goals and policies from the Merced County General Plan are relevant to B.F. Sisk Dam Raise and Reservoir Expansion Project resources. The Merced General Plan, adopted in 2013, has established the year 2030 as the plan's time horizon (Merced County 2013).

C.3.3.1 Water Quality

The Water Element contains the following goal and policies related to water quality (Merced County 2013):

- Goal W-2: Protect the quality of surface and groundwater resources to meet the needs of all users.

- Policy W-2.1: Ensure that land uses and development on or near water resources will not impair the quality or productive capacity of these water resources.
- Policy W-2.2: Prepare updated development regulations, such as BMPs, that prevent adverse effects on water resources from construction and development activities.
- Policy W-2.3: Encourage the use of natural channels for drainage and flood control to benefit water quality and other natural resource values.
- Policy W-2.4: Encourage agriculture and urban practices to comply with the requirements of the RWQCB for irrigated lands and confined animal facilities, which mandate agricultural practices that minimize erosion and the generation of contaminated runoff to ground or surface waters by providing assistance and incentives
- Policy W-2.7: Monitor and enforce provisions of the USEPA NPDES program to control non-point source water pollution.
- Policy W-2.8: Coordinate with the SWRCB, RWQCB, and other responsible agencies to ensure that sources of water contamination (including boron, salt, selenium and other trace element concentrations) do not enter agricultural or domestic water supplies and will be reduced where water quality is already affected.

C.3.3.2 Noise and Vibration

The plan includes noise standards for new noise-sensitive land uses such as residences, hospitals, and churches that are affected by transportation noise sources, as shown in Table 4 (Merced County 2013). Table 5 summarizes the interior and exterior noise level standards for noise-sensitive areas affected by existing non-transportation noise sources.

Table 4. Noise Standards for New Uses Affected by Traffic, Railroad and Airport Noise in Merced County

New Land Use	Sensitive Outdoor Area[1] – L_{dn} (dBA)	Sensitive Indoor Area[2] – L_{dn} (dBA)
All residential[3]	65	45
Transient Lodging[3,4]	65	45
Hospitals & Nursing Homes[3,4,5]	65	45
Theaters & Auditoriums[4]	---	35
Churches, Meeting Halls, Schools, Libraries, etc.[4]	65	40
Office Buildings[4]	65	45
Commercial Buildings[4]	---	50
Playgrounds, Parks, etc.	70	---
Industry[4]	65	50

Source: Merced County 2013.

Notes:

[1] Sensitive Outdoor Areas include primary outdoor activity areas associated with any given land use at which noise-sensitivity exists and the location at which the County's exterior noise level standards are applied.

[2] Sensitive Interior Areas includes any interior area associated with any given land use at which noise-sensitivity exists and the location at which the County's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, theaters. Interior noise level standards are applied within noise-sensitive areas of the various land uses with windows and doors in the closed positions.
[3] Railroad warning horn usage shall not be included in the computation of Ldn.
[4] Only the interior noise level standard shall apply if there are no sensitive exterior spaces proposed for these uses.
[5] Since hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital staff or patients.

Table 5. Non-Transportation Noise Standards Median (L_{50}) / Maximum (L_{max})[1]

Receiving Land Use	Outdoor Daytime (dBA)	Outdoor Nighttime (dBA)	Interior Day or Night (dBA)
All residential	55 / 75	50 / 70	35 / 55
Transient Lodging[4]	55 / 75	---	35 / 55
Hospitals & Nursing Homes[5,6]	55 / 75	---	35 / 55
Theaters & Auditoriums[6]	---	---	30 / 50
Churches, Meeting Halls, Schools, Libraries, etc.[6]	55 / 75	---	35 / 60
Office Buildings[6]	60 / 75	---	45 / 65
Commercial Buildings[6]	55 / 75	---	45 / 65
Playgrounds, Parks, etc.[6]	65 / 75	---	---
Industry[6]	60 / 80	---	50 / 70

Source: Merced County 2013.

Notes:
[1] These standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards in this table, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.
[2] Sensitive Outdoor Areas include primary outdoor activity areas associated with any given land use at which noise-sensitivity exists and the location at which the County's exterior noise level standards are applied.
[3] Sensitive Interior Areas includes any interior area associated with any given land use at which noise-sensitivity exists and the location at which the County's interior noise level standards are applied. Examples of sensitive interior spaces include, but are not limited to, all habitable rooms of residential and transient lodging facilities, hospital rooms, classrooms, library interiors, offices, worship spaces, theaters. Interior noise level standards are applied within noise-sensitive areas of the various land uses with windows and doors in the closed positions.
[4] Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
[5] Since hospitals are often noise-generating uses, the exterior noise level standards are applicable only to clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
[6] The outdoor activity areas of these uses (if any) are not typically used during nighttime hours.

These standards are enforced to protect noise-sensitive land uses in the county and do not pertain to short-term construction noise.

C.3.3.3 Geology, Seismicity, and Soils

The Health and Safety Element outlines the following goals and policies related to seismic and geologic hazards (Merced County 2013):

- Goal HS-1: Minimize the loss of life, injury, and property damage of County residents due to seismic and geologic hazards.

- Policy HS-1.1: Require that all new habitable structures be located and designed in compliance with the Alquist-Priolo Special Studies Zone Act and related state earthquake legislation.

- Policy HS-1.2: Support efforts to obtain financial assistance from federal and state agencies in order to implement corrective seismic safety measures required for existing County buildings and structures.

- Policy HS-1.3: Require all new structures located within dam inundation areas to conform to standards of dam safety as required by the State Division of SOD.

- Policy HS-1.4: Require earthquake resistant design for proposed critical structures such as hospitals, fire stations, emergency communication centers, private schools, high occupancy buildings, bridges and freeway overpasses, and dams that are subject to County permitting requirements.

- Policy HS-1.5: Encourage educational programs to inform the public of earthquake dangers in Merced County.

- Policy HS-1.6: Prohibit habitable structures on areas of unconsolidated landslide debris or in areas vulnerable to landslides.

- Policy HS-1.7: Discourage construction and grading on slopes in excess of 30%.

- Policy HS-1.8: Require that the provisions of the International Building Code be used to regulate projects subject to hazards from slope instability.

- Policy HS-1.9: Require and enforce all standards contained in the International Building Code related to construction on unstable soils.

The Natural Resources Element addresses goals, objectives, and policies related to soil and mineral resources in the county. Applicable policies include:

- Goal NR-3: Facilitate orderly development and extraction of mineral resources while preserving open space, natural resources, and soil resources and avoiding or mitigating significant adverse impacts.

  - Policy NR-3.1: Protect soil resources from erosion, contamination, and other effects that substantially reduce their value or lead to the creation of hazards.

  - Policy NR-3.2: Require minimal disturbance of vegetation during construction to improve soil stability, reduce erosion, and improve stormwater quality.

  - Policy NR-3.3: Encourage landowners to participate in programs that reduce soil erosion and increase soil productivity. This shall include promoting and coordinating the efforts of University of California Cooperative Extension, various Resource Conservation Districts, and other similar agencies and organizations.

C.3.3.4 Visual Resources

The Natural Resources Element and a Recreation and Cultural Resources Element provide goals and policies for visual resources in the county. The following policies are relevant to the protection of visual resources in the project area:

- Goal NR-4: Scenic Resources: Protect scenic resources and vistas.
  - Policy NR-4.1: Scenic Resource Preservation: Promote the preservation of agricultural land, ranch land, and other open space areas as a means of protecting the County's scenic resources.
  - Policy NR-4.2: Special Review Process for Structures Adjacent to Scenic Highways: Coordinate with Caltrans, during the review of proposed structures and activities located adjacent to state-designated scenic highways, to ensure that scenic vistas and local scenic values are not significantly degraded.
  - Policy NR-4.4: New Roads: Consider the surrounding landscape, topography, and existing scenic values when determining the location and construction of new roads.
  - Policy NR-4.5: Light Pollution Reduction: Require good lighting practices, such as the use of specific light fixtures that reduce the light pollution, minimize light impacts, and preserve views of the night sky.
- Goal RCR-1: Preserve, enhance, expand, and manage Merced County's diverse system of regional parks, trails, recreation areas, and natural resources for the enjoyment of present and future residents and park visitors.
  - Policy RCR-1.11: Scenic Resource and Public Land Protection: Encourage the use of regional parks and open space areas as a mechanism to preserve the County's natural scenic beauty and protect land for public purposes.

C.3.3.5 Fisheries Resources

The Natural Resources Element sets forth the following goal and policies regarding fisheries resources:

- Goal NR-1: Preserve and protect, through coordination with the public and private sectors, the biological resources of the County.
  - Policy NR-1.1: Habitat Protection- Identify areas that have significant long-term habitat and wetland values including riparian corridors, wetlands, grasslands, rivers and waterways, oak woodlands, and vernal pools, and provide information to landowners.
  - Policy NR-1.2: Protected Natural Lands- Identify and support methods to increase the acreage of protected natural lands and special habitats, including but not limited to, wetlands, grasslands, and vernal pools, potentially through the use of conservation easements.

- Policy NR-1.4: Important Vegetative Resource Protection- Minimize the removal of vegetative resources which stabilize slopes, reduce surface water runoff, erosion, and sedimentation.

- Policy NR-1.5: Wetland and Riparian Habitat Buffer- Identify wetlands and riparian habitat areas and designate a buffer zone around each area sufficient to protect them from degradation, encroachment, or loss.

- Policy NR-1.11: On-Going Habitat Protection and Monitoring- Cooperate with local, state, and federal agencies to ensure that adequate on---going protection and monitoring occurs adjacent to rare and endangered species habitats or within identified significant wetlands.

- Policy NR-1.12: Wetland Avoidance- Avoid or minimize loss of existing wetland resources by careful placement and construction of any necessary new public utilities and facilities, including roads, railroads, high speed rail, sewage disposal ponds, gas lines, electrical lines, and water/wastewater systems.

- Policy NR-1.13: Wetland Setbacks- Require an appropriate setback, to be determined during the development review process, for developed and agricultural uses from the delineated edges of wetlands.

- Policy NR-1.15: Urban Forest Protection and Expansion- Protect existing trees and encourage the planting of new trees in existing communities. Adopt an Oak Woodland Ordinance that requires trees, larger than a specified diameter, that are removed to accommodate development be replaced at a set ratio.

- Policy NR-1.17: Agency Coordination- Coordinate with private, local, state, and federal agencies to assist in the protection of biological resources and prevention of degradation, encroachment, or loss of resources managed by these agencies.

C.3.3.6 Recreation

The Recreation and Cultural Resources Element provides policy context to achieve the county's vision for recreation opportunities. The following goal and policies are relevant to the protection of recreation in the project area:

- Goal RCR-1: Preserve, enhance, expand, and manage Merced County's diverse system of regional parks, trails, recreation areas, and natural resources for the enjoyment of present and future residents and park visitors.

  - Policy RCR-1.1: Public Recreation Land Use - Encourage the continuation and expansion of existing public recreation land uses, including, but not limited to, public beaches, parks, recreation areas, wild areas, and trails.

  - Policy RCR-1.11: Scenic Resource and Public Land Protection - Encourage the use of regional parks and open space areas as a mechanism to preserve the County's natural scenic beauty and protect land for public resources.

- Policy RCR-1.12: Recreation Services - Support recreation services to promote the full use of recreation facilities within their design capacity, and improve connections and access to a wide range of recreation opportunities in order to improve the quality of life for residents and visitors.

C.3.3.7 Cultural Resources

The main goals and policies governing cultural resources at the regional or local level in Merced County are outlined in the 2030 Merced County General Plan (Merced County 2013). The most inclusive of these is Goal RCR-2, which calls for the protection and preservation of cultural, archaeological, and historic resources to maintain the unique character of Merced County.

C.3.4 Merced County Office of Environmental Services

Emergency preparedness, coordination and direction of wide-scale disasters and emergencies are provided by the Merced County Office of Environmental Services (OES). The Merced County OES coordinates planning, response, recovery, and mitigation activities with many partners including incorporated and unincorporated cities, special districts, and some private agencies. The Merced County OES and their partner agencies coordinate and maintain Emergency Operations Plans according to the National Incident Management System for the County. Contained within the Merced County Emergency Operations Plan is guidance for handling and managing large-scale incidents and disasters including public health threats (Merced County 2020).

C.3.5 San Joaquin Valley Air Pollution Control District Air Quality Management Plans

The San Joaquin Valley Air Pollution Control District (SJVAPCD) has jurisdiction over the San Joaquin Valley Air Basin, which includes O_3, PM_{10}, and $PM_{2.5}$ nonattainment areas. Figure 1 depicts the location of the SJVAPCD and nearby air districts in relation to the components associated with the proposed action.

The air districts have adopted a series of air quality management plans to meet the CAAQS and NAAQS. These plans require, among other emissions-reducing activities, control technology for existing sources; control programs for area sources and indirect sources; a permitting system designed to ensure no net increase in emissions from any new or modified permitted sources of emissions; transportation control measures; sufficient control strategies to achieve a 5% or more annual reduction in emissions (or 15% or more in a three-year period) for volatile organic compound, nitrogen oxides, CO, and PM_{10}; and demonstration of compliance with CARB's established reporting periods for compliance with air quality goals.

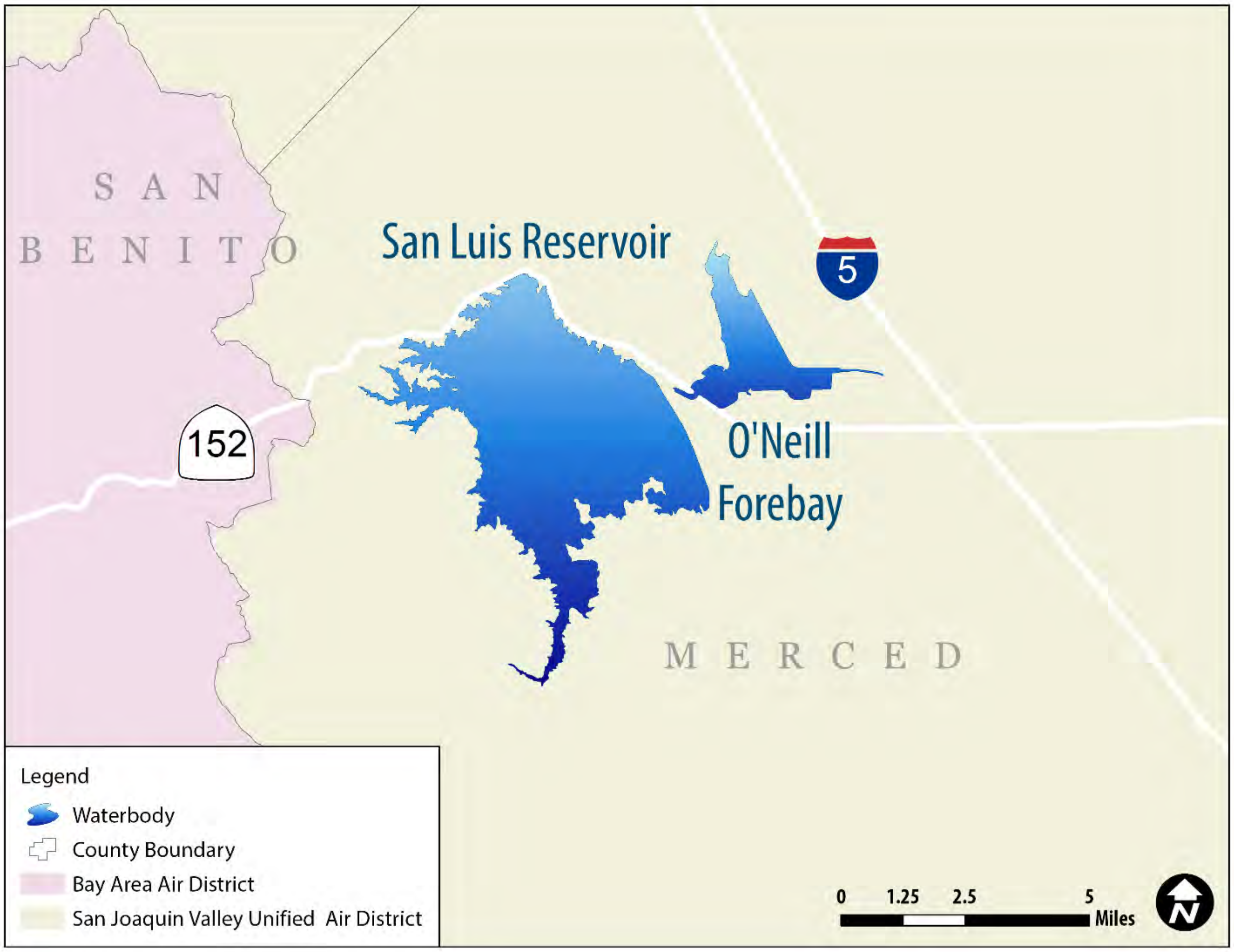

Figure 1. California Air Districts

C.3.6 San Joaquin Valley Air Pollution Control District Programs

The SJVAPCD is the local agency that is primarily responsible for regulating emissions from stationary sources. It also develops plans and implements control measures as required by state and federal requirements. To assist the Lead Agency with analyzing GHG emission and climate change impacts under CEQA, the SJVAPCD adopted two policies:

- "Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency" (SJVAPCD 2009a)
- "Guidance for Valley Land-use Agencies in Addressing GHG Emission Impacts for New Projects under CEQA" (SJVAPCD 2009b)

The SJVAPCD has not adopted a quantitative threshold for evaluating the significance of GHG emissions; however, the SJVAPCD's guidance document for Valley land-use agencies (2009b) would be most relevant for assessing GHG-related impacts from the proposed restoration activities. In this guidance document, the SJVAPCD relies on the implementation of best performance standards (BPS), defined as the most effective achieved-in-practice means of reducing or limiting GHG emissions from a GHG emissions source, for evaluating a project's significance. Projects implementing BPS would be determined to have less than significant individual and cumulative impacts on global climate change.

If a project does not implement BPS, then quantification of project-specific GHG emissions would be required. If project-related emissions would be reduced or mitigated by at least 29% compared to business-as-usual[4], then the project would be determined to have a less than significant individual and cumulative impact for GHG.

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[4] Business-as-usual "is referenced in the CARB's AB 32 Scoping Plan as the Business-as-usual emissions occurring in 2020 if the average baseline emissions during the 2002-2004 period were grown to 2020 levels, without controls. Therefore, 2002-2004 emissions factors, on a unit of activity basis, multiplied by the activity expected to occur in 2020, is an appropriate representative of 2020 business as usual (BAU)." (SJVAPCD 2009b)

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix D: Water Quality Technical Appendix

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Appendix D Water Quality Technical Appendix

The sections below provide detailed information about constituents of concern listed in the Clean Water Act (CWA) and beneficial uses of California waters defined in the California Water Code. This section also discusses water quality in the Sacramento-San Joaquin River Delta (Delta), and general water quality characteristics of reservoirs. Water quality monitoring and water quality modeling results are included.

D.1 Clean Water Act Section 303(d) Listed Water Bodies

Various water bodies within the area of analysis have been identified as impaired for certain constituents of concern, as listed on the 2016 Section 303(d) list under the CWA. CWA Section 303(d) requires states to identify water bodies that do not meet applicable water quality standards after the application of certain technology-based controls on point source discharges. As defined in the CWA and federal regulations, water quality standards include the designated beneficial uses of a water body, the adopted water quality criteria necessary to protect those uses, and an antidegradation policy. As defined in the Porter-Cologne Water Quality Control Act, water quality standards are associated with designated beneficial uses of a water body, the established water quality objectives (both narrative and numeric), and California's nondegradation policy (State Water Resources Control Board [SWRCB] Resolution No. 68-16). Appendix C, Regulatory Setting contains a description of the CWA and the Section 303(d) listing process.

Certain water bodies in the area of analysis are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 1 presents the 2016 Section 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water. Section D.2 provides information on the constituents of concern listed in Table 1.

Table 1. Section 303(d) Listed Water Bodies Within the Area of Analysis and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected[1]	Proposed TMDL Completion Year	Region
O'Neill Forebay	Mercury PCBs	Source Unknown Source Unknown	2,254 acres 2,254 acres	2012 2027	Merced County
Sacramento-San Joaquin River Delta	Chlordane DDT Dieldrin Dioxin compounds (including 2,3,7,8-TCDD) Furan Compounds Invasive Species Mercury PCBs PCBs (dioxin-like) Selenium	Nonpoint Source Nonpoint Source Nonpoint Source Atmospheric Deposition Atmospheric Deposition Ballast Water Industrial Point Sources, Unknown Nonpoint Source, Municipal Point Sources, Resource Extraction Nonpoint Source Municipal Point Sources Resource Extraction, Atmospheric Deposition, Unknown Nonpoint Source	41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres 41,736 acres	2029 2013 2013 2019 2019 2019 2008 2008 2010 2016	Contra Costa, Sacramento, San Joaquin, Solano and Yolo Counties
San Luis Reservoir	Chlordane DDT Mercury PCBs	Source Unknown Source Unknown Source Unknown Source Unknown	13,007 acres 13,007 acres 13,007 acres 13,007 acres	2027 2027 2027 2027	Merced County

Source: SWRCB 2018a

[1] Estimated area affected is given as the surface area (acres) of lakes or estuaries or length (river miles) for river systems.

DDT – dichlorodiphenyltrichloroethane
PCB – polychlorinated biphenyl
TCDD – tetrachlorodibenzodioxin
TMDL – total maximum daily load

D.2 Constitutes of Concern

D.2.1 Chlordane

Chlordane is a manufactured chemical that was used as a pesticide in the United States from 1948 to 1988. Technically, chlordane is not a single chemical but a mixture of pure chlordane and many related chemicals. It does not occur naturally in the environment. It is a thick liquid whose color ranges from colorless to amber. Chlordane has a mild, irritating smell. Some of its trade names are

Octachlor and Velsicol 1068. Until 1983, chlordane was used as a pesticide on crops like corn and citrus and on home lawns and gardens. Because of concern about damage to the environment and harm to human health, the United States Environmental Protection Agency (EPA) banned all uses of chlordane in 1983 except to control termites. In 1988, EPA banned all uses (Agency for Toxic Substances and Disease Registry [ATSDR] 1995).

Chlordane entered the environment through its use as a pesticide on and as termite control. Chlordane sticks strongly to soil particles at the surface and is not likely to enter groundwater. It can stay in the soil for over 20 years. Most chlordane leaves soil by evaporation to the air, where it breaks down slowly. Chlordane does not dissolve easily in water, and it builds up in the tissues of fish, birds, and mammals. Exposure to chlordane could occur by eating crops grown in soil that contains chlordane; eating fish or shellfish caught in water that is contaminated by chlordane; breathing air or touching soil near homes treated for termites with chlordane; and by breathing air or by touching soil near waste sites or landfills.

Chlordane affects the nervous system, digestive system, and liver in people and animals. Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice have occurred in people who breathed air containing high concentrations of chlordane or accidentally swallowed small amounts of chlordane. Large amounts of chlordane taken by mouth can cause convulsions and death in people. Federal agencies have made several recommendations to protect human health, including:

- EPA recommends that a child should not drink water with more than 60 parts of chlordane per billion parts of drinking water (60 parts per billion [ppb]) for longer than 1 day. The EPA has set a limit in drinking water of 2 ppb.
- EPA requires spills or releases of chlordane into the environment of 1 pound or more to be reported to the EPA (ATSDR 1995).
- The United States Food and Drug Administration (FDA) limits the amount of chlordane and its breakdown products in most fruits and vegetables to less than 300 ppb and in animal fat and fish to less than 100 ppb (ATSDR 1995).
- The Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), and American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 0.5 milligrams of chlordane per cubic meter (mg/m^3) in workplace air for an 8-hour workday, 40-hour workweek. These agencies have advised that eye and skin contact should be avoided because this may be a significant route of exposure (ATSDR 1995).

EPA has established the following freshwater and saltwater aquatic life criteria for chlordane:

- 2.4 micrograms per liter (μg/L) maximum concentration; 0.0043 μg/L continuous concentration for freshwater aquatic life (EPA 2010a).
- 0.09 μg/L maximum concentration; 0.004 μg/L continuous concentration for saltwater aquatic life (EPA 2010a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not involve the use of Chlordane and would not impact levels of Chlordane in the San Luis Reservoir region.

D.2.2 DDT

Dichlorodiphenyltrichloroethane (DDT) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the United States was banned in 1972 because of damage to wildlife, but it is still used in some countries. Dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD) are chemicals similar to DDT that contaminate commercial DDT preparations (ATSDR 2019).

DDT entered the environment when it was used as a pesticide; it still enters the environment because of current use in other countries. DDT sticks strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms. Half the DDT in soil will break down in 2–15 years, depending on the type of soil. Only a small amount will go through the soil into groundwater, and it does not dissolve easily in water. Exposure to DDT occurs through eating contaminated foods, such as root and leafy vegetable, fatty meat, fish, and poultry, but levels are low; eating contaminated imported foods from countries that still allow the use of DDT to control pests; breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals; infants fed on breast milk from mothers who have been exposed; and breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies. Federal agencies have made several recommendations to protect human health, including:

- OSHA sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek (ATSDR 2019).
- FDA has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market (ATSDR 2019).

DDT, and especially DDE, builds up in plants and in fatty tissues of fish, birds, and other animals. In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Short-term oral exposure to small amounts of DDT or its breakdown products may have harmful effects on animal reproduction. EPA has established the following freshwater and saltwater aquatic life criteria for DDT:

- 1.1 μg/L maximum concentration; 0.001 μg/L continuous concentration for freshwater aquatic life (EPA 2010a).

- 0.13 μg/L maximum concentration; 0.001 μg/L continuous concentration for saltwater aquatic life (EPA 2010a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not involve the use of DDT and would not impact levels of DDT in the San Luis Reservoir region.

D.2.3 Diazinon

Diazinon is the common name of an organophosphorus insecticide used to control pest insects in soil, on ornamental plants, and on fruit and vegetable field crops. It also is used to control household pests such as flies, fleas, and cockroaches. This chemical is manufactured and does not occur naturally in the environment. The pure chemical is colorless and practically odorless oil. Most of the diazinon used is in liquid form, but it is possible to be exposed to the chemical in a solid form. Diazinon does not burn easily and does not dissolve easily in water (ATSDR 2008).

Most environmental diazinon contamination comes from agricultural and household application to control insects. Sales of home and garden products ceased in the United States in 2004 for products containing diazinon; however, some people may have these products stored at their homes. Diazinon also may enter the environment during the manufacturing process. It is often sprayed on crops and plants, so small particles of the chemical may be carried away from the field or yard before falling to the ground. After diazinon has been applied, it may be present in the soil, surface waters, and on the surface of the plants. Diazinon on soil and plant surfaces may be washed into surface waters by rain. In the environment, diazinon is rapidly broken down into a variety of other chemicals. It can move through the soil and contaminate ground water. Diazinon is not likely to build up to high or dangerous levels in animal or plant foods. Exposure to diazinon occurs through contact with contaminated soils or contaminated runoff water or groundwater. People who work in the manufacture and professional application of diazinon have the most significant exposure to this insecticide.

Most cases of unintentional diazinon poisoning in people have resulted from short exposures to high concentrations of the material. Diazinon affects the nervous system. Some mild symptoms include headache, dizziness, weakness, feelings of anxiety, constriction of the pupils of the eye, and not being able to see clearly. More severe symptoms include nausea and vomiting, abdominal cramps, slow pulse, diarrhea, pinpoint pupils, difficulty breathing, and coma. EPA has developed the following recommendations to protect human health:

- No harmful effects in a child are expected with exposure to diazinon in drinking water at a concentration of 20 μg/L for up to 10 days.
- Lifetime exposure to 1 μg/L diazinon in drinking water is not expected to cause harmful effects.

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not involve the use of diazinon and would not impact levels of diazinon in the San Luis Reservoir region.

D.2.4 Dieldrin

Pure dieldrin is a white powder with a mild chemical odor. The less pure commercial powders have a tan color. Neither substance occurs naturally in the environment. From the 1950s until 1970, dieldrin was a widely used pesticide for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of dieldrin in 1974, except to control termites. In 1987, EPA banned all uses (ATSDR 2002).

Sunlight and bacteria change aldrin to dieldrin so that dieldrin is the compound more likely to be found in the environment. They bind tightly to soil and slowly evaporate to the air. Dieldrin in soil and water breaks down slowly. Plants take in and store aldrin and dieldrin from the soil. Aldrin rapidly changes to dieldrin in plants and animals. Dieldrin is stored in the fat and leaves the body slowly. Dieldrin is everywhere in the environment, but at low levels. Exposure could occur through eating food like fish or shellfish from lakes or streams contaminated with either chemical or contaminated root crops, dairy products, or meats. Air, surface water, or soil near waste sites may contain higher levels.

People who have ingested large amounts of aldrin or dieldrin suffered convulsions and some died. Health effects may occur after a longer period of exposure to smaller amounts because these chemicals build up in the body. Some workers exposed to moderate levels in the air for a long time had headaches, dizziness, irritability, vomiting, and uncontrolled muscle movements. Workers removed from the source of exposure rapidly recovered from most of these effects. Animals exposed to high amounts of aldrin or dieldrin also had nervous system effects. In animals, oral exposure to lower levels for a long period also affected the liver and decreased their ability to fight infections. Federal agencies have made several recommendations to protect human health, including:

- EPA limits the amount of aldrin and dieldrin that may be present in drinking water to 0.001 and 0.002 milligrams per liter (mg/L) of water, respectively, for protection against health effects other than cancer. EPA has determined that a maximum concentration of aldrin and dieldrin of 0.0002 mg/L in drinking water limits the lifetime risk of developing cancer from exposure to each compound to 1 in 10,000 (ATSDR 2002).

- OSHA sets a maximum average of 0.25 milligrams of aldrin and dieldrin per cubic meter of air (0.25 mg/m^3) in the workplace during an 8-hour shift, 40-hour workweek. NIOSH also recommends a limit of 0.25 mg/m^3 for both compounds for up to a 10-hour workday, 40-hour week (ATSDR 2002).

- FDA regulates the residues of aldrin and dieldrin in raw foods. The allowable range is from 0 to 0.1 parts per million (ppm), depending on the type of food product (ATSDR 2002).

EPA has established the following freshwater and saltwater aquatic life criteria for aldrin and dieldrin:

- Dieldrin – 2.5 μg/L maximum concentration; 0.0019 μg/L continuous concentration for freshwater aquatic life (EPA 2010a).

- Dieldrin – 0.71 μg/L maximum concentration; 0.0019 μg/L continuous concentration for saltwater aquatic life (EPA 2010a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not involve the use of dieldrin and would not impact levels of dieldrin in the San Luis Reservoir region.

D.2.5 Dioxin and Furan Compounds

Dioxin and furan is the abbreviated or short name for a family of toxic substances that all share a similar chemical structure. Most dioxins and furans are not man-made or produced intentionally but are created when other chemicals or products are made.

The chlorinated dibenzo-p-dioxins (CDDs) are a class of compounds that are loosely referred to as dioxins. There are 75 possible dioxins. One of these compounds is called 2,3,7,8-tetrachlorodibenzodioxin (TCDD). It is one of the most toxic of the CDDs and is the one most studied. In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless, and the odors of the other CDDs are not known. CDDs are not intentionally manufactured by industry except for research purposes or as by-products. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs also are formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators (ATSDR 1998).

When released into the air, some CDDs may be transported long distances, even around the globe. When released in waste waters, some CDDs are broken down by sunlight and some evaporate to air, but most attach to soil and settle to the bottom sediment in water. CDD concentrations may build up in the food chain, resulting in measurable levels in animals. Eating food, primarily meat, dairy products, and fish makes up more than 90% of the intake of CDDs for the general population. Exposure also could occur by breathing low levels in air and drinking low levels in water; skin contact with certain pesticides and herbicides; living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs; and working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels. In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Federal agencies have made several recommendations to protect human health, including:

- EPA has set a limit of 0.00003 μg/L of 2,3,7,8-TCDD in drinking water (ATSDR 1998).

- Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA.
- FDA recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (ppt) (ATSDR 1998).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not create dioxins and furans and would not impact levels of dioxins and furans in the San Luis Reservoir region.

D.2.6 Invasive Species

The introduction of invasive species is the leading cause of biodiversity loss in aquatic systems. Nonnative plants or animals existing within a habitat are considered exotic species and can either be deliberately or accidentally introduced. Exotic species include plants, fishes, algae, mollusks, crustaceans, bacteria, and viruses. Many exotic species become invasive or otherwise cause harm to the economy, environment, or human health in their nonnative environment.

There are several different ways invasive species are introduced into freshwater environments, including ballast water, hull fouling, aquaculture escapes, and accidental or intentional introductions, among others (EPA 2016a). Vessels can be a significant pathway for the introduction or spread of invasive species through the discharge of ballast water containing invasive species or the transport of invasive species that have accumulated on ships' hulls. EPA and its federal partners, such as the United States Coast Guard, are working together and using their authorities to help address the environmental and economic threats associated with ship-related introductions of invasive species (EPA 2016a).

Invasive species can affect aquatic ecosystems directly or by affecting the land in ways that harm aquatic ecosystems. Invasive species represent the second leading cause of species extinction and loss of biodiversity in aquatic environments worldwide. They result in considerable economic effects through direct economic losses and management/control costs while dramatically altering ecosystems supporting commercial and recreational activities. Effects on aquatic ecosystems result in decreased native populations, modified water tables, changes in run-off dynamics, and fire frequency, among other alterations. These ecological changes in turn impact many recreational and commercial activities dependent on aquatic ecosystems (EPA 2016a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not create the potential for the introduction of invasive species in the San Luis Reservoir region.

D.2.7 Mercury

Mercury is a naturally occurring metal that has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make. Metallic mercury is used to produce chlorine gas and caustic soda and is used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments (ATSDR 1999).

Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and manufacturing plants. It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity. Methylmercury may be formed in water and soil by bacteria. Exposure to mercury can occur through eating fish or shellfish contaminated with methylmercury; breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels, release of mercury from dental work and medical treatments, and breathing contaminated workplace air or skin contact during use in the workplace (from businesses and industries that use mercury).

The nervous system is sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause effects such as lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation. Federal agencies have made several recommendations to protect human health, including:

- EPA has set a limit of 2 ppb of mercury in drinking water (ATSDR 1999).
- FDA has set a maximum permissible level of 1 ppm of methylmercury in seafood (ATSDR 1999).
- OSHA has set limits of 0.1 mg/m^3 of organic mercury in workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour workweeks (ATSDR 1999).

Various studies have shown that mercury is a mutagen, teratogen, and carcinogen. It bioaccumulates and biomagnifies in food chains. The inorganic forms of mercury are not as toxic as the organic forms (Eisler 1987). Mammalian species tend to absorb organic forms of mercury through the respiratory tract, gastrointestinal tract, and skin. The organic forms can cross placental barriers.

Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury. Chronic mercury poisoning in fish can cause emaciation due to appetite loss, brain lesions, diminished response to light intensity, inability to capture food, and abnormal muscle coordination (Eisler 1987). In general, aquatic species accumulate mercury rapidly and excretion is slow.

In mammals, subchronic exposure to mercury can cause deleterious effects on reproduction, growth and development, behavior, blood and serum chemistry, histology, and metabolism. Methylmercury irreversibly destroys neurons of the central nervous system. Symptoms to mercury exposure may not be evident for years after initial exposure (Eisler 1987). Smaller mammals are more sensitive to mercury exposure. Carnivorous mammals have been found to have greater concentrations of mercury within the liver and kidney than herbivorous species. EPA has established the following freshwater and saltwater aquatic life criteria for mercury:

- 2.1 μg/L maximum concentration; 0.012 μg/L continuous concentration for freshwater aquatic life (EPA 2010a).
- 1.8 μg/L maximum concentration; 0.025 μg/L continuous concentration for saltwater aquatic life (EPA 2010a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not generate or release mercury and would not impact levels of mercury in the San Luis Reservoir region.

D.2.8 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are made up of up to 209 individual chlorinated compounds known as congeners. No known natural sources of PCBs exist. They are in the form of either oily liquids or solids that may be colorless to light yellow or as vapor in air. No known smell or taste is associated with PCBs. In the United States, some commercial PCB mixtures are known by the trade name Aroclor. They are used as coolants and lubricants in transformers, capacitors, and other electrical equipment since they do not burn easily and are good insulators. In 1977, manufacturing of PCBs was stopped in the United States because of links to harmful effects. Products older than 1977 containing PCBs include old florescent lighting fixtures and electrical devices containing PCB capacitors and old microscope and hydraulic oils (ATSDR 2014).

During their manufacture, use and disposal, PCBs entered the air, water and soil caused from accidental spills and leaks during their transport, and from leaks or fires in products containing PCBs. PCBs are also released from hazardous waste sites, illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes incinerators. Since PCBs do not break down easily they may remain in the environment for long periods of time. PCBs in air can travel long distances and deposited in areas far away from the source. Most PCBs in water stick to organic particles and bottom sediments, however, a few may remain dissolved. They will bind strongly with soil. Small organisms and fish will take up PCBs in water as well as other animals who ingest them. PCBs accumulate in fish and marine mammals and may reach levels many thousands of times higher than in water (ATSDR 2014).

PCBs exposure to humans is through the use of things that leak PCBs into the air when they get hot including fluorescent lighting fixtures and electrical devices and appliances such as television sets and refrigerators that were made 30 or more years ago. They could also be a source of skin exposure. Ingesting contaminated food especially fish, meat or dairy products. Air near hazardous waste sites and contaminated well water are also sources of PCB contamination. Workplace exposure is prevalent during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials (ATSDR 2014).

Harmful health effects from PCB exposure to humans includes skin conditions such as acne and rashes. In other studies of workers exposed to PCBs, changes in blood and urine occurred that may indicate liver damage; however, PCB exposure in the general population is not likely to cause skin and liver effects. The United States Department of Health and Human Services has concluded that PCBs may reasonably be anticipated to be carcinogens and EPA and the International Agency for Research on Cancer have determined that PCBs are probably carcinogenic to humans (ATSDR 2014).

Federal and state agencies have made several recommendations to protect human health, including:

- EPA limits PCBs in drinking water to 0.5 ppb (ATSDR 2006).

- EPA requires that discharges, spills, or accidental releases of 1 pound or more into the environment must be reported (ATSDR 2006).
- EPA standard for eating the fish or shellfish or drinking the water from lakes or streams contaminated with PCBs is 0.17 ppt due to bioaccumulation (ATSDR 2006).
- FDA requires that infant and junior foods, eggs, milk, other dairy products, fish and shellfish, poultry, and red meat contain no more than 0.2–3 ppm (ATSDR 2006).
- OSHA limits worker inhalation over a period of 8 hours for 5 days per week of 42% chlorine PCBs to 1 mg/m^3 of air and 54% chlorine PCBs to 0.5 mg/m^3 of air (ATSDR 2006).
- Fish and wildlife consumption advisories for PCBs have been established by many states (ATSDR 2014).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not generate or release PCBs and would not impact levels of PCBs in the San Luis Reservoir region.

D.2.9 Selenium

Selenium is a metal commonly found in rocks and soil. In the environment, selenium is not often found in the pure form. Much of the selenium in rocks is combined with sulfide minerals or with silver, copper, lead, and nickel minerals. Selenium and oxygen combine to form several compounds. Selenium sulfide is a bright red-yellow powder used in antidandruff shampoo. Processed selenium is used in the electronics industry; as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; and as a constituent of fungicides (ATSDR 2003).

Small selenium particles in the air settle to the ground or are taken out of the air in rain. Selenium dust can enter the air from burning coal and oil. Soluble selenium compounds in agricultural fields can leave the field in irrigation drainage water and can enter water from rocks, soil, and industrial waste. Some compounds dissolve in water and some will settle to the bottom as particles. Selenium can collect in animals that live in water containing high levels of it. It can accumulate up the food chain. Exposure to selenium occurs by breathing air that contains it and by eating food, drinking water, or taking dietary supplements that contain it (ATSDR 2003).

People exposed to high levels of selenium orally over the short term have reported nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations have been known to cause a disease called selenosis, which includes hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities). Respiratory tract irritation, bronchitis, difficulty breathing, and stomach pains can be experiences with brief exposures to high levels of elemental selenium or selenium dioxide in air (ATSDR 2003). Federal agencies have made several recommendations to protect human health, including:

- EPA maximum contaminant level (MCL) for selenium in drinking water is 50 parts of selenium per billion parts of water (50 ppb) (ATSDR 2003).

- OSHA exposure limit for selenium compounds in workplace air is 0.2 mg/m^3 of selenium in air for an 8-hour day over a 40-hour workweek (ATSDR 2003).

- ATSDR and EPA have determined that 5 mg of selenium per kilogram of body weight taken daily would not be expected to cause any adverse health effects over the lifetime of such intake (ATSDR 2003).

Selenium bioaccumulates in aquatic food chains and causes toxic effects on fish and bird embryos (Lemly 1999). In aquatic organisms, selenium can result in loss of equilibrium and other neurological disorders, liver damage, reproductive failure, reduced growth, reduced movement rate, chromosomal aberrations, reduced hemoglobin and increased white blood cell count, and necrosis of the ovaries (EPA 2006). EPA has established the following freshwater and saltwater aquatic life criteria for selenium:

- 20 μg/L maximum concentration; 5 μg/L continuous concentration for freshwater aquatic life (EPA 2010a).

- 290 μg/L maximum concentration; 71 μg/L continuous concentration for saltwater aquatic life (EPA 2010a).

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project would not generate selenium and would not impact levels of selenium in the San Luis Reservoir region.

D.2.10 Unknown Toxicity

An unknown toxicity is defined as a toxicity that has been found within a waterbody but further testing has not been done to discover what the toxicity specifically is (Richard 2002). Waterbodies with unknown toxicity are those in which organisms exposed to water samples have shown signs of acute or chronic effects, including mortality, impaired growth, or reduced fecundity.

The construction and operation of the B.F. Sisk Dam Raise and Reservoir Expansion Project is not expected to impact levels of unknown toxicity in the San Luis Reservoir region.

D.3 Beneficial Uses

Application of water quality objectives (i.e., standards) to protect designated beneficial uses is critical to water quality management in California. State law defines beneficial uses to include "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

1. All water quality problems can generally be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (Central Valley RWQCB 2018).
2. Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use; it is merely a use that cannot be satisfied to the detriment of beneficial

uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (Central Valley RWQCB 2018).

3. The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters (Central Valley RWQCB 2018).
4. Fish, plants, and other wildlife and humans use water beneficially.

The Porter-Cologne Water Quality Control Act defines water quality objectives as, "…the limits or levels of water quality constituents or characteristics which are established for the reasonable protections of the beneficial uses of water or the preventions of nuisance within a specified area" (Water Code 13050(H)). The basin plans present water quality objectives in numerical or narrative format for specified water bodies or for protection of specified beneficial uses throughout a specific basin or region.

Beneficial use designation (and water quality objectives) must be reviewed at least once during each 3-year period for the purpose of modification as appropriate (40 Code of Federal Regulations [CFR] 131.20). The beneficial uses and abbreviations listed below are standard basin plan designations (Central Valley RWQCB 2018).

Municipal and Domestic Supply (MUN) – Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) – Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Industrial Service Supply (IND) – Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Industrial Process Supply (PRO) – Uses of water for industrial activities that depend primarily on water quality.

Ground Water Recharge (GWR) – Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) – Uses of water for natural or artificial maintenance of surface water quantity or quality.

Navigation (NAV) – Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) – Uses of water for hydropower generation.

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, canoeing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2) – Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) – Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) – Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) – Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) – Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wildlife Habitat (WILD) – Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) – Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance, where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) – Uses of water that support aquatic habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

Migration of Aquatic Organisms (MIGR) – Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN) – Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) – Uses of water that support habitats suitable for the collection of filter feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

The beneficial uses designated for waters within the area of analysis are presented in Table 2 (San Luis Region) and in Table 3 (Sacramento-San Joaquin River Delta Region). The beneficial uses designated for any specifically identified water body generally also apply to its tributary streams. In some cases, a beneficial use may not be applicable to the entire body of water. In these cases, RWQCB judgment is applied. Water bodies within the basins that do not have beneficial uses designated are assigned municipal and domestic supply designations per the provisions of SWRCB Resolution No. 88-63. These municipal and domestic supply designations in no way affect the presence or absence of other beneficial uses in these water bodies.

Table 2. Beneficial Uses of Water Bodies in the San Luis Region

Beneficial Use Designation	San Luis Reservoir	O'Neill Forebay
Municipal and Domestic Supply (MUN)	X	X
Agricultural Supply – Irrigation (AGR)	X	X
Agricultural Supply – Stock Watering (AGR)	X	X
Industrial Process Supply (PROC)		
Industrial Service Supply (IND)	X	
Industrial Power (POW)	X	
Water Contact Recreation (REC-1)	X	X
Canoeing and Rafting Recreation (REC-1)		
Non-contact Water Recreation (REC-2)	X	X
Wildlife Habitat (WILD)	X	
Navigation (NAV)		
Cold Freshwater Habitat (COLD)		
Warm Freshwater Habitat (WARM)	X	X
Cold Migration (MIGR)		
Warm Migration (MIGR)		
Cold Spawning (SPWN)		
Warm Spawning (SPWN)		

Source: Central Valley RWQCB 2018

Table 3. Beneficial Uses of Water Bodies in the Sacramento-San Joaquin River Delta

Beneficial Use Designation	Sacramento-San Joaquin River Delta
Municipal and Domestic Supply (MUN)	X
Agricultural Supply – Irrigation (AGR)	X
Industrial Process Supply (PRO)	X
Industrial Service Supply (IND)	X
Agricultural Supply (AGR)	X
Groundwater Recharge (GWR)	X
Navigation (NAV)	X
Water Contact Recreation (REC-1)	X
Non-contact Water Recreation (REC-2)	X
Shellfish Harvesting (SHELL)	X
Commercial and Sport Fishing (COMM)	X
Warm Freshwater Habitat (WARM)	X
Cold Freshwater Habitat (COLD)	X
Migration of aquatic organisms (MIGR)	X
Spawning, Reproduction, and/or Early Development (SPWN)	X
Estuarine Habitat (EST)	X
Wildlife Habitat (WILD)	X
Rare, Threatened, or Endangered Species (RARE)	X

Source: SWRCB 2018b

D.4 Reservoir Water Quality

This section describes how lakes and reservoirs function and the limnological processes that occur within them to provide a better understanding of water quality.

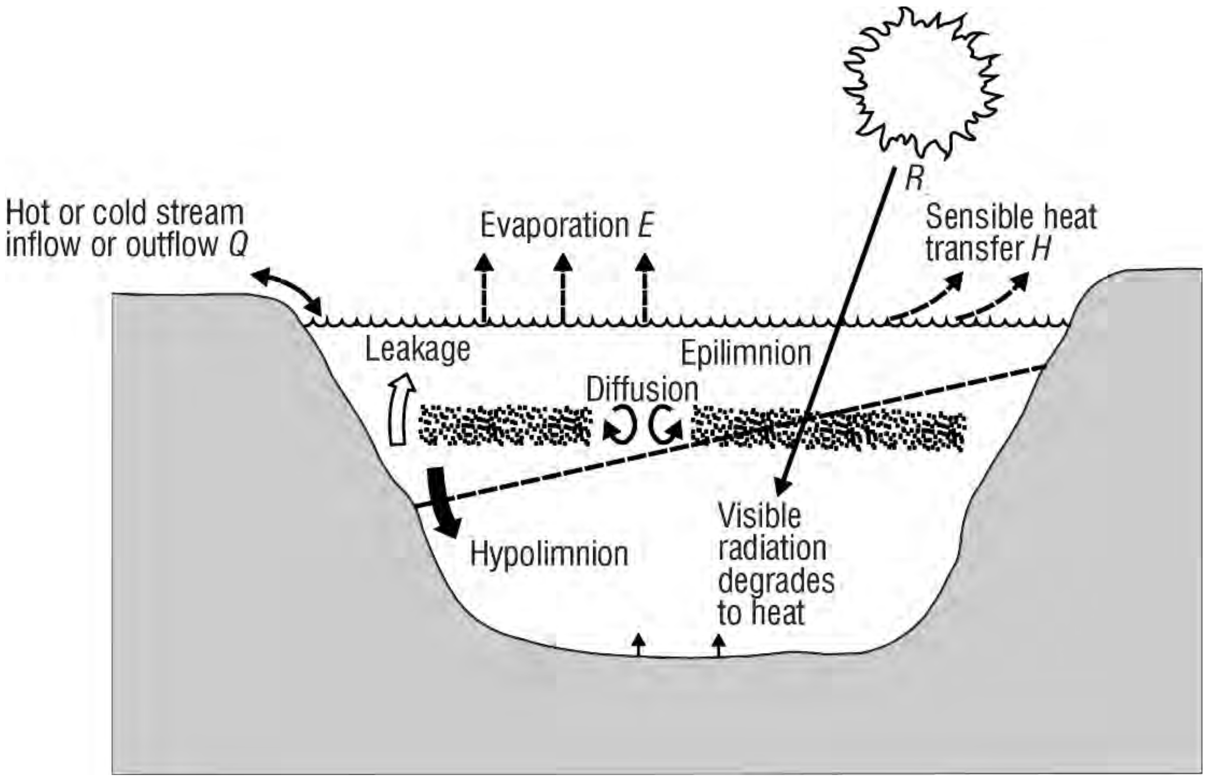
D.4.1 Physiochemical Reservoir Processes

Certain physiochemical parameters (water temperature and dissolved oxygen) associated with lakes and reservoirs typically exhibit direct relationships to depth. Because water density changes with water temperature, most water bodies have a temperature gradient that decreases with depth. In reservoirs, warmer water generally is found near the surface and the volume of warm water tends to gradually decrease down through the water column. Conversely, a greater volume of cold water is found near the bottom of the reservoir, and this is often known as the cold water pool (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

Because the solubility of dissolved oxygen in water is related to changes in pressure and temperature, cold water generally contains a greater percentage of dissolved oxygen as compared to warm water. However, in most systems there are additional demands that may affect this relationship. Plant and animal respiration can consume large amounts of dissolved oxygen but the major consumption of oxygen in lakes and reservoirs is attributed to bacterial respiration associated with the decomposition of organic matter settling out of the water column. Additionally, wind action across the surface of lakes promotes mixing, which generally results in greater dissolved oxygen concentrations near the surface (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

D.4.2 Summer/Winter – Stratification/Mixing

In spring and early summer, water near the lake surface begins to warm as it absorbs energy from increased solar radiation associated with longer daylight hours (Figure 1). Because of the thermal properties associated with water, the warmer layers of water remain near the surface while denser, colder water sinks deeper into the water column. Over time, this creates distinct thermal layers (known as the epilimnion, metalimnion/thermocline, and hypolimnion) within the water column. Once the spring thermocline is established, it is thermodynamically stable and usually can be destroyed only by cooling of the epilimnion. At this point, the hypolimnion is effectively isolated from the surface and dissolved oxygen cannot be replenished except by diffusion from the metalimnion, which is slow (Horne and Goldman 1994; Wetzel 1983; Moss 1998).



Source: Horne and Goldman 1994

Figure 1. Horizontal Cross-Sectional View of the Physiochemical Processes and Stratification Layers Occurring in Lakes and Reservoirs

In the fall, less solar radiation reaches the lake surface during the day, while heat losses at the surface of the water are greater at night than they are deeper in the water column. Cooling water at the surface is denser than warmer water below and so it sinks, causing the warmer water to rise to the surface. These convective currents and wind-induced mixing begin to weaken the thermocline. The epilimnion increases in depth as water temperature decreases. Eventually the water temperature and density differences between adjacent water layers are so slight that a strong wind can overcome the remaining resistance to mixing in the water column and the lake undergoes fall overturn, mixing from top to bottom. Fall overturn causes oxygen-saturated water at the surface to be distributed throughout the various depths of the epilimnetic and hypolimnetic layers. When circulation is complete, dissolved oxygen continues at saturation according to solubility at existing temperatures. These mixing events are important because they enable low or depleted oxygen stores in the hypolimnion and near the lakebed to be replenished. This also ensures that aerobic activities associated with bacterial decomposition in and above the lake sediments continue to occur. Additionally, mixing distributes organic nutrients (e.g., nitrogen and phosphorous) which are accumulated at the bottom of the lake throughout the summer, through the water column (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

D.4.3 Potential Lake Constituents of Concern: Nutrients/Metals/Sedimentation

Healthy lake ecosystems contain small quantities of nutrients from natural sources. An increased or accelerated input of nutrients (primarily nitrogen and phosphorous) may disrupt the balance of lake ecosystems by altering physical, chemical, and biological processes within the system. Excessive nutrients can stimulate increased productivity, which can lead to short-term population explosions of algae and aquatic macrophytes. Eventually the algae and other vegetation die off and sink to the bottom of the lake where it undergoes bacterial decomposition. As the bacteria continue to break down the organic matter, the decomposition process elicits a high biochemical oxygen demand, which can deplete dissolved oxygen in the water. At a substantial level, this may deprive fish and other aquatic organisms of oxygen, which in turn can lead to fish kills or produce foul odors in the water (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

In addition, when San Luis Reservoir is drawn down too low, the reliability and water quality of deliveries to the CVP San Felipe Division can be adversely affected. When storage levels drop below an elevation of 369 feet, about 300,000 acre-feet (AF) in storage, known as “low point” conditions, algal blooms occurring during summer and fall can enter the lower intake of the Pacheco Pumping Plant and water deliveries to San Felipe Division CVP water contractors can be adversely affected; water quality within the algal blooms is not suitable for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County and can clog irrigation systems of agricultural customers in Santa Clara and San Benito Counties.

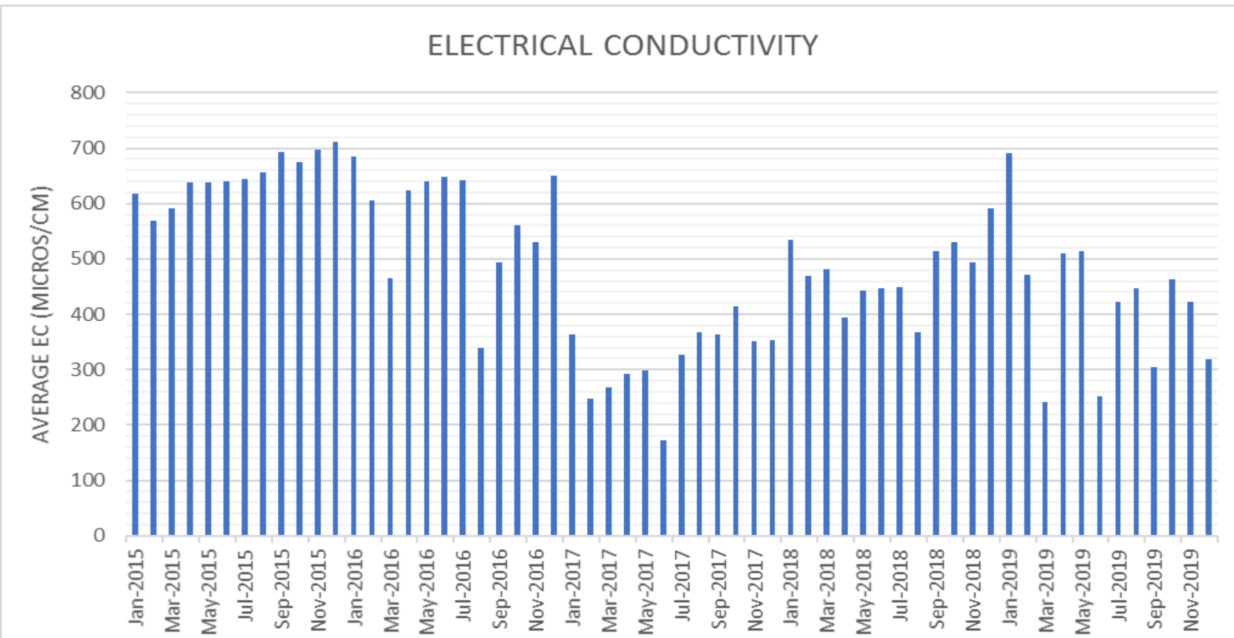
After nutrient loading, metals are typically the second most common lake pollutant of concern and are often found to accumulate in lake sediments. These substances are a concern because many of them are harmful to humans and aquatic organisms. While many metals become concentrated in the sediment, they generally remain there unless disturbed and resuspended in the water column. Reservoir drawdown has the potential to alter the concentration and mobility of metals found in the sediment within and around the reservoir by reducing the volume of the storage pool. Additionally, exposing a greater amount of the shoreline acreage surrounding the waterbody could potentially lead to increased shoreline erosion, which may increase the amount of sediment loading and suspended solids within the reservoir. In addition to concerns associated with metals, increased sedimentation may reduce water clarity or impair physiological mechanisms associated with aquatic organisms (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

D.5 Water Quality Monitoring

D.5.1 Merced County Region

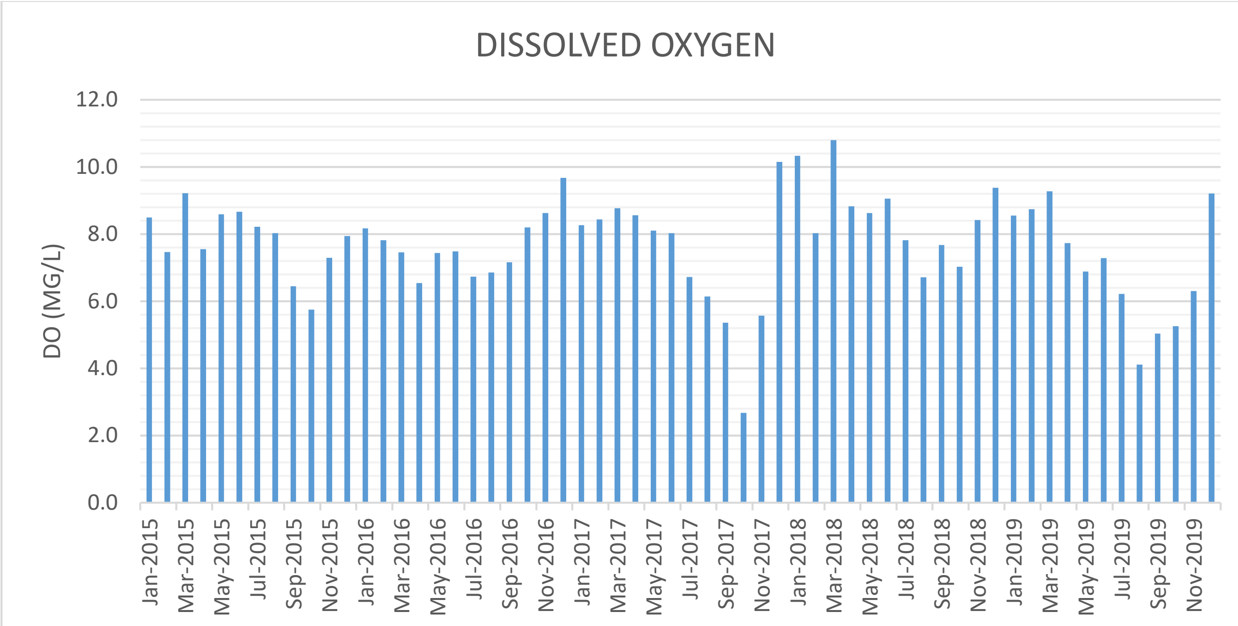
Water quality samples are routinely collected through automated monitoring at O'Neill Forebay at Gianelli Pumping Plant. Electrical conductivity (EC), dissolved oxygen (DO), and dissolved nitrate data from this sampling location are presented in Figure 2 through Figure 4. Periodic boat-based in lake sampling occurs at multiple locations on San Luis Reservoir. Historic algae count data collected at Pacheco Pumping Plant indicate greatest algae cell counts during mid- to late-summer months, peaking in some years above 70,000 algae cell counts.

EC is directly related to the concentration of dissolved solids in the water. Salinity is related to EC in that dissolved ions that increase conductivity also increase salinity. Historic water quality data at O'Neill Forebay from 2015 through 2019 are within the typical range of EC values for tap water in the United States.



Source: California Department of Water Resources (DWR) California Data Exchange Center (CDEC) 2019

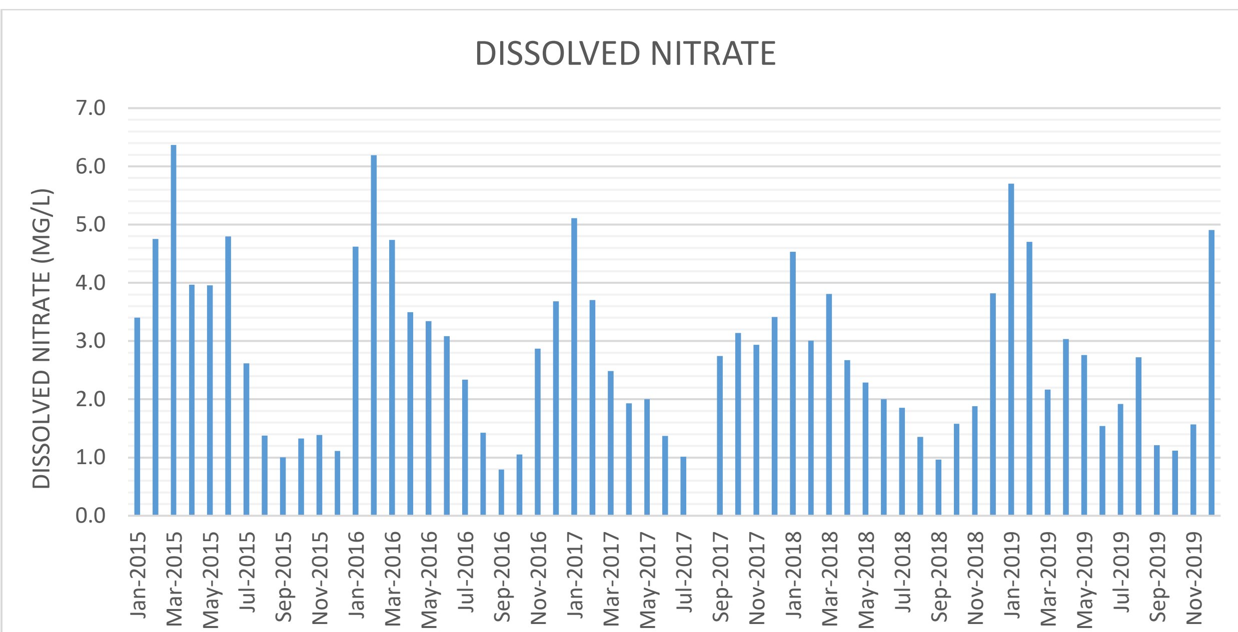
Figure 2. Electrical Conductivity in O'Neill Forebay as Measured at Gianelli Pumping Plant



Source: DWR CDEC 2019

Figure 3. Dissolved Oxygen in O'Neill Forebay as Measured at Gianelli Pumping Plant

As shown in Figure 3, DO concentrations in O'Neill Forebay vary between 5 and 10 mg/L from 2015 through 2019. DO is often lowest in the late summer and fall following excessive algae growth. As algae dies and creates decomposing organic matter the process consumes DO, indicated by the low late summer DO levels in O'Neill Forebay.



Source: DWR CDEC 2019

Figure 4. Dissolved Nitrate in O'Neill Forebay as Measured at Gianelli Pumping Plant

Nitrate levels in O'Neill Forebay from 2015 through 2019 indicate late winter/early spring peaks when algae growth is limited because of low temperatures and when nitrogen from land-based sources is washed into waterways with winter-spring precipitation events. Nitrate levels drop beginning in late spring as algae begins to form and depletes nitrate levels through late fall. Despite annual fluctuations of approximately 5 mg/L, nitrate levels remain below EPA National Primary Drinking Water Regulations of 10 mg/L (EPA 2016b); however, they typically remain above levels that have been associated with a high risk of nuisance growth and eutrophication (EPA 1980, 2001).

D.5.2 Delta Region and South-of-Delta Central Valley Project and State Water Project Facilities

San Luis Reservoir provides off-stream storage, with most water supplied to the reservoir by water conveyed through the Delta. The Delta region forms the low-lying outlet of the Central Valley, which comprises the channels of the Sacramento and San Joaquin Rivers, including from about the I-Street Bridge in Sacramento on the Sacramento River and Vernalis on the San Joaquin River, west to Martinez, and includes Suisun Bay and the Suisun Marsh. West of Martinez is the Carquinez Strait and San Pablo and San Francisco Bays. Estuarine areas occur from the Delta to San Francisco Bay depending on season of the year and outflow conditions.

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) pumping from the south Delta through the Harvey O. Banks Pumping Plant, Jones Pumping Plant, and other smaller diversions throughout the Delta. These Delta hydrodynamic conditions are primarily measured using the parameters of Sacramento and San Joaquin River flows, Delta outflow, Delta inflow, location of the low salinity zone, Old and Middle River flows, and Delta exports.

The transition area between saline waters and fresh water, frequently referred to as the low salinity zone[1] (LSZ), is typically located within Suisun Bay and the western Delta. Changes in the location of the LSZ are commonly measured by the position of X2, which is controlled by parameters such as daily tidal flows, Delta inflow, and Delta exports. Aquatic organisms have different salinity tolerances and preferences, and as such, changes in the position of the LSZ and X2 are commonly used to characterize likely changes in species distribution and other ecological parameters. The location of X2 is an indicator of the extent of saltwater intrusion into the Delta and thus is used to indicate changes to salinity concentrations within the Delta.

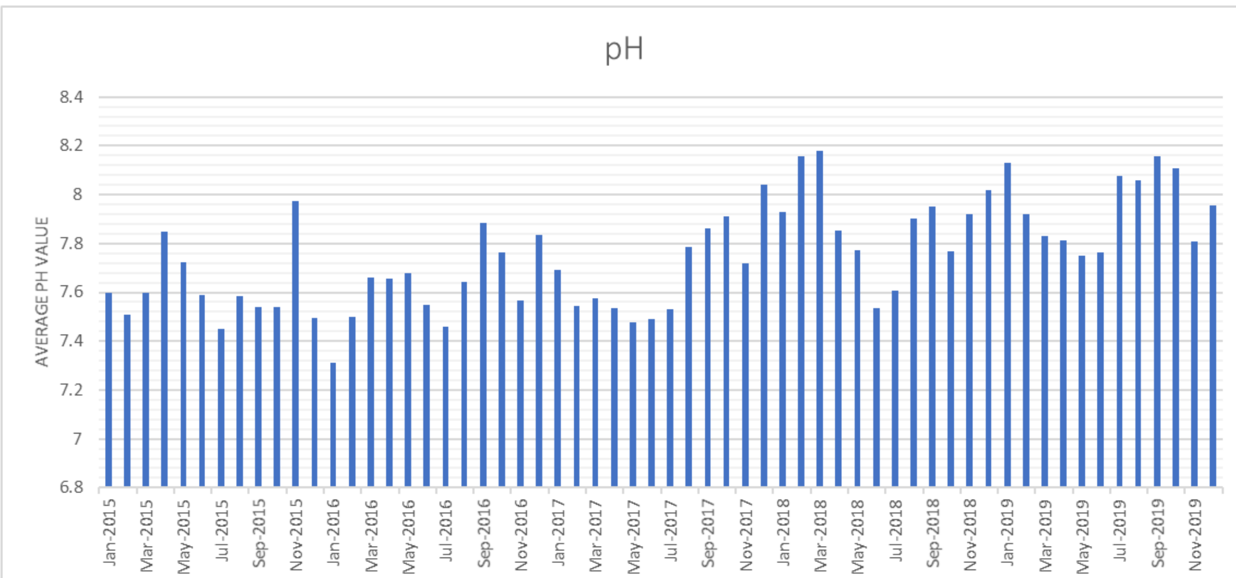
The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. The relative concentrations of these constituents over time is closely related to hydrodynamic conditions, including the position of X2, described above. Other physical parameters, including pH, temperature, and EC can interact with water quality constituents of concern to increase or decrease

[1] The low salinity zone is often referenced by X2, which is the distance upstream, in kilometers, from the Golden Gate Bridge where tidally averaged salinity is equal to 2 ppt. X2 is largely determined by Delta outflow (Kimmerer 2004).

their effects on aquatic organisms and other beneficial uses. Figure 5 through Figure 7 present historical data from 2015–2019 for pH, temperature, and EC.

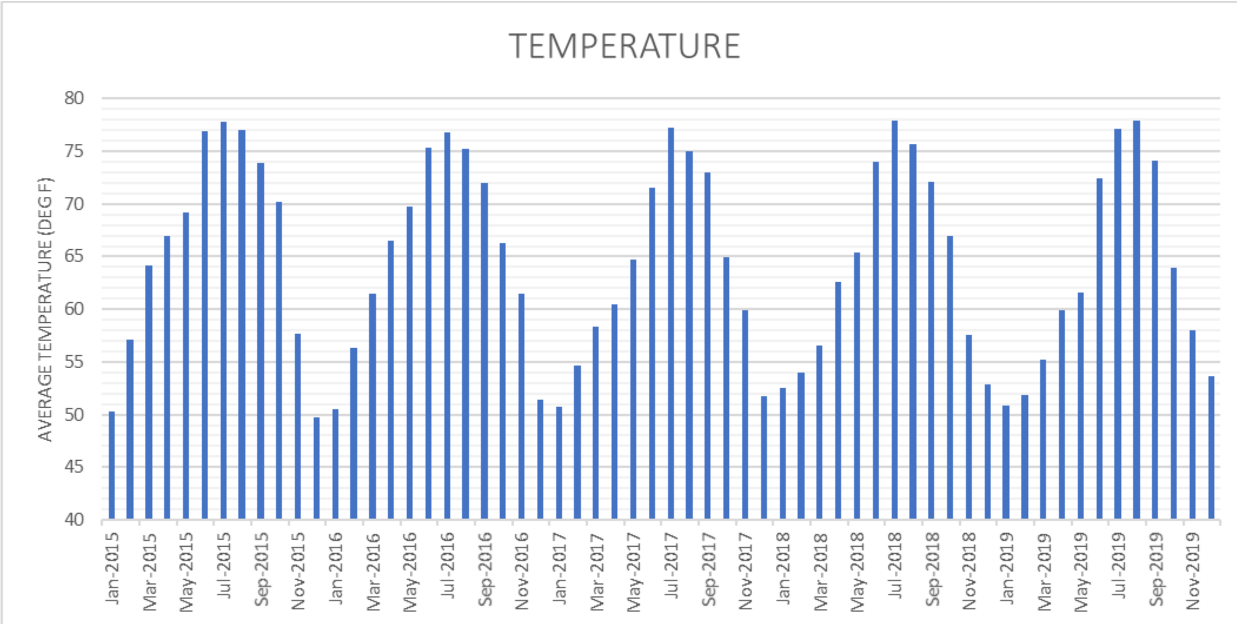
The Jones Pumping Plant diverts water from the Delta into the Delta-Mendota Canal that conveys Central Valley Project (CVP) water to users in the Central Valley and includes San Luis Reservoir as a storage feature. Similar to the Delta region, water quality constituents of concern in the Delta-Mendota Canal can be categorized broadly as metals, pesticides, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.

The Banks Pumping Plant diverts water from the Delta into Bethany Reservoir and then the California Aqueduct. Water diverted to the California Aqueduct is conveyed south to State Water Project (SWP) water contractors via the O'Neill Forebay and San Luis Reservoir. Water quality constituents of concern in the South-of-Delta SWP, similar to the Delta region and Delta-Mendota Canal, include metals, pesticides, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon.



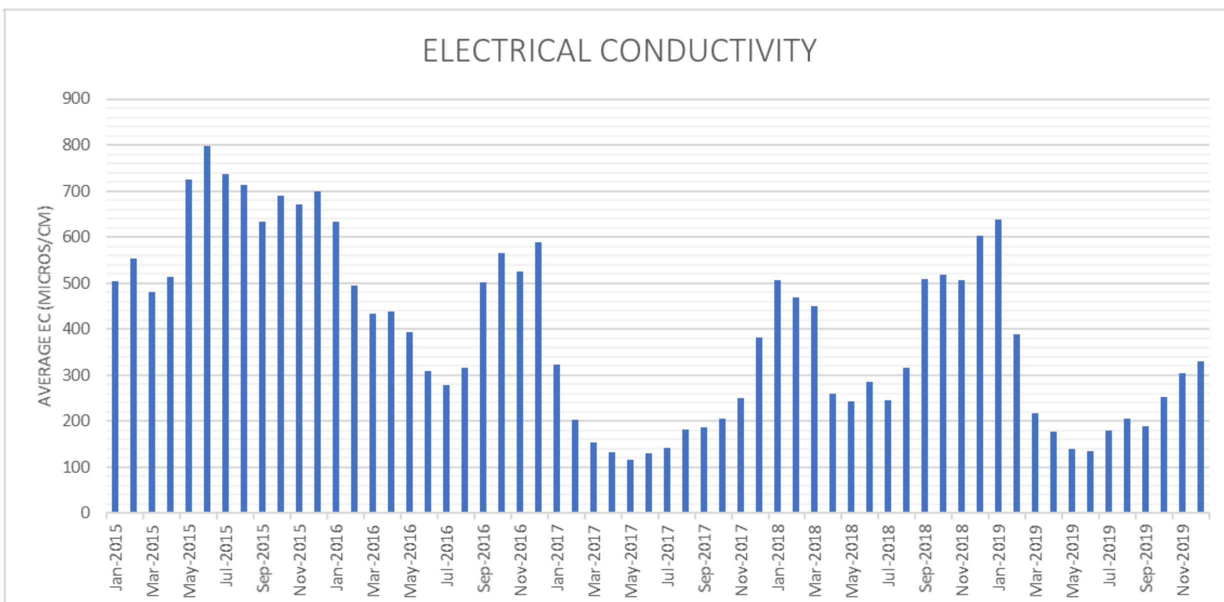
Source: DWR CDEC 2019

Figure 5. pH in Clifton Court Forebay



Source: DWR CDEC 2019

Figure 6. Temperature in Clifton Court Forebay



Source: DWR CDEC 2019

Figure 7. Electrical Conductivity in Clifton Court Forebay

D.6 Water Quality Modeling Results

Water quality monitoring data and computer modeling were used to aid in evaluating potential impacts. Temporary construction-related effects and long-term operational effects were considered as part of this evaluation. Temporary construction-related impacts were evaluated qualitatively based on anticipated construction practices, materials, locations, and duration of construction and related activities. Long-term effects were evaluated using results from computer modeling tools. Specifically, the California Simulation Model II (CalSim II) was used to estimate both existing (short term) and future (long term) changes in reservoir storage and stream flow within the area of analysis.

The CalSim II model's monthly simulation of an actual daily (or even hourly) operation of CVP and SWP results in several limitations in use of model results. Model results must be used in a comparative manner to reduce effects of use of monthly and other assumptions that are indicative of real-time operations but do not specifically match real-time observations. CalSim II model output is based upon a monthly time step. CalSim II model output includes minor fluctuations of up to 5 percent due to model assumptions and approaches. Therefore, if quantitative changes between a specific alternative and the No Project/No Action Alternative are 5 percent or less, conditions under the specific alternative would be considered "similar" to conditions under the No Project/No Action Alternative.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CalSim II utilizes a series of operating rules to reach a solution to allow for continuation of the simulation. It is recognized that these operating rules are a simplified version of complex decision processes that CVP and SWP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be evaluated on a comparative basis between alternatives and approximate extreme operational conditions.

D.6.1 X2 Results

X2 calculations were completed to provide an indication of changes to salinity throughout the Delta. The X2 water quality parameter represents the distance from the Golden Gate to the location of 2 parts per thousand salinity concentration in the Delta. Larger values indicate that the salinity concentrations are increasing in the Delta because of reductions in outflow and the movement of the salinity zone further into the Delta, and smaller values indicate lower salinity concentrations as the salinity zone is pushed further out of the Delta.

Under the Operation of Alternative 2, X2 results indicate that there would be no changes to Delta salinity levels resulting from changes in Delta outflows. Table 4 and Table 5 summarize X2 results which modeled potential changes in salinity in comparison to the No Project/No Action Alternative.

Table 4. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 2 (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 5. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 2 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
AN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under the Operation of Alternative 3 CVP Only Storage, X2 results indicate that on average there are negligible changes to Delta salinity levels resulting from changes in Delta outflows. Table 6 and Table 7 summarize X2 results which modeled potential changes in salinity in comparison to the No Project/No Action Alternative. Positive values indicate movement of the salinity zone further east and potentially higher salinity concentrations in the Delta while negative values indicate the zones movement further west and lower salinity concentration in the Delta.

Under the Operation of Alternative 3 CVP/SWP Split Storage, changes to X2, and thus Delta salinity concentrations, would be similar to effects under Operation of CVP Only Storage, as shown in Table 8 and Table 9.

Under the Operation of all configurations of the Investor-Directed Storage, changes to X2 would be similar to effects under Operation of CVP Only Storage, as shown in Table 10 and Table 11.

Table 6. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
AN	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
D	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.2
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 7. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%
AN	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 8. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
AN	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 9. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%
AN	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 10. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
AN	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
D	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.2
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 11. Modeled Difference in Delta X2 between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%
AN	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

D.6.2 South-of-Delta Export Results

As noted above, water quality in the Delta and the South-of-Delta CVP and SWP is closely related to changes in hydrodynamics. Changes in South-of-Delta exports are directly linked to hydrodynamic conditions and can impact water quality conditions (e.g., salinity and TDS levels) in the central and southern Delta and in South-of-Delta CVP and SWP water supplies. Greater exports during winter and spring, particularly during storm events, could draw turbidity and TDS from the

Sacramento and San Joaquin Rivers into the central and southern Delta. Greater exports during the summer and spring, lower Delta inflow months, could draw salinity further into the central and southern Delta.

Under Alternative 2, South-of-Delta exports are expected to decrease during winter months, as the change in San Luis Reservoir operations would reduce exports to allow for the storage of reserved water to be used in drier years. As shown in Table 12 and Table 13, this would be a less than 1 percent total change on average compared to the No Project/No Action conditions and is not expected to have a measurable impact on water quality conditions in the Delta.

Table 12. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 2 (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	-1	-16	-6	-14	-23	-5	0	0	0	0	0	-66
AN	0	0	0	-11	-6	-14	-2	0	0	0	0	0	-33
BN	0	-7	-5	-13	-21	-2	0	0	0	0	0	0	-48
D	0	0	0	0	-10	-13	0	0	0	0	0	0	-24
C	0	0	0	0	-8	-2	0	0	0	0	0	0	-9
All	0	-1	-6	-5	-12	-13	-2	0	0	0	0	0	-40

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 13. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 2 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-0.4%	-0.1%	-3.2%	-1.2%	-2.7%	-4.5%	-0.9%	0.1%	0.0%	0.0%	0.0%	0.0%	-1.1%
AN	0.0%	0.0%	0.0%	-2.5%	-1.4%	-3.4%	-0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.6%
BN	0.0%	-1.4%	-1.0%	-3.0%	-4.8%	-0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.9%
D	0.0%	0.0%	0.0%	0.0%	-2.8%	-4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.6%
C	0.0%	0.0%	0.0%	0.0%	-2.3%	-0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.3%
All	-0.1%	-0.2%	-1.2%	-1.2%	-2.7%	-3.4%	-0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.8%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under Alternative 3, South-of-Delta exports are expected to increase during wet and above normal year types as increased San Luis Reservoir storage will allow for greater exports when more water is available.

Exports under the Operation of CVP Only Storage are expected to increase by as much as 25,000 AF annually on average, with larger increases in the wetter years and little to no increase in the drier years. Table 14 shows the change in South-of-Delta exports under this alternative. As shown in Table 15, this would be a less than 1 percent change on average compared to the no project/no action conditions and is not expected to have a measurable impact on water quality conditions in the Delta.

Operation of the CVP/SWP Split Storage would be similar to Operation of CVP Only Storage, with exports increasing by 24,000 AF annually on average, as shown in Table 16. This would be a less than 1 percent change on average compared to the No Project/No Action conditions, as shown in Table 17 and is not expected to have a measurable impact on water quality conditions in the Delta.

Operation of the Investor-Directed Storage Configurations A and B would be similar to Operation of CVP Only Storage, with exports increasing by 39,000 AF annually on average, as shown in Table 16. Operation of the Investor-Directed Storage Configurations C and D would be similar to Operation of CVP Only Storage, with exports increasing by 14,000 AF annually on average, as shown in Table 19. All of the Investor-Directed Storage configurations would result in a less than 1 percent change on average compared to the No Project/No Action conditions, as shown in Table 19 and Table 21 and is not expected to have a measurable impact on water quality conditions in the Delta.

Table 14. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-3	1	5	9	2	24	17	3	0	-7	1	2	54
AN	1	5	-3	5	18	5	11	7	1	-2	1	-1	50
BN	0	2	12	-8	2	11	-9	0	0	7	-5	3	13
D	0	0	3	-3	3	3	-1	-1	0	0	2	-1	6
C	0	0	0	0	0	6	0	0	0	0	0	0	7
All	-1	1	4	2	4	12	6	2	0	-1	0	1	29

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 15. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-0.8%	0.1%	1.0%	1.6%	0.3%	4.7%	3.6%	0.7%	-0.1%	-1.1%	0.1%	0.8%	-0.8%
AN	0.4%	1.1%	-0.5%	1.2%	4.2%	1.3%	2.8%	1.9%	0.2%	-0.3%	0.2%	-0.5%	0.4%
BN	-0.1%	0.3%	2.2%	-2.0%	0.4%	3.3%	-2.8%	-0.2%	-0.1%	1.2%	-0.9%	0.6%	-0.1%
D	-0.1%	0.0%	0.7%	-0.7%	0.8%	1.0%	-0.4%	-0.5%	0.1%	0.1%	0.7%	-0.1%	-0.1%
C	0.1%	0.0%	0.0%	0.1%	0.0%	2.2%	0.3%	0.1%	0.0%	0.2%	-0.1%	0.0%	0.1%
All	-0.3%	0.3%	0.7%	0.4%	1.0%	3.0%	1.7%	0.5%	0.0%	-0.3%	0.0%	0.3%	-0.3%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 16. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1	0	2	3	2	20	9	3	0	-5	-2	4	36
AN	3	1	-2	5	12	4	12	4	0	-1	1	2	42
BN	2	3	5	-6	6	1	0	0	-10	-1	9	1	10
D	-2	-3	1	0	0	1	-2	0	1	8	-1	1	3
C	0	0	1	1	1	7	0	0	0	1	0	0	10
All	1	0	1	1	4	8	4	1	-2	0	1	2	21

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 17. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.2%	0.0%	0.3%	0.5%	0.3%	3.9%	1.9%	0.6%	-0.1%	-0.7%	-0.3%	1.3%	0.6%
AN	1.0%	0.2%	-0.3%	1.0%	2.8%	0.9%	2.9%	1.1%	0.1%	-0.2%	0.2%	1.1%	0.8%
BN	0.5%	0.6%	0.9%	-1.3%	1.4%	0.2%	0.1%	0.0%	-3.2%	-0.3%	1.7%	0.2%	0.2%
D	-0.5%	-0.6%	0.1%	0.1%	0.0%	0.3%	-1.1%	-0.1%	0.4%	2.0%	-0.4%	0.1%	0.1%
C	-0.1%	0.0%	0.2%	0.2%	0.3%	2.8%	0.0%	0.1%	-0.3%	0.4%	0.2%	0.0%	0.3%
All	0.2%	0.0%	0.3%	0.2%	0.8%	2.1%	1.2%	0.4%	-0.5%	0.0%	0.2%	0.6%	0.4%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 18. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-5	2	5	7	1	29	26	11	0	4	2	2	82
AN	-3	4	-3	5	21	6	8	7	0	1	3	1	50
BN	1	4	9	-7	5	12	-3	-1	3	1	0	3	25
D	-1	0	4	0	2	1	1	-2	-1	4	-4	0	2
C	0	0	1	0	0	6	0	0	0	1	0	0	8
All	-2	2	4	2	5	13	9	4	0	2	0	1	39

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 19. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1.1%	0.3%	0.9%	1.3%	0.2%	5.6%	5.2%	2.2%	0.0%	0.6%	0.3%	0.6%	1.3%
AN	-0.9%	0.7%	-0.6%	1.2%	4.8%	1.5%	2.0%	2.0%	-0.1%	0.2%	0.5%	0.4%	1.0%
BN	0.2%	0.7%	1.8%	-1.7%	1.2%	3.2%	-0.9%	-0.2%	0.9%	0.1%	0.0%	0.5%	0.5%
D	-0.3%	-0.1%	0.7%	0.0%	0.5%	0.3%	0.3%	-0.9%	-0.5%	1.0%	-1.7%	0.0%	0.1%
C	0.1%	0.0%	0.1%	0.1%	-0.1%	2.2%	0.1%	0.0%	-0.1%	0.6%	0.0%	-0.1%	0.3%
All	-0.5%	0.3%	0.7%	0.4%	1.1%	3.3%	2.6%	1.2%	0.0%	0.5%	0.0%	0.3%	0.8%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 20. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-5	1	-2	-6	-2	9	18	12	0	4	2	2	32
AN	-3	4	-3	4	12	4	6	7	0	1	3	1	35
BN	1	4	1	-7	-2	-7	-2	-1	3	1	0	3	-8
D	-1	0	4	-2	0	1	1	-2	-1	4	-4	0	-2
C	0	0	1	0	0	4	0	0	0	1	0	0	6
All	-2	1	0	-3	1	3	6	4	0	2	0	1	14

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

Table 21. Modeled Difference in Total South-of-Delta Exports between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1.3%	0.1%	-0.3%	-1.1%	-0.3%	1.7%	3.7%	2.5%	0.0%	0.6%	0.3%	0.6%	0.5%
AN	-0.9%	0.7%	-0.6%	0.9%	2.7%	1.0%	1.4%	2.0%	-0.1%	0.2%	0.5%	0.4%	0.7%
BN	0.2%	0.7%	0.2%	-1.7%	-0.5%	-1.9%	-0.6%	-0.2%	0.9%	0.1%	0.0%	0.5%	-0.2%
D	-0.3%	-0.1%	0.7%	-0.5%	0.0%	0.4%	0.3%	-0.9%	-0.5%	1.0%	-1.7%	0.0%	0.0%
C	0.1%	0.0%	0.1%	0.1%	-0.1%	1.5%	0.1%	0.0%	-0.1%	0.6%	0.0%	-0.1%	0.2%
All	-0.6%	0.3%	0.0%	-0.7%	0.2%	0.8%	1.8%	1.3%	0.0%	0.5%	0.0%	0.3%	0.3%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Your document is ready for your review. Type – Sacramento River Water Year Type; W – Wet

D.6.3 Delta Outflow Results

Under operation of the Alternative 2, Delta outflows are expected to increase during winter months as the change in San Luis Reservoir operations reduce exports to allow for the storage of reserved water to be used in drier years. Like the X2 analysis above, Delta outflow can be used as an indicator of potential changes to salinity concentrations as a result of the project alternatives. Table 22 shows the change in Delta outflow under this alternative. As shown in Table 23, operation of this configuration would result in a less than 1 percent change on average compared to the No Project/No Action conditions and is not expected to have a measurable impact on water quality conditions in the Delta.

Table 22. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 2 (cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	25	12	267	99	257	373	77	-7	0	0	0	0	1,104
AN	0	0	0	183	111	226	28	0	0	0	0	0	549
BN	0	117	88	204	381	29	0	0	0	0	0	0	818
D	0	0	0	0	185	216	-1	0	0	0	0	0	401
C	0	0	0	0	140	28	0	0	0	0	0	0	168
All	8	20	97	88	216	215	29	-2	0	0	0	0	669

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 23. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 2 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.3%	0.1%	0.5%	0.1%	0.2%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
AN	0.0%	0.0%	0.0%	0.4%	0.2%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
BN	0.0%	2.0%	0.6%	0.9%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%
D	0.0%	0.0%	0.0%	0.0%	0.8%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
C	0.0%	0.0%	0.0%	0.0%	1.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
All	0.1%	0.2%	0.4%	0.2%	0.4%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under operation of the Alternative 3, Delta outflows generally decrease slightly during wetter year types because of increased storage capacity in San Luis Reservoir and increase slightly during the drier years. Like the X2 analysis above, Delta outflow can be used as an indicator of potential changes to salinity concentrations because of the project alternatives.

Delta outflow under the Operation of CVP Only Storage are expected to decrease as much as 576 cubic feet per second (cfs) annually in some water year types. On the contrary, during below normal and dry year types, Delta outflow will increase by as much as 95 cfs annually, when some CVP deliveries that would be supported directly by Delta exports are instead supplied from the expanded

San Luis Reservoir. Table 24 shows the change in Delta outflow under this alternative. As shown in Table 25, operation of this configuration would result in a less than 1 percent change on average compared to the No Project/No Action conditions and is not expected to have a measurable impact on water quality conditions in the Delta.

Operation of the CVP/SWP Split Storage would be similar to Operation of CVP Only Storage, with Delta outflow decreasing up to 603 cfs annually in the wetter years and increasing up to 125 cfs annually in the drier years, as shown in Table 26. This would be a less than 1 percent change on average compared to the No Project/No Action conditions, as shown in Table 27 and is not expected to have a measurable impact on water quality conditions in the Delta.

Operation of all configurations of the Investor-Directed Storage would be the same as the Operation of CVP Only Storage, as shown in Table 28 and Table 29.

Table 24. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	61	24	64	-20	-47	-112	-290	-27	6	-34	-1	-69	-444
AN	-42	-73	-1	-28	-261	-16	-79	-111	16	12	0	7	-576
BN	2	36	-14	-72	27	-10	8	-17	8	67	5	8	50
D	0	10	27	33	-2	33	-2	-1	1	4	0	-7	95
C	0	0	-1	23	4	-1	0	0	0	-1	2	0	27
All	13	3	25	-9	-53	-31	-104	-29	6	1	1	-21	-198

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 25. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.7%	0.2%	0.1%	0.0%	0.0%	-0.1%	-0.6%	-0.1%	0.0%	-0.3%	0.0%	-0.6%	0.2%
AN	-0.7%	-0.7%	0.0%	-0.1%	-0.4%	0.0%	-0.3%	-0.7%	0.2%	0.1%	0.0%	0.1%	0.2%
BN	0.0%	0.5%	-0.1%	-0.4%	0.1%	-0.1%	0.1%	-0.1%	0.1%	0.8%	0.1%	0.2%	0.5%
D	0.0%	0.2%	0.3%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.2%	0.3%
C	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%
All	0.2%	0.0%	0.1%	0.0%	-0.1%	-0.1%	-0.4%	-0.2%	0.1%	0.0%	0.0%	-0.3%	0.3%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 26. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	11	4	-7	-42	-37	-158	-240	-36	16	-55	-1	8	-536
AN	-43	-65	-2	-37	-212	-32	-127	-60	7	-35	24	-20	-603
BN	-3	39	-2	-18	20	-1	8	-7	6	71	-1	13	125
D	8	13	8	-3	1	15	-10	-2	0	4	-1	2	33
C	0	0	4	-29	50	-6	1	0	0	2	0	0	21
All	-2	-1	0	-27	-35	-52	-97	-23	7	-12	3	2	-238

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 27. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.1%	0.0%	0.0%	0.0%	0.0%	-0.2%	-0.5%	-0.1%	0.1%	-0.5%	0.0%	0.1%	-0.1%
AN	-0.7%	-0.6%	0.0%	-0.1%	-0.3%	-0.1%	-0.4%	-0.4%	0.1%	-0.3%	0.4%	-0.2%	-0.2%
BN	0.0%	0.5%	0.0%	-0.1%	0.1%	0.0%	0.1%	-0.1%	0.1%	0.9%	0.0%	0.4%	0.1%
D	0.1%	0.2%	0.1%	0.0%	0.0%	0.1%	-0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
C	0.0%	0.0%	0.1%	-0.2%	0.3%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.3%	-0.1%	0.1%	-0.2%	0.1%	0.0%	-0.1%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 28. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	61	24	64	-20	-47	-112	-290	-27	6	-34	-1	-69	-444
AN	-42	-73	-1	-28	-261	-16	-79	-111	16	12	0	7	-576
BN	2	36	-14	-72	27	-10	8	-17	8	67	5	8	50
D	0	10	27	33	-2	33	-2	-1	1	4	0	-7	95
C	0	0	-1	23	4	-1	0	0	0	-1	2	0	27
All	13	3	25	-9	-53	-31	-104	-29	6	1	1	-21	-198

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 29. Modeled Difference in Delta Outflow between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0.7%	0.2%	0.1%	0.0%	0.0%	-0.1%	-0.6%	-0.1%	0.0%	-0.3%	0.0%	-0.6%	-0.1%
AN	-0.7%	-0.7%	0.0%	-0.1%	-0.4%	0.0%	-0.3%	-0.7%	0.2%	0.1%	0.0%	0.1%	-0.2%
BN	0.0%	0.5%	-0.1%	-0.4%	0.1%	-0.1%	0.1%	-0.1%	0.1%	0.8%	0.1%	0.2%	0.0%
D	0.0%	0.2%	0.3%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.2%	0.1%
C	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
All	0.2%	0.0%	0.1%	0.0%	-0.1%	-0.1%	-0.4%	-0.2%	0.1%	0.0%	0.0%	-0.3%	-0.1%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

D.6.4 Reservoir Storage Results

Under Alternative 2, a change in reservoir operations would increase the water levels at San Luis Reservoir due to the storage of reserved water to be used in drier years. Based on CalSim II modeling results, Operation of Alternative 2 would lead to monthly increases in storage of an average 3.2 percent throughout the year. Table 30 and Table 31 summarize the change in total San Luis Reservoir storage as a result of this configuration.

Table 30. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 2 (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	66	74	61	57	41	11	3	1	0	22	53	74	465
AN	56	63	66	57	51	32	24	12	0	21	44	58	484
BN	54	54	52	42	20	16	13	7	1	17	34	46	356
D	47	53	56	59	49	31	25	13	0	9	17	24	383
C	19	22	23	24	17	13	11	6	1	3	4	5	148
All	51	57	54	51	38	20	14	7	0	15	33	46	387

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 31. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 2 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	11.0%	9.0%	6.0%	4.3%	2.6%	0.6%	0.2%	0.1%	0.0%	2.1%	5.9%	11.1%	3.2%
AN	13.2%	10.0%	7.4%	4.7%	3.6%	2.0%	1.5%	0.9%	0.0%	3.0%	8.0%	18.9%	4.1%
BN	11.5%	8.3%	5.9%	3.6%	1.4%	1.0%	0.8%	0.5%	0.1%	2.2%	5.6%	7.9%	2.9%
D	13.8%	10.0%	7.2%	5.6%	3.8%	2.1%	1.8%	1.0%	0.0%	1.3%	4.8%	6.7%	3.7%
C	4.2%	3.7%	3.1%	2.5%	1.4%	1.0%	0.8%	0.5%	0.2%	0.5%	1.5%	2.1%	1.5%
All	10.8%	8.5%	6.1%	4.3%	2.7%	1.3%	0.9%	0.5%	0.0%	1.9%	5.6%	9.7%	3.2%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under Alternative 3, a 10-foot maximum reservoir surface raise under this alternative would increase the water storage capacity at San Luis Reservoir by approximately 130,000 AF.

Based on CalSim II modeling results, Operation of CVP Only Storage would lead to monthly increases in storage of an average 3.2 percent throughout the year. Increased storage would be most apparent during late spring months of wet water year types, when storage would increase by approximately 85,000 AF, a 4.6 percent increase in total storage. Table 32 and Table 33 summarize the change in total San Luis Reservoir storage because of this configuration.

Operation of the CVP/SWP Split Storage would be similar to Operation of CVP Only Storage, with monthly increases in storage of an average 2.3 percent throughout the year, as shown in Table 34 and Table 35.

Operation of the Investor-Directed Storage Configurations A and B would be similar to Operation of CVP Only Storage, with monthly increases in storage of an average 2.6 percent throughout the year, as shown in Table 36 and Table 37. Operation of the Investor-Directed Storage Configurations C and D would have the largest increase in storage, with storage increasing an average 5.7 percent annually on average, as shown in Table 38 and Table 39.

Table 32. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	20	24	31	38	39	66	85	76	58	40	34	34	546
AN	3	2	-2	4	22	32	43	40	26	12	13	7	202
BN	24	27	35	26	27	40	35	29	19	5	2	1	272
D	6	4	6	2	3	12	9	5	2	-2	-2	-1	44
C	3	5	6	8	8	22	21	17	12	8	6	7	125
All	12	13	17	18	22	37	44	38	27	16	13	13	271

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 33. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	3.4%	3.0%	3.1%	3.0%	2.5%	3.8%	4.6%	4.5%	4.2%	3.7%	3.6%	5.0%	3.2%
AN	0.6%	0.3%	-0.2%	0.3%	1.5%	2.1%	2.7%	2.9%	2.7%	1.8%	2.5%	2.7%	4.1%
BN	5.4%	4.0%	3.9%	2.3%	2.0%	2.7%	2.4%	2.4%	2.3%	0.9%	0.5%	0.3%	3.2%
D	1.6%	0.6%	0.7%	0.2%	0.2%	0.8%	0.6%	0.4%	0.2%	-0.2%	-0.4%	-0.2%	3.4%
C	0.8%	0.9%	0.9%	0.8%	0.7%	1.7%	1.6%	1.5%	1.4%	1.5%	2.0%	2.3%	1.5%
All	2.5%	2.0%	1.9%	1.5%	1.5%	2.4%	2.8%	2.7%	2.5%	2.0%	2.3%	2.7%	3.2%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 34. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	30	29	31	34	38	58	70	66	55	46	40	38	535
AN	8	7	0	13	25	32	47	42	30	24	21	20	268
BN	16	16	20	13	17	32	24	22	15	6	1	-1	183
D	11	7	7	7	8	13	10	8	-3	-1	6	6	80
C	2	3	5	6	8	22	21	17	12	9	6	5	116
All	16	15	15	17	21	34	38	35	25	20	18	17	273

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 35. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	5.1%	3.6%	3.1%	2.6%	2.4%	3.3%	3.8%	3.9%	4.0%	4.3%	4.3%	5.5%	3.7%
AN	1.8%	1.0%	0.0%	1.1%	1.7%	2.1%	2.9%	3.0%	3.1%	3.6%	3.9%	7.2%	2.3%
BN	3.7%	2.5%	2.3%	1.1%	1.2%	2.2%	1.7%	1.8%	1.8%	1.0%	0.1%	-0.2%	1.6%
D	3.0%	1.3%	0.9%	0.6%	0.6%	0.9%	0.7%	0.6%	-0.2%	-0.2%	1.5%	1.5%	0.7%
C	0.5%	0.6%	0.7%	0.7%	0.7%	1.6%	1.6%	1.5%	1.3%	1.6%	1.9%	1.8%	1.2%
All	3.4%	2.2%	1.7%	1.5%	1.5%	2.2%	2.4%	2.5%	2.4%	2.5%	3.1%	3.7%	2.3%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 36. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	29	33	40	43	44	71	89	71	33	37	43	46	581
AN	6	6	3	12	33	43	50	42	24	19	22	21	283
BN	27	28	38	28	32	48	43	30	10	3	-3	-3	280
D	13	13	16	15	18	25	21	14	5	1	-1	-1	141
C	0	2	4	5	6	19	17	14	9	5	3	3	86
All	17	19	23	24	29	45	50	39	18	16	17	18	314

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 37. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4.9%	4.1%	4.0%	3.4%	2.8%	4.1%	4.9%	4.2%	2.5%	3.5%	4.6%	6.8%	4.0%
AN	1.4%	0.9%	0.4%	1.0%	2.3%	2.8%	3.2%	3.0%	2.5%	2.9%	4.1%	7.5%	2.4%
BN	6.0%	4.2%	4.2%	2.4%	2.3%	3.3%	3.0%	2.4%	1.2%	0.5%	-0.7%	-0.6%	2.5%
D	3.5%	2.3%	2.0%	1.4%	1.3%	1.7%	1.4%	1.0%	0.5%	0.1%	-0.2%	-0.1%	1.3%
C	0.0%	0.3%	0.5%	0.5%	0.5%	1.4%	1.3%	1.2%	1.0%	0.9%	1.0%	1.2%	0.9%
All	3.6%	2.8%	2.6%	2.1%	2.0%	2.9%	3.2%	2.7%	1.7%	2.0%	2.9%	3.8%	2.6%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 38. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	89	101	105	100	99	99	103	71	20	47	83	108	1,026
AN	57	64	65	74	87	88	84	56	15	33	61	74	757
BN	73	82	85	74	68	68	58	33	2	14	26	40	624
D	55	62	68	71	72	67	56	30	1	6	14	22	524
C	19	23	27	29	30	39	34	23	9	7	6	8	255
All	63	72	76	75	76	77	72	47	11	24	44	58	694

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 39. Modeled Difference in San Luis Reservoir Storage between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	14.9%	12.5%	10.5%	7.7%	6.3%	5.7%	5.6%	4.2%	1.5%	4.3%	9.0%	15.9%	7.0%
AN	12.6%	9.6%	7.0%	6.1%	6.0%	5.7%	5.3%	4.0%	1.5%	5.0%	11.5%	27.1%	6.5%
BN	16.5%	12.3%	9.4%	6.4%	4.9%	4.6%	4.0%	2.7%	0.3%	2.3%	5.3%	8.1%	5.6%
D	14.8%	10.8%	8.4%	6.4%	5.3%	4.5%	3.7%	2.2%	0.1%	0.8%	3.4%	5.2%	4.7%
C	4.5%	4.3%	3.9%	3.0%	2.5%	2.9%	2.6%	1.9%	1.0%	1.2%	2.1%	2.9%	2.6%
All	13.4%	10.7%	8.5%	6.4%	5.4%	4.9%	4.6%	3.3%	1.0%	3.1%	7.5%	12.3%	5.7%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

D.6.5 Reservoir Elevation Results

Based on CalSim II modeling results, Operation of Alternative 2 would lead to an average maximum elevation increase of approximately 9 feet, or a 2 percent increase, in September and October of Wet

Years. Table 40 and Table 41 summarize the monthly change in total San Luis Reservoir elevation as a result of this alternative.

Table 40. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 2 (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	8.4	8.1	6.3	5.3	3.6	1.0	0.3	0.1	0.0	2.2	5.6	9.0
AN	7.5	7.2	7.0	5.6	4.7	2.9	2.2	1.2	0.0	2.5	5.5	8.8
BN	6.9	5.9	5.1	3.8	1.8	1.4	1.2	0.7	0.1	2.0	4.4	6.0
D	6.5	6.2	5.7	5.6	4.4	2.7	2.2	1.2	0.0	0.9	2.3	3.1
C	2.8	2.6	2.4	2.3	1.5	1.1	1.0	0.6	0.1	0.4	0.7	0.8
All	6.8	6.4	5.6	4.8	3.4	1.8	1.3	0.7	0.0	1.6	3.9	5.9

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 41. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 2 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2.1%	1.9%	1.4%	1.1%	0.7%	0.2%	0.1%	0.0%	0.0%	0.5%	1.3%	2.2%
AN	1.9%	1.8%	1.6%	1.2%	1.0%	0.6%	0.4%	0.2%	0.0%	0.6%	1.4%	2.4%
BN	1.8%	1.4%	1.2%	0.8%	0.4%	0.3%	0.2%	0.2%	0.0%	0.5%	1.1%	1.5%
D	1.7%	1.5%	1.3%	1.2%	0.9%	0.5%	0.5%	0.3%	0.0%	0.2%	0.6%	0.8%
C	0.7%	0.7%	0.6%	0.5%	0.3%	0.2%	0.2%	0.1%	0.0%	0.1%	0.2%	0.2%
All	1.7%	1.6%	1.3%	1.0%	0.7%	0.4%	0.3%	0.1%	0.0%	0.4%	1.0%	1.5%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Under Alternative 3, additional storage under this alternative would increase the water surface elevation at San Luis Reservoir.

Based on CalSim II modeling results, Operation of CVP Only Storage would lead to an average maximum elevation increase of 6 feet, or a 1 percent increase, in April and May of Wet Years. Table 42 and Table 43 summarize the monthly change in total San Luis Reservoir elevation as a result of this configuration.

Operation of the CVP/SWP Split Storage would lead to an average maximum elevation increase of 5 feet, or a 1 percent increase, in April and May of Wet Years. Table 44 and Table 45 summarize the monthly change in total San Luis Reservoir elevation as a result of this configuration.

Operation of the Investor-Directed Storage Configurations A and B would lead to an average maximum elevation increase of almost seven feet, or a 1 percent increase, in April Wet Years. Table 46 and Table 47 summarize the monthly change in total San Luis Reservoir elevation as a result of this configuration. Operation of the Investor-Directed Storage Configurations C and D would lead to an average maximum elevation increase of almost 13 feet, or a 3 percent increase, in September of Wet Years. Table 48 and Table 49 summarize the monthly change in total San Luis Reservoir elevation as a result of this configuration.

Table 42. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2.0	2.2	2.7	3.2	3.1	5.1	6.6	6.1	4.8	3.6	3.1	3.6
AN	0.5	0.3	0.0	0.4	1.7	2.5	3.4	3.3	2.2	1.1	1.4	0.9
BN	2.6	2.8	3.3	2.4	2.4	3.5	3.0	2.7	1.9	0.7	0.5	0.3
D	0.8	0.4	0.6	0.1	0.2	0.9	0.7	0.4	0.1	-0.2	-0.2	-0.1
C	0.4	0.5	0.7	0.7	0.7	1.9	1.8	1.5	1.1	0.9	0.8	0.9
All	1.3	1.3	1.5	1.5	1.7	3.0	3.5	3.1	2.3	1.5	1.3	1.4

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 43. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 CVP Only Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.5%	0.5%	0.6%	0.7%	0.6%	1.0%	1.3%	1.2%	1.0%	0.8%	0.7%	0.9%
AN	0.1%	0.1%	0.0%	0.1%	0.4%	0.5%	0.7%	0.7%	0.5%	0.3%	0.4%	0.2%
BN	0.7%	0.7%	0.7%	0.5%	0.5%	0.7%	0.6%	0.6%	0.4%	0.2%	0.1%	0.1%
D	0.2%	0.1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	-0.1%	0.0%
C	0.1%	0.1%	0.2%	0.2%	0.2%	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.3%
All	0.3%	0.3%	0.4%	0.3%	0.4%	0.6%	0.7%	0.6%	0.5%	0.3%	0.3%	0.4%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 44. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2.9	2.6	2.7	2.7	3.0	4.6	5.5	5.3	4.6	4.1	3.7	3.8
AN	1.1	0.8	-0.1	1.0	1.8	2.5	3.7	3.4	2.6	2.2	2.1	2.5
BN	1.7	1.7	1.9	1.2	1.5	2.7	2.0	1.9	1.4	0.7	0.0	-0.2
D	1.5	0.9	0.7	0.6	0.7	1.1	0.8	0.6	-0.2	-0.1	0.6	0.6
C	0.2	0.3	0.5	0.6	0.7	1.8	1.7	1.5	1.1	0.9	0.8	0.7
All	1.7	1.4	1.3	1.4	1.7	2.7	3.0	2.8	2.2	1.9	1.8	1.8

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W - Wet

Table 45. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.7%	0.6%	0.6%	0.6%	0.6%	0.9%	1.0%	1.0%	1.0%	0.9%	0.8%	0.9%
AN	0.3%	0.2%	0.0%	0.2%	0.4%	0.5%	0.7%	0.7%	0.6%	0.5%	0.5%	0.7%
BN	0.4%	0.4%	0.4%	0.3%	0.3%	0.6%	0.4%	0.4%	0.3%	0.2%	0.0%	0.0%
D	0.4%	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%	0.1%	-0.1%	0.0%	0.2%	0.2%
C	0.1%	0.1%	0.1%	0.1%	0.2%	0.4%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%
All	0.4%	0.3%	0.3%	0.3%	0.4%	0.5%	0.6%	0.6%	0.5%	0.4%	0.4%	0.5%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W - Wet

Table 46. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	3.3	3.3	3.6	3.7	3.6	5.6	7.0	5.7	2.9	3.5	4.2	5.4
AN	1.2	0.8	0.6	1.2	2.8	3.5	4.1	3.6	2.3	2.0	2.4	2.7
BN	3.4	3.0	3.5	2.5	2.8	4.2	3.7	2.8	1.1	0.5	-0.2	-0.2
D	1.9	1.6	1.7	1.5	1.6	2.1	1.8	1.2	0.6	0.1	0.0	0.0
C	0.0	0.2	0.4	0.4	0.5	1.5	1.4	1.2	0.8	0.5	0.4	0.4
All	2.1	2.0	2.1	2.1	2.4	3.6	4.0	3.2	1.7	1.6	1.7	2.2

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 47. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations A and B (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.8%	0.8%	0.8%	0.8%	0.7%	1.1%	1.3%	1.1%	0.6%	0.8%	1.0%	1.3%
AN	0.3%	0.2%	0.1%	0.3%	0.6%	0.7%	0.8%	0.7%	0.5%	0.5%	0.6%	0.7%
BN	0.9%	0.7%	0.8%	0.5%	0.6%	0.8%	0.8%	0.6%	0.3%	0.1%	-0.1%	-0.1%
D	0.5%	0.4%	0.4%	0.3%	0.3%	0.4%	0.4%	0.3%	0.1%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.1%	0.1%	0.1%	0.3%	0.3%	0.3%	0.2%	0.1%	0.1%	0.1%
All	0.5%	0.5%	0.5%	0.5%	0.5%	0.7%	0.8%	0.7%	0.4%	0.4%	0.4%	0.6%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 48. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	10.7	10.6	10.2	8.9	8.3	8.0	8.2	5.8	1.7	4.5	8.5	12.7
AN	7.9	7.4	7.0	7.1	7.6	7.5	7.1	4.9	1.3	3.7	7.3	10.7
BN	9.2	8.7	8.0	6.7	5.9	5.9	5.1	3.1	0.2	1.7	3.5	5.4
D	7.5	7.2	7.0	6.6	6.3	5.7	4.8	2.7	0.1	0.7	2.0	2.8
C	2.7	2.8	2.8	2.8	2.7	3.3	2.9	2.0	0.8	0.8	0.9	1.2
All	8.1	7.9	7.5	6.9	6.6	6.4	6.0	4.0	0.9	2.5	4.9	7.3

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 49. Modeled Difference in San Luis Reservoir Elevation between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configurations C and D (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2.7%	2.5%	2.3%	1.9%	1.7%	1.6%	1.6%	1.1%	0.4%	1.0%	1.9%	3.1%
AN	2.0%	1.8%	1.5%	1.5%	1.5%	1.5%	1.3%	0.9%	0.3%	0.9%	1.8%	2.9%
BN	2.1%	2.0%	1.8%	1.4%	1.2%	1.1%	1.0%	0.6%	0.0%	0.3%	0.6%	1.1%
D	2.0%	1.7%	1.6%	1.4%	1.2%	1.1%	0.9%	0.6%	0.1%	0.3%	0.7%	1.0%
C	0.9%	0.9%	0.9%	0.8%	0.7%	0.9%	0.8%	0.5%	0.2%	0.2%	0.2%	0.3%
All	2.1%	1.9%	1.7%	1.5%	1.3%	1.3%	1.2%	0.8%	0.2%	0.6%	1.2%	1.9%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Operation of Alternative 3 has the potential to impact the surface elevation of Shasta Lake at Shasta Dam, Folsom Lake at Folsom Dam, and Lake Oroville at Oroville Dam. There would be no change to the operation and surface elevation of Trinity Lake at Trinity Dam. As shown in Table 50 through Table 55, changes to reservoir elevations at these locations would be minimal.

Table 50. Modeled Difference in Shasta Lake Elevation between the No Project/No Action Conditions and Alternative 3 (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.2	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.6
AN	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3
BN	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.0	-0.1
D	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	-0.4	-0.2	-0.2
C	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.3	-0.2
All	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 51. Modeled Difference in Shasta Lake Elevation between the No Project/No Action Conditions and Alternative 3 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
AN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 52. Modeled Difference in Folsom Lake Elevation between the No Project/No Action Conditions and Alternative 3 (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.2	0.2
AN	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
BN	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1
D	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
C	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	-0.2
All	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 53. Modeled Difference in Folsom Lake Elevation between the No Project/No Action Conditions and Alternative 3 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
AN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 54. Modeled Difference in Lake Oroville Elevation between the No Project/No Action Conditions and Alternative 3 (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	-0.2	-0.1	-0.1
AN	-0.1	0.0	0.2	0.2	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.8	-0.9
BN	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.3	-0.5	-0.4	-0.5
D	-0.4	-0.4	-0.6	-0.6	-0.5	-0.5	-0.4	-0.2	-0.2	0.0	-0.1	-0.1
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.8	-0.6
All	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.4	-0.4

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 55. Modeled Difference in Lake Oroville Elevation between the No Project/No Action Conditions and Alternative 3 (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
AN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
All	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

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Appendix E: Surface Water Supply Technical Report

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Appendix E Surface Water Supply Technical Report

The federal and state governments constructed the Central Valley Project (CVP) and State Water Project (SWP) in pursuit of the State Water Plan to maximize use of the state's water supplies and provide flood control. The federal CVP currently has approximately 250 water delivery contracts (including Sacramento River Settlement Contracts) (United States Fish and Wildlife Service [USFWS] 2008). The SWP currently has contracts to deliver supplies to 29 water suppliers across the state. These water contracts are subject to reductions, depending on the amount of water available each year. Water forecasting starts in the fall of the previous year when storage and hydrologic conditions are assessed. Annual water allocation for both the CVP and SWP are generally announced early in the calendar year for the following growing season and updated monthly.

This water supply technical report includes San Luis Reservoir, CVP facilities including the Delta-Mendota Canal and the San Felipe Division, and SWP facilities including the California Aqueduct. Figure 1 shows the study area.

E.1 San Luis Reservoir

San Luis Reservoir is an off-stream storage reservoir in Merced County. The United States Department of Interior, Bureau of Reclamation (Reclamation) owns and jointly operates San Luis Reservoir with the California Department of Water Resources (DWR) to provide seasonal storage for the CVP and the SWP. San Luis Reservoir is capable of receiving water from both the Delta-Mendota Canal and the California Aqueduct, which enables the CVP and SWP to pump water into the reservoir during the wet season (October through March) and release water into the conveyance facilities during the dry season (April through September) 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. This section describes the annual reservoir operations, water storage and releases, and water supply facilities associated with San Luis Reservoir.

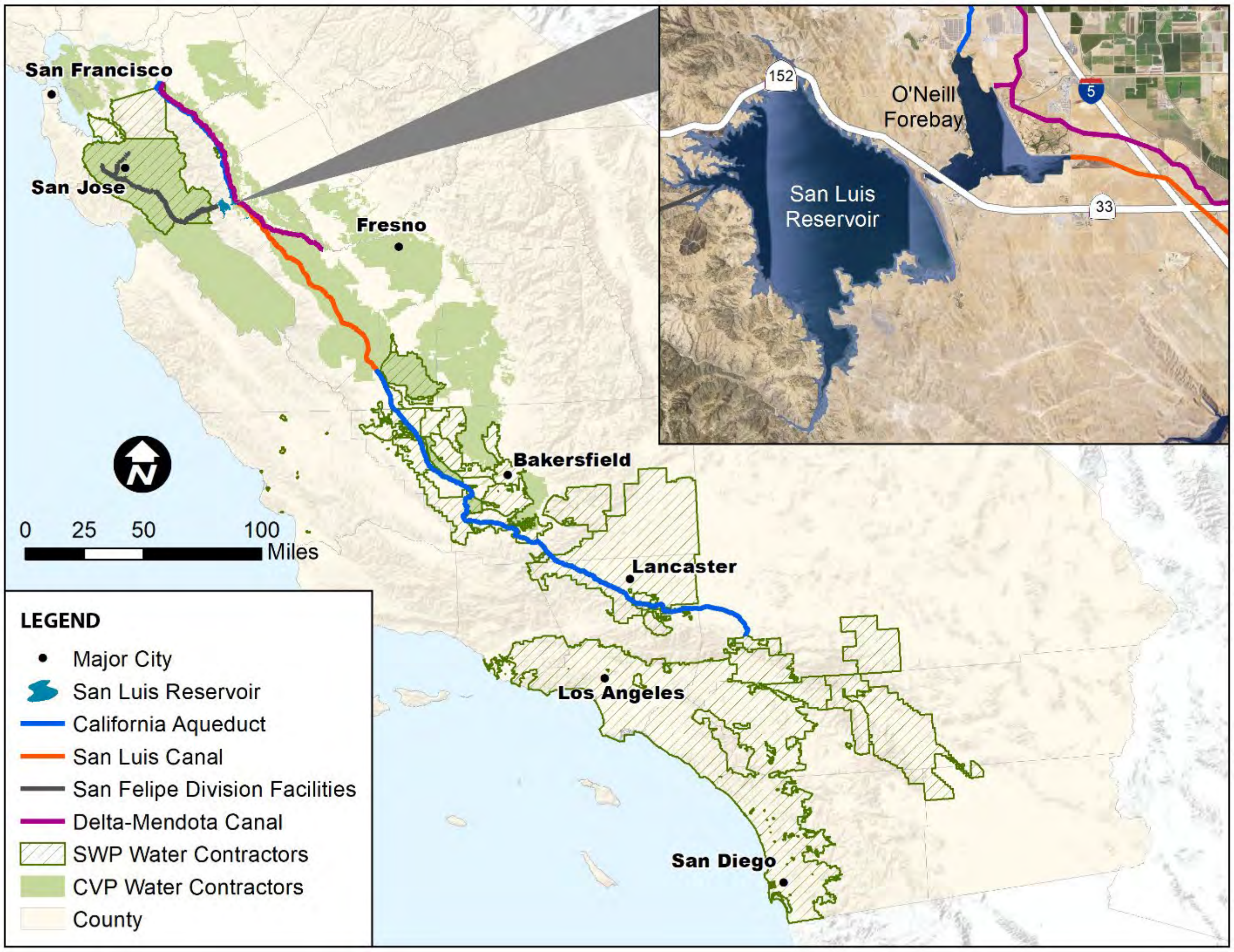
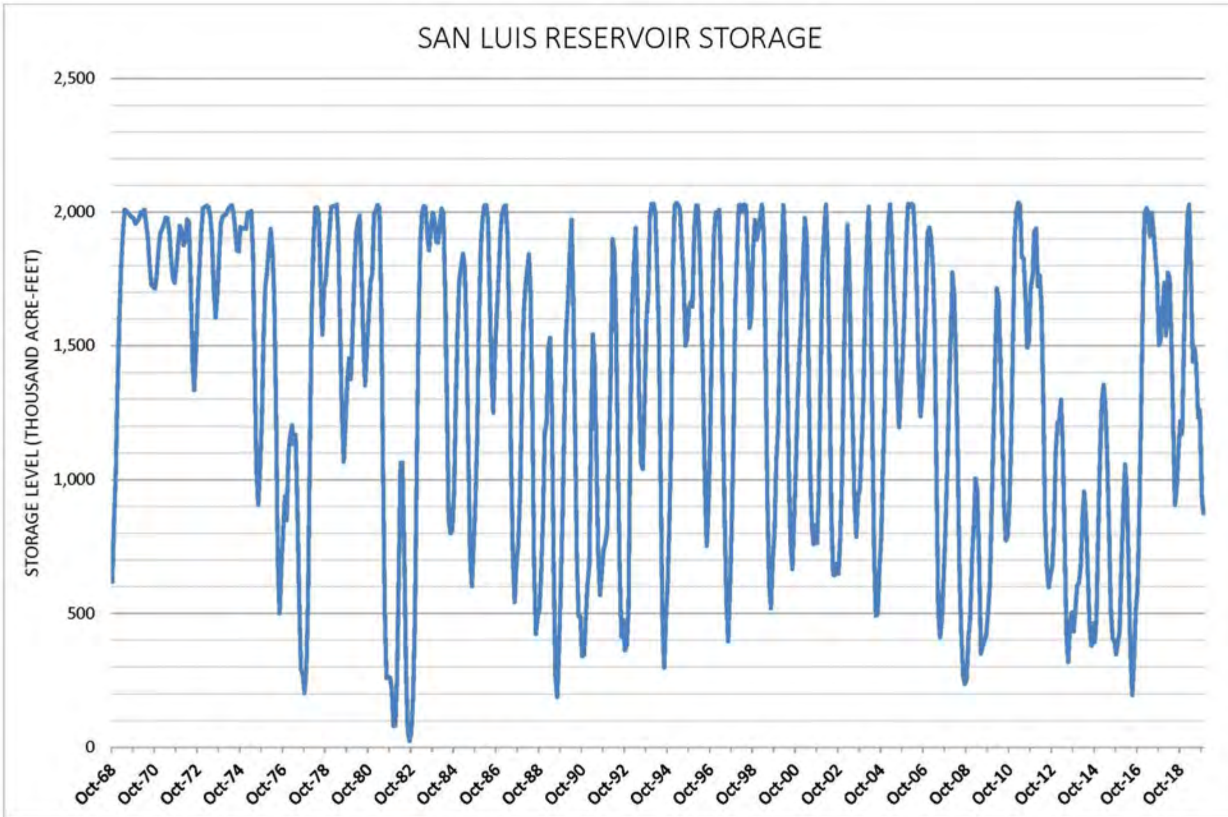


Figure 1. Surface Water Supply Study Area

Figure 2 shows monthly storage in San Luis Reservoir from 1968 through 2019. Storage is highly variable throughout the year as the reservoir refills in the fall and winter months and releases water in spring and summer to meet CVP and SWP demands. In most years, the storage level in San Luis Reservoir has remained above 300 thousand acre-feet (TAF). As Figure 2 shows, San Luis Reservoir was drawn down in 1981 and 1982 to a storage level of 79 TAF to facilitate repairs. During the drought periods of 1976–1977, 1988–1992 and 2007-2008, the reservoir was drawn down to below 300 TAF. San Luis Reservoir also fell below 300 TAF in the summer of 2016 (DWR California Data Exchange Center [CDEC] 2019).



Source: DWR California Data Exchange Center (CDEC) 2019

Figure 2. Monthly Storage in San Luis Reservoir from 1968 to 2019

Table 1 presents average monthly storage in San Luis Reservoir from 1968 through 2019. February, March, and April typically have the highest average storage as this is just after spring snowmelt from Northern California has been pumped through the Delta into the California Aqueduct and Delta-Mendota Canal and on to San Luis Reservoir. On average, storage in the reservoir is generally lowest in July, August, and September as water is being released to meet demands.

Table 1. Average Monthly Storage in San Luis Reservoir (1968 through 2019)

Month	Storage (acre-feet)
January	1,475,953
February	1,628,474
March	1,762,224
April	1,693,288
May	1,451,058
June	1,137,430
July	894,445
August	775,277
September	846,592

Month	Storage (acre-feet)
October	909,379
November	1,048,939
December	1,248,938

Source: DWR CDEC 2019

During summer months, releases from San Luis Reservoir into O'Neill Forebay are made via the Gianelli Intake and the Gianelli Pumping-Generating Plant turbines, which generate electricity. The water flows east into the San Luis Canal, and occasionally, water is also released from O'Neill Forebay back into the Delta-Mendota Canal, where electricity is also generated.

E.2 South-of-Delta CVP Facilities and Contractors

E.2.1 South-of-Delta CVP Facilities

Reclamation operates the CVP, which diverts water from the Delta using the C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) into the Delta-Mendota Canal. The Delta-Mendota Canal is a 117-mile long canal that delivers water to users in the Central Valley and to and from San Luis Reservoir for storage. Water conveyed through the Delta-Mendota Canal to San Luis Reservoir is pumped from the canal to the O'Neill Forebay where it connects with the California Aqueduct and the San Luis Canal. The Delta-Mendota Canal continues east from the O'Neill Forebay to the Mendota Pool (Reclamation 2019). The Jones Pumping Plant and the DMC is operated and maintained by the SLDMWA under a operation and maintenance agreement with Reclamation.

E.2.2 South-of-Delta CVP Contractors

South-of-Delta CVP contractors are located south of the Sacramento and San Joaquin River's Delta and consist of the Delta Division, Cross Valley Canal Contractors, San Felipe Division, and San Luis Unit.

The San Luis & Delta-Mendota Water Authority (SLDMWA) was formed in 1992 and covers approximately 3,300 square miles on the west side of the San Joaquin Valley. It extends from the City of Tracy in San Joaquin County in the north to Kettleman City in Kings County in the south and contains 28 member agencies in the Central Valley Region and Santa Clara and San Benito Counties, 25 of which contract with Reclamation for CVP water (see Table 2 below).

Table 2. SLDMWA Member Agencies

Upper Delta-Mendota Canal	San Luis Canal	Exchange Contractors and Refuges	San Felipe Division	Lower Delta-Mendota Canal and Mendota Pool
Banta-Carbona Irrigation District	Panoche Water District	Central California Irrigation District	San Benito County Water District	Broadview Water District
Byron-Bethany Irrigation District	San Luis Water District	Columbia Canal Company (a friend)	Santa Clara Valley Water District	Eagle Field Water District
City of Tracy	Westlands Water District	Firebaugh Canal Water District		Fresno Slough Water District
Del Puerto Water District		Grassland Water District		James Irrigation District
Patterson Water District		Henry Miller Reclamation District #2131		Laguna Water District
Westside Irrigation District				Mercy Springs Water District
West Stanislaus Irrigation District				Oro Loma Water District
				Pacheco Water District
				Reclamation District 1606
				Tranquillity Irrigation District

Water supplies for the SLDMWA member agencies include SWP and CVP water, groundwater, local surface water, recycled, purified, and transfer water. The SLDMWA agencies hold contracts for approximately 3.0 million acre-feet (MAF) of CVP water annually. Approximately 2.5 MAF of the water is used to irrigate 1.2 million acres of agricultural lands in the Central Valley and Santa Clara and San Benito Counties, while 150 to 250 TAF is used for municipal and industrial (M&I) purposes, and 250 to 300 TAF is used for environmental purposes including wildlife habitat management in the San Joaquin Valley (SLDMWA 2020).

In the past, Reclamation has made significant cutbacks to water deliveries for many CVP contractors due to drought and regulatory restrictions, among other factors, as shown in Table 3. The implementation of the 2008 and 2009 United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) Biological Opinions for the long-term operations of SWP and CVP resulted in substantial changes in South-of-Delta CVP deliveries. In addition, State Water Board Decision 1641 and the Central Valley Project Improvement Act (CVPIA) have also impacted CVP deliveries. Because of groundwater overdraft conditions throughout the SLDMWA region, groundwater supplies are declining. This has further reduced water supplies for the SLDMWA agencies.

In 2014 and 2015, critical water years, South-of-Delta CVP allocations were 0% for agricultural contractors and 25%, or approximately 42 TAF, for M&I contractors (Reclamation 2020a). In 2019, a wet water year, South-of-Delta CVP allocations were revised to 75%, or approximately 1.5 MAF, for agricultural contractors and 100%, or approximately 138 TAF, for M&I contractors in June 2019 (Reclamation 2020a). Most recently, in February 2020, South-of-Delta CVP agricultural water service contractors received an initial allocation of 20% of contracted supplies, and South-of Delta M&I contractors initially received a 70% allocation (Reclamation 2020b).

Table 3. Water Allocations for South-of-Delta CVP Contractors, 2014-2019 (Percent of Maximum Contract Allocation)

	2014	2015	2016	2017	2018	2019
Agricultural	0%	0%	5%	100%	50%	75%
M&I	50%	25%	55%	100%	75%	100%
Exchange Contractors	65%	75%	100%	100%	100%	100%
Refuges (Level 2)[1]	65%	75%	100%	100%	100%	100%
Eastside Division	55%	0%	0%	100%	100%	100%

Source: Reclamation 2020a

Notes: [1] Refuge water supplies are categorized into Level 2 and Incremental Level 4. Level 2 represents the historical average amount of water deliveries prior to the Central Valley Project Improvement Act enactment in 1992 and is the baseline water required for wildlife habitat management. Incremental Level 4 represents the additional increment of water required for optimal wetland habitat development.

E.3 South-of-Delta SWP Facilities and Contractors

E.3.1 South-of-Delta SWP Facilities

DWR operates the SWP, which diverts water from the Delta through the Harvey O. Banks Pumping Plant (Banks Pumping Plant) into Bethany Reservoir. The California Aqueduct is 444 miles long and delivers water from Bethany Reservoir south to the Central Valley and Southern California. The California Aqueduct flows south 60 miles to O'Neill Forebay at San Luis Reservoir (DWR 2018). At O'Neill Forebay, the California Aqueduct becomes the San Luis Canal, which is managed jointly by Reclamation and DWR and serves both the CVP and SWP. The San Luis Canal is federally-built and extends 103 miles from O'Neil Forebay southeast to just past Kettleman City (Reclamation 2019). At this point it becomes the California Aqueduct again, an SWP facility that delivers water over the Tehachapi Mountains to southern California.

E.3.2 South-of-Delta SWP Contractors

The SWP delivers water to 29 public water agencies in Northern, Central and Southern California that hold long-term contracts for surface water deliveries (see Table 4 below for a list of South-of-Delta agencies with SWP contracts). The agencies deliver water for both urban and agricultural use, representing over 25 million municipal water users and 750,000 acres of irrigated farmland. Five of the agencies use the SWP water primarily for agricultural uses and the remaining 24 use the SWP water primarily for municipal use.

Table 4. South-of-Delta SWP Contractors

Alameda County Flood Control & Water Conservation District - Zone 7	Metropolitan Water District of Southern California
Alameda County Water District	Mojave Water Agency
Antelope Valley-East Kern Water Agency	Oak Flat Water District
Castaic Lake Water Agency	Palmdale Water District
Coachella Valley Water District	San Bernardino Valley Municipal Water District
County of Kings	San Gabriel Valley Municipal Water District
Crestline-Lake Arrowhead Water Agency	San Gorgonio Pass Water Agency
Desert Water Agency	San Luis Obispo County Flood Control and Water Conservation District
Dudley Ridge Water District	Santa Barbara County Flood Control and Water Conservation District
Empire-West Side Irrigation District	Santa Clara Valley Water District
Kern County Water Agency	Tulare Lake Basin Water Storage District
Littlerock Creek Irrigation District	Ventura County Watershed Protection District

Water supplies for the agencies include imported SWP water, groundwater, local surface water, and for some agencies other imported supplies. Some agencies also have recycled or purified water sources and desalination. The agencies collectively have received deliveries ranging from approximately 1.4 MAF in dry water years to approximately 4.0 MAF in wet years.

Similar to CVP South-of-Delta deliveries, SWP exports from the Delta and the corresponding South-of-Delta deliveries have decreased over time. Implementation of the 2008 and 2009 USFWS and NMFS Biological Opinions for the Long-Term Operations of the SWP and CVP, State Water Board Decision 1641, and CVPIA resulted in substantial changes in South-of-Delta SWP deliveries. In the period between 2005 and 2013, average annual SWP exports have fallen by 12% (DWR 2018).

E.4 Water Supply Modeling Results

Water operations modeling of the CVP/SWP system was performed using CalSim II. CalSim II is a planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems. CalSim II modeling was developed from a baseline model provided by Reclamation to the project team. The model's input hydrology includes historical hydrology projected to water year 2030 with climate change and with projected 2020 modifications for operations upstream of the rim reservoirs.

The CalSim II model monthly simulation of an actual daily (or even hourly) operation of CVP and SWP results in several limitations in use of model results. Model results must be used in a comparative manner to reduce effects of use of monthly and other assumptions that are indicative of real-time operations, but do not specifically match real-time observations. CalSim II model output is based upon a monthly time step. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches. Therefore, if quantitative changes between a specific alternative and the No Action Alternative are 5% or less, conditions under the specific alternative would be considered to be "similar" to conditions under the No Action Alternative.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CalSim II utilizes a series of operating rules to reach a solution to allow for continuation of the simulation. It is recognized that these operating rules are a simplified version of very complex decision processes that CVP and SWP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be evaluated on a comparative basis between alternatives and are an approximation of extreme operational conditions.

E.4.1 Alternative 2 Deliveries

The following sections provide CalSim II modeling results for Alternative 2, which would change the current approach for annual CVP water supply allocations.

E.4.1.1 Deliveries to CVP Contractors

Deliveries to North-of-Delta CVP Contractors Under operation of Alternative 2, there would be no changes to North-of-Delta CVP deliveries.

Agricultural Deliveries to South-of-Delta CVP Contractors Under operation of Alternative 2, average annual South-of-Delta CVP agricultural deliveries are expected to decrease up to 86 TAF under certain water year types. There would be some small increases in deliveries in the Spring months; however, these increases would not offset the expected decreases in the Fall months in most years. Table 5 and Table 6 summarize the change in delivery of South-of-Delta CVP agricultural water under Alternative 2. Figure 3 and Figure 4 show the modeled impacts of the Alternative 2 on CVP South-of-Delta agricultural deliveries.

Table 5. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-8	-9	-3	-3	0	4	2	3	1	-21	-31	-20	-86
AN	-7	-7	-4	-2	0	5	5	12	12	-20	-23	-14	-42
BN	-8	-8	-3	-2	0	2	2	6	6	-16	-16	-13	-50
D	-6	-6	-3	-2	0	5	5	12	13	-8	-8	-7	-7
C	-2	-2	-1	-1	0	2	2	4	4	-2	-2	-1	0
All	-7	-7	-3	-2	0	4	3	7	7	-15	-18	-12	-42

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 6. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-30%	-51%	-9%	-4%	0%	5%	2%	1%	0%	-7%	-15%	-56%	-6%
AN	-29%	-46%	-11%	-3%	0%	9%	6%	8%	5%	-9%	-15%	-62%	-4%
BN	-32%	-51%	-11%	-4%	0%	4%	4%	5%	4%	-9%	-14%	-47%	-6%
D	-31%	-49%	-12%	-5%	0%	15%	10%	13%	9%	-7%	-10%	-31%	-1%
C	-17%	-24%	-6%	-3%	0%	7%	6%	8%	6%	-3%	-4%	-10%	0%
All	-29%	-47%	-10%	-4%	0%	8%	5%	6%	4%	-7%	-13%	-46%	-4%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.

Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

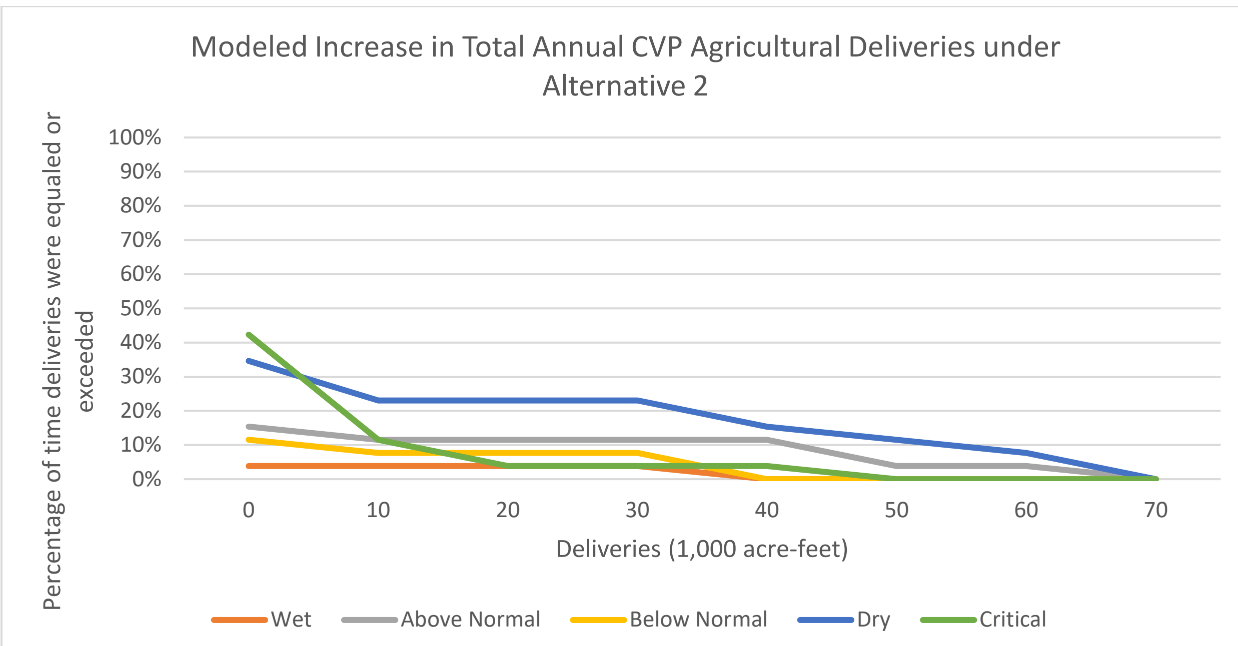


Figure 3. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 2

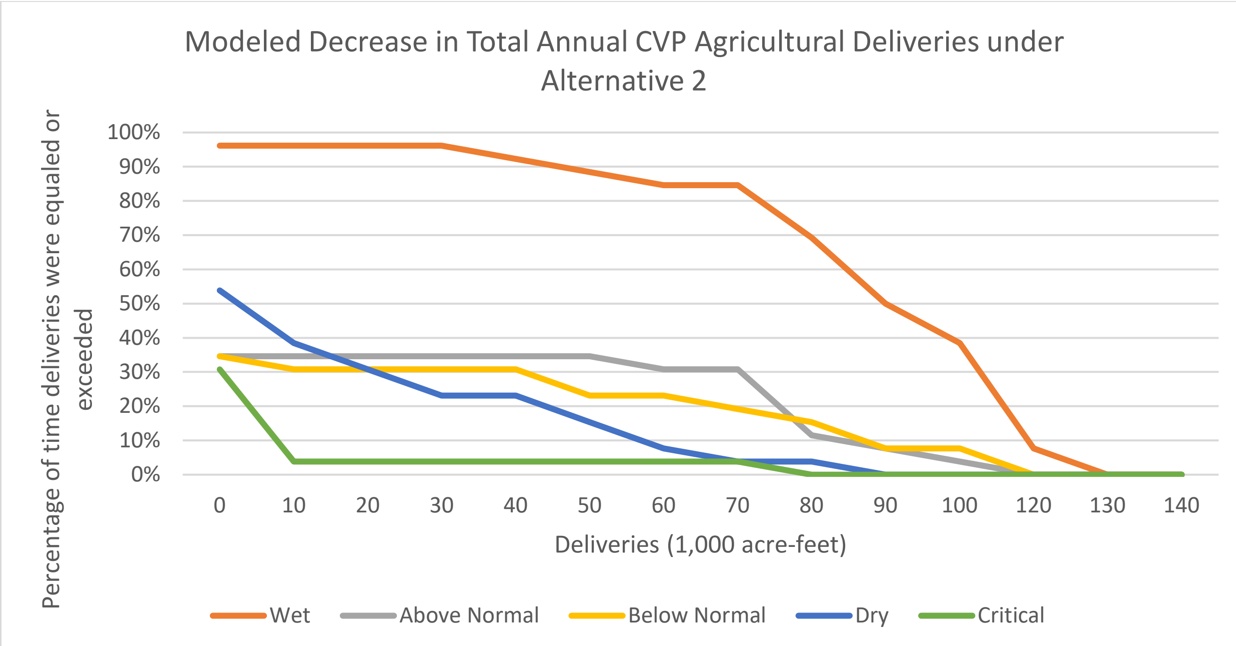


Figure 4. Modeled Decrease in Total CVP South-of-Delta Agricultural Deliveries under Alternative 2

Municipal and Industrial Deliveries to South-of-Delta CVP Contractors Under operation of Alternative 2, average annual South-of-Delta CVP M&I deliveries are expected to decrease up to 2 TAF under certain water year types. Table 7 and Table 8 summarize the change in delivery of CVP water under this option.

Table 7. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	-1	0	-2
AN	0	0	0	0	0	0	0	0	0	0	0	0	-1
BN	0	0	0	0	0	0	0	0	0	0	0	0	-1
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0	-1

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 8. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2%	-1%	-1%	-1%	0%	1%	0%	0%	0%	-4%	-5%	-3%	-1%
AN	-2%	-1%	-1%	0%	0%	1%	1%	2%	2%	-4%	-4%	-3%	-1%
BN	-2%	-1%	-1%	-1%	0%	0%	1%	1%	1%	-3%	-3%	-2%	-1%
D	-1%	-1%	-1%	-1%	0%	1%	1%	3%	3%	-2%	-2%	-1%	0%
C	-1%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%
All	-2%	-1%	-1%	-1%	0%	1%	1%	1%	1%	-3%	-3%	-2%	-1%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Deliveries to South-of-Delta CVP Refuges Under operation of Alternative 2, South-of-Delta CVP refuge deliveries would not change and be the same as the No Project/No Action Conditions.

E.4.1.2 Deliveries to SWP Contractors

The CalSim II model tracks three categories of SWP deliveries – Table A contract allocations (i.e., firm), Article 21 (i.e., surplus or interruptible), and Article 56 (i.e., carryover). Article 21 water is available to SWP contractors when SWP storage in San Luis Reservoir is full and there is excess water in the Delta. Article 56 water, referred to as carryover water, is Table A water allocated to a contractor in one year but held in San Luis Reservoir until it was delivered in the following calendar year.

Changes to average annual South-of-Delta SWP deliveries under Alternative 2 are expected to be minimal. Table 9 and Table 10 summarize the change in delivery of Table A SWP water under Alternative 2. Table 11 and 12 summarizes the change in delivery of Article 21 SWP water under Alternative 2.

Table 9. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	3
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	3
All	0	0	0	0	0	0	0	0	0	0	0	0	1

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 10. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
AN	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BN	0%	0%	0%	2%	1%	1%	0%	0%	0%	0%	0%	0%	0%
D	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
C	0%	0%	0%	1%	1%	5%	2%	1%	0%	0%	0%	0%	0%
All	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 11. Averaged Modeled Difference in Article 21 SWP Deliveries between the No Project/No Action Conditions and Alternative 2 by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	2	1	3	1	0	0	0	0	0	6
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	0	1	0	0	0	0	0	0	2

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

E.4.2 Alternative 3 Deliveries

The following sections provide CalSim II modeling results for Alternative 3, which would raise Sisk Dam by approximately ten feet and increase storage capacity at San Luis Reservoir by approximately 130 TAF.

E.4.2.1 Deliveries to CVP Contractors

Deliveries to North-of-Delta CVP Contractors Under operation of all configurations of Alternative 3, changes to North-of-Delta CVP deliveries are expected to be minimal, with decrease of approximately 1 TAF under certain water year types.

Agricultural Deliveries to South-of-Delta CVP Contractors Under operation of Alternative 3 CVP Only Storage, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 78 TAF under certain water year types. CalSim II relies on assumption and approaches that contribute to minor fluctuations of up to 5% and projected changes of less than 5% are not identified as an adverse or beneficial water supply effect. Table 12 and Table 13 summarize the change in delivery of CVP water under this option. Figure 5 shows the modeled impacts of the Alternative 3 CVP Only Storage on CVP South-of-Delta agricultural deliveries.

Table 12. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	2	0	1	2	2	2	6	15	21	12	11	2	78
AN	1	1	1	3	3	1	3	9	15	11	4	1	54
BN	0	0	1	1	1	3	6	10	13	10	5	1	50
D	1	1	1	2	3	1	2	4	4	4	2	0	25
C	0	0	1	1	1	1	2	4	5	3	2	1	20
All	1	1	1	2	2	2	4	9	12	8	6	1	49

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 13. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	7%	3%	3%	2%	3%	3%	6%	9%	8%	4%	5%	7%	5%
AN	5%	5%	4%	5%	4%	2%	3%	6%	7%	5%	3%	5%	5%
BN	1%	1%	4%	1%	1%	6%	9%	10%	8%	6%	4%	3%	6%
D	5%	6%	5%	4%	4%	2%	3%	4%	3%	4%	2%	1%	3%
C	3%	3%	3%	3%	3%	3%	6%	7%	7%	4%	4%	4%	5%
All	5%	3%	3%	3%	3%	3%	5%	7%	6%	4%	4%	5%	5%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

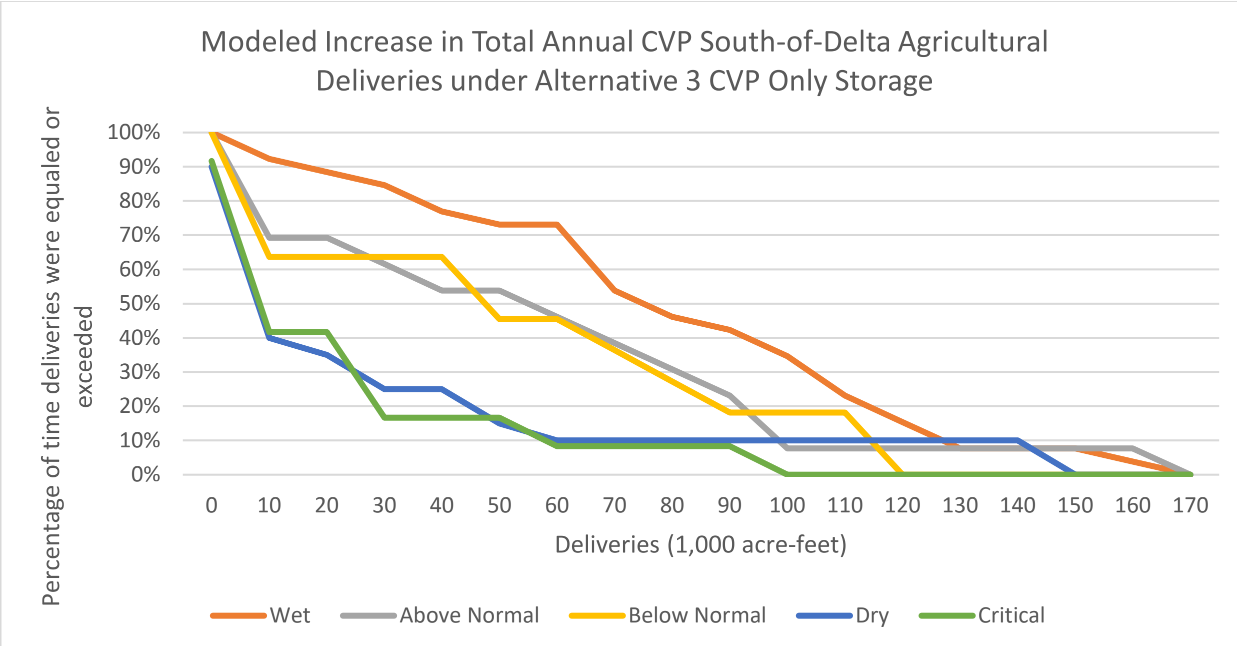


Figure 5. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 CVP Only Storage

Under operation of Alternative 3 CVP/SWP Split Storage, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 35 TAF under certain water year types. Table 14 and Table 15 summarize the change in delivery of CVP water under this option. Figure 6 shows the modeled impacts of the Alternative 3 CVP/SWP Split Storage on CVP South-of-Delta agricultural deliveries.

Table 14. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	1	1	1	4	8	10	3	3	3	35
AN	1	0	1	1	1	1	2	6	9	3	1	0	25
BN	0	0	0	0	1	2	3	5	7	4	3	1	24
D	0	0	1	1	1	1	1	2	3	2	1	0	14
C	0	0	0	1	1	0	1	3	4	2	1	0	15
All	0	0	0	1	1	1	2	5	7	2	2	1	24

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 15. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1%	1%	1%	1%	1%	2%	4%	5%	4%	1%	1%	9%	2%
AN	2%	2%	2%	2%	2%	1%	2%	4%	4%	1%	1%	0%	2%
BN	0%	0%	1%	-1%	1%	4%	5%	4%	4%	2%	2%	2%	3%
D	3%	3%	2%	2%	2%	2%	2%	2%	2%	1%	1%	0%	2%
C	2%	1%	2%	2%	2%	2%	5%	6%	6%	3%	3%	3%	4%
All	1%	1%	1%	1%	2%	2%	3%	4%	4%	1%	1%	4%	2%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

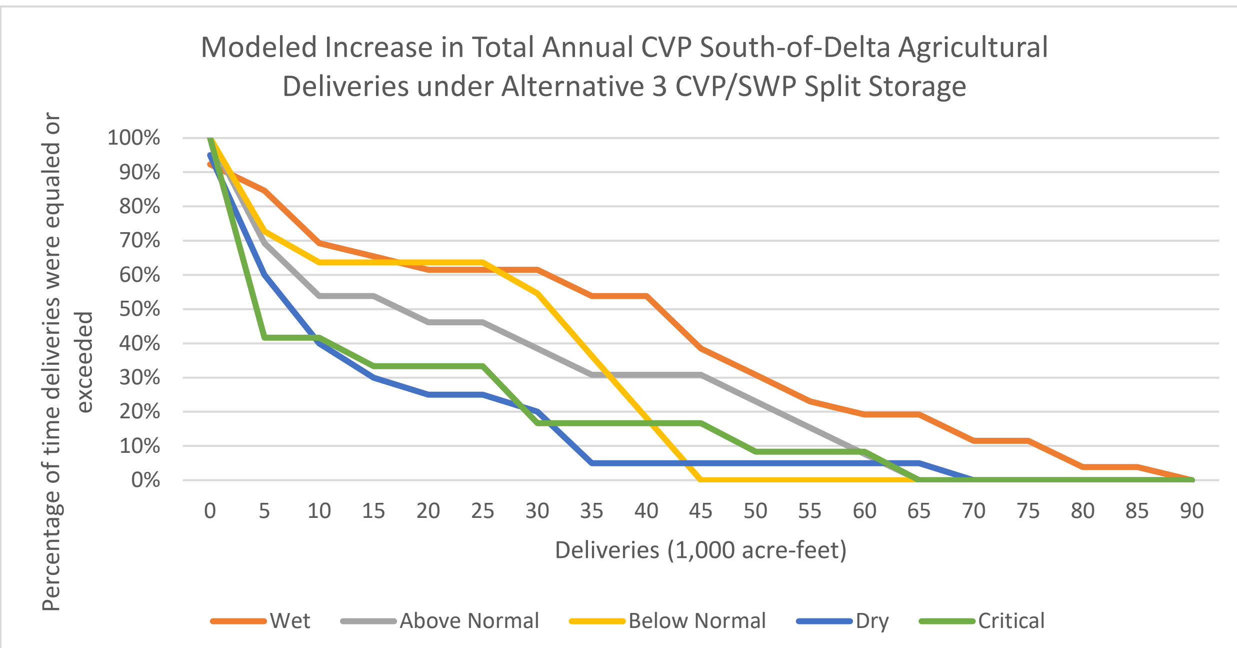


Figure 6. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 CVP/SWP Split Storage

Under operation of Alternative 3 Investor-Directed Storage Configuration A, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 74 TAF under certain water year types. Table 16 and Table 17 summarize the change in delivery of CVP water under this option. Figure 7 shows the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration A on CVP South-of-Delta agricultural deliveries.

Table 16. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	1	1	1	3	8	26	32	1	1	0	74
AN	0	0	0	0	0	2	3	10	14	4	3	1	38
BN	0	0	0	0	1	3	7	15	19	5	4	1	56
D	1	0	1	1	1	1	2	5	7	3	2	1	24
C	0	0	0	1	1	0	1	2	4	2	2	1	15
All	0	0	0	1	1	2	5	13	17	3	2	1	45

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 17. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	2%	2%	1%	1%	1%	4%	8%	15%	11%	0%	0%	1%	5%
AN	1%	1%	1%	1%	1%	3%	4%	6%	6%	2%	2%	4%	3%
BN	1%	1%	1%	1%	1%	7%	10%	14%	12%	3%	3%	4%	6%
D	3%	3%	2%	2%	2%	2%	4%	5%	5%	2%	2%	3%	3%
C	3%	3%	2%	2%	2%	1%	4%	5%	5%	3%	4%	4%	4%
All	2%	2%	1%	1%	1%	4%	7%	11%	9%	1%	1%	2%	5%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

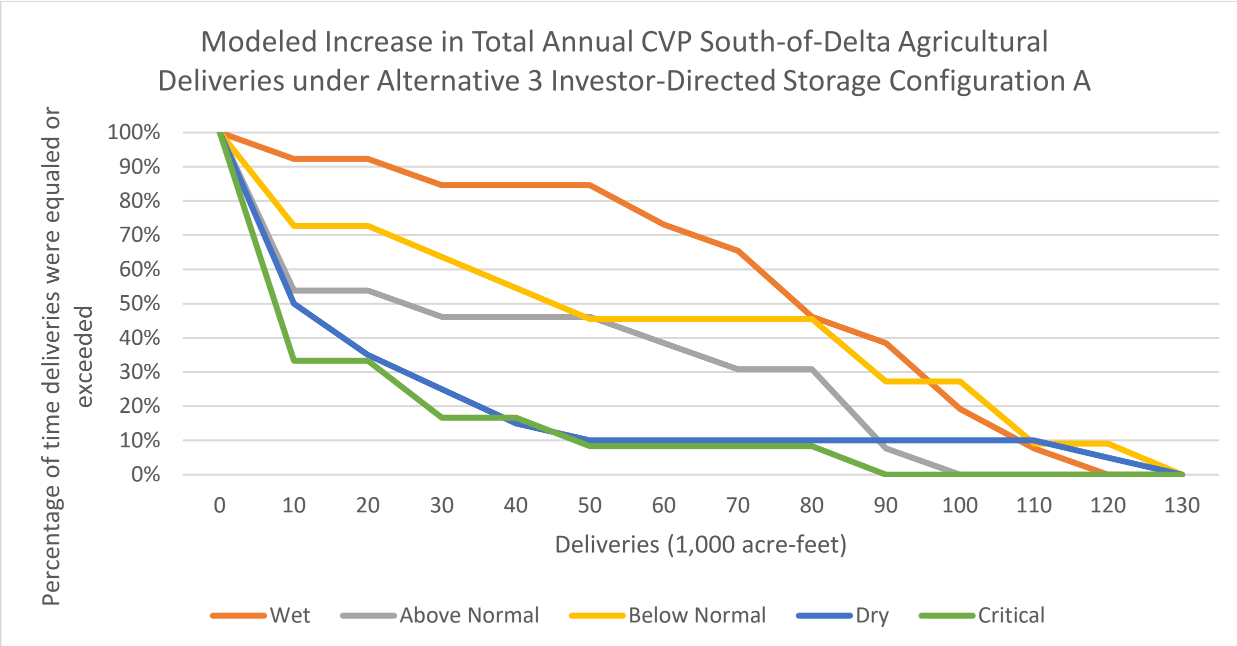


Figure 7. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration A

Under operation of Alternative 3 Investor-Directed Storage Configuration B, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 10 TAF under certain water year types. Table 18 and Table 19 summarize the change in delivery of CVP water under this option. Figure 8 shows the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration B on CVP South-of-Delta agricultural deliveries.

Table 18. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration B by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	1	3	4	0	0	0	10
AN	0	0	0	0	0	0	0	1	2	1	0	0	5
BN	0	0	0	0	0	0	1	2	2	1	0	0	7
D	0	0	0	0	0	0	0	1	1	0	0	0	3
C	0	0	0	0	0	0	0	0	0	0	0	0	2
All	0	0	0	0	0	0	1	2	2	0	0	0	6

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 19. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration B by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0%	0%	0%	0%	0%	1%	1%	2%	1%	0%	0%	0%	1%
AN	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	1%	0%
BN	0%	0%	0%	0%	0%	1%	1%	2%	1%	0%	0%	1%	1%
D	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%
C	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%
All	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

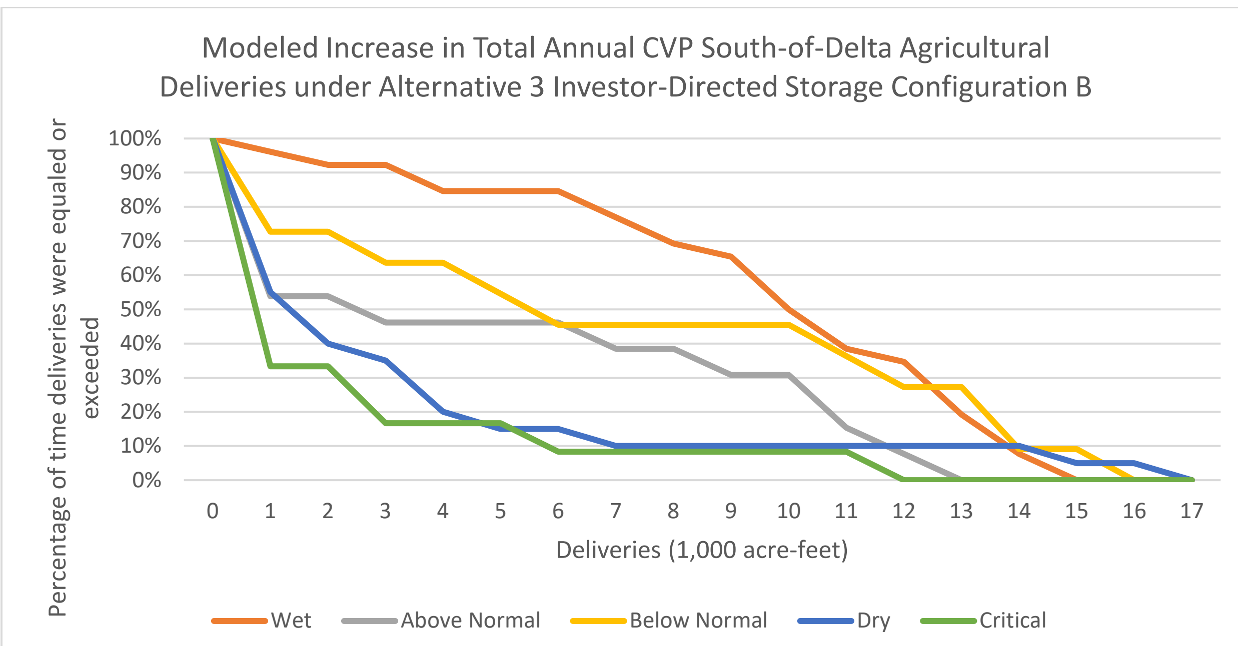


Figure 8. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration B

Under operation of Alternative 3 Investor-Directed Storage Configuration C, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 28 TAF under certain water year types. Table 20 and Table 21 summarize the change in delivery of CVP water under this option. Figure 9 and Figure 10 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration C on CVP South-of-Delta agricultural deliveries.

Table 20. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/ No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-7	-7	-3	-2	0	8	14	37	42	-17	-24	-16	26
AN	-6	-6	-3	-2	0	6	10	26	32	-14	-16	-10	17
BN	-6	-6	-2	-1	0	6	10	24	28	-9	-10	-9	24
D	-4	-5	-2	-2	1	5	8	20	23	-5	-5	-5	28
C	-2	-2	-1	0	1	2	4	9	11	1	0	-1	23
All	-5	-5	-2	-1	1	6	10	25	29	-10	-13	-9	25

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 21. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/ No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-25%	-39%	-7%	-3%	1%	11%	13%	21%	15%	-5%	-12%	-44%	2%
AN	-23%	-36%	-9%	-4%	0%	12%	12%	17%	14%	-6%	-11%	-47%	2%
BN	-25%	-40%	-8%	-2%	1%	15%	16%	23%	17%	-6%	-9%	-35%	3%
D	-23%	-37%	-8%	-3%	1%	16%	16%	21%	16%	-4%	-6%	-23%	4%
C	-11%	-16%	-3%	-1%	2%	10%	13%	17%	15%	1%	1%	-4%	5%
All	-23%	-36%	-7%	-3%	1%	12%	14%	20%	15%	-5%	-10%	-35%	2%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

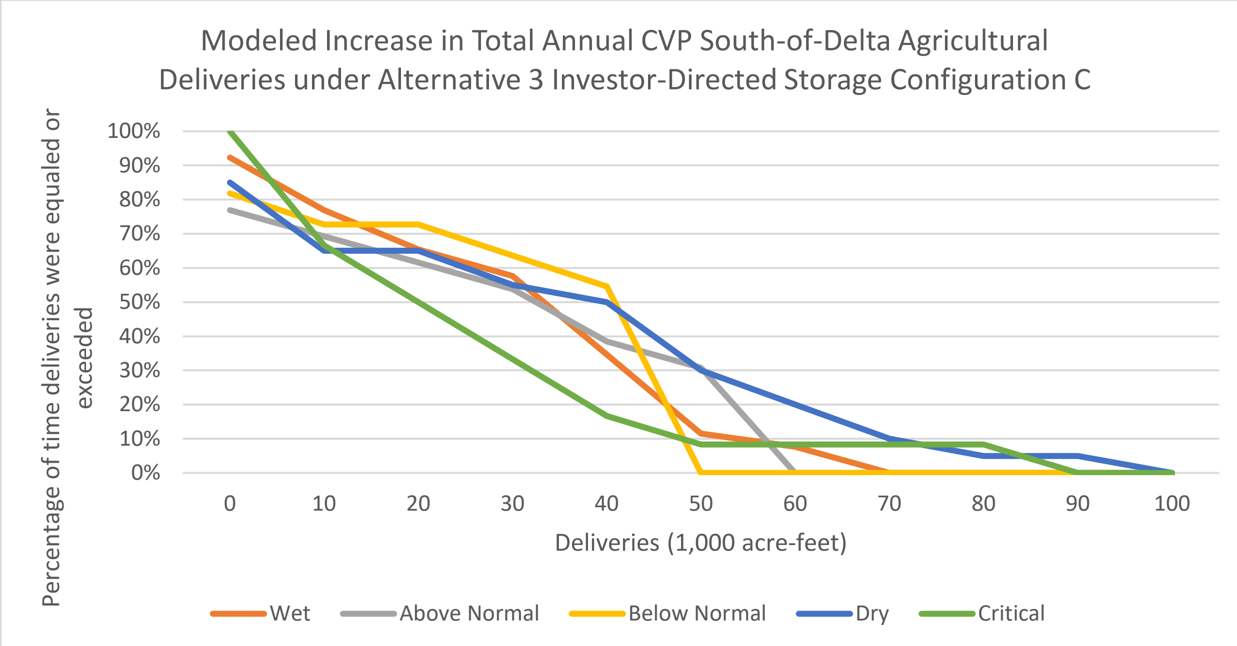


Figure 9. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration C

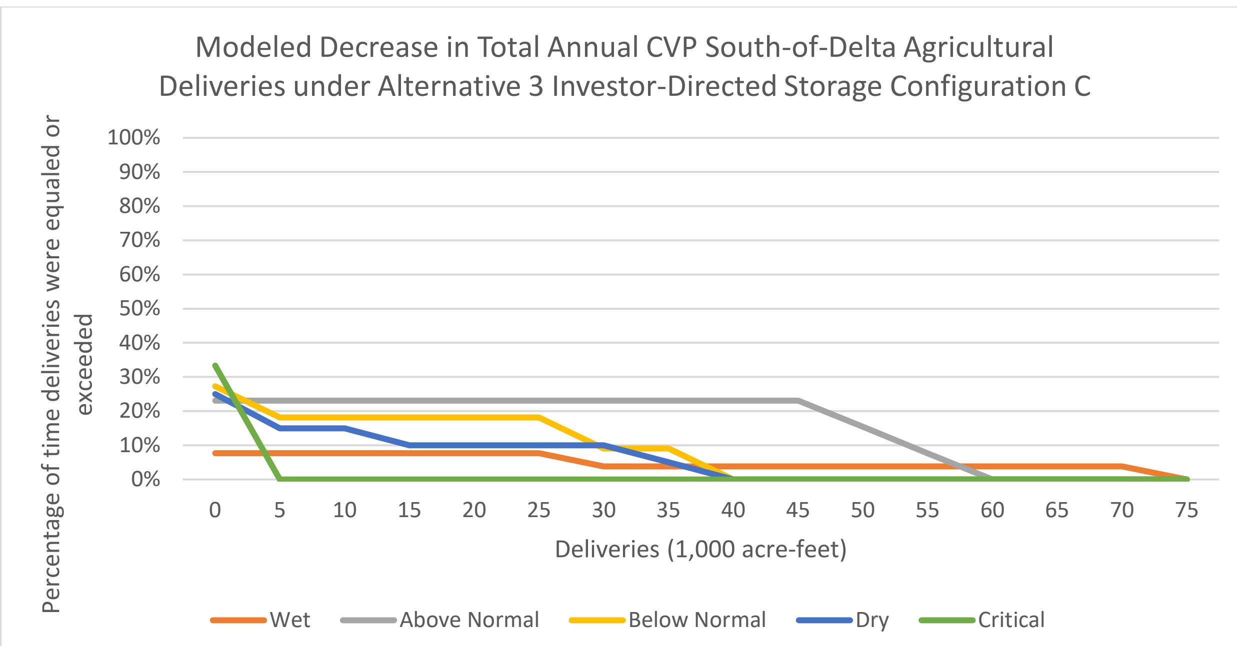


Figure 10. Modeled Decrease in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration C

Under operation of Alternative 3 Investor-Directed Storage Configuration D, average annual South-of-Delta CVP agricultural deliveries are expected to increase up to 4 TAF under certain water year types. Table 22 and Table 23 summarize the change in delivery of CVP water under this option. Figure 11 and Figure 12 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration D on CVP South-of-Delta agricultural deliveries.

Table 22. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration D by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1	-1	0	0	0	1	2	5	5	-2	-3	-2	4
AN	-1	-1	0	0	0	1	1	3	4	-2	-2	-1	2
BN	-1	-1	0	0	0	1	1	3	4	-1	-1	-1	4
D	-1	-1	0	0	0	1	1	2	3	-1	-1	-1	3
C	0	0	0	0	0	0	1	1	2	0	0	0	3
All	-1	-1	0	0	0	1	1	3	4	-1	-2	-1	3

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 23. Averaged Modeled Difference in Total CVP Agricultural Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration D by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-3%	-5%	-1%	0%	0%	1%	2%	3%	2%	-1%	-2%	-5%	0%
AN	-3%	-4%	-1%	0%	0%	1%	2%	2%	2%	-1%	-1%	-6%	0%
BN	-3%	-4%	-1%	0%	0%	2%	2%	3%	2%	-1%	-1%	-4%	0%
D	-3%	-5%	-1%	0%	0%	2%	2%	2%	2%	-1%	-1%	-3%	0%
C	-2%	-3%	-1%	0%	0%	2%	2%	3%	2%	0%	0%	-1%	1%
All	-3%	-5%	-1%	0%	0%	2%	2%	3%	2%	-1%	-1%	-4%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

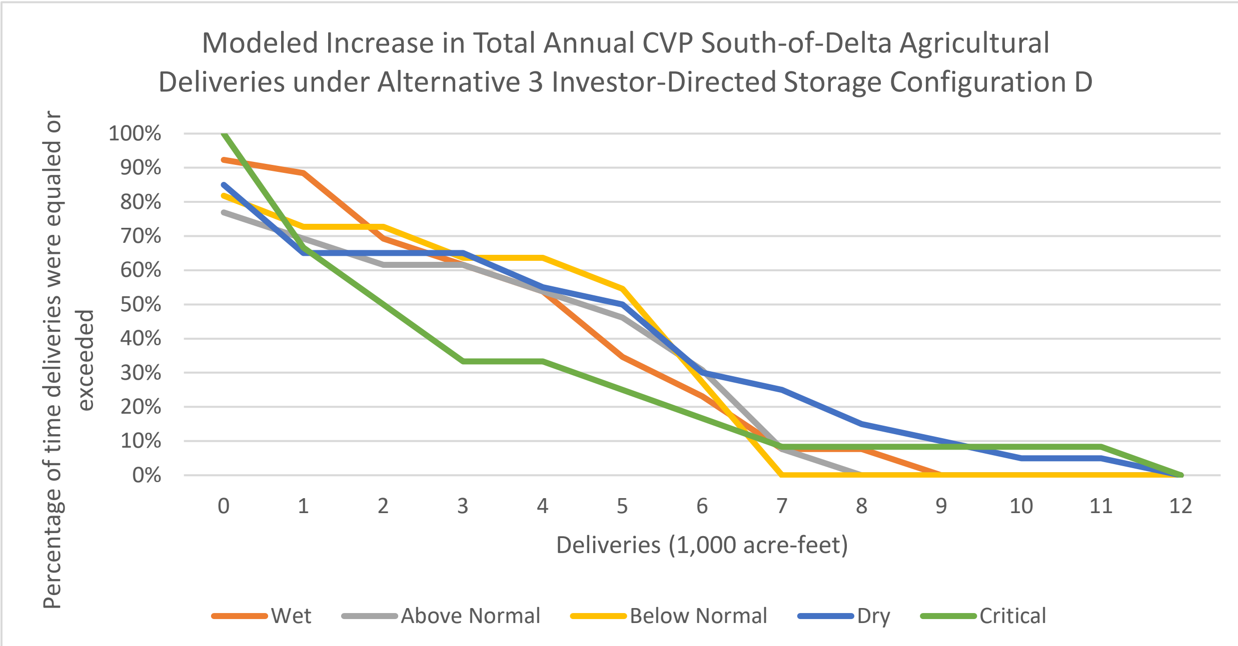


Figure 11. Modeled Increase in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration D

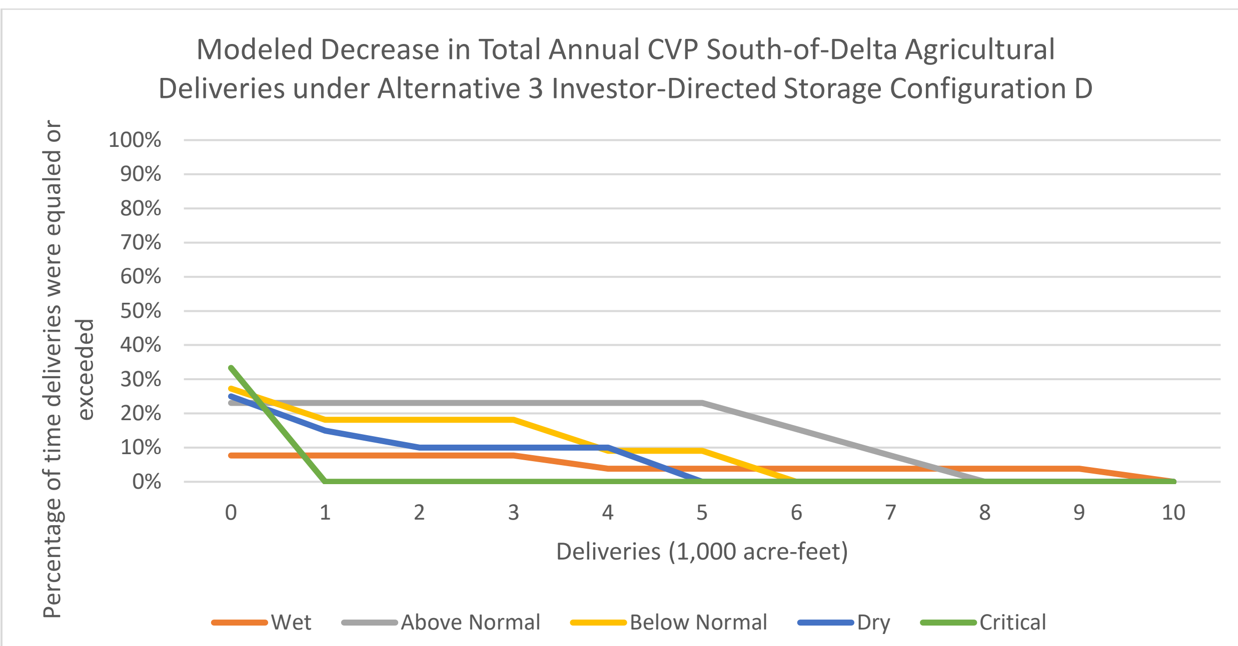


Figure 12. Modeled Decrease in Total CVP South-of-Delta Agricultural Deliveries under Alternative 3 Investor-Directed Storage Configuration D

Municipal and Industrial Deliveries to South-of-Delta CVP Contractors Under operation of Alternative 3 CVP Only Storage, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 2 TAF under certain water year types. Table 24 and Table 25 summarize the change in delivery of CVP water under this option. Figure 13 shows the modeled impacts of the Alternative 3 CVP Only Storage on CVP South-of-Delta M&I deliveries.

Table 24. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	2
AN	0	0	0	0	0	0	0	0	0	0	0	0	1
BN	0	0	0	0	0	0	0	0	0	0	0	0	2
D	0	0	0	0	0	0	0	0	0	0	0	0	2
C	0	0	0	0	0	0	0	0	0	0	0	0	1
All	0	0	0	0	0	0	0	0	0	0	0	0	2

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 25. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1%	1%	1%	1%	1%	1%	1%	2%	3%	1%	1%	3%	1%
AN	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	0%	-2%	1%
BN	0%	0%	0%	0%	0%	3%	3%	4%	3%	3%	2%	2%	2%
D	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	1%	1%	1%
C	1%	1%	1%	1%	1%	1%	1%	2%	2%	1%	1%	1%	1%
All	1%	1%	1%	1%	1%	1%	1%	2%	2%	1%	1%	2%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

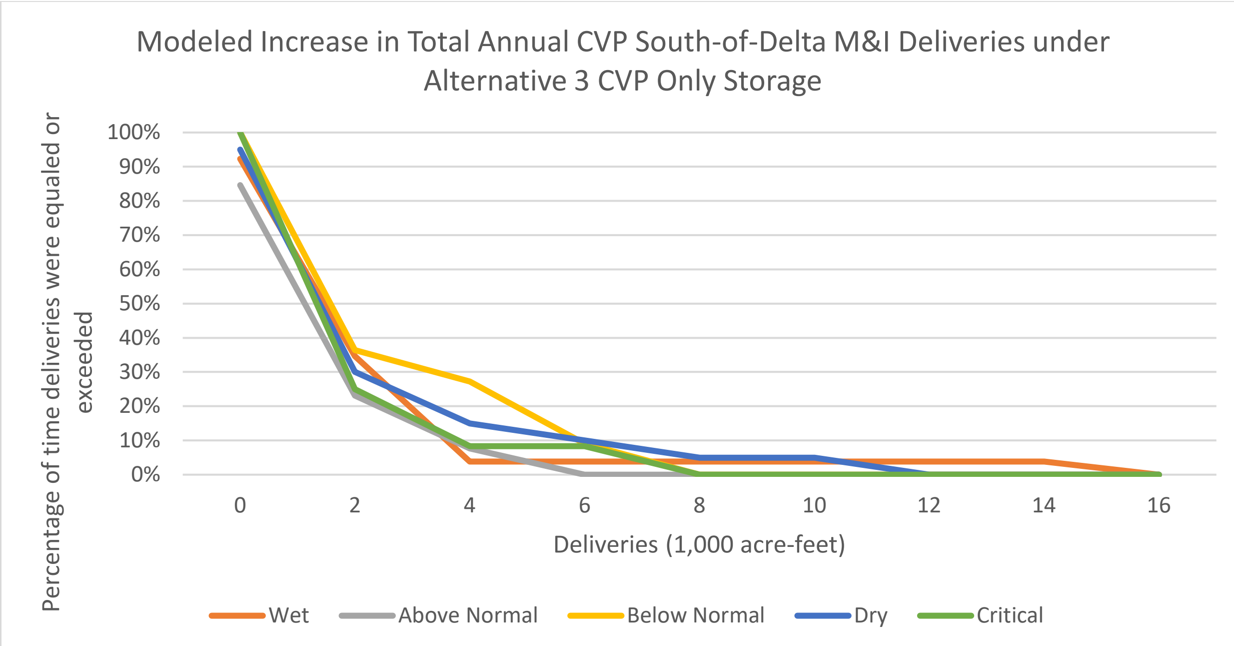


Figure 13. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 CVP Only Storage

Under operation of Alternative 3 CVP/SWP Split Storage, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 2 TAF under certain water year types. Table 26 and Table 27 summarize the change in delivery of CVP water under this option. Figure 14 shows the modeled impacts of the Alternative 3 CVP/SWP Split Storage on CVP South-of-Delta M&I deliveries.

Table 26. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	1	2
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	1
D	0	0	0	0	0	0	0	0	0	0	0	0	1
C	0	0	0	0	0	0	0	0	0	0	0	0	1
All	0	0	0	0	0	0	0	0	0	0	0	0	1

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 27. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%	0%	9%	1%
AN	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	-2%	0%
BN	0%	0%	0%	0%	0%	1%	2%	2%	2%	1%	1%	1%	1%
D	1%	1%	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%
C	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
All	0%	0%	1%	0%	1%	1%	1%	1%	1%	0%	0%	3%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

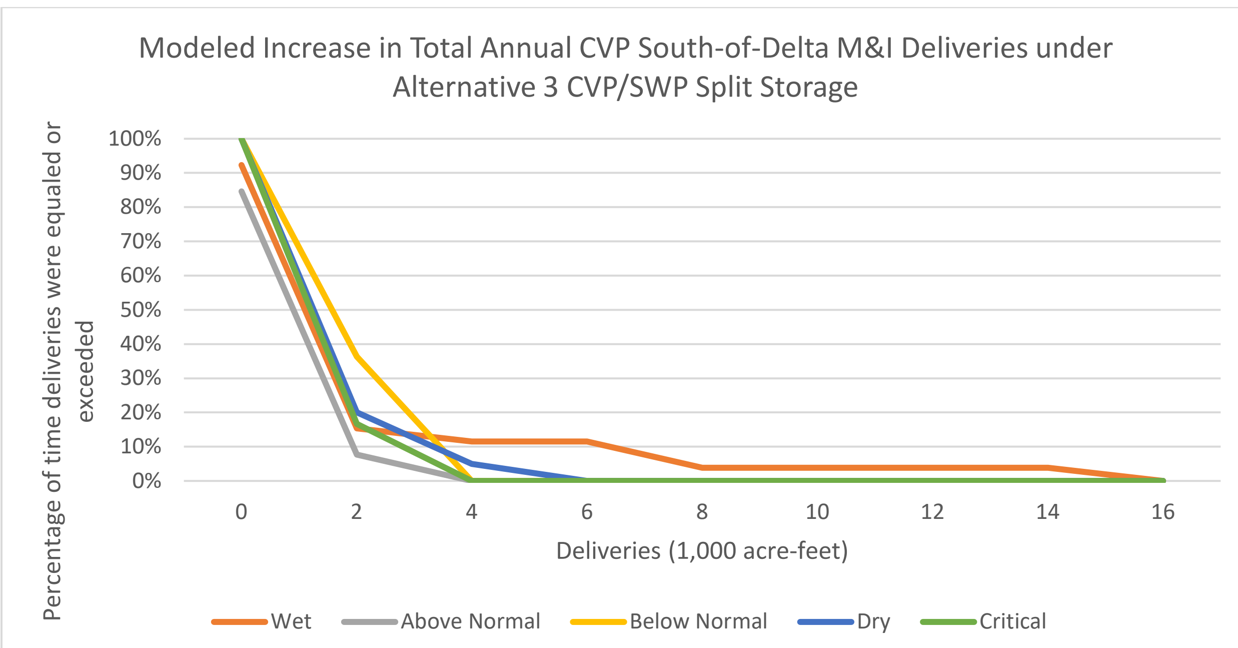


Figure 14. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 CVP/SWP Split Storage

Under operation of Alternative 3 Investor-Directed Storage Configuration A, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 4 TAF under certain water year types. Table 28 and Table 29 summarize the change in delivery of CVP water under this option. Figure 15 and Figure 16 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration A on CVP South-of-Delta M&I deliveries.

Table 28. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	2	-2	-2	2	6	-2	0	1	2	0	-1	0	4
AN	2	-2	-2	2	6	-2	0	0	1	0	-2	1	3
BN	1	-2	-2	2	6	-2	0	1	2	1	-1	-2	4
D	2	-2	-2	2	6	-2	0	1	1	0	-1	-2	2
C	2	-2	-2	1	5	-2	0	1	1	0	-1	-2	2
All	2	-2	-2	2	6	-2	0	1	1	0	-1	-1	3

Notes: Modeling Period 1922-2003, Data results from CalSim modeling.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 29. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	22%	-19%	-19%	19%	157%	-17%	2%	11%	14%	2%	-9%	-3%	3%
AN	17%	-17%	-16%	21%	158%	-19%	-2%	3%	6%	-4%	-15%	11%	2%
BN	16%	-18%	-18%	21%	163%	-16%	5%	13%	17%	6%	-7%	-17%	4%
D	21%	-18%	-18%	20%	159%	-18%	1%	10%	13%	3%	-9%	-18%	2%
C	23%	-17%	-17%	19%	150%	-23%	-1%	11%	13%	3%	-8%	-17%	2%
All	20%	-18%	-18%	20%	157%	-18%	1%	10%	13%	2%	-10%	-9%	3%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

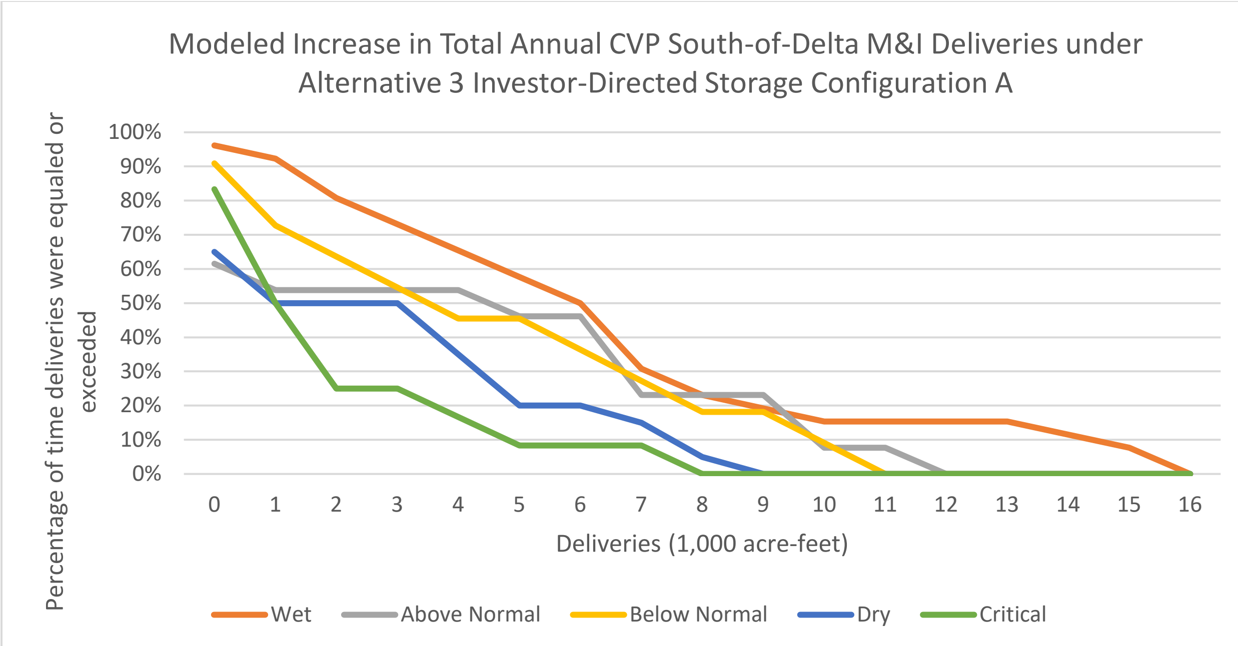


Figure 15. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration A

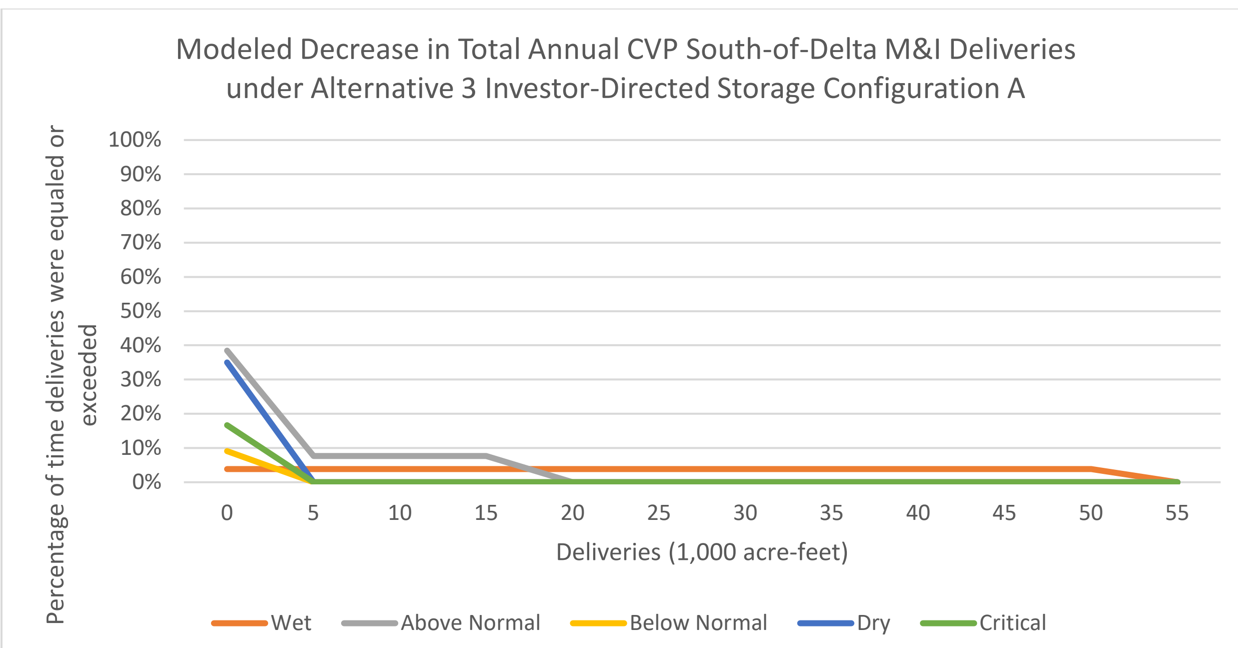


Figure 16. Modeled Decrease in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration A

Under operation of Alternative 3 Investor-Directed Storage Configuration B, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 75 TAF under certain water year types. Table 30 and Table 31 summarizes the change in delivery of CVP water under this option. Figure 17 and Figure 18 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration B on CVP South-of-Delta M&I deliveries.

Table 30. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration B by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	7	2	3	7	12	4	6	8	8	7	5	6	75
AN	5	1	1	5	9	0	3	5	6	6	3	4	48
BN	4	0	0	4	9	2	5	7	9	9	6	2	59
D	4	0	1	5	9	-1	2	3	5	4	2	-1	34
C	3	0	0	3	7	-2	1	2	3	3	1	-1	21
All	5	1	1	5	10	1	4	5	6	6	4	2	51

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 31. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration B by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	78%	20%	20%	83%	297%	27%	54%	68%	72%	56%	39%	47%	56%
AN	51%	9%	9%	62%	246%	1%	27%	42%	58%	53%	26%	42%	39%
BN	43%	1%	2%	54%	235%	20%	55%	76%	98%	91%	55%	17%	50%
D	54%	4%	5%	61%	250%	-8%	18%	37%	51%	44%	20%	-5%	30%
C	43%	-4%	-3%	45%	208%	-17%	11%	31%	44%	36%	14%	-8%	21%
All	58%	9%	9%	65%	257%	9%	37%	53%	65%	55%	32%	21%	42%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

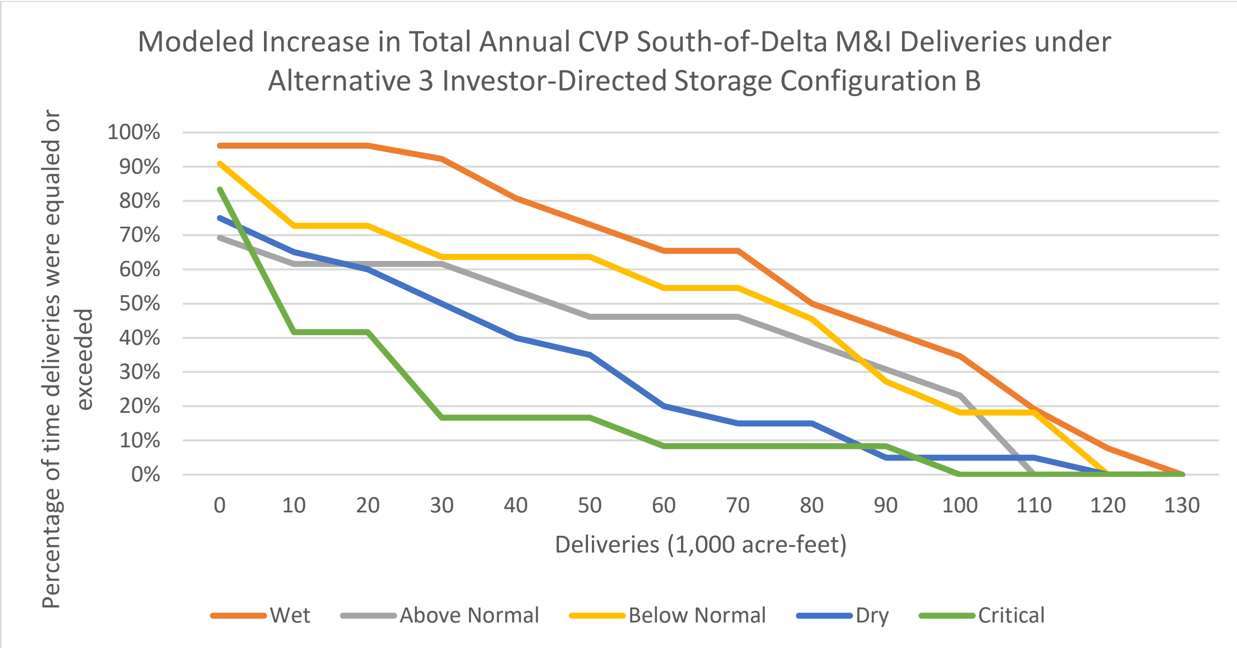


Figure 17. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration B

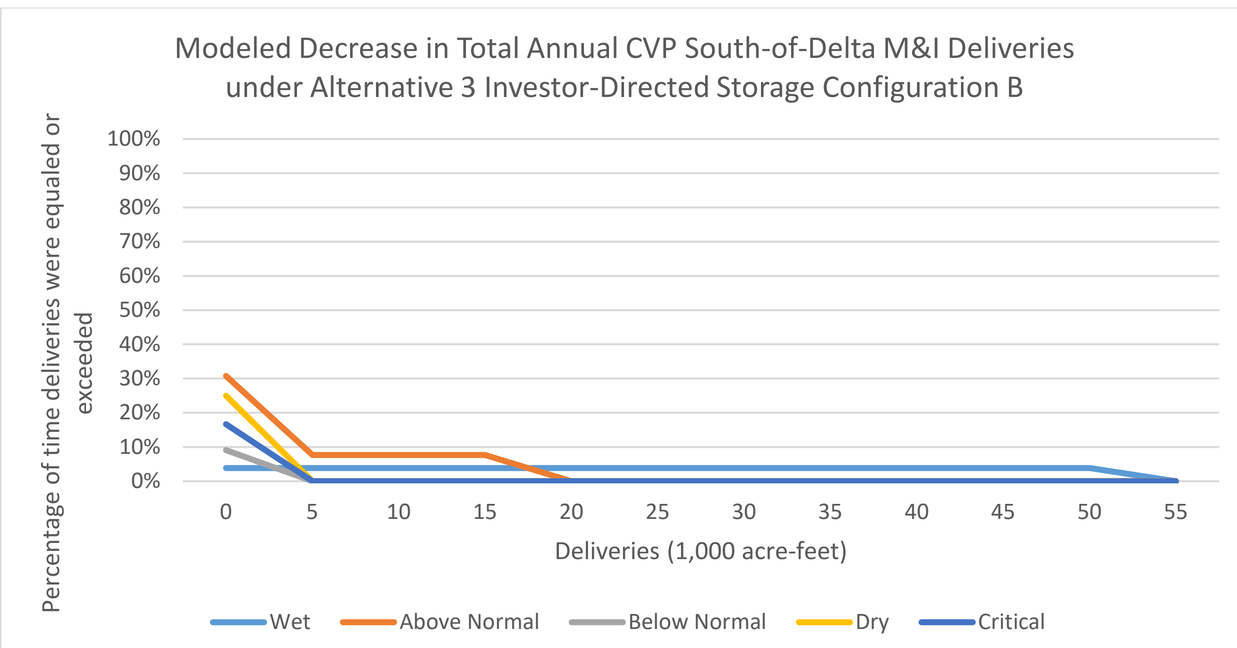


Figure 18. Modeled Decrease in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration B

Under operation of Alternative 3 Investor-Directed Storage Configuration C, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 2 TAF under certain water year types. Table 32 and Table 33 summarizes the change in delivery of CVP water under this option. Figure 19 and Figure 20 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration C on CVP South-of-Delta M&I deliveries.

Table 32. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	2	-3	-3	1	6	-3	0	1	1	0	-2	-1	0
AN	1	-2	-2	2	6	-2	0	0	0	-1	-2	1	0
BN	1	-2	-2	2	6	-2	0	1	1	0	-1	-2	2
D	2	-2	-2	2	6	-2	0	1	1	0	-1	-2	2
C	2	-2	-2	1	5	-2	0	1	1	0	-1	-2	2
All	2	-2	-2	1	6	-2	0	1	1	0	-1	-1	1

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 33. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	20%	-21%	-20%	16%	151%	-19%	-1%	8%	10%	-1%	-12%	-6%	0%
AN	14%	-18%	-18%	19%	152%	-20%	-3%	1%	4%	-6%	-17%	9%	0%
BN	15%	-19%	-19%	20%	161%	-18%	2%	11%	14%	3%	-9%	-19%	2%
D	20%	-19%	-18%	19%	156%	-17%	2%	11%	14%	3%	-8%	-17%	2%
C	23%	-17%	-16%	19%	150%	-22%	1%	12%	15%	4%	-7%	-16%	2%
All	19%	-19%	-19%	18%	153%	-19%	0%	8%	11%	0%	-11%	-10%	1%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

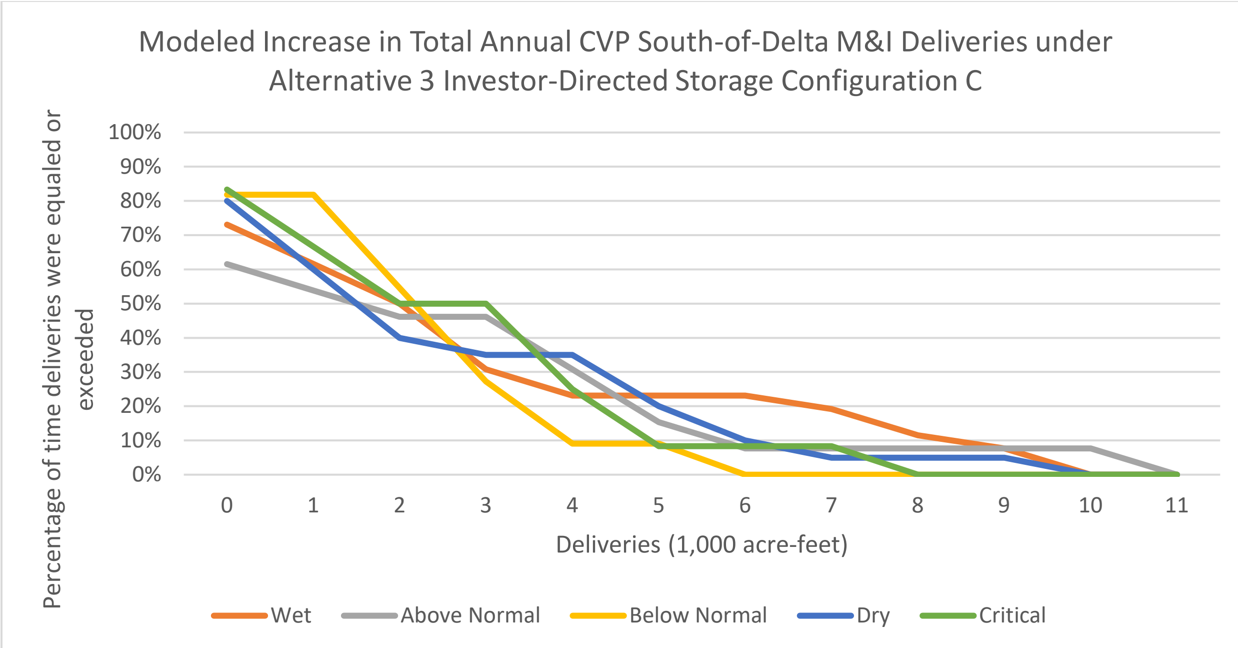


Figure 19. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration C

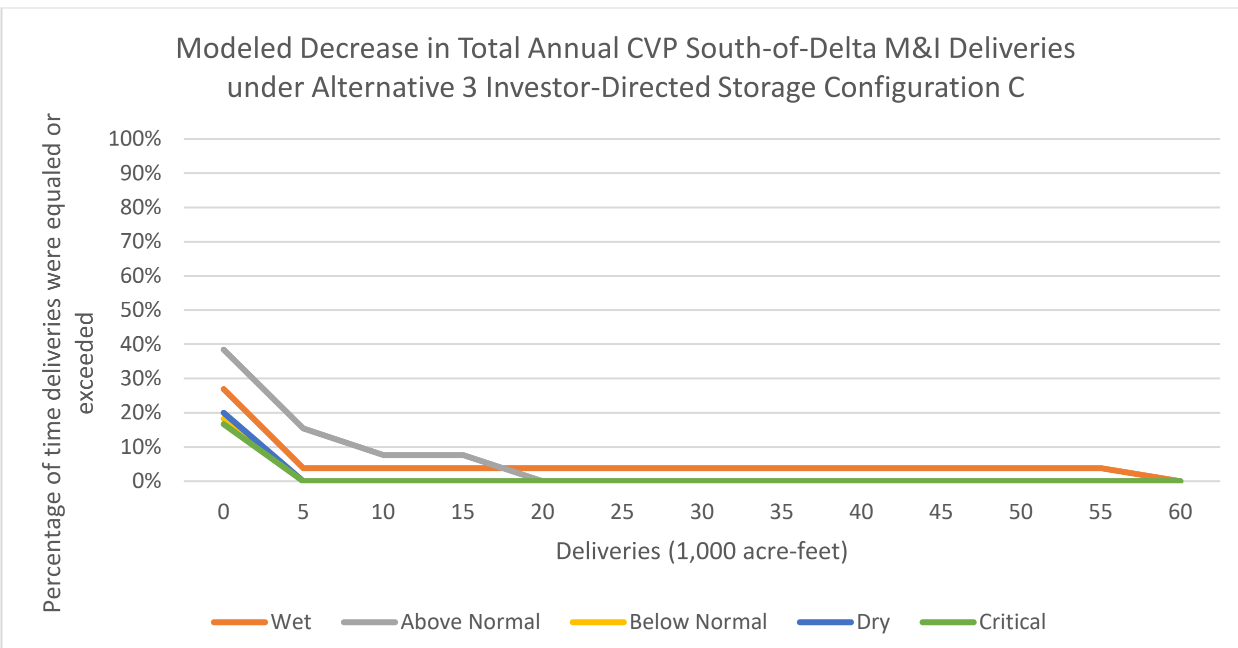


Figure 20. Modeled Decrease in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration C

Under operation of Alternative 3 Investor-Directed Storage Configuration D, average annual South-of-Delta CVP M&I deliveries are expected to increase up to 35 TAF under certain water year types. Table 34 and Table 35 summarizes the change in delivery of CVP water under this option. Figure 21 and Figure 22 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration D on CVP South-of-Delta M&I deliveries.

Table 34. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration D by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	0	0	4	9	-1	1	3	3	2	0	1	26
AN	2	-2	-2	2	6	-2	1	2	3	2	0	2	14
BN	3	-1	-1	3	8	0	2	4	5	5	2	-1	29
D	3	-1	0	4	8	1	3	4	5	5	3	1	35
C	3	0	0	3	7	-1	2	4	5	4	3	0	30
All	3	-1	-1	3	8	-1	2	3	4	3	1	1	27

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 35. Averaged Modeled Difference in Total CVP M&I Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration D by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	48%	-1%	-1%	49%	220%	-8%	12%	23%	27%	16%	2%	7%	19%
AN	19%	-15%	-15%	24%	165%	-15%	7%	17%	27%	20%	0%	20%	11%
BN	30%	-8%	-8%	39%	203%	-4%	24%	40%	55%	47%	22%	-4%	25%
D	42%	-5%	-4%	46%	217%	6%	31%	48%	57%	48%	27%	6%	31%
C	45%	-3%	-2%	46%	211%	-5%	26%	46%	59%	49%	26%	3%	29%
All	39%	-6%	-5%	42%	207%	-5%	18%	33%	41%	31%	12%	6%	23%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

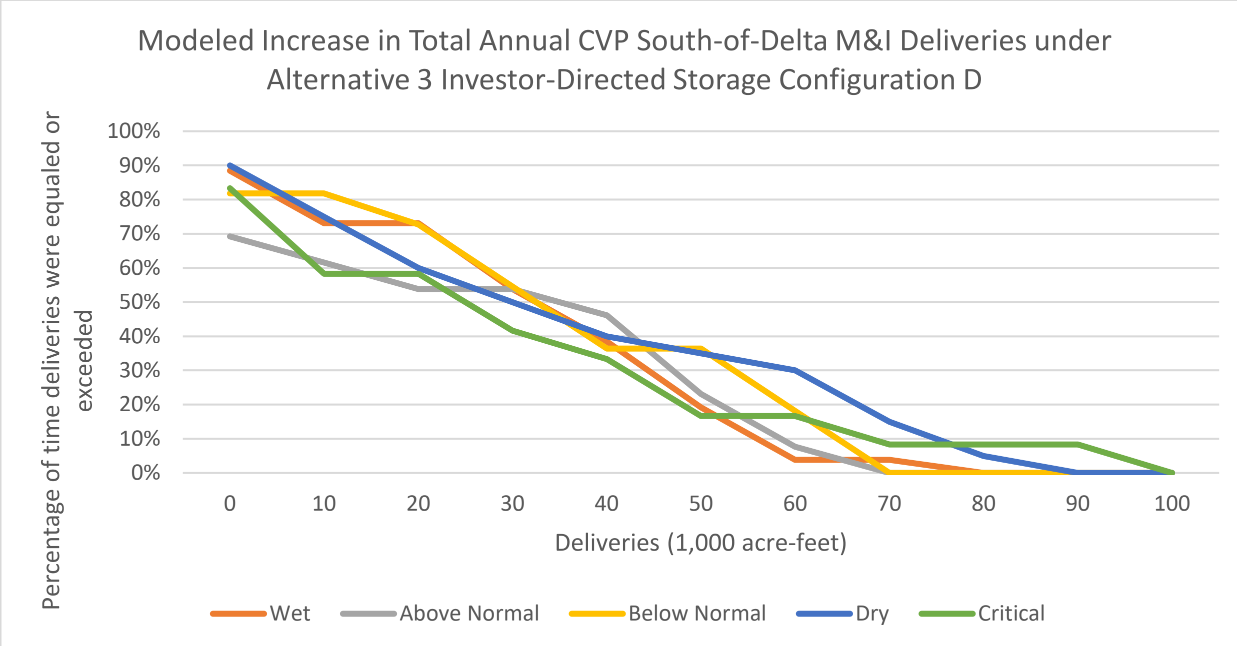


Figure 21. Modeled Increase in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration D

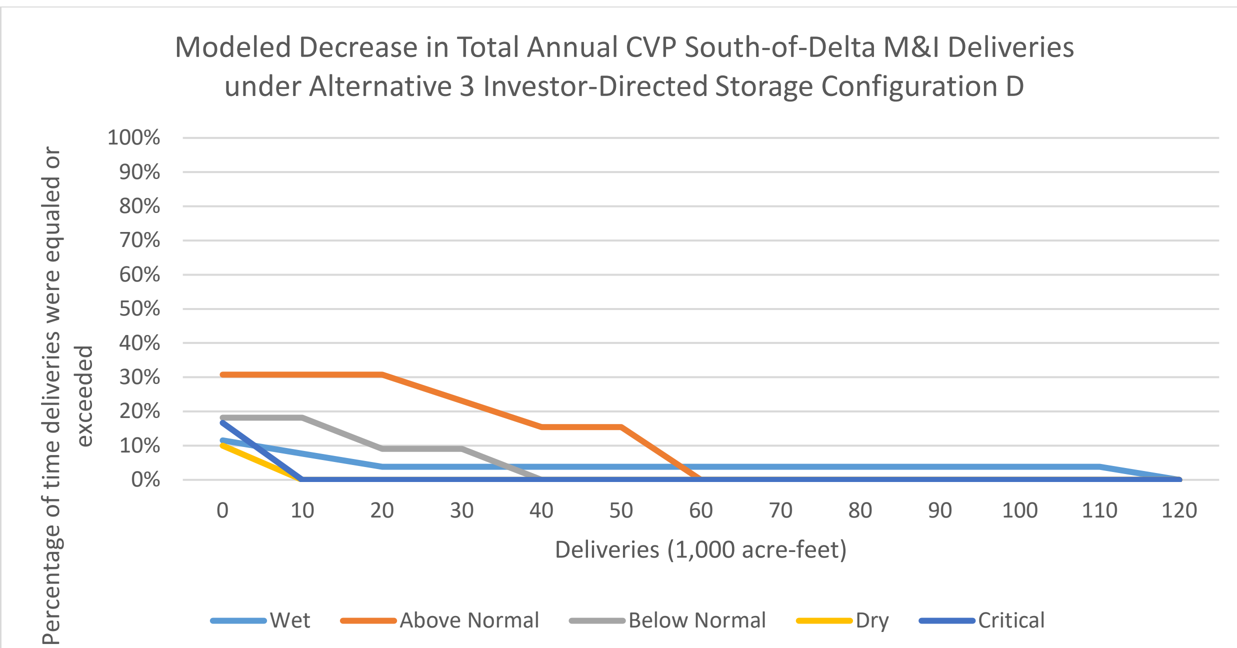


Figure 22. Modeled Decrease in Total CVP South-of-Delta M&I Deliveries under Alternative 3 Investor-Directed Storage Configuration D

Deliveries to South-of-Delta CVP Refuges Under operation of Alternative 3 CVP Only Storage and CVP/SWP Split Storage, changes to South-of-Delta CVP refuge deliveries are expected to be minimal, with an average annual increase of approximately 1 TAF. Under operation of Alternative 3 Investor-Directed Storage Configuration B and Configuration D, South-of-Delta CVP refuge deliveries would not change and be the same as the No Project/No Action Conditions.

Under operation of Alternative 3 Investor-Directed Storage Configuration A, average annual South-of-Delta CVP refuge deliveries are expected to increase up to 14 TAF under certain water year types. Table 36 and Table 37 summarizes the change in delivery of CVP water under this option. Figure 23 shows the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration A on CVP South-of-Delta refuge deliveries.

Table 36. Averaged Modeled Difference in Total CVP Refuge Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	1	2	5	6	0	0	0	14
AN	0	0	0	0	0	0	1	2	3	1	1	0	7
BN	0	0	0	0	0	1	1	3	4	1	1	0	11
D	0	0	0	0	0	0	0	1	1	1	0	0	5
C	0	0	0	0	0	0	0	0	1	0	0	0	3
All	0	0	0	0	0	0	1	3	3	1	0	0	9

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 37. Averaged Modeled Difference in Total CVP Refuge Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration A by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0%	0%	1%	2%	3%	11%	13%	19%	22%	2%	1%	0%	5%
AN	0%	0%	0%	1%	1%	5%	5%	7%	10%	12%	5%	1%	3%
BN	0%	0%	0%	1%	2%	9%	11%	11%	13%	14%	6%	0%	4%
D	0%	0%	1%	2%	4%	2%	3%	4%	5%	8%	4%	0%	2%
C	0%	0%	0%	2%	3%	1%	2%	2%	3%	8%	3%	0%	1%
All	0%	0%	0%	2%	3%	6%	8%	10%	12%	8%	3%	0%	3%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

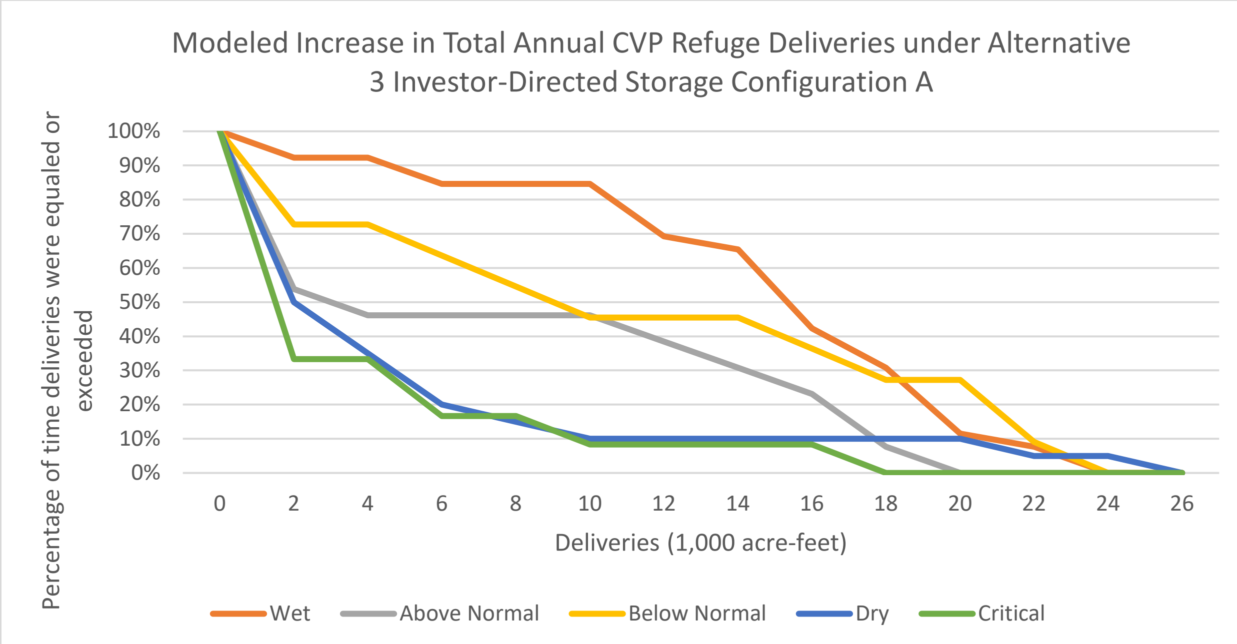


Figure 23. Modeled Increase in Total CVP South-of-Delta Refuge Deliveries under Alternative 3 Investor-Directed Storage Configuration A

Under operation of Alternative 3 Investor-Directed Storage Configuration C, average annual South-of-Delta CVP refuge deliveries are expected to increase up to 5 TAF under certain water year types. Table 38 and Table 39 summarizes the change in delivery of CVP water under this option. Figure 24 and Figure 25 show the modeled impacts of the Alternative 3 Investor-Directed Storage Configuration C on CVP South-of-Delta refuge deliveries.

Table 38. Averaged Modeled Difference in Total CVP Refuge Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1	-1	-1	0	0	2	3	7	8	-3	-5	-3	5
AN	-1	-1	-1	0	0	1	2	5	6	-3	-3	-2	3
BN	-1	-1	0	0	0	1	2	5	5	-2	-2	-2	5
D	-1	-1	0	0	0	1	2	4	4	-1	-1	-1	5
C	0	0	0	0	0	0	1	2	2	0	0	0	4
All	-1	-1	0	0	0	1	2	5	6	-2	-2	-2	5

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 39. Averaged Modeled Difference in Total CVP Refuge Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage Configuration C by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2%	-3%	-3%	-4%	2%	28%	22%	28%	29%	-45%	-39%	-7%	2%
AN	-2%	-3%	-3%	-5%	1%	22%	16%	19%	22%	-37%	-27%	-6%	1%
BN	-2%	-3%	-2%	-3%	2%	21%	16%	18%	19%	-26%	-17%	-4%	2%
D	-1%	-2%	-2%	-4%	3%	18%	13%	15%	16%	-13%	-9%	-2%	2%
C	0%	-1%	-1%	-1%	3%	9%	7%	8%	9%	3%	1%	0%	2%
All	-2%	-3%	-2%	-3%	2%	21%	16%	19%	21%	-27%	-22%	-4%	2%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

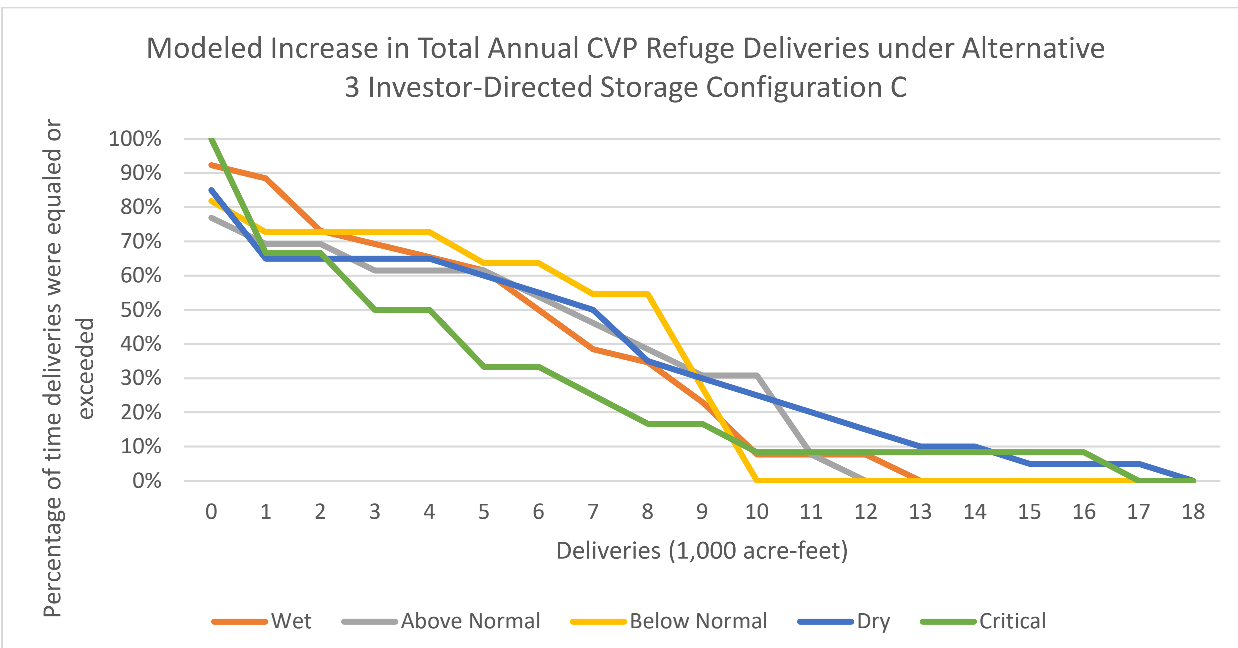


Figure 24. Modeled Increase in Total CVP South-of-Delta Refuge Deliveries under Alternative 3 Investor-Directed Storage Configuration C

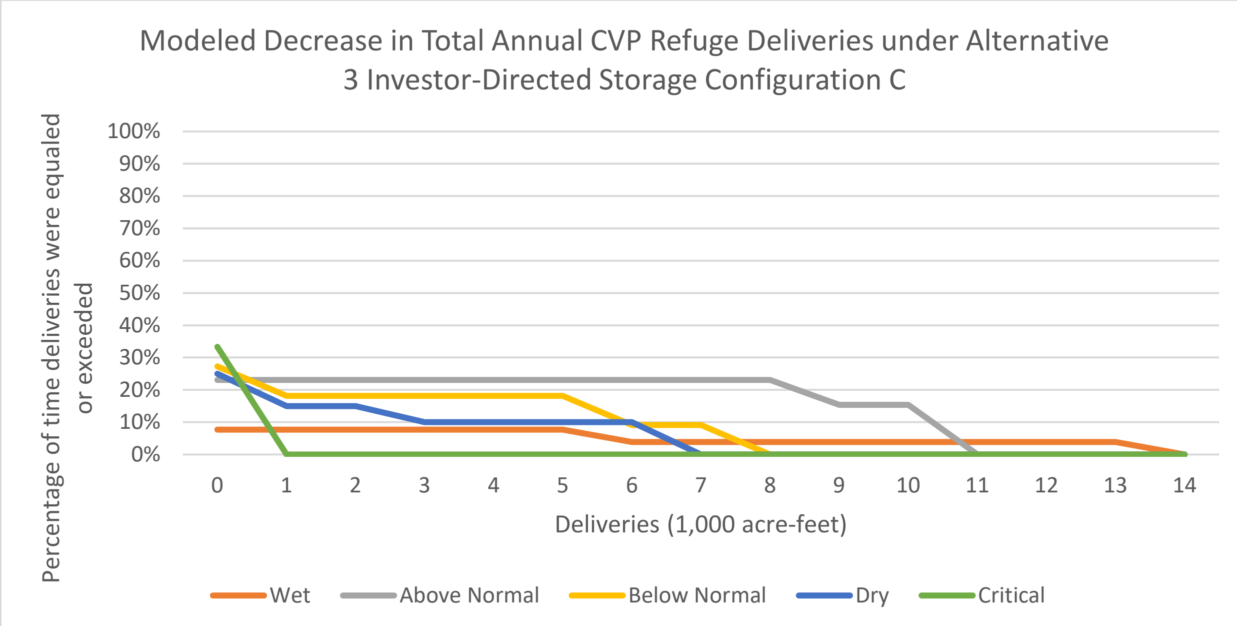


Figure 25. Modeled Decrease in Total CVP South-of-Delta Refuge Deliveries under Alternative 3 Investor-Directed Storage Configuration C

E.4.2.2 Deliveries to SWP Contractors

Under operation of Alternative 3 CVP Only Storage, average annual South-of-Delta SWP Table A deliveries are expected to decrease up to 21 TAF under certain water year types. Table 40 and Table 41 summarize the change in delivery of Table A SWP water under this configuration. Figure 26 shows the modeled impacts of the Alternative 3 CVP Only Storage on SWP water supply. Average annual Table A SWP deliveries would decrease slightly in all year types. CalSim II relies on assumption and approaches that contribute to minor fluctuations of up to 5% and projected changes of less than 5% are not identified as an adverse or beneficial water supply effect. San Luis Reservoir and SWP operations would also be adjusted to avoid impacts to deliveries.

Table 40. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	-3	-3	0	0	0	-1	-4	-3	-2	-2	-2	-21
AN	-4	2	0	0	0	1	0	0	0	0	-1	1	-2
BN	-1	-1	2	0	0	-5	-5	-6	-3	1	1	2	-15
D	-1	-1	0	0	0	0	0	-1	-1	-1	-1	-2	-8
C	-2	-2	-2	0	0	0	0	0	0	0	0	-1	-7
All	-2	-1	-1	0	0	-1	-1	-2	-2	-1	-1	-1	-12

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 41. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1%	-1%	-1%	0%	0%	0%	-1%	-1%	-1%	0%	0%	-1%	-1%
AN	-2%	1%	0%	-1%	-1%	1%	0%	0%	0%	0%	0%	0%	0%
BN	-1%	-1%	1%	0%	-1%	-8%	-4%	-3%	-1%	0%	0%	1%	-1%
D	-1%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	-1%	0%
C	-1%	-1%	-1%	0%	-4%	-1%	0%	0%	0%	0%	0%	-1%	-1%
All	-1%	-1%	0%	0%	0%	-1%	-1%	-1%	-1%	0%	0%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

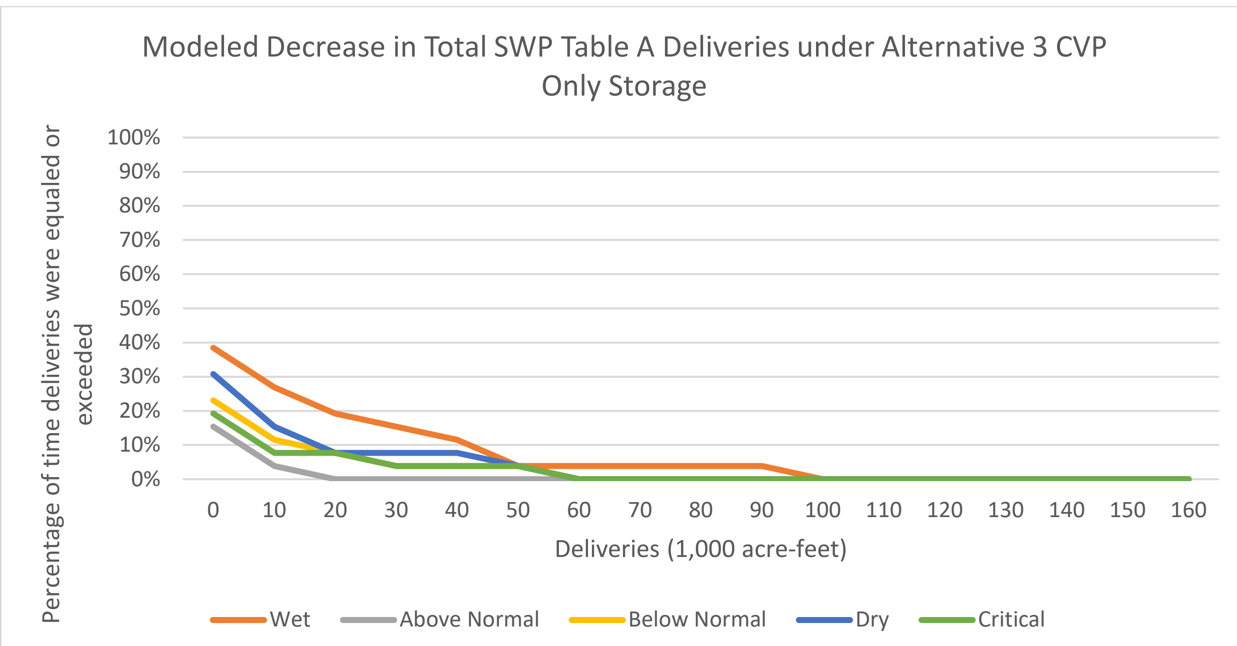


Figure 26. Modeled Decrease in Total SWP Table A Deliveries under Alternative 3 CVP Only Storage

In addition, this alternative would reduce potential surplus water supply (Article 21) deliveries to SWP contractors as CVP deliveries increase. Table 42 summarizes the change in delivery of Article 21 SWP water under this configuration. Figure 27 shows the modeled impacts of the Alternative 3 CVP Only Storage on SWP surplus water supply. The availability of this surplus water in any particular year is uncertain, and contractors do not base long term water supply decisions based on the availability, or lack thereof, of this water.

Table 42. Averaged Modeled Difference in Article 21 SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP Only Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	-1	0	-2	0	-6	-7	0	0	0	0	0	-16
AN	0	0	0	-1	-2	-6	-4	0	0	0	0	0	-13
BN	0	0	0	0	0	0	-4	0	0	0	0	0	-4
D	0	0	0	0	0	-6	0	-1	0	0	0	0	-6
C	0	0	0	0	0	-9	0	0	0	0	0	0	-9
All	0	0	0	-1	0	-5	-3	0	0	0	0	0	-10

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

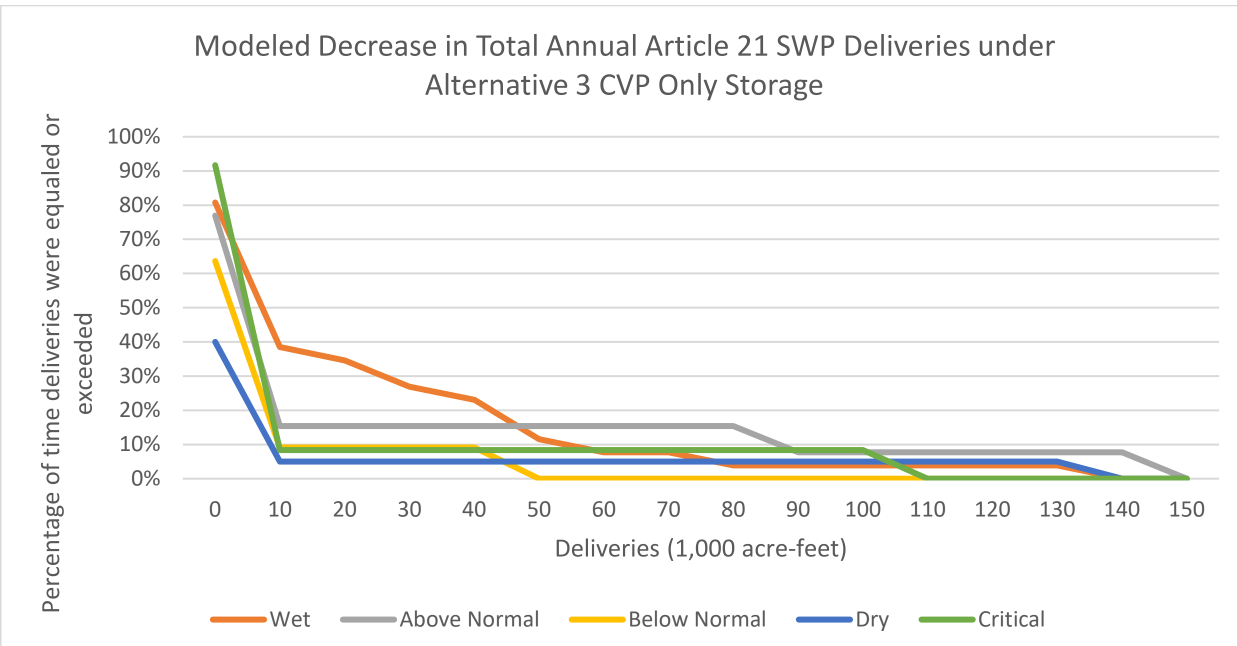


Figure 27. Modeled Decrease in Total SWP Article 21 Deliveries under Alternative 3 CVP Only Storage

Annual South-of-Delta SWP deliveries are expected to increase up to 24 TAF in certain water year types under Alternative 3 CVP/SWP Split Storage. Table 43 and Table 44 summarizes the change in delivery of Table A SWP water under this alternative. Average annual Table A SWP deliveries would increase slightly in all year types. Figure 28 and Figure 29 show the modeled impacts of Alternative 3 on SWP Table A water supply.

Table 43. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	2	1	-1	0	0	1	1	-1	0	1	1	0	6
AN	4	3	4	-1	0	0	1	2	3	3	2	2	24
BN	2	1	3	0	0	-4	0	-3	0	4	4	3	9
D	0	1	-1	0	0	0	3	2	1	0	-1	0	6
C	-1	-1	-1	0	0	0	1	0	0	1	1	0	1
All	1	1	0	0	0	0	2	0	1	1	1	1	9

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 44. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP/SWP Split Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1%	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%
AN	2%	2%	2%	-4%	1%	0%	1%	1%	1%	1%	0%	1%	1%
BN	1%	0%	1%	0%	-1%	-6%	0%	-1%	0%	1%	1%	1%	0%
D	0%	0%	0%	1%	2%	1%	5%	2%	1%	0%	0%	0%	0%
C	0%	-1%	-1%	0%	-1%	0%	7%	0%	0%	1%	1%	0%	0%
All	1%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

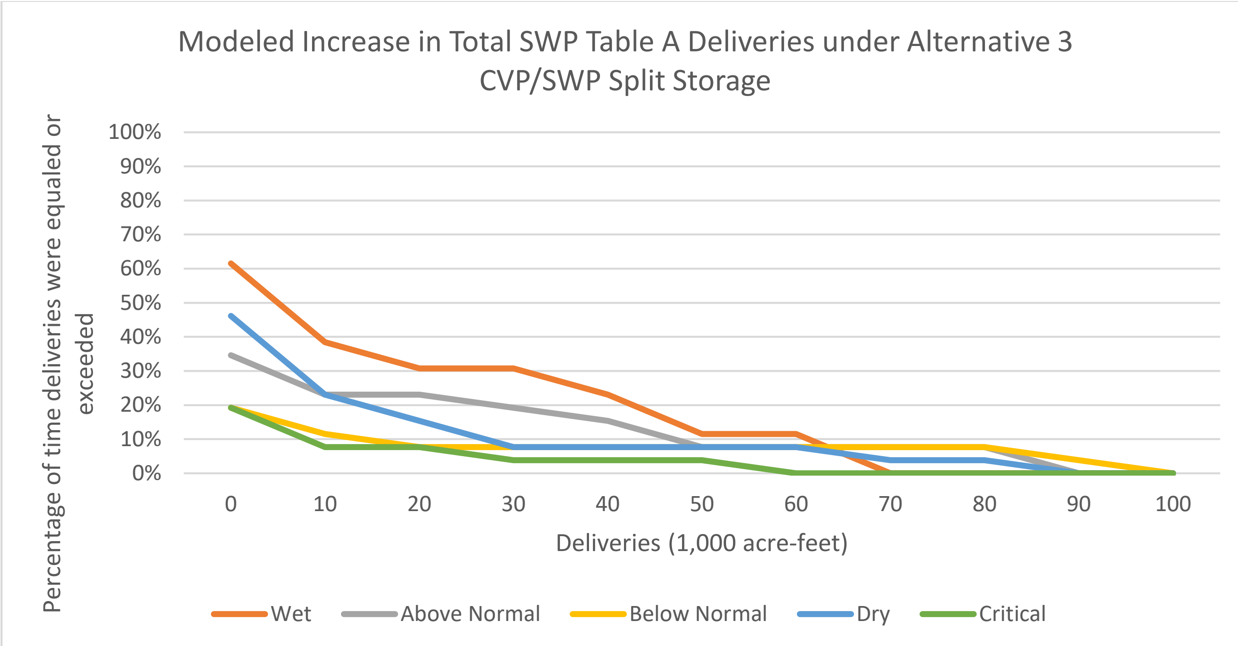


Figure 28. Modeled Increase in Total SWP Table A Deliveries under Alternative 3 CVP/SWP Split Storage

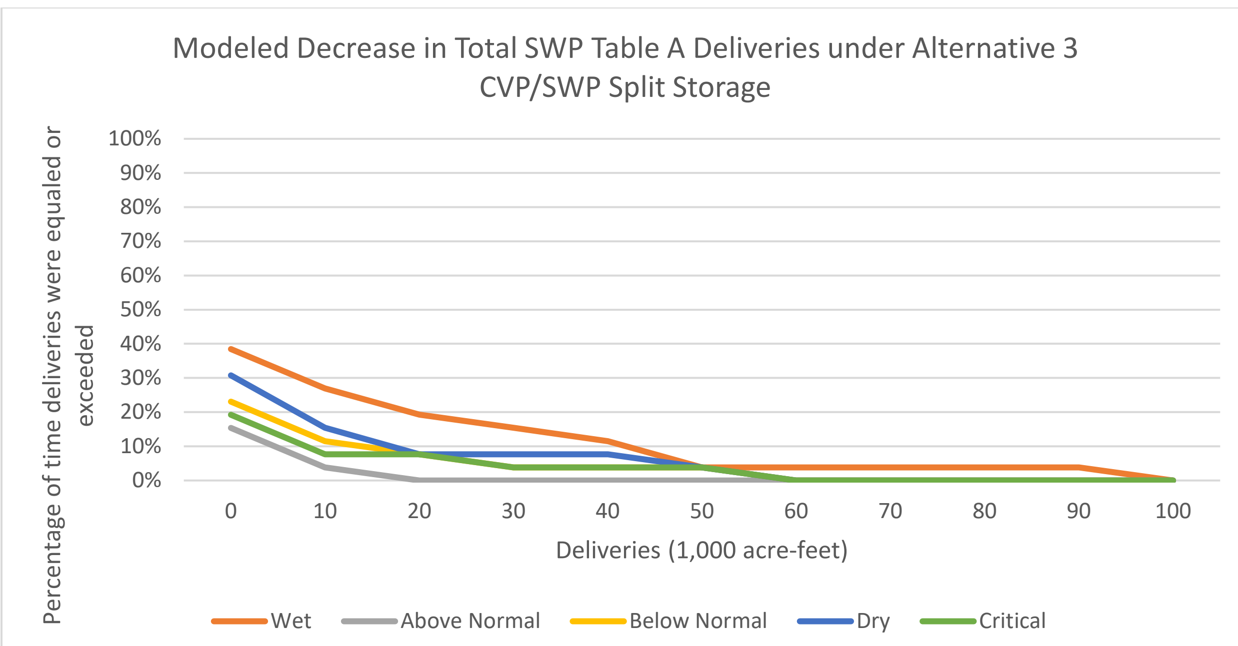


Figure 29. Modeled Decrease in Total SWP Table A Deliveries under Alternative 3 CVP/SWP Split Storage

In addition, this alternative would reduce potential surplus water supply (Article 21) deliveries to SWP contractors by up to 24,000 AF in some water year types as CVP deliveries increase. Table 45 summarizes the change in delivery of Article 21 SWP water under this alternative. Figure 30 shows the modeled impacts Alternative 3 on SWP surplus water supply. The availability of this surplus water in any particular year is uncertain, and contractors do not base long term water supply decisions based on the availability, or lack thereof, of this water.

Table 45. Averaged Modeled Difference in Article 21 SWP Deliveries between the No Project/No Action Conditions and Alternative 3 CVP CVP/SWP Split Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	-4	-2	-9	-8	-1	0	0	0	0	-24
AN	0	0	0	-6	-2	-6	-4	0	0	0	0	0	-18
BN	0	0	0	0	0	-10	-4	0	0	0	0	0	-14
D	0	0	0	0	0	-6	-1	-2	0	0	0	0	-10
C	0	0	0	0	0	-8	-1	0	0	0	0	0	-9
All	0	0	0	-2	-1	-8	-4	-1	0	0	0	0	-16

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

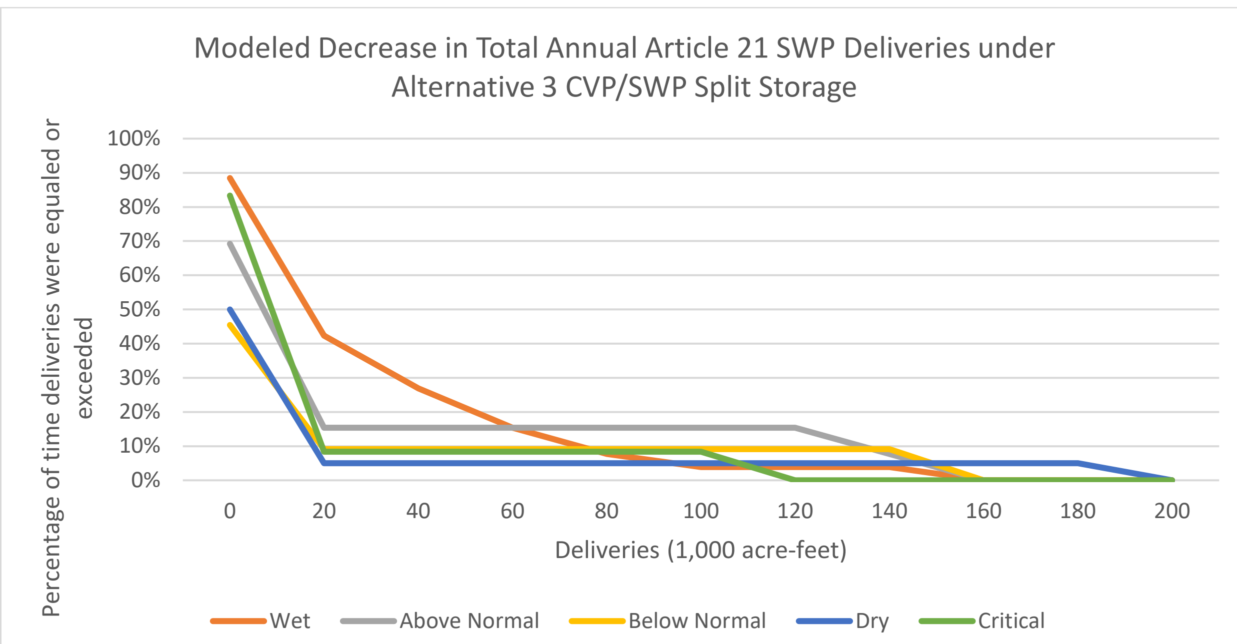


Figure 30. Modeled Decrease in Total SWP Article 21 Deliveries under Alternative 3 CVP/SWP Split Storage

Annual South-of-Delta SWP deliveries are expected to decrease up to 21 TAF in certain water year types under Alternative 3 Investor-Directed Storage. Table 46 and Table 47 summarizes the change in delivery of Table A SWP water under this alternative. Average annual Table A SWP deliveries would decrease slightly in all year types except critical and dry water years where they would increase by less than 1%. Figure 31 and Figure 32 show the modeled impacts Alternative 3 on SWP Table A water supply.

Table 46. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	-3	-3	0	0	0	-1	-4	-3	-2	-2	-2	-21
AN	-4	2	0	0	0	1	0	0	0	0	-1	1	-2
BN	-1	-1	2	0	0	-5	-5	-6	-3	1	1	2	-15
D	-1	-1	0	0	0	0	0	-1	-1	-1	-1	-2	-8
C	-2	-2	-2	0	0	0	0	0	0	0	0	-1	-7
All	-2	-1	-1	0	0	-1	-1	-2	-2	-1	-1	-1	-12

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

Table 47. Averaged Modeled Difference in Table A SWP Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage by Water Year Type (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1%	-1%	-1%	0%	0%	0%	-1%	-1%	-1%	0%	0%	-1%	-1%
AN	-2%	1%	0%	-1%	-1%	1%	0%	0%	0%	0%	0%	0%	0%
BN	-1%	-1%	1%	0%	-1%	-8%	-4%	-3%	-1%	0%	0%	1%	-1%
D	-1%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	-1%	0%
C	-1%	-1%	-1%	0%	-4%	-1%	0%	0%	0%	0%	0%	-1%	-1%
All	-1%	-1%	0%	0%	0%	-1%	-1%	-1%	-1%	0%	0%	0%	0%

Notes: Modeling Period 1922-2003, Data results from CalSim modeling. CalSim II model output includes minor fluctuations of up to 5% due to model assumptions and approaches.
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

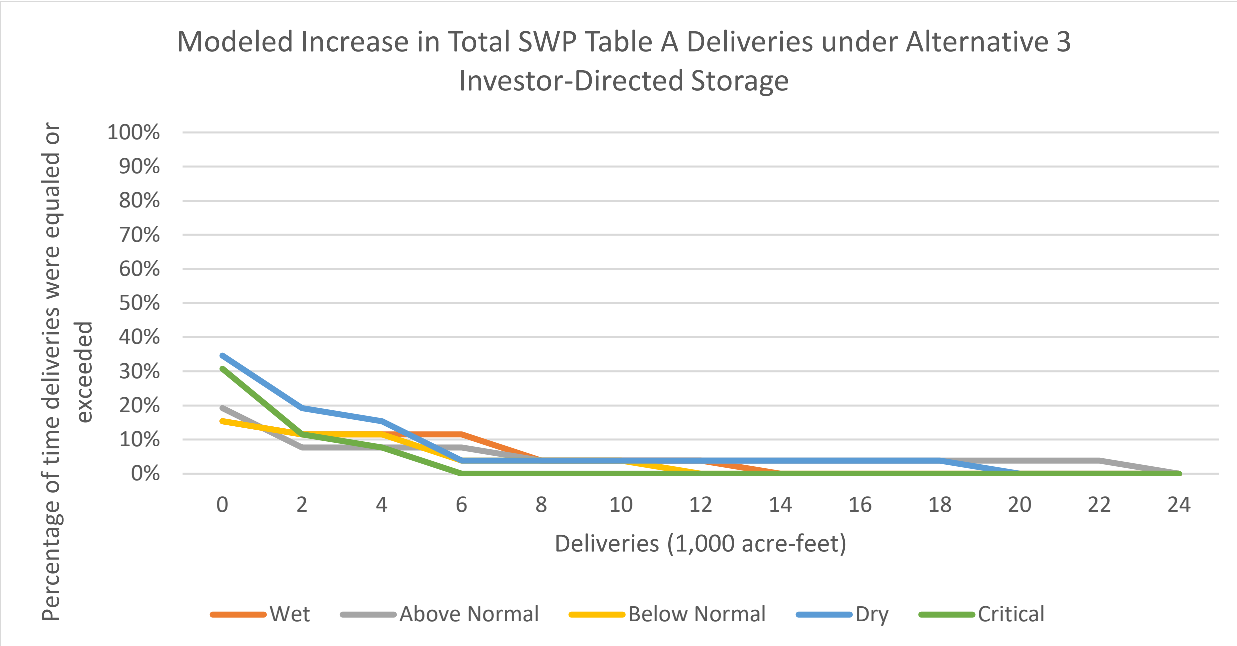


Figure 31. Modeled Increase in Total SWP Table A Deliveries under Alternative 3 Investor-Directed Storage

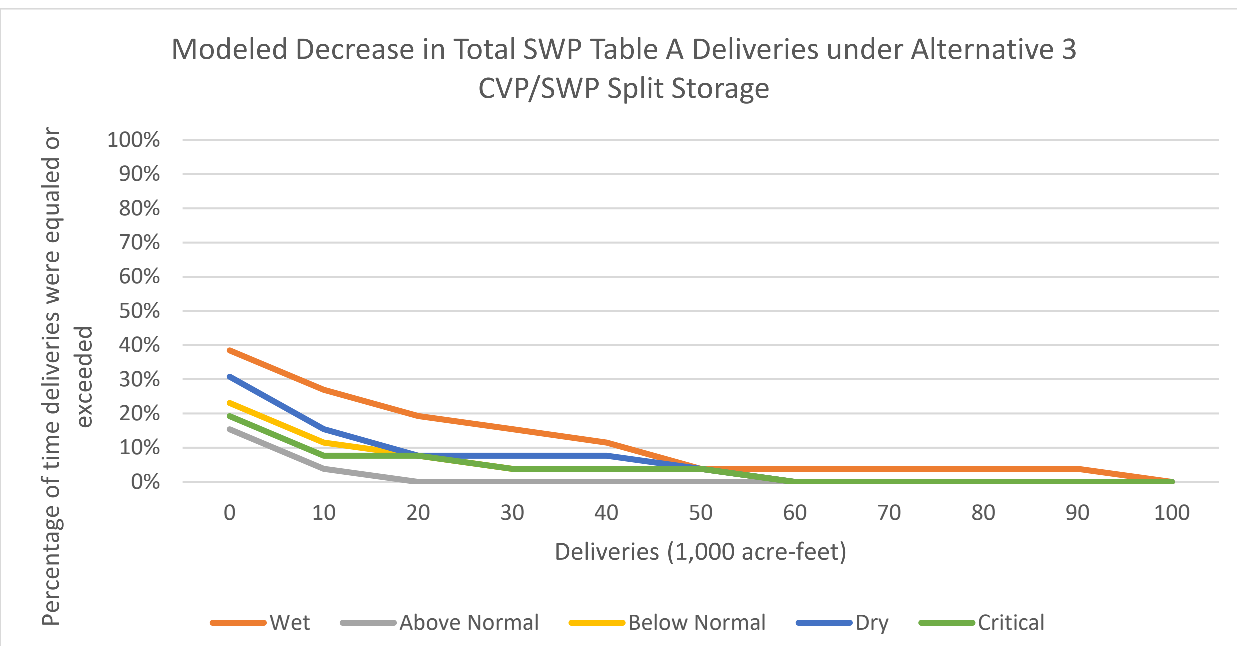


Figure 32. Modeled Decrease in Total SWP Table A Deliveries under Alternative 3 Investor-Directed Storage

In addition, this alternative would reduce potential surplus water supply (Article 21) deliveries to SWP contractors as CVP deliveries increase. Table 48 summarizes the change in delivery of Article 21 SWP water under this alternative. Figure 33 shows the modeled impacts Alternative 3 on SWP surplus water supply. The availability of this surplus water in any particular year is uncertain, and contractors do not base long term water supply decisions based on the availability, or lack thereof, of this water.

Table 48. Averaged Modeled Difference in Article 21 SWP Deliveries between the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage by Water Year Type (1,000 acre-feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	-1	0	-2	0	-6	-7	0	0	0	0	0	-16
AN	0	0	0	-1	-2	-6	-4	0	0	0	0	0	-13
BN	0	0	0	0	0	0	-4	0	0	0	0	0	-4
D	0	0	0	0	0	-6	0	-1	0	0	0	0	-6
C	0	0	0	0	0	-9	0	0	0	0	0	0	-9
All	0	0	0	-1	0	-5	-3	0	0	0	0	0	-10

Notes: Modeling Period 1922-2003, Data results from CalSim modeling
Key: AN – Above Normal; BN – Below Normal; C – Critical; D – Dry; Sac Yr Type – Sacramento River Water Year Type; W – Wet

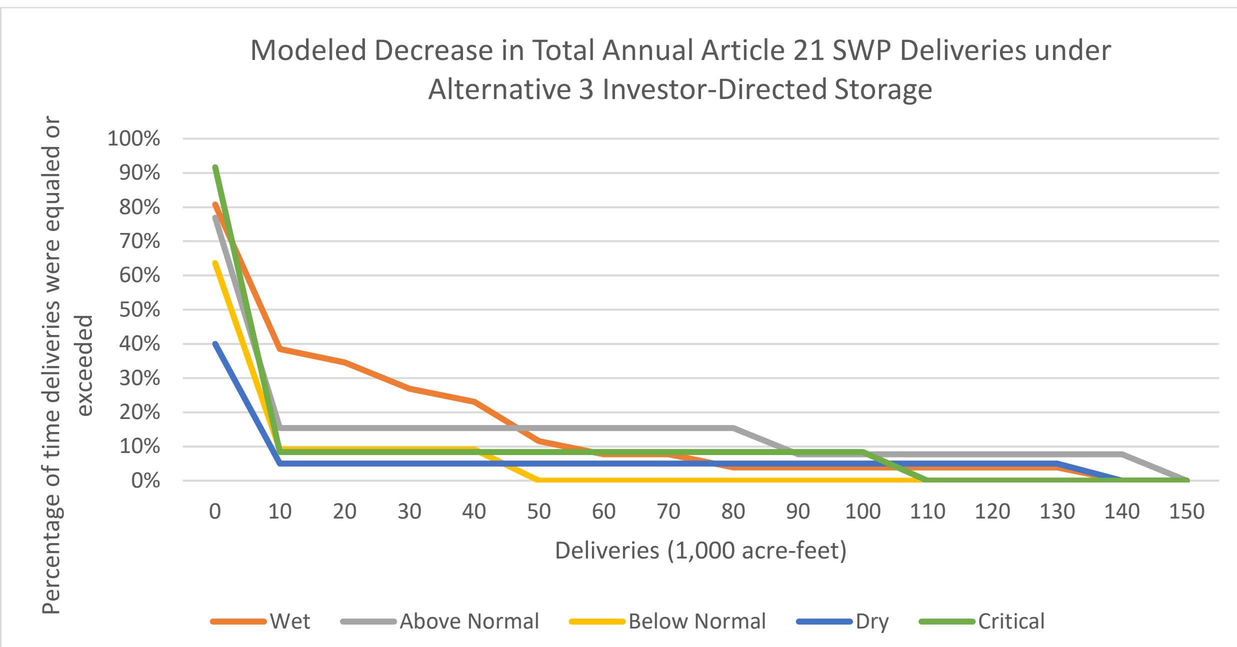


Figure 33. Modeled Decrease in Total SWP Article 21 Deliveries under the No Project/No Action Conditions and Alternative 3 Investor-Directed Storage

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix F1: Detailed Greenhouse Gas Emission Analysis Approach

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Appendix F1 Detailed Greenhouse Gas Emissions Analysis Approach

F1.1 Assessment Methods

F1.1.1 Greenhouse Gas Emissions

Construction emissions are described as temporary or "short term" in duration. These temporary and short-term emissions have the potential to represent a significant impact to greenhouse gas (GHG) emissions and climate change. GHG emissions are caused by on- and off-road vehicle exhaust.

The emissions estimation method (i.e., specific emission calculation equations) was based on the California Emission Estimator Model (CalEEMod), Version 2016.3.2 (California Air Pollution Control Officers Association [CAPCOA] 2017), although the calculations were performed outside of the model for flexibility. The CalEEMod is "inflexible" because it is difficult to analyze projects with multiple phases or alternatives because nuanced assumptions cannot always be included in the calculations. Construction-related and operational emissions were estimated using multiple sources as described below.

- OFFROAD2017 Off-Road Emissions Inventory Model (California Air Resources Board [CARB] 2017a)
- EMFAC2017 Web Database (CARB 2017b)
- The Climate Registry 2020 Default Emission Factors (The Climate Registry 2020a)
- The Climate Registry Utility-Specific Emission Factors (The Climate Registry 2020b)
- CalEEMod User's Guide, Appendix D: Default Data Tables (CAPCOA 2017)

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of carbon dioxide (CO_2) equivalent (CO_2e) emissions, which express, for a given mixture of GHG, the amount of CO_2 that would have the same GWP over a specific timescale. CO_2e is determined by multiplying the mass of each GHG by its GWP.

This analysis uses the GWP from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (Forster et al. 2007) for a 100-year time period to estimate CO_2e. This approach is consistent with the federal GHG Reporting Rule (40 Code of Federal Regulations [CFR] 98), as effective on January 1, 2014 (78 FR 71904) and California's 2000-2017 GHG Inventory Trends Report (CARB 2019). The GWPs used in this analysis are 25 for methane (CH_4) and 298 for nitrous oxide (N_2O).

The following sections provide additional discussion of emission estimation methodologies used for each source group. Detailed emission calculations are provided in Appendix F2.

F1.1.1.1 Onsite Construction Equipment Engine Emissions

Emission factors were developed using CARB's OFFROAD2017 model. The OFFROAD2017 model does not estimate emissions of CH_4 and N_2O; therefore, it was necessary to estimate these emissions separately. The Climate Registry's 2020 Default Emission Factors were used to estimate emissions. Emission factors for "Construction/Mining Equipment" were used to estimate CH_4 and N_2O emissions for all off-road construction equipment.

F1.1.1.2 Purchased Electricity

Additional pumping at the Gianelli Pumping-Generation Plant and the Pacheco Pumping plant would increase GHG emissions from the operation of electric pumps. Utility-specific CO_2 emission factors from Pacific Gas & Electric (The Climate Registry 2020a) and regional CH_4 and N_2O emission factors for California (The Climate Registry 2020b) were used to estimate emissions.

F1.1.1.3 Deforestation

Deforestation from land use changes would occur as a result of the proposed action. The change in sequestered CO_2 from the removal of forest land (scrubs and trees), cropland, and grassland was calculated using methods in CalEEMod Appendix A (CAPCOA 2017).

F1.2 Significance Criteria

Impacts on GHG emissions would be considered significant if the proposed project or alternatives would: (1) generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or (2) conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the GHG emissions.

F1.2.1 California Department of Water Resources Climate Action Plan

In May 2012, California Department of Water Resources (DWR) adopted the DWR *Climate Action Plan-Phase I: Greenhouse Gas Emissions Reduction Plan* (GGERP), which details DWR's efforts to reduce its GHG emissions consistent with Executive Order S-3-05 and the Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32). DWR also adopted the Initial Study/Negative Declaration prepared for the GGERP in accordance with the California Environmental Quality Act (CEQA) Guidelines review and public process. The GGERP provides estimates of historical (back to 1990), current, and future GHG emissions related to operations, construction, maintenance, and business practices (e.g., building-related energy use). The GGERP specifies aggressive 2020 and 2050 emission reduction goals and identifies a list of GHG emissions reduction measures to achieve these goals. DWR's *Implementation Procedures* (2014) were followed to evaluate consistency with the GGERP.

DWR specifically prepared its GGERP as a "Plan for the Reduction of Greenhouse Gas Emissions" for purposes of CEQA Guidelines Section 15183.5. That section provides that such a document, which must meet certain specified requirements, "may be used in the cumulative impacts analysis of later projects." Because global climate change, by nature, is a global cumulative impact, an individual project's compliance with a qualifying GHG reduction plan may suffice to mitigate the project's incremental contribution to that cumulative impact to a level that is not "cumulatively considerable." (See CEQA Guidelines, Section 15064, subd. (h)(3).)

More specifically, "[l]ater project-specific environmental documents may tier from and/or incorporate by reference" the "programmatic review" conducted for the GHG emissions reduction plan. "An environmental document that relies on a greenhouse gas reduction plan for a cumulative impacts analysis must identify those requirements specified in the plan that apply to the project, and, if those requirements are not otherwise binding and enforceable, incorporate those requirements as mitigation measures applicable to the project." (See CEQA Guidelines Section 15183.5, subd. (b)(2).)

Section 12 of the GGERP outlines the steps that each DWR project will take to demonstrate consistency with the GGERP. These steps include: (1) analysis of GHG emissions from construction of the proposed project; (2) determination that the construction emissions from the project do not exceed the levels of construction emissions analyzed in the GGERP; (3) incorporation into the design of the project DWR's project-level GHG emissions reduction strategies; (4) determination that the project does not conflict with DWR's ability to implement any of the "Specific Action" GHG emissions reduction measures identified in the GGERP; and (5) determination that the project would not add electricity demands to the State Water Project system that could alter DWR's emissions reduction trajectory in such a way as to impede its ability to meet its emissions reduction goals.

F1.2.2 DWR Extraordinary Construction Project Determination

If construction activities are to be performed by outside contractors, then the project must be evaluated against the following Extraordinary Construction Project Thresholds established by DWR:

- Total Construction Emissions of 25,000 metric tons CO_2e ($MTCO_2e$)
- Maximum Annual Construction Emissions of 12,500 $MTCO_2e$

If the project exceeds either one of these thresholds, then the construction emissions from the project must be analyzed and, if necessary, mitigated on a project-specific basis. Even if a project exceeds the Extraordinary Construction Project thresholds, only the construction activity emissions need to be analyzed on a project-specific basis. However, projects can still rely on the analysis in the GGERP for operations, maintenance, and business activity emissions provided they meet other consistency requirements.

F1.3 Plan Consistency

The action alternative was compared to various plans, policies, and regulations that were enacted to reduce GHG emissions. If an alternative is found to be consistent with the applicable plans, then impacts associated with construction and operation would be less than significant for the second criterion related to GHG impacts.

F1.3.1 Initial Scoping Plan

The action alternative was compared to the AB 32 Initial Scoping Plan (CARB 2008) for consistency. The initial scoping plan contains a variety of strategies that were designed to reduce the state's GHG emissions. Table 1 summarizes the 18 strategies contained in the initial scoping plan and the alternatives were evaluated for consistency. As shown in the table, emission reduction measures would either not be applicable or the alternatives would be constructed in such a way that they would be compliant.

Table 1. Initial Scoping Plan Measures Consistency Analysis

Emission Reduction Measure	Project Consistency
1. California Cap-and-Trade Program Linked to Western Climate Initiative Partner Jurisdictions. Implement a broad-based California cap-and-trade program to provide a firm limit on emissions. Link the California cap–and-trade program with other Western Climate Initiative Partner programs to create a regional market system to achieve greater environmental and economic benefits for California. Ensure California's program meets all applicable AB 32 requirements for market-based mechanisms.	**Not Applicable.** The project is not a part of an industry that is required to comply with the cap-and-trade regulations.
2. California Light-Duty Vehicle GHG Standards. Implement adopted Pavley standards and planned second phase of the program. Align zero-emission vehicle, alternative and renewable fuel and vehicle technology programs with long-term climate change goals.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
3. Energy Efficiency. Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly-owned utilities).	**Consistent.** Any new buildings built as part of an action alternative (e.g., new pump station buildings) would be constructed in compliance with the state's energy efficiency regulations for buildings.
4. Renewables Portfolio Standard. Achieve 33%renewable energy mix statewide.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
5. Low Carbon Fuel Standard. Develop and adopt the Low Carbon Fuel Standard.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
6. Regional Transportation-Related GHG Targets. Develop regional GHG emissions reduction targets for passenger vehicles.	**Not Applicable.** The regional transportation plans developed for the Bay Area contain provisions required under Senate Bill 375 to reduce GHG emissions from vehicle miles traveled. The regional transportation plans do not have any requirements that apply to the action alternatives.
7. Vehicle Efficiency Measures. Implement light-duty vehicle efficiency measures.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.

Emission Reduction Measure	Project Consistency
8. Goods Movement. Implement adopted regulations for the use of shore power for ships at berth. Improve efficiency in goods movement activities.	**Not Applicable.** The project does not propose any changes to goods movement from trucks, ports, and other related facilities.
9. Million Solar Roofs Program. Install 3,000 megawatts of solar-electric capacity under California's existing solar programs.	**Not Applicable.** The project does not impede the ability of the state to install additional solar roofs.
10. Medium/Heavy-Duty Vehicles. Adopt medium and heavy-duty vehicle efficiency measures.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
11. Industrial Emissions. Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce GHG emissions and provide other pollution reduction co-benefits. Reduce GHG emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.	**Not Applicable.** This measure only applies to major industrial facilities emitting more than 500,000 $MTCO_2e$ per year.
12. High Speed Rail. Support implementation of a high-speed rail system.	**Not Applicable.** This is a statewide measure that is not implemented by a project proponent.
13. Green Building Strategy. Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.	**Consistent.** Any new buildings built as part of an action alternative (e.g., new pump station buildings) would use green building strategies to the extent possible.
14. High Global Warming Potential Gases. Adopt measure to reduce high global warming potential gases.	**Not Applicable.** This project does not include air conditioning or refrigeration.
15. Recycling and Waste. Reduce methane emissions at landfills. Increase waste diversion, composting and other beneficial uses of organic materials, and mandate commercial recycling. Move toward zero-waste.	**Not Applicable.** Project operations would not result in the generation of waste.
16. Sustainable Forests. Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation.	**Not Applicable.** None of the alternatives under consideration would be in forested areas or areas zoned as forestland.
17. Water. Continue efficiency programs and use cleaner energy sources to move and treat water.	**Consistent**. Additional electricity use would be required to pump water. Equipment used to move, treat, and use water would be consistent with energy efficiency and clean power requirements established by the state and local municipalities.

Emission Reduction Measure	Project Consistency
18. Agriculture. In the near-term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020.	**Not Applicable.** The project site is not designated or in use for agricultural purposes.

Source: CARB 2008

Key:

AB = Assembly Bill; GHG = greenhouse gas; $MTCO_2e$ = metric tons carbon dioxide equivalent

F1.3.2 Climate Change Scoping Plan Update

California's 2017 Climate Change Scoping Plan (CARB 2017c) contains various emission reduction strategies to help the state to meet the goals of Executive Order B-30-15 and Senate Bill (SB) 32 to achieve a 2030 goal of reducing GHG emissions 40% below 2020 levels. The updated scoping plan contains various emission reduction measures that are specific to the water sector. Table 2 summarizes the various measures and evaluates if the action alternatives would be consistent.

Table 2. 2017 Updated Scoping Plan Measures Consistency Analysis

Emission Reduction Measure	Project Consistency
1. As directed by Governor Brown's Executive Order B-37-16, DWR and State Water Resource Control Board (SWRCB) will develop and implement new water use targets to generate more statewide water conservation than existing targets (the existing state law requires a 20% reduction in urban per capita water use by 2020 [SBx7-7, Steinberg, Chapter 4, Statutes of 2009]). The new water use targets will be based on strengthened standards for indoor use, outdoor irrigation, commercial, industrial, and institutional water use.	**Not Applicable.** The proposed project would not impede DWR's and SWRCB's ability to implement statewide water conservation targets.
2. SWRCB will develop long-term water conservation regulation, and permanently prohibit practices that waste potable water.	**Not Applicable.** The proposed project would not impede SWRCB's ability to implement its recommendations to use water more wisely.
3. DWR and SWRCB will develop and implement actions to minimize water system leaks, and to set performance standards for water loss, as required by SB 555 (Wolk, Chapter 679, Statutes of 2015).	**Not Applicable.** The measure is only applicable to urban retail water suppliers.
4. DWR and California Department of Food and Agriculture (CDFA) will update existing requirements for agricultural water management plans to increase water system efficiency.	**Not Applicable.** The project site is not designated or in use for agricultural purposes.
5. California Energy Commission (CEC) will certify innovative technologies for water conservation and water loss detection and control.	**Not Applicable.** The measure is only applicable at utility, household, and appliance levels.

Emission Reduction Measure	Project Consistency
6. CEC will continue to update the state's Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601–1608) for appliances offered for sale in California to establish standards that reduce energy consumption for devices that use electricity, gas, and/or water.	**Not Applicable.** The proposed project would not operation any appliances subject to the emission reduction measure.
7. CalEPA will oversee development of a voluntary registry for GHG emissions resulting from the water-energy nexus, as required by SB 1425 (Pavley, Chapter 596, Statutes of 2016).	**Not Applicable.** The proposed project would not impede the state's ability to develop a GHG emission registry.
8. The State Water Project (SWP) has entered long-term contracts to procure renewable electricity from 140 MW solar installations in California.	**Not Applicable.** The proposed project would not interfere with the ability of the SWP to procure renewable electricity.
9. As described in its Climate Action Plan, DWR will continue to increase the use of renewable energy to operate the SWP.	**Not Applicable.** The proposed project would not interfere with the ability of DWR to increase its renewable energy use.

Source: CARB 2017c

Key:

CalEPA = California Environmental Protection Agency; CDFA = California Department of Food and Agriculture; CEC = California Energy Commission; DWR = Department of Water Resources; GHG = greenhouse gas; MW = megawatt; SB = Senate Bill; SWP = State Water Project; SWRCB = State Water Resources Control Board

F1.4 References

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix F2: Air Quality and Greenhouse Gas Emissions Detailed Calculations

Air Quality Calculations

Criteria Pollutant Construction Emissions Summary

Table 1. Maximum Daily Unmitigated Emissions

Source	Maximum Daily Emissions (pounds per day)					
	VOC	NOx	CO	SOx	PM10	PM2.5
Onsite Construction Equipment	41	336	295	1	14	12
Construction Worker Commuting	0	1	23	0	6	2
Haul Truck Trips	2	147	18	1	9	3
Fugitive Dust						
Material Handling	--	--	--	--	8	1
Bulldozing	--	--	--	--	85	9
Grading	--	--	--	--	6	3
Paved Road Dust - Haul Roads	--	--	--	--	8	2
Unpaved Road Dust - Haul Roads	--	--	--	--	4,529	453
Dam Raise Subtotal	**43**	**485**	**336**	**2**	**4,664**	**486**
SR-152 Improvements Subtotal	**202**	**3,160**	**913**	**3**	**143**	**129**
Grand Total	**245**	**3,645**	**1,249**	**4**	**4,808**	**615**

Table 2. Maximum Annual Unmitigated Emissions

Source	Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
Onsite Construction Equipment	8	61	54	0	2	2
Construction Worker Commuting	0	0	4	0	1	0
Haul Truck Trips	0	27	3	0	2	1
Fugitive Dust						
Material Handling	--	--	--	--	1	0
Bulldozing	--	--	--	--	16	2
Grading	--	--	--	--	1	1
Paved Road Dust - Haul Roads	--	--	--	--	1	0
Unpaved Road Dust - Haul Roads	--	--	--	--	716	72
Dam Raise Subtotal	**8**	**88**	**61**	**0**	**740**	**78**
SR-152 Improvements Subtotal	**15**	**232**	**78**	**0**	**10**	**9**
Grand Total	**23**	**320**	**140**	**1**	**751**	**87**
General Conformity Threshold	10	10	n/a	100	100	100
CEQA Significance Threshold	10	10	100	27	15	15
Exceed De Minimis Threshold?	Yes	Yes	n/a	No	Yes	No
Exceed CEQA Threshold?	Yes	Yes	Yes	No	Yes	Yes

Note:
General conformity requires all direct and indirect actions be compared against the de minimis thresholds.
Therefore, if construction activities could occur simultaneously, then emissions must be added together for comparison.

Table 3. Unmitigated Onsite Construction Equipment Emissions

					Emission Factors (g/hp-hr or g/mi)						Daily Emissions (lb/day)						Annual Emissions (tons/year)					
Equipment Type	**Quantity**	**OFFROAD Description**	**HP**	**Hours per Day**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**
Excavators	3	ConstMin - Excavators	158	20	0.061	1.176	0.444	0.002	0.022	0.020	1.27	24.57	9.29	0.04	0.46	0.42	0.23	4.48	1.70	0.01	0.08	0.08
Bulldozers	4	ConstMin - Rubber Tired Dozers	249	20	0.170	1.022	1.818	0.002	0.079	0.073	7.46	44.87	79.83	0.08	3.48	3.20	1.36	8.19	14.57	0.02	0.64	0.58
Cranes/Lifts	5	ConstMin - Cranes	231	20	0.078	0.443	0.799	0.001	0.034	0.031	3.96	22.54	40.68	0.07	1.73	1.59	0.72	4.11	7.42	0.01	0.31	0.29
Compactors	5	ConstMin - Rollers	80	20	0.092	1.281	0.976	0.002	0.048	0.044	1.61	22.59	17.21	0.03	0.85	0.78	0.29	4.12	3.14	0.01	0.16	0.14
Graders	2	ConstMin - Graders	188	20	0.097	0.496	0.999	0.002	0.033	0.031	1.61	8.22	16.57	0.03	0.55	0.51	0.29	1.50	3.02	0.01	0.10	0.09
Scrapers	2	ConstMin - Scrapers	367	20	0.099	0.760	0.921	0.002	0.036	0.033	3.19	24.61	29.81	0.08	1.15	1.06	0.58	4.49	5.44	0.01	0.21	0.19
Loaders (small)	2	ConstMin - Rubber Tired Loaders	188	20	0.065	0.420	0.540	0.002	0.018	0.017	1.07	6.95	8.95	0.03	0.30	0.27	0.20	1.27	1.63	0.01	0.05	0.05
Loaders (large)	3	ConstMin - Rubber Tired Loaders	541	20	0.071	0.456	0.528	0.002	0.020	0.018	5.09	32.66	37.77	0.13	1.42	1.30	0.93	5.96	6.89	0.02	0.26	0.24
Dump trucks	13	ConstMin - Off-Highway Trucks	403	20	0.068	0.448	0.415	0.002	0.015	0.014	15.66	103.58	95.80	0.43	3.40	3.12	2.86	18.90	17.48	0.08	0.62	0.57
Water Trucks	5		N/A	20	0.067	1.378	0.080	0.006	0.054	0.026	0.22	4.56	0.26	0.02	0.18	0.09	0.04	0.83	0.05	0.00	0.03	0.02
Offroad equipment have units of g/hp-hr; onroad equipment have units of g/mi.										**Total**	**41.15**	**295.15**	**336.18**	**0.94**	**13.51**	**12.35**	7.51	53.86	61.35	0.17	2.47	2.25

Note:
Offroad equipment emission factors from OFFROAD2017 model.
Onroad truck emission factors from EMFAC2014.

Sources:
OFFROAD2017: https://www.arb.ca.gov/orion/
EMFAC2017: https://arb.ca.gov/emfac/2017/

Operating Schedule

2 shifts per day
10 hours per shift
365 days per year

Construction Start: 2025

Speed Limit for Onroad Vehicles (Onsite)

15 miles per hour
(speed limit is 35 mph on site, but it is assumed that a water truck will be operating at a lower rate of speed)

Conversions

453.6 grams per pound
2,000 pounds per ton

Offsite Construction Emissions

Table 4. Unmitigated Emission Factors (g/mi)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.008	0.590	0.039	0.003	0.001	0.008	0.037	0.100	0.147	0.001	0.002	0.016	0.025	0.044
Haul trucks	0.041	0.427	3.473	0.016	0.017	0.036	0.062	0.100	0.215	0.017	0.009	0.026	0.025	0.077

Table 5. Unmitigated Daily Emissions (pounds per day)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.32	22.58	1.49	0.10	0.05	0.31	1.41	3.84	5.61	0.05	0.08	0.60	0.96	1.69
Haul trucks	1.72	18.09	147.01	0.67	0.73	1.52	2.61	4.25	9.12	0.70	0.38	1.12	1.06	3.26
Total	**2.03**	**40.67**	**148.50**	**0.77**	**0.78**	**1.83**	**4.02**	**8.10**	**14.73**	**0.75**	**0.46**	**1.72**	**2.02**	**4.95**

Table 6. Unmitigated Annual Emissions (tons per year)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.06	4.12	0.27	0.02	0.01	0.06	0.26	0.70	1.02	0.01	0.01	0.11	0.18	0.31
Haul trucks	0.31	3.30	26.83	0.12	0.13	0.28	0.48	0.78	1.66	0.13	0.07	0.20	0.19	0.60
Total	**0.37**	**7.42**	**27.10**	**0.14**	**0.14**	**0.33**	**0.73**	**1.48**	**2.69**	**0.14**	**0.08**	**0.31**	**0.37**	**0.90**

One-way trip distance
Workers 40 miles per trip
Trucks 40 miles per trip

Maximum Daily Workers and Trucks
217 workers per d(130 day time workers and 87 night time workers)
240 trucks per day

Conversions
453.6 grams per pound
2,000 pounds per ton

Operating Schedule
365 days per year

Construction Start Year
2025

Fugitive Dust Emissions - Material Handling

Excavated Volume

11,200 cubic yards per shift
8,176,000 cubic yards per year

Equation (AP-42, Chapter 13.2.4):

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

where:

E = emission factor, pound per ton
k = particle size multiplier
U = mean wind speed, miles per hour
M = material moisture content, %

Average Wind Speed 9.43 mph
Source: MesoWest, Station CF031 (Rt. 152 San Luis), 2019 data. Accessed on: April 19, 2020. Available at: mesowest.utah.edu.

Material Moisture Content: 7.9 %
Source: EPA. 1998. AP-42, Chapter 11-9, Overburden moisture content, bulldozing.

Table 7. Material Handling Emissions

		EF	Emissions	
Size	**k**	**lb/ton**	**lbs/day**	**tpy**
PM10	0.35	3.7E-04	8.2	1.5
PM2.5	0.053	5.7E-05	1.2	0.2

Operating Schedule

2 shift per day
7 days per week
365 days per year

Density

1.25 tons per cubic yard
Note: CalEEMod assumes haul trucks can handle 20 tons or 16 cy.

Number of Drops

2 drops per truck *(one drop at borrow site and one drop at dam site)*

Dust Control

61% reduction from watering at least 3 times per day
Source: CalEEMod

Fugitive Dust Emissions - Grading

<u>Operating Schedule</u>

2	graders
7.1	miles per hour (AP-42, Table 11.9-3)
20	hours per day (total)
142	miles per day
51,830	miles per year *assumes 365 days per year*

<u>Equations (AP-42, Chapter 11.9):</u>

$TSP = 0.040(S)^{2.5}$ and $PM15 = 0.051(S)^{2.0}$

where:
S = mean vehicle speed, miles per hour

<u>Scaling Factors</u>

PM10	0.60	(multiply the 15-micron equation by this fraction to determine emissions)
PM2.5	0.031	(multiply the TSP equation by this fraction to determine emissions)

Table 8. Grading Emissions

	EF	Emissions	
Size	**lb/VMT**	**lbs/day**	**tpy**
PM10	1.54	85.4	15.6
PM2.5	0.17	9.2	1.7

<u>Dust Control</u>

61% reduction from watering at least 3 times per day
Source: CalEEMod

Fugitive Dust Emissions - Bulldozing

Operating Schedule

4	bulldozers	
20	hours per day (total)	
7,300	hours per year (total)	*assumes 365 days per year*

Equations (AP-42, Chapter 11.9):

$$TSP = \frac{5.7(s)^{1.2}}{M^{1.3}} \quad \text{and} \quad PM15 = \frac{1.0(s)^{1.5}}{M^{1.4}}$$

where:

s = silt content	6.9	%	(AP-42, Table 11.9-3, Overburden)
M = material moisture content	7.9	%	(AP-42, Table 11.9-3, Overburden)

Scaling Factors

PM10	0.75	(multiply the 15-micron equation by this fraction to determine emissions)
PM2.5	0.105	(multiply the TSP equation by this fraction to determine emissions)

Table 9. Bulldozing Emissions

	EF	Emissions	
Size	**lb/hr**	**lbs/day**	**tpy**
PM10	0.75	5.9	1.1
PM2.5	0.41	3.2	0.6

Dust Control

61% reduction from watering at least 3 times per day

Source: CalEEMod

Fugitive Dust Emissions - Paved Road Dust (Haul Roads)

Number of Trucks	13	
Excavated quantity	11,200	cubic yards per shift
Number of shifts	2	shift per day
	1,723	cubic yards per truck per day
	46.75	cubic yards per truck (body capacity)
	74	trips per day per truck (loaded and unloaded trips)
Haul Road Length	0.8	miles one-way (paved road; total route is 3.2 miles)
	770	miles per day
	280,904	miles per year *assumes 365 days per year*

Table 10. Paved Road Dust Emissions

Size	EF, g/VMT		Emissions	
	Uncontrolled	**Controlled**	**lbs/day**	**tpy**
PM10	22.2	21.5	7.5	1.3
PM2.5	5.6	5.4	1.9	0.3

Note: Uncontrolled EF used for daily emissions and controlled EF used for annual emissions.

Dust Control

80% assumes pipe-grid trackout-control device installed

Source: SCAQMD, Mitigation Measures, Fugitive Dust from Paved Roads

http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust

Conversions

453.6 grams per pound

2,000 pounds per ton

Percentage of haul route paved (estimated from Google Earth) 25%

Fugitive Dust Emissions - Unpaved Road Dust (Haul Roads)

Number of Trucks	13		
Excavated quantity	11,200	cubic yards per shift	
Number of shifts	2	shift per day	
	1,723	cubic yards per truck per day	
	46.75	cubic yards per truck (body capacity)	
	74	trips per day per truck (loaded and unloaded trips)	
Haul Road Length	2.4	miles one-way (unpaved road; total route is 3.2 miles)	
	2,309	miles per day	
	842,712	miles per year	*assumes 365 days per year*

<u>Equations (AP-42, Chapter 13.2.2):</u>

$$E = k(s/12)^a (W/3)^b$$

$$E_{ext} = E[(365 - P)/365]$$

where:

k, a, and b are empirical constants
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
Eext = annual size-specific emission factor extrapolated for natural mitigation
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

silt content (construction)	8.5	%	(AP-42, Table 13.2.2-1)
days of precipitation	49		(CalEEMod default)
Unloaded truck weight	50	tons	
Loaded truck weight	126	tons	
Average vehicle weight	88	tons	(estimated from eqiupment specifications)

Table 11. Unmitigated Unpaved Road Dust Emissions

				EF, lb/VMT		Emissions	
Size	**k**	**a**	**b**	**Uncontrolled**	**Controlled**	**lbs/day**	**tpy**
PM10	1.5	0.9	0.45	5.0	4.4	4,529.0	715.6
PM2.5	0.15	0.9	0.45	0.5	0.4	452.9	71.6

Source: AP-42, Table 13.2.2-2

<u>Dust Control</u>

61% reduction from watering at least 3 times per day

Source: CalEEMod

Percentage of haul route unpaved 75%
(estimated from Google Earth)

<u>Conversions</u>

2,000 pounds per ton

EMFAC2017 Emission Factors
On-Road Motor Vehicles

Table 12. Unmitigated Emission Factors for Construction Worker Commutes

		grams per mile												
Air Basin	**Year**	**ROG**	**TOG**	**NOx**	**CO**	**SOx**	**PM10 Exhaust**	**PM10 Tire Wear**	**PM10 Brake Wear**	**PM10 Total**	**PM2.5 Exhaust**	**PM2.5 Tire Wear**	**PM2.5 Brake Wear**	**PM2.5 Total**
San Joaquin Valley	2020	0.0182	0.0265	0.0802	0.9372	0.0030	0.0017	0.0080	0.0368	0.0465	0.0016	0.0020	0.0158	0.0193
	2021	0.0153	0.0223	0.0681	0.8369	0.0029	0.0016	0.0080	0.0368	0.0464	0.0015	0.0020	0.0158	0.0192
	2022	0.0130	0.0190	0.0584	0.7556	0.0028	0.0015	0.0080	0.0368	0.0463	0.0014	0.0020	0.0158	0.0192
	2023	0.0111	0.0161	0.0504	0.6879	0.0027	0.0015	0.0080	0.0368	0.0462	0.0013	0.0020	0.0158	0.0191
	2024	0.0096	0.0139	0.0440	0.6354	0.0026	0.0014	0.0080	0.0368	0.0461	0.0013	0.0020	0.0158	0.0190
	2025	0.0083	0.0120	0.0389	0.5900	0.0026	0.0013	0.0080	0.0368	0.0461	0.0012	0.0020	0.0158	0.0190
	2026	0.0073	0.0106	0.0349	0.5570	0.0025	0.0013	0.0080	0.0368	0.0460	0.0012	0.0020	0.0158	0.0189
	2027	0.0064	0.0094	0.0316	0.5263	0.0024	0.0012	0.0080	0.0368	0.0460	0.0011	0.0020	0.0158	0.0189
	2028	0.0057	0.0083	0.0289	0.5012	0.0023	0.0011	0.0080	0.0368	0.0459	0.0010	0.0020	0.0158	0.0188
	2029	0.0051	0.0075	0.0267	0.4798	0.0023	0.0011	0.0080	0.0368	0.0458	0.0010	0.0020	0.0158	0.0187
	2030	0.0046	0.0067	0.0249	0.4621	0.0022	0.0010	0.0080	0.0368	0.0457	0.0009	0.0020	0.0158	0.0187
	2031	0.0042	0.0061	0.0234	0.4468	0.0022	0.0009	0.0080	0.0368	0.0457	0.0009	0.0020	0.0158	0.0186
	2032	0.0038	0.0056	0.0222	0.4339	0.0021	0.0009	0.0080	0.0368	0.0456	0.0008	0.0020	0.0158	0.0186
	2033	0.0035	0.0051	0.0211	0.4228	0.0021	0.0008	0.0080	0.0368	0.0456	0.0008	0.0020	0.0158	0.0185
	2034	0.0032	0.0047	0.0203	0.4130	0.0021	0.0008	0.0080	0.0368	0.0455	0.0007	0.0020	0.0158	0.0185
	2035	0.0030	0.0043	0.0196	0.4046	0.0020	0.0007	0.0080	0.0368	0.0455	0.0007	0.0020	0.0158	0.0184

Note:
Vehicle fleet mix includes gasoline, diesel, and electric automobiles (LDA) and light-duty trucks (LDT1 and LDT2).

Table 13. Unmitigated Emission Factors for Haul and Delivery Trucks

		grams per mile												
Air Basin	**Year**	**ROG**	**TOG**	**NOx**	**CO**	**SOx**	**PM10 Exhaust**	**PM10 Tire Wear**	**PM10 Brake Wear**	**PM10 Total**	**PM2.5 Exhaust**	**PM2.5 Tire Wear**	**PM2.5 Brake Wear**	**PM2.5 Total**
San Joaquin Valley	2020	0.527	0.600	7.583	1.298	0.018	0.142	0.036	0.062	0.2396	0.136	0.009	0.026	0.1712
	2021	0.426	0.485	6.517	1.137	0.018	0.115	0.036	0.062	0.2130	0.110	0.009	0.026	0.1457
	2022	0.178	0.203	4.728	0.664	0.017	0.044	0.036	0.062	0.1420	0.042	0.009	0.026	0.0778
	2023	0.044	0.050	3.551	0.426	0.016	0.018	0.036	0.062	0.1158	0.017	0.009	0.026	0.0527
	2024	0.042	0.048	3.508	0.427	0.016	0.018	0.036	0.062	0.1154	0.017	0.009	0.026	0.0523
	2025	0.041	0.046	3.473	0.427	0.016	0.017	0.036	0.062	0.1150	0.017	0.009	0.026	0.0520
	2026	0.039	0.044	3.442	0.428	0.016	0.017	0.036	0.062	0.1147	0.016	0.009	0.026	0.0517
	2027	0.038	0.043	3.413	0.428	0.015	0.017	0.036	0.062	0.1145	0.016	0.009	0.026	0.0515
	2028	0.037	0.042	3.394	0.429	0.015	0.017	0.036	0.062	0.1143	0.016	0.009	0.026	0.0513
	2029	0.036	0.041	3.383	0.430	0.015	0.016	0.036	0.062	0.1142	0.016	0.009	0.026	0.0512
	2030	0.035	0.040	3.376	0.431	0.015	0.016	0.036	0.062	0.1141	0.016	0.009	0.026	0.0511
	2031	0.034	0.039	3.371	0.432	0.015	0.016	0.036	0.062	0.1140	0.016	0.009	0.026	0.0510
	2032	0.034	0.039	3.365	0.432	0.015	0.016	0.036	0.062	0.1140	0.016	0.009	0.026	0.0510
	2033	0.033	0.038	3.357	0.433	0.014	0.016	0.036	0.062	0.1139	0.015	0.009	0.026	0.0509
	2034	0.033	0.038	3.347	0.432	0.014	0.016	0.036	0.062	0.1138	0.015	0.009	0.026	0.0509
	2035	0.033	0.037	3.336	0.432	0.014	0.016	0.036	0.062	0.1137	0.015	0.009	0.026	0.0508

Table 14. Unmitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2020	5	0.218	0.248	0.181	3.782	0.009	0.021	0.008	0.037	0.066	0.020	0.002	0.016	0.038
2020	10	0.162	0.184	0.159	2.825	0.008	0.017	0.008	0.037	0.062	0.016	0.002	0.016	0.034
2020	15	0.082	0.093	0.121	1.402	0.006	0.013	0.008	0.037	0.058	0.013	0.002	0.016	0.031
2020	20	0.036	0.041	0.097	0.570	0.005	0.011	0.008	0.037	0.056	0.011	0.002	0.016	0.028
2020	25	0.022	0.025	0.083	0.349	0.004	0.009	0.008	0.037	0.054	0.008	0.002	0.016	0.026
2020	30	0.017	0.019	0.077	0.268	0.004	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2020	35	0.014	0.016	0.076	0.217	0.003	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2020	40	0.012	0.014	0.076	0.184	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2020	45	0.011	0.012	0.077	0.162	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2020	50	0.010	0.011	0.077	0.146	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2020	55	0.009	0.011	0.077	0.136	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2020	60	0.009	0.010	0.076	0.136	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2020	65	0.009	0.011	0.075	0.144	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2021	5	0.211	0.240	0.169	3.804	0.009	0.019	0.008	0.037	0.064	0.018	0.002	0.016	0.036
2021	10	0.157	0.179	0.148	2.841	0.007	0.016	0.008	0.037	0.061	0.015	0.002	0.016	0.033
2021	15	0.079	0.090	0.111	1.407	0.006	0.012	0.008	0.037	0.057	0.012	0.002	0.016	0.030
2021	20	0.034	0.039	0.088	0.570	0.005	0.010	0.008	0.037	0.055	0.010	0.002	0.016	0.028
2021	25	0.021	0.024	0.074	0.345	0.004	0.008	0.008	0.037	0.053	0.008	0.002	0.016	0.026
2021	30	0.016	0.018	0.068	0.265	0.004	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2021	35	0.013	0.015	0.067	0.215	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2021	40	0.011	0.013	0.067	0.181	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2021	45	0.010	0.012	0.067	0.159	0.003	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2021	50	0.009	0.010	0.067	0.142	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2021	55	0.009	0.010	0.068	0.132	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2021	60	0.008	0.010	0.065	0.130	0.004	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2021	65	0.009	0.010	0.066	0.137	0.004	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2022	5	0.203	0.231	0.157	3.798	0.008	0.017	0.008	0.037	0.062	0.017	0.002	0.016	0.034
2022	10	0.151	0.172	0.137	2.838	0.007	0.014	0.008	0.037	0.059	0.014	0.002	0.016	0.032
2022	15	0.076	0.087	0.101	1.404	0.006	0.011	0.008	0.037	0.056	0.011	0.002	0.016	0.029
2022	20	0.032	0.037	0.080	0.566	0.005	0.009	0.008	0.037	0.054	0.009	0.002	0.016	0.027
2022	25	0.020	0.023	0.066	0.341	0.004	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2022	30	0.015	0.017	0.061	0.261	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2022	35	0.013	0.014	0.059	0.211	0.003	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2022	40	0.011	0.012	0.059	0.177	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2022	45	0.009	0.011	0.059	0.155	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2022	50	0.009	0.010	0.059	0.138	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2022	55	0.008	0.009	0.059	0.127	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2022	60	0.008	0.009	0.057	0.124	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2022	65	0.008	0.009	0.057	0.130	0.004	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2023	5	0.195	0.222	0.146	3.784	0.008	0.016	0.008	0.037	0.061	0.015	0.002	0.016	0.033
2023	10	0.146	0.166	0.127	2.828	0.007	0.013	0.008	0.037	0.058	0.013	0.002	0.016	0.030
2023	15	0.073	0.083	0.093	1.397	0.006	0.010	0.008	0.037	0.055	0.010	0.002	0.016	0.028
2023	20	0.031	0.035	0.073	0.561	0.005	0.009	0.008	0.037	0.054	0.008	0.002	0.016	0.026
2023	25	0.019	0.021	0.059	0.337	0.004	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2023	30	0.014	0.016	0.054	0.258	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2023	35	0.012	0.013	0.053	0.208	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2023	40	0.010	0.011	0.052	0.174	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2023	45	0.009	0.010	0.052	0.152	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2023	50	0.008	0.009	0.052	0.135	0.003	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2023	55	0.007	0.008	0.051	0.123	0.003	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2023	60	0.007	0.008	0.049	0.120	0.003	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2023	65	0.007	0.008	0.050	0.125	0.004	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022

Table 14. Unmitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2024	5	0.187	0.213	0.135	3.761	0.008	0.014	0.008	0.037	0.059	0.014	0.002	0.016	0.031
2024	10	0.140	0.160	0.118	2.817	0.007	0.012	0.008	0.037	0.057	0.012	0.002	0.016	0.029
2024	15	0.070	0.080	0.086	1.390	0.006	0.010	0.008	0.037	0.055	0.009	0.002	0.016	0.027
2024	20	0.029	0.033	0.066	0.555	0.005	0.008	0.008	0.037	0.053	0.008	0.002	0.016	0.025
2024	25	0.018	0.020	0.053	0.332	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2024	30	0.014	0.016	0.049	0.254	0.003	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2024	35	0.011	0.013	0.047	0.205	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2024	40	0.009	0.011	0.046	0.171	0.003	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	45	0.008	0.010	0.046	0.149	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	50	0.007	0.008	0.045	0.131	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	55	0.007	0.008	0.045	0.119	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	60	0.007	0.008	0.043	0.116	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	65	0.007	0.008	0.044	0.120	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	5	0.179	0.204	0.126	3.731	0.008	0.013	0.008	0.037	0.058	0.012	0.002	0.016	0.030
2025	10	0.135	0.153	0.110	2.795	0.007	0.011	0.008	0.037	0.056	0.011	0.002	0.016	0.028
2025	15	0.067	0.077	0.080	1.378	0.006	0.009	0.008	0.037	0.054	0.009	0.002	0.016	0.026
2025	20	0.028	0.032	0.060	0.549	0.005	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2025	25	0.017	0.019	0.048	0.328	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2025	30	0.013	0.015	0.044	0.250	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2025	35	0.011	0.012	0.042	0.201	0.003	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	40	0.009	0.010	0.041	0.168	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	45	0.008	0.009	0.041	0.146	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	50	0.007	0.008	0.040	0.128	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	55	0.006	0.007	0.039	0.116	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2025	60	0.006	0.007	0.038	0.112	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2025	65	0.006	0.007	0.038	0.116	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2026	5	0.172	0.196	0.118	3.695	0.008	0.012	0.008	0.037	0.057	0.012	0.002	0.016	0.029
2026	10	0.129	0.147	0.102	2.769	0.006	0.011	0.008	0.037	0.055	0.010	0.002	0.016	0.028
2026	15	0.065	0.074	0.074	1.366	0.005	0.008	0.008	0.037	0.053	0.008	0.002	0.016	0.026
2026	20	0.027	0.030	0.055	0.542	0.005	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2026	25	0.016	0.018	0.044	0.323	0.004	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2026	30	0.012	0.014	0.040	0.247	0.003	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2026	35	0.010	0.011	0.038	0.198	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2026	40	0.008	0.010	0.037	0.165	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2026	45	0.007	0.008	0.037	0.143	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2026	50	0.007	0.007	0.035	0.126	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2026	55	0.006	0.007	0.035	0.113	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2026	60	0.006	0.007	0.034	0.109	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2026	65	0.006	0.007	0.034	0.112	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	5	0.164	0.187	0.109	3.654	0.007	0.010	0.008	0.037	0.055	0.010	0.002	0.016	0.027
2027	10	0.123	0.140	0.094	2.740	0.006	0.009	0.008	0.037	0.054	0.009	0.002	0.016	0.026
2027	15	0.061	0.070	0.067	1.350	0.005	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2027	20	0.025	0.028	0.049	0.534	0.004	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2027	25	0.015	0.017	0.039	0.318	0.004	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2027	30	0.011	0.013	0.035	0.242	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2027	35	0.009	0.010	0.032	0.194	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2027	40	0.008	0.009	0.031	0.161	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	45	0.007	0.008	0.031	0.139	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	50	0.006	0.007	0.030	0.122	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	55	0.005	0.006	0.029	0.109	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	60	0.005	0.006	0.028	0.104	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	65	0.005	0.006	0.028	0.107	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021

Table 14. Unmitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2028	5	0.156	0.178	0.101	3.609	0.007	0.008	0.008	0.037	0.053	0.008	0.002	0.016	0.026
2028	10	0.117	0.134	0.087	2.707	0.006	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2028	15	0.058	0.066	0.061	1.332	0.005	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2028	20	0.023	0.027	0.044	0.525	0.004	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2028	25	0.014	0.016	0.034	0.312	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2028	30	0.011	0.012	0.031	0.237	0.003	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2028	35	0.009	0.010	0.028	0.190	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2028	40	0.007	0.008	0.027	0.158	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2028	45	0.006	0.007	0.026	0.136	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2028	50	0.005	0.006	0.025	0.118	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2028	55	0.005	0.006	0.024	0.105	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	60	0.005	0.005	0.023	0.100	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	65	0.005	0.005	0.024	0.102	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	5	0.149	0.169	0.094	3.558	0.007	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2029	10	0.112	0.127	0.080	2.670	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2029	15	0.055	0.063	0.056	1.312	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2029	20	0.022	0.025	0.040	0.516	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2029	25	0.013	0.015	0.031	0.305	0.004	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2029	30	0.010	0.011	0.027	0.232	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2029	35	0.008	0.009	0.025	0.186	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2029	40	0.007	0.008	0.023	0.154	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2029	45	0.006	0.007	0.023	0.132	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	50	0.005	0.006	0.021	0.114	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	55	0.004	0.005	0.021	0.102	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	60	0.004	0.005	0.020	0.096	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	65	0.004	0.005	0.020	0.098	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	5	0.142	0.162	0.088	3.506	0.007	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2030	10	0.107	0.122	0.075	2.632	0.006	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2030	15	0.053	0.060	0.052	1.292	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2030	20	0.021	0.024	0.036	0.508	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2030	25	0.012	0.014	0.028	0.300	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2030	30	0.009	0.011	0.025	0.228	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2030	35	0.008	0.009	0.022	0.182	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2030	40	0.006	0.007	0.021	0.151	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	45	0.005	0.006	0.020	0.129	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	50	0.005	0.005	0.019	0.112	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	55	0.004	0.005	0.018	0.099	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	60	0.004	0.004	0.017	0.093	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	65	0.004	0.004	0.018	0.094	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	5	0.136	0.155	0.083	3.453	0.007	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2031	10	0.102	0.117	0.070	2.594	0.006	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2031	15	0.050	0.057	0.049	1.272	0.005	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2031	20	0.020	0.023	0.034	0.499	0.004	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2031	25	0.012	0.013	0.026	0.295	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2031	30	0.009	0.010	0.022	0.224	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2031	35	0.007	0.008	0.020	0.179	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	40	0.006	0.007	0.019	0.148	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	45	0.005	0.006	0.018	0.127	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	50	0.004	0.005	0.017	0.110	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	55	0.004	0.004	0.016	0.097	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	60	0.004	0.004	0.015	0.091	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2031	65	0.004	0.004	0.016	0.092	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019

Table 14. Unmitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2032	5	0.130	0.148	0.078	3.400	0.007	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2032	10	0.098	0.112	0.066	2.554	0.006	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2032	15	0.048	0.055	0.046	1.252	0.005	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2032	20	0.019	0.022	0.031	0.491	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2032	25	0.011	0.013	0.024	0.291	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2032	30	0.009	0.010	0.021	0.221	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	35	0.007	0.008	0.019	0.176	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	40	0.006	0.006	0.017	0.145	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	45	0.005	0.006	0.016	0.124	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	50	0.004	0.005	0.015	0.107	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2032	55	0.004	0.004	0.015	0.095	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2032	60	0.003	0.004	0.014	0.089	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2032	65	0.004	0.004	0.014	0.090	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2033	5	0.125	0.142	0.073	3.347	0.007	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2033	10	0.094	0.107	0.062	2.515	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2033	15	0.046	0.053	0.043	1.232	0.005	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2033	20	0.018	0.021	0.029	0.484	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2033	25	0.011	0.012	0.022	0.286	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	30	0.008	0.009	0.019	0.217	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	35	0.007	0.007	0.017	0.173	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	40	0.005	0.006	0.016	0.143	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	45	0.005	0.005	0.015	0.122	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2033	50	0.004	0.005	0.014	0.106	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2033	55	0.004	0.004	0.013	0.093	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2033	60	0.003	0.004	0.013	0.088	0.003	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	65	0.003	0.004	0.013	0.088	0.003	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	5	0.120	0.136	0.069	3.297	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2034	10	0.090	0.103	0.059	2.478	0.005	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2034	15	0.044	0.051	0.040	1.213	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2034	20	0.018	0.020	0.028	0.476	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2034	25	0.010	0.012	0.021	0.282	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2034	30	0.008	0.009	0.018	0.214	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2034	35	0.006	0.007	0.016	0.170	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2034	40	0.005	0.006	0.015	0.141	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2034	45	0.004	0.005	0.014	0.120	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2034	50	0.004	0.004	0.013	0.104	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	55	0.003	0.004	0.012	0.092	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	60	0.003	0.004	0.012	0.086	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	65	0.003	0.004	0.012	0.087	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	5	0.115	0.131	0.066	3.250	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2035	10	0.087	0.099	0.056	2.443	0.005	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2035	15	0.043	0.049	0.038	1.196	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2035	20	0.017	0.019	0.026	0.469	0.004	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2035	25	0.010	0.011	0.020	0.278	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2035	30	0.008	0.009	0.017	0.211	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2035	35	0.006	0.007	0.015	0.168	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2035	40	0.005	0.006	0.014	0.139	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2035	45	0.004	0.005	0.013	0.118	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	50	0.004	0.004	0.012	0.102	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	55	0.003	0.004	0.011	0.090	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	60	0.003	0.003	0.011	0.085	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	65	0.003	0.003	0.011	0.085	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019

Emission Factors
Paved Road Dust Emissions

Equation 1:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

where:	E	=	particulate emission factor (having units matching the units of k),
	k	=	particle size multiplier for particle size range and units of interest (see below),
	sL	=	road surface silt loading (grams per square meter) (g/m2), and
	W	=	average weight (tons) of the vehicles traveling the road.

Equation 2:

$$E_{ext} = [k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N)$$

where: k, sL, and W are as defined in Equation 1 and

E_{ext}	=	annual or other long-term average emission factor in the same units as k,
P	=	number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N	=	number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Table 15. Particle Size Multipliers for Paved Road Equation

Size Range [a]	Ref.	Particle Size Multiplier, k [b]		
		g/VKT	g/VMT	lb/VMT
$PM_{2.5}$	[c]	0.15	0.25	0.00054
PM_{10}		0.62	1.00	0.0022
PM_{15}		0.77	1.23	0.0027
PM_{30}	[d]	3.23	5.24	0.011

Source: USEPA. 2011. Compilation of Air Pollutant Emission Factors (AP-42). Fifth Edition, Volume I. Chapter 13.2.1 Paved Roads. January. Available online at: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf [Accessed July 17, 2012].

Notes:

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Offsite Construction Vehicles

Number precipitation days >0.1 inches

Merced County	49

Road silt loading	0.03	g/m^2	(AP-42, Table 13.2.1-2, ADT > 10,000, ubiquitous baseline)
Average vehicle weight	2.4	tons	

Source: CAPCOA. 2013. California Emissions Estimator Model User's Guide, Version 2013.2, Appendix D: Default Data Tables. Prepared by ENVIRON International Corporation and California Air Districts. July. Available online at: http://www.caleemod.com/ [Accessed on July 28, 2016].

Table 16. Paved Road Dust Emission Factors - Offsite Construction Vehicles

	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
County	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Merced	0.100	0.025	0.097	0.024

Note:
Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

Haul Road Vehicles

<u>Number precipitation days >0.1 inches</u>			
Merced County	49		
Road silt loading	0.2	g/m^2	(AP-42, Table 13.2.1-2, ADT 500-5,000, ubiquitous baseline)
Unloaded truck weight	50	tons	
	126	tons	
Average vehicle weight	88	tons	(estimated from eqiupment specifications)

Table 17. Paved Road Dust Emission Factors - Onsite Haul Trucks

	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
County	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Merced	22.2	5.6	21.5	5.4

Note:
Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

Criteria Pollutant Construction Emissions Summary

Table 18. SR 152 Modifications - Maximum Daily Unmitigated Emissions

	Daily Emissions (lbs/day)					
Source	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Off-Road Construction Equipment	19	261	155	1	7	7
On-Road Haul Trucks and Delivery Vehicles	0	34	4	0	2	1
Construction Worker Commuting	0	1	12	0	3	1
Marine Emissions (Tugboats)	182	2,864	742	2	131	120
Total	**202**	**3,160**	**913**	**3**	**143**	**129**

Table 19. SR 152 Modifications - Annual Unmitigated Emissions

	Annual Emissions (tons per year)					
Source	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Off-Road Construction Equipment	4	41	28	0	1	1
On-Road Haul Trucks and Delivery Vehicles	0	4	1	0	0	0
Construction Worker Commuting	0	0	2	0	0	0
Marine Emissions (Tugboats)	12	186	48	0	9	8
Total	**15**	**232**	**78**	**0**	**10**	**9**

SR 152 Construction Emissions Summary

Table 20. Maximum Unmitigated Onsite Construction Equipment Daily Emissions (pounds per day)

Phase	Subphase	ROG	CO	NOx	SOx	PM10	PM2.5
Raise Embankment by 10 VLF	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	19.4	154.9	261.4	0.5	5.1	4.7
	10 RCP CULVERT	1.6	17.0	12.9	0.0	0.6	0.5
	15 RIPRAP	18.7	148.3	171.7	0.4	7.5	6.8
	16 FILTER	2.1	28.0	17.1	0.0	0.9	0.8
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	3.2	38.6	28.9	0.1	1.3	1.2
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	4.0	53.6	31.2	0.1	1.3	1.2
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	3.2	38.6	28.9	0.1	1.3	1.2
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	4.0	53.6	31.2	0.1	1.3	1.2
	40 STORMWATER SYSTEM	2.4	28.2	19.0	0.1	0.9	0.8
	Raise Embankment by 10 VLF Maximum Daily Emissions	19.4	154.9	261.4	0.5	7.5	6.8
East Overlook Grading and Pavement	15 RIPRAP	2.5	27.0	21.7	0.0	1.1	1.0
	50 EAST OVERLOOK GRADING	1.4	16.7	11.5	0.0	0.6	0.5
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	5.8	72.3	48.3	0.2	2.0	1.9
	East Overlook Grading and Pavement Maximum Daily Emissions	5.8	72.3	48.3	0.2	2.0	1.9
Basalt Hill Site Develoment	200 BASALT HILL DOCKING AREA	1.8	22.8	15.5	0.0	0.8	0.8
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	1.7	23.5	13.6	0.0	0.6	0.6
	Basalt Hill Site Develoment Maximum Daily Emissions	1.8	23.5	15.5	0.0	0.8	0.8
	Maximum Daily Emissions	**19.4**	**154.9**	**261.4**	**0.5**	**7.5**	**6.8**

Table 21. Maximum Unmitigated Onsite Construction Equipment Annual Emissions (tons per year)

Phase	Subphase	ROG	CO	NOx	SOx	PM10	PM2.5
Raise Embankment by 10 VLF	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.7	12.9	24.2	0.0	0.4	0.4
	10 RCP CULVERT	0.0	0.0	0.0	0.0	0.0	0.0
	15 RIPRAP	1.6	11.7	14.3	0.0	0.6	0.6
	16 FILTER	0.0	0.4	0.2	0.0	0.0	0.0
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	0.0	0.2	0.1	0.0	0.0	0.0
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	0.1	0.6	0.7	0.0	0.0	0.0
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	0.0	0.1	0.1	0.0	0.0	0.0
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	0.1	0.6	0.7	0.0	0.0	0.0
	40 STORMWATER SYSTEM	0.0	0.1	0.0	0.0	0.0	0.0
	Raise Embankment by 10 VLF Subtotal	3.5	26.7	40.3	0.1	1.1	1.0
East Overlook Grading and Pavement	15 RIPRAP	0.0	0.1	0.1	0.0	0.0	0.0
	50 EAST OVERLOOK GRADING	0.0	0.0	0.0	0.0	0.0	0.0
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	0.0	0.1	0.1	0.0	0.0	0.0
	East Overlook Grading and Pavement Subtotal	0.0	0.2	0.3	0.0	0.0	0.0
Basalt Hill Site Develoment	200 BASALT HILL DOCKING AREA	0.0	0.0	0.0	0.0	0.0	0.0
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	0.1	1.0	0.5	0.0	0.0	0.0
	Basalt Hill Site Develoment Subtotal	0.1	1.0	0.5	0.0	0.0	0.0
	Maximum Annual Emissions	**3.6**	**27.9**	**41.1**	**0.1**	**1.2**	**1.1**

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	19,500.00	19,500.00	5	ConstMin - Off-Highway Trucks	916
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	11,700.00	11,700.00	3	ConstMin - Rubber Tired Loaders	197
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	3,900.00	3,900.00	1	ConstMin - Cranes	330
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	400.00	400.00	1	ConstMin - Excavators	138
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	719.74	719.74	1	ConstMin - Cranes	195
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	9.78	9.78	1	ConstMin - Rough Terrain Forklifts	110
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	128.00	128.00	1	N/A - onroad	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	531.33	531.33	1	OFF - ConstMin - Plate Compactors	8
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	531.33	531.33	1	N/A - no emissions	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	212.53	212.53	1	ConstMin - Tractors/Loaders/Backhoes	93
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	9,360.00	9,360.00	3	Portable Equipment - Non-Rental Generator	201
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	320.00	320.00	1	N/A - onroad	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	15,600.00	15,600.00	4	Portable Equipment - Non-Rental Generator	101
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	63,040.71	63,040.71	25	n/a	n/a
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	117.64	117.64	1	ConstMin - Cranes	330
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	30.00	30.00	1	ConstMin - Rough Terrain Forklifts	110
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	12.00	12.00	1	ConstMin - Excavators	244
	10 RCP CULVERT Subtotal	159.64	159.64	3	n/a	n/a
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	256.00	256.00	1	N/A - no emissions	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	256.00	256.00	1	N/A - onroad	n/a
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	4,550.90	4,550.90	2	ConstMin - Rollers	80
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	9,101.80	9,101.80	3	ConstMin - Crawler Tractors	158
15 RIPRAP	On-Highway Water Truck 4000 Gallon	4,550.90	4,550.90	2	N/A - onroad	n/a
15 RIPRAP	Rear Dump Truck 12-18 cy	13,652.67	13,652.67	4	N/A - onroad	n/a
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	821.84	821.84	1	ConstMin - Graders	140
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	62,663.43	62,663.43	16	OFF - ConstMin - Plate Compactors	8
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	62,663.43	62,663.43	16	ConstMin - Cranes	195
15 RIPRAP	1.00 cy Standard Clamshell Bucket	62,663.43	62,663.43	16	N/A - no emissions	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	12,820.00	12,820.00	4	ConstMin - Cranes	330
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	392.00	392.00	1	ConstMin - Skid Steer Loaders	46
15 RIPRAP	Flatbed Truck 20,000 GVW	392.00	392.00	1	N/A - onroad	n/a
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	1,241.54	1,241.54	1	ConstMin - Cranes	270
15 RIPRAP	Portable welder Diesel 300 amps	1,241.54	1,241.54	1	OFF - Light Commercial - Welders	14
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	1,241.54	1,241.54	1	N/A - no emissions	n/a
	15 RIPRAP Subtotal	238,509.02	238,509.02	71	n/a	n/a
16 FILTER	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	128.00	128.00	1	N/A - onroad	n/a
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	328.00	328.00	1	ConstMin - Rollers	80
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	656.00	656.00	1	ConstMin - Crawler Tractors	158
16 FILTER	On-Highway Water Truck 4000 Gallon	328.00	328.00	1	N/A - onroad	n/a
16 FILTER	Rear Dump Truck 12-18 cy	984.00	984.00	1	N/A - onroad	n/a
16 FILTER	Articulated Frame Grader Cat 12H 140HP	410.92	410.92	1	ConstMin - Graders	140
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	1,285.39	1,285.39	1	ConstMin - Tractors/Loaders/Backhoes	101
	16 FILTER Subtotal	4,248.31	4,248.31	8	n/a	n/a

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	0.064	0.426	1.081	0.002	0.017	0.015
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	0.058	0.415	0.389	0.002	0.013	0.012
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.056	0.469	0.504	0.001	0.021	0.019
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.054	1.175	0.353	0.002	0.017	0.016
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.062	1.174	0.452	0.002	0.033	0.030
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.065	1.285	0.666	0.002	0.020	0.018
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	0.058	0.369	0.293	0.002	0.012	0.011
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.061	1.350	0.067	0.005	0.052	0.025
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	0.057	1.068	0.258	0.002	0.012	0.011
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.056	0.469	0.504	0.001	0.021	0.019
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.062	1.174	0.452	0.002	0.033	0.030
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.048	0.419	0.317	0.002	0.011	0.010
	10 RCP CULVERT Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Rear Dump Truck 12-18 cy	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	0.056	0.469	0.504	0.001	0.021	0.019
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.119	1.325	1.191	0.002	0.028	0.026
15 RIPRAP	Flatbed Truck 20,000 GVW	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
15 RIPRAP	Portable welder Diesel 300 amps	0.256	1.255	1.945	0.004	0.078	0.072
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
16 FILTER	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
16 FILTER	Rear Dump Truck 12-18 cy	0.061	1.350	0.067	0.005	0.052	0.025
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
	16 FILTER Subtotal	n/a	n/a	n/a	n/a	n/a	n/a

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

		Daily Emissions (lb/day)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	13.0	86.1	218.3	0.4	3.4	3.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	1.5	10.8	10.1	0.0	0.3	0.3
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.8	6.8	7.3	0.0	0.3	0.3
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.3	7.2	2.1	0.0	0.1	0.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.6	3.6	5.6	0.0	0.2	0.2
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.3	5.7	2.2	0.0	0.2	0.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.3	5.3	2.7	0.0	0.1	0.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	1.5	9.8	7.8	0.0	0.3	0.3
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	1.0	19.0	4.6	0.0	0.2	0.2
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	19.4	154.9	261.4	0.5	5.1	4.7
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.8	6.8	7.3	0.0	0.3	0.3
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.3	5.7	2.2	0.0	0.2	0.1
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.5	4.5	3.4	0.0	0.1	0.1
	10 RCP CULVERT Subtotal	1.6	17.0	12.9	0.0	0.6	0.5
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.6	9.0	6.3	0.0	0.3	0.3
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	2.3	28.7	19.7	0.0	1.1	1.0
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.2	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	1.3	8.4	10.1	0.0	0.4	0.4
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	9.3	57.3	89.2	0.2	3.7	3.4
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	3.3	27.3	29.3	0.1	1.2	1.1
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.2	2.7	2.4	0.0	0.1	0.1
15 RIPRAP	Flatbed Truck 20,000 GVW	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.8	5.0	7.7	0.0	0.3	0.3
15 RIPRAP	Portable welder Diesel 300 amps	0.2	0.8	1.2	0.0	0.0	0.0
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	18.7	148.3	171.7	0.4	7.5	6.8
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	9.6	6.6	0.0	0.4	0.3
16 FILTER	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
	16 FILTER Subtotal	2.1	28.0	17.1	0.0	0.9	0.8

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Annual Emissions (tons per year) ROG	CO	NOx	SOx	PM10	PM2.5
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	1.3	8.4	21.3	0.0	0.3	0.3
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	0.1	1.1	1.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.1	0.7	0.7	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.0	0.1	0.1	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	0.1	0.8	0.6	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	0.1	1.9	0.4	0.0	0.0	0.0
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	1.7	12.9	24.2	0.0	0.4	0.4
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
	10 RCP CULVERT Subtotal	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.5	0.4	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.2	2.2	1.5	0.0	0.1	0.1
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.0	0.2	0.1	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.8	1.0	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.9	5.6	8.7	0.0	0.4	0.3
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	0.3	2.2	2.3	0.0	0.1	0.1
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Flatbed Truck 20,000 GVW	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.0	0.2	0.2	0.0	0.0	0.0
15 RIPRAP	Portable welder Diesel 300 amps	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	1.6	11.7	14.3	0.0	0.6	0.6
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.2	0.1	0.0	0.0	0.0
16 FILTER	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.0	0.1	0.1	0.0	0.0	0.0
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.2	0.1	0.0	0.0	0.0
	16 FILTER Subtotal	0.0	0.4	0.2	0.0	0.0	0.0

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	304.93	304.93	1	ConstMin - Rollers	80
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	6.22	6.22	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	403.57	403.57	1	ConstMin - Tractors/Loaders/Backhoes	101
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	298.71	298.71	1	ConstMin - Crawler Tractors	158
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	298.71	298.71	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	40.48	40.48	1	ConstMin - Graders	140
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1,520.17	1,520.17	10	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	10.37	10.37	1	OFF - ConstMin - Concrete/Industrial Saws	98
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	10.37	10.37	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	122.67	122.67	1	ConstMin - Rubber Tired Loaders	160
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	122.67	122.67	1	ConstMin - Excavators	244
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	122.67	122.67	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	56.80	56.80	1	ConstMin - Excavators	186
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	340.74	340.74	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	757.20	757.20	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	821.20	821.20	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	3,407.41	3,407.41	1	OFF - ConstMin - Plate Compactors	8
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	3,407.41	3,407.41	1	ConstMin - Cranes	195
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	3,407.41	3,407.41	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	1,362.96	1,362.96	1	ConstMin - Tractors/Loaders/Backhoes	93
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	68.19	68.19	1	ConstMin - Pavers	155
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	136.36	136.36	1	ConstMin - Rollers	138
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	3.11	3.11	1	ConstMin - Pavers	81
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	3.11	3.11	1	ConstMin - Rollers	33
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	3.11	3.11	1	ConstMin - Tractors/Loaders/Backhoes	101
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	14,227.76	14,227.76	19	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	304.93	304.93	1	ConstMin - Rollers	80
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	6.22	6.22	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	11.95	11.95	1	ConstMin - Tractors/Loaders/Backhoes	101
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	298.71	298.71	1	ConstMin - Crawler Tractors	158
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	298.71	298.71	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	40.48	40.48	1	ConstMin - Graders	140
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1,128.55	1,128.55	10	n/a	n/a

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.045	1.293	0.651	0.002	0.013	0.012
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.096	0.599	0.938	0.002	0.038	0.035
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.073	1.195	0.449	0.002	0.023	0.021
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.048	0.419	0.317	0.002	0.011	0.010
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.061	1.350	0.067	0.005	0.052	0.025
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.065	1.285	0.666	0.002	0.020	0.018
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.069	1.254	0.574	0.002	0.028	0.026
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.042	1.095	0.329	0.002	0.014	0.013
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.095	1.428	1.018	0.002	0.050	0.046
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.198	1.540	1.342	0.002	0.055	0.050
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.045	1.293	0.651	0.002	0.013	0.012
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.096	0.599	0.938	0.002	0.038	0.035
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Daily Emissions (lb/day)					
		ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.2	4.6	2.3	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	1.0	6.1	9.5	0.0	0.4	0.4
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	9.6	6.6	0.0	0.4	0.3
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	3.20	38.59	28.89	0.07	1.34	1.23
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.5	8.4	3.2	0.0	0.2	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.5	4.5	3.4	0.0	0.1	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.6	3.6	5.6	0.0	0.2	0.2
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.3	5.3	2.7	0.0	0.1	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.5	8.6	3.9	0.0	0.2	0.2
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.3	6.7	2.0	0.0	0.1	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.3	5.1	3.6	0.0	0.2	0.2
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.3	2.2	2.0	0.0	0.1	0.1
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	3.97	53.61	31.22	0.11	1.33	1.22
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.2	4.6	2.3	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	1.0	6.1	9.5	0.0	0.4	0.4
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	9.6	6.6	0.0	0.4	0.3
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	3.20	38.59	28.89	0.07	1.34	1.23

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Annual Emissions (tons per year)					
		ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	0.01	0.17	0.10	0.00	0.00	0.00
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.0	0.3	0.5	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.2	0.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	0.07	0.61	0.66	0.00	0.03	0.02
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	0.01	0.12	0.08	0.00	0.00	0.00

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	10.37	10.37	1	OFF - ConstMin - Concrete/Industrial Saws	98
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	10.37	10.37	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	122.67	122.67	1	ConstMin - Rubber Tired Loaders	160
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	122.67	122.67	1	ConstMin - Excavators	244
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	122.67	122.67	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	56.80	56.80	1	ConstMin - Excavators	186
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	340.74	340.74	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	757.20	757.20	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	821.20	821.20	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	3,407.41	3,407.41	1	OFF - ConstMin - Plate Compactors	8
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	3,407.41	3,407.41	1	ConstMin - Cranes	195
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	3,407.41	3,407.41	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	1,362.96	1,362.96	1	ConstMin - Tractors/Loaders/Backhoes	93
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	68.19	68.19	1	ConstMin - Pavers	155
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	136.36	136.36	1	ConstMin - Rollers	138
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	7.11	7.11	1	ConstMin - Pavers	81
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	7.11	7.11	1	ConstMin - Rollers	33
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	7.11	7.11	1	ConstMin - Tractors/Loaders/Backhoes	101
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	14,239.76	14,239.76	19	n/a	n/a
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	425.36	425.36	1	ConstMin - Tractors/Loaders/Backhoes	101
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	-50.72	-50.72	-1	OFF - ConstMin - Plate Compactors	8
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	262.42	262.42	1	OFF - ConstMin - Rollers	18
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	72.28	72.28	1	N/A - onroad	n/a
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	272.00	272.00	1	OFF - Light Commercial - Pumps	2
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	272.00	272.00	1	N/A - no emissions	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	272.00	272.00	1	N/A - no emissions	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	19.88	19.88	1	ConstMin - Excavators	186
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	340.77	340.77	1	N/A - onroad	n/a
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.37	0.37	1	ConstMin - Rough Terrain Forklifts	110
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	190.40	190.40	1	ConstMin - Excavators	138
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	2.86	2.86	1	ConstMin - Cranes	270
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	2.86	2.86	1	OFF - Light Commercial - Welders	14
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	2.86	2.86	1	N/A - no emissions	n/a
	40 STORMWATER SYSTEM Subtotal	2,085.34	2,085.34	12	n/a	n/a
	Grand Total	**339,159.26**	**339,159.26**	**177**		
	Maximum	**238,509.02**	**238,509.02**	**71**		

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.073	1.195	0.449	0.002	0.023	0.021
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.048	0.419	0.317	0.002	0.011	0.010
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.061	1.350	0.067	0.005	0.052	0.025
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.065	1.285	0.666	0.002	0.020	0.018
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.069	1.254	0.574	0.002	0.028	0.026
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.042	1.095	0.329	0.002	0.014	0.013
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.095	1.428	1.018	0.002	0.050	0.046
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.198	1.540	1.342	0.002	0.055	0.050
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.311	1.647	2.370	0.005	0.091	0.083
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.061	1.350	0.067	0.005	0.052	0.025
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.419	2.210	3.177	0.006	0.129	0.119
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.061	1.350	0.067	0.005	0.052	0.025
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.062	1.174	0.452	0.002	0.033	0.030
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.054	1.175	0.353	0.002	0.017	0.016
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.256	1.255	1.945	0.004	0.078	0.072
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
	Grand Total						
	Maximum						

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

		Daily Emissions (lb/day)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.5	8.4	3.2	0.0	0.2	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.5	4.5	3.4	0.0	0.1	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.6	3.6	5.6	0.0	0.2	0.2
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.3	5.3	2.7	0.0	0.1	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.5	8.6	3.9	0.0	0.2	0.2
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.3	6.7	2.0	0.0	0.1	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.3	5.1	3.6	0.0	0.2	0.2
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.3	2.2	2.0	0.0	0.1	0.1
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	3.97	53.61	31.22	0.11	1.33	1.22
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	-0.1	-0.5	-0.6	0.0	0.0	0.0
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.2	1.3	1.9	0.0	0.1	0.1
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.0	0.2	0.3	0.0	0.0	0.0
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.3	5.7	2.2	0.0	0.2	0.1
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.3	7.2	2.1	0.0	0.1	0.1
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.8	5.0	7.7	0.0	0.3	0.3
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.2	0.8	1.2	0.0	0.0	0.0
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	2.44	28.21	18.99	0.07	0.86	0.79
	Grand Total	**58.60**	**560.76**	**602.33**	**1.46**	**20.27**	**18.62**
	Maximum	**19.39**	**154.88**	**261.43**	**0.55**	**7.45**	**6.85**

Table 22. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Unmitigated)

Phase	Equipment Description	Annual Emissions (tons per year)					
		ROG	CO	NOx	SOx	PM10	PM2.5
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.0	0.3	0.5	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.2	0.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	0.07	0.62	0.66	0.00	0.03	0.02
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	0.01	0.10	0.04	0.00	0.00	0.00
	Grand Total	**3.48**	**26.73**	**40.34**	**0.09**	**1.14**	**1.05**
	Maximum	**1.72**	**12.90**	**24.19**	**0.05**	**0.62**	**0.57**

Table 23. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Unmitigated)

Phase	Equipment Description	Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	8.20	8.20	1	ConstMin - Rollers	80
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	16.40	16.40	1	ConstMin - Crawler Tractors	158
15 RIPRAP	On-Highway Water Truck 4000 Gallon	8.20	8.20	1	N/A - onroad	n/a
15 RIPRAP	Rear Dump Truck 12-18 cy	24.61	24.61	1	N/A - onroad	n/a
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	6.06	6.06	1	ConstMin - Graders	140
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	924.36	924.36	1	OFF - ConstMin - Plate Compactors	8
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	924.36	924.36	1	ConstMin - Cranes	195
15 RIPRAP	1.00 cy Standard Clamshell Bucket	924.36	924.36	1	N/A - no emissions	n/a
	15 RIPRAP Subtotal	2,964.55	2,964.55	10	n/a	n/a
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	48.00	48.00	1	N/A - no emissions	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	48.00	48.00	1	N/A - onroad	n/a
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	8.59	8.59	1	ConstMin - Rollers	80
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	8.59	8.59	1	ConstMin - Excavators	186
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	8.59	8.59	1	N/A - onroad	n/a
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	5.62	5.62	1	ConstMin - Graders	140
	50 EAST OVERLOOK GRADING Subtotal	127.39	127.39	6	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	7.89	7.89	1	ConstMin - Rollers	80
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	10.54	10.54	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	20.36	20.36	1	ConstMin - Tractors/Loaders/Backhoes	101
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	4.32	4.32	1	OFF - ConstMin - Concrete/Industrial Saws	98
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	31.11	31.11	1	ConstMin - Rubber Tired Loaders	160
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	31.11	31.11	1	ConstMin - Excavators	244
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	31.11	31.11	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	16.07	16.07	1	ConstMin - Excavators	186
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	86.42	86.42	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	192.04	192.04	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	320.04	320.04	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	1.67	1.67	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	4.48	4.48	1	ConstMin - Graders	140
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	512.33	512.33	1	OFF - ConstMin - Plate Compactors	8
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	512.33	512.33	1	ConstMin - Cranes	195
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	512.33	512.33	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	204.93	204.93	1	ConstMin - Tractors/Loaders/Backhoes	93
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	21.78	21.78	1	ConstMin - Pavers	155
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	21.78	21.78	1	ConstMin - Rollers	33
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	21.78	21.78	1	ConstMin - Rollers	138
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	2,731.97	2,731.97	23	n/a	n/a
	Grand Total	5,823.91	5,823.91	39	n/a	n/a
	Maximum	2,964.55	2,964.55	23	n/a	n/a

Table 23. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Unmitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Rear Dump Truck 12-18 cy	0.061	1.350	0.067	0.005	0.052	0.025
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
	50 EAST OVERLOOK GRADING Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.045	1.293	0.651	0.002	0.013	0.012
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	0.096	0.599	0.938	0.002	0.038	0.035
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.055	1.144	0.359	0.002	0.017	0.016
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.073	1.195	0.449	0.002	0.023	0.021
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.048	0.419	0.317	0.002	0.011	0.010
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.061	1.350	0.067	0.005	0.052	0.025
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.067	0.417	0.649	0.001	0.027	0.025
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.065	1.285	0.666	0.002	0.020	0.018
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.069	1.254	0.574	0.002	0.028	0.026
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.198	1.540	1.342	0.002	0.055	0.050
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.042	1.095	0.329	0.002	0.014	0.013
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
	Grand Total	n/a	n/a	n/a	n/a	n/a	n/a
	Maximum	n/a	n/a	n/a	n/a	n/a	n/a

Table 23. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Unmitigated)

		Daily Emissions (lb/day)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	9.6	6.6	0.0	0.4	0.3
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.6	3.6	5.6	0.0	0.2	0.2
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	2.5	27.0	21.7	0.0	1.1	1.0
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
	50 EAST OVERLOOK GRADING Subtotal	1.44	16.66	11.52	0.03	0.55	0.51
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.2	4.6	2.3	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	1.0	6.1	9.5	0.0	0.4	0.4
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.2	5.1	1.6	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.5	8.4	3.2	0.0	0.2	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.5	4.5	3.4	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.6	3.6	5.6	0.0	0.2	0.2
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.3	5.3	2.7	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.5	8.6	3.9	0.0	0.2	0.2
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.3	2.2	2.0	0.0	0.1	0.1
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.3	6.7	2.0	0.0	0.1	0.1
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	5.80	72.31	48.32	0.15	2.04	1.88
	Grand Total	9.72	115.94	81.53	0.23	3.68	3.38
	Maximum	5.80	72.31	48.32	0.15	2.04	1.88

Table 23. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Unmitigated)

		Annual Emissions (tons per year)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	PM2.5
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.0	0.1	0.1	0.0	0.0	0.0
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	0.0	0.1	0.1	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	50 EAST OVERLOOK GRADING Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.0	0.0	0.1	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	0.01	0.11	0.11	0.00	0.00	0.00
	Grand Total	0.03	0.21	0.26	0.00	0.01	0.01
	Maximum	0.02	0.11	0.15	0.00	0.01	0.01

Table 24. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Unmitigated)

Phase	Equipment Description	Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	35.56	35.56	1	ConstMin - Rollers	80
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	35.56	35.56	1	ConstMin - Crawler Tractors	158
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	35.56	35.56	1	N/A - onroad	n/a
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	9.60	9.60	1	ConstMin - Graders	140
	200 BASALT HILL DOCKING AREA Subtotal	244.28	244.28	6	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	364.73	364.73	1	ConstMin - Rollers	80
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	364.73	364.73	1	ConstMin - Excavators	186
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	2,639.68	2,639.68	1	N/A - onroad	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	2,342.53	2,342.53	1	ConstMin - Graders	140
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	2,274.95	2,274.95	1	ConstMin - Rollers	142
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	8,114.62	8,114.62	7	n/a	n/a
	Grand Total	**8,358.90**	**8,358.90**	**13**	**n/a**	**n/a**
	Maximum	**8,114.62**	**8,114.62**	**7**	**n/a**	**n/a**

Table 24. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Unmitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.111	1.374	0.941	0.002	0.052	0.048
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
	200 BASALT HILL DOCKING AREA Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.061	1.350	0.067	0.005	0.052	0.025
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.083	1.280	0.895	0.002	0.040	0.036
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.048	0.419	0.317	0.002	0.011	0.010
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	0.061	1.350	0.067	0.005	0.052	0.025
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	0.121	1.392	0.933	0.002	0.052	0.048
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	0.042	1.095	0.329	0.002	0.014	0.013
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
	Grand Total	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
	Maximum	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Table 24. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Unmitigated)

		Daily Emissions (lb/day)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	9.6	6.6	0.0	0.4	0.3
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
	200 BASALT HILL DOCKING AREA Subtotal	1.82	22.80	15.48	0.03	0.83	0.76
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	4.5	3.2	0.0	0.1	0.1
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.4	3.4	2.6	0.0	0.1	0.1
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	0.7	8.6	5.8	0.0	0.3	0.3
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	0.3	6.9	2.1	0.0	0.1	0.1
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	1.70	23.52	13.58	0.05	0.64	0.59
	Grand Total	**3.52**	**46.32**	**29.06**	**0.08**	**1.47**	**1.35**
	Maximum	**1.82**	**23.52**	**15.48**	**0.05**	**0.83**	**0.76**

Table 24. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Unmitigated)

Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
		Annual Emissions (tons per year)					
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	200 BASALT HILL DOCKING AREA Subtotal	0.00	0.01	0.01	0.00	0.00	0.00
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	0.0	0.5	0.3	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	0.0	0.4	0.1	0.0	0.0	0.0
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	0.07	0.97	0.51	0.00	0.03	0.02
	Grand Total	**0.07**	**0.98**	**0.52**	**0.00**	**0.03**	**0.02**
	Maximum	**0.07**	**0.97**	**0.51**	**0.00**	**0.03**	**0.02**

SR 152 Modifications
Haul Truck and Construction Worker Commuting Emissions

Table 25. Trip Rate Information

Vehicle Type	Round Trips: Max Day Trips	Round Trips: Total Trips	One-Way Distance (miles)	VMT: Daily	VMT: Total
Haul Trucks	112	29,200	40	4,492	1,168,000
Workers	260	67,600	40	10,400	2,704,000
Grand Total	**372**	**96,800**	**n/a**	**14,892**	**3,872,000**

Table 26. Maximum Daily Unmitigated Emissions

	Truck Emission Factors (g/mi)	0.038	3.413	0.428	0.015	0.206	0.074
	Worker Emission Factors (g/mi)	0.006	0.032	0.526	0.002	0.138	0.042
	Maximum Daily VMT	**Peak Daily Emissions (lbs/day)**					
Vehicle Type	**(miles/day)**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Haul Trucks	4,492	0.37	33.80	4.24	0.15	2.04	0.74
Workers	10,400	0.15	0.72	12.07	0.06	3.16	0.96
Grand Total	**10,400**	**0.15**	**0.72**	**12.07**	**0.06**	**3.16**	**0.96**

Note:
PM_{10} and $PM_{2.5}$ emission factors include exhaust, tire wear, brake wear, and resuspension of loose material on the road surface (paved road dust).
Emission factors for 2027 used because the start year has the highest emission factors and represents the worst-case impact.

Table 27. Annual Unmitigated Emissions

	Truck Emission Factors (g/mi)	0.038	3.413	0.428	0.015	0.204	0.074
	Worker Emission Factors (g/mi)	0.006	0.032	0.526	0.002	0.138	0.042
	Annual VMT	**Annual Emissions (tons/year)**					
Vehicle Type	**(miles/year)**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Haul Trucks	1,168,000	0.05	4.39	0.55	0.02	0.26	0.09
Workers	2,704,000	0.02	0.09	1.57	0.01	0.41	0.12
Grand Total	**2,704,000**	**0.02**	**0.09**	**1.57**	**0.01**	**0.41**	**0.12**

Note:
PM_{10} and $PM_{2.5}$ emission factors include exhaust, tire wear, brake wear, and resuspension of loose material on the road surface (paved road dust). Annual emissions include natural control efficiency from precipitation.
Mileage assumed to be distributed evenly over each year of construction. Therefore, annual VMT value represents the mileage that would occur in each year of construction.

Start Year: 2027

Conversions
1 pound = 453.6 grams
1 ton = 2000 pounds

Number of Construction Workers
130 workers per day

Truck Trips
29,200 trips per year
112 trips per day

Construction Schedule
5 days per week
260 days per year

SR 152 Modifications
Marine Emissions

Table 28. Unmitigated Propulsion Engine Emission Factor Equation Variables

Vessel Type	Average HP	Average Age	Model Year	Useful Life	Load Factor	Fuel Correction Factor			Deterioration Factor				Zero-Hour Emission Factor (g/bhp-hr)			
						NOx	PM	ROG	NOx	PM	ROG	CO	NOx	PM	ROG	CO
Tug Boats	1,274	32	1995	21	0.50	0.930	0.720	0.720	0.21	0.67	0.44	0.25	12.98	0.50	0.84	2.99

Note:
Barges and dredgers are not typically self-propelled and emissions from barge/dredger propulsion engines are not estimated.
Model year equal to construction start date (year) minus average age of vessel.
A fuel correction factor of 0.72 for hydrocarbon emissions applied to all diesel-powered engines beginning with the 1994 calendar year.

Table 29. Unmitigated Propulsion Engine Emission Factors

Vessel Type	Aged Emission Factor - 2027 (g/bhp-hr)				
	NOx	PM10	ROG	CO	SO2
Tug Boats	7.97	0.36	0.51	2.06	0.0055

Note:
Starting in 2007, California required the use of ultra low sulfur diesel fuel (ULSD - 15 ppmw sulfur).
SO2 (g/hp-hr) = (S content in X/1,000,000) x (2 SO2/g S) x BSFC (184 g/hp-hr)

Construction Start Date 2027

Table 30. Maximum Daily Unmitigated Marine Vessel Emissions

Vessel Type	Quantity	Trips per Day	Hours per Trip	No. Propulsion Engines	Propulsion Engine Emissions (lbs/day)					
					ROG	NOx	CO	SO2	PM10	PM2.5
Tug Boats	16	2	2	2	181.61	2,864.23	742.21	1.98	130.78	120.32

Note:
Hours per trip estimated to assume that marine vessels would be operating 8 hours per day.
PM2.5 emissions estimated using PM10 emissions and the California Emission Inventory and Reporting System (CEIDARS) particulate matter (PM) speciation profile no. 425 for diesel vehicle exhaust.
"Trips" represent one-day trips and are double the data provided by the engineers.

Table 31. Annual Unmitigated Marine Vessel Emissions by Year

Year	Annual Emissions (tons per year)					
	ROG	NOx	CO	SO2	PM10	PM2.5
Propulsion Engines	11.80	186.17	48.24	0.13	8.50	7.82

Note:
Hours per trip estimated to assume that marine vessels would be operating 8 hours per day.
PM2.5 emissions estimated using PM10 emissions and the California Emission Inventory and Reporting System (CEIDARS) particulate matter (PM) speciation profile no. 425 for diesel vehicle exhaust.
"Trips" represent one-day trips and are double the data provided by the engineers.

ROG, CO, NOx, or PM Emission Estimation Method

$$E = EF_0 \times F \times \left(1 + D \times \frac{A}{UL}\right) \times HP \times LF \times Hr$$

Where:			
	E	=	amount of emissions of a pollutant (PM and NOx) emitted during one period
	EF_0	=	the model year, horsepower, and engine use (propulsion or auxiliary) specific zero hour emission factor (when engine is new)
	F	=	fuel correction factor that accounts for emission reduction benefits from burning cleaner fuel
	D	=	horsepower and pollutant specific engine deterioration factor, which is the percentage increase of emission factors at the end of the useful life of the engine
	A	=	age of the engine when the emissions are estimated
	UL	=	vessel type and engine use specific engine useful life
	HP	=	rated horsepower of the engine
	LF	=	vessel type and engine use specific engine load factor
	Hr	=	number of annual operating hours of the engine

Source: California Air Resources Board. 2010. Staff Report: Initial Statement of Reasons for the Proposed Rulemaking. Amendments to the Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Base
http://www.arb.ca.gov/ports/marinevess/harborcraft/hcdocuments.htm

SOx Emission Estimation Method

$$F_c = HP \times LF \times Hr \times BSFC$$

Where:			
	Fc	=	fuel consumed per engine per year
	HP	=	rated horsepower of the engine
	Hr	=	number of annual operating hours of the engine
	LF	=	vessel type specific engine load factor
	BSFC	=	brake specific fuel consumption rate; 0.078 gal/kW-hr or 184 g/hp-hr

The sulfur content is assumed to be 15ppm per 13 CCR 2281(a).

<u>Conversion Factors</u>

453.6	grams per pound
2000	pounds per ton

<u>Operating Schedule</u>

10	hours per shift
5	days per week
260	days per year

<u>PMSIZE Profile</u>

0.92	PM2.5:PM10

Profile No. 425, Diesel Vehicle Exhaust

Emission Factors
Paved Road Dust Emissions

Equation 1:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

where:
- E = particulate emission factor (having units matching the units of k),
- k = particle size multiplier for particle size range and units of interest (see below),
- sL = road surface silt loading (grams per square meter) (g/m2), and
- W = average weight (tons) of the vehicles traveling the road.

Equation 2:

$$E_{ext} = [k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N)$$

where: k, sL, and W are as defined in Equation 1 and
- E_{ext} = annual or other long-term average emission factor in the same units as k,
- P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
- N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Table 32. Particle Size Multipliers for Paved Road Equation

		Particle Size Multiplier, k [b]		
Size Range [a]	**Ref.**	**g/VKT**	**g/VMT**	**lb/VMT**
$PM_{2.5}$	[c]	0.15	0.25	0.00054
PM_{10}		0.62	1.00	0.0022
PM_{15}		0.77	1.23	0.0027
PM_{30}	[d]	3.23	5.24	0.011

Source: USEPA. 2011. Compilation of Air Pollutant Emission Factors (AP-42). Fifth Edition, Volume I. Chapter 13.2.1 Paved Roads. January. Available online at: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf [Accessed October 18, 2018].

Notes:

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Default Assumptions

<u>Number precipitation days >0.1 inches</u>

San Joaquin Valley Air Basin 45

Road silt loading 0.03 g/m^2 (AP-42, ADT > 10,000, ubiquitous baseline)

Average vehicle weight 2.2 tons

Source: CAPCOA. 2017. California Emissions Estimator Model User's Guide, Version 2016.3.2, Appendix D: Default Data Tables. Prepared by BREEZE Software, A Division of Trinity Consultants in collaboration with South Coast Air Quality Management District and the California Air Districts. November. Available online at: http://www.caleemod.com/ [Accessed on October 18, 2018].

Table 33. Paved Road Dust Emission Factors

	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
Air Basin	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
San Joaquin Valley	0.092	0.023	0.089	0.022
San Francisco Bay Area	0.092	0.023	0.088	0.022

Note:

Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

SR 152 Modifications
Data Tables

Table 34. California Commercial Harbor Craft Engine Profile by Vessel Type

Vessel Type	Propulsion Engine # of Engines per Vessel	Propulsion Engine Average Annual Operating Hrs	Propulsion Engine Useful Life	Auxiliary Engine # of Engines per Vessel	Auxiliary Engine Average Annual Operating Hrs	Auxiliary Engine Useful Life
Commercial Fishing	1.12	1,250	21	0.46	1,633	15
Charter Fishing	1.77	1,622	16	0.75	2,077	15
Ferry/excursion Vessels	2.01	1,843	20	1.23	1,254	20
Crew and Supply	2.5	788	22	1.1	3,036	22
Pilot Vessels	1.7	1,031	19	0.14	994	25
Tug Boats	1.92	2,274	21	1.59	2,486	23
Tow Boats	2.1	1,993	26	1.17	2,965	25
Work Boats	1.46	675	17	0.32	750	23
Others	1.11	779	23	0.46	805	22

Source: California Air Resources Board (CARB). Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 35. Engine Load Factor by Vessel Type and by Engine Use

Vessel Type	Propulsion Engine Load	Auxiliary Engine Load
Commercial Fishing	0.27	0.43
Charter Fishing	0.52	0.43
Ferry/excursion Vessels	0.42	0.43
Crew and Supply	0.45	0.43
Pilot Vessels	0.51	0.43
Tug Boats	0.5	0.31
Tow Boats	0.68	0.43
Work Boats	0.45	0.43
Others	0.52	0.43

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 36. Fuel Correction Factor

Calendar Years	Horsepower Range	Model Years	NOx	PM
1994-2006	<25	Pre-1995	0.930	0.750
	25-50	Pre-1999		
	51-100	Pre-1998		
	101-175	Pre-1997		
	176+	Pre-1996		
	<25	1995+	0.948	0.822
	25-50	1999-2010		
	51-100	1998-2010		
	101-175	1997-2010		
	176+	1996-2010		
2007+	<25	Pre-1995	0.930	0.720
	25-50	Pre-1999		
	51-100	Pre-1998		
	101-175	Pre-1997		
	176+	Pre-1996		
	<25	1995+	0.948	0.800
	25-50	1999-2010		
	51-100	1998-2010		
	101-175	1997-2010		
	176+	1996-2010		
	All	2011+	0.948	0.852

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 37. Engine Deterioration Factor

Horsepower Range	NOx	PM	HC	CO
25-50	0.06	0.31	0.51	0.41
51-250	0.14	0.44	0.28	0.16
>251	0.21	0.67	0.44	0.25

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 38. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

		Main Engines				Auxiliary Engines			
HP Range	**Model Year**	**NOx**	**PM**	**ROG**	**CO**	**NOx**	**PM**	**ROG**	**CO**
25-50 hp	pre-1998	8.14	0.72	1.84	3.65	6.90	0.64	2.19	5.15
	1998-1999	8.14	0.72	1.80	3.65	6.90	0.64	2.14	5.15
	2000-2004	7.31	0.72	1.80	3.65	6.90	0.64	2.14	5.15
	2005-2008	5.32	0.30	1.80	3.73	5.32	0.30	2.14	3.73
	2009-2020	5.32	0.22	1.80	3.73	5.32	0.22	2.14	3.73
51-120 hp	pre-1997	15.34	0.80	1.44	3.50	13.00	0.71	1.71	4.94
	1997-1999	10.33	0.66	0.99	2.55	8.75	0.58	1.18	3.59
	2000-2004	7.31	0.66	0.99	2.55	7.31	0.58	1.18	3.59
	2005-2008	5.32	0.30	0.99	3.73	5.32	0.30	1.18	3.73
	2009-2020	5.32	0.22	0.99	3.73	5.32	0.22	1.18	3.73
121-175 hp	pre-1971	16.52	0.73	1.32	3.21	14.00	0.65	1.57	4.53
	1971-1978	15.34	0.63	1.10	3.21	13.00	0.55	1.31	4.53
	1979-1983	14.16	0.52	1.00	3.21	12.00	0.46	1.19	4.53
	1984-1986	12.98	0.52	0.94	3.14	11.00	0.46	1.12	4.43
	1987-1995	12.98	0.52	0.88	3.07	11.00	0.46	1.05	4.33
	1996-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2012	5.10	0.22	0.68	3.73	5.10	0.22	0.81	3.73
	2013-2020	3.80	0.09	0.68	3.73	3.80	0.09	0.81	3.73
176-250 hp	pre-1971	16.52	0.73	1.32	3.21	14.00	0.65	1.57	4.53
	1971-1978	15.34	0.63	1.10	3.21	13.00	0.55	1.31	4.53
	1979-1983	14.16	0.52	1.00	3.21	12.00	0.46	1.19	4.53
	1984-1986	12.98	0.52	0.94	3.14	11.00	0.46	1.12	4.43
	1987-1994	12.98	0.52	0.88	3.07	11.00	0.46	1.05	4.33
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2013	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2014-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73
251-500 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1994	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2013	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2014-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73

Table 38. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

HP Range	Model Year	Main Engines NOx	Main Engines PM	Main Engines ROG	Main Engines CO	Auxiliary Engines NOx	Auxiliary Engines PM	Auxiliary Engines ROG	Auxiliary Engines CO
501-750 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1994	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2012	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2013-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73
751-1900 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2011	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2012-2016	4.09	0.08	0.68	3.73	4.09	0.08	0.81	3.73
	2017-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.73
1901-3300 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2012	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2013-2015	4.37	0.10	0.68	3.73	4.37	0.10	0.81	3.73
	2016-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.73

Table 38. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

HP Range	Model Year	Main Engines NOx	Main Engines PM	Main Engines ROG	Main Engines CO	Auxiliary Engines NOx	Auxiliary Engines PM	Auxiliary Engines ROG	Auxiliary Engines CO
3301-5000 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2013	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2014-2015	4.94	0.25	0.68	3.73	4.94	0.25	0.81	3.75
	2016-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.75

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 39. Quantity of Auxiliary Engines and Average Horsepower

Vessel Category	# Auxiliary Engines	Horsepower Range	Horsepower Average
Commercial Fishing	212	6 - 300	71
Tug Boats	120	7 - 300	111
Ferry/excursion Vessels	98	10 - 400	94
Charter Fishing	82	4 - 185	50
Others	34	10 - 240	56
Work Boats	26	9 - 221	101
Crew and Supply	22	16 - 110	79
Tow Boats	21	18 - 175	79
Pilot Vessels	1	N/A	30

min	max
30	111

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Table 40. Quantity of Propulsion Engines and Average Horsepower

Vessel Category	# Propulsion Engines	Horsepower			min	max
		Range	Average			
Commercial Fishing	516	8 – 1,485	230		230	1274
Charter Fishing	192	80 – 1,400	381			
Ferry/excursion Vessels	164	35 – 3,110	733			
Tug Boats	144	24 – 3,600	1,274			
Work Boats	99	15 – 1,300	239			
Others	89	28 - 764	281			
Crew and Supply	50	225 - 750	439			
Tow Boats	38	24 – 1,500	500			
Pilot Vessels	15	230 - 550	408			

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Table 41. Vessel Age

Vessel Category	Age
Charter Fishing	27
Ferry/excursion Vessels	27
Tug Boats	32
Commercial Fishing	32
Pilot Vessels	24
Work Boats	27
Crew and Supply	27
Tow Boats	39

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Criteria Pollutant Construction Emissions Summary

Table 42. Maximum Daily Mitigated Emissions

Source	Maximum Daily Emissions (pounds per day)					
	VOC	NOx	CO	SOx	PM10	PM2.5
Onsite Construction Equipment	21	60	233	1	2	2
Construction Worker Commuting	0	1	23	0	6	2
Haul Truck Trips	1	118	16	1	9	3
Fugitive Dust						
Material Handling	--	--	--	--	8	1
Bulldozing	--	--	--	--	85	9
Grading	--	--	--	--	6	3
Paved Road Dust - Haul Roads	--	--	--	--	8	2
Unpaved Road Dust - Haul Roads	--	--	--	--	116	12
Dam Raise Subtotal	**23**	**180**	**272**	**2**	**240**	**34**
SR-152 Improvements Subtotal	**125**	**346**	**928**	**3**	**24**	**19**
Grand Total	**147**	**526**	**1,200**	**4**	**264**	**53**

Table 43. Maximum Annual Mitigated Emissions

Source	Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
Onsite Construction Equipment	4	11	42	0	0	0
Construction Worker Commuting	0	0	4	0	1	0
Haul Truck Trips	0	22	3	0	2	1
Fugitive Dust						
Material Handling	--	--	--	--	1	0
Bulldozing	--	--	--	--	16	2
Grading	--	--	--	--	1	1
Paved Road Dust - Haul Roads	--	--	--	--	1	0
Unpaved Road Dust - Haul Roads	--	--	--	--	18	2
Dam Raise Subtotal	**4**	**33**	**50**	**0**	**41**	**6**
SR-152 Improvements Subtotal	**9**	**34**	**76**	**0**	**2**	**2**
Grand Total	**13**	**67**	**126**	**1**	**43**	**7**
General Conformity Threshold	10	10	n/a	100	100	100
CEQA Significance Threshold	10	10	100	27	15	15
Exceed De Minimis Threshold?	Yes	Yes	n/a	No	No	No
Exceed CEQA Threshold?	Yes	Yes	Yes	No	Yes	No

Note:
General conformity requires all direct and indirect actions be compared against the de minimis thresholds.
Therefore, if construction activities could occur simultaneously, then emissions must be added together for comparison.

Table 44. Mitigated Onsite Construction Equipment Emissions

					Emission Factors (g/hp-hr or g/mi)						Daily Emissions (lb/day)						Annual Emissions (tons/year)					
Equipment Type	**Quantity**	**OFFROAD Description**	**HP**	**Hours per Day**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**	**ROG**	**CO**	**NOX**	**SO2**	**PM10**	**PM2.5**
Excavators	3	ConstMin - Excavators	158	20	0.032	1.136	0.103	0.002	0.004	0.004	0.66	23.75	2.15	0.04	0.08	0.07	0.12	4.33	0.39	0.01	0.01	0.01
Bulldozers	4	ConstMin - Rubber Tired Dozers	249	20	0.043	0.426	0.110	0.002	0.004	0.004	1.90	18.71	4.84	0.08	0.18	0.17	0.35	3.41	0.88	0.02	0.03	0.03
Cranes/Lifts	5	ConstMin - Cranes	231	20	0.022	0.287	0.077	0.001	0.003	0.003	1.11	14.61	3.92	0.07	0.14	0.13	0.20	2.67	0.72	0.01	0.03	0.02
Compactors	5	ConstMin - Rollers	80	20	0.035	1.208	0.512	0.002	0.004	0.004	0.61	21.31	9.03	0.03	0.07	0.06	0.11	3.89	1.65	0.01	0.01	0.01
Graders	2	ConstMin - Graders	188	20	0.034	0.415	0.110	0.002	0.004	0.004	0.57	6.88	1.83	0.03	0.07	0.06	0.10	1.25	0.33	0.01	0.01	0.01
Scrapers	2	ConstMin - Scrapers	367	20	0.038	0.476	0.130	0.002	0.005	0.004	1.23	15.40	4.20	0.08	0.15	0.14	0.23	2.81	0.77	0.01	0.03	0.03
Loaders (small)	2	ConstMin - Rubber Tired Loaders	188	20	0.037	0.383	0.100	0.002	0.004	0.003	0.61	6.35	1.65	0.03	0.06	0.06	0.11	1.16	0.30	0.01	0.01	0.01
Loaders (large)	3	ConstMin - Rubber Tired Loaders	541	20	0.040	0.377	0.101	0.002	0.004	0.004	2.87	26.96	7.24	0.13	0.28	0.25	0.52	4.92	1.32	0.02	0.05	0.05
Dump trucks	13	ConstMin - Off-Highway Trucks	403	20	0.049	0.410	0.109	0.002	0.004	0.004	11.28	94.71	25.25	0.43	0.99	0.91	2.06	17.28	4.61	0.08	0.18	0.17
Water Trucks	5		N/A	20	0.057	1.246	0.057	0.005	0.050	0.023	0.19	4.12	0.19	0.02	0.16	0.07	0.03	0.75	0.03	0.00	0.03	0.01
Offroad equipment have units of g/hp-hr; onroad equipment have units of g/mi.										**Total**	**21.05**	**232.78**	**60.30**	**0.94**	**2.18**	**1.93**	3.84	42.48	11.01	0.17	0.40	0.35

Note:
Offroad equipment emission factors from OFFROAD2017 model.
Onroad truck emission factors from EMFAC2014.

Sources:
OFFROAD2017: https://www.arb.ca.gov/orion/
EMFAC2017: https://arb.ca.gov/emfac/2017/

<u>Operating Schedule</u>

2 shifts per day
10 hours per shift
365 days per year

Construction Start: 2025

<u>Speed Limit for Onroad Vehicles (Onsite)</u>

15 miles per hour
(speed limit is 35 mph on site, but it is assumed that a water truck will be operating at a lower rate of speed)

<u>Conversions</u>

453.6 grams per pound
2,000 pounds per ton

Offsite Construction Emissions

Table 45. Mitigated Emission Factors (g/mi)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.008	0.590	0.039	0.003	0.001	0.008	0.037	0.100	0.147	0.001	0.002	0.016	0.025	0.044
Haul trucks	0.028	0.389	2.787	0.015	0.012	0.036	0.062	0.100	0.210	0.012	0.009	0.026	0.025	0.072

Table 46. Mitigated Daily Emissions (pounds per day)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.32	22.58	1.49	0.10	0.05	0.31	1.41	3.84	5.61	0.05	0.08	0.60	0.96	1.69
Haul trucks	1.18	16.47	117.97	0.63	0.51	1.52	2.61	4.25	8.90	0.49	0.38	1.12	1.06	3.06
Total	**1.50**	**39.05**	**119.46**	**0.73**	**0.56**	**1.83**	**4.02**	**8.10**	**14.51**	**0.54**	**0.46**	**1.72**	**2.02**	**4.74**

Table 47. Mitigated Annual Emissions (tons per year)

Source	ROG	CO	NOx	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Paved Road Dust	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Paved Road Dust	PM2.5 Total
Construction workers	0.06	4.12	0.27	0.02	0.01	0.06	0.26	0.70	1.02	0.01	0.01	0.11	0.18	0.31
Haul trucks	0.22	3.01	21.53	0.11	0.09	0.28	0.48	0.78	1.62	0.09	0.07	0.20	0.19	0.56
Total	**0.27**	**7.13**	**21.80**	**0.13**	**0.10**	**0.33**	**0.73**	**1.48**	**2.65**	**0.10**	**0.08**	**0.31**	**0.37**	**0.87**

One-way trip distance
Workers 40 miles per trip
Trucks 40 miles per trip

Maximum Daily Workers and Trucks
217 workers per day (130 day time workers and 87 night time workers)
240 trucks per day

Conversions
453.6 grams per pound
2,000 pounds per ton

Operating Schedule
365 days per year

Construction Start Year
2025

Fugitive Dust Emissions - Material Handling

<u>Excavated Volume</u>
11,200 cubic yards per shift
8,176,000 cubic yards per year

<u>Equation (AP-42, Chapter 13.2.4):</u>

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

where:
E = emission factor, pound per ton
k = particle size multiplier
U = mean wind speed, miles per hour
M = material moisture content, %

Average Wind Speed 9.43 mph
Source: MesoWest, Station CF031 (Rt. 152 San Luis), 2019 data. Accessed on: April 19, 2020. Available at: mesowest.utah.edu.

Material Moisture Content: 7.9 %
Source: EPA. 1998. AP-42, Chapter 11-9, Overburden moisture content, bulldozing.

Table 48. Material Handling Emissions

		EF	Emissions	
Size	**k**	**lb/ton**	**lbs/day**	**tpy**
PM10	0.35	3.7E-04	8.2	1.5
PM2.5	0.053	5.7E-05	1.2	0.2

<u>Operating Schedule</u>
2 shift per day
7 days per week
365 days per year

<u>Density</u>
1.25 tons per cubic yard
Note: CalEEMod assumes haul trucks can handle 20 tons or 16 cy.

<u>Number of Drops</u>
2 drops per truck *(one drop at borrow site and one drop at dam site)*

<u>Dust Control</u>
61% reduction from watering at least 3 times per day
Source: CalEEMod

Fugitive Dust Emissions - Grading

Operating Schedule

2 graders
7.1 miles per hour (AP-42, Table 11.9-3)
20 hours per day (total)
142 miles per day
51,830 miles per year *assumes 365 days per year*

Equations (AP-42, Chapter 11.9):

$TSP = 0.040(S)^{2.5}$ and $PM15 = 0.051(S)^{2.0}$

where:
S = mean vehicle speed, miles per hour

Scaling Factors

PM10 0.60 (multiply the 15-micron equation by this fraction to determine emissions)
PM2.5 0.031 (multiply the TSP equation by this fraction to determine emissions)

Table 49. Grading Emissions

	EF	Emissions	
Size	**lb/VMT**	**lbs/day**	**tpy**
PM10	1.54	85.4	15.6
PM2.5	0.17	9.2	1.7

Dust Control

61% reduction from watering at least 3 times per day
Source: CalEEMod

Fugitive Dust Emissions - Bulldozing

Operating Schedule

4	bulldozers	
20	hours per day (total)	
7,300	hours per year (total)	*assumes 365 days per year*

Equations (AP-42, Chapter 11.9):

$$TSP = \frac{5.7(s)^{1.2}}{M^{1.3}} \quad \text{and} \quad PM15 = \frac{1.0(s)^{1.5}}{M^{1.4}}$$

where:

s = silt content	6.9 %	(AP-42, Table 11.9-3, Overburden)
M = material moisture content	7.9 %	(AP-42, Table 11.9-3, Overburden)

Scaling Factors

PM10	0.75	(multiply the 15-micron equation by this fraction to determine emissions)
PM2.5	0.105	(multiply the TSP equation by this fraction to determine emissions)

Table 50. Bulldozing Emissions

	EF	Emissions	
Size	**lb/hr**	**lbs/day**	**tpy**
PM10	0.75	5.9	1.1
PM2.5	0.41	3.2	0.6

Dust Control

61% reduction from watering at least 3 times per day

Source: CalEEMod

Fugitive Dust Emissions - Paved Road Dust (Haul Roads)

Number of Trucks	13	
Excavated quantity	11,200	cubic yards per shift
Number of shifts	2	shift per day
	1,723	cubic yards per truck per day
	46.75	cubic yards per truck (body capacity)
	74	trips per day per truck (loaded and unloaded trips)
Haul Road Length	0.8	miles one-way (paved road; total route is 3.2 miles)
	770	miles per day
	280,904	miles per year *assumes 365 days per year*

Table 51. Paved Road Dust Emissions

Size	EF, g/VMT		Emissions	
	Uncontrolled	Controlled	lbs/day	tpy
PM10	22.2	21.5	7.5	1.3
PM2.5	5.6	5.4	1.9	0.3

Note: Uncontrolled EF used for daily emissions and controlled EF used for annual emissions.

<u>Dust Control</u>

80% assumes pipe-grid trackout-control device installed

Source: SCAQMD, Mitigation Measures, Fugitive Dust from Paved Roads

http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust

<u>Conversions</u>

453.6 grams per pound
2,000 pounds per ton

Percentage of haul route paved 25%
(estimated from Google Earth)

Fugitive Dust Emissions - Unpaved Road Dust (Haul Roads)

Number of Trucks	13	
Excavated quantity	11,200	cubic yards per shift
Number of shifts	2	shift per day
	1,723	cubic yards per truck per day
	46.75	cubic yards per truck (body capacity)
	74	trips per day per truck (loaded and unloaded trips)
Haul Road Length	2.4	miles one-way (unpaved road; total route is 3.2 miles)
	2,309	miles per day
	842,712	miles per year *assumes 365 days per year*

Equations (AP-42, Chapter 13.2.2):

$$E = k(s/12)^a(W/3)^b$$

$$E_{ext} = E[(365 - P)/365]$$

where:

k, a, and b are empirical constants
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
Eext = annual size-specific emission factor extrapolated for natural mitigation
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

silt content (construction)	8.5	%	(AP-42, Table 13.2.2-1)
days of precipitation	49		(CalEEMod default)
Unloaded truck weight	50	tons	
Loaded truck weight	126	tons	
Average vehicle weight	88	tons	(estimated from eqiupment specifications)

Table 52. Mitigated Unpaved Road Dust Emissions

				EF, lb/VMT		Emissions	
Size	**k**	**a**	**b**	**Uncontrolled**	**Controlled**	**lbs/day**	**tpy**
PM10	1.5	0.9	0.45	5.0	4.4	116.1	18.3
PM2.5	0.15	0.9	0.45	0.5	0.4	11.6	1.8

Source: AP-42, Table 13.2.2-2

Dust Control

61% reduction from watering at least 3 times per day
99% paving all unpaved roads (mitigation)

Source: CalEEMod

Percentage of haul route unpaved 75%
(estimated from Google Earth)

Conversions

2,000 pounds per ton

EMFAC2017 Emission Factors
On-Road Motor Vehicles

Table 53. Mitigated Emission Factors for Construction Worker Commutes

		grams per mile												
Air Basin	Year	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
San Joaquin Valley	2020	0.0182	0.0265	0.0802	0.9372	0.0030	0.0017	0.0080	0.0368	0.0465	0.0016	0.0020	0.0158	0.0193
	2021	0.0153	0.0223	0.0681	0.8369	0.0029	0.0016	0.0080	0.0368	0.0464	0.0015	0.0020	0.0158	0.0192
	2022	0.0130	0.0190	0.0584	0.7556	0.0028	0.0015	0.0080	0.0368	0.0463	0.0014	0.0020	0.0158	0.0192
	2023	0.0111	0.0161	0.0504	0.6879	0.0027	0.0015	0.0080	0.0368	0.0462	0.0013	0.0020	0.0158	0.0191
	2024	0.0096	0.0139	0.0440	0.6354	0.0026	0.0014	0.0080	0.0368	0.0461	0.0013	0.0020	0.0158	0.0190
	2025	0.0083	0.0120	0.0389	0.5900	0.0026	0.0013	0.0080	0.0368	0.0461	0.0012	0.0020	0.0158	0.0190
	2026	0.0073	0.0106	0.0349	0.5570	0.0025	0.0013	0.0080	0.0368	0.0460	0.0012	0.0020	0.0158	0.0189
	2027	0.0064	0.0094	0.0316	0.5263	0.0024	0.0012	0.0080	0.0368	0.0460	0.0011	0.0020	0.0158	0.0189
	2028	0.0057	0.0083	0.0289	0.5012	0.0023	0.0011	0.0080	0.0368	0.0459	0.0010	0.0020	0.0158	0.0188
	2029	0.0051	0.0075	0.0267	0.4798	0.0023	0.0011	0.0080	0.0368	0.0458	0.0010	0.0020	0.0158	0.0187
	2030	0.0046	0.0067	0.0249	0.4621	0.0022	0.0010	0.0080	0.0368	0.0457	0.0009	0.0020	0.0158	0.0187
	2031	0.0042	0.0061	0.0234	0.4468	0.0022	0.0009	0.0080	0.0368	0.0457	0.0009	0.0020	0.0158	0.0186
	2032	0.0038	0.0056	0.0222	0.4339	0.0021	0.0009	0.0080	0.0368	0.0456	0.0008	0.0020	0.0158	0.0186
	2033	0.0035	0.0051	0.0211	0.4228	0.0021	0.0008	0.0080	0.0368	0.0456	0.0008	0.0020	0.0158	0.0185
	2034	0.0032	0.0047	0.0203	0.4130	0.0021	0.0008	0.0080	0.0368	0.0455	0.0007	0.0020	0.0158	0.0185
	2035	0.0030	0.0043	0.0196	0.4046	0.0020	0.0007	0.0080	0.0368	0.0455	0.0007	0.0020	0.0158	0.0184

Note:
Vehicle fleet mix includes gasoline, diesel, and electric automobiles (LDA) and light-duty trucks (LDT1 and LDT2).

Table 54. Mitigated Emission Factors for Haul and Delivery Trucks

		grams per mile												
Air Basin	Year	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
San Joaquin Valley	2020	0.0261	0.0298	2.4935	0.3643	0.0157	0.0100	0.0360	0.0617	0.1078	0.0096	0.0090	0.0265	0.0451
	2021	0.0265	0.0301	2.5472	0.3688	0.0155	0.0104	0.0360	0.0617	0.1082	0.0100	0.0090	0.0265	0.0454
	2022	0.0270	0.0307	2.6332	0.3760	0.0154	0.0110	0.0360	0.0617	0.1088	0.0106	0.0090	0.0265	0.0460
	2023	0.0275	0.0313	2.7101	0.3825	0.0153	0.0116	0.0360	0.0617	0.1093	0.0111	0.0090	0.0265	0.0465
	2024	0.0277	0.0315	2.7488	0.3858	0.0151	0.0119	0.0360	0.0617	0.1096	0.0114	0.0090	0.0265	0.0468
	2025	0.0279	0.0318	2.7871	0.3890	0.0148	0.0121	0.0360	0.0617	0.1099	0.0116	0.0090	0.0265	0.0471
	2026	0.0282	0.0321	2.8261	0.3923	0.0147	0.0124	0.0360	0.0617	0.1102	0.0119	0.0090	0.0265	0.0473
	2027	0.0284	0.0323	2.8647	0.3956	0.0145	0.0127	0.0360	0.0617	0.1104	0.0121	0.0090	0.0265	0.0476
	2028	0.0286	0.0326	2.9042	0.3989	0.0143	0.0130	0.0360	0.0617	0.1107	0.0124	0.0090	0.0265	0.0479
	2029	0.0288	0.0328	2.9360	0.4016	0.0142	0.0132	0.0360	0.0617	0.1109	0.0126	0.0090	0.0265	0.0481
	2030	0.0290	0.0330	2.9590	0.4036	0.0140	0.0134	0.0360	0.0617	0.1111	0.0128	0.0090	0.0265	0.0483
	2031	0.0291	0.0332	2.9882	0.4060	0.0139	0.0136	0.0360	0.0617	0.1113	0.0130	0.0090	0.0265	0.0485
	2032	0.0293	0.0334	3.0197	0.4087	0.0138	0.0138	0.0360	0.0617	0.1115	0.0132	0.0090	0.0265	0.0487
	2033	0.0295	0.0336	3.0493	0.4112	0.0137	0.0140	0.0360	0.0617	0.1118	0.0134	0.0090	0.0265	0.0489
	2034	0.0297	0.0338	3.0720	0.4131	0.0135	0.0142	0.0360	0.0617	0.1119	0.0136	0.0090	0.0265	0.0490
	2035	0.0298	0.0339	3.0900	0.4146	0.0134	0.0143	0.0360	0.0617	0.1121	0.0137	0.0090	0.0265	0.0492

Table 55. Mitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2020	5	0.193	0.220	0.144	3.429	0.008	0.008	0.008	0.037	0.053	0.008	0.002	0.016	0.025
2020	10	0.145	0.165	0.120	2.566	0.007	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2020	15	0.071	0.081	0.080	1.255	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2020	20	0.028	0.031	0.053	0.489	0.005	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2020	25	0.016	0.019	0.040	0.291	0.004	0.005	0.008	0.037	0.049	0.005	0.002	0.016	0.022
2020	30	0.012	0.014	0.033	0.220	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2020	35	0.010	0.011	0.029	0.175	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2020	40	0.008	0.009	0.025	0.145	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2020	45	0.007	0.008	0.023	0.123	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2020	50	0.006	0.007	0.021	0.106	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2020	55	0.005	0.006	0.020	0.093	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2020	60	0.005	0.006	0.019	0.088	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2020	65	0.005	0.006	0.019	0.087	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2021	5	0.186	0.212	0.135	3.443	0.008	0.008	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2021	10	0.139	0.159	0.112	2.579	0.007	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2021	15	0.068	0.077	0.075	1.260	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2021	20	0.027	0.030	0.049	0.492	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2021	25	0.016	0.018	0.037	0.292	0.004	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2021	30	0.012	0.014	0.031	0.221	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2021	35	0.010	0.011	0.027	0.176	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2021	40	0.008	0.009	0.024	0.145	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2021	45	0.007	0.008	0.022	0.123	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2021	50	0.006	0.007	0.020	0.107	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2021	55	0.005	0.006	0.018	0.093	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2021	60	0.005	0.005	0.018	0.088	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2021	65	0.005	0.005	0.018	0.088	0.004	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2022	5	0.177	0.202	0.124	3.432	0.008	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.025
2022	10	0.133	0.151	0.103	2.572	0.007	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2022	15	0.065	0.074	0.069	1.256	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2022	20	0.025	0.029	0.046	0.491	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2022	25	0.015	0.017	0.034	0.291	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2022	30	0.011	0.013	0.029	0.220	0.003	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2022	35	0.009	0.010	0.025	0.176	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2022	40	0.007	0.009	0.022	0.145	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2022	45	0.006	0.007	0.020	0.123	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2022	50	0.005	0.006	0.018	0.106	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2022	55	0.005	0.005	0.017	0.093	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2022	60	0.005	0.005	0.016	0.088	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2022	65	0.005	0.005	0.016	0.087	0.004	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2023	5	0.169	0.193	0.116	3.420	0.008	0.007	0.008	0.037	0.052	0.007	0.002	0.016	0.024
2023	10	0.127	0.145	0.096	2.564	0.007	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2023	15	0.062	0.071	0.064	1.253	0.006	0.006	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2023	20	0.024	0.028	0.043	0.491	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2023	25	0.014	0.016	0.032	0.290	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2023	30	0.011	0.012	0.027	0.219	0.003	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2023	35	0.009	0.010	0.023	0.175	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2023	40	0.007	0.008	0.020	0.144	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2023	45	0.006	0.007	0.019	0.123	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2023	50	0.005	0.006	0.017	0.106	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2023	55	0.005	0.005	0.016	0.093	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2023	60	0.004	0.005	0.015	0.087	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2023	65	0.004	0.005	0.015	0.087	0.004	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020

Table 55. Mitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2024	5	0.162	0.185	0.108	3.409	0.008	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2024	10	0.122	0.139	0.090	2.561	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2024	15	0.060	0.068	0.060	1.252	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2024	20	0.023	0.027	0.040	0.490	0.005	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2024	25	0.014	0.016	0.030	0.289	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2024	30	0.010	0.012	0.025	0.219	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2024	35	0.008	0.009	0.021	0.175	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2024	40	0.007	0.008	0.019	0.144	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2024	45	0.006	0.007	0.017	0.123	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2024	50	0.005	0.006	0.016	0.106	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2024	55	0.004	0.005	0.015	0.092	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2024	60	0.004	0.005	0.014	0.087	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2024	65	0.004	0.005	0.014	0.087	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2025	5	0.156	0.177	0.101	3.394	0.007	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.024
2025	10	0.117	0.133	0.085	2.550	0.006	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2025	15	0.057	0.065	0.057	1.246	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2025	20	0.022	0.026	0.038	0.488	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2025	25	0.013	0.015	0.028	0.288	0.004	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2025	30	0.010	0.011	0.023	0.218	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2025	35	0.008	0.009	0.020	0.174	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2025	40	0.007	0.008	0.018	0.144	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2025	45	0.006	0.006	0.016	0.122	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2025	50	0.005	0.006	0.015	0.105	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2025	55	0.004	0.005	0.014	0.092	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2025	60	0.004	0.005	0.013	0.087	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2025	65	0.004	0.005	0.013	0.086	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	5	0.150	0.171	0.095	3.380	0.007	0.006	0.008	0.037	0.051	0.006	0.002	0.016	0.023
2026	10	0.113	0.128	0.080	2.541	0.006	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2026	15	0.055	0.063	0.053	1.242	0.005	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2026	20	0.022	0.025	0.035	0.485	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2026	25	0.013	0.014	0.026	0.287	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2026	30	0.010	0.011	0.022	0.217	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2026	35	0.008	0.009	0.019	0.173	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2026	40	0.006	0.007	0.017	0.143	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	45	0.005	0.006	0.015	0.122	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	50	0.005	0.005	0.014	0.105	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	55	0.004	0.005	0.013	0.092	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	60	0.004	0.004	0.013	0.086	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2026	65	0.004	0.004	0.012	0.086	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	5	0.144	0.164	0.090	3.361	0.007	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2027	10	0.109	0.124	0.075	2.527	0.006	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2027	15	0.053	0.060	0.050	1.235	0.005	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2027	20	0.021	0.024	0.033	0.483	0.004	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2027	25	0.012	0.014	0.025	0.285	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	30	0.009	0.011	0.021	0.216	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2027	35	0.007	0.008	0.018	0.172	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2027	40	0.006	0.007	0.016	0.142	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	45	0.005	0.006	0.014	0.121	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	50	0.004	0.005	0.013	0.104	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	55	0.004	0.004	0.012	0.092	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	60	0.004	0.004	0.012	0.086	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2027	65	0.004	0.004	0.012	0.086	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020

Table 55. Mitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2028	5	0.139	0.158	0.085	3.340	0.007	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.023
2028	10	0.105	0.119	0.071	2.512	0.006	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2028	15	0.051	0.058	0.048	1.228	0.005	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2028	20	0.020	0.023	0.032	0.480	0.004	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2028	25	0.012	0.013	0.023	0.284	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2028	30	0.009	0.010	0.020	0.215	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2028	35	0.007	0.008	0.017	0.171	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	40	0.006	0.007	0.015	0.141	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	45	0.005	0.006	0.014	0.120	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	50	0.004	0.005	0.013	0.104	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	55	0.004	0.004	0.012	0.091	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2028	60	0.004	0.004	0.011	0.085	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2028	65	0.004	0.004	0.011	0.085	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2029	5	0.134	0.152	0.080	3.316	0.007	0.005	0.008	0.037	0.050	0.005	0.002	0.016	0.022
2029	10	0.101	0.115	0.067	2.494	0.006	0.005	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2029	15	0.049	0.056	0.045	1.219	0.005	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2029	20	0.019	0.022	0.030	0.477	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2029	25	0.011	0.013	0.022	0.282	0.003	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2029	30	0.009	0.010	0.018	0.213	0.003	0.003	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	35	0.007	0.008	0.016	0.170	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	40	0.006	0.006	0.014	0.140	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	45	0.005	0.006	0.013	0.119	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	50	0.004	0.005	0.012	0.103	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2029	55	0.004	0.004	0.011	0.090	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2029	60	0.003	0.004	0.011	0.085	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2029	65	0.003	0.004	0.011	0.084	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2030	5	0.129	0.147	0.076	3.291	0.007	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2030	10	0.097	0.111	0.064	2.475	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2030	15	0.048	0.054	0.043	1.210	0.005	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2030	20	0.019	0.021	0.028	0.473	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2030	25	0.011	0.012	0.021	0.280	0.003	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2030	30	0.008	0.009	0.018	0.212	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	35	0.007	0.008	0.015	0.169	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	40	0.005	0.006	0.014	0.139	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	45	0.005	0.005	0.012	0.119	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2030	50	0.004	0.005	0.011	0.102	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2030	55	0.004	0.004	0.010	0.090	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2030	60	0.003	0.004	0.010	0.084	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2030	65	0.003	0.004	0.010	0.084	0.003	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2031	5	0.124	0.142	0.073	3.264	0.007	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2031	10	0.094	0.107	0.061	2.455	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.022
2031	15	0.046	0.052	0.041	1.200	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2031	20	0.018	0.021	0.027	0.470	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2031	25	0.011	0.012	0.020	0.278	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	30	0.008	0.009	0.017	0.210	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	35	0.006	0.007	0.014	0.168	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	40	0.005	0.006	0.013	0.138	0.002	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2031	45	0.005	0.005	0.012	0.118	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2031	50	0.004	0.004	0.011	0.101	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2031	55	0.003	0.004	0.010	0.089	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2031	60	0.003	0.004	0.010	0.084	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2031	65	0.003	0.004	0.010	0.083	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019

Table 55. Mitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile												
Year	Speed	ROG	TOG	NOx	CO	SOx	PM10 Exhaust	PM10 Tire Wear	PM10 Brake Wear	PM10 Total	PM2.5 Exhaust	PM2.5 Tire Wear	PM2.5 Brake Wear	PM2.5 Total
2032	5	0.120	0.137	0.069	3.235	0.006	0.004	0.008	0.037	0.049	0.004	0.002	0.016	0.021
2032	10	0.091	0.103	0.058	2.433	0.006	0.004	0.008	0.037	0.048	0.004	0.002	0.016	0.021
2032	15	0.044	0.050	0.039	1.189	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2032	20	0.017	0.020	0.026	0.465	0.004	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2032	25	0.010	0.012	0.019	0.275	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	30	0.008	0.009	0.016	0.208	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	35	0.006	0.007	0.014	0.166	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2032	40	0.005	0.006	0.012	0.137	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2032	45	0.004	0.005	0.011	0.117	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2032	50	0.004	0.004	0.010	0.101	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2032	55	0.003	0.004	0.010	0.088	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2032	60	0.003	0.004	0.009	0.083	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2032	65	0.003	0.003	0.009	0.083	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	5	0.116	0.132	0.066	3.204	0.006	0.004	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2033	10	0.088	0.100	0.055	2.410	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2033	15	0.043	0.049	0.037	1.177	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2033	20	0.017	0.019	0.025	0.461	0.004	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2033	25	0.010	0.011	0.018	0.273	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	30	0.007	0.009	0.015	0.207	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2033	35	0.006	0.007	0.013	0.165	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2033	40	0.005	0.006	0.012	0.136	0.002	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2033	45	0.004	0.005	0.011	0.116	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	50	0.004	0.004	0.010	0.100	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	55	0.003	0.004	0.009	0.088	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	60	0.003	0.003	0.009	0.082	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2033	65	0.003	0.003	0.009	0.082	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	5	0.112	0.128	0.063	3.176	0.006	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2034	10	0.085	0.096	0.053	2.388	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2034	15	0.041	0.047	0.035	1.166	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.020
2034	20	0.016	0.019	0.024	0.457	0.004	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2034	25	0.010	0.011	0.017	0.271	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2034	30	0.007	0.008	0.015	0.205	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.019
2034	35	0.006	0.007	0.013	0.163	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2034	40	0.005	0.005	0.011	0.135	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	45	0.004	0.005	0.010	0.114	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	50	0.004	0.004	0.009	0.099	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	55	0.003	0.004	0.009	0.087	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	60	0.003	0.003	0.008	0.081	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2034	65	0.003	0.003	0.008	0.081	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	5	0.109	0.124	0.061	3.148	0.006	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2035	10	0.082	0.093	0.051	2.367	0.005	0.003	0.008	0.037	0.048	0.003	0.002	0.016	0.021
2035	15	0.040	0.046	0.034	1.156	0.005	0.003	0.008	0.037	0.047	0.003	0.002	0.016	0.020
2035	20	0.016	0.018	0.023	0.453	0.004	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2035	25	0.009	0.011	0.017	0.269	0.003	0.002	0.008	0.037	0.047	0.002	0.002	0.016	0.020
2035	30	0.007	0.008	0.014	0.203	0.003	0.002	0.008	0.037	0.046	0.002	0.002	0.016	0.019
2035	35	0.006	0.006	0.012	0.162	0.002	0.002	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	40	0.005	0.005	0.011	0.133	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	45	0.004	0.004	0.010	0.113	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	50	0.003	0.004	0.009	0.098	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	55	0.003	0.003	0.008	0.086	0.002	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	60	0.003	0.003	0.008	0.081	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019
2035	65	0.003	0.003	0.008	0.081	0.003	0.001	0.008	0.037	0.046	0.001	0.002	0.016	0.019

Emission Factors
Paved Road Dust Emissions

Equation 1:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

where:
- E = particulate emission factor (having units matching the units of k),
- k = particle size multiplier for particle size range and units of interest (see below),
- sL = road surface silt loading (grams per square meter) (g/m2), and
- W = average weight (tons) of the vehicles traveling the road.

Equation 2:

$$E_{ext} = [k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N)$$

where: k, sL, and W are as defined in Equation 1 and
- E_{ext} = annual or other long-term average emission factor in the same units as k,
- P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
- N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Table 56. Particle Size Multipliers for Paved Road Equation

Size Range [a]	Ref.	Particle Size Multiplier, k [b]		
		g/VKT	g/VMT	lb/VMT
$PM_{2.5}$	[c]	0.15	0.25	0.00054
PM_{10}		0.62	1.00	0.0022
PM_{15}		0.77	1.23	0.0027
PM_{30}	[d]	3.23	5.24	0.011

Source: USEPA. 2011. Compilation of Air Pollutant Emission Factors (AP-42). Fifth Edition, Volume I. Chapter 13.2.1 Paved Roads. January. Available online at: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf [Accessed July 17, 2012].

Notes:

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Offsite Construction Vehicles

<u>Number precipitation days >0.1 inches</u>

Merced County	49

Road silt loading	0.03	g/m^2	(AP-42, Table 13.2.1-2, ADT > 10,000, ubiquitous baseline)
Average vehicle weight	2.4	tons	

Source: CAPCOA. 2013. California Emissions Estimator Model User's Guide, Version 2013.2, Appendix D: Default Data Tables. Prepared by ENVIRON International Corporation and California Air Districts. July. Available online at: http://www.caleemod.com/ [Accessed on July 28, 2016].

Table 57. Paved Road Dust Emission Factors - Offsite Construction Vehicles

County	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Merced	0.100	0.025	0.097	0.024

Note:
Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

Haul Road Vehicles

Number precipitation days >0.1 inches
Merced County 49

Road silt loading	0.2	g/m^2	(AP-42, Table 13.2.1-2, ADT 500-5,000, ubiquitous baseline)
Unloaded truck weight	50	tons	
	126	tons	
Average vehicle weight	88	tons	(estimated from eqiupment specifications)

Table 58. Paved Road Dust Emission Factors - Onsite Haul Trucks

County	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Merced	22.2	5.6	21.5	5.4

Note:
Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

Criteria Pollutant Construction Emissions Summary

Table 59. SR 152 Modifications - Maximum Daily Mitigated Emissions

	Daily Emissions (lbs/day)					
Source	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Off-Road Construction Equipment	14	200	146	1	2	2
On-Road Haul Trucks and Delivery Vehicles	0	28	4	0	2	1
Construction Worker Commuting	0	1	12	0	3	1
Marine Emissions (Tugboats)	110	117	766	2	17	16
Total	**125**	**346**	**928**	**3**	**24**	**19**

Table 60. SR 152 Modifications - Annual Mitigated Emissions

	Annual Emissions (tons per year)					
Source	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Off-Road Construction Equipment	2	23	24	0	0	0
On-Road Haul Trucks and Delivery Vehicles	0	4	1	0	0	0
Construction Worker Commuting	0	0	2	0	0	0
Marine Emissions (Tugboats)	7	8	50	0	1	1
Total	**9**	**34**	**76**	**0**	**2**	**2**

SR 152 Construction Emissions Summary

Table 61. Maximum Mitigated Onsite Construction Equipment Daily Emissions (pounds per day)

Phase	Subphase	ROG	CO	NOx	SOx	PM10	PM2.5
Raise Embankment by 10 VLF	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	14.2	145.7	200.2	0.5	2.3	2.1
	10 RCP CULVERT	0.8	13.8	2.7	0.1	0.1	0.1
	15 RIPRAP	7.6	115.1	36.2	0.4	1.2	1.1
	16 FILTER	0.8	26.4	3.8	0.0	0.1	0.1
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	1.3	35.2	6.9	0.1	0.2	0.1
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	2.2	50.4	11.5	0.1	0.3	0.2
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	1.3	35.2	6.9	0.1	0.2	0.1
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	2.2	50.4	11.5	0.1	0.3	0.2
	40 STORMWATER SYSTEM	1.4	25.9	6.1	0.1	0.2	0.2
	Raise Embankment by 10 VLF Maximum Daily Emissions	14.2	145.7	200.2	0.5	2.3	2.1
East Overlook Grading and Pavement	15 RIPRAP	0.9	24.4	4.6	0.0	0.1	0.1
	50 EAST OVERLOOK GRADING	0.7	15.6	3.4	0.0	0.1	0.1
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	2.9	66.8	15.1	0.2	0.3	0.3
	East Overlook Grading and Pavement Maximum Daily Emissions	2.9	66.8	15.1	0.2	0.3	0.3
Basalt Hill Site Develoment	200 BASALT HILL DOCKING AREA	0.7	21.3	3.3	0.0	0.1	0.1
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	0.8	22.4	4.0	0.0	0.1	0.1
	Basalt Hill Site Develoment Maximum Daily Emissions	0.8	22.4	4.0	0.0	0.1	0.1
	Maximum Daily Emissions	**14.2**	**145.7**	**200.2**	**0.5**	**2.3**	**2.1**

Table 62. Maximum Annual Mitigated Onsite Construction Equipment Emissions (tons per year)

Phase	Subphase	ROG	CO	NOx	SOx	PM10	PM2.5
Raise Embankment by 10 VLF	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.3	12.2	19.1	0.0	0.2	0.2
	10 RCP CULVERT	0.0	0.0	0.0	0.0	0.0	0.0
	15 RIPRAP	0.6	8.9	2.9	0.0	0.1	0.1
	16 FILTER	0.0	0.4	0.0	0.0	0.0	0.0
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	0.0	0.2	0.0	0.0	0.0	0.0
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	0.0	0.5	0.2	0.0	0.0	0.0
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	0.0	0.1	0.0	0.0	0.0	0.0
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	0.0	0.5	0.2	0.0	0.0	0.0
	40 STORMWATER SYSTEM	0.0	0.1	0.0	0.0	0.0	0.0
	Raise Embankment by 10 VLF Subtotal	2.0	22.9	22.5	0.1	0.3	0.3
East Overlook Grading and Pavement	15 RIPRAP	0.0	0.1	0.0	0.0	0.0	0.0
	50 EAST OVERLOOK GRADING	0.0	0.0	0.0	0.0	0.0	0.0
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	0.0	0.1	0.0	0.0	0.0	0.0
	East Overlook Grading and Pavement Subtotal	0.0	0.2	0.1	0.0	0.0	0.0
Basalt Hill Site Develoment	200 BASALT HILL DOCKING AREA	0.0	0.0	0.0	0.0	0.0	0.0
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	0.0	0.9	0.1	0.0	0.0	0.0
	Basalt Hill Site Develoment Subtotal	0.0	0.9	0.1	0.0	0.0	0.0
	Maximum Annual Emissions	**2.1**	**24.0**	**22.6**	**0.1**	**0.3**	**0.3**
	General Conformity Threshold	10	n/a	10	100	100	100
	CEQA Significance Threshold	10	100	10	27	15	15
	Exceed De Minimis Threshold?	No	n/a	Yes	No	No	No
	Exceed CEQA Threshold?	No	No	Yes	No	No	No

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	19,500.00	19,500.00	5	ConstMin - Off-Highway Trucks	916
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	11,700.00	11,700.00	3	ConstMin - Rubber Tired Loaders	197
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	3,900.00	3,900.00	1	ConstMin - Cranes	330
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	400.00	400.00	1	ConstMin - Excavators	138
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	719.74	719.74	1	ConstMin - Cranes	195
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	9.78	9.78	1	ConstMin - Rough Terrain Forklifts	110
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	128.00	128.00	1	N/A - onroad	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	531.33	531.33	1	OFF - ConstMin - Plate Compactors	8
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	531.33	531.33	1	N/A - no emissions	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	212.53	212.53	1	ConstMin - Tractors/Loaders/Backhoes	93
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	9,360.00	9,360.00	3	Portable Equipment - Non-Rental Generator	201
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	320.00	320.00	1	N/A - onroad	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	15,600.00	15,600.00	4	Portable Equipment - Non-Rental Generator	101
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	63,040.71	63,040.71	25	n/a	n/a
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	117.64	117.64	1	ConstMin - Cranes	330
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	30.00	30.00	1	ConstMin - Rough Terrain Forklifts	110
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	12.00	12.00	1	ConstMin - Excavators	244
	10 RCP CULVERT Subtotal	159.64	159.64	3	n/a	n/a
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	256.00	256.00	1	N/A - no emissions	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	256.00	256.00	1	N/A - onroad	n/a
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	4,550.90	4,550.90	2	ConstMin - Rollers	80
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	9,101.80	9,101.80	3	ConstMin - Crawler Tractors	158
15 RIPRAP	On-Highway Water Truck 4000 Gallon	4,550.90	4,550.90	2	N/A - onroad	n/a
15 RIPRAP	Rear Dump Truck 12-18 cy	13,652.67	13,652.67	4	N/A - onroad	n/a
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	821.84	821.84	1	ConstMin - Graders	140
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	62,663.43	62,663.43	16	OFF - ConstMin - Plate Compactors	8
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	62,663.43	62,663.43	16	ConstMin - Cranes	195
15 RIPRAP	1.00 cy Standard Clamshell Bucket	62,663.43	62,663.43	16	N/A - no emissions	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	12,820.00	12,820.00	4	ConstMin - Cranes	330
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	392.00	392.00	1	ConstMin - Skid Steer Loaders	46
15 RIPRAP	Flatbed Truck 20,000 GVW	392.00	392.00	1	N/A - onroad	n/a
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	1,241.54	1,241.54	1	ConstMin - Cranes	270
15 RIPRAP	Portable welder Diesel 300 amps	1,241.54	1,241.54	1	OFF - Light Commercial - Welders	14
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	1,241.54	1,241.54	1	N/A - no emissions	n/a
	15 RIPRAP Subtotal	238,509.02	238,509.02	71	n/a	n/a
16 FILTER	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	128.00	128.00	1	N/A - onroad	n/a
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	328.00	328.00	1	ConstMin - Rollers	80
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	656.00	656.00	1	ConstMin - Crawler Tractors	158
16 FILTER	On-Highway Water Truck 4000 Gallon	328.00	328.00	1	N/A - onroad	n/a
16 FILTER	Rear Dump Truck 12-18 cy	984.00	984.00	1	N/A - onroad	n/a
16 FILTER	Articulated Frame Grader Cat 12H 140HP	410.92	410.92	1	ConstMin - Graders	140
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	1,285.39	1,285.39	1	ConstMin - Tractors/Loaders/Backhoes	101
	16 FILTER Subtotal	4,248.31	4,248.31	8	n/a	n/a

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	0.050	0.407	0.937	0.002	0.009	0.008
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	0.040	0.389	0.101	0.002	0.004	0.004
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.022	0.283	0.077	0.001	0.003	0.003
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.033	1.146	0.103	0.002	0.004	0.004
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.023	1.125	0.105	0.002	0.004	0.003
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.047	1.260	0.520	0.002	0.005	0.004
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	0.045	0.364	0.043	0.002	0.003	0.003
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.053	1.235	0.050	0.005	0.049	0.022
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	0.044	1.064	0.078	0.002	0.004	0.004
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.022	0.283	0.077	0.001	0.003	0.003
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.023	1.125	0.105	0.002	0.004	0.003
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.033	0.392	0.104	0.002	0.004	0.003
	10 RCP CULVERT Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Rear Dump Truck 12-18 cy	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	0.022	0.283	0.077	0.001	0.003	0.003
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.056	1.196	1.055	0.002	0.004	0.004
15 RIPRAP	Flatbed Truck 20,000 GVW	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
15 RIPRAP	Portable welder Diesel 300 amps	0.252	1.248	1.917	0.004	0.073	0.067
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004
16 FILTER	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
16 FILTER	Rear Dump Truck 12-18 cy	0.053	1.235	0.050	0.005	0.049	0.022
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
	16 FILTER Subtotal	n/a	n/a	n/a	n/a	n/a	n/a

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Daily Emissions (lb/day)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	10.0	82.1	189.3	0.4	1.9	1.7
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	1.0	10.1	2.6	0.0	0.1	0.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.3	4.1	1.1	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.2	7.0	0.6	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.2	2.5	0.7	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.1	5.5	0.5	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.2	5.2	2.1	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	1.2	9.7	1.1	0.0	0.1	0.1
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	0.8	19.0	1.4	0.0	0.1	0.1
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	14.2	145.7	200.2	0.5	2.3	2.1
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.3	4.1	1.1	0.0	0.0	0.0
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.1	5.5	0.5	0.0	0.0	0.0
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.4	4.2	1.1	0.0	0.0	0.0
	10 RCP CULVERT Subtotal	0.8	13.8	2.7	0.1	0.1	0.1
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.3	8.6	3.6	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.8	26.7	2.4	0.0	0.1	0.1
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.2	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	1.3	8.4	10.1	0.0	0.4	0.4
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	3.1	39.8	10.6	0.2	0.4	0.4
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	1.3	16.5	4.5	0.1	0.2	0.1
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.1	2.4	2.1	0.0	0.0	0.0
15 RIPRAP	Flatbed Truck 20,000 GVW	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.3	3.4	0.9	0.0	0.0	0.0
15 RIPRAP	Portable welder Diesel 300 amps	0.2	0.8	1.2	0.0	0.0	0.0
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	7.6	115.1	36.2	0.4	1.2	1.1
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.3	8.9	0.8	0.0	0.0	0.0
16 FILTER	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
	16 FILTER Subtotal	0.8	26.4	3.8	0.0	0.1	0.1

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Annual Emissions (tons per year) ROG	CO	NOx	SOx	PM10	PM2.5
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80CY Off-Road Mech Drive Rear Dump Cat 777	1.0	8.0	18.5	0.0	0.2	0.2
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	0.1	1.0	0.3	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	100MT All/Rough Terrain Hydro Crane	0.0	0.4	0.1	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.0	0.1	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	40MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 150kw	0.1	0.8	0.1	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Flatbed Truck 20,000 GVW	0.0	0.0	0.0	0.0	0.0	0.0
05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1	Large Generator Set 75kw	0.1	1.8	0.1	0.0	0.0	0.0
	05 STAGING/CONVEYOR BELT BRIDGE/STOCKPILE SITE DEVELOPMENT ALT. 1 Subtotal	1.3	12.2	19.1	0.0	0.2	0.2
10 RCP CULVERT	100MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
10 RCP CULVERT	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
10 RCP CULVERT	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
	10 RCP CULVERT Subtotal	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.5	0.2	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.1	2.0	0.2	0.0	0.0	0.0
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.0	0.2	0.0	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.8	1.0	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.3	3.9	1.0	0.0	0.0	0.0
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	100MT All/Rough Terrain Hydro Crane	0.1	1.3	0.4	0.0	0.0	0.0
15 RIPRAP	Skid Steer Loader 46HP 1750# Bobcat S175	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Flatbed Truck 20,000 GVW	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	80MT All/Rough Terrain Hydro Crane	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Portable welder Diesel 300 amps	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	0.6	8.9	2.9	0.0	0.1	0.1
16 FILTER	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
16 FILTER	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
16 FILTER	Articulated Frame Grader Cat 12H 140HP	0.0	0.1	0.0	0.0	0.0	0.0
16 FILTER	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.2	0.0	0.0	0.0	0.0
	16 FILTER Subtotal	0.0	0.4	0.0	0.0	0.0	0.0

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	304.93	304.93	1	ConstMin - Rollers	80
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	6.22	6.22	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	403.57	403.57	1	ConstMin - Tractors/Loaders/Backhoes	101
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	298.71	298.71	1	ConstMin - Crawler Tractors	158
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	298.71	298.71	1	N/A - onroad	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	40.48	40.48	1	ConstMin - Graders	140
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1,520.17	1,520.17	10	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	10.37	10.37	1	OFF - ConstMin - Concrete/Industrial Saws	98
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	10.37	10.37	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	122.67	122.67	1	ConstMin - Rubber Tired Loaders	160
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	122.67	122.67	1	ConstMin - Excavators	244
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	122.67	122.67	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	56.80	56.80	1	ConstMin - Excavators	186
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	340.74	340.74	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	757.20	757.20	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	821.20	821.20	1	N/A - onroad	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	3,407.41	3,407.41	1	OFF - ConstMin - Plate Compactors	8
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	3,407.41	3,407.41	1	ConstMin - Cranes	195
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	3,407.41	3,407.41	1	N/A - no emissions	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	1,362.96	1,362.96	1	ConstMin - Tractors/Loaders/Backhoes	93
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	68.19	68.19	1	ConstMin - Pavers	155
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	136.36	136.36	1	ConstMin - Rollers	138
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	3.11	3.11	1	ConstMin - Pavers	81
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	3.11	3.11	1	ConstMin - Rollers	33
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	3.11	3.11	1	ConstMin - Tractors/Loaders/Backhoes	101
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	14,227.76	14,227.76	19	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	304.93	304.93	1	ConstMin - Rollers	80
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	6.22	6.22	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	11.95	11.95	1	ConstMin - Tractors/Loaders/Backhoes	101
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	298.71	298.71	1	ConstMin - Crawler Tractors	158
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	298.71	298.71	1	N/A - onroad	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	40.48	40.48	1	ConstMin - Graders	140
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1,128.55	1,128.55	10	n/a	n/a

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Emission Factors (g/hp-hr or g/mi) ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.034	1.278	0.545	0.002	0.004	0.004
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.035	0.433	0.115	0.002	0.004	0.004
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.043	1.164	0.102	0.002	0.004	0.004
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.033	0.392	0.104	0.002	0.004	0.003
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.053	1.235	0.050	0.005	0.049	0.022
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.047	1.260	0.520	0.002	0.005	0.004
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.030	1.209	0.111	0.002	0.004	0.004
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.025	1.074	0.099	0.002	0.004	0.003
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.043	1.358	0.570	0.002	0.005	0.004
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.062	1.254	1.080	0.002	0.004	0.004
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.034	1.278	0.545	0.002	0.004	0.004
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.035	0.433	0.115	0.002	0.004	0.004
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Daily Emissions (lb/day)					
		ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.1	4.5	1.9	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.4	4.4	1.2	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.3	8.9	0.8	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1.29	35.25	6.88	0.07	0.15	0.14
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.3	8.2	0.7	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.4	4.2	1.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.3	3.2	0.9	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.2	2.5	0.7	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.2	5.2	2.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.2	8.3	0.8	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.2	6.5	0.6	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.2	4.9	2.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.1	1.8	1.6	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	2.17	50.41	11.53	0.11	0.26	0.24
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.1	4.5	1.9	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.4	4.4	1.2	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.3	8.9	0.8	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	1.29	35.25	6.88	0.07	0.15	0.14

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Annual Emissions (tons per year)					
Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.1	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	20 LAKESIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	0.00	0.16	0.03	0.00	0.00	0.00
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.0	0.2	0.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.2	0.1	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
	25 LAKESIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	0.03	0.51	0.19	0.00	0.01	0.00
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.1	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	30 BAYSIDE EMBANKMENT STA 299+00 TO STA 322+00 Subtotal	0.00	0.11	0.02	0.00	0.00	0.00

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

Phase	Equipment Description	Total Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	10.37	10.37	1	OFF - ConstMin - Concrete/Industrial Saws	98
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	10.37	10.37	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	122.67	122.67	1	ConstMin - Rubber Tired Loaders	160
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	122.67	122.67	1	ConstMin - Excavators	244
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	122.67	122.67	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	56.80	56.80	1	ConstMin - Excavators	186
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	340.74	340.74	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	757.20	757.20	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	821.20	821.20	1	N/A - onroad	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	3,407.41	3,407.41	1	OFF - ConstMin - Plate Compactors	8
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	3,407.41	3,407.41	1	ConstMin - Cranes	195
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	3,407.41	3,407.41	1	N/A - no emissions	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	1,362.96	1,362.96	1	ConstMin - Tractors/Loaders/Backhoes	93
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	68.19	68.19	1	ConstMin - Pavers	155
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	136.36	136.36	1	ConstMin - Rollers	138
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	7.11	7.11	1	ConstMin - Pavers	81
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	7.11	7.11	1	ConstMin - Rollers	33
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	7.11	7.11	1	ConstMin - Tractors/Loaders/Backhoes	101
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	14,239.76	14,239.76	19	n/a	n/a
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	425.36	425.36	1	ConstMin - Tractors/Loaders/Backhoes	101
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	-50.72	-50.72	-1	OFF - ConstMin - Plate Compactors	8
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	262.42	262.42	1	OFF - ConstMin - Rollers	18
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	72.28	72.28	1	N/A - onroad	n/a
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	272.00	272.00	1	OFF - Light Commercial - Pumps	2
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	272.00	272.00	1	N/A - no emissions	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	272.00	272.00	1	N/A - no emissions	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	19.88	19.88	1	ConstMin - Excavators	186
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	340.77	340.77	1	N/A - onroad	n/a
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.37	0.37	1	ConstMin - Rough Terrain Forklifts	110
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	190.40	190.40	1	ConstMin - Excavators	138
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	2.86	2.86	1	ConstMin - Cranes	270
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	2.86	2.86	1	OFF - Light Commercial - Welders	14
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	2.86	2.86	1	N/A - no emissions	n/a
	40 STORMWATER SYSTEM Subtotal	2,085.34	2,085.34	12	n/a	n/a
	Grand Total	**339,159.26**	**339,159.26**	**177**		
	Maximum	**238,509.02**	**238,509.02**	**71**		

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.043	1.164	0.102	0.002	0.004	0.004
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.033	0.392	0.104	0.002	0.004	0.003
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.053	1.235	0.050	0.005	0.049	0.022
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.047	1.260	0.520	0.002	0.005	0.004
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.030	1.209	0.111	0.002	0.004	0.004
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.025	1.074	0.099	0.002	0.004	0.003
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.043	1.358	0.570	0.002	0.005	0.004
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.062	1.254	1.080	0.002	0.004	0.004
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.311	1.647	2.370	0.005	0.091	0.083
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.053	1.235	0.050	0.005	0.049	0.022
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.411	2.200	3.127	0.006	0.120	0.110
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.053	1.235	0.050	0.005	0.049	0.022
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.023	1.125	0.105	0.002	0.004	0.003
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.033	1.146	0.103	0.002	0.004	0.004
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.252	1.248	1.917	0.004	0.073	0.067
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
	Grand Total						
	Maximum						

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Daily Emissions (lb/day)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.3	8.2	0.7	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.4	4.2	1.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.3	3.2	0.9	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.2	2.5	0.7	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.2	5.2	2.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.2	8.3	0.8	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.2	6.5	0.6	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.2	4.9	2.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.1	1.8	1.6	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	2.17	50.41	11.53	0.11	0.26	0.24
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	-0.1	-0.5	-0.6	0.0	0.0	0.0
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.2	1.3	1.9	0.0	0.1	0.1
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.0	0.2	0.3	0.0	0.0	0.0
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.3	3.2	0.9	0.0	0.0	0.0
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.1	5.5	0.5	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.2	7.0	0.6	0.0	0.0	0.0
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.3	3.4	0.9	0.0	0.0	0.0
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.2	0.8	1.2	0.0	0.0	0.0
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	1.37	25.89	6.07	0.07	0.23	0.21
	Grand Total	**31.67**	**498.14**	**285.78**	**1.46**	**4.72**	**4.32**
	Maximum	**14.17**	**145.75**	**200.15**	**0.55**	**2.28**	**2.09**

Table 63. Detailed Emissions Summary for Bid Item 01 - Raise Embankment by 10 VLF (Mitigated)

		Annual Emissions (tons per year)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	40MT All/Rough Terrain Hydro Crane	0.0	0.2	0.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.2	0.1	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
	35 BAYSIDE PAVEMENT STA 299+00 TO STA 322+00 Subtotal	0.03	0.52	0.19	0.00	0.01	0.00
40 STORMWATER SYSTEM	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.1	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Electric Submersible Pump 2HP/2"	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Discharge Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Suction Hose 2.0 in	n/a	n/a	n/a	n/a	n/a	n/a
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Telescopic Boom Lift Truck Grad 534 -10Kips	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Hydraulic Excavator Cat. 320 138HP 1.25cy	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	80MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Portable welder Diesel 300 amps	0.0	0.0	0.0	0.0	0.0	0.0
40 STORMWATER SYSTEM	Torch Cutting Acetylene-Oxygen 150'	n/a	n/a	n/a	n/a	n/a	n/a
	40 STORMWATER SYSTEM Subtotal	0.00	0.10	0.02	0.00	0.00	0.00
	Grand Total	**2.02**	**22.90**	**22.47**	**0.09**	**0.33**	**0.30**
	Maximum	**1.29**	**12.15**	**19.09**	**0.05**	**0.21**	**0.19**

Table 64. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Mitigated)

Phase	Equipment Description	Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	8.20	8.20	1	ConstMin - Rollers	80
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	16.40	16.40	1	ConstMin - Crawler Tractors	158
15 RIPRAP	On-Highway Water Truck 4000 Gallon	8.20	8.20	1	N/A - onroad	n/a
15 RIPRAP	Rear Dump Truck 12-18 cy	24.61	24.61	1	N/A - onroad	n/a
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	6.06	6.06	1	ConstMin - Graders	140
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	924.36	924.36	1	OFF - ConstMin - Plate Compactors	8
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	924.36	924.36	1	ConstMin - Cranes	195
15 RIPRAP	1.00 cy Standard Clamshell Bucket	924.36	924.36	1	N/A - no emissions	n/a
	15 RIPRAP Subtotal	2,964.55	2,964.55	10	n/a	n/a
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	48.00	48.00	1	N/A - no emissions	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	48.00	48.00	1	N/A - onroad	n/a
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	8.59	8.59	1	ConstMin - Rollers	80
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	8.59	8.59	1	ConstMin - Excavators	186
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	8.59	8.59	1	N/A - onroad	n/a
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	5.62	5.62	1	ConstMin - Graders	140
	50 EAST OVERLOOK GRADING Subtotal	127.39	127.39	6	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	33.33	1	ConstMin - Rough Terrain Forklifts	80
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	7.89	7.89	1	ConstMin - Rollers	80
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	6.22	6.22	1	ConstMin - Crawler Tractors	230
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	10.54	10.54	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	20.36	20.36	1	ConstMin - Tractors/Loaders/Backhoes	101
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	4.32	4.32	1	OFF - ConstMin - Concrete/Industrial Saws	98
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	31.11	31.11	1	ConstMin - Rubber Tired Loaders	160
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	31.11	31.11	1	ConstMin - Excavators	244
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	31.11	31.11	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	16.07	16.07	1	ConstMin - Excavators	186
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	86.42	86.42	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	192.04	192.04	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	320.04	320.04	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	128.00	128.00	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	1.67	1.67	1	N/A - onroad	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	4.48	4.48	1	ConstMin - Graders	140
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	512.33	512.33	1	OFF - ConstMin - Plate Compactors	8
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	512.33	512.33	1	ConstMin - Cranes	195
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	512.33	512.33	1	N/A - no emissions	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	204.93	204.93	1	ConstMin - Tractors/Loaders/Backhoes	93
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	21.78	21.78	1	ConstMin - Pavers	155
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	21.78	21.78	1	ConstMin - Rollers	33
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	21.78	21.78	1	ConstMin - Rollers	138
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	2,731.97	2,731.97	23	n/a	n/a
	Grand Total	5,823.91	5,823.91	39	n/a	n/a
	Maximum	2,964.55	2,964.55	23	n/a	n/a

Table 64. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Mitigated)

		Emission Factors (g/hp-hr or g/mi)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Rear Dump Truck 12-18 cy	0.053	1.235	0.050	0.005	0.049	0.022
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
	50 EAST OVERLOOK GRADING Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.034	1.278	0.545	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	0.035	0.433	0.115	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.033	1.113	0.100	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.043	1.164	0.102	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.033	0.392	0.104	0.002	0.004	0.003
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.053	1.235	0.050	0.005	0.049	0.022
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.235	1.492	1.781	0.004	0.070	0.064
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.023	0.289	0.077	0.001	0.003	0.003
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.047	1.260	0.520	0.002	0.005	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.030	1.209	0.111	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.062	1.254	1.080	0.002	0.004	0.004
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.025	1.074	0.099	0.002	0.004	0.003
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	n/a	n/a	n/a	n/a	n/a	n/a
	Grand Total	n/a	n/a	n/a	n/a	n/a	n/a
	Maximum	n/a	n/a	n/a	n/a	n/a	n/a

Table 64. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Mitigated)

Phase	Equipment Description	ROG	CO	NOx	SOx	PM10	PM2.5
		Daily Emissions (lb/day)					
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.3	8.9	0.8	0.0	0.0	0.0
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.2	2.5	0.7	0.0	0.0	0.0
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	0.9	24.4	4.6	0.0	0.1	0.1
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.3	3.2	0.9	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
	50 EAST OVERLOOK GRADING Subtotal	0.69	15.65	3.39	0.03	0.08	0.07
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.1	4.5	1.9	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.1	4.3	1.8	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	0.4	4.4	1.2	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.1	5.0	0.4	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.3	8.2	0.7	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.4	4.2	1.1	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.3	3.2	0.9	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.0	0.1	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.3	8.0	0.7	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.1	0.5	0.6	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.2	2.5	0.7	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.2	5.2	2.1	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.2	8.3	0.8	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.1	1.8	1.6	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.2	6.5	0.6	0.0	0.0	0.0
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	2.90	66.84	15.12	0.15	0.35	0.32
	Grand Total	4.53	106.89	23.14	0.23	0.55	0.50
	Maximum	2.90	66.84	15.12	0.15	0.35	0.32

Table 64. Detailed Emissions Summary for Bid Item 03 - East Overlook Grading and Pavement (Mitigated)

		Annual Emissions (tons per year)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	PM2.5
15 RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
15 RIPRAP	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Rear Dump Truck 12-18 cy	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
15 RIPRAP	40MT All/Rough Terrain Hydro Crane	0.0	0.1	0.0	0.0	0.0	0.0
15 RIPRAP	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
	15 RIPRAP Subtotal	0.0	0.1	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
50 EAST OVERLOOK GRADING	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
50 EAST OVERLOOK GRADING	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	50 EAST OVERLOOK GRADING Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Telescopic Boom Lift Truck Grad 534 -6Kips	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Standard Crawler Dozer Cat. D7R 230HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 2500 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Concrete Saw 20" Gasoline	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 330 244HP 2.25cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Impact Breaker 1K 1Kbpm	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Rear Dump Truck 07-08 cy	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Rear Dump Full Trailers, 20cy	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Hand Held Vibratory Plate 25" 8.0HP	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	40MT All/Rough Terrain Hydro Crane	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	1.00 cy Standard Clamshell Bucket	n/a	n/a	n/a	n/a	n/a	n/a
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Loader Backhoe C420-93HP 1.25cy- 15' depth	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	0.0	0.0	0.0	0.0	0.0	0.0
55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	0.0	0.0	0.0	0.0	0.0	0.0
	55 EAST OVERLOOK PARKING PAVEMENT DEMO AND REBUILD Subtotal	0.01	0.09	0.03	0.00	0.00	0.00
	Grand Total	0.01	0.17	0.06	0.00	0.00	0.00
	Maximum	0.01	0.09	0.03	0.00	0.00	0.00

Table 65. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Mitigated)

Phase	Equipment Description	Project Hours	Maximum Annual Hours	Minimum Required Equipment	OFFROAD 2017 Description	Power Rating, hp
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	35.56	35.56	1	ConstMin - Rollers	80
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	35.56	35.56	1	ConstMin - Crawler Tractors	158
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	35.56	35.56	1	N/A - onroad	n/a
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	9.60	9.60	1	ConstMin - Graders	140
	200 BASALT HILL DOCKING AREA Subtotal	244.28	244.28	6	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	64.00	64.00	1	N/A - no emissions	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	64.00	64.00	1	N/A - onroad	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	364.73	364.73	1	ConstMin - Rollers	80
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	364.73	364.73	1	ConstMin - Excavators	186
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	2,639.68	2,639.68	1	N/A - onroad	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	2,342.53	2,342.53	1	ConstMin - Graders	140
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	2,274.95	2,274.95	1	ConstMin - Rollers	142
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	8,114.62	8,114.62	7	n/a	n/a
	Grand Total	**8,358.90**	**8,358.90**	**13**	**n/a**	**n/a**
	Maximum	**8,114.62**	**8,114.62**	**7**	**n/a**	**n/a**

Table 65. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Mitigated)

		Emission Factors (g/hp-hr or g/mi)						Daily Emissions (lb/day)					
Phase	**Equipment Description**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**ROG**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022	0.0	0.1	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004	0.1	4.3	1.8	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.036	1.278	0.116	0.002	0.004	0.004	0.3	8.9	0.8	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022	0.0	0.1	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004	0.3	8.0	0.7	0.0	0.0	0.0
	200 BASALT HILL DOCKING AREA Subtotal	n/a	n/a	n/a	n/a	n/a	n/a	0.66	21.34	3.34	0.03	0.08	0.07
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.053	1.235	0.050	0.005	0.049	0.022	0.0	0.1	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.037	1.219	0.514	0.002	0.004	0.004	0.1	4.3	1.8	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.033	0.392	0.104	0.002	0.004	0.003	0.3	3.2	0.9	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	0.053	1.235	0.050	0.005	0.049	0.022	0.0	0.1	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	0.045	1.301	0.116	0.002	0.005	0.004	0.3	8.0	0.7	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	0.025	1.074	0.099	0.002	0.004	0.003	0.2	6.7	0.6	0.0	0.0	0.0
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	n/a	n/a	n/a	n/a	n/a	n/a	0.84	22.37	4.01	0.05	0.10	0.09
	Grand Total	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**1.51**	**43.72**	**7.35**	**0.08**	**0.18**	**0.16**
	Maximum	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**0.84**	**22.37**	**4.01**	**0.05**	**0.10**	**0.09**

Table 65. Detailed Emissions Summary for Bid Item 04 - Basalt Hill Site Development (Mitigated)

Phase	Equipment Description	Annual Emissions (tons per year)					
		ROG	CO	NOx	SOx	PM10	PM2.5
200 BASALT HILL DOCKING AREA	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
200 BASALT HILL DOCKING AREA	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
200 BASALT HILL DOCKING AREA	Articulated Frame Grader Cat 12H 140HP	0.0	0.0	0.0	0.0	0.0	0.0
	200 BASALT HILL DOCKING AREA Subtotal	0.00	0.01	0.00	0.00	0.00	0.00
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	80 Ton 16 Wheel Equipment Trailer	n/a	n/a	n/a	n/a	n/a	n/a
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Hydraulic Excavator Cat. 325 186HP 1.50cy	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	On-Highway Water Truck 4000 Gallon	0.0	0.0	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Articulated Frame Grader Cat 12H 140HP	0.0	0.5	0.0	0.0	0.0	0.0
215 BASALT HILL AGGREGATE ROAD DEVELOPMENT	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	0.0	0.4	0.0	0.0	0.0	0.0
	215 BASALT HILL AGGREGATE ROAD DEVELOPMENT Subtotal	0.03	0.92	0.10	0.00	0.00	0.00
	Grand Total	**0.03**	**0.94**	**0.10**	**0.00**	**0.00**	**0.00**
	Maximum	**0.03**	**0.92**	**0.10**	**0.00**	**0.00**	**0.00**

SR 152 Modifications
Haul Truck and Construction Worker Commuting Emissions

Table 66. Trip Rate Information

Vehicle Type	Round Trips		One-Way Distance	VMT	
	Max Day Trips	Total Trips	(miles)	Daily	Total
Haul Trucks	112	29,200	40	4,492	1,168,000
Workers	260	67,600	40	10,400	2,704,000
Grand Total	**372**	**96,800**	**n/a**	**14,892**	**3,872,000**

Table 67. Maximum Daily Mitigated Emissions

	Truck Emission Factors (g/mi)	0.028	2.865	0.396	0.014	0.202	0.070
	Worker Emission Factors (g/mi)	0.006	0.032	0.526	0.002	0.138	0.041
	Maximum Daily VMT	**Peak Daily Emissions (lbs/day)**					
Vehicle Type	**(miles/day)**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Haul Trucks	4,492	0.28	28.37	3.92	0.14	2.00	0.69
Workers	10,400	0.15	0.72	12.07	0.06	3.16	0.94
Grand Total	**10,400**	**0.15**	**0.72**	**12.07**	**0.06**	**3.16**	**0.94**

Note:
PM_{10} and $PM_{2.5}$ emission factors include exhaust, tire wear, brake wear, and resuspension of loose material on the road surface (paved road dust).
Emission factors for 2027 used because the start year has the highest emission factors and represents the worst-case impact.

Table 68. Annual Mitigated Emissions

	Truck Emission Factors (g/mi)	0.028	2.865	0.396	0.014	0.200	0.070
	Worker Emission Factors (g/mi)	0.006	0.032	0.526	0.002	0.135	0.041
	Annual VMT	**Annual Emissions (tons/year)**					
Vehicle Type	**(miles/year)**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Haul Trucks	1,168,000	0.04	3.69	0.51	0.02	0.26	0.09
Workers	2,704,000	0.02	0.09	1.57	0.01	0.40	0.12
Grand Total	**2,704,000**	**0.02**	**0.09**	**1.57**	**0.01**	**0.40**	**0.12**

Note:
PM_{10} and $PM_{2.5}$ emission factors include exhaust, tire wear, brake wear, and resuspension of loose material on the road surface (paved road dust). Annual emissions include natural control eff
Mileage assumed to be distributed evenly over each year of construction. Therefore, annual VMT value represents the mileage that would occur in each year of construction.

Start Year: 2027

Conversions

1 pound = 453.6 grams
1 ton = 2000 pounds

Number of Construction Workers

130 workers per day

Truck Trips

29,200 trips per year
112 trips per day

Construction Schedule

5 days per week
260 days per year

SR 152 Modifications
Marine Emissions

Table 69. Mitigated Propulsion Engine Emission Factor Equation Variables

Vessel Type	Average HP	Average Age	Model Year	Useful Life	Load Factor	Fuel Correction Factor			Deterioration Factor				Zero-Hour Emission Factor (g/bhp-hr)			
						NOx	PM	ROG	NOx	PM	ROG	CO	NOx	PM	ROG	CO
Tug Boats	1,274	12	2015	21	0.50	0.948	0.852	0.720	0.21	0.67	0.44	0.25	4.09	0.08	0.68	3.73

Note:
Barges and dredgers are not typically self-propelled and emissions from barge/dredger propulsion engines are not estimated.
Model year equal to construction start date (year) minus average age of vessel.
A fuel correction factor of 0.72 for hydrocarbon emissions applied to all diesel-powered engines beginning with the 1994 calendar year.

Table 70. Mitigated Propulsion Engine Emission Factors

Vessel Type	Aged Emission Factor - 2027 (g/bhp-hr)				
	NOx	PM10	ROG	CO	SO2
Tug Boats	0.33	0.05	0.31	2.13	0.0055

Note:
Starting in 2007, California required the use of ultra low sulfur diesel fuel (ULSD - 15 ppmw sulfur).
SO2 (g/hp-hr) = (S content in X/1,000,000) x (2 SO2/g S) x BSFC (184 g/hp-hr)

Construction Start Date 2027

Table 71. Maximum Daily Mitigated Marine Vessel Emissions

Vessel Type	Quantity	Trips per Day	Hours per Trip	No. Propulsion Engines	Propulsion Engine Emissions (lbs/day)					
					ROG	NOx	CO	SO2	PM10	PM2.5
Tug Boats	16	2	2	2	110.13	117.09	766.26	1.98	16.94	15.59

Note:
Hours per trip estimated to assume that marine vessels would be operating 8 hours per day.
PM2.5 emissions estimated using PM10 emissions and the California Emission Inventory and Reporting System (CEIDARS) particulate matter (PM) speciation profile no. 425 for diesel vehicle exhaust.
"Trips" represent one-day trips and are double the data provided by the engineers.

Table 72. Annual Mitigated Marine Vessel Emissions by Year

Year	Annual Emissions (tons per year)					
	ROG	NOx	CO	SO2	PM10	PM2.5
Propulsion Engines	7.16	7.61	49.81	0.13	1.10	1.01

Note:
Hours per trip estimated to assume that marine vessels would be operating 8 hours per day.
PM2.5 emissions estimated using PM10 emissions and the California Emission Inventory and Reporting System (CEIDARS) particulate matter (PM) speciation profile no. 425 for diesel vehicle exhaust.
"Trips" represent one-day trips and are double the data provided by the engineers.

ROG, CO, NOx, or PM Emission Estimation Method

$$E = EF_0 \times F \times \left(1 + D \times \frac{A}{UL}\right) \times HP \times LF \times Hr$$

Where:	E	=	amount of emissions of a pollutant (PM and NOx) emitted during one period
	EF_0	=	the model year, horsepower, and engine use (propulsion or auxiliary) specific zero hour emission factor (when engine is new)
	F	=	fuel correction factor that accounts for emission reduction benefits from burning cleaner fuel
	D	=	horsepower and pollutant specific engine deterioration factor, which is the percentage increase of emission factors at the end of the useful life of the engine
	A	=	age of the engine when the emissions are estimated
	UL	=	vessel type and engine use specific engine useful life
	HP	=	rated horsepower of the engine
	LF	=	vessel type and engine use specific engine load factor
	Hr	=	number of annual operating hours of the engine

Source: California Air Resources Board. 2010. Staff Report: Initial Statement of Reasons for the Proposed Rulemaking. Amendments to the Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline.
http://www.arb.ca.gov/ports/marinevess/harborcraft/hcdocuments.htm

SOx Emission Estimation Method

$$F_c = HP \times LF \times Hr \times BSFC$$

Where:	Fc	=	fuel consumed per engine per year
	HP	=	rated horsepower of the engine
	Hr	=	number of annual operating hours of the engine
	LF	=	vessel type specific engine load factor
	BSFC	=	brake specific fuel consumption rate; 0.078 gal/kW-hr or 184 g/hp-hr

The sulfur content is assumed to be 15ppm per 13 CCR 2281(a).

Conversion Factors

453.6	grams per pound
2000	pounds per ton

Operating Schedule

10	hours per shift
5	days per week
260	days per year

PMSIZE Profile

0.92 PM2.5:PM10

Profile No. 425, Diesel Vehicle Exhaust

Mitigation Measures

Ships, Propulsion Engines

-Selective Catalytic Reduction with low sulfur fuel	85%	NOx reduction

Ships, Auxiliary Engines

-Selective Catalytic Reduction with low sulfur fuel	85%	NOx reduction
Tug Boats	61%	VOC reduction
Crew and Supply	52%	VOC reduction

Emission Factors
Paved Road Dust Emissions

Equation 1:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

where:
E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m2), and
W = average weight (tons) of the vehicles traveling the road.

Equation 2:

$$E_{ext} = [k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N)$$

where: k, sL, and W are as defined in Equation 1 and
E_{ext} = annual or other long-term average emission factor in the same units as k,
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Table 73. Particle Size Multipliers for Paved Road Equation

		Particle Size Multiplier, k [b]		
Size Range [a]	**Ref.**	**g/VKT**	**g/VMT**	**lb/VMT**
$PM_{2.5}$	[c]	0.15	0.25	0.00054
PM_{10}		0.62	1.00	0.0022
PM_{15}		0.77	1.23	0.0027
PM_{30}	[d]	3.23	5.24	0.011

Source: USEPA. 2011. Compilation of Air Pollutant Emission Factors (AP-42). Fifth Edition, Volume I. Chapter 13.2.1 Paved Roads. January. Available online at: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf [Accessed October 18, 2018].
Notes:
[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.
[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.
[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Default Assumptions

Number precipitation days >0.1 inches
San Joaquin Valley Air Basin 45

Road silt loading 0.03 g/m^2 (AP-42, ADT > 10,000, ubiquitous baseline)
Average vehicle weight 2.2 tons

Source: CAPCOA. 2017. California Emissions Estimator Model User's Guide, Version 2016.3.2, Appendix D: Default Data Tables. Prepared by BREEZE Software, A Division of Trinity Consultants in collaboration with South Coast Air Quality Management District and the California Air Districts. November. Available online at: http://www.caleemod.com/ [Accessed on October 18, 2018].

Table 74. Paved Road Dust Emission Factors

	Emission Factor (g/VMT)			
	Uncontrolled		Controlled	
Air Basin	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
San Joaquin Valley	0.092	0.023	0.089	0.022
San Francisco Bay Area	0.092	0.023	0.088	0.022

Note:
Controlled emission factor only valid for long-term (annual) emissions; uncontrolled emission factor used for daily emissions.

SR 152 Modifications
Data Tables

Table 75. California Commercial Harbor Craft Engine Profile by Vessel Type

Vessel Type	Propulsion Engine			Auxiliary Engine		
	# of Engines per Vessel	Average Annual Operating Hrs	Useful Life	# of Engines per Vessel	Average Annual Operating Hrs	Useful Life
Commercial Fishing	1.12	1,250	21	0.46	1,633	15
Charter Fishing	1.77	1,622	16	0.75	2,077	15
Ferry/excursion Vessels	2.01	1,843	20	1.23	1,254	20
Crew and Supply	2.5	788	22	1.1	3,036	22
Pilot Vessels	1.7	1,031	19	0.14	994	25
Tug Boats	1.92	2,274	21	1.59	2,486	23
Tow Boats	2.1	1,993	26	1.17	2,965	25
Work Boats	1.46	675	17	0.32	750	23
Others	1.11	779	23	0.46	805	22

Source: California Air Resources Board (CARB). Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 76. Engine Load Factor by Vessel Type and by Engine Use

Vessel Type	Propulsion Engine Load	Auxiliary Engine Load
Commercial Fishing	0.27	0.43
Charter Fishing	0.52	0.43
Ferry/excursion Vessels	0.42	0.43
Crew and Supply	0.45	0.43
Pilot Vessels	0.51	0.43
Tug Boats	0.5	0.31
Tow Boats	0.68	0.43
Work Boats	0.45	0.43
Others	0.52	0.43

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 77. Fuel Correction Factor

Calendar Years	Horsepower Range	Model Years	NOx	PM
1994-2006	<25	Pre-1995	0.930	0.750
	25-50	Pre-1999		
	51-100	Pre-1998		
	101-175	Pre-1997		
	176+	Pre-1996		
	<25	1995+	0.948	0.822
	25-50	1999-2010		
	51-100	1998-2010		
	101-175	1997-2010		
	176+	1996-2010		
2007+	<25	Pre-1995	0.930	0.720
	25-50	Pre-1999		
	51-100	Pre-1998		
	101-175	Pre-1997		
	176+	Pre-1996		
	<25	1995+	0.948	0.800
	25-50	1999-2010		
	51-100	1998-2010		
	101-175	1997-2010		
	176+	1996-2010		
	All	2011+	0.948	0.852

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 78. Engine Deterioration Factor

Horsepower Range	NOx	PM	HC	CO
25-50	0.06	0.31	0.51	0.41
51-250	0.14	0.44	0.28	0.16
>251	0.21	0.67	0.44	0.25

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 79. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

HP Range	Model Year	Main Engines				Auxiliary Engines			
		NOx	PM	ROG	CO	NOx	PM	ROG	CO
25-50 hp	pre-1998	8.14	0.72	1.84	3.65	6.90	0.64	2.19	5.15
	1998-1999	8.14	0.72	1.80	3.65	6.90	0.64	2.14	5.15
	2000-2004	7.31	0.72	1.80	3.65	6.90	0.64	2.14	5.15
	2005-2008	5.32	0.30	1.80	3.73	5.32	0.30	2.14	3.73
	2009-2020	5.32	0.22	1.80	3.73	5.32	0.22	2.14	3.73
51-120 hp	pre-1997	15.34	0.80	1.44	3.50	13.00	0.71	1.71	4.94
	1997-1999	10.33	0.66	0.99	2.55	8.75	0.58	1.18	3.59
	2000-2004	7.31	0.66	0.99	2.55	7.31	0.58	1.18	3.59
	2005-2008	5.32	0.30	0.99	3.73	5.32	0.30	1.18	3.73
	2009-2020	5.32	0.22	0.99	3.73	5.32	0.22	1.18	3.73
121-175 hp	pre-1971	16.52	0.73	1.32	3.21	14.00	0.65	1.57	4.53
	1971-1978	15.34	0.63	1.10	3.21	13.00	0.55	1.31	4.53
	1979-1983	14.16	0.52	1.00	3.21	12.00	0.46	1.19	4.53
	1984-1986	12.98	0.52	0.94	3.14	11.00	0.46	1.12	4.43
	1987-1995	12.98	0.52	0.88	3.07	11.00	0.46	1.05	4.33
	1996-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2012	5.10	0.22	0.68	3.73	5.10	0.22	0.81	3.73
	2013-2020	3.80	0.09	0.68	3.73	3.80	0.09	0.81	3.73
176-250 hp	pre-1971	16.52	0.73	1.32	3.21	14.00	0.65	1.57	4.53
	1971-1978	15.34	0.63	1.10	3.21	13.00	0.55	1.31	4.53
	1979-1983	14.16	0.52	1.00	3.21	12.00	0.46	1.19	4.53
	1984-1986	12.98	0.52	0.94	3.14	11.00	0.46	1.12	4.43
	1987-1994	12.98	0.52	0.88	3.07	11.00	0.46	1.05	4.33
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2013	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2014-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73
251-500 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1994	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2003	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2004-2013	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2014-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73

Table 79. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

HP Range	Model Year	Main Engines				Auxiliary Engines			
		NOx	PM	ROG	CO	NOx	PM	ROG	CO
501-750 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1994	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1995-1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2012	5.10	0.15	0.68	3.73	5.10	0.15	0.81	3.73
	2013-2020	3.99	0.08	0.68	3.73	3.99	0.08	0.81	3.73
751-1900 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2011	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2012-2016	4.09	0.08	0.68	3.73	4.09	0.08	0.81	3.73
	2017-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.73
1901-3300 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2012	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2013-2015	4.37	0.10	0.68	3.73	4.37	0.10	0.81	3.73
	2016-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.73

Table 79. Commercial Harbor Craft Emission Factor Table (Zero-Hour)

		Main Engines				Auxiliary Engines			
HP Range	Model Year	NOx	PM	ROG	CO	NOx	PM	ROG	CO
3301-5000 hp	pre-1971	16.52	0.70	1.26	3.07	14.00	0.62	1.50	4.33
	1971-1978	15.34	0.60	1.05	3.07	13.00	0.53	1.25	4.33
	1979-1983	14.16	0.50	0.95	3.07	12.00	0.45	1.13	4.33
	1984-1986	12.98	0.50	0.90	3.07	11.00	0.45	1.07	4.33
	1987-1998	12.98	0.50	0.84	2.99	11.00	0.45	1.00	4.22
	1999	9.64	0.36	0.68	1.97	8.17	0.32	0.81	2.78
	2000-2006	7.31	0.36	0.68	1.97	7.31	0.32	0.81	2.78
	2007-2013	5.53	0.20	0.68	3.73	5.53	0.20	0.81	3.73
	2014-2015	4.94	0.25	0.68	3.73	4.94	0.25	0.81	3.75
	2016-2020	1.30	0.03	0.18	3.73	1.30	0.03	0.18	3.75

Source: CARB. Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, Appendix B [2007 Rulemaking], Available online at: http://www.arb.ca.gov/regact/2007/chc07/appb.pdf [Accessed on: June 13, 2016].

Table 80. Quantity of Auxiliary Engines and Average Horsepower

Vessel Category	# Auxiliary Engines	Horsepower	
		Range	Average
Commercial Fishing	212	6 - 300	71
Tug Boats	120	7 - 300	111
Ferry/excursion Vessels	98	10 - 400	94
Charter Fishing	82	4 - 185	50
Others	34	10 - 240	56
Work Boats	26	9 - 221	101
Crew and Supply	22	16 - 110	79
Tow Boats	21	18 - 175	79
Pilot Vessels	1	N/A	30

min	max
30	111

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Table 81. Quantity of Propulsion Engines and Average Horsepower

Vessel Category	# Propulsion Engines	Horsepower	
		Range	Average
Commercial Fishing	516	8 – 1,485	230
Charter Fishing	192	80 – 1,400	381
Ferry/excursion Vessels	164	35 – 3,110	733
Tug Boats	144	24 – 3,600	1,274
Work Boats	99	15 – 1,300	239
Others	89	28 - 764	281
Crew and Supply	50	225 - 750	439
Tow Boats	38	24 – 1,500	500
Pilot Vessels	15	230 - 550	408

min	max
230	1274

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Table 82. Vessel Age

Vessel Category	Age
Charter Fishing	27
Ferry/excursion Vessels	27
Tug Boats	32
Commercial Fishing	32
Pilot Vessels	24
Work Boats	27
Crew and Supply	27
Tow Boats	39

Source: CARB. 2004. Statewide Commercial Harbor Craft Survey, Final Report. March. Available online at: http://www.arb.ca.gov/ports/marinevess/documents/hcsurveyrep0304.pdf [Accessed on: June 13, 2016].

Note:

Vessel categories changed from cited document to be consistent with names used in 2007 and 2010 rulemaking documents to assist with VLOOKUP formulas.

Greenhouse Gas Calculations

B.F. Sisk Dam Raise Alternative

Table 1. Purchased Electricity Emissions

Source	Electricity (kWh/year)	Annual Emissions (MT/year)			Annual Emissions (MTCO2e/year)			
		CO2	CH4	N2O	CO2	CH4	N2O	CO2e
Emission Factors (lbs/MWh)	n/a	206.29	0.034	0.004	n/a	n/a	n/a	n/a
Additional Pumping at Gianelli	46,474,926	4,349	0.72	0.084	4,349	18	25	4,392
Additional Pumping at Pacheco	6,128,562	573	0.09	0.011	573	2	3	579
Total	**52,603,488**	**4,922**	**0.81**	**0.095**	**4,922**	**20**	**28**	**4,971**

CO2 Emission Factor Source: The Climate Registry. 2020. Utility-Specific Emission Rates, 2018 Emission Rates, Pacific Gas & Electric. Available online at https://www.theclimateregistry.org/our-members/cris-public-reports/ [Accessed on May 5, 2020].

CH4 and N2O Emission Factor Source: The Climate Registry. 2020. 2020 Default Emission Factors, Table 3.1, U.S. Default Factors for Calculating Emissions from Grid Electricity by eGRID Subregion; CAMX. Available online at https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf [Accesssed on May 5, 2020].

Conversions

60	minutes per hour	
24	hours per day	
24,160	scf per ton	(http://www.uigi.com/o2_conv.html)
1,000,000	grams per metric ton	
1,000	kW per MW	
453.6	grams per pound	

GWP

CO2	1
CH4	25
N2O	298

Source: The Climate Registery. 2018. Default Emission Factors. Table B.1, AR4.

Gianelli

14	months of additional pumping over 82 year model record
0.17	annual average months per year
124	hours per year

Gianelli Pumping Plant Capacity

Number of Pumps	8	
Rating per Pump	63,000	hp
Total Power Rating	504,000	hp
	375,833	kW

Pacheco

39	months of additional pumping over 82 year model record
0.48	annual average months per year
342	hours per year

Pacheco Pumping Plant Capacity

Number of Pumps	12	
Rating per Pump	2,000	hp
Total Power Rating	24,000	hp
	17,897	kW

B.F. Sisk Dam Raise Alternative

Table 2. Habitat Impacts Associated with Alternative 3

Habitat Type	San Luis Reservoir Expansion Impact (Acres)		
	Construction Footprint	Inundation Footprint	Total Impact
Terrestrial Habitats			
Annual Grasslands	29.70	307.17	336.87
Purple Needlegrass	0.0	3.95	3.95
Blue Oak Woodland	0.87	54.28	55.15
California Sycamore Woodland	0.0	0.36	0.36
California Sagebrush Scrub	0.0	4.21	4.21
Urban	18.30	7.93	26.23
Terrestrial Subtotal	**48.87**	**377.90**	**426.77**
Aquatic Habitats			
Pond	0	0	0
Intermittent Channel	0	3.18	3.18
Ephemeral Channel	0	0.77	0.77
Fresh Water Emergent	0	0.99	0.99
Seep	0	0.04	0.04
Lacustrine	0	12.79	12.79
Aquatic Subtotal	**0.0**	**17.77**	**17.77**
Totals	**48.87**	**395.67**	**444.54**

Table 3. Vegetation Land Use Changes with Alternative 3

Vegetation Type	Total Impact (Acres)	Default CO_2 Accumulation per Acre ($MTCO_2$/acre)	Total CO_2 Accumulation ($MTCO_2$)
Cropland	0.00	6.2	0.0
Forest Land-Scrub	4.21	14.3	60.2
Forest Land-Trees	55.51	111	6,161.6
Grassland	340.82	4.31	1,468.9
Wetlands	17.77	0	0.0
Total	**418.31**	**n/a**	**7,690.7**

Land Use Change

Overall Change in Sequestered CO2 (MTCO2) =

$$\sum_i (SeqCO_2)_i \times (area)_i - \sum_j (SeqCO_2)_j \times (area)_j$$

Where:

$SeqCO_2$	=	mass of sequestered CO_2 per unit area ($MTCO_2$/acre)
area	=	area of land for specific land use type (acre)
i	=	index for final land use type
j	=	index for initial land use type

Table 4. Mass of Sequestered Carbon Dioxide by Unit Area

Land Use	Sub-Category	Default CO_2 accumulation per acre ($MTCO_2$/acre)
Forest Land	Scrub	14.3
	Trees	111
Cropland	--	6.2
Grassland	--	4.31
Wetlands	--	0

Source:

California Air Pollution Control Officers Association (CAPCOA). 2017. California Emissions Estimator Model User's Guide, Version 2016.3.2. Appendix A: Calculation Details for CalEEMod. Available online at http://www.caleemod.com/ [Accessed May 5, 2020].

Greenhouse Gas Construction Emissions Summary

Table 5. Sisk Dam Raise Alternative - Annual Emissions

	Annual Emissions (tons per year)			
Source	**CO2**	**CH4**	**N2O**	**CO2e**
	2025			
Off-Road Construction Equipment	16,894	1	1	17,166
On-Road Haul Trucks and Delivery Vehicles	11,789	0	2	12,342
Construction Worker Commuting	1,636	0	0	1,645
2025 Total Emissions	**30,319**	**1**	**3**	**31,153**
	2026			
Off-Road Construction Equipment	16,889	1	1	17,160
On-Road Haul Trucks and Delivery Vehicles	11,638	0	2	12,184
Construction Worker Commuting	1,585	0	0	1,594
2026 Total Emissions	**30,113**	**1**	**3**	**30,938**
	2027			
Off-Road Construction Equipment	16,878	1	1	17,147
On-Road Haul Trucks and Delivery Vehicles	11,468	0	2	12,005
Construction Worker Commuting	1,538	0	0	1,546
2027 Total Emissions	**29,883**	**1**	**3**	**30,698**
	2028			
Off-Road Construction Equipment	16,869	1	1	17,137
On-Road Haul Trucks and Delivery Vehicles	11,314	0	2	11,844
Construction Worker Commuting	1,496	0	0	1,503
2028 Total Emissions	**29,679**	**1**	**3**	**30,485**
	2029			
Off-Road Construction Equipment	16,859	1	1	17,126
On-Road Haul Trucks and Delivery Vehicles	11,181	0	2	11,706
Construction Worker Commuting	1,458	0	0	1,465
2029 Total Emissions	**29,498**	**1**	**3**	**30,296**
	2030			
Off-Road Construction Equipment	16,850	1	1	17,117
On-Road Haul Trucks and Delivery Vehicles	11,053	0	2	11,571
Construction Worker Commuting	1,424	0	0	1,431
2030 Total Emissions	**29,328**	**1**	**3**	**30,119**
	2031			
Off-Road Construction Equipment	16,842	1	1	17,108
On-Road Haul Trucks and Delivery Vehicles	10,931	0	2	11,444
Construction Worker Commuting	1,395	0	0	1,402
2031 Total Emissions	**29,168**	**1**	**3**	**29,953**
	2032			
Off-Road Construction Equipment	16,836	1	1	17,101
On-Road Haul Trucks and Delivery Vehicles	10,809	0	2	11,315
Construction Worker Commuting	1,369	0	0	1,375
2032 Total Emissions	**29,013**	**1**	**3**	**29,791**
Maximum Annual Emissions	**30,319**	**1**	**3**	**31,153**
Annual Significance Threshold	n/a	n/a	n/a	12,500
Significant?	n/a	n/a	n/a	Yes
Grand Total Emissions	**237,002**	**8**	**21**	**243,433**
Project Significance Threshold	n/a	n/a	n/a	25,000
Significant?	n/a	n/a	n/a	Yes

Table 6. Sisk Dam Raise Alternative - Maximum Annual Emissions by Subcomponent

	Annual Emissions (tons per year)			
Source	**CO2**	**CH4**	**N2O**	**CO2e**
Dam Raise	30,319	1	3	31,153
SR-152 Modifications	31,972	1	2	32,493
Total	**62,291**	**2**	**4**	**63,646**

Table 7. Sisk Dam Raise Alternative - Total Emissions by Subcomponent

	Annual Emissions (tons per year)			
Source	**CO2**	**CH4**	**N2O**	**CO2e**
Dam Raise	237,002	8	21	243,433
SR-152 Modifications	31,972	1	2	32,493
Total	**268,973**	**10**	**23**	**275,926**

Sisk Dam Raise Alternative

Table 8. Onsite Construction Equipment Emission Factors

				Emission Factors (											
				2025			2026			2027			2028		
Equipment	Quantity	OFFROAD Description	HP	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O
Excavators	3	ConstMin - Excavators	158	201.74	0.0135	0.0093	201.69	0.0128	0.0093	201.75	0.0123	0.0093	201.78	0.0118	0.0093
Bulldozers	4	ConstMin - Rubber Tired Dozers	249	208.70	0.0219	0.0097	208.71	0.0209	0.0097	208.44	0.0201	0.0097	208.45	0.0193	0.0097
Cranes/Lifts	5	ConstMin - Cranes	231	152.11	0.0107	0.0070	152.08	0.0102	0.0070	152.08	0.0098	0.0070	152.12	0.0094	0.0070
Compactors	5	ConstMin - Rollers	80	198.24	0.0191	0.0092	198.23	0.0180	0.0092	198.27	0.0172	0.0092	198.32	0.0164	0.0092
Graders	2	ConstMin - Graders	188	216.01	0.0142	0.0100	215.99	0.0136	0.0100	216.23	0.0131	0.0100	216.15	0.0127	0.0100
Scrapers	2	ConstMin - Scrapers	367	255.59	0.0202	0.0118	255.46	0.0194	0.0118	255.24	0.0187	0.0118	255.21	0.0180	0.0118
Loaders (small)	2	ConstMin - Rubber Tired Loaders	188	190.55	0.0123	0.0088	190.58	0.0118	0.0088	190.69	0.0113	0.0088	190.71	0.0109	0.0088
Loaders (large)	3	ConstMin - Rubber Tired Loaders	541	191.26	0.0121	0.0088	191.16	0.0116	0.0088	191.23	0.0112	0.0088	190.99	0.0108	0.0088
Dump trucks	13	ConstMin - Off-Highway Trucks	403	202.36	0.0127	0.0093	202.52	0.0122	0.0093	202.45	0.0119	0.0093	202.49	0.0116	0.0093
Water Trucks	5		N/A	595.60	0.0031	0.0936	580.62	0.0030	0.0913	565.85	0.0028	0.0889	552.19	0.0027	0.0868

Table 9. Onsite Construction Equipment Emissions by Pollutant

				Annual Emissions (m											
				2025			2026			2027			2028		
Equipment	Quantity	OFFROAD Description	HP	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O
Excavators	3	ConstMin - Excavators	158	698.06	0.05	0.03	697.88	0.04	0.03	698.09	0.04	0.03	698.18	0.04	0.03
Bulldozers	4	ConstMin - Rubber Tired Dozers	249	1,517.42	0.16	0.07	1,517.51	0.15	0.07	1,515.52	0.15	0.07	1,515.56	0.14	0.07
Cranes/Lifts	5	ConstMin - Cranes	231	1,282.49	0.09	0.06	1,282.28	0.09	0.06	1,282.28	0.08	0.06	1,282.58	0.08	0.06
Compactors	5	ConstMin - Rollers	80	578.87	0.06	0.03	578.84	0.05	0.03	578.96	0.05	0.03	579.09	0.05	0.03
Graders	2	ConstMin - Graders	188	592.89	0.04	0.03	592.85	0.04	0.03	593.50	0.04	0.03	593.30	0.03	0.03
Scrapers	2	ConstMin - Scrapers	367	1,369.53	0.11	0.06	1,368.82	0.10	0.06	1,367.61	0.10	0.06	1,367.45	0.10	0.06
Loaders (small)	2	ConstMin - Rubber Tired Loaders	188	523.01	0.03	0.02	523.11	0.03	0.02	523.41	0.03	0.02	523.47	0.03	0.02
Loaders (large)	3	ConstMin - Rubber Tired Loaders	541	2,266.01	0.14	0.10	2,264.82	0.14	0.10	2,265.61	0.13	0.10	2,262.82	0.13	0.10
Dump trucks	13	ConstMin - Off-Highway Trucks	403	7,739.20	0.49	0.36	7,745.28	0.47	0.36	7,742.72	0.45	0.36	7,744.08	0.44	0.36
Water Trucks	5		N/A	326.09	0.00	0.05	317.89	0.00	0.05	309.80	0.00	0.05	302.32	0.00	0.05
			Total	**16,893.57**	**1.16**	**0.82**	**16,889.28**	**1.12**	**0.82**	**16,877.50**	**1.08**	**0.81**	**16,868.86**	**1.04**	**0.81**

Table 10. Summary of Onsite Construction Equipment Emissions

				Annual Emissions (MTCO2e per year)							
Equipment	Quantity	OFFROAD Description	HP	2025	2026	2027	2028	2029	2030	2031	2032
Excavators	3	ConstMin - Excavators	158	709	709	709	709	709	709	709	709
Bulldozers	4	ConstMin - Rubber Tired Dozers	249	1,542	1,542	1,540	1,540	1,540	1,540	1,540	1,539
Cranes/Lifts	5	ConstMin - Cranes	231	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302
Compactors	5	ConstMin - Rollers	80	588	588	588	588	588	588	588	588
Graders	2	ConstMin - Graders	188	602	602	603	602	602	602	602	602
Scrapers	2	ConstMin - Scrapers	367	1,391	1,390	1,389	1,389	1,388	1,388	1,388	1,387
Loaders (small)	2	ConstMin - Rubber Tired Loaders	188	531	531	531	531	531	531	531	531
Loaders (large)	3	ConstMin - Rubber Tired Loaders	541	2,301	2,299	2,300	2,297	2,293	2,293	2,293	2,293
Dump trucks	13	ConstMin - Off-Highway Trucks	403	7,858	7,864	7,861	7,862	7,863	7,861	7,859	7,858
Water Trucks	5		N/A	341	333	324	317	309	303	297	291
			Total	**17,166**	**17,160**	**17,147**	**17,137**	**17,126**	**17,117**	**17,108**	**17,101**

<u>Operating Schedule</u>
8 years
20 hours per day
365 days per year

<u>Global Warming Potential</u>

CO2	1
CH4	25
N2O	298

<u>Conversions</u>
1,000,000 grams per metric ton

<u>Speed Limit</u>
15 miles per hour

Sisk Dam Raise Alternative

Table 8. Onsite Construction Equipment Emission Factors

Equipment	Quantity	OFFROAD Description	g/hp-hr or g/mi)											
			2029			2030			2031			2032		
			CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O
Excavators	3	ConstMin - Excavators	201.78	0.0114	0.0093	201.77	0.0110	0.0093	201.77	0.0107	0.0093	201.78	0.0105	0.0093
Bulldozers	4	ConstMin - Rubber Tired Dozers	208.43	0.0185	0.0097	208.43	0.0179	0.0097	208.44	0.0172	0.0097	208.44	0.0167	0.0097
Cranes/Lifts	5	ConstMin - Cranes	152.11	0.0090	0.0070	152.11	0.0087	0.0070	152.10	0.0084	0.0070	152.10	0.0083	0.0070
Compactors	5	ConstMin - Rollers	198.33	0.0157	0.0092	198.32	0.0151	0.0092	198.31	0.0146	0.0092	198.31	0.0141	0.0092
Graders	2	ConstMin - Graders	216.06	0.0123	0.0100	216.01	0.0119	0.0100	216.02	0.0116	0.0100	216.02	0.0113	0.0100
Scrapers	2	ConstMin - Scrapers	255.10	0.0174	0.0118	255.05	0.0168	0.0118	255.03	0.0163	0.0118	255.03	0.0159	0.0118
Loaders (small)	2	ConstMin - Rubber Tired Loaders	190.66	0.0106	0.0088	190.65	0.0102	0.0088	190.65	0.0100	0.0088	190.65	0.0098	0.0088
Loaders (large)	3	ConstMin - Rubber Tired Loaders	190.69	0.0105	0.0088	190.70	0.0102	0.0088	190.67	0.0099	0.0088	190.69	0.0097	0.0088
Dump trucks	13	ConstMin - Off-Highway Trucks	202.52	0.0113	0.0094	202.48	0.0112	0.0094	202.43	0.0110	0.0094	202.39	0.0109	0.0094
Water Trucks	5		539.62	0.0026	0.0848	528.25	0.0025	0.0830	517.85	0.0023	0.0814	508.31	0.0022	0.0799

Table 9. Onsite Construction Equipment Emissions by Pollut

Equipment	Quantity	OFFROAD Description	etric tons per year)											
			2029			2030			2031			2032		
			CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O
Excavators	3	ConstMin - Excavators	698.18	0.04	0.03	698.16	0.04	0.03	698.16	0.04	0.03	698.18	0.04	0.03
Bulldozers	4	ConstMin - Rubber Tired Dozers	1,515.44	0.13	0.07	1,515.44	0.13	0.07	1,515.50	0.13	0.07	1,515.50	0.12	0.07
Cranes/Lifts	5	ConstMin - Cranes	1,282.54	0.08	0.06	1,282.48	0.07	0.06	1,282.43	0.07	0.06	1,282.41	0.07	0.06
Compactors	5	ConstMin - Rollers	579.12	0.05	0.03	579.10	0.04	0.03	579.07	0.04	0.03	579.07	0.04	0.03
Graders	2	ConstMin - Graders	593.04	0.03	0.03	592.90	0.03	0.03	592.94	0.03	0.03	592.93	0.03	0.03
Scrapers	2	ConstMin - Scrapers	1,366.85	0.09	0.06	1,366.62	0.09	0.06	1,366.53	0.09	0.06	1,366.49	0.08	0.06
Loaders (small)	2	ConstMin - Rubber Tired Loaders	523.31	0.03	0.02	523.30	0.03	0.02	523.30	0.03	0.02	523.30	0.03	0.02
Loaders (large)	3	ConstMin - Rubber Tired Loaders	2,259.24	0.12	0.10	2,259.36	0.12	0.10	2,259.09	0.12	0.10	2,259.23	0.12	0.10
Dump trucks	13	ConstMin - Off-Highway Trucks	7,745.37	0.43	0.36	7,743.89	0.43	0.36	7,741.80	0.42	0.36	7,740.50	0.42	0.36
Water Trucks	5		295.44	0.00	0.05	289.22	0.00	0.05	283.53	0.00	0.04	278.30	0.00	0.04
			16,858.53	**1.01**	**0.81**	**16,850.46**	**0.98**	**0.81**	**16,842.35**	**0.96**	**0.81**	**16,835.92**	**0.95**	**0.81**

Table 10. Summary of Onsite Construction Equipment Emiss

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Equipment	Quantity	OFFROAD Description
Excavators	3	ConstMin - Excavators
Bulldozers	4	ConstMin - Rubber Tired Dozers
Cranes/Lifts	5	ConstMin - Cranes
Compactors	5	ConstMin - Rollers
Graders	2	ConstMin - Graders
Scrapers	2	ConstMin - Scrapers
Loaders (small)	2	ConstMin - Rubber Tired Loaders
Loaders (large)	3	ConstMin - Rubber Tired Loaders
Dump trucks	13	ConstMin - Off-Highway Trucks
Water Trucks	5	

Operating Schedule

8 years
20 hours per day
365 days per year

Sisk Dam Raise Alternative

Table 11. Offsite Construction Emissions - Construction Worker Commuting

	Annual	Emission Factors (g/mi)			Annual Emissions (metric tons per year)			
Year	VMT	CO2	CH4	N2O	CO2	CH4	N2O	CO2e
2025	6,336,400	258.23	0.0022	0.0045	1,636	0.01	0.03	1,645
2026	6,336,400	250.22	0.0019	0.0042	1,585	0.01	0.03	1,594
2027	6,336,400	242.73	0.0017	0.0040	1,538	0.01	0.03	1,546
2028	6,336,400	236.05	0.0016	0.0038	1,496	0.01	0.02	1,503
2029	6,336,400	230.09	0.0014	0.0037	1,458	0.01	0.02	1,465
2030	6,336,400	224.80	0.0013	0.0036	1,424	0.01	0.02	1,431
2031	6,336,400	220.11	0.0012	0.0035	1,395	0.01	0.02	1,402
2032	6,336,400	215.98	0.0011	0.0034	1,369	0.01	0.02	1,375

Table 12. Offsite Construction Emissions - Haul Trucks

	Annual	Emission Factors (g/mi)			Annual Emissions (metric tons per year)			
Year	VMT	CO2	CH4	N2O	CO2	CH4	N2O	CO2e
2025	7,008,000	1,682.27	0.0019	0.2644	11,789	0.01	1.85	12,342
2026	7,008,000	1,660.70	0.0018	0.2610	11,638	0.01	1.83	12,184
2027	7,008,000	1,636.36	0.0018	0.2572	11,468	0.01	1.80	12,005
2028	7,008,000	1,614.47	0.0017	0.2538	11,314	0.01	1.78	11,844
2029	7,008,000	1,595.53	0.0017	0.2508	11,181	0.01	1.76	11,706
2030	7,008,000	1,577.22	0.0016	0.2479	11,053	0.01	1.74	11,571
2031	7,008,000	1,559.82	0.0016	0.2452	10,931	0.01	1.72	11,444
2032	7,008,000	1,542.35	0.0016	0.2424	10,809	0.01	1.70	11,315

Note: Emission factors estimated from EMFAC2017.

One-way trip distance

Workers	40	miles per trip
Trucks	40	miles per trip

Global Warming Potential

CO2	1
CH4	25
N2O	298

Conversions

1,000,000 grams per metric ton

Maximum Daily Workers and Trucks

217 workers per day (130 day time workers and 87 night time workers)

240 trucks per day

Operating Schedule

365 days per year

On-Road Motor Vehicle Emission Factors

Table 13. Unmitigated Emission Factors for Construction Worker Commutes

	grams per mile		
Year	CO2	CH4	N2O
2020	304.93	0.0043	0.0071
2021	295.48	0.0037	0.0064
2022	286.08	0.0032	0.0058
2023	276.71	0.0028	0.0053
2024	267.46	0.0024	0.0048
2025	258.23	0.0022	0.0045
2026	250.22	0.0019	0.0042
2027	242.73	0.0017	0.0040
2028	236.05	0.0016	0.0038
2029	230.09	0.0014	0.0037
2030	224.80	0.0013	0.0036
2031	220.11	0.0012	0.0035
2032	215.98	0.0011	0.0034
2033	212.35	0.0010	0.0033
2034	209.17	0.0010	0.0033
2035	206.41	0.0009	0.0032

Note:
Vehicle fleet mix includes gasoline, diesel, and electric automobiles (LDA) and light-duty trucks (LDT1 and LDT2).

Table 14. Unmitigated Emission Factors for Haul and Delivery Trucks

	grams per mile		
Year	CO2	CH4	N2O
2020	1,892.05	0.0245	0.2974
2021	1,859.78	0.0198	0.2923
2022	1,793.76	0.0083	0.2820
2023	1,726.74	0.0020	0.2714
2024	1,704.13	0.0020	0.2679
2025	1,682.27	0.0019	0.2644
2026	1,660.70	0.0018	0.2610
2027	1,636.36	0.0018	0.2572
2028	1,614.47	0.0017	0.2538
2029	1,595.53	0.0017	0.2508
2030	1,577.22	0.0016	0.2479
2031	1,559.82	0.0016	0.2452
2032	1,542.35	0.0016	0.2424
2033	1,524.68	0.0016	0.2397
2034	1,505.70	0.0015	0.2367
2035	1,486.40	0.0015	0.2336

Table 15. Unmitigated Emission Factors for On-Site Water Trucks (San Joaquin Valley Air Basin)

		grams per mile		
Year	Speed	CO2	CH4	N2O
2020	5	935.12	0.0101	0.1470
2020	10	793.86	0.0075	0.1248
2020	15	673.79	0.0038	0.1059
2020	20	560.03	0.0017	0.0880
2020	25	471.42	0.0010	0.0741
2020	30	407.88	0.0008	0.0641
2020	35	370.08	0.0007	0.0582
2020	40	346.00	0.0006	0.0544
2020	45	333.76	0.0005	0.0525
2020	50	334.94	0.0005	0.0526
2020	55	352.63	0.0004	0.0554
2020	60	382.51	0.0004	0.0601
2020	65	429.10	0.0004	0.0674
2020	70	461.48	0.0004	0.0725
2021	5	914.16	0.0098	0.1437
2021	10	776.32	0.0073	0.1220
2021	15	658.76	0.0037	0.1035
2021	20	548.01	0.0016	0.0861
2021	25	460.59	0.0010	0.0724
2021	30	398.49	0.0008	0.0626
2021	35	361.78	0.0006	0.0569
2021	40	338.18	0.0005	0.0532
2021	45	326.45	0.0005	0.0513
2021	50	327.59	0.0004	0.0515
2021	55	344.89	0.0004	0.0542
2021	60	373.54	0.0004	0.0587
2021	65	419.69	0.0004	0.0660
2021	70	450.86	0.0004	0.0709
2022	5	892.70	0.0094	0.1403
2022	10	758.11	0.0070	0.1192
2022	15	643.43	0.0035	0.1011
2022	20	535.45	0.0015	0.0842
2022	25	449.59	0.0009	0.0707
2022	30	389.05	0.0007	0.0612
2022	35	353.26	0.0006	0.0555
2022	40	330.20	0.0005	0.0519
2022	45	318.90	0.0004	0.0501
2022	50	319.97	0.0004	0.0503
2022	55	336.71	0.0004	0.0529
2022	60	364.75	0.0004	0.0573
2022	65	409.74	0.0004	0.0644
2022	70	440.02	0.0004	0.0692
2023	5	870.76	0.0091	0.1369
2023	10	739.52	0.0068	0.1162
2023	15	627.74	0.0034	0.0987
2023	20	522.62	0.0014	0.0821
2023	25	438.41	0.0009	0.0689
2023	30	379.43	0.0007	0.0596
2023	35	344.58	0.0005	0.0542
2023	40	322.07	0.0005	0.0506
2023	45	311.19	0.0004	0.0489
2023	50	312.19	0.0004	0.0491
2023	55	328.40	0.0003	0.0516
2023	60	355.82	0.0003	0.0559
2023	65	399.63	0.0003	0.0628
2023	70	429.02	0.0003	0.0674

Year	Speed	grams per mile		
		CO2	CH4	N2O
2024	5	848.21	0.0087	0.1333
2024	10	721.09	0.0065	0.1133
2024	15	612.12	0.0033	0.0962
2024	20	509.36	0.0014	0.0801
2024	25	427.09	0.0008	0.0671
2024	30	369.77	0.0006	0.0581
2024	35	335.79	0.0005	0.0528
2024	40	314.02	0.0004	0.0494
2024	45	303.30	0.0004	0.0477
2024	50	304.02	0.0003	0.0478
2024	55	319.84	0.0003	0.0503
2024	60	346.59	0.0003	0.0545
2024	65	389.39	0.0003	0.0612
2024	70	417.88	0.0003	0.0657
2025	5	825.11	0.0083	0.1297
2025	10	701.60	0.0062	0.1103
2025	15	595.60	0.0031	0.0936
2025	20	495.78	0.0013	0.0779
2025	25	415.44	0.0008	0.0653
2025	30	359.71	0.0006	0.0565
2025	35	326.69	0.0005	0.0514
2025	40	305.52	0.0004	0.0480
2025	45	295.17	0.0004	0.0464
2025	50	295.83	0.0003	0.0465
2025	55	311.17	0.0003	0.0489
2025	60	337.21	0.0003	0.0530
2025	65	378.80	0.0003	0.0595
2025	70	406.43	0.0003	0.0639
2026	5	803.64	0.0080	0.1263
2026	10	683.39	0.0060	0.1074
2026	15	580.62	0.0030	0.0913
2026	20	482.68	0.0012	0.0759
2026	25	404.74	0.0007	0.0636
2026	30	350.40	0.0006	0.0551
2026	35	318.08	0.0005	0.0500
2026	40	297.59	0.0004	0.0468
2026	45	287.37	0.0003	0.0452
2026	50	288.34	0.0003	0.0453
2026	55	304.08	0.0003	0.0478
2026	60	328.47	0.0003	0.0516
2026	65	368.60	0.0003	0.0579
2026	70	395.91	0.0003	0.0622
2027	5	783.15	0.0076	0.1231
2027	10	665.98	0.0057	0.1047
2027	15	565.85	0.0028	0.0889
2027	20	470.48	0.0012	0.0740
2027	25	394.45	0.0007	0.0620
2027	30	341.51	0.0005	0.0537
2027	35	310.01	0.0004	0.0487
2027	40	290.03	0.0004	0.0456
2027	45	280.08	0.0003	0.0440
2027	50	281.02	0.0003	0.0442
2027	55	296.37	0.0002	0.0466
2027	60	320.13	0.0002	0.0503
2027	65	359.28	0.0002	0.0565
2027	70	385.87	0.0002	0.0607

Year	Speed	grams per mile		
		CO2	CH4	N2O
2028	5	764.04	0.0073	0.1201
2028	10	649.79	0.0055	0.1021
2028	15	552.19	0.0027	0.0868
2028	20	459.24	0.0011	0.0722
2028	25	384.99	0.0007	0.0605
2028	30	333.35	0.0005	0.0524
2028	35	302.59	0.0004	0.0476
2028	40	283.05	0.0003	0.0445
2028	45	273.35	0.0003	0.0430
2028	50	274.27	0.0003	0.0431
2028	55	289.26	0.0002	0.0455
2028	60	312.47	0.0002	0.0491
2028	65	350.74	0.0002	0.0551
2028	70	376.68	0.0002	0.0592
2029	5	746.66	0.0069	0.1174
2029	10	635.06	0.0052	0.0998
2029	15	539.62	0.0026	0.0848
2029	20	448.89	0.0010	0.0706
2029	25	376.35	0.0006	0.0592
2029	30	325.84	0.0005	0.0512
2029	35	295.79	0.0004	0.0465
2029	40	276.67	0.0003	0.0435
2029	45	267.19	0.0003	0.0420
2029	50	268.10	0.0002	0.0421
2029	55	282.77	0.0002	0.0444
2029	60	305.47	0.0002	0.0480
2029	65	342.90	0.0002	0.0539
2029	70	368.27	0.0002	0.0579
2030	5	730.92	0.0066	0.1149
2030	10	621.73	0.0050	0.0977
2030	15	528.25	0.0025	0.0830
2030	20	439.45	0.0010	0.0691
2030	25	368.55	0.0006	0.0579
2030	30	319.05	0.0004	0.0502
2030	35	289.61	0.0003	0.0455
2030	40	270.89	0.0003	0.0426
2030	45	261.58	0.0003	0.0411
2030	50	262.49	0.0002	0.0413
2030	55	276.87	0.0002	0.0435
2030	60	299.12	0.0002	0.0470
2030	65	335.79	0.0002	0.0528
2030	70	360.65	0.0002	0.0567
2031	5	716.57	0.0063	0.1126
2031	10	609.57	0.0048	0.0958
2031	15	517.85	0.0023	0.0814
2031	20	430.84	0.0009	0.0677
2031	25	361.48	0.0005	0.0568
2031	30	312.87	0.0004	0.0492
2031	35	284.00	0.0003	0.0446
2031	40	265.62	0.0003	0.0418
2031	45	256.47	0.0002	0.0403
2031	50	257.38	0.0002	0.0405
2031	55	271.50	0.0002	0.0427
2031	60	293.35	0.0002	0.0461
2031	65	329.34	0.0002	0.0518
2031	70	353.75	0.0002	0.0556

Year	Speed	grams per mile		
		CO2	CH4	N2O
2032	5	703.42	0.0061	0.1106
2032	10	598.42	0.0046	0.0941
2032	15	508.31	0.0022	0.0799
2032	20	422.91	0.0009	0.0665
2032	25	355.01	0.0005	0.0558
2032	30	307.22	0.0004	0.0483
2032	35	278.86	0.0003	0.0438
2032	40	260.79	0.0003	0.0410
2032	45	251.77	0.0002	0.0396
2032	50	252.68	0.0002	0.0397
2032	55	266.57	0.0002	0.0419
2032	60	288.06	0.0002	0.0453
2032	65	323.44	0.0002	0.0508
2032	70	347.45	0.0002	0.0546
2033	5	691.51	0.0058	0.1087
2033	10	588.30	0.0044	0.0925
2033	15	499.64	0.0021	0.0785
2033	20	415.68	0.0009	0.0653
2033	25	349.15	0.0005	0.0549
2033	30	302.10	0.0004	0.0475
2033	35	274.20	0.0003	0.0431
2033	40	256.42	0.0003	0.0403
2033	45	247.50	0.0002	0.0389
2033	50	248.42	0.0002	0.0390
2033	55	262.09	0.0002	0.0412
2033	60	283.25	0.0002	0.0445
2033	65	318.09	0.0002	0.0500
2033	70	341.74	0.0002	0.0537
2034	5	680.87	0.0056	0.1070
2034	10	579.25	0.0042	0.0910
2034	15	491.87	0.0021	0.0773
2034	20	409.19	0.0008	0.0643
2034	25	343.93	0.0005	0.0541
2034	30	297.52	0.0004	0.0468
2034	35	270.03	0.0003	0.0424
2034	40	252.50	0.0002	0.0397
2034	45	243.67	0.0002	0.0383
2034	50	244.59	0.0002	0.0384
2034	55	258.07	0.0002	0.0406
2034	60	278.95	0.0001	0.0438
2034	65	313.31	0.0001	0.0492
2034	70	336.65	0.0001	0.0529
2035	5	671.38	0.0054	0.1055
2035	10	571.16	0.0040	0.0898
2035	15	484.93	0.0020	0.0762
2035	20	403.37	0.0008	0.0634
2035	25	339.26	0.0005	0.0533
2035	30	293.43	0.0004	0.0461
2035	35	266.30	0.0003	0.0419
2035	40	249.00	0.0002	0.0391
2035	45	240.24	0.0002	0.0378
2035	50	241.17	0.0002	0.0379
2035	55	254.48	0.0002	0.0400
2035	60	275.11	0.0001	0.0432
2035	65	309.04	0.0001	0.0486
2035	70	332.11	0.0001	0.0522

Table 16. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Bore/Drill Rigs	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Bore/Drill Rigs	50	0.0139	0.0140	0.0139	0.0138	0.0139	0.0139	0.0139	0.0139
ConstMin - Bore/Drill Rigs	75	0.0116	0.0117	0.0122	0.0122	0.0121	0.0121	0.0121	0.0121
ConstMin - Bore/Drill Rigs	100	0.0121	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Bore/Drill Rigs	175	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Bore/Drill Rigs	300	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Bore/Drill Rigs	600	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121
ConstMin - Bore/Drill Rigs	750	0.0123	0.0124	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Bore/Drill Rigs	9999	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Cranes	25	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
ConstMin - Cranes	50	0.0079	0.0079	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
ConstMin - Cranes	75	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	100	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	175	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	300	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	600	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	750	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	9999	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Crawler Tractors	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Crawler Tractors	50	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116
ConstMin - Crawler Tractors	75	0.0105	0.0108	0.0107	0.0107	0.0108	0.0108	0.0108	0.0108
ConstMin - Crawler Tractors	100	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	175	0.0105	0.0105	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Crawler Tractors	300	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	600	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	750	0.0104	0.0104	0.0105	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Crawler Tractors	9999	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Excavators	25	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Excavators	50	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Excavators	75	0.0093	0.0094	0.0095	0.0094	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	100	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	175	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	300	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	600	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	750	0.0094	0.0094	0.0094	0.0093	0.0094	0.0094	0.0094	0.0094
ConstMin - Excavators	9999	0.0094	0.0094	0.0094	0.0094	0.0093	0.0093	0.0093	0.0093
ConstMin - Graders	25	0.0111	0.0000	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Graders	50	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Graders	75	0.0103	0.0106	0.0103	0.0104	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	100	0.0099	0.0099	0.0099	0.0099	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	175	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	300	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	600	0.0099	0.0099	0.0099	0.0098	0.0099	0.0099	0.0099	0.0099
ConstMin - Graders	9999	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Off-Highway Tractors	25	0.0118	0.0000	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Off-Highway Tractors	50	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Off-Highway Tractors	75	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	100	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107
ConstMin - Off-Highway Tractors	175	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	300	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	600	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	750	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	9999	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Trucks	25	0.0000	0.0104	0.0000	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Off-Highway Trucks	50	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103
ConstMin - Off-Highway Trucks	75	0.0092	0.0095	0.0094	0.0094	0.0094	0.0094	0.0094	0.0094

Table 16. Off-Road Equipment N2O Emission Factors

		N2O Emission Factor (g/hp-hr)							
Vehicle Class	HP Bin	2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Off-Highway Trucks	100	0.0094	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	175	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	300	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	600	0.0093	0.0093	0.0093	0.0093	0.0094	0.0094	0.0094	0.0094
ConstMin - Off-Highway Trucks	750	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	9999	0.0093	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Other Construction Equipment	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Other Construction Equipment	50	0.0114	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
ConstMin - Other Construction Equipment	75	0.0100	0.0100	0.0101	0.0101	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	100	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	175	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	300	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	600	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	750	0.0102	0.0102	0.0102	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	9999	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Pavers	50	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
ConstMin - Pavers	75	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	100	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	175	0.0102	0.0102	0.0102	0.0102	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	300	0.0101	0.0101	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Pavers	600	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	750	0.0101	0.0102	0.0101	0.0101	0.0000	0.0102	0.0102	0.0102
ConstMin - Pavers	9999	0.0000	0.0000	0.0000	0.0000	0.0102	0.0000	0.0000	0.0000
ConstMin - Paving Equipment	25	0.0000	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Paving Equipment	50	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Paving Equipment	75	0.0086	0.0086	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	100	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	175	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	300	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	600	0.0087	0.0087	0.0087	0.0086	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	750	0.0087	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
ConstMin - Paving Equipment	9999	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Rollers	25	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Rollers	50	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Rollers	75	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	100	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	175	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	300	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	600	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rough Terrain Forklifts	25	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109
ConstMin - Rough Terrain Forklifts	50	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109
ConstMin - Rough Terrain Forklifts	75	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099
ConstMin - Rough Terrain Forklifts	100	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	175	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	300	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	600	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	750	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Dozers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Rubber Tired Dozers	50	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107
ConstMin - Rubber Tired Dozers	75	0.0097	0.0097	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Rubber Tired Dozers	100	0.0097	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Dozers	175	0.0097	0.0097	0.0096	0.0097	0.0096	0.0096	0.0096	0.0096
ConstMin - Rubber Tired Dozers	300	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
ConstMin - Rubber Tired Dozers	600	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
ConstMin - Rubber Tired Dozers	750	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097

Table 16. Off-Road Equipment N2O Emission Factors

		N2O Emission Factor (g/hp-hr)							
Vehicle Class	HP Bin	2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Rubber Tired Loaders	25	0.0000	0.0000	0.0000	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Loaders	50	0.0099	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Loaders	75	0.0088	0.0088	0.0088	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Rubber Tired Loaders	100	0.0087	0.0088	0.0087	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	175	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	300	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	600	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	750	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	9999	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089
ConstMin - Scrapers	25	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131
ConstMin - Scrapers	50	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129
ConstMin - Scrapers	75	0.0119	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	100	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	175	0.0119	0.0118	0.0118	0.0118	0.0118	0.0119	0.0118	0.0118
ConstMin - Scrapers	300	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	600	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	750	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	9999	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Skid Steer Loaders	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Skid Steer Loaders	50	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Skid Steer Loaders	75	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	100	0.0090	0.0090	0.0090	0.0090	0.0089	0.0089	0.0089	0.0089
ConstMin - Skid Steer Loaders	175	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	300	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	600	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	9999	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Surfacing Equipment	25	0.0000	0.0000	0.0000	0.0082	0.0082	0.0082	0.0082	0.0082
ConstMin - Surfacing Equipment	50	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082
ConstMin - Surfacing Equipment	75	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	100	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	175	0.0074	0.0074	0.0074	0.0073	0.0073	0.0073	0.0073	0.0073
ConstMin - Surfacing Equipment	300	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	600	0.0073	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	750	0.0074	0.0073	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	9999	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Sweepers/Scrubbers	25	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124	0.0124	0.0124
ConstMin - Sweepers/Scrubbers	50	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124
ConstMin - Sweepers/Scrubbers	75	0.0111	0.0111	0.0110	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	100	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	175	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	300	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	600	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	9999	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Tractors/Loaders/Backhoes	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Tractors/Loaders/Backhoes	50	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099
ConstMin - Tractors/Loaders/Backhoes	75	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	100	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	175	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	300	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	600	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	750	0.0086	0.0088	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089
ConstMin - Tractors/Loaders/Backhoes	9999	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Trenchers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Trenchers	50	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137
ConstMin - Trenchers	75	0.0121	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Trenchers	100	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123

Table 16. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr) 2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Trenchers	175	0.0123	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Trenchers	300	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	600	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	750	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	9999	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
Industrial - Aerial Lifts	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Industrial - Aerial Lifts	50	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Aerial Lifts	75	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	100	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	175	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	300	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	600	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Forklifts	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Industrial - Forklifts	50	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055
Industrial - Forklifts	75	0.0048	0.0048	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	100	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	175	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	300	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	600	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	9999	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Other General Industrial Equipment	25	0.0093	0.0093	0.0093	0.0093	0.0000	0.0093	0.0093	0.0093
Industrial - Other General Industrial Equipment	50	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
Industrial - Other General Industrial Equipment	75	0.0083	0.0083	0.0084	0.0083	0.0084	0.0084	0.0084	0.0083
Industrial - Other General Industrial Equipment	100	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Other General Industrial Equipment	175	0.0083	0.0083	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Other General Industrial Equipment	300	0.0084	0.0084	0.0084	0.0084	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	600	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	750	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	9999	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other Material Handling Equipment	25	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0000	0.0107
Industrial - Other Material Handling Equipment	50	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108
Industrial - Other Material Handling Equipment	75	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0097	0.0096
Industrial - Other Material Handling Equipment	100	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	175	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
Industrial - Other Material Handling Equipment	300	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	600	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	750	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
Industrial - Other Material Handling Equipment	9999	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
OFF - ConstMin - Bore/Drill Rigs	25	0.0200	0.0201	0.0202	0.0203	0.0202	0.0202	0.0202	0.0202
OFF - ConstMin - Cement and Mortar Mixers	25	0.0151	0.0151	0.0151	0.0152	0.0151	0.0151	0.0151	0.0151
OFF - ConstMin - Concrete/Industrial Saws	25	0.0189	0.0186	0.0187	0.0195	0.0199	0.0202	0.0197	0.0193
OFF - ConstMin - Concrete/Industrial Saws	50	0.0199	0.0198	0.0199	0.0198	0.0198	0.0197	0.0196	0.0198
OFF - ConstMin - Dumpers/Tenders	25	0.0100	0.0100	0.0099	0.0101	0.0100	0.0101	0.0101	0.0102
OFF - ConstMin - Excavators	25	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154
OFF - ConstMin - Other Construction Equipment	25	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167
OFF - ConstMin - Pavers	25	0.0167	0.0166	0.0166	0.0166	0.0165	0.0166	0.0165	0.0166
OFF - ConstMin - Paving Equipment	25	0.0141	0.0141	0.0142	0.0141	0.0144	0.0145	0.0144	0.0143
OFF - ConstMin - Plate Compactors	25	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116
OFF - ConstMin - Rollers	25	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151
OFF - ConstMin - Rubber Tired Loaders	25	0.0144	0.0146	0.0146	0.0146	0.0145	0.0146	0.0144	0.0143
OFF - ConstMin - Signal Boards	25	0.0221	0.0221	0.0221	0.0222	0.0221	0.0222	0.0221	0.0221
OFF - ConstMin - Signal Boards	50	0.0223	0.0221	0.0221	0.0224	0.0221	0.0222	0.0220	0.0220
OFF - ConstMin - Skid Steer Loaders	25	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148
OFF - ConstMin - Tractors/Loaders/Backhoes	25	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148
OFF - ConstMin - Trenchers	25	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202
OFF - Industrial - Aerial Lifts	25	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124

Table 16. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr) 2025	2026	2027	2028	2029	2030	2031	2032
OFF - Industrial - Other General Industrial Equipment	25	0.0137	0.0137	0.0138	0.0137	0.0137	0.0137	0.0137	0.0138
OFF - Industrial - Sweepers/Scrubbers	25	0.0182	0.0182	0.0182	0.0183	0.0182	0.0183	0.0183	0.0183
OFF - Light Commercial - Air Compressors	25	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0128	0.0129
OFF - Light Commercial - Air Compressors	50	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
OFF - Light Commercial - Generator Sets	25	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Generator Sets	50	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0199	0.0200
OFF - Light Commercial - Pressure Washers	25	0.0069	0.0069	0.0068	0.0069	0.0070	0.0070	0.0071	0.0072
OFF - Light Commercial - Pressure Washers	50	0.0073	0.0072	0.0074	0.0075	0.0076	0.0077	0.0076	0.0075
OFF - Light Commercial - Pumps	25	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Pumps	50	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Welders	25	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121
OFF - Light Commercial - Welders	50	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
Portable Equipment - Non-Rental Compressor	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Compressor	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Generator	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Other Portable Equipment	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Pump	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081

Table 16. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
Portable Equipment - Rental Generator	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Rental Other Portable Equipment	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Rental Pump	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081

N2O Emission Factor

0.472 grams per gallon

Source: The Climate Registry. 2020. Default Emission Factors. Table 2.7 U.S. Default Factors for Calculating CH4 and N2O Emissions from Non-Highway Vehicles, Construction/Mining Equipment, Diesel - Equ

Note:

Calculated fuel consumption factor (gallons per horsepower-hour) calculated from OFFROAD2017 and multiplied by N2O emission factor to convert to grams per horsepower-hour.

Greenhouse Gas Construction Emissions Summary

Table 17. SR 152 Modifications - Annual Unmitigated Emissions

Source	Annual Emissions (metric tons per year)			
	CO2	CH4	N2O	CO2e
Off-Road Construction Equipment				
Raise Embankment	8,369	1	0	8,499
East Overlook	57	0	0	58
Basalt Hill	158	0	0	161
Off-Road Construction Equipment Subtotal	8,585	1	0	8,718
On-Road Haul Trucks and Delivery Vehicles	1,911	0	0	2,001
Construction Worker Commuting	656	0	0	660
Marine Emissions (Tugboats)	12,235	0	1	12,397
Total	**31,972**	**1**	**2**	**32,493**

SR 152 Modifications
Raise Embankment by 10 VLF

Table 18. Onsite Construction Equipment Emission Factors (Raise Embankment by 10 VLF)

Equipment	Project Hours	OFFROAD Description	HP	Emission Factors (g/hp-hr or g/mi)			Annual Emissions (metric tons per year)			
				CO2	CH4	N2O	CO2	CH4	N2O	CO2e
80CY Off-Road Mech Drive Rear Dump Cat 777	19,500.00	ConstMin - Off-Highway Trucks	916	199.29	0.0123	0.0092	3,559.69	0.22	0.16	3,614.28
Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	11,700.00	ConstMin - Rubber Tired Loaders	197	190.69	0.0113	0.0088	439.53	0.03	0.02	446.23
100MT All/Rough Terrain Hydro Crane	16,837.64	ConstMin - Cranes	330	152.11	0.0096	0.0070	845.17	0.05	0.04	858.14
Hydraulic Excavator Cat. 320 138HP 1.25cy	590.40	ConstMin - Excavators	138	201.75	0.0123	0.0093	16.44	0.00	0.00	16.69
40MT All/Rough Terrain Hydro Crane	70,197.99	ConstMin - Cranes	195	152.08	0.0098	0.0070	2,081.80	0.13	0.10	2,113.81
Telescopic Boom Lift Truck Grad 534 -10Kips	40.15	ConstMin - Rough Terrain Forklifts	110	212.20	0.0167	0.0098	0.94	0.00	0.00	0.95
On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	2,282.40	N/A - onroad	n/a	565.853	0.003	0.089	1.29	0.00	0.00	1.35
Hand Held Vibratory Plate 25" 8.0HP	69,958.86	OFF - ConstMin - Plate Compactors	8	244.33	0.0257	0.0116	136.74	0.01	0.01	139.05
Loader Backhoe C420-93HP 1.25cy- 15' depth	2,938.45	ConstMin - Tractors/Loaders/Backhoes	93	195.17	0.0144	0.0090	53.34	0.00	0.00	54.17
Large Generator Set 150kw	9,360.00	Portable Equipment - Non-Rental Generator	201	166.78	0.0091	0.0077	313.77	0.02	0.01	318.52
Flatbed Truck 20,000 GVW	712.00	N/A - onroad	n/a	565.853	0.003	0.089	0.40	0.00	0.00	0.42
Large Generator Set 75kw	15,600.00	Portable Equipment - Non-Rental Generator	101	166.78	0.0147	0.0077	262.77	0.02	0.01	266.97
Hydraulic Excavator Cat. 330 244HP 2.25cy	257.34	ConstMin - Excavators	244	201.79	0.0111	0.0093	12.67	0.00	0.00	12.86
Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	5,488.76	ConstMin - Rollers	80	198.27	0.0172	0.0092	87.06	0.01	0.00	88.45
Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	10,355.22	ConstMin - Crawler Tractors	158	225.85	0.0199	0.0104	369.52	0.03	0.02	375.43
On-Highway Water Truck 4000 Gallon	5,476.32	N/A - onroad	n/a	565.853	0.003	0.089	3.10	0.00	0.00	3.24
Rear Dump Truck 12-18 cy	14,977.44	N/A - onroad	n/a	565.853	0.003	0.089	8.48	0.00	0.00	8.87
Articulated Frame Grader Cat 12H 140HP	1,313.72	ConstMin - Graders	140	217.33	0.0148	0.0100	39.97	0.00	0.00	40.59
Skid Steer Loader 46HP 1750# Bobcat S175	392.00	ConstMin - Skid Steer Loaders	46	216.89	0.0208	0.0100	3.91	0.00	0.00	3.97
80MT All/Rough Terrain Hydro Crane	1,244.40	ConstMin - Cranes	270	152.08	0.0096	0.0070	51.10	0.00	0.00	51.88
Portable welder Diesel 300 amps	1,244.40	OFF - Light Commercial - Welders	33	255.73	0.0221	0.0122	10.50	0.00	0.00	10.67
Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	2,136.49	ConstMin - Tractors/Loaders/Backhoes	101	193.84	0.0144	0.0090	41.83	0.00	0.00	42.48
Telescopic Boom Lift Truck Grad 534 -6Kips	66.66	ConstMin - Rough Terrain Forklifts	80	212.53	0.0167	0.0098	1.13	0.00	0.00	1.15
Standard Crawler Dozer Cat. D7R 230HP	12.44	ConstMin - Crawler Tractors	230	226.20	0.0168	0.0105	0.65	0.00	0.00	0.66
On-Highway Water Truck 2500 Gallon	33.18	N/A - onroad	n/a	565.853	0.003	0.089	0.02	0.00	0.00	0.02
Concrete Saw 20" Gasoline	20.74	OFF - ConstMin - Concrete/Industrial Saws	31	413.82	0.0307	0.0199	0.27	0.00	0.00	0.27
Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	245.34	ConstMin - Rubber Tired Loaders	160	190.64	0.0128	0.0088	7.48	0.00	0.00	7.60
Hydraulic Excavator Cat. 325 186HP 1.50cy	133.48	ConstMin - Excavators	186	201.79	0.0111	0.0093	5.01	0.00	0.00	5.09
Rear Dump Truck 07-08 cy	753.76	N/A - onroad	n/a	565.853	0.003	0.089	0.43	0.00	0.00	0.45
Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	136.38	ConstMin - Pavers	155	219.48	0.0197	0.0102	4.64	0.00	0.00	4.71
Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	272.72	ConstMin - Rollers	138	197.89	0.0132	0.0092	7.45	0.00	0.00	7.56
Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	10.22	ConstMin - Pavers	81	218.59	0.0268	0.0101	0.18	0.00	0.00	0.18
Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	10.22	ConstMin - Rollers	33	220.42	0.0338	0.0102	0.07	0.00	0.00	0.08
Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	262.42	OFF - ConstMin - Rollers	18	318.33	0.0346	0.0151	1.50	0.00	0.00	1.53
Electric Submersible Pump 2HP/2"	272.00	OFF - Light Commercial - Pumps	2	420.50	0.0450	0.0200	0.23	0.00	0.00	0.23
Total	**264,833.54**					**Total**	**8,369.07**	**0.55**	**0.39**	**8,498.58**

Global Warming Potential

CO2	1
CH4	25
N2O	298

Conversions

1,000,000 grams per metric ton

Speed Limit

15 miles per hour

SR 152 Modifications
East Overlook Grading and Pavement

Table 19. Onsite Construction Equipment Emission Factors (East Overlook Grading and Pavement)

Equipment	Project Hours	OFFROAD Description	HP	Emission Factors (g/hp-hr or g/mi) CO2	CH4	N2O	Annual Emissions (metric tons per year) CO2	CH4	N2O	CO2e
On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	432.04	N/A - onroad	n/a	565.853	0.003	0.089	0.24	0.00	0.00	0.26
Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	24.68	ConstMin - Rollers	80	198.27	0.0172	0.0092	0.39	0.00	0.00	0.40
Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	16.40	ConstMin - Crawler Tractors	158	225.85	0.0199	0.0104	0.59	0.00	0.00	0.59
On-Highway Water Truck 4000 Gallon	18.46	N/A - onroad	n/a	565.853	0.003	0.089	0.01	0.00	0.00	0.01
Rear Dump Truck 12-18 cy	24.61	N/A - onroad	n/a	565.853	0.003	0.089	0.01	0.00	0.00	0.01
Articulated Frame Grader Cat 12H 140HP	16.16	ConstMin - Graders	140	217.33	0.0148	0.0100	0.49	0.00	0.00	0.50
Hand Held Vibratory Plate 25" 8.0HP	1,436.69	OFF - ConstMin - Plate Compactors	8	244.33	0.0257	0.0116	2.81	0.00	0.00	2.86
40MT All/Rough Terrain Hydro Crane	1,436.69	ConstMin - Cranes	195	152.08	0.0098	0.0070	42.61	0.00	0.00	43.26
Hydraulic Excavator Cat. 325 186HP 1.50cy	24.66	ConstMin - Excavators	186	201.79	0.0111	0.0093	0.93	0.00	0.00	0.94
Telescopic Boom Lift Truck Grad 534 -6Kips	33.33	ConstMin - Rough Terrain Forklifts	80	212.53	0.0147	0.0098	0.57	0.00	0.00	0.58
Standard Crawler Dozer Cat. D7R 230HP	6.22	ConstMin - Crawler Tractors	230	226.20	0.0168	0.0105	0.32	0.00	0.00	0.33
On-Highway Water Truck 2500 Gallon	10.54	N/A - onroad	n/a	565.853	0.003	0.089	0.01	0.00	0.00	0.01
Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	20.36	ConstMin - Tractors/Loaders/Backhoes	101	193.84	0.0144	0.0090	0.40	0.00	0.00	0.40
Concrete Saw 20" Gasoline	4.32	OFF - ConstMin - Concrete/Industrial Saws	31	413.82	0.0307	0.0199	0.06	0.00	0.00	0.06
Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	31.11	ConstMin - Rubber Tired Loaders	160	190.64	0.0128	0.0088	0.95	0.00	0.00	0.96
Hydraulic Excavator Cat. 330 244HP 2.25cy	31.11	ConstMin - Excavators	244	201.79	0.0111	0.0093	1.53	0.00	0.00	1.55
Rear Dump Truck 07-08 cy	86.42	N/A - onroad	n/a	565.853	0.003	0.089	0.05	0.00	0.00	0.05
Loader Backhoe C420-93HP 1.25cy- 15' depth	204.93	ConstMin - Tractors/Loaders/Backhoes	93	195.17	0.0144	0.0090	3.72	0.00	0.00	3.78
Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	21.78	ConstMin - Pavers	155	219.48	0.0197	0.0102	0.74	0.00	0.00	0.75
Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	21.78	ConstMin - Rollers	33	220.42	0.0338	0.0102	0.16	0.00	0.00	0.16
Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	21.78	ConstMin - Rollers	138	197.89	0.0132	0.0092	0.59	0.00	0.00	0.60
Total	**3,924.07**						**57.17**	**0.00**	**0.00**	**58.07**

Global Warming Potential

CO2	1
CH4	25
N2O	298

Conversions
1,000,000 grams per metric ton

Speed Limit
15 miles per hour

SR 152 Modifications
East Overlook Grading and Pavement

Table 20. Onsite Construction Equipment Emission Factors (East Overlook Grading and Pavement)

Equipment	Project Hours	OFFROAD Description	HP	Emission Factors (g/hp-hr or g/mi)			Annual Emissions (metric tons per year)			
				CO2	CH4	N2O	CO2	CH4	N2O	CO2e
On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	128.00	N/A - onroad	n/a	565.853	0.003	0.089	0.07	0.00	0.00	0.08
Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	400.29	ConstMin - Rollers	80	198.27	0.0172	0.0092	6.35	0.00	0.00	6.45
Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	35.56	ConstMin - Crawler Tractors	158	225.85	0.0199	0.0104	1.27	0.00	0.00	1.29
On-Highway Water Truck 4000 Gallon	2,675.24	N/A - onroad	n/a	565.853	0.003	0.089	1.51	0.00	0.00	1.58
Articulated Frame Grader Cat 12H 140HP	2,352.13	ConstMin - Graders	140	217.33	0.0148	0.0100	71.57	0.00	0.00	72.67
Hydraulic Excavator Cat. 325 186HP 1.50cy	364.73	ConstMin - Excavators	186	201.79	0.0111	0.0093	13.69	0.00	0.00	13.90
Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	2,274.95	ConstMin - Rollers	142	197.89	0.0132	0.0092	63.93	0.00	0.00	64.92
Total	**8,230.90**						**158.39**	**0.01**	**0.01**	**160.89**

Global Warming Potential

CO2	1
CH4	25
N2O	298

Conversions

1,000,000 grams per metric ton

Speed Limit

15 miles per hour

SR 152 Modifications
Haul Truck and Construction Worker Commuting Emissions

Table 21. Annual Unmitigated Emissions

	Truck Emission Factors (g/mi)	1,636.36	0.00	0.26	n/a
	Worker Emission Factors (g/mi)	242.73	0.00	0.00	n/a
	Annual VMT	**Annual Emissions (metric tons/year)**			
Vehicle Type	**(miles/year)**	**CO2**	**CH4**	**N2O**	**CO2e**
Haul Trucks	1,168,000	1,911.27	0.00	0.30	2,000.85
Construction Workers	2,704,000	656.34	0.00	0.01	659.70
Grand Total	**3,872,000**	**2,567.61**	**0.01**	**0.31**	**2,660.55**

Start Year: 2027

Global Warming Potential

CO2	1
CH4	25
N2O	298

Conversions

1,000,000 grams per metric ton

Speed Limit

15 miles per hour

One-Way Trip Distance

40 miles

Number of Construction Workers

130 workers per day

Truck Trips

29,200 trips per year

Construction Schedule

5 days per week
260 days per year

SR 152 Modifications
Marine Emissions

Table 22. Propulsion Engine Emission Factors

Vessel Type	Average HP	Fuel Consumption (lb/hr)	Fuel Consumption (gal/hr)	Emission Factor (kg/hr) CO2	Emission Factor (kg/hr) CH4	Emission Factor (kg/hr) N2O
Tug Boats	1,274	517	72	735.27	0.004	0.032

Note:
Barges and dredgers are not typically self-propelled and emissions from barge/dredger propulsion engines are not estimated.

Table 23. Annual Marine Vessel Emissions

Vessel Type	Quantity	Trips per project	Hours per Trip	No. Propulsion Engines	Propulsion Engine Emissions (MT/project) CO2	CH4	N2O	CO2e
Tug Boats	16	260	2	2	12,234.94	0.07	0.54	12,397.44
					GWP	1	25	298

Note:
Hours per trip estimated to assume that marine vessels would be operating 8 hours per day.
"Trips" represent one-day trips and are double the data provided by the engineers.

Conversion Factors
453.6 grams per pound
1,000 kilograms per metric ton
1,000 grams per kilogram

BSFC = 184 g/hp-hr (http://www.arb.ca.gov/regact/2007/chc07/appb.pdf)

Density
0.86 g/mL
7.18 lb/gal

Operating Schedule
10 hours per shift
5 days per week
260 days per year

On-Road Motor Vehicle Emission Factors

Table 24. Unmitigated Emission Factors for Construction Worker Commutes

	grams per mile		
Year	CO2	CH4	N2O
2020	304.93	0.0043	0.0071
2021	295.48	0.0037	0.0064
2022	286.08	0.0032	0.0058
2023	276.71	0.0028	0.0053
2024	267.46	0.0024	0.0048
2025	258.23	0.0022	0.0045
2026	250.22	0.0019	0.0042
2027	242.73	0.0017	0.0040
2028	236.05	0.0016	0.0038
2029	230.09	0.0014	0.0037
2030	224.80	0.0013	0.0036
2031	220.11	0.0012	0.0035
2032	215.98	0.0011	0.0034
2033	212.35	0.0010	0.0033
2034	209.17	0.0010	0.0033
2035	206.41	0.0009	0.0032

Note:
Vehicle fleet mix includes gasoline, diesel, and electric automobiles (LDA) and light-duty trucks (LDT1 and LDT2).

Table 25. Unmitigated Emission Factors for Haul and Delivery Trucks

	grams per mile		
Year	CO2	CH4	N2O
2020	1,892.05	0.0245	0.2974
2021	1,859.78	0.0198	0.2923
2022	1,793.76	0.0083	0.2820
2023	1,726.74	0.0020	0.2714
2024	1,704.13	0.0020	0.2679
2025	1,682.27	0.0019	0.2644
2026	1,660.70	0.0018	0.2610
2027	1,636.36	0.0018	0.2572
2028	1,614.47	0.0017	0.2538
2029	1,595.53	0.0017	0.2508
2030	1,577.22	0.0016	0.2479
2031	1,559.82	0.0016	0.2452
2032	1,542.35	0.0016	0.2424
2033	1,524.68	0.0016	0.2397
2034	1,505.70	0.0015	0.2367
2035	1,486.40	0.0015	0.2336

Table 26. Unmitigated Emission Factors for On-Site Water Trucks

Year	Speed	grams per mile		
		CO2	CH4	N2O
2020	5	935.12	0.0101	0.1470
2020	10	793.86	0.0075	0.1248
2020	15	673.79	0.0038	0.1059
2020	20	560.03	0.0017	0.0880
2020	25	471.42	0.0010	0.0741
2020	30	407.88	0.0008	0.0641
2020	35	370.08	0.0007	0.0582
2020	40	346.00	0.0006	0.0544
2020	45	333.76	0.0005	0.0525
2020	50	334.94	0.0005	0.0526
2020	55	352.63	0.0004	0.0554
2020	60	382.51	0.0004	0.0601
2020	65	429.10	0.0004	0.0674
2020	70	461.48	0.0004	0.0725
2021	5	914.16	0.0098	0.1437
2021	10	776.32	0.0073	0.1220
2021	15	658.76	0.0037	0.1035
2021	20	548.01	0.0016	0.0861
2021	25	460.59	0.0010	0.0724
2021	30	398.49	0.0008	0.0626
2021	35	361.78	0.0006	0.0569
2021	40	338.18	0.0005	0.0532
2021	45	326.45	0.0005	0.0513
2021	50	327.59	0.0004	0.0515
2021	55	344.89	0.0004	0.0542
2021	60	373.54	0.0004	0.0587
2021	65	419.69	0.0004	0.0660
2021	70	450.86	0.0004	0.0709
2022	5	892.70	0.0094	0.1403
2022	10	758.11	0.0070	0.1192
2022	15	643.43	0.0035	0.1011
2022	20	535.45	0.0015	0.0842
2022	25	449.59	0.0009	0.0707
2022	30	389.05	0.0007	0.0612
2022	35	353.26	0.0006	0.0555
2022	40	330.20	0.0005	0.0519
2022	45	318.90	0.0004	0.0501
2022	50	319.97	0.0004	0.0503
2022	55	336.71	0.0004	0.0529
2022	60	364.75	0.0004	0.0573
2022	65	409.74	0.0004	0.0644
2022	70	440.02	0.0004	0.0692
2023	5	870.76	0.0091	0.1369
2023	10	739.52	0.0068	0.1162
2023	15	627.74	0.0034	0.0987
2023	20	522.62	0.0014	0.0821
2023	25	438.41	0.0009	0.0689
2023	30	379.43	0.0007	0.0596
2023	35	344.58	0.0005	0.0542
2023	40	322.07	0.0005	0.0506
2023	45	311.19	0.0004	0.0489
2023	50	312.19	0.0004	0.0491
2023	55	328.40	0.0003	0.0516
2023	60	355.82	0.0003	0.0559
2023	65	399.63	0.0003	0.0628
2023	70	429.02	0.0003	0.0674

Table 26. Unmitigated Emission Factors for On-Site Water Trucks

Year	Speed	grams per mile		
		CO2	CH4	N2O
2024	5	848.21	0.0087	0.1333
2024	10	721.09	0.0065	0.1133
2024	15	612.12	0.0033	0.0962
2024	20	509.36	0.0014	0.0801
2024	25	427.09	0.0008	0.0671
2024	30	369.77	0.0006	0.0581
2024	35	335.79	0.0005	0.0528
2024	40	314.02	0.0004	0.0494
2024	45	303.30	0.0004	0.0477
2024	50	304.02	0.0003	0.0478
2024	55	319.84	0.0003	0.0503
2024	60	346.59	0.0003	0.0545
2024	65	389.39	0.0003	0.0612
2024	70	417.88	0.0003	0.0657
2025	5	825.11	0.0083	0.1297
2025	10	701.60	0.0062	0.1103
2025	15	595.60	0.0031	0.0936
2025	20	495.78	0.0013	0.0779
2025	25	415.44	0.0008	0.0653
2025	30	359.71	0.0006	0.0565
2025	35	326.69	0.0005	0.0514
2025	40	305.52	0.0004	0.0480
2025	45	295.17	0.0004	0.0464
2025	50	295.83	0.0003	0.0465
2025	55	311.17	0.0003	0.0489
2025	60	337.21	0.0003	0.0530
2025	65	378.80	0.0003	0.0595
2025	70	406.43	0.0003	0.0639
2026	5	803.64	0.0080	0.1263
2026	10	683.39	0.0060	0.1074
2026	15	580.62	0.0030	0.0913
2026	20	482.68	0.0012	0.0759
2026	25	404.74	0.0007	0.0636
2026	30	350.40	0.0006	0.0551
2026	35	318.08	0.0005	0.0500
2026	40	297.59	0.0004	0.0468
2026	45	287.37	0.0003	0.0452
2026	50	288.34	0.0003	0.0453
2026	55	304.08	0.0003	0.0478
2026	60	328.47	0.0003	0.0516
2026	65	368.60	0.0003	0.0579
2026	70	395.91	0.0003	0.0622
2027	5	783.15	0.0076	0.1231
2027	10	665.98	0.0057	0.1047
2027	15	565.85	0.0028	0.0889
2027	20	470.48	0.0012	0.0740
2027	25	394.45	0.0007	0.0620
2027	30	341.51	0.0005	0.0537
2027	35	310.01	0.0004	0.0487
2027	40	290.03	0.0004	0.0456
2027	45	280.08	0.0003	0.0440
2027	50	281.02	0.0003	0.0442
2027	55	296.37	0.0002	0.0466
2027	60	320.13	0.0002	0.0503
2027	65	359.28	0.0002	0.0565
2027	70	385.87	0.0002	0.0607

Table 26. Unmitigated Emission Factors for On-Site Water Trucks

		grams per mile		
Year	Speed	CO2	CH4	N2O
2028	5	764.04	0.0073	0.1201
2028	10	649.79	0.0055	0.1021
2028	15	552.19	0.0027	0.0868
2028	20	459.24	0.0011	0.0722
2028	25	384.99	0.0007	0.0605
2028	30	333.35	0.0005	0.0524
2028	35	302.59	0.0004	0.0476
2028	40	283.05	0.0003	0.0445
2028	45	273.35	0.0003	0.0430
2028	50	274.27	0.0003	0.0431
2028	55	289.26	0.0002	0.0455
2028	60	312.47	0.0002	0.0491
2028	65	350.74	0.0002	0.0551
2028	70	376.68	0.0002	0.0592
2029	5	746.66	0.0069	0.1174
2029	10	635.06	0.0052	0.0998
2029	15	539.62	0.0026	0.0848
2029	20	448.89	0.0010	0.0706
2029	25	376.35	0.0006	0.0592
2029	30	325.84	0.0005	0.0512
2029	35	295.79	0.0004	0.0465
2029	40	276.67	0.0003	0.0435
2029	45	267.19	0.0003	0.0420
2029	50	268.10	0.0002	0.0421
2029	55	282.77	0.0002	0.0444
2029	60	305.47	0.0002	0.0480
2029	65	342.90	0.0002	0.0539
2029	70	368.27	0.0002	0.0579
2030	5	730.92	0.0066	0.1149
2030	10	621.73	0.0050	0.0977
2030	15	528.25	0.0025	0.0830
2030	20	439.45	0.0010	0.0691
2030	25	368.55	0.0006	0.0579
2030	30	319.05	0.0004	0.0502
2030	35	289.61	0.0003	0.0455
2030	40	270.89	0.0003	0.0426
2030	45	261.58	0.0003	0.0411
2030	50	262.49	0.0002	0.0413
2030	55	276.87	0.0002	0.0435
2030	60	299.12	0.0002	0.0470
2030	65	335.79	0.0002	0.0528
2030	70	360.65	0.0002	0.0567
2031	5	716.57	0.0063	0.1126
2031	10	609.57	0.0048	0.0958
2031	15	517.85	0.0023	0.0814
2031	20	430.84	0.0009	0.0677
2031	25	361.48	0.0005	0.0568
2031	30	312.87	0.0004	0.0492
2031	35	284.00	0.0003	0.0446
2031	40	265.62	0.0003	0.0418
2031	45	256.47	0.0002	0.0403
2031	50	257.38	0.0002	0.0405
2031	55	271.50	0.0002	0.0427
2031	60	293.35	0.0002	0.0461
2031	65	329.34	0.0002	0.0518
2031	70	353.75	0.0002	0.0556

Table 26. Unmitigated Emission Factors for On-Site Water Trucks

		grams per mile		
Year	Speed	CO2	CH4	N2O
2032	5	703.42	0.0061	0.1106
2032	10	598.42	0.0046	0.0941
2032	15	508.31	0.0022	0.0799
2032	20	422.91	0.0009	0.0665
2032	25	355.01	0.0005	0.0558
2032	30	307.22	0.0004	0.0483
2032	35	278.86	0.0003	0.0438
2032	40	260.79	0.0003	0.0410
2032	45	251.77	0.0002	0.0396
2032	50	252.68	0.0002	0.0397
2032	55	266.57	0.0002	0.0419
2032	60	288.06	0.0002	0.0453
2032	65	323.44	0.0002	0.0508
2032	70	347.45	0.0002	0.0546
2033	5	691.51	0.0058	0.1087
2033	10	588.30	0.0044	0.0925
2033	15	499.64	0.0021	0.0785
2033	20	415.68	0.0009	0.0653
2033	25	349.15	0.0005	0.0549
2033	30	302.10	0.0004	0.0475
2033	35	274.20	0.0003	0.0431
2033	40	256.42	0.0003	0.0403
2033	45	247.50	0.0002	0.0389
2033	50	248.42	0.0002	0.0390
2033	55	262.09	0.0002	0.0412
2033	60	283.25	0.0002	0.0445
2033	65	318.09	0.0002	0.0500
2033	70	341.74	0.0002	0.0537
2034	5	680.87	0.0056	0.1070
2034	10	579.25	0.0042	0.0910
2034	15	491.87	0.0021	0.0773
2034	20	409.19	0.0008	0.0643
2034	25	343.93	0.0005	0.0541
2034	30	297.52	0.0004	0.0468
2034	35	270.03	0.0003	0.0424
2034	40	252.50	0.0002	0.0397
2034	45	243.67	0.0002	0.0383
2034	50	244.59	0.0002	0.0384
2034	55	258.07	0.0002	0.0406
2034	60	278.95	0.0001	0.0438
2034	65	313.31	0.0001	0.0492
2034	70	336.65	0.0001	0.0529
2035	5	671.38	0.0054	0.1055
2035	10	571.16	0.0040	0.0898
2035	15	484.93	0.0020	0.0762
2035	20	403.37	0.0008	0.0634
2035	25	339.26	0.0005	0.0533
2035	30	293.43	0.0004	0.0461
2035	35	266.30	0.0003	0.0419
2035	40	249.00	0.0002	0.0391
2035	45	240.24	0.0002	0.0378
2035	50	241.17	0.0002	0.0379
2035	55	254.48	0.0002	0.0400
2035	60	275.11	0.0001	0.0432
2035	65	309.04	0.0001	0.0486
2035	70	332.11	0.0001	0.0522

Table 27. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Bore/Drill Rigs	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Bore/Drill Rigs	50	0.0139	0.0140	0.0139	0.0138	0.0139	0.0139	0.0139	0.0139
ConstMin - Bore/Drill Rigs	75	0.0116	0.0117	0.0122	0.0122	0.0121	0.0121	0.0121	0.0121
ConstMin - Bore/Drill Rigs	100	0.0121	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Bore/Drill Rigs	175	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Bore/Drill Rigs	300	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Bore/Drill Rigs	600	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121
ConstMin - Bore/Drill Rigs	750	0.0123	0.0124	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Bore/Drill Rigs	9999	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Cranes	25	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
ConstMin - Cranes	50	0.0079	0.0079	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
ConstMin - Cranes	75	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	100	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	175	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	300	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	600	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	750	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Cranes	9999	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
ConstMin - Crawler Tractors	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Crawler Tractors	50	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116
ConstMin - Crawler Tractors	75	0.0105	0.0108	0.0107	0.0107	0.0108	0.0108	0.0108	0.0108
ConstMin - Crawler Tractors	100	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	175	0.0105	0.0105	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Crawler Tractors	300	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	600	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
ConstMin - Crawler Tractors	750	0.0104	0.0104	0.0105	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Crawler Tractors	9999	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Excavators	25	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Excavators	50	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Excavators	75	0.0093	0.0094	0.0095	0.0094	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	100	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	175	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	300	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	600	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Excavators	750	0.0094	0.0094	0.0094	0.0093	0.0094	0.0094	0.0094	0.0094
ConstMin - Excavators	9999	0.0094	0.0094	0.0094	0.0094	0.0093	0.0093	0.0093	0.0093
ConstMin - Graders	25	0.0111	0.0000	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Graders	50	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Graders	75	0.0103	0.0106	0.0103	0.0104	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	100	0.0099	0.0099	0.0099	0.0099	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	175	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	300	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Graders	600	0.0099	0.0099	0.0099	0.0098	0.0099	0.0099	0.0099	0.0099
ConstMin - Graders	9999	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Off-Highway Tractors	25	0.0118	0.0000	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Off-Highway Tractors	50	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Off-Highway Tractors	75	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	100	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107
ConstMin - Off-Highway Tractors	175	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	300	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	600	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	750	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Tractors	9999	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
ConstMin - Off-Highway Trucks	25	0.0000	0.0104	0.0000	0.0104	0.0104	0.0104	0.0104	0.0104
ConstMin - Off-Highway Trucks	50	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103
ConstMin - Off-Highway Trucks	75	0.0092	0.0095	0.0094	0.0094	0.0094	0.0094	0.0094	0.0094

Table 27. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Off-Highway Trucks	100	0.0094	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	175	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	300	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	600	0.0093	0.0093	0.0093	0.0093	0.0094	0.0094	0.0094	0.0094
ConstMin - Off-Highway Trucks	750	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
ConstMin - Off-Highway Trucks	9999	0.0093	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Other Construction Equipment	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Other Construction Equipment	50	0.0114	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
ConstMin - Other Construction Equipment	75	0.0100	0.0100	0.0101	0.0101	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	100	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	175	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	300	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	600	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Other Construction Equipment	750	0.0102	0.0102	0.0102	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Other Construction Equipment	9999	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Pavers	50	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
ConstMin - Pavers	75	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	100	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	175	0.0102	0.0102	0.0102	0.0102	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	300	0.0101	0.0101	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Pavers	600	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
ConstMin - Pavers	750	0.0101	0.0102	0.0101	0.0101	0.0000	0.0102	0.0102	0.0102
ConstMin - Pavers	9999	0.0000	0.0000	0.0000	0.0000	0.0102	0.0000	0.0000	0.0000
ConstMin - Paving Equipment	25	0.0000	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Paving Equipment	50	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Paving Equipment	75	0.0086	0.0086	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	100	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	175	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	300	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	600	0.0087	0.0087	0.0087	0.0086	0.0087	0.0087	0.0087	0.0087
ConstMin - Paving Equipment	750	0.0087	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
ConstMin - Paving Equipment	9999	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
ConstMin - Rollers	25	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Rollers	50	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102	0.0102
ConstMin - Rollers	75	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	100	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	175	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	300	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rollers	600	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092
ConstMin - Rough Terrain Forklifts	25	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109
ConstMin - Rough Terrain Forklifts	50	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109	0.0109
ConstMin - Rough Terrain Forklifts	75	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099
ConstMin - Rough Terrain Forklifts	100	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	175	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	300	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	600	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rough Terrain Forklifts	750	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Dozers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Rubber Tired Dozers	50	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107
ConstMin - Rubber Tired Dozers	75	0.0097	0.0097	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
ConstMin - Rubber Tired Dozers	100	0.0097	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Dozers	175	0.0097	0.0097	0.0096	0.0097	0.0096	0.0096	0.0096	0.0096
ConstMin - Rubber Tired Dozers	300	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
ConstMin - Rubber Tired Dozers	600	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
ConstMin - Rubber Tired Dozers	750	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097

Table 27. Off-Road Equipment N2O Emission Factors

		N2O Emission Factor (g/hp-hr)							
Vehicle Class	**HP Bin**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
ConstMin - Rubber Tired Loaders	25	0.0000	0.0000	0.0000	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Loaders	50	0.0099	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098
ConstMin - Rubber Tired Loaders	75	0.0088	0.0088	0.0088	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Rubber Tired Loaders	100	0.0087	0.0088	0.0087	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	175	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	300	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	600	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	750	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
ConstMin - Rubber Tired Loaders	9999	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089
ConstMin - Scrapers	25	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131	0.0131
ConstMin - Scrapers	50	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129
ConstMin - Scrapers	75	0.0119	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	100	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	175	0.0119	0.0118	0.0118	0.0118	0.0118	0.0119	0.0118	0.0118
ConstMin - Scrapers	300	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	600	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	750	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Scrapers	9999	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118	0.0118
ConstMin - Skid Steer Loaders	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Skid Steer Loaders	50	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
ConstMin - Skid Steer Loaders	75	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	100	0.0090	0.0090	0.0090	0.0090	0.0089	0.0089	0.0089	0.0089
ConstMin - Skid Steer Loaders	175	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	300	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	600	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Skid Steer Loaders	9999	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Surfacing Equipment	25	0.0000	0.0000	0.0000	0.0082	0.0082	0.0082	0.0082	0.0082
ConstMin - Surfacing Equipment	50	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082
ConstMin - Surfacing Equipment	75	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	100	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	175	0.0074	0.0074	0.0074	0.0073	0.0073	0.0073	0.0073	0.0073
ConstMin - Surfacing Equipment	300	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	600	0.0073	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	750	0.0074	0.0073	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Surfacing Equipment	9999	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
ConstMin - Sweepers/Scrubbers	25	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124	0.0124	0.0124
ConstMin - Sweepers/Scrubbers	50	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124
ConstMin - Sweepers/Scrubbers	75	0.0111	0.0111	0.0110	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	100	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	175	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	300	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	600	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Sweepers/Scrubbers	9999	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111	0.0111
ConstMin - Tractors/Loaders/Backhoes	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Tractors/Loaders/Backhoes	50	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099
ConstMin - Tractors/Loaders/Backhoes	75	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	100	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	175	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	300	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	600	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Tractors/Loaders/Backhoes	750	0.0086	0.0088	0.0089	0.0089	0.0089	0.0089	0.0089	0.0089
ConstMin - Tractors/Loaders/Backhoes	9999	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
ConstMin - Trenchers	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ConstMin - Trenchers	50	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137
ConstMin - Trenchers	75	0.0121	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Trenchers	100	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123

Table 27. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
ConstMin - Trenchers	175	0.0123	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
ConstMin - Trenchers	300	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	600	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	750	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
ConstMin - Trenchers	9999	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123	0.0123
Industrial - Aerial Lifts	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Industrial - Aerial Lifts	50	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Aerial Lifts	75	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	100	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	175	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	300	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Aerial Lifts	600	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Industrial - Forklifts	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Industrial - Forklifts	50	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055
Industrial - Forklifts	75	0.0048	0.0048	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	100	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	175	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	300	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	600	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Forklifts	9999	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
Industrial - Other General Industrial Equipment	25	0.0093	0.0093	0.0093	0.0093	0.0000	0.0093	0.0093	0.0093
Industrial - Other General Industrial Equipment	50	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093
Industrial - Other General Industrial Equipment	75	0.0083	0.0083	0.0084	0.0083	0.0084	0.0084	0.0084	0.0083
Industrial - Other General Industrial Equipment	100	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Other General Industrial Equipment	175	0.0083	0.0083	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
Industrial - Other General Industrial Equipment	300	0.0084	0.0084	0.0084	0.0084	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	600	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	750	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other General Industrial Equipment	9999	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
Industrial - Other Material Handling Equipment	25	0.0107	0.0107	0.0107	0.0107	0.0107	0.0107	0.0000	0.0107
Industrial - Other Material Handling Equipment	50	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108
Industrial - Other Material Handling Equipment	75	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0097	0.0096
Industrial - Other Material Handling Equipment	100	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	175	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
Industrial - Other Material Handling Equipment	300	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	600	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097
Industrial - Other Material Handling Equipment	750	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
Industrial - Other Material Handling Equipment	9999	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
OFF - ConstMin - Bore/Drill Rigs	25	0.0200	0.0201	0.0202	0.0203	0.0202	0.0202	0.0202	0.0202
OFF - ConstMin - Cement and Mortar Mixers	25	0.0151	0.0151	0.0151	0.0152	0.0151	0.0151	0.0151	0.0151
OFF - ConstMin - Concrete/Industrial Saws	25	0.0189	0.0186	0.0187	0.0195	0.0199	0.0202	0.0197	0.0193
OFF - ConstMin - Concrete/Industrial Saws	50	0.0199	0.0198	0.0199	0.0198	0.0198	0.0197	0.0196	0.0198
OFF - ConstMin - Dumpers/Tenders	25	0.0100	0.0100	0.0099	0.0101	0.0100	0.0101	0.0101	0.0102
OFF - ConstMin - Excavators	25	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154
OFF - ConstMin - Other Construction Equipment	25	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167
OFF - ConstMin - Pavers	25	0.0167	0.0166	0.0166	0.0166	0.0165	0.0166	0.0165	0.0166
OFF - ConstMin - Paving Equipment	25	0.0141	0.0141	0.0142	0.0141	0.0144	0.0145	0.0144	0.0143
OFF - ConstMin - Plate Compactors	25	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116
OFF - ConstMin - Rollers	25	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151
OFF - ConstMin - Rubber Tired Loaders	25	0.0144	0.0146	0.0146	0.0146	0.0145	0.0146	0.0144	0.0143
OFF - ConstMin - Signal Boards	25	0.0221	0.0221	0.0221	0.0222	0.0221	0.0222	0.0221	0.0221
OFF - ConstMin - Signal Boards	50	0.0223	0.0221	0.0221	0.0224	0.0221	0.0222	0.0220	0.0220
OFF - ConstMin - Skid Steer Loaders	25	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148
OFF - ConstMin - Tractors/Loaders/Backhoes	25	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148	0.0148
OFF - ConstMin - Trenchers	25	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202
OFF - Industrial - Aerial Lifts	25	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124

Table 27. Off-Road Equipment N2O Emission Factors

Vehicle Class	HP Bin	N2O Emission Factor (g/hp-hr)							
		2025	2026	2027	2028	2029	2030	2031	2032
OFF - Industrial - Other General Industrial Equipment	25	0.0137	0.0137	0.0138	0.0137	0.0137	0.0137	0.0137	0.0138
OFF - Industrial - Sweepers/Scrubbers	25	0.0182	0.0182	0.0182	0.0183	0.0182	0.0183	0.0183	0.0183
OFF - Light Commercial - Air Compressors	25	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0128	0.0129
OFF - Light Commercial - Air Compressors	50	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130	0.0130
OFF - Light Commercial - Generator Sets	25	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Generator Sets	50	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0199	0.0200
OFF - Light Commercial - Pressure Washers	25	0.0069	0.0069	0.0068	0.0069	0.0070	0.0070	0.0071	0.0072
OFF - Light Commercial - Pressure Washers	50	0.0073	0.0072	0.0074	0.0075	0.0076	0.0077	0.0076	0.0075
OFF - Light Commercial - Pumps	25	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Pumps	50	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
OFF - Light Commercial - Welders	25	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121	0.0121
OFF - Light Commercial - Welders	50	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122
Portable Equipment - Non-Rental Compressor	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Compressor	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Compressor	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Generator	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Generator	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Other Portable Equipment	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Other Portable Equipment	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Non-Rental Pump	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Non-Rental Pump	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Compressor	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081

Table 27. Off-Road Equipment N2O Emission Factors

		N2O Emission Factor (g/hp-hr)							
Vehicle Class	**HP Bin**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Portable Equipment - Rental Generator	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Generator	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Rental Other Portable Equipment	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Other Portable Equipment	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	50	0.0084	0.0085	0.0086	0.0087	0.0088	0.0089	0.0090	0.0091
Portable Equipment - Rental Pump	75	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	100	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	175	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	300	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	600	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	750	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081
Portable Equipment - Rental Pump	9999	0.0075	0.0076	0.0077	0.0078	0.0079	0.0080	0.0081	0.0081

N2O Emission Factor

0.472 grams per gallon

Source: The Climate Registry. 2020. Default Emission Factors. Table 2.7 U.S. Default Factors for Calculating CH4 and N2O Emissions from Non-Highway Vehicles, Construction/Mining Equipment, Diesel - Equ

Note:

Calculated fuel consumption factor (gallons per horsepower-hour) calculated from OFFROAD2017 and multiplied by N2O emission factor to convert to grams per horsepower-hour.

GHG Emission Factors

Table 28. US Default CO2 Emission Factors for Transport Fuels

Fuel Type	Carbon Content (Per Unit Energy)	Heat Content	Fraction Oxidized	CO2 Emission Factor (Per Unit Volume)
Fuels Measured in Gallons	**kg C / MMBtu**	**MMBtu / barrel**		**kg CO2 / gallon**
Gasoline	19.2	5.25	1	8.78
Diesel Fuel	20.2	5.80	1	10.21
Aviation Gasoline	18.9	5.04	1	8.31
Jet Fuel (Jet A or A-1)	19.7	5.67	1	9.75
Kerosene	20.5	5.67	1	10.15
Residual Fuel Oil No. 5	19.9	5.88	1	10.21
Residual Fuel Oil No. 6	20.5	6.30	1	11.27
Crude Oil	20.3	5.80	1	10.29
Biodiesel (B100)	20.1	5.38	1	9.45
Ethanol (E100)	18.7	3.53	1	5.75
Methanol	NA	NA	1	4.10
Liquefied Natural Gas (LNG)	NA	NA	1	4.46
Liquefied Petroleum Gas (LPG)	17.2	3.86	1	5.68
Propane (Liquid)	16.8	3.82	1	5.72
Ethane	17.1	2.86	1	4.11
Isobutane	17.7	4.16	1	6.30
Butane	17.8	4.33	1	6.54
Renewable Diesel (R100)	20.2	5.80	1	10.21
Fuels Measured in Standard Cubic Feet	**kg C / MMBtu**	**Btu / Standard cubic foot**		**kg CO2 / Standard cubic foot**
Compressed Natural Gas (CNG)	14.5	1,027	1	0.05444
Propane (Gas)	16.8	2,516	1	0.15
Renewable Diesel (R100)	14.5	1,027	1	0

Source: 2018 Climate Registry Default Emission Factors, Table 13.1
https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf

Table 29. US Default CH4 and N2O Emission Factors for Non-Highway Vehicles

Vehicle Type / Fuel Type	CH4 (g / gallon)	N2O (g / gallon)
Ships and Boats		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.06	0.45
Gasoline	0.64	0.22
Locomotives		
Diesel Fuel	0.80	0.26
Agricultural Equipment		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
Construction/Mining Equipment		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
Other Non-Highway		
Snowmobiles (Gasoline)	0.50	0.22
Other Recreational (Gasoline)	0.50	0.22
Other Small Utility (Gasoline)	0.50	0.22
Other Large Utility (Gasoline)	0.50	0.22
Other Large Utility (Diesel)	0.58	0.26
Aircraft		
Jet Fuel	0.00	0.31
Aviation Gasoline	7.05	0.11

Source: 2018 Climate Registry Default Emission Factors, Table 13.7
https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix F3: DWR Consistency Determination Forms

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DWR GHG Emissions Reduction Plan Consistency Determination Form

For Projects Using Contractors or Other Outside Labor

Print Form

This form is to be used by DWR project managers to document a DWR CEQA project's consistency with the DWR Greenhouse Gas Emissions Reduction Plan. This form is to be used only when DWR is the Lead Agency and when contractors or outside labor and equipment are use to implement the project.

Additional Guidance on filling out this form can be found at:
dwrclimatecange.water.ca.gov/guidance_resources.cfm

The DWR Greenhouse Gas Emissions Reduction Plan can be accessed at:
http://www.water.ca.gov/climatechange/CAP.cfm

California Department of Water Resources
1416 9th Steet
Sacramento, CA
95814
dwrclimatechange.water.ca.gov
www.water.ca.gov/climatechange

Project Name:	B.F. Sisk Dam Raise and Reservoir Expansion Project
Environmental Document type:	Draft EIR/SEIS
Manager's Name:	
Manager's email:	
Division:	
Office, Branch, or Field Division	

Short Project Description:

Alternative 3, the Dam Raise Alternative, would be completed by placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development by the B.F. Sisk SOD Modification Project. The 10-foot embankment raise would support an increase in reservoir storage capacity of 130 TAF. Under this alternative, there are three sub-alternatives that evaluate different operational configurations of this new storage capacity. The sub alternatives cover varying assignment and use of the increased storage space, as described in more detail below.

Project GHG Emissions Summary

Total Construction Emissions	271,595	$mtCO_2e$
Maximum Annual Construction Emissions	64,067	$mtCO_2e$

All other emissions from the project not accounted for above will occur as ongoing operational, maintenance, or business activity emissions and therefore have already been accounted for and analyzed in the GGERP.

Extraordinary Construction Project Determination

Do total project construction emissions exceed 25,000 $mtCO_2e$ for the entire construction phase or exceed 12,500 $mtCO_2e$ in any single year of construction.

- (●) Yes - Addition analysis is required, consult with C4
- ( ) No - Additional analysis not required

Project GHG Reduction Plan Checklist

- [x] All Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project. (Project Level GHG Emissions Reduction Measures)

Or

- [x] All feasible Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project and and Measures not incorporated have been listed and determined not be apply to the proposed project (include as an attachment)

- [x] Project does not conflict with any of the Specific Action GHG Emissions Reduction Measures (Specific Action GHG Emissions Reduction Measures)

Would implementation of the project result in additional energy demands on the SWP system of 15 GWh/yr or greater?

( ) Yes (•) No

If you answered Yes, attach a Renewable Power Procurement Plan update approval letter from the DWR SWP Power and Risk Office.

Is there substantial evidence that the effects of the proposed project may be cumulatively considerable notwithstanding the proposed project's compliance with the requirements of the DWR GHG Reduction Plan?

( ) Yes (•) No

If you answered Yes, the project is not eligible for streamlined analysis of GHG emissions using the DWR GHG Emissions Reduction Plan. (See CEQA Guidelines, section 15183.5, subdivision (b)(2).)

Based on the information provided above and information provided in associated environmental documentation completed pursuant to the above referenced project, the DWR CEQA Climate Change Committee has determined that the proposed project is consistent with the DWR Greenhouse Gas Reduction Plan and the greenhouse gasses emitted by the project are covered by the plan's analysis.

Project Manager Signature:		Date:
C4 Approval Signature:		Date:

Attachments:

- [x] GHG Emissions Inventory
- [ ] List and Explanation of excluded Project Level GHG Emissions Reduction Measures
- [ ] Plan to update Renewable Energy Procurement Plan from DWR SWP Power and Risk Office

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix G1: Noise and Vibration Supporting Information

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Appendix G1 Noise and Vibration Supporting Information

This appendix presents a framework for understanding noise and vibration levels. In addition, this appendix provides a detailed description of existing noise and vibration levels and sensitive receptors with the potential to be affected by the proposed action.

G1.1 Noise and Vibration Terminology

G1.1.1 Noise

Noise can be generally defined as unwanted sound. Sound, traveling in the form of waves from a source, is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level (referred to as sound level) is the most common descriptor used to characterize the loudness of an ambient sound level. It is measured in decibels (dB), with 0 dB corresponding roughly to the threshold of human hearing and 120–140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency but rather a broad band of frequencies varying in levels of magnitude (sound power). The sound pressure level therefore constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. Consequently, when assessing potential noise impacts, sound is measured using an electronic filter that deemphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies and greater sensitivity to mid-range frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted dB (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in Table 1.

Table 1. Typical Noise Levels

	Noise Level (dBA)
Common Outdoor Activities	
Jet flyover at 1,000 feet	105
Gas lawnmower at 3 feet	95
Diesel truck at 50 feet at 50 mph	85
Noise urban area, daytime	75
Gas lawnmower, 100 feet	70

	Noise Level (dBA)
Commercial area	65
Heavy traffic at 300 feet	60
Quiet urban daytime	50
Quiet urban nighttime	40
Quite suburban nighttime	35
Quiet rural nighttime	25
Common Indoor Activities	
Rock band	110
Food blender at 3 feet	85
Garbage disposal at 3 feet	80
Vacuum cleaner at 10 feet	70
Normal speech at 3 feet	65
Large business office	55
Dishwasher in next room	50
Theater, large conference room (background)	40
Library	30
Bedroom at night, concert hall (background)	25
Broadcast/recording studio	15

Source: California Department of Transportation (Caltrans) 2013a
dBA = A-weighted decibel scale
mph = miles per hour

A key concept in evaluating potential noise impacts is the perceived effect of incremental increase in existing noise levels. Table 2 presents the effect of increasing noise levels. For example, the table shows that an increase of 3 dBA is barely perceptible, an increase of 5 dBA is noticeable, and a 10 dBA increase would be perceived by someone to be a doubling of noise.

Table 2. Decibel Changes, Loudness, and Energy Loss

Sound Level Change (dBA)	Relative Loudness/ Impact	Acoustical Energy Gain (%)
0	Reference	0
+3	Barely Perceptible Change	50
+5	Noticeable Change	67
+10	Twice as Loud	90
+20	Four Times as Loud	99

Source: Federal Highway Administration (FHWA) 2011
dBA = A-weighted decibel scale

Noise analyses and regulations use the following terms:

- **L_{eq}: Equivalent energy level** – A-weighted sound level corresponding to a steady-state sound level that contains the same total energy as a varying signal over a given sample period. This is typically computed over 1-, 8-, and 24-hour sample periods.

- **L_{dn}: Day-night average level** – the energy average sound level for a 24-hour day determined after the addition of a 10 dBA penalty to all noise events occurring at night between 10:00 p.m. and 7:00 a.m. This is a useful measure for community noise impact because people in their homes are much more sensitive to noise at night when they are relaxing or sleeping than they are in the daytime.

- **L_{max}: Maximum noise level** – representing the highest sound level measured for a given period.

- **L_{min}: Minimum noise level** – representing the lowest sound level measured for a given period.

- **L_x: Statistical noise descriptor** – the noise level exceeded X% of a specified time period. For example, L_{10} indicates the noise level that is exceeded 10% of the time during a given period.

- **CNEL: Community Noise Equivalent Level** – a 24-hour average L_{eq} that includes the addition of five dBA to sound levels from 7:00 p.m. to 10:00 p.m. and an addition of 10 dBA to sound levels from 10:00 p.m. to 7:00 a.m. The CNEL is commonly used in California instead of the L_{dn}.

Noise effects on humans can range from annoyance to physical discomfort and harm. Sleeping patterns, speech communication, mental acuity, and heart and breathing rates can all be disturbed by noise. Perception of the noise is affected by its pitch, loudness, and character.

Sound levels from isolated point sources of noise typically decrease by about 6 dBA for every doubling of distance from the noise source. When the noise source is a continuous line, such as vehicle traffic on a highway, sound levels decrease by about 3 dBA for every doubling of distance. Noise levels also can be affected by several factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can affect the reduction of noise levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) and the presence of dense vegetation also can affect the degree to which sound is attenuated over distance.

G1.1.2 Vibration

Vibration refers to ground-borne noise and perceptible motion. The most common impacts from ground-borne vibration include annoyance, movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, disruption of vibration-sensitive operations or activities, and triggering of landslides. Vibrations caused by construction can be interpreted as energy transmitted in waves through the soil mass. These energy waves generally dissipate with distance from the vibration source due to spreading of the energy and frictional losses. Thus, ground-borne vibrations from most construction activities rarely reach the levels that can damage structures but can achieve the perceptible ranges in buildings close to construction sites (Federal Transit Authority [FTA] 2006).

In extreme cases, vibration can cause damage to buildings or equipment. In most circumstances, common ground-induced vibrations related to roadway traffic and construction activities pose no threat to buildings or structures, with the occasional exception of blasting and sheet pile-driving during construction. To assess the potential for structural damage associated with vibration, the vibratory ground motion near the affected structure is measured in terms of peak particle velocity (PPV) in the vertical and horizontal directions, typically in units of inches per second (in/sec). The PPV is defined as the maximum instantaneous peak of the vibration signal. California Department of Transportation (Caltrans) estimates that frequent generation of vibration at levels exceeding 0.3 in/sec can damage older residential structures and cause annoyance to humans (Caltrans 2013b).

Annoyance from vibration often occurs when the vibration exceeds the threshold of perception. A vibration level that causes annoyance would be well below the damage threshold for normal buildings. Ground-borne vibration generally does not provoke adverse human reaction to those who are outdoors, as the effects associated with the shaking of building are absent.

Construction activities can either result in continuous or single-impact (transient) vibration impacts. Typical equipment or activities that could result in continuous vibration impacts include excavation equipment, traffic, vibratory pile drivers, and vibratory compaction equipment; examples of transient vibration sources include blasting and drop balls. Some construction activities, like jackhammers or impact pile drivers, can continually generate single transient events at a high frequency; however, for evaluation purposes, such equipment would be regarded as having frequent or continuous vibration impacts.

G1.1.2.1 Area of Analysis

The area of analysis for noise includes San Luis Reservoir (Merced County) where construction would occur. Figure 1 shows the area of analysis and the sensitive receptors for the dam raise actions under Alternative 3. Figure 2 shows the area of analysis and sensitive receptors for the State Route (SR) 152 modifications under Alternative 3.

G1.2 Existing Conditions

Noise sources currently existing in the area of analysis are of three general types: agricultural noise, general stationary noise, and general mobile noise. No major sources of vibration are known to exist in the area of the San Luis Reservoir.

Farm operations produce noise from a variety of sources. These sources include heavy equipment for plowing and harvesting, dairy equipment, crop-spraying aircraft, wind turbines for frost protection, on-site processing equipment, and irrigation water pumps. In addition to affecting the farmers and farm laborers, agricultural noise affects those living in or near agricultural areas.

General stationary noises (i.e., those emanating from fixed locations) are associated with a variety of land uses. Stationary sources include air conditioning units, power tools, motors, generators, appliances, and manufacturing and industrial facilities. Noise-sensitive receptors may have stationary noise sources at their locations.

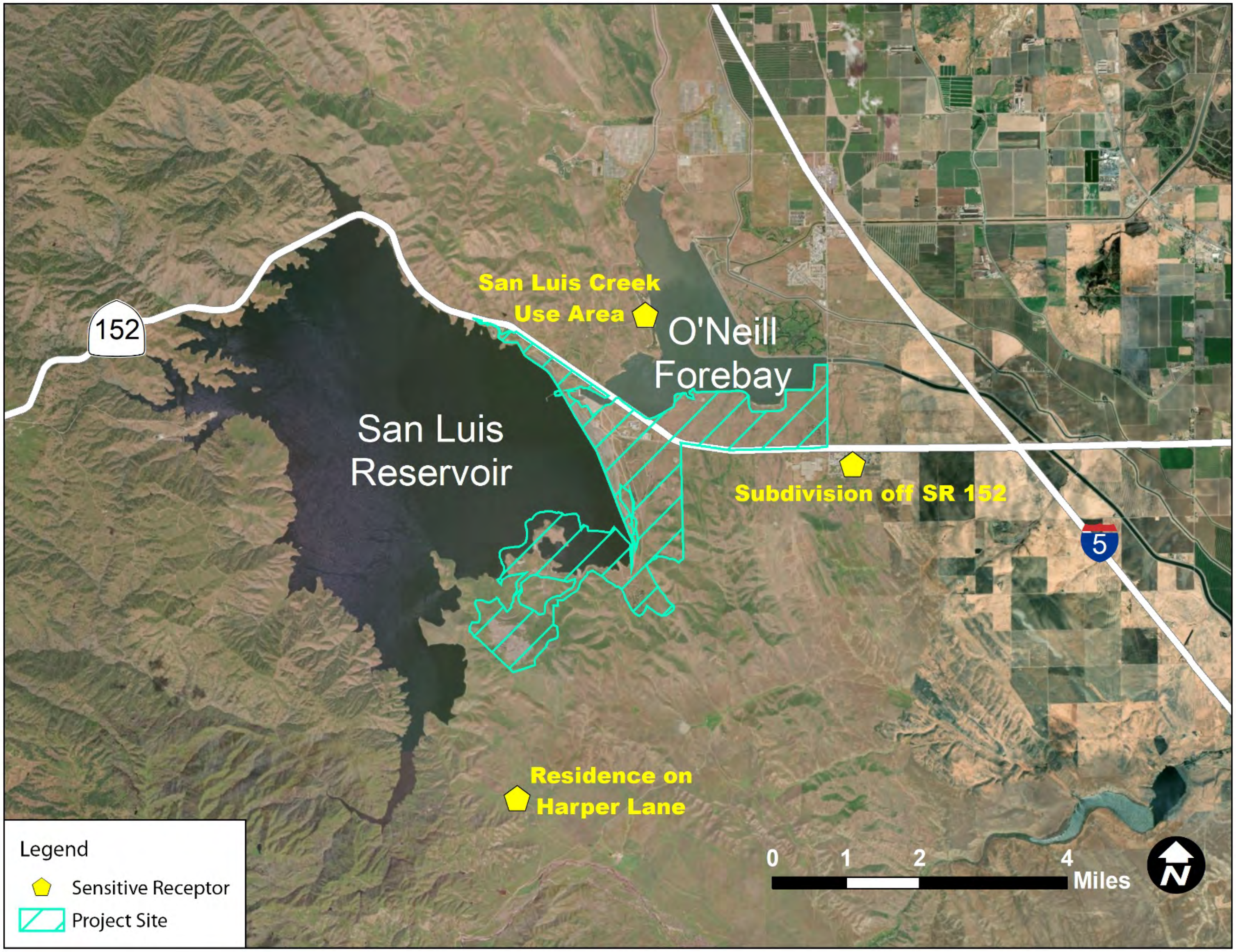


Figure 1. Noise and Vibration Area of Analysis for Dam Raise Action

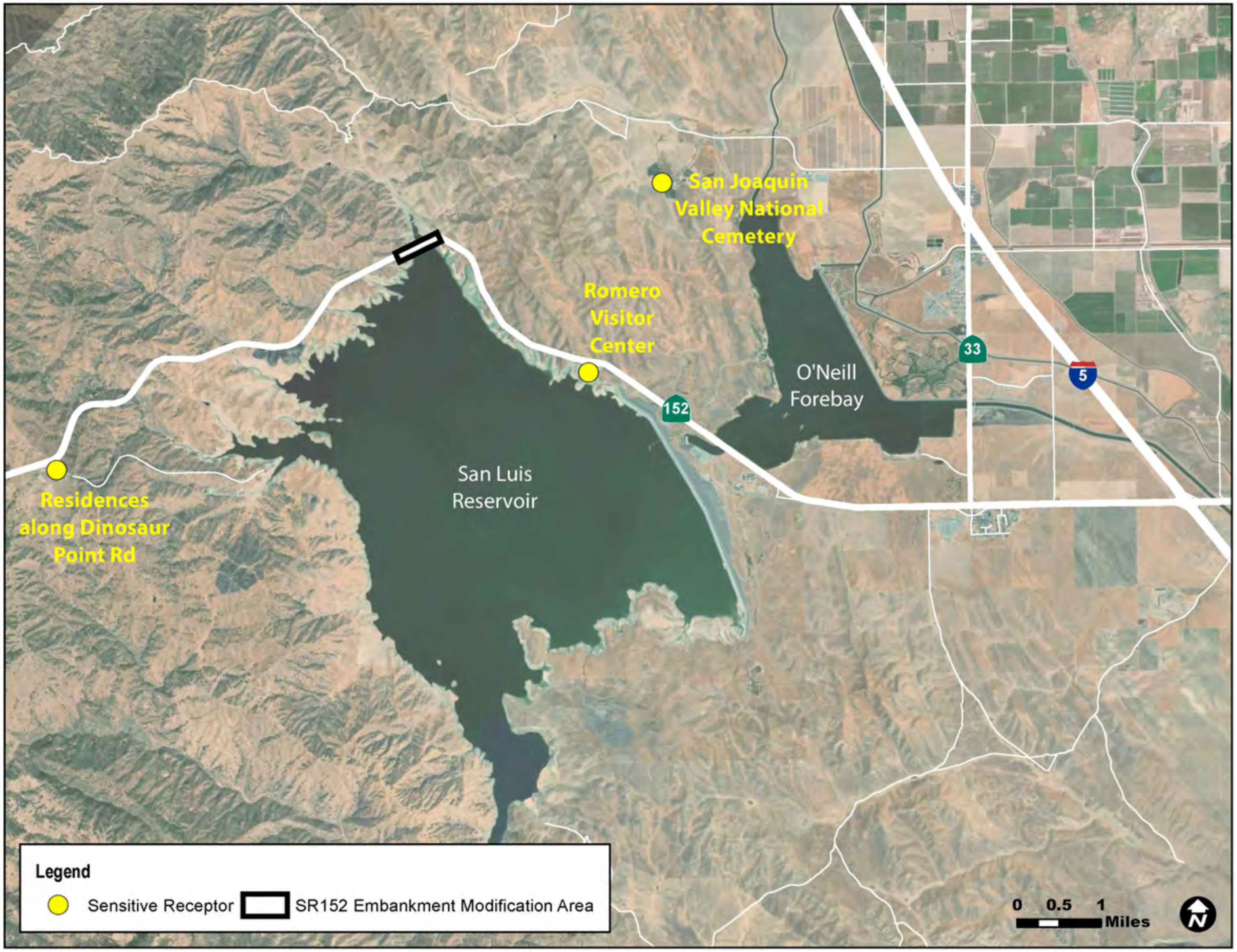


Figure 2. Noise and Vibration Area of Analysis for SR 152 Modifications

General mobile noise sources include vehicles, aircraft, and trains. Mobile noise is usually temporary and variable but can be intense and annoying because of its abruptness and intensity. In urban areas, these mobile sources contribute to the ambient noise.

Merced County varies from rural to urban environments and includes farming, industrial, residential, and commercial noise sources. The sections below describe the prevailing noise conditions (and vibration conditions, if unusual) and noise-and vibration-sensitive receptors in the area of analysis. Overall, no major long-term sources of vibration are known to exist in the area of analysis.

G1.2.1 Merced County

As summarized in Chapter 3, in specific areas of Merced County, transportation noise is the dominant noise source. These sources include railroads, vehicular traffic, and airports (Merced County has five general aviation airports). Other areas of the county are dominated by agricultural land uses and are relatively quiet. Freight and passenger trains pass through Merced County frequently and constitute a primary source of noise. The county's rail traffic includes both high- and low-speed lines.

Specific noise sources throughout Merced County include sand and gravel excavation; a biomass electrical generating plant; trucking companies; chicken farms; fruit, nut, and vegetable processing and packaging plants; dog kennels; auto wreckers; winery processing facilities; dairies; recreational boating; and an auto racetrack.

The noise source closest to the proposed alternatives near San Luis Reservoir is the O'Neill Forebay Recreational Boating area. Motorboats are the main source of noise at O'Neill Forebay.

The *2030 Merced County General Plan Background Report* (Merced County 2012) includes predicted traffic noise levels and traffic noise level increases expected with buildout associated with the general plan. The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model was used in the general plan to predict hourly L_{eq} values for free-flowing traffic conditions. To predict L_{dn} values, the input volume was adjusted to account for the day/night distribution of traffic. The 2016 traffic volume data from Caltrans (2017) shows annual average daily traffic (AADT) volumes on SR 152 that are similar to those listed in Table 3.

Table 3. Traffic Noise Level Data, Merced County

SR 152 Segment	Existing (2010) AADT	Existing (2010) L_{dn} @ 100 Feet (dB)	2030 No Project L_{dn} @ 100 Feet (dB)	Change from Existing (dB)	2030 Buildout L_{dn} @ 100 Feet (dB)	Change from Existing (dB)
Santa Clara County Line to SR 33	23,800	74	78	5	78	5
SR 33 to Interstate 5	23,000	74	79	5	79	5
Interstate 5 to Ortigalita Rd. (West Los Banos)	21,600	72	77	5	77	5
Ortigalita Rd. to SR 165	26,500	73	74	1	74	1
SR 165 to Ward Rd. (East Los Banos)	32,000	74	74	0	74	0

SR 152 Segment	Existing (2010) AADT	Existing (2010) L_{dn} @ 100 Feet (dB)	2030 No Project L_{dn} @ 100 Feet (dB)	Change from Existing (dB)	2030 Buildout L_{dn} @ 100 Feet (dB)	Change from Existing (dB)
Ward Rd. to SR 33 (Dos Palos)	17,500	72	75	3	75	3
SR 33 to SR 59	15,300	72	73	2	73	2
SR 59 to Madera County Line	15,400	71	73	2	73	2

Source: Merced County 2012
AADT = annual average daily traffic
dB = decibel
L_{dn} = day-night average noise level
SR = state route

Merced County (2013) performed a community noise survey in 2006 for the general plan to quantify existing noise levels in the quieter parts of the county. The survey included a monitoring location in the unincorporated town of Santa Nella, approximately 2 miles northeast of the reservoir. Based on the noise measurement results summarized in Table 4, a L_{dn} of 56 dBA was estimated for this location. Noise sources included traffic noise from the interstate and natural sounds.

Table 4. Merced County Noise Survey Data for the Town of Santa Nella

Time Period	L_{eq} (dB)	L_{max} (dB)
Morning	45.9	52.6
Afternoon	51.9	61.8
Nighttime	49.6	57.2

Source: Merced County 2013
dB = decibel
L_{eq} = equivalent (average) noise level
L_{max} = maximum noise levels

G1.2.2 San Luis Reservoir

Noise monitoring conducted for the project consisted of continuous 24-hour noise readings at the San Luis Creek Use Area and campground on O'Neill Forebay. Additionally, spot-check noise readings were taken at several recreational locations at San Luis Reservoir. Table 5 lists the 24-hour noise readings taken at the San Luis Creek campground. The quietest noise levels were measured during the early afternoon during periods of calm winds; these measured 36–38 dBA 1-hour L_{eq} at the San Luis Creek Use Area. The noise levels increased at night from wind rustling the leaves in surrounding trees. Nighttime noise levels increased to 42 dBA 1-hour L_{eq} around the San Luis Creek Use Area.

Table 5. 24-Hour Baseline Noise Monitoring Results in Proposed Project Area (at San Luis Creek Campground)

Date	Time	1-hour L_{eq} (dBA)
9/11/2003	13:00	46
	14:00	38
	15:00	38
	16:00	37
	17:00	36
	18:00	36
	19:00	38
	20:00	37
	21:00	40
	22:00	40
	23:00	38
9/12/2003	0:00	38
	1:00	38
	2:00	37
	3:00	42
	4:00	39
	5:00	40
	6:00	41
	7:00	39
	8:00	44
	9:00	41
	10:00	40
	11:00	40

Source: Santa Clara Valley Water District 2003
dBA = A-weighted decibel scale
L_{eq} = equivalent energy level

Table 6 summarizes the findings from noise monitoring completed at recreational sites around San Luis Reservoir and O'Neill Forebay. Measured daytime noise levels at campgrounds and picnic areas were low, ranging from 39 to 43 dBA L_{eq} (5-, 10-, and 15-minute durations), with most of the observed noise generated by cars traveling on nearby park roads. Power boats on the reservoir are an additional noise source.

Table 6. Baseline Noise Monitoring Results

Location	Date	Start Time	Duration (minutes)	L_{eq} (dBA)	Dominant Noise Sources
Medeiros Picnic Area	9/11/2003	3:35 p.m.	10	43	Cars on local park road
Basalt Area Campground #5	9/11/2003	2:55 p.m.	10	42	Cars on campground road
Dinosaur Point Picnic Area	9/12/2003	10:14 a.m.	10	40	Very quiet
Visitor Center	9/11/2003	9:46 a.m.	15	48	Traffic on SR 152, cars in parking lot
San Luis Creek Area Boat Launch	9/11/2003	11:07 a.m.	10	42	Cars in parking lot, airplanes
Pacheco State Park (at gate to Dinosaur Point)	9/12/2003	10:45 a.m.	5	39	Very quiet; some wind noise

Source: Santa Clara Valley Water District 2003
dBA = A-weighted decibel scale
L_{eq} = equivalent energy level

The *San Luis Reservoir Resource State Recreation Area Final Resource Management Plan/General Plan and Final Environmental Impact Statement/Environmental Impact Report* (United States Department of the Interior, Bureau of Reclamation [Reclamation] and California Department of Parks and Recreation [CDPR] 2013) identifies noise-sensitive land uses around the reservoir. The Basalt Use Area and the Dinosaur Point Use Area would be closed during construction and are not included as noise-sensitive receptors in this analysis. Additionally, the operations and maintenance facilities for the California Department of Water Resources (DWR) and the Gianelli Pumping Plant were not included as noise-sensitive receptors because they are on-site workers and are covered by Occupational Safety and Health Administration (OSHA) noise regulations to protect workers from excessive noise exposure. The receptors analyzed include:

- Romero Visitor Center (located along SR 152 west of the Gonzaga Road entrance).
- San Luis Wildlife Area (managed by the California Department of Fish and Wildlife, located at the western edge of the reservoir, north of Pacheco State Park); this area is designated for hiking, bird watching, and hunting. There are no developed facilities in this area.
- O'Neill Forebay Wildlife Area (located northeast of the O'Neill Forebay); this area is used for hunting and passive recreation.
- San Luis Creek Use Area (located on the north side of SR 152, west of O'Neill Forebay); this area is the most developed within the project area and contains group and recreational vehicle camping, a swimming beach, boat launch site, and picnic areas.
- Medeiros Use Area (located on the south side of the O'Neill Forebay and north of SR 152); this area is predominantly used for windsurfing and camping.
- Los Banos Creek Use Area (located southeast of the San Luis Reservoir approximately 1.5 miles west of Interstate 5); this area contains flood management facilities, hiking trails, camping, and picnic areas, among other recreational uses.

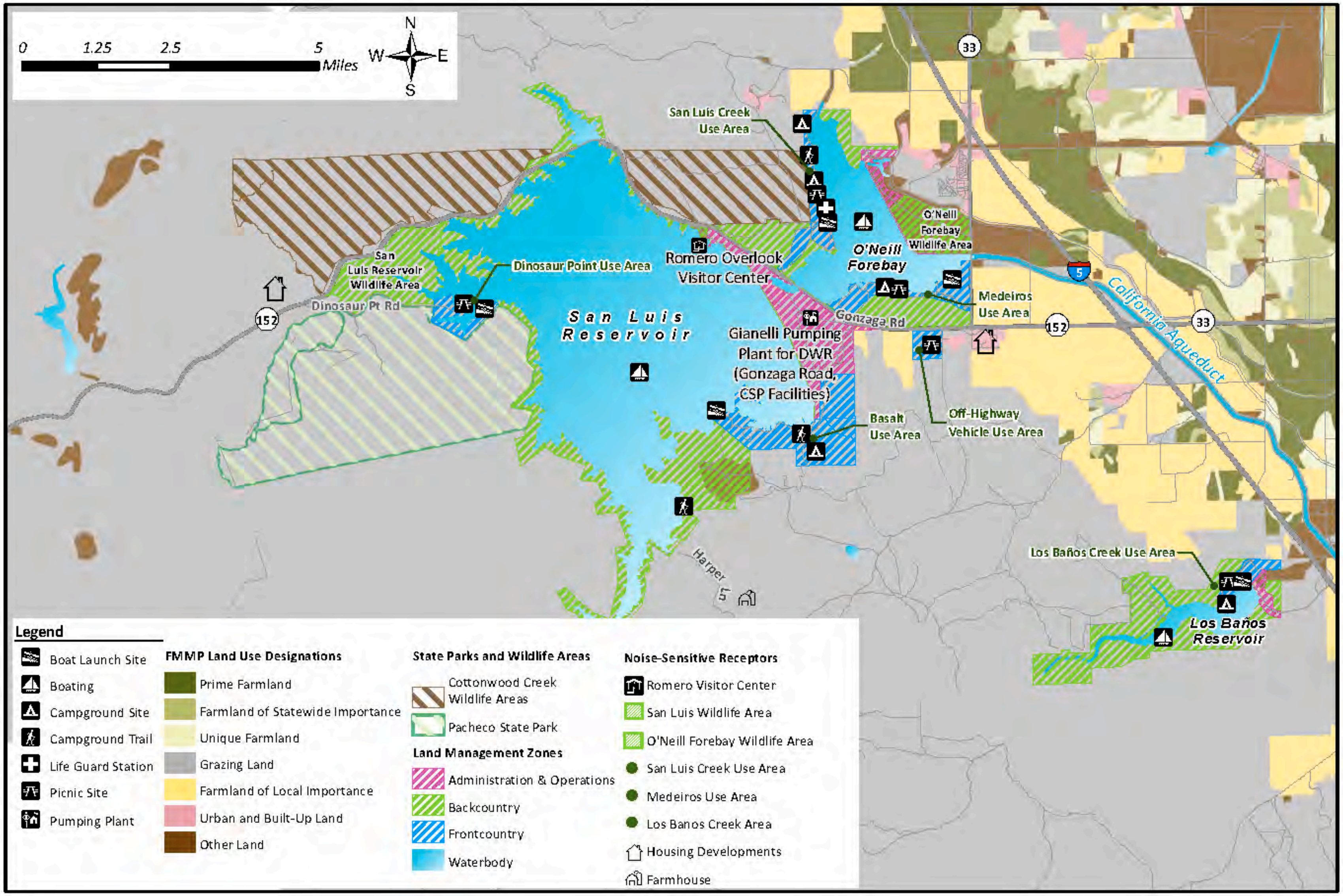
Land uses surrounding San Luis Reservoir consist mainly of publicly owned parkland and wildlife areas maintained and managed by the State of California. Several campgrounds and day-use picnic areas present along the shores of the reservoir and forebay are relatively close to areas where construction activities would take place under Alternative 3. The residences nearest potential construction sites at San Luis Reservoir include a cluster of homes on Dinosaur Point Road between SR 152 and Whiskey Flat Trail and a farmhouse located approximately 1 mile southeast of the reservoir along Harper Lane. Northeast of O'Neill Forebay, housing tracts face SR 33, which would be a travel route for workers and haul trucks. Figure 3 shows these noise-sensitive land uses around San Luis Reservoir.

G1.3 Assessment Methods

This section describes the approach and methods used to analyze the noise and vibration impacts related to construction and operation of the project alternatives. The focus of this analysis is on potential temporary construction and long-term impacts to local noise-sensitive receptor sites located near the proposed alternatives. Off-site vehicle trip assumptions are consistent with those used in Section 4.7, Traffic and Transportation, and construction and operational activities are consistent with those used in Section 4.3, Air Quality.

Activities with the potential for generating short-term, temporary increases in noise levels include construction activities and construction-related traffic. No long-term noise impacts from operation are anticipated. Activities that would have no or negligible noise impacts include the implementation of nonstructural measures, including operational changes to San Luis Reservoir.

The noise level at nearby sensitive receptors during the construction of each alternative was calculated by (1) attenuating the construction sound level for distance to the receptor and (2) logarithmically adding the attenuated construction noise source level to the ambient noise level. Ambient noise levels used for Alternative 3 noise analysis include B.F. Sisk Dam SOD Modification Project construction actions (102 dBA for daytime and 88 dBA for nighttime).Construction noise was predicted using the equations and guiding principles from the FHWA Roadway Construction Noise Model (RCNM). The RCNM database provides maximum noise levels for various pieces of construction equipment at a reference distance of 50 feet. The types of construction equipment that could be used during the construction of each alternative, the percentage of time that the equipment would operate at full power (usage factor) during an hour, and each piece's maximum noise level are presented in Table 7. The construction equipment for the dam raise portion of Alternative 3 is anticipated to operate 24 hours per day, seven days per week, 12 months per year for 8 years (2025–2032). Blasting operations at Basalt Hill would be limited to the hours between 6:00 a.m. and 6:00 p.m. Construction equipment for the SR 152 modification portion of Alternative 3 is anticipated to operate 18–24 months (2027–2029).



Source: Reclamation and CDPR 2013

Figure 3. Noise-Sensitive Land Uses Near San Luis Reservoir

Table 7. Construction Equipment Types and Noise Levels

Equipment Type	Usage Factor	L_{max} at 50 Feet
All Other Equipment Greater than 5 hp	50%	85
Auger Drill Rig	20%	84
Compactor (ground)	20%	83
Concrete Mixer Truck	40%	79
Concrete Pump Truck	20%	81
Concrete Saw	20%	90
Crane	16%	81
Dozer	40%	82
Drill Rig Truck	20%	79
Dump Truck	40%	76
Excavator	40%	81
Flat Bed Truck	40%	74
Front End Loader	40%	79
Generator	50%	81
Grader	40%	85
Roller	20%	80
Scraper	40%	84
Slurry Trenching Machine	50%	80

Source: FTA 2006
hp = horsepower
L_{max} = maximum noise level measured during a monitoring period

G1.4 Significance Criteria

The significance criteria described below were developed consistent with the CEQA guidelines (applicable to this project) to determine the significance of potential impacts on noise that could result from implementation of the project. As summarized in Section 4.6, impacts on noise would be considered potentially significant if the project would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance or applicable standards of other agencies
- Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels
- Exposure of persons residing or working within a project area with excessive noise levels located within an airport land use plan or within 2 miles of a public airport or public use airport where such plan has not been adopted.

The Merced County Code (see Sections C.3.1 and C.3.2 in Appendix C) sets sound level limitations that no sound source should exceed the background sound level at the receiving property line by 10 dBA or more during the daytime hours (7:00 a.m. to 10:00 p.m.) and by 5 dBA or more during the nighttime hours (10:00 p.m. to 7:00 a.m.). However, the county's ordinance exempts construction activities during the daytime hours between 7:00 a.m. and 6:00 p.m. Therefore, noise levels would be significant if they exceed the background sound level by 5 dBA or more during the nighttime hours. Project construction and operation that produce vibration levels that exceed 0.3 in/sec would be significant (Caltrans 2013b).

The significance criteria described above apply to the noise receptors that could be affected by the project. Changes in noise are determined relative to existing conditions and the No Project/No Action Alternative.

G1.5 Noise and Vibration Calculation Summary Tables

G1.5.1 Alternative 1 – No Project/No Action

Table 8 summarizes the daytime and nighttime unmitigated L_{eq} that would occur at the nearest sensitive receptor from each construction area for the crest raise actions under the No Project/No Action Alternative. Noise levels at San Luis Creek Use Area and the subdivision off SR 152 would exceed the daytime significance criterion of a 10 dBA increase and the nighttime significance criteria of a 5 dBA increase.

Table 8. Maximum 1-Hour Daytime and Nighttime Construction Phase Leq (dBA) Under No Project/No Action Alternative

Sensitive Receptor	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Daytime			
Residence on Harper Lane	42	2	No
San Luis Creek Use Area	57	17	Yes
Subdivision off SR 152	51/ 52*	11/ 12*	Yes
Nighttime			
Residence on Harper Lane	32	2	No
San Luis Creek Use Area	46	16	Yes
Subdivision off SR 152	41	11	Yes

Note:
[1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day and 30 dBA at night.
* =increased dBA level if conveyor option was utilized
Key: dBA = A-weighted decibel scale

Table 9 summarizes the peak day maximum PPV (in/sec) at sensitive receptors for the crest raise actions under the No Project/No Action Alternative. No construction actions under the No Project/No Action Alternative would generate PPV levels above the 0.3 in/sec significance threshold.

Table 9. Peak Day Maximum PPV at Sensitive Receptors Under No Project/ No Action Alternative

Sensitive Receptor	Maximum PPV (in/sec)	Significant?
Residence on Harper Lane	0.003160	No
San Luis Creek Use Area	0.015836	No
Subdivision off SR 152	0.008856	No

Key: in/sec= inches per second; PPV= peak particle velocity

G1.5.2 Alternative 3 – B.F. Sisk Dam Raise

G1.5.2.1 Construction of Dam Raise

Table 10 summarizes the daytime and nighttime unmitigated L_{eq} that would occur at the nearest sensitive receptor from each construction area for the dam raise action under Alternative 3. Construction actions associated with the dam raise would not increase noise levels at sensitive receptors above 102 dBA (daytime) and 88 dBA (nighttime) already experienced under the No Project/ No Action Alternative.

Table 10. Maximum 1-Hour Construction Phase L_{eq} (dBA) Increase Over No Project/No Action Alternative – Alternative 3 (Dam Raise Construction)

Sensitive Receptor	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?
Daytime			
Residence on Harper Lane	102	0	No
San Luis Creek Use Area	102	0	No
Subdivision off SR 152	102	0	No
Nighttime			
Residence on Harper Lane	88	0	No
San Luis Creek Use Area	88	0	No
Subdivision off SR 152	88	0	No

[1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day and 30 dBA at night.
dBA = A-weighted decibel scale

Table 11 summarizes the peak day maximum PPV (in/sec) at sensitive receptors for the dam raise action under Alternative 3. Detailed calculations are provided in Appendix G2. No construction actions under the dam raise would generate PPV levels above the 0.3 in/sec significance threshold; therefore, vibration impacts would be less than significant.

Table 11. Peak Day Maximum PPV at Sensitive Receptors near the Dam Raise Construction

Sensitive Receptor	Maximum PPV (in/sec)	Significant?
Residence on Harper Lane	0.000142	No
Residence on unnamed access road	0.000712	No
Residence off SR 152	0.000398	No

Reference distance for blasting is 2,500 feet.
Significance threshold: 0.3 in/sec
in/sec= inch per second
PPV= peak particle velocity

G1.5.2.2 SR 152 Modifications

Tables 12 and 13 summarizes the daytime and nighttime unmitigated L_{eq} that would occur at the nearest sensitive receptor from the construction area for the SR 152 modifications under Alternative 3. Construction actions associated with SR 152 modifications would not increase noise levels at sensitive receptors above 102 dBA (daytime) and 88 dBA (nighttime) already experienced under the No Project/No Action Alternative.

Table 12. Maximum 1-Hour Daytime Construction Phase L_{eq} (dBA) Increase Over No Project/No Action Alternative – Alternative 3 (SR 152 Modifications)

Construction Phase	Total Noise Level[1](dBA)	Increased Noise Level (dBA)	Significant?[2]
Romero Visitor Center Sensitive Receptor			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	102	0	No
RCP Culvert	102	0	No
Riprap	102	0	No
Filter	102	0	No
Lakeside Embankment	102	0	No
Lakeside Pavement	102	0	No
Bayside Embankment	102	0	No
Bayside Pavement	102	0	No
Stormwater System	102	0	No
East Overlook Grading and Pavement			
Riprap	102	0	No
East Overlook Grading	102	0	No
East Overlook Parking Pavement Demolition and Rebuild	102	0	No
Basalt Hill Site Development			
Basalt Hill Docking Area	102	0	No
Basalt Hill Aggregate Road Development	102	0	No

Construction Phase	Total Noise Level[1](dBA)	Increased Noise Level (dBA)	Significant?[2]
San Joaquin Valley National Cemetery Sensitive Receptor			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	102	0	No
RCP Culvert	102	0	No
Riprap	102	0	No
Filter	102	0	No
Lakeside Embankment	102	0	No
Lakeside Pavement	102	0	No
Bayside Embankment	102	0	No
Bayside Pavement	102	0	No
Stormwater System	102	0	No
East Overlook Grading and Pavement			
Riprap	102	0	No
East Overlook Grading	102	0	No
East Overlook Parking Pavement Demolition and Rebuild	102	0	No
Basalt Hill Site Development			
Basalt Hill Docking Area	102	0	No
Basalt Hill Aggregate Road Development	102	0	No
Residence on Dinosaur Point Road Sensitive Receptor			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	102	0	No
RCP Culvert	102	0	No
Riprap	102	0	No
Filter	102	0	No
Lakeside Embankment	102	0	No
Lakeside Pavement	102	0	No
Bayside Embankment	102	0	No
Bayside Pavement	102	0	No
Stormwater System	102	0	No
East Overlook Grading and Pavement			
Riprap	102	0	No
East Overlook Grading	102	0	No
East Overlook Parking Pavement Demolition and Rebuild	102	0	No
Basalt Hill Site Development			
Basalt Hill Docking Area	102	0	No
Basalt Hill Aggregate Road Development	102	0	No

[1] Ambient (background) noise level during existing conditions equal to 40 dBA during the day.
[2] Daytime significant increased noise level threshold is 10 dBA.
dBA = A-weighted decibel scale

Table 13. Maximum 1-Hour Nighttime Construction Phase L_{eq} (dBA) Increase Over No Project/No Action Alternative – Alternative 3 (SR 152 Modifications)

Construction Phase	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?[2]
Romero Visitor Center			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	88	0	No
RCP Culvert	88	0	No
Riprap	88	0	No
Filter	88	0	No
Lakeside Embankment	88	0	No
Lakeside Pavement	88	0	No
Bayside Embankment	88	0	No
Bayside Pavement	88	0	No
Stormwater System	88	0	No
East Overlook Grading and Pavement			
Riprap	88	0	No
East Overlook Grading	88	0	No
East Overlook Parking Pavement Demolition and Rebuild	88	0	No
Basalt Hill Site Development			
Basalt Hill Docking Area	88	0	No
Basalt Hill Aggregate Road Development	88	0	No
San Joaquin Valley National Cemetery			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	88	0	No
RCP Culvert	88	0	No
Riprap	88	0	No
Filter	88	0	No
Lakeside Embankment	88	0	No
Lakeside Pavement	88	0	No
Bayside Embankment	88	0	No
Bayside Pavement	88	0	No
Stormwater System	88	0	No
East Overlook Grading and Pavement			
Riprap	88	0	No
East Overlook Grading	88	0	No
East Overlook Parking Pavement Demolition and Rebuild	88	0	No

Construction Phase	Total Noise Level[1] (dBA)	Increased Noise Level (dBA)	Significant?[2]
Basalt Hill Site Development			
Basalt Hill Docking Area	88	0	No
Basalt Hill Aggregate Road Development	88	0	No
Residence on Dinosaur Point Road			
Raise Embankment			
Staging/Conveyor Belt Bridge/ Stockpile Site Development	88	0	No
RCP Culvert	88	0	No
Riprap	88	0	No
Filter	88	0	No
Lakeside Embankment	88	0	No
Lakeside Pavement	88	0	No
Bayside Embankment	88	0	No
Bayside Pavement	88	0	No
Stormwater System	88	0	No
East Overlook Grading and Pavement			
Riprap	88	0	No
East Overlook Grading	88	0	No
East Overlook Parking Pavement Demolition and Rebuild	88	0	No
Basalt Hill Site Development			
Basalt Hill Docking Area	88	0	No
Basalt Hill Aggregate Road Development	88	0	No

[1] Ambient (background) noise level during existing conditions equal to 30 dBA at night.
[2] Nighttime significant increased noise level threshold is 5 dBA.
dBA = A-weighted decibel scale

Table 14 summarizes the peak day maximum PPV (in/sec) at the closest sensitive receptor (Romero Visitor Center) to the SR 152 modifications under Alternative 3. Detailed calculations are provided in Appendix G2. No construction phases under the SR 152 modifications would generate PPV levels above the 0.3 in/sec significance threshold; therefore, vibration impacts would be less than significant.

Table 14. Peak Day Maximum PPV at the Closest Sensitive Receptor near the SR 152 Modifications

Construction Phase	Maximum PPV (in/sec)	Significant?
Raise Embankment		
Staging/Conveyor Belt Bridge/ Stockpile Site Development	0.000137	No
RCP	0.000023	No
Riprap	0.000587	No
Filter	0.000056	No
Lakeside Embankment	0.000060	No
Lakeside Pavement	0.000172	No
Bayside Embankment	0.000080	No
Bayside Pavement	0.000149	No
Stormwater System	0.000061	No
East Overlook Grading and Pavement		
Riprap	0.000074	No
East Overlook Grading	0.000008	No
East Overlook Parking Pavement Demolition and Rebuild	0.000221	No
Basalt Hill Site Development		
Basalt Hill Docking Area	0.000049	No
Basalt Hill Aggregate Road Development	0.000057	No

Closest sensitive receptor to the center of construction is Romero Visitor Center at 12,400 feet.
Significance threshold: 0.3 in/sec
in/sec= inch per second
PPV= peak particle velocity

Table 15 summarizes construction vehicle equivalent noise levels for the dam raise actions under Alternative 3. Traffic would increase along Basalt Road by a sizable percentage and would substantially increase the equivalent noise level on this road by more than 10 dBA, representing a doubling of noise levels. This would result in a significant traffic-related noise impact.

Table 15. Dam Raise Construction Vehicles Equivalent Noise Levels

Type	Roadway	Maximum Daily Truck Hauling	Maximum Daily Worker Trips	Total with Project	Significant?
Interstate	I-5 at junction with SR-152	160	108	35,467	No
US	SR-152 at junction with I-5	160	108	30,250	No
State Route	SR-152 at junction with SR-33	432	304	35,070	No
State Route	SR-33 at junction with I-5	48	22	14,216	No
State Route	SR-152 at Cottonwood Bay	0	108	36,688	No
Local	Basalt Rd	480	434	10,070	Yes

Note: Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Table 16 summarizes construction vehicle equivalent noise levels for the SR 152 modifications under Alternative 3. Construction traffic noise associated with hauling and worker trips for the SR 152 modifications would cause a slight increase in traffic noise at Basalt Road but would not produce traffic noise levels that constitute a significant impact.

Table 16. SR 152 Modification Construction Vehicles Equivalent Noise Levels

Type	Roadway	Maximum Daily Truck Hauling	Maximum Daily Worker Trips	Total with Project	Significant?
Interstate	I-5 at junction with SR-152	24	44	33,894	No
US	SR-152 at junction with I-5	24	44	28,694	No
State Route	SR-152 at junction with SR-33	66	118	30,904	No
State Route	SR-33 at junction with I-5	8	12	13,695	No
State Route	SR-152 at Cottonwood Bay	0	130	36,710	No
Local	Basalt Rd	74	260	2,141	No

Note: Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

G1.6 References

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Appendix G2: Noise and Vibration Calculations

Construction Noise - Equipment
Enlarged Reservoir Alternative

Table 1. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Day	Excavator	Excavator	40%	81	77	3	5	86	82
	Bulldozer	Dozer	40%	82	78	4	6	88	84
	Crane/ Lift	Crane	16%	81	73	5	7	88	80
	Compactor	Compactor (ground)	20%	83	76	5	7	90	83
	Grader	Grader	40%	85	81	2	3	88	84
	Scraper	Scraper	40%	84	80	2	3	87	83
	Loader	Dozer	40%	82	78	5	7	89	85
	Dump Truck	Dump Truck	40%	76	72	13	11	87	83
	Water Truck	Tractor	40%	84	80	5	7	91	87
	Blasting	Blasting	1%	94	74	4	6	100	80
							Peak Day Total	**98**	**94**

Table 2. 1-Hour Nighttime Construction Noise Level at 50 Feet (dBA)

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Day	Excavator	Excavator	40%	81	77	3	5	86	82
	Bulldozer	Dozer	40%	82	78	4	6	88	84
	Crane/ Lift	Crane	16%	81	73	5	7	88	80
	Compactor	Compactor (ground)	20%	83	76	5	7	90	83
	Grader	Grader	40%	85	81	2	3	88	84
	Scraper	Scraper	40%	84	80	2	3	87	83
	Loader	Dozer	40%	82	78	5	7	89	85
	Dump Truck	Dump Truck	40%	76	72	13		76	72
	Water Truck	Tractor	40%	84	80	5	7	91	87
							Peak Day Total	**98**	**93**

Table 3. 1-Hour Daytime Construction Noise Level at the Receptor (dBA)

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	94	94	94
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	30	48	42
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 4. 1-Hour Nighttime Construction Noise Level at the Receptor (dBA)

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	93	93	93
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	29	47	42
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

County		Significance Level	
Merced	Daytime	10	dBA
	Nighttime	5	dBA

No Action Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	102
Nightime Background Noise (dBA)	88

Sensitive Receptor Locations:

San Luis Creek Use Area	5,600	feet
Residence on Harper Lane	16,400	feet
Subdivision off SR 152	8,250	feet

Construction Noise - Traffic
Dam Raise

Table 5. Construction Vehicles - Equivalent Noise Levels

Type	Roadway	No Action Alternative (2027) AADT	Maximum Daily Truck Hauling Trips	Maximum Daily Worker Trips	Speed (mph)	Equivalency Factor for Heavy-Duty Vehicles	Equivalent Vehicles	Total With Project	Increase Ratio
Interstate	I-5 at junction with SR-152	33,695	160	108	55	10.4	1,772	35,467	1.05
US	SR-152 at junction with I-5	28,478	160	108	55	10.4	1,772	30,250	1.06
State Route	SR-152 at junction with SR-33	30,273	432	304	55	10.4	4,797	35,070	1.16
State Route	SR-33 at junction with I-5	13,695	48	22	55	10.4	521	14,216	1.04
State Route	SR-152 at Cottonwood Bay	36,580	0	108	55	10.4	108	36,688	1.00
Local	Basalt Rd	468	480	434	35	19.1	9,602	10,070	**21.52**
								Maximum	**21.52**
								Significant?	**Yes**

Note:
Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Doubling of the noise source produces only a 3 dB increase, which is a barely perceptible change; therefore, there would be no audible change in traffic noise.
FHWA. 2011. Highway Traffic Noise: Analysis and Abatement Guidance.

Construction Noise - Equipment
Enlarged Reservoir Alternative

Table 6. 1-Hour Construction Noise Level at 50 Feet (dBA)-Raise Embankment by 10 VLF

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Staging/ Conveyor Belt Bridge/ Stockpi	80CY Off-Road Mech Drive Rear Dump Cat 777	Dump Truck	40%	76	72	5	7	83	79
	Loader Articulated Wheel Cat 950 197HP 4.00cy- 40K#	Front End Loader	40%	79	75	3	5	84	80
	100MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	Hydraulic Excavator Cat. 320 138HP 1.25cy	Excavator	40%	81	77	1	0	81	77
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	Telescopic Boom Lift Truck Grad 534 -10Kips	Man Lift	20%	75	68	1	0	75	68
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	1	0	85	82
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	1	0	87	80
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Backhoe	40%	78	74	1	0	78	74
	Large Generator Set 150kw	Generator	50%	81	78	3	5	86	83
	Flatbed Truck 20,000 GVW	Flat Bed Truck	40%	74	70	1	0	74	70
	Large Generator Set 75kw	Generator	50%	81	78	4	6	87	84
	Barge Engines	Generator	50%	81	78	16	12	93	90
							Staging/ Conveyor Belt Bridge/ Stockpile Site Development Total	**97**	**94**
RCP Culvert	100MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	Telescopic Boom Lift Truck Grad 534 -10Kips	Man Lift	20%	75	68	1	0	75	68
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Excavator	40%	81	77	1	0	81	77
							RCP Culvert Total	**85**	**79**
RIPRAP	80 Ton 16 Wheel Equipment Trailer	Flat Bed Truck	40%	74	70	1	0	74	70
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	3	87	83
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	2	5	88	81
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Dozer	40%	82	78	3	3	85	81
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	2	6	82	78
	Rear Dump Truck 12-18 cy	Dump Truck	40%	76	72	4	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	12	97	93
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	16	12	97	94
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	16	12	93	85
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	16	6	93	86
	100MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	4	0	81	73
	Skid Steer Loader 46HP 1750# Bobcat S175	Front End Loader	40%	79	75	1	0	79	75
	Flatbed Truck 20,000 GVW	Flat Bed Truck	40%	74	70	1	0	74	70
	80MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	Portable welder Diesel 300 amps	Welder/Torch	40%	74	70	1	0	74	70
	Torch Cutting Acetylene-Oxygen 150'	Welder/Torch	40%	74	70	1	0	74	70
							RIPRAP Total	**102**	**98**
Filter	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Dump Truck	40%	76	72	1	0	76	72
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Front End Loader	40%	79	75	1	0	79	75
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Rear Dump Truck 12-18 cy	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
							Filter Total	**90**	**86**
Lakeside Embankment STA	Telescopic Boom Lift Truck Grad 534 -6Kips	Man Lift	20%	75	68	1	0	75	68
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Dozer Cat. D7R 230HP	Dozer	40%	82	78	1	0	82	78
	On-Highway Water Truck 2500 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Front End Loader	40%	79	75	1	0	79	75
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
							Lakeside Embankment STA Total	**92**	**89**
Lakeside Pavement STA	Concrete Saw 20" Gasoline	Concrete Saw	20%	90	83	1	0	90	83
	On-Highway Water Truck 2500 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Front End Loader	40%	79	75	1	0	79	75
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Excavator	40%	81	77	1	0	81	77
	Hydraulic Impact Breaker 1K 1Kbpm	Impact Pile Driver	20%	101	94	1	0	101	94
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	Rear Dump Truck 07-08 cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Rear Dump Full Trailers, 20cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	1	0	85	82
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	1	0	87	80
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Backhoe	40%	78	74	1	0	78	74
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Paver	50%	77	74	1	0	77	74
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Compactor (ground)	20%	83	76	1	0	83	76
	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	Paver	50%	77	74	1	0	77	74
	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	Compactor (ground)	20%	83	76	1	0	83	76
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
							Lakeside Pavement STA Total	**102**	**97**
Bayside Embankment STA	Telescopic Boom Lift Truck Grad 534 -6Kips	Man Lift	20%	75	68	1	0	75	68
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Dozer Cat. D7R 230HP	Dozer	40%	82	78	1	0	82	78
	On-Highway Water Truck 2500 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Front End Loader	40%	79	75	1	0	79	75
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
							Bayside Embankment STA Total	**92**	**97**
Bayside Pavement STA	Concrete Saw 20" Gasoline	Concrete Saw	20%	90	83	1	0	90	83
	On-Highway Water Truck 2500 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Front End Loader	40%	79	75	1	0	79	75
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Excavator	40%	81	77	1	0	81	77
	Hydraulic Impact Breaker 1K 1Kbpm	Impact Pile Driver	20%	101	94	1	0	101	94
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	Rear Dump Truck 07-08 cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Rear Dump Full Trailers, 20cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	1	0	85	82
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	1	0	87	80
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Backhoe	40%	78	74	1	0	78	74
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Paver	50%	77	74	1	0	77	74
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Compactor (ground)	20%	83	76	1	0	83	76
	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	Paver	50%	77	74	1	0	77	74
	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	Compactor (ground)	20%	83	76	1	0	83	76
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
							Bayside Pavement STA Total	**102**	**99**
Stormwater System	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	-	-	-	-
	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	Compactor (ground)	20%	83	76	1	0	83	76
	Rear Dump Truck 07-08 cy	Dump Truck	40%	76	72	1	0	76	72
	Electric Submersible Pump 2HP/2"	Pumps	50%	81	78	1	0	81	78
	Discharge Hose 2.0 in	Pneumatic Tools	50%	85	82	1	0	85	82
	Suction Hose 2.0 in	Pneumatic Tools	50%	85	82	1	0	85	82
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	Rear Dump Truck 12-18 cy	Dump Truck	40%	76	72	1	0	76	72
	Telescopic Boom Lift Truck Grad 534 -10Kips	Man Lift	20%	75	68	1	0	75	68
	Hydraulic Excavator Cat. 320 138HP 1.25cy	Excavator	40%	81	77	1	0	81	77
	80MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	Portable welder Diesel 300 amps	Welder/Torch	40%	74	70	1	0	74	70
	Torch Cutting Acetylene-Oxygen 150'	Welder/Torch	40%	74	70	1	0	74	70
							Stormwater System Total	**92**	**99**

Table 7. 1-Hour Daytime Construction Noise Level at the Romero Visitor Center (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	12,400	12,400	12,400	12,400	12,400	12,400	12,400	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	35	21	40	28	31	38	39	41	36
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102	102	102	102	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

Table 8. 1-Hour Daytime Construction Noise Level at the San Joaquin Valley National Cemetery (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to SJ Valley National Cemetery (ft)	14,450	14,500	14,500	14,500	14,500	14,500	14,500	14,500	14,500
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93
1-Hour Construction Noise Level at the Receptor (dBA)	32	18	37	25	28	35	36	38	33
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102	102	102	102	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

Table 9. 1-Hour Daytime Construction Noise Level at the Residence on Dinosaur Point Road (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to Residence on Dinosaur Point Road (ft)	25,300	25,300	25,300	25,300	25,300	25,300	25,300	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	19	4	23	11	15	22	22	24	19
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102	102	102	102	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

Table 10. 1-Hour Nighttime Construction Noise Level at the Romero Visitor Center (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	12,400	12,400	12,400	12,400	12,400	12,400	12,400	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	35	21	40	28	31	38	39	41	36
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88	88	88	88	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

Table 11. 1-Hour Nighttime Construction Noise Level at the San Joaquin Valley National Cemetery (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to SJ Valley National Cemetery (ft)	14,450	14,450	14,450	14,450	14,450	14,450	14,450	14,450	14,450
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.89	11.89	11.89	11.89	11.89	11.89	11.89	11.89
1-Hour Construction Noise Level at the Receptor (dBA)	32	18	37	25	28	35	36	38	33
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88	88	88	88	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

Table 12. 1-Hour Nighttime Construction Noise Level at the Residence on Dinosaur Point Road (dBA)

Location	Staging/Conveyor Belt Bridge/ Stockpile Site Development	RCP Culvert	RipRap	Filter	Lakeside Embankment	Lakeside Pavement	Bayside Embankment	Bayside Pavement	Stormwater System
Distance from the Center of Construction Activity to Residence on Dinosaur Point Road (ft)	25,300	25,300	25,300	25,300	25,300	25,300	25,300	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	94	79	98	86	89	97	97	99	94
Distance Divergence (dBA)	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	19	4	23	11	15	22	22	24	19
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88	88	88	88	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0	0	0	0	0	0	0
Significant?	No	No	No	No	No	No	No	No	No

County		Significance Level	
Merced	Daytime	10	dBA
	Nighttime	5	dBA

No Action Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	102
Nightime Background Noise (dBA)	88
Sensitive Receptor Locations:	

Closet senstive receptor:

Residence on Dinosaur Point Road	25,300	feet
Romero Visitor Center	12,400	feet
SJ Valley National Cemetery	14,450	feet

Construction Noise – Equipment
Enlarged Reservoir Alternative

Table 13. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)-East Overlook Grading and Pavement

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
RIPRAP	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Dump Truck	40%	76	72	1	0	76	72
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Front End Loader	40%	79	75	1	0	79	75
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Rear Dump Truck 12-18 cy	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	1	0	85	82
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	1	0	87	80
							RIPRAP Total	**93**	**88**
East Overlook Grading	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Dump Truck	40%	76	72	1	0	76	72
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
							East Overlook Grading Total	**90**	**86**
East Overlook Parking Pavement Demo and Rebuild	Telescopic Boom Lift Truck Grad 534 -6Kips	Man Lift	20%	75	68	1	0	75	68
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Dozer Cat. D7R 230HP	Dozer	40%	82	78	1	0	82	78
	On-Highway Water Truck 2500 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Backhoe	40%	78	74	1	0	78	74
	Concrete Saw 20" Gasoline	Concrete Saw	20%	90	83	1	0	90	83
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Front End Loader	40%	79	75	1	0	79	75
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Excavator	40%	81	77	1	0	81	77
	Hydraulic Impact Breaker 1K 1Kbpm	Impact Pile Driver	20%	101	94	1	0	101	94
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	Rear Dump Truck 07-08 cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Rear Dump Full Trailers, 20cy	Dump Truck	40%	76	72	1	0	76	72
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
	Hand Held Vibratory Plate 25" 8.0HP	Pneumatic Tools	50%	85	82	1	0	85	82
	40MT All/Rough Terrain Hydro Crane	Crane	16%	81	73	1	0	81	73
	1.00 cy Standard Clamshell Bucket	Clam Shovel (dropping)	20%	87	80	1	0	87	80
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Backhoe	40%	78	74	1	0	78	74
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Paver	50%	77	74	1	0	77	74
	Tandem Vibratory Comp. BOMAG 40" 33HP- 2.4MT	Compactor (ground)	20%	83	76	1	0	83	76
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Compactor (ground)	20%	83	76	1	0	83	76
							East Overlook Parking Pavement Demo and Rebuild Total	**102**	**96**

Table 14. 1-Hour Daytime Construction Noise Level at Romero Visitor Center (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	12,400	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	47.9	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	30	28	38
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 15. 1-Hour Daytime Construction Noise Level at San Joaquin Valley National Cemetery (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to SJ Valley National Cemetery (ft)	14,450	14,450	14,450
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	49.2	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.89	11.89
1-Hour Construction Noise Level at the Receptor (dBA)	27	25	35
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 16. 1-Hour Daytime Construction Noise Level at Residence on Dinosaur Point Rd (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to Residence on Dinosaur Point Rd (ft)	25,300	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	54.1	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	13	11	21
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102	102
Daytime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 17. 1-Hour Nighttime Construction Noise Level at the Romero Visitor Center (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to the Romero Visitor Center (ft)	12,400	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	47.9	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	30	28	38
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 18. 1-Hour Nighttime Construction Noise Level at San Joaquin Valley National Cemetery (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to the Closest Sensitive Receptor (Romero Visitor Center) (ft)	14,450	14,450	14,450
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	49.2	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.89	11.89
1-Hour Construction Noise Level at the Receptor (dBA)	27	25	35
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

Table 19. 1-Hour Nighttime Construction Noise Level at Residence on Dinosaur Point Rd (dBA)

Location	RipRap	East Overlook Grading	East Overlook Parking Pavement Demo and Rebuild
Distance from the Center of Construction Activity to the Residence on Dinosaur Point Rd (ft)	25,300	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	88	86	96
Distance Divergence (dBA)	54.1	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	13	11	21
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88	88
Nighttime Increase Over Existing (dBA)	0	0	0
Significant?	No	No	No

County		Significance Level
Merced	Daytime	10 dBA
	Nighttime	5 dBA

No Action Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	102
Nightime Background Noise (dBA)	88

Sensitive Receptor Locations:

Residence on Dinosaur Point Road	25,300 feet
Romero Visitor Center	12,400 feet
SJ Valley National Cemetery	14,450 feet

Construction Noise - Equipment
Enlarged Reservoir Alternative

Table 20. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)-Basalt Hill Site Development

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Basalt Hill Docking	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Front End Loader	40%	79	75	1	0	79	75
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
							Basalt Hill Docking Total	**91**	**87**
Basalt Hill Aggregate Road Developme	80 Ton 16 Wheel Equipment Trailer	Pneumatic Tools	50%	85	82	1	0	85	82
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Tractor	40%	84	80	1	0	84	80
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Compactor (ground)	20%	83	76	1	0	83	76
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Excavator	40%	81	77	1	0	81	77
	On-Highway Water Truck 4000 Gallon	Dump Truck	40%	76	72	1	0	76	72
	Articulated Frame Grader Cat 12H 140HP	Grader	40%	85	81	1	0	85	81
	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	Compactor (ground)	20%	83	76	1	0	83	76
							Basalt Hill Aggregate Road Development Total	**92**	**87**

Table 21. 1-Hour Daytime Construction Noise Level at Romero Visitor Center (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	29	29
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102
Daytime Increase Over Existing (dBA)	0	0
Significant?	No	No

Table 22. 1-Hour Daytime Construction Noise Level at San Joaquin Valley National Cemetery (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to SJ Valley National Cemetery (ft)	14,450	14,450
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.89
1-Hour Construction Noise Level at the Receptor (dBA)	26	26
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102
Daytime Increase Over Existing (dBA)	0	0
Significant?	No	No

Table 23. 1-Hour Daytime Construction Noise Level at Residence on Dinosaur Point Road (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	12	12
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	102	102
Daytime Increase Over Existing (dBA)	0	0
Significant?	No	No

Table 24. 1-Hour Nighttime Construction Noise Level at the Romero Visitor Center (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to Romero Visitor Center (ft)	12,400	12,400
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	47.9	47.9
Atmospheric Attenuation (dBA)	10.20	10.20
1-Hour Construction Noise Level at the Receptor (dBA)	29	29
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88
Nighttime Increase Over Existing (dBA)	0	0
Significant?	No	No

Table 25. 1-Hour Nighttime Construction Noise Level at the San Joaquin Valley National Cemetery (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to SJ Valley National Cemetery (ft)	14,450	14,450
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	49.2	49.2
Atmospheric Attenuation (dBA)	11.89	11.89
1-Hour Construction Noise Level at the Receptor (dBA)	26	26
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88
Nighttime Increase Over Existing (dBA)	0	0
Significant?	No	No

Table 26. 1-Hour Nighttime Construction Noise Level at the Residence on Dinosaur Point Road (dBA)

Location	Basalt Hill Docking	Basalt Hill Aggregate Road Development
Distance from the Center of Construction Activity to Residence on Dinosaur Point Rd (ft)	25,300	25,300
1-Hour Construction Noise Level at 50 ft (dBA)	87	87
Distance Divergence (dBA)	54.1	54.1
Atmospheric Attenuation (dBA)	20.82	20.82
1-Hour Construction Noise Level at the Receptor (dBA)	12	12
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	88	88
Nighttime Increase Over Existing (dBA)	0	0
Significant?	No	No

County		Significance Level
Merced	Daytime	10 dBA
	Nighttime	5 dBA

No Action Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	102
Nightime Background Noise (dBA)	88

Sensitive Receptor Locations:

Residence on Dinosaur Point Road	25,300 feet
Romero Visitor Center	12,400 feet
SJ Valley National Cemetery	14,450 feet

Construction Noise - Traffic
Dam Raise- SR 152 Modifications

Table 26. Construction Vehicles - Equivalent Noise Levels

Type	Roadway	No Action Alternative (2027) AADT	Maximum Daily Truck Hauling Trips	Maximum Daily Worker Trips	Speed (mph)	Equivalency Factor for Heavy-Duty Vehicles	Equivalent Vehicles	Total With Project	Increase Ratio
Interstate	I-5 at junction with SR-152	33,600	24	44	55	10.4	294	33,894	1.01
US	SR-152 at junction with I-5	28,400	24	44	55	10.4	294	28,694	1.01
State Route	SR-152 at junction with SR-33	30,100	66	118	55	10.4	804	30,904	1.03
State Route	SR-33 at junction with I-5	13,600	8	12	55	10.4	95	13,695	1.01
State Route	SR-152 at Cottonwood Bay	36,580	0	130	55	10.4	130	36,710	1.00
Local	Basalt Rd	468	74	260	35	19.1	1,673	2,141	4.58
								Maximum	**4.58**
								Significant?	**No**

Note:
Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Doubling of the noise source produces only a 3 dB increase, which is a barely perceptible change; therefore, there would be no audible change in traffic noise.
FHWA. 2011. Highway Traffic Noise: Analysis and Abatement Guidance.

Table 27. Atmospheric Attenuation

Assumptions	Merced	Santa Clara
Ambient pressure (kPa)	101.3	101.3
Temperature (F)	68	68
Relative humidity (%)	90	90
Frequency of noise source (Hz)	500	500
Air Attenuation Coefficient (α, dB/km)	2.7	2.7
(dB/ft)	0.0008	0.0008

$A_{air} = \alpha d$

Conversion:
0.3048 m/ft
1000 m/km

Weather in Merced County
Average temperature 62.9 °F
Average relative humidity 79.48 %

Weather in Santa Clara County
Average temperature 59.7 °F
Average relative humidity 81.51 %

Reference:
Harris, Cyril M. 1998. Handbook of Acoustical Measurements and Noise Control. 3rd ed. - Chapter 3 Calculation of Attenuation
http://www.usa.com/santa-clara-county-ca-weather.htm; http://www.usa.com/merced-county-ca-weather.htm

Table 28. Equipment noise emissions and acoustical usage factors database

Equipment Description	Impact Device?	Acoustical Use Factor	Spec 721.560 Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50 ft (dBA, slow)
All Other Equipment > 5 hp	No	50%	85	N/A
Auger Drill Rig	No	20%	85	84
Backhoe	No	40%	80	78
Bar Bender	No	20%	80	N/A
Blasting	Yes	1%	94	N/A
Boring Jack Power Unit	No	50%	80	83
Chain Saw	No	20%	85	84
Clam Shovel (dropping)	Yes	20%	93	87
Compactor (ground)	No	20%	80	83
Compressor (air)	No	40%	80	78
Concrete Batch Plant	No	15%	83	N/A
Concrete Mixer Truck	No	40%	85	79
Concrete Pump Truck	No	20%	82	81
Concrete Saw	No	20%	90	90
Conveyor	No	100%	90	90
Crane	No	16%	85	81
Dozer	No	40%	85	82
Drill Rig Truck	No	20%	84	79
Drum Mixer	No	50%	80	80
Dump Truck	No	40%	84	76
Excavator	No	40%	85	81
Flat Bed Truck	No	40%	84	74
Front End Loader	No	40%	80	79
Generator	No	50%	82	81
Generator (<25KVA, VMS signs)	No	50%	70	73
Gradall	No	40%	85	83
Grader	No	40%	85	N/A
Grapple (on backhoe)	No	40%	85	87
Horizontal Boring Hydr. Jack	No	25%	80	82
Hydra Break Ram	Yes	10%	90	N/A
Impact Pile Driver	Yes	20%	95	101
Jackhammer	Yes	20%	85	89
Man Lift	No	20%	85	75
Mounted Impact Hammer (hoe ram)	Yes	20%	90	90
Pavement Scarifier	No	20%	85	90
Paver	No	50%	85	77
Pickup Truck	No	40%	55	75
Pneumatic Tools	No	50%	85	85
Pumps	No	50%	77	81
Refrigerator Unit	No	100%	82	73
Rivit Buster/Chipping Gun	Yes	20%	85	79
Rock Drill	No	20%	85	81
Roller	No	20%	85	80
Sand Blasting (Single Nozzle)	No	20%	85	96
Scraper	No	40%	85	84
Shears (on backhoe)	No	40%	85	96
Slurry Plant	No	100%	78	78
Slurry Trenching Machine	No	50%	82	80
Soil Mix Drill Rig	No	50%	80	N/A
Tractor	No	40%	84	N/A
Vacuum Excavator (vac-truck)	No	40%	85	85
Vacuum Street Sweeper	No	10%	80	82
Ventilation Fan	No	100%	85	79
Vibrating Hopper	No	50%	85	87
Vibratory Concrete Mixer	No	20%	80	80
Vibratory Pile Driver	No	20%	95	101
Warning Horn	No	5%	85	83
Welder/Torch	No	40%	73	74

Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power. In case of construction blasting, the equipment gives a very short duration blast and can be quantified by using a 1% usage factor in the RCNM to allow for some prediction.

FHWA. RCNM User's Guide - Table 1. CA/T equipment noise emissions and acoustical usage factors database.

Table 29. Average Ambient Noise Levels for Various Land Uses

Land Use Description	Average Ldn (dBA)	Daytime Leq (dBA)	Nighttime Leq (dBA)
Wilderness	35	35	25
Rural Residential	40	40	30
Quiet Suburban Residential	50	50	40
Normal Suburban Residential	55	55	45
Urban Residential	60	60	50
Noisy Urban Residential	65	65	55
Very Noisy Urban Residential	70	70	60

Source: U.S. EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974.

Table 30. Noise Reductions from Mitigation Measures

Mitigation Type	Reduction (dBA)
Noise barrier or other obstruction just barely breaks the line-of-sight between the noise source and the receptor	3
Noise source completely enclosed or completely shielded with solid barrier located close to the source	8
Enclosure and/or barrier with some gaps	5
Noise source completely enclosed and completely shielded with a solid barrier located close to the source	10
Noise source enclosed or shielded with heavy vinyl noise curtain material	5

Source: FHWA. RCNM User's Guide Appendix A Best Practices for Calculating Estimated Shielding for Use in the RCNM

Construction Equipment

Table 31. Equiment Description Lookup Table

Equipment Description	RCNM Description
Barges	
Boats	
Bulldozer	Dozer
Chipper	All Other Equipment > 5 hp
Concrete Pumpers	Concrete Pump Truck
Concrete Saw Cutters	Concrete Saw
Concrete Trucks	Concrete Mixer Truck
Cranes	Crane
Dreges	
Drill Rig	Auger Drill Rig
Dump Truck	Dump Truck
Equipment and Material Delivery Trucks	
Excavator	Excavator
Flatbed Trucks (on site)	Flat Bed Truck
Grader	Grader
Gravel /Paving Trucks	
Loaders	Front End Loader
Portable Diesel Generators	Generator
Roller	Roller
Scraper	Scraper
TBM	
Truck Mounted Drill Rig (Wells)	Drill Rig Truck
Vertical Conveyor	
Vibrating Plate	Compactor (ground)
Water Truck	Dump Truck
Wheel Trencher	Slurry Trenching Machine

Note:
Equipment without RCNM descriptions are not included in the noise analysis.

Table 32. Number of Equivalent Vehicles as a Function of Vehicle Type and Speed Based on TNM Reference Energy Mean Emission Levels

Speed (km/h [mph])		Equivalent Vehicles		
		1 Heavy Truck	1 Medium Truck	1 Auto
56	(35)	19.1	7.1	1
64	(40)	15.1	5.8	1
72	(45)	12.9	5	1
80	(50)	11.5	4.5	1
88.5	(55)	10.4	4.1	1
97	(60)	9.6	3.7	1
105	(65)	7.9	3.5	1
113	(70)	8.3	3.2	1

Source: Caltrans. 2009. Technical Noise Supplement. Prepared by ICF Jones & Stokes. November.

Construction Vibration - Equipment
Enlarged Reservoir Alternative

Table 33. Construction Vibration

Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	At Source	Residence on Harper Lane	Creek Use Area	Subdivision off SR 152
			Distance (ft):	25	16,400	5,600	8,250
				PPV (in/sec)	PPV (in/sec)	PPV (in/sec)	PPV (in/sec)
Peak Day	Excavator	n/a	2	n/a	n/a	n/a	n/a
	Dozer	Large Bulldozer	3	0.267	0.000016	0.000080	0.000045
	Crane/Lift	n/a	5	n/a	n/a	n/a	n/a
	Compactor	Small bulldozer	5	0.015	0.000001	0.000004	0.000003
	Grader	Large Bulldozer	2	0.178	0.000011	0.000053	0.000030
	Scraper	Large Bulldozer	2	0.178	0.000011	0.000053	0.000030
	Loader	Loaded Trucks	5	0.380	0.000023	0.000113	0.000063
	Dump Truck	Loaded Trucks	13	0.988	0.000059	0.000295	0.000165
	Water Truck	Loaded Trucks	5	0.380	0.000023	0.000113	0.000063
	Blasting	n/a	4	0.050	0.002976	0.014914	0.008341
			Peak Day Total	**N/A**	**0.000142**	**0.000712**	**0.000398**

Note: Reference distance for blasting is 2,500 feet

Significance Threshold

0.3 in/sec

Construction Vibration – Equipment
Enlarged Reservoir Alternative

Table 34. Construction Vibration

			Distance (ft):	At Source 25	Residence on Dinosaur Point Road 25,300	Romero Visitor Center 12,400	SJ Valley National Cemetery 14,450
Phase	**Equipment Description**	**Equivalent Equipment Types**	**Number of Equipment**	**PPV (in/sec)**	**PPV (in/sec)**	**PPV (in/sec)**	**PPV (in/sec)**
Staging/ Conveyor Belt Bridge/ Stockpile Site Development	80CY Off-Road Mech Drive Rear Dump Cat 777	Loaded Trucks	5	0.380	0.000012	0.000034	0.000027
	Loader Articulated Wheel Cat 950 197HP 4.00cy-40K#	Loaded Trucks	3	0.228	0.000007	0.000021	0.000016
	100MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Excavator Cat. 320 138HP 1.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	40MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Telescopic Boom Lift Truck Grad 534 -10Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Hand Held Vibratory Plate 25" 8.0HP	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	1	0.202	0.000006	0.000018	0.000015
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Small bulldozer	1	0.003	0.000000	0.000000	0.000000
	Large Generator Set 150kw	n/a	3	n/a	n/a	n/a	n/a
	Flatbed Truck 20,000 GVW	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Large Generator Set 75kw	n/a	4	n/a	n/a	n/a	n/a
	Barge Engines	n/a	16	n/a	n/a	n/a	n/a
			Staging/ Conveyor Belt Bridge/ Stockpile Site Development Total	**N/A**	**0.000047**	**0.000137**	**0.000109**
RCP Culvert	100MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Telescopic Boom Lift Truck Grad 534 -10Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			RCP Culvert Total	**N/A**	**0.000008**	**0.000023**	**0.000018**
RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	2	0.42	0.000013	0.000038	0.000030
	Standard Crawler Loader Cat. 963 158HP 3.20cy-43K#	Large Bulldozer	3	0.267	0.000008	0.000024	0.000019
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	2	0.152	0.000005	0.000014	0.000011
	Rear Dump Truck 12-18 cy	Loaded Trucks	4	0.304	0.000009	0.000028	0.000022
	Articulated Frame Grader Cat 12H 140HP	Small bulldozer	1	0.003	0.000000	0.000000	0.000000
	Hand Held Vibratory Plate 25" 8.0HP	n/a	16	n/a	n/a	n/a	n/a
	40MT All/Rough Terrain Hydro Crane	Large Bulldozer	16	1.424	0.000044	0.000129	0.000102
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	16	3.232	0.000100	0.000293	0.000233
	100MT All/Rough Terrain Hydro Crane	Large Bulldozer	4	0.356	0.000011	0.000032	0.000026
	Skid Steer Loader 46HP 1750# Bobcat S175	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Flatbed Truck 20,000 GVW	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	80MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Portable welder Diesel 300 amps	n/a	1	n/a	n/a	n/a	n/a
	Torch Cutting Acetylene-Oxygen 150'	n/a	1	n/a	n/a	n/a	n/a
			RIPRAP Total	**N/A**	**0.000202**	**0.000587**	**0.000467**
Filter	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	Standard Crawler Loader Cat. 963 158HP 3.20cy-43K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Rear Dump Truck 12-18 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Small bulldozer	1	0.003	0.000000	0.000000	0.000000
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Filter Total	**N/A**	**0.000019**	**0.000056**	**0.000045**
Lakeside Embankment STA	Telescopic Boom Lift Truck Grad 534 -6Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller		0	-	-	-
	Standard Crawler Dozer Cat. D7R 230HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 2500 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Standard Crawler Loader Cat. 963 158HP 3.20cy-43K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Lakeside Embankment STA Total	**N/A**	**0.000021**	**0.000060**	**0.000047**

Phase	Equipment Description	Equivalent Equipment Types	Distance (ft): Number of Equipment	At Source 25 PPV (in/sec)	Residence on Dinosaur Point Road 25,300 PPV (in/sec)	Romero Visitor Center 12,400 PPV (in/sec)	SJ Valley National Cemetery 14,450 PPV (in/sec)
Lakeside Pavement STA	Concrete Saw 20" Gasoline	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Water Truck 2500 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Impact Breaker 1K 1Kbpm	Jackhammer	1	0.035	0.000001	0.000003	0.000003
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Rear Dump Truck 07-08 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	On-Highway Rear Dump Full Trailers, 20cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	Hand Held Vibratory Plate 25" 8.0HP	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	40MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	1	0.202	0.000006	0.000018	0.000015
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Tandem Vibratory Comp. BOMAG 40" 33HP-2.4MT	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Lakeside Pavement STA Total	**N/A**	**0.000059**	**0.000172**	**0.000136**
Bayside Embankment STA	Telescopic Boom Lift Truck Grad 534 -6Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	Standard Crawler Dozer Cat. D7R 230HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 2500 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Standard Crawler Loader Cat. 963 158HP 3.20cy-43K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Bayside Embankment STA Total	**N/A**	**0.000027**	**0.000080**	**0.000064**
Bayside Pavement STA	Concrete Saw 20" Gasoline	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Water Truck 2500 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Impact Breaker 1K 1Kbpm	Jackhammer	1	0.035	0.000001	0.000003	0.000003
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Rear Dump Truck 07-08 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	On-Highway Rear Dump Full Trailers, 20cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	Hand Held Vibratory Plate 25" 8.0HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	40MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	1	0.202	0.000006	0.000018	0.000015
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Vibratory Roller	1	0.21	0.000007	0.000019	0.000015
	Crawler Mntd Asphalt Paver 5'-13' ABG Titan 125 21K	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Tandem Vibratory Comp. BOMAG 40" 33HP-2.4MT	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Bayside Pavement STA Total	**N/A**	**0.000051**	**0.000149**	**0.000118**
Stormwater System	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hand Held Vibratory Plate 25" 8.0HP	Vibratory Roller	0	0	-	-	-
	Trench Compactor Wacker RT820 3K#/32" 18HP 4-Drum	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Rear Dump Truck 07-08 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Electric Submersible Pump 2HP/2"	n/a	1	n/a	n/a	n/a	n/a
	Discharge Hose 2.0 in	n/a	1	n/a	n/a	n/a	n/a
	Suction Hose 2.0 in	n/a	1	n/a	n/a	n/a	n/a
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Rear Dump Truck 12-18 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Telescopic Boom Lift Truck Grad 534 -10Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Hydraulic Excavator Cat. 320 138HP 1.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	80MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Portable welder Diesel 300 amps	n/a	1	n/a	n/a	n/a	n/a
	Torch Cutting Acetylene-Oxygen 150'	n/a	1	n/a	n/a	n/a	n/a
			Stormwater System Total	**N/A**	**0.000021**	**0.000061**	**0.000048**

Significance Threshold
0.3 in/sec

Construction Vibration – Equipment
Enlarged Reservoir Alternative

Table 35. Construction Vibration

Phase	Equipment Description	Equivalent Equipment Types	Distance (ft): Number of Equipment	At Source 25 PPV (in/sec)	Residence on Dinosaur Point Road 25,300 PPV (in/sec)	Romero Visitor Center 12,400 PPV (in/sec)	SJ Valley National Cemetery 14,450 PPV (in/sec)
RIPRAP	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1				
	Rear Dump Truck 12-18 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hand Held Vibratory Plate 25" 8.0HP	n/a	1	n/a	n/a	n/a	n/a
	40MT All/Rough Terrain Hydro Crane	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	1	0.202	0.000006	0.000018	0.000015
			RIPRAP Total	**N/A**	**0.000025**	**0.000074**	**0.000059**
East Overlook Grading	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			East Overlook Grading Total	**N/A**	**0.000017**	**0.000049**	**0.000039**
East Overlook Parking Pavement Demo and Rebuild	Telescopic Boom Lift Truck Grad 534 -6Kips	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	Standard Crawler Dozer Cat. D7R 230HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 2500 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Loader Backhoe C446-101HP 1.50cy- 17'+ Depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Concrete Saw 20" Gasoline	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Loader Articulated Wheel Cat 938G 160HP 3.00cy- 33K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Excavator Cat. 330 244HP 2.25cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Impact Breaker 1K 1Kbpm	Jackhammer	1	0.035	0.000001	0.000003	0.000003
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Rear Dump Truck 07-08 cy	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	On-Highway Rear Dump Full Trailers, 20cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hand Held Vibratory Plate 25" 8.0HP	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	40MT All/Rough Terrain Hydro Crane	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	1.00 cy Standard Clamshell Bucket	Clam shovel drop (slurry wall)	1	0.202	0.000006	0.000018	0.000015
	Loader Backhoe C420-93HP 1.25cy- 15' depth	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Wheel Mntd Asphalt Pavers 10'-30' Barber-Greene-BG-260	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Tandem Vibratory Comp. BOMAG 40" 33HP-2.4MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	Tandem Vibratory Comp. Cat. CB634C 84" 138HP- 11.3MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
			East Overlook Parking Pavement Demo and Rebuild Total	**N/A**	**0.000076**	**0.000221**	**0.000175**

Significance Threshold

0.3 in/sec

Construction Vibration - Equipment
Enlarged Reservoir Alternative

Table 36. Construction Vibration

				At Source	Residence on Dinosaur Point Road	Romero Visitor Center	SJ Valley National Cemetery
			Distance (ft):	25	25,300	12,400	14,450
Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	PPV (in/sec)	PPV (in/sec)	PPV (in/sec)	PPV (in/sec)
Basalt Hill Docking	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
	Standard Crawler Loader Cat. 963 158HP 3.20cy- 43K#	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
			Basalt Hill Docking Total	**N/A**	**0.000017**	**0.000049**	**0.000039**
Basalt Hill Aggregate Road Developme	80 Ton 16 Wheel Equipment Trailer	n/a	1	n/a	n/a	n/a	n/a
	On-Highway Truck Tractors Maximum Gross Vehicle Weight: 75,000 lbs	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Cat CP/CS323 Pad/Smooth Vibratory Compactor 80HP-4.6MT	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Hydraulic Excavator Cat. 325 186HP 1.50cy	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	On-Highway Water Truck 4000 Gallon	Loaded Trucks	1	0.076	0.000002	0.000007	0.000005
	Articulated Frame Grader Cat 12H 140HP	Large Bulldozer	1	0.089	0.000003	0.000008	0.000006
	Cat CP/CS563 Pad/Smooth Vibratory Compactor 142HP-11MT	Vibratory Roller	1	0.210	0.000007	0.000019	0.000015
			Basalt Hill Aggregate Road Development Total	**N/A**	**0.000020**	**0.000057**	**0.000045**

Significance Threshold
0.3 in/sec

Table 37. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 ft (in/sec)	Approximate Lv† at 25 ft
Pile Driver (impact)	0.644	104
Pile Driver (sonic)	0.17	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall) - in soil	0.008	66
Hydromill (slurry wall) - in rock	0.017	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Federal Transit Administration. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. May.
Note:
Values for pile drivers are based on the typical vibration source levels.
† RMS velocity in decibels (VdB) re 1 micro-inch/second

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix H: Traffic and Transportation Appendix

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Appendix H Traffic and Transportation Appendix

The Traffic and Transportation Appendix supplements Section 4.7, Traffic and Transportation in the *B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS)*. The sections below provide detailed information about traffic flow assessment methods, trip generation, and roadway/intersection operations under each action alternative.

Traffic analysis in the State of California is guided by standards set at the state level by the California Department of Transportation (Caltrans) and by local jurisdictions. State highways fall under Caltrans jurisdiction. Other roadways fall under the local jurisdiction, either city or county, in which they are located.

Each jurisdiction has adopted standards regarding the desired performance level of traffic conditions on the circulation system within its jurisdiction. A performance measure called "Level of Service" (LOS) is used to characterize traffic operating conditions of a circulation element. Progressively worsening traffic operating conditions are given the letter grades "A" through "F." Table 1 summarizes the traffic operating conditions associated with each LOS designation. Table 2 provides LOS criteria for Merced County roadways.

Table 1. Level of Service Characteristics

LOS	Traffic Condition
A	Free flow conditions; low volumes; high operating speeds; uninterrupted flow; no restriction on maneuverability; drivers maintain desired speeds; little or no delays
B	Stable flow conditions; operating speeds beginning to be restricted
C	Stable flow but speed and maneuverability restricted by higher traffic volumes; satisfactory operating speed for urban conditions; delays at signals
D	Approaching unstable flow; low speeds; major delays at signals; little freedom to maneuver
E	Lower operating speeds; volume at or near capacity; unstable flow; major delays and stoppages
F	Forced flow conditions; low speeds; volumes below capacity, may be zero; stoppages for long periods because of downstream congestion

Source: Transportation Research Board (TRB) 2010

Table 2. Level of Service Criteria for Roadways – Merced County

#	Area	Facility	Interchanges	Intersections	Flow	Lanes	Median	Level of Service (Average Annual Daily Traffic)				
								A	B	C	D	E
1	Urban	Freeway	< 2 miles apart	-	-	4	N/A	22,000	36,000	52,000	67,000	76,500
2	Urban	Expressway	-	-	-	4	Divided	-	-	21,400	31,100	32,900
3	Urban	Highway	-	-	Uninterrupted	2	Undivided	2,000	7,000	13,800	19,600	27,000
4	Urban	Highway	-	< 2/mile	-	2	Undivided	-	4,200	13,800	16,400	16,900
5	Urban	Highway	-	< 4.5/mile	-	2	Undivided	-	1,900	11,200	15,400	16,300
6	Urban	Collector	-	-	-	2	Undivided	-	-	4,800	10,000	12,600
7	Urban	Highway	-	< 4.5/mile	-	4	Undivided	-	3,500	23,200	29,100	30,600
8	Urban	Arterial	-	-	-	4	Undivided	-	-	15,600	27,800	29,400
9	Urban	Highway	-	< 2/mile	-	4	Undivided	3,500	20,900	24,600	25,700	-
10	Urban	Collector	-	-	-	4	Undivided	-	-	9,800	19,200	22,800
11	Urban	Highway	-	< 2/mile	-	2	Undivided	-	4,000	13,100	15,500	16,300
12	Urban	Arterial	-	-	-	2	Undivided	-	-	7,000	13,600	14,600
13	Transition	Freeway	-	-	-	4	-	23,500	38,700	52,500	62,200	69,100
14	Transition	Collector	-	-	-	2	Undivided	-	-	4,400	9,400	12,000
15	Rural	Freeway	-	-	-	6	-	33,100	54,300	73,900	87,400	97,200
16	Rural	Freeway	-	-	-	4	-	21,300	35,300	47,900	56,600	63,000
17	Rural	Non-Freeway	-	-	Uninterrupted	4	Divided	17,500	28,600	40,800	52,400	58,300
18	Rural	Non-Freeway	-	-	Isolated Stops	4	-	-	2,900	17,400	23,000	25,200
19	Rural	Non-Freeway	-	-	Uninterrupted	2	Undivided	2,600	5,300	8,600	13,800	22,300
20	Rural	Non-Freeway	-	-	Isolated Stops	2	Undivided	-	1,900	8,000	10,700	12,100
21	Suburban	Non-Freeway	-	-	Interrupted	4	Divided	-	5,300	25,200	29,400	31,200
22	Suburban	Highway	-	-	Uninterrupted	2	Undivided	2,500	7,200	12,700	17,300	23,500
23	Suburban	Arterial	-	-	Interrupted	2	Undivided	-	2,200	11,000	13,900	14,900
24	Suburban	Collector	-	-	-	2	Undivided	-	-	1,900	7,600	10,100

Source: Merced County 2013

While most motorists consider LOS A, B, and C satisfactory travel conditions, LOS D is considered marginally acceptable. Congestion and delay are considered unacceptable to most motorists and are given the LOS E or F ratings. Table 3 presents local and regional LOS standards established by each jurisdiction within the study area.

Table 3. LOS Standards of Significance

Regulatory Agency	LOS Thresholds
Caltrans[1]	LOS D
Merced County[2]	LOS D for freeways and urban roadways, LOS C for other rural roadways

[1] *Source: Comment from Caltrans*

[2] *Source: Merced County 2013*

Figure 1 shows the road network surrounding the proposed construction sites in the San Luis Reservoir area and the focus areas for the traffic and transportation impact analysis.

H.1 Traffic Flow Assessment Methods

The project alternatives would result in increases in traffic during construction and small or no changes during operations. This impact assessment analyzes the increase in traffic that would occur during construction based on changes to the LOS. LOS thresholds provided in Table 3 for the relevant jurisdictions are used to identify traffic impacts. In addition to daily operations, the impact assessment includes a.m. and p.m. peak hours. It is assumed that the a.m. peak hour occurs between 7:00 and 9:00 a.m. and the p.m. peak hour occurs between 4:00 and 6:00 p.m.

For roadways within Merced County, the LOS value was determined using the county's annual average daily traffic (AADT) value, physical characteristics (e.g., number of lanes), and their location (e.g., urban, suburban, rural). The LOS criteria for different types of roadways in Merced County is provided in Table 2.

For each project alternative, construction data (including the number of construction trucks, construction truck routes and schedule, number of workers, and worker traffic routes and schedule) were used to identify anticipated short-term construction-related and long-term operations-related trip generation. These additional short- and long-term trips were assigned to roadways located near the service areas to determine traffic operations under various project alternatives. Using the traffic operations' assessment methods mentioned above and the LOS standards of significance summarized in Table 3, potential transportation impacts to neighboring roadways were determined for each project alternative.

Figure 1. Traffic and Transportation Area of Analysis

H.2 Trip Generation

H.2.1 Alternative 1 –No Project/No Action Alternative

The No Project/No Action Alternative includes the connected B.F. Sisk Dam Safety of Dams (SOD) Modification Project. There was an evaluation of potential traffic effects from construction of the B.F. Sisk Dam SOD Modification Project completed by Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) in its Environmental Impact Statement/ Environmental Impact Report (EIS/EIR).

A maximum of 59 construction-related trucks and 50 daytime and 25 nighttime construction-related workers daily (resulting in 118 truck and 150 worker trips per day) would be involved with the B.F. Sisk Dam SOD Modification Project. The construction year considered for analyzing this alternative is 2027. It is assumed that all construction truck trips would be distributed between 6:00 a.m. and 12:00 p.m. The construction personnel trips are assumed to occur inbound before 6:00 a.m. and before 6:00 p.m. and outbound after 6:00 a.m. and after 6:00 p.m., which translates to 50 daytime workers entering the construction site before 6:00 a.m. and leaving after 6:00 p.m., while 25 nighttime workers enter the construction site before 6:00 p.m. and leave after 6:00 a.m.. Therefore, only the nighttime worker trips would occur during the a.m. and p.m. peak hours. Workers were assumed to access the construction site from the east via Interstate (I)-5, State Route (SR) 152, and SR 33. Materials and truck trips were assumed to originate from Los Banos and other locations along I-5. Trip generation and distribution of construction-related trips associated with the B.F. Sisk Dam SOD Modification Project is summarized in Table 4.

Table 4. Trip Generation – Alternative 1 No Project/No Action

Type of Trip	Time Period			
	a.m. peak hour[1]	p.m. peak hour[1]	Off-peak hours	Total daily
Construction Truck Trip	20	0	98	118
Construction Personnel Trip	25	25	100	150
Total Construction-Related Trip	45	25	198	268

Source: B.F. Sisk Dam SOD Modification Project EIS/EIR (Reclamation 2019)

H.2.2 Alternative 3 Dam Raise Action

A maximum of 240 construction-related trucks and 130 daytime and 87 nighttime construction-related workers daily (resulting in 480 truck and 434 worker trips per day) would be involved with the Alternative 3 dam raise. The construction year considered for analyzing this alternative is 2027. It is assumed that all construction truck trips would be distributed throughout the 24-hour construction so that 10 percent of the daily trips would occur during the a.m. and p.m. peak hours. The construction personnel trips are assumed to occur inbound before 6:00 a.m. and before 6:00 p.m. and outbound after 6:00 a.m. and after 6:00 p.m., which translates to 130 daytime workers entering the construction site before 6:00 a.m. and leaving after 6:00 p.m., while 87 nighttime workers enter the construction site before 6:00 p.m. and leave after 6:00 a.m.. Therefore, only the nighttime worker trips would occur during the a.m. and p.m. peak hours. A quarter (25 percent) of workers were assumed to access the construction site from the west via United States (US) 101 and SR 152, while 75 percent would access from the east via I-5, SR 152, and SR 33. Materials and truck trips were assumed to originate from Los Banos and other locations along I-5. Alternative 3 Dam Raise is not expected to add any long-term trips to the project site after the construction is completed. Trip generation and distribution of construction-related trips that would be associated with Alternative 3 Dam Raise is summarized in Table 5.

Table 5. Trip Generation – Alternative 3 Dam Raise

Type of Trip	Time Period			
	a.m. peak hour[1]	p.m. peak hour[1]	Off-peak hours	Total daily
Construction Truck Trip	48	48	384	480
Construction Personnel Trip	87	87	260	434
Total Construction-Related Trip	135	135	644	914

Source: Based on draft feasibility design assumptions

H.2.3 Alternative 3 SR 152 Modifications

A maximum of 37 construction-related trucks and 130 daytime construction-related workers daily (resulting in 74 truck and 260 worker trips per day) would be involved with the Alternative 3 SR 152 modifications. The construction year considered for analyzing this alternative is 2027. It is assumed that all construction truck trips would be distributed throughout the 24-hour construction so that 10 percent of the daily trips would occur during the a.m. and p.m. peak hours. The construction personnel trips are assumed to occur inbound before 6:00 a.m. and outbound after 6:00 p.m., which translates to 130 daytime workers entering the construction site before 6:00 a.m. and leaving after 6:00 p.m. Therefore, no worker trips would occur during the a.m. and p.m. peak hours. Half (50 percent) of workers were assumed to access the construction site from the west via US 101 and SR 152, while 50 percent would access from the east via I-5, SR 152, and SR 33. Materials and truck trips were assumed to originate from Los Banos and other locations along I-5. Alternative 3 SR 152 modifications are not expected to add any long-term trips to the project site after construction is completed. Trip generation and distribution of construction-related trips that would be associated with Alternative 3 SR 152 modifications is summarized in Table 6.

Table 6. Trip Generation – Alternative 3 SR 152 Modifications

Type of Trip	Time Period			
	a.m. Peak Hour[1]	p.m. Peak Hour[1]	Off-Peak Hours	Total Daily
Construction Truck Trip	8	8	58	74
Construction Personnel Trip	0	0	260	260
Total Construction-Related Trip	8	8	318	334

Source: Based on draft feasibility design assumptions

H.3 Roadway Operations

H.3.1 Alternative 1 –No Project/No Action Alternative

Roadway operations during construction of the connected B.F. Sisk Dam SOD Modification Project assumed as part of the No Project/No Action Alternative are summarized in Tables 7 and 8. Since the San Luis Reservoir region is rural in area, background traffic growth is expected to be minimal. For this analysis, it was assumed that background traffic would increase 0.5 percent annually from 2017 to 2027. This assumption was made using engineering judgement and general knowledge about traffic volume trends in rural areas.

Highway Capacity Software (version 7) and Synchro for roadway sections and intersections, respectively, were used to analyze traffic conditions during the a.m. and p.m. peak hours, based on the *Highway Capacity Manual 2010* methodology (TRB 2010).

At the Basalt Road and Access Road to Visitor Center intersections with SR 152, temporary traffic signals are assumed to be installed for use during the construction period.

Table 7. Daily Roadway Operations – Alternative 1 No Project/No Action

Roadway	Future (2027) Volume	Maximum Daily Truck Trips	Maximum Daily Worker Trips	Total Volume During SOD Construction (2027)	LOS During SOD Construction (2027)
I-5 at SR 152	33,600	45	50	33,695	B
SR 152 at I-5	28,400	28	50	28,478	B
SR 152 at SR 33	30,100	73	100	30,273	B
SR 152 at Cottonwood Bay	36,580	0	0	36,580	C
SR 33 at I-5	13,600	45	50	13,695	F
Basalt Rd at SR 152	200	118	150	468	B

Table 8. Peak Hour Roadway/Intersection Operations – Alternative 1 No Project/No Action

Roadway/ Intersection	Future (2027) Volume	Maximum Truck Trips	Maximum Worker Trips	Total Volume During SOD Construction (2027)	LOS During SOD Construction (2027)
a.m. Peak Hour					
I-5 NB at SR 152	2,150	4	0	2,154	C
I-5 SB at SR 152	1,800	4	8	1,812	C
SR 152 EB at I-5	1,100	2	9	1,111	B
SR 152 WB at I-5	1,450	2	0	1,452	B

Roadway/ Intersection	Future (2027) Volume	Maximum Truck Trips	Maximum Worker Trips	Total Volume During SOD Construction (2027)	LOS During SOD Construction (2027)
SR 152 EB at SR 33	200	6	17	223	A
SR 152 WB at SR 33	1,600	6	0	1,606	B
SR 152 EB at Cottonwood Bay	250	0	0	250	A
SR 152 WB at Cottonwood Bay	1,950	0	0	1,950	C
SR 33 NB at I-5	600	4	8	612	D
SR 33 SB at I-5	350	4	0	354	D
Basalt Rd NB at SR 152	10	10	25	45	B
Basalt Rd SB at SR 152	10	10	0	20	A
SR 152/Basalt Road					A*
SR 152/Visitor Center					A*
p.m. Peak Hour					
I-5 NB at SR 152	2,050	0	8	2,058	C
I-5 SB at SR 152	1,850	0	0	1,850	C
SR 152 EB at I-5	1,800	0	0	1,800	B
SR 152 WB at I-5	850	0	9	859	A
SR 152 EB at SR 33	1,900	0	0	1,900	C
SR 152 WB at SR 33	700	0	17	717	A
SR 152 EB at Cottonwood Bay	2,300	0	0	2,300	C
SR 152 WB at Cottonwood Bay	850	0	0	850	A
SR 33 NB at I-5	700	0	0	700	E
SR 33 SB at I-5	300	0	8	308	D
Basalt Rd NB at SR 152	10	0	0	10	A
Basalt Rd SB at SR 152	10	0	25	35	B
SR 152/Basalt Road					A*
SR 152/Visitor Center					A*

* LOS at signalized intersections based on average delay for all approaches.

H.3.2 Alternative 3 Dam Raise and Highway 152 Modifications

Roadway operations during construction of Alternative 3 are summarized in Tables 9 and 10. The effects identified from implementation of the Alternative 3 dam raise and Highway 152 modifications are additive above those necessary for the B.F. Sisk Dam SOD Modification Project considered as part of the No Project/No Action Alternative.

Because the San Luis Reservoir region is rural in area, background traffic growth is expected to be minimal. For this analysis, it was assumed that background traffic would increase 0.5 percent annually from 2017 to 2027. It is expected that the SR 152 at Cottonwood Bay section will be partially closed during construction—one out of the two lanes in each direction would be closed to vehicular traffic.

For daily operations, the added construction-related trips would not change the LOS at any of the study roadway segments in Merced County, except for the SR 152 at Cottonwood Bay section. At this location, the added construction-related trips and lane closures would change the LOS from C to F, resulting in a significant unavoidable impact as no feasible mitigation measures are identified.

Highway Capacity Software (version 7) and Synchro for roadway sections and intersections, respectively, were used to analyze traffic conditions during the a.m. and p.m. peak hours, based on the *Highway Capacity Manual 2010* methodology (TRB 2010).

At the Basalt Road and Access Road to Visitor Center intersections with SR 152, temporary traffic signals are assumed to be installed for use during the construction period. At the SR 152 at Cottonwood Bay section, the work zone analysis was performed in Highway Capacity Software (HCS) to model the lane closure scenario during the a.m. and p.m. peak hours.

The added construction-related trips would not change the LOS at any of the study roadway segments or intersections, except at the following locations:

- SR 152 eastbound segment at I-5 (p.m. peak hour)
- SR 152 eastbound segment at Cottonwood Bay (p.m. peak hour)
- SR 152 westbound segment at Cottonwood Bay (a.m. peak hour)
- Basalt Road northbound segment at SR 152 (a.m. peak hour)
- Basalt Road southbound segment at SR 152 (p.m. peak hour)
- Basalt Road intersection with SR 152 (a.m. and p.m. peak hours)

For the section of SR 152 where it crosses over Cottonwood Creek, the lane closures during construction and the added construction-related trips would result in a significant unavoidable impact on LOS during peak hours during construction, as no feasible mitigation measures are identified.

At locations other than SR 152 at Cottonwood Bay, for peak hour operations, the added construction-related trips either would not change the LOS or would change the LOS without exceeding the LOS threshold.

Note that this analysis was conducted assuming that the construction of the SR 152 modifications would occur during the daytime. There is a possibility that some construction may happen during nighttime. If construction activities were shifted to nighttime, it would not change the LOS analysis findings and impact determinations previously described.

Table 9. Daily Roadway Operations – Alternative 3 Dam Raise & Highway 152 Modifications

Roadway	Alternative 1 2027 Volume	Alternative 1 LOS (2027)	Maximum Daily Truck Trips	Maximum Daily Worker Trips	Total Volume During Construction (2027)	LOS During Construction (2027)	LOS Change
I-5 at SR 152	33,695	B	184	152	34,031	B	No Change
SR 152 at I-5	28,478	B	184	152	28,814	B	No Change
SR 152 at SR 33	30,273	B	498	422	31,193	B	No Change
SR 152 at Cottonwood Bay	36,580	C	0	238	36,818	F	Significant Unavoidable Impact
SR 33 at I-5	13,695	F	56	34	13,785	F	No Change
Basalt Rd at SR 152	468	B	554	694	1,716	B	No Change

Table 10. Peak Hour Roadway/Intersection Operations – Alternative 3 Dam Raise and SR 152 Modifications

Roadway/ Intersection	Alternative 1 2027 Volume	Alternative 1 LOS (2027)	Maximum Truck Trips	Maximum Worker Trips	Total Volume During Construction (2027)	LOS During Construction (2027)	LOS Change
a.m. Peak Hour							
I-5 NB at SR 152	2,154	C	9	0	2,163	C	No Change
I-5 SB at SR 152	1,812	C	9	21	1,842	C	No Change
SR 152 EB at I-5	1,111	B	9	22	1,142	B	No Change
SR 152 WB at I-5	1,452	B	9	0	1,461	B	No Change
SR 152 EB at SR 33	223	A	25	61	309	A	No Change
SR 152 WB at SR 33	1,606	B	25	0	1,631	B	No Change
SR 152 EB at Cottonwood Bay	238	A	4	0	242	A	No Change
SR 152 WB at Cottonwood Bay	1,628	B	4	22	1,654	F	Significant Unavoidable Impact
SR 33 NB at I-5	612	D	3	4	619	D	No Change
SR 33 SB at I-5	354	D	3	0	357	D	No Change
Basalt Rd NB at SR 152	45	B	24	87	156	C	Higher but does not exceed LOS C
Basalt Rd SB at SR 152	20	A	24	0	44	A	No Change
SR 152/Basalt Road		A*				B*	Higher but does not exceed LOS C
SR 152/Visitor Center		A*				A*	No Change

Roadway/ Intersection	Alternative 1 2027 Volume	Alternative 1 LOS (2027)	Maximum Truck Trips	Maximum Worker Trips	Total Volume During Construction (2027)	LOS During Construction (2027)	LOS Change
p.m. Peak Hour							
I-5 NB at SR 152	2,058	C	9	21	2,088	C	No Change
I-5 SB at SR 152	1,850	C	9	0	1,859	C	No Change
SR 152 EB at I-5	1,800	B	9	0	1,809	C	Higher but does not exceed LOS D
SR 152 WB at I-5	859	A	9	22	890	A	No Change
SR 152 EB at SR 33	1,900	C	25	0	1,925	C	No Change
SR 152 WB at SR 33	717	A	25	61	803	A	No Change
SR 152 EB at Cottonwood Bay	1,938	C	4	22	1,964	F	Significant Unavoidable Impact
SR 152 WB at Cottonwood Bay	698	A	4	0	702	C	Higher but does not exceed LOS D
SR 33 NB at I-5	700	E	3	0	703	E	No Change
SR 33 SB at I-5	308	D	3	4	315	D	No Change
Basalt Rd NB at SR 152	10	A	24	0	34	A	No Change
Basalt Rd SB at SR 152	35	B	24	87	146	C	Higher but does not exceed LOS C
SR 152/Basalt Road		A*				B*	Higher but does not exceed LOS C
SR 152/Visitor Center		A*				A*	No Change

* LOS at signalized intersections based on average delay for all approaches.

H.4 References

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix I: Hazards and Hazardous Materials Supporting Information

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Appendix I Hazards and Hazardous Materials Supporting Information

This appendix presents a description of potential hazards and hazardous materials[1] present within the area of analysis. Potential hazards discussed in this appendix are limited to the potential for wildfire and conflict with local airports, and hazardous materials impacts from the project alternatives. Potential impacts with other hazards including, seismic and landslide risk are discussed Section 4.13, Geology, Seismicity, and Soils.

I.1 Area of Analysis

The area of analysis for hazards and hazardous materials is the San Luis Reservoir State Recreation Area (SRA) which includes San Luis Reservoir (Merced County). The key areas affected by the project within San Luis Reservoir SRA would be B. F. Sisk Dam, the Basalt Hill Borrow Area and Borrow Area 6.

I.2 Existing Conditions at San Luis Reservoir

This section describes potentially hazardous conditions and hazardous materials sites within the area of analysis. Hazardous materials sites were identified using the EnviroStor Database managed by the California Department of Toxic Substances Control (DTSC) (DTSC 2017) and the GeoTracker Database managed by the State Water Resources Control Board (SWRCB) (SWRCB 2017).

San Luis Reservoir is not located within 2 miles of a public or private land-based airport. However, the San Luis Reservoir Seaplane Base allows water landings of planes on the reservoir. Approximately 25 aircraft operations per year take place at the reservoir. No overnight mooring of seaplanes is allowed and landing must be at least 500 feet from shore. Notices to Airmen (NOTAMs) are provided as needed from the Seaplane Base. Federal Aviation Administration Information listed on Airport-Data describes the elevation of San Luis Reservoir to be 544 feet and that elevations may change due to seasonal conditions and can be as low as 340 feet (Airport-Data 2013).

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[1] The California Health and Safety Code defines a hazardous material as "any material that because of its quantity, concentration, or physical or chemical characteristics poses a significant present or potential hazard to human health and safety, or the environment. Hazardous materials include, but are not limited to, hazardous substances, hazardous waste, radioactive materials, and any material which a handler or the administrating agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment" (Health and Safety Code Section 25501).

The project area is surrounded by wildlands and the potential for a wildfire in this area does exist which could affect neighboring urbanized areas of Santa Nella. The current *2030 Merced County General Plan, Background Report* includes a map of Fire Hazard Severity Zones. Much of the undeveloped and rural area surrounding San Luis Reservoir SRA is designated within a Moderate or High fire severity zone and is within the State Responsibility Area, which is protected by California Department of Forestry and Fire Protection (CalFire). In addition, the Merced County Fire Department provides primary response services to urban fires in unincorporated Merced County Local Responsibility Areas. In recognition of the severity of wildland fire hazards, the State has enacted legislation that requires local jurisdictions to adopt minimum standards, such as road standards for access, identification of infrastructure and buildings, private water supply reserves, fuel breaks and greenbelts, defensible space perimeters around structures, and specific building requirements to increase protection and improve fire prevention and response services (Merced County 2013).

The closest school to San Luis Reservoir SRA is Romero Elementary School on West Luis Road in Santa Nella. This school is located approximately 1.5 miles east of O'Neill Forebay and is within the Gustine Unified School District (Gustine Unified School District 2017).

Table 1 lists active or unresolved hazardous materials sites within five miles of the B.F. Sisk Dam. One active hazardous materials site was discovered within the San Luis Reservoir SRA under California Department of General Services management. This listed site consists of soil and groundwater contamination from a leaking underground storage tank (LUST) containing gasoline. The status of the site is open and remediation of soil and groundwater occurred under the supervision of Merced County until September 2009. Central Valley Regional Water Quality Control Board (RWQCB) has issued a request to California Department of General Services to continue with monitoring and the installation of additional monitoring wells to assess the extent of soil and groundwater contamination still present (Central Valley RWQCB 2016). Four open hazardous materials sites are within five miles of the B.F. Sisk Dam. The Anderson's Pea Soup LUST cleanup site on State Route (SR) 33 is contaminated with diesel and gasoline. The Anderson's Pea Soup site is open with a completed site assessment and interim remedial action. Santa Nella Parcel 41, formerly known as Central Valley Pipelines, is located on Santa Nella Road. Santa Nella Parcel 41 is open and currently under remediation for crude oil contamination. The Forebay Chevron site located on Gonzaga Road and is open with a completed site assessment.

There are five sites with permitted underground storage tanks (USTs) listed along SR 33 and two permitted UST sites near the intersection of SR 153 and SR 33 within five miles of B.F. Sisk Dam.

Table 1. Active Hazardous Materials Sites and Permitted Facilities near B.F. Sisk Dam

Haz. Mat Site Name/ Database ID Number	Haz. Mat Site Location/Distance from B.F. Sisk Dam	Regulatory Agency	Contaminant of Concern	Cleanup Status
San Luis Reservoir SRA Geotracker LUST Cleanup Site (T0604700256)	31426 Gonzaga Rd Gustine/0.0 miles	Central Valley RWQCB	gasoline	Open – Site Assessment as of 3/27/2015
Anderson's Pea Soup Geotracker LUST Cleanup Site (T0604711623)	12411 S Highway 33/4.8 miles	Central Valley RWQCB	diesel, gasoline	Open – Assessment & Interim Remedial Action
Santa Nella Parcel 41, Former Central Valley Pipelines Geotracker Cleanup Program Site (T10000005154)	Santa Nella Rd. Santa Nella/3.6 miles	Central Valley RWQCB	crude oil	Open – Remediation as of 3/11/2016
Forebay Chevron Geotracker LUST Cleanup Site (T10000005867)	29860 Gonzaga Rd. Santa Nella/0.0 miles	Central Valley RWQCB	benzene, diesel, ethylbenzene, gasoline, MTBE/TBA/ other fuel oxygenates, naphthalene, petroleum hydrocarbons	Open – Site Assessment as of 4/28/2014
Chevron Station #92513 Geotracker Permitted UST (FA0000808)	12801 Hwy 33 Santa Nella/4.1 miles	Merced County	N/A	N/A
Santa Nella Travel Center. Geotracker Permitted UST (FA0003674)	12310 Hwy 33 Santa Nella/4.6 miles	Merced County	N/A	N/A
7-Eleven Inc. Store # 37973 Geotracker Permitted UST (FA0000626)	12845 Hwy 33 Santa Nella/4.2 miles	Merced County	N/A	N/A
Arco AM/PM/Pennywise Travel Center Geotracker Permitted UST (FA0004571)	12185 Hwy 33 Gustine/4.6 miles	Merced County	N/A	N/A
Rotten Robbie #59 Geotracker Permitted UST (FA0000757)	12860 Hwy 33 Santa Nella/4.2 miles	Merced County	N/A	N/A

Haz. Mat Site Name/ Database ID Number	Haz. Mat Site Location/Distance from B.F. Sisk Dam	Regulatory Agency	Contaminant of Concern	Cleanup Status
Forebay Unocal Geotracker Permitted UST (FA0005654)	28960 Gonzaga Rd. Santa Nella/1.0 mile	Merced County	N/A	N/A
Santa Nella Petro Geotracker Permitted UST (FA0001926)	28991 Gonzaga Rd. Santa Nella/3.0 miles	Merced County	N/A	N/A

Source: SWRCB 2017 and DTSC 2017
Key:
Hwy = Highway
LUST = Leaking Underground Storage Tank
SRA = State Recreation Area
RWQCB = Regional Water Quality Control Board

Emergency evacuation routes within the study and surrounding areas for the SRA include freeways, arterials and major/minor collector roads in the County. State highways would be the primary routes including I-5, SR 33 and SR 152. All roads leading to I-5 and the State Routes would also be evacuation routes out of the SRA (Merced County 2013). Fire protection and emergency medical response at the SRA are provided by CalFire's station south of Gonzaga Road and east of the SRA Administrative Offices. Park rangers and lifeguards are also trained for emergency medical response.

I.3 References

Airport-Data. 2013. Airport-Data.com San Luis Reservoir Seaplane Base (0O0) Information. Accessed on 09 15 2017. Available at: https://www.airport-data.com/airport/0O0/.

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Appendix J1: Fish Resources in the Area of Analysis

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Appendix J1 Fish Resources in the Area of Analysis

Aquatic habitats throughout the area of analysis provide vital fish spawning, rearing, and/or migratory habitat for a diverse assemblage of native and nonnative species. Key life stages and needs of the species of primary management concern with the greatest potential to be affected by the Proposed Project alternatives are discussed below. These species collectively represent a diversity of life histories and environmental/habitat requirements, and they are among the most sensitive to environmental perturbation; therefore, findings from assessments of these species can be effectively used to make inferences about other fish species in the study area.

J1.1 Special-status Fish Species

Several native anadromous and resident species have been listed as threatened or endangered under the Federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA) or are candidates for listing. Seven fish species listed under ESA or CESA have the potential to occur in the watercourses in the area of analysis, as shown in Table 1. One of these species, longfin smelt, is a candidate for federal listing in addition to its current CESA listing. Additionally, three species have the potential to occur in the watercourses in the area of analysis that are listed as either federal or state species of concern (Table 1).

Table 1. Special-Status Fish Species with the Potential to Occur within the Area of Analysis.

Common Name	Scientific Name	Status (Federal/ State)	Primary Habitat and Critical Seasonal Periods	Occurrence in Area of Analysis
Central Valley Steelhead	*Oncorhynchus mykiss*	FT/—	Anadromous species using riverine, estuarine, and saltwater habitat. Migration potentially occurs year-round.	Sacramento River Basin, San Joaquin River Basin, Delta
Central Valley Chinook salmon, fall/late fall-run	*Oncorhynchus tshawytscha*	SC/CSC	Anadromous species using riverine, estuarine, and saltwater habitat. Adult migration occurs mainly from September through December but has been observed as late as June. Primary juvenile outmigration occurs from January through June.	Sacramento River Basin, San Joaquin River Basin, Delta

Common Name	Scientific Name	Status (Federal/ State)	Primary Habitat and Critical Seasonal Periods	Occurrence in Area of Analysis
Central Valley spring-run Chinook salmon	*Oncorhynchus tshawytscha*	FT/ST	Anadromous species using riverine, estuarine, and saltwater habitat. Adult migration potentially occurs from March through May. Juvenile outmigration occurs from November through April.	Sacramento River Basin, San Joaquin River Basin, Delta
Sacramento River winter-run Chinook salmon	*Oncorhynchus tshawytscha*	FE/SE	Anadromous species using riverine, estuarine, and saltwater habitat. Adult migration potentially occurs from January through May. Juvenile outmigration occurs from November through mid-March.	Sacramento River, Delta
Green sturgeon	*Acipenser medirostris*	FT/CSC	Green sturgeon are an anadromous species, migrating from the ocean to freshwater to spawn. They exist in the Sacramento River system, as well as in the Eel, Mad, Klamath, and Smith rivers in the northwest portion of California.	Sacramento River Basin, San Joaquin River Basin, Delta
Delta smelt	*Hypomesus transpacificus*	FT/SE	Spends most of its life in the Sacramento–San Joaquin estuary. Spawns in shallow, fresh or slightly brackish water upriver from the mixing zone, including in the Sacramento River, Mokelumne River system, Cache Slough region, San Francisco Bay Delta, and Montezuma Slough area.	Sacramento River Basin, San Joaquin River Basin, Delta
Longfin smelt	*Spirinchus thaleichthys*	—/ST	The longfin smelt is an anadromous species that spawns in the Delta and tributaries to San Francisco, San Pablo and Suisun Bays, and rears in the brackish areas of the San Francisco Bay and Delta. Adults are found in more saline waters including in the coastal ocean up to Alaska.	Sacramento River Basin, San Joaquin River Basin, Delta

Common Name	Scientific Name	Status (Federal/ State)	Primary Habitat and Critical Seasonal Periods	Occurrence in Area of Analysis
California / San Joaquin Roach	*Lavinia symmetricus* ssp. 1	—/CSC	Occurs in small, warm tributaries, to larger streams that flowed through open foothill woodlands of oak and foothill pine. Located in the foothills in much of the same region that contains the pikeminnow- hardhead-sucker assemblage.	Occurs upstream of large reservoirs or in tributary streams that would not be affected by the project.
Sacramento perch	*Archoplites interruptus*	—/CSC	Historically found in the sloughs, slow moving rivers, and lakes of the central valley. Prefer warm water. Aquatic vegetation is essential for young. (Within native range only)	Found in isolated quarry lakes in the Livermore Valley and has been found in San Luis Reservoir.
Pacific Lamprey	*Lampetra tridentata*	—/CSC	An anadromous species that, like steelhead, migrate into freshwater to spawn and juveniles return to the ocean to mature.	Sacramento River Basin, San Joaquin River Basin, Delta

Sources: CDFW 2016; Moyle 2002
Key to Status Codes:

Federal Status:	State Status:
SC: Species of Concern	SE: Endangered
FE: Endangered	ST: Threatened
FT: Threatened	CSC: Species of Special Concern

J1.1.1 Central Valley Steelhead

National Marine Fisheries Service (NMFS) has divided steelhead into six distinct groups, called distinct population segment (DPS), based on genetic testing and life history patterns. Recognition of these groups helps conserve diversity in the various life history adaptations. The Central Valley DPS includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries, excluding steelhead from the San Francisco and San Pablo Bays and their tributaries. Designated critical habitat includes 2,308 miles of stream habitat within the Central Valley as well as estuary habitat within the San Francisco-San Pablo-Suisun Bay complex (NMFS 2007).

Central Valley steelhead historically migrated upstream into the high gradient upper reaches of Central Valley streams and rivers for spawning and juvenile rearing. Construction of dams and impoundments on the majority of Central Valley rivers has created impassable barriers to upstream migration and substantially reduced the geographic distribution of steelhead. Although quantitative estimates of the number of adult steelhead returning to Central Valley streams to spawn are not available, anecdotal information and observations indicate that population abundance is low. Steelhead distribution is currently restricted to the mainstem Sacramento River downstream of Keswick Dam, the Feather River downstream of Oroville Dam, the American River downstream of

Nimbus Dam, the Mokelumne River downstream of Comanche Dam, and a number of smaller tributaries to the Sacramento River system, Delta, and San Francisco Bay. Low numbers of steelhead have also been reported from the San Joaquin River tributaries. The Central Valley steelhead population is composed of both naturally spawning steelhead and steelhead produced in hatcheries. NMFS recently released the Central Valley Chinook Salmon and Steelhead Recovery Plan (NMFS 2014).

Central Valley steelhead have a similar life history as described for other Pacific salmonids (below). The steelhead life cycle is characterized by a high degree of flexibility (plasticity) in the duration of both their freshwater and marine rearing phases. The steelhead life cycle is adapted to respond to environmental variability in stream hydrology and other environmental conditions. Unlike Chinook salmon that die after spawning, adult steelhead may migrate downstream after spawning and return to spawn in subsequent years. Steelhead that do not migrate to the ocean, but spend their entire life in freshwater, are known as resident rainbow trout. Adult steelhead migrate upstream during the fall and winter (September through approximately February) with steelhead migration into the upper Sacramento River typically occurring during the fall and adults migrating into lower tributaries typically during the late fall and winter. Spawning typically occurs during the winter and spring (December - April) with the majority of spawning activity occurring during January and March. Downstream migration of steelhead smolts typically occurs during the late winter and early spring (January - May). The seasonal timing of downstream migration of steelhead smolts may vary in response to a variety of environmental and physiological factors including changes in water temperature, and in changes in stream flow and increased turbidity, resulting from stormwater runoff. Juvenile steelhead rear within the coastal marine waters for approximately two to three years before returning to their natal stream as spawning adults.

Central Valley steelhead are listed as a threatened species under the ESA. Steelhead are not listed for protection under the CESA but are identified as a species of concern.

J1.1.2 Central Valley Fall-/Late Fall-Run Chinook Salmon

Fall-run Chinook salmon are the most abundant species of Pacific Salmon inhabiting the Sacramento and San Joaquin river systems. Fall-run Chinook salmon are not listed for protection under either CESA or ESA. In addition to fall-run Chinook salmon the group of Pacific Salmon is comprised of late fall-run Chinook salmon (which are not listed under either ESA or CESA), spring-run Chinook salmon and winter-run Chinook salmon, which are discussed below. Although fall-run and late fall-run Chinook salmon are not listed for protection under ESA they are included in this analysis since the area of analysis includes habitat identified as essential fish habitat (EFH) for Pacific salmon.

Although fall-run and late fall-run Chinook salmon inhabit a number of watersheds within the Central Valley for spawning and juvenile rearing, the largest populations occur within the mainstem Sacramento, Feather, Yuba, American, Mokelumne, Merced, Tuolumne, and Stanislaus rivers. Fall-run Chinook salmon, in addition to spawning in these river systems, are also produced in fish hatcheries located on the Sacramento, Feather, American, Mokelumne, and Merced rivers. Hatchery operations are intended to mitigate for the loss of access to upstream spawning and juvenile rearing habitat resulting from construction of dams and reservoirs within the Central Valley in addition to producing fall-run Chinook salmon as part of the ocean salmon enhancement program to support commercial and recreational ocean salmon fisheries. Fall-run Chinook salmon also support an inland recreational fishery.

Fall-run and late fall-run Chinook salmon have a similar life history as described for other Pacific salmon (above). Adult fall-run Chinook salmon migrate from the coastal marine waters upstream through San Francisco Bay, Suisun Bay, and the Delta during late summer and early fall (approximately late July to early December). Fall-run Chinook salmon spawning occurs between October and December with the greatest spawning activity occurring typically in November and early December. The success of fall-run Chinook salmon spawning is dependent, in part, on seasonal water temperatures. After incubating and hatching, the young salmon emerge from the gravel redd as fry. A portion of the fry population migrate downstream soon after emergence, where they rear within the lower river channels, Delta, and estuary, during the spring months. The remaining portion of juvenile salmon continue to rear in the upstream stream systems through the spring months, until they are physiologically adapted to migration into saltwater (smolting), which typically takes place between April and early June. A small proportion of the fall-run Chinook salmon juveniles may, in some systems, rear through the summer and fall months migrating downstream during the fall, winter, or early spring as yearlings. Adult Chinook salmon spawn at ages ranging from approximately two to five-years-old with the majority of adult fall-run Chinook salmon returning at age three. Chinook salmon, unlike steelhead, die after spawning.

In 1998, NMFS proposed that Central Valley fall-run and late fall-run Chinook salmon be listed under ESA as a threatened species. Based upon further analysis, and public comment, NMFS decided that fall-run and late fall-run Chinook salmon did not warrant listing but rather remain as a candidate species for further analysis and evaluation.

J1.1.3 Central Valley Spring-Run Chinook Salmon

Spring-run Chinook salmon were historically found throughout the Central Valley from the upper tributaries of the Sacramento to as far south as the upper reaches of the San Joaquin in total numbers ranging from 1-2 million adults per year (Yoshiyama et al. 1998, Lindley et al. 2004). Abundance declined precipitously following construction of Shasta and Keswick dams and agricultural and urban development (Yoshiyama et al. 1998), and spring-run have become restricted to only two self-sustaining populations (Mill and Deer Creek, Butte Creek) and anecdotal occurrences in other tributaries of the Sacramento (NMFS 2016). Spring-run were completely extirpated from the San Joaquin and its tributaries, although reintroduction efforts have been underway since 2014 in a 60 kilometers (km) reach of the San Joaquin below Friant Dam (NMFS 2016). Abundance of Central Valley spring-run has been highly variable since 1970, reaching above 30,000 spawners in some years and below 1,000 in recent years following prolonged drought (NMFS 2016). Despite this, studies have shown a recent number of adult Chinook returning to the Mokelumne, Stanislaus, and Tuolumne Rivers (NMFS 2016). The Feather River Fish Hatchery also has a production that is designated part of the ecologically significant unit (ESU), however it is likely that these fish are hybridized with more common fall-run Chinook due to hatchery practices (NMFS 2016, Moyle et al. 2017).

The Central Valley spring-run Chinook salmon are distinguished from other ESUs of Chinook salmon by adult migration timing and spawning season. From February to June, adult spring-run return to their natal streams when increased run-off from snow melt and precipitation allow them to reach tributaries which are normally unavailable to fall- and winter-run adults which migrate during lower instream flows (NMFS 2016, Moyle et al. 2017). After migrating, adults hold in cold-water pools over the summer months before spawning (Moyle 2002). Following an incubation period lasting 40-60 days, juveniles rear as alevin for an additional 4-6 weeks (Moyle 2002). At this point, there is considerable plasticity within their rearing strategy. Some individuals will immediately migrate from their natal streams to the Delta and estuary; some will slowly migrate to the estuary, rearing for periods in other tributaries and floodplains along the route; and some individuals will remain and rear in their natal streams for roughly one year before migrating quickly through the Delta and estuary (Garman & McReynolds 2009). Individuals then spend 2 to 4 years in the ocean before returning.

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of spring-run Chinook salmon. The largest threat is loss of spawning habitat and continued degradation of available remaining habitat (NMFS 2016). There has been little expansion of available spawning habitat since the listing of spring-run Chinook, however there are planned future projects to remove dams and improve fish passage, increasing spawning habitat for the species. In addition, the continued degradation of current habitat threatens the continued success of the species, including the continued simplification and channelization of river mainstems, disconnection of floodplain habitat, and withdrawal of water from streams through agricultural diversions and pumps (Moyle et al. 2017). Much of the decline of habitat quality is attributed to the construction and operation of the Central Valley Project (CVP) and State Water Project (SWP) (Cummins et al. 2008), however steps are being taken to reduce the impacts of water exports on water quality and instream flows following the 2009 CVP/SWP biological opinion (NMFS 2009). Other threats to spring-run Chinook salmon are decrease in genetic diversity and introgression with fall-run Chinook salmon and effects from climate change (NMFS 2016, Moyle et al. 2017).

Spring-run Chinook salmon were listed as threatened under the federal ESA and threatened under CESA in 1999 (NMFS 2016).

J1.1.4 Sacramento River Winter-Run Chinook Salmon

The Sacramento River winter-run Chinook salmon (SRWR) is an ESU of Chinook salmon which evolved exclusively in the upper reaches of the Sacramento River. Historically, winter-run Chinook salmon abundance is assumed to have been close to 200,000 spawners per year (NMFS 2005) with reported spawnings in the Little Sacramento, McCloud, and lower Pit Rivers, and Battle Creek (Moyle et al. 1989, Lindley et al. 2007). Since the construction of the Shasta and Keswick Dams, as well as increased hydroelectric operations, those populations have since been extirpated (Lindley et al. 2007). Currently, only a single population exists in the reach of the Sacramento River between Keswick Dam near Redding and Red Bluff Diversion (Lindley et al. 2007, NMFS 2016).

Winter-run Chinook are distinguished by their unique life history. Historically, the streams that supported the SRWR population were defined by consistently cool temperatures year-round (Moyle et al. 2017). Winter-run adults migrate upstream into freshwater in January through May (Moyle et al. 2017), holding in the cool outflows from Keswick Dam until spawning in spring and summer. Fry emerge from July through October (Yoshiyama et al. 1998, Williams 2006), and then rear for 5-10 months in the cool reach below Keswick Dam (Yoshiyama et al. 1998) before migrating downstream through the Delta and San Francisco Bay to the ocean. Chinook typically will spend 2 to 3 years in the ocean, before returning to spawn.

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of winter-run Chinook salmon, the greatest of which is loss of spawning habitat due to the construction of Shasta and Keswick Dams (NMFS 1998). The development of the dams has moved suitable spawning gravel downstream (Stillwater 2006), increased urbanization and channelization, and decreased water quality and flow (NMFS 2016, Moyle et al. 2017), threatening both availability of spawning habitat and rearing habitat for juveniles. To combat this, projects are currently underway to provide passage above the dams for access to spawning habitat (NMFS 2016). Other threats to SRWR include decreases in genetic diversity (Lindley et al. 2007, NMFS 2016, Moyle et al. 2017), predation on out-migrating juveniles (Grossman 2016, Moyle et al. 2017), incidental take from recreational fishing (Moyle et al. 2017), entrainment into diversions (Kimmerer 2008), runoff (Moyle et al. 2017), and climate change (Moyle et al. 2017).

Winter-run Chinook salmon were listed as threatened under the federal ESA and endangered under CESA in 1989. They were reclassified as federally endangered in 1992 and critical habitat was designated by NMFS. Current abundance trends have been negative for the past 5 decades, with the run of 2011 marking the lowest run since the establishment of the Livingston Stone National Fish Hatchery (LSNFH) (NMFS 2016). The LSNFH has continuously produced a supplemental stock of SRWR Chinook since its completion in 1997. As part of the 2016 5-year status review, the current total population size, including Sacramento River and LSNFH fish, is 11,770 (NMFS 2016). In the beginning of its operational phase, LSNFH fish production was contributing approximately 5-10% of the spawning run (NMFS 2016). However, that number has been increasing, reaching ~20% in 2005 and 2014, and exceeding 30% in 2012 (NMFS 2016). Over the last 12 years the average influence is 13% (SD=±8%), placing the population at moderate risk of extinction (NMFS 2016).

J1.1.5 North American Green Sturgeon

North American green sturgeon are large, anadromous, long-living fish that are widely distributed along the Pacific coast of North America, spending a significant amount of their life in the ocean (Moyle 2002). Specifically, the southern distinct population segment of green sturgeon (sDPS) ranges from the Bering Sea in Alaska to El Socorro, Baja California. Within California, sDPS are widely distributed in the Sacramento-San Joaquin Delta and estuary areas. Green sturgeon are known to occur and spawn in the Sacramento River and some of its tributaries including the Feather, Yuba, and Bear Rivers. Furthermore, sDPS utilize the lower San Joaquin River but there is a lack of historical records indicating that they once spawned in the system (NMFS 2018). Within the freshwater portion of their range, sDPS distribution is limited by permanent or flow-dependent barriers such as Shasta and Keswick Dams, Fremont and Tisdale weirs, and Oroville, Daguerre Point, and Englebright Dams (Mora et al. 2009).

Green sturgeon reach sexual maturity at about 15 years of age, typically spawning every 3-4 years (NMFS 2018). During spawning runs, adult sDPS enter San Francisco Bay between mid-February and early May and migrate rapidly up the Sacramento River searching for deep, turbulent flows to spawn (Vogel 2008, Benson et al. 2007, Poytress et al. 2009). Spawning habitat most preferred by green sturgeon are water velocities between 1.0-1.1 meters per second (m/s), depths of 8-9 meters (m), and substrate containing small to medium sized sand, gravel, cobble, or boulder substrate (Wyman et al. 2018), as green sturgeon eggs are adhesive and stick to cobble and gravel surfaces or settle into crevices in the river bottom. Larvae hatch from eggs between 6-8 days, assuming optimal temperature conditions. Juveniles can spend up to three years in freshwater (Klimley et al. 2015) before migrating to the ocean. After spawning, adult sDPS will hold in the Sacramento River for several months before migrating back to the ocean in the fall. Green sturgeon are also known to migrate back to the ocean soon after spawning in the spring and summer months (Heublein et al. 2009).

North American green sturgeon are subject to many anthropogenic and non-anthropogenic threats, the greatest of these is alterations to critical spawning and rearing habitats (NMFS 2018). In the Sacramento River Basin, dams block access to about 9% of historically available spawning habitat (Mora et al. 2009) as well as disrupt timing of spawning runs and diminish habitat suitability for eggs and larvae (Moser et al. 2016). Furthermore, human construction projects and activities like water diversions, power generation, and dredging activities pose entrainment and impingement threats to the sDPS. Areas of particular concern of entrainment are the Sutter and Yolo bypasses where during high flows, sDPS move easily over the weirs, but at low flows, they are left stranded behind the weirs with no access back to the main river (Mussen et al. 2014). Other threats to sDPS include non-native species introductions, pesticide and pollutant runoff (Domagalski et al. 2000), poaching, and climate change.

The sDPS of North American green sturgeon is listed as threatened under the ESA (NMFS 2006).

J1.1.6 Delta Smelt

The Delta Smelt is a small (max 120 millimeter [mm] total length), transparent fish endemic to the San Francisco Bay – Delta. They are restricted to an area extending from the Sacramento River at the confluence of the Feather River, south to the fork of the San Joaquin and Old Rivers, and west into the San Pablo Bay (Moyle et al. 2016). Recently their distribution, especially during summer and fall, has become restricted to the north, east and west Delta as warmer temperatures and clearer water in the central and south Delta likely cause survival to drop (Merz et al. 2011, Moyle et al. 2016).

As its entire life cycle is carried out within fresh or brackish water, Delta Smelt may be considered a “semi-anadromous” or “weakly anadromous” fish, spawning in freshwater and rearing in fresh or brackish water (Bennet 2005, Grimaldo et al. 2009, Sommer et al. 2011). Adults begin seasonal migrations into freshwater following the “first flush”, usually in December and then hold for at least a month before spawning in late February or March through May (Bennet 2005, Grimaldo et al. 2009). Natural spawning behavior is unknown and has not been witnessed in the wild, though laboratory spawning events have shown them to be broadcast spawners with eggs that adhere to the bottom and sides of tanks (Lindberg et al. 2013, LaCava et al. 2015), however their preferred natural substrate is unknown (Bennet 2005). Females and males may spawn multiple times within one season based on laboratory experiments (LaCava et al. 2015). As larvae develop, they rear in freshwater (Dege & Brown 2004, Sommer & Mejia 2013). As they grow, post-larvae and juveniles move into the low salinity zone as rising water temperatures in the Delta push them out of the freshwater areas. Recent surveys indicate that a subset of the population may inhabit the Cache Slough area, which is freshwater, all year-round.

The list of threats to Delta Smelt is extensive and management actions are frequently met with public criticism and complicated by a growing human population. One of the threats to Delta Smelt is entrainment in water diversions, particularly the CVP and SWP, both of which are located in the south Delta. These pumps export enormous volumes of water out of the Delta which, when combined with low inflows, can create strong currents carrying smelt toward the pumps (Monsen et al. 2007). Smelt are most vulnerable to entrainment during the upstream migration of adults and as larvae begin to move downstream toward the Central Delta (Sommer et al. 2011, Moyle et al. 2016).

Modeling has shown that up to 25% of larval or juvenile smelt and as much as 50% of the adult population may be entrained by increased pumping activities during high export years (Kimmerer 2008); however, there remains significant uncertainty around those estimates. Another serious threat to Delta Smelt is a decline in abundance of food resources, including calanoid copepods and mysid shrimp (Kimmerer et al. 2012, Brown et al. 2016). Studies of growth, condition, and gut fullness show that Delta Smelt may be experiencing food limitation (Feyrer et al. 2003, Bennett 2005, Hammock et al. 2015), and that a mismatch between juveniles and their prey may reduce recruitment (Bennett 2005). Low food availability and quality coupled with warmer temperatures likely intensify stress and may explain reduced survival (Bennett 2005, Bennett et al. 2008). Other threats to smelt are alteration and loss of habitat, predation, contaminants, and climate change (Brown et al. 2013).

Abundance of Delta Smelt has been in general decline since the 1980's leading to its listing by federal and state governments as threatened in 1993 and critical habitat designation in 1994. Further declines in abundance led to its reclassification as endangered under the CESA in 2010.

J1.1.7 Longfin Smelt

Longfin Smelt are small, euryhaline, and anadromous fish (Moyle 2002, Rosenfield 2010) found along the Pacific Coast of North America from Prince William Sound, Alaska south to the San Francisco Bay estuary in California (Lee et al. 1980; Garwood 2017). The detection of Longfin Smelt within the estuary throughout the year suggests that, as with Striped Bass, anadromy is one of several life history strategies or contingents in this population. The San Francisco Bay/Sacramento–San Joaquin River Delta (Bay-Delta) population of Longfin Smelt is thought to be the southern-most reproducing population along the Pacific Coast and the largest spawning population in California. The Bay-Delta population of Longfin Smelt is recognized as a DPS under the ESA. The Bay-Delta population of Longfin Smelt occurs throughout the San Francisco Bay-Delta system and in the coastal waters west of the Golden Gate Bridge (77 Federal Register [FR] 19755). Within the San Francisco Estuary, they have been documented north as far as the town of Colusa on the Sacramento River, east as far as Lathrop on the San Joaquin River, and south as far as Alviso and Coyote sloughs in the South San Francisco Bay (Merz et al. 2013).

Longfin Smelt are short-lived and semelparous, usually living for two years in saline water, and then moving to brackish or freshwater to spawn and die (Moyle 2002, Rosenfield 2010). Mature adults generally migrate upstream to spawning areas during the late fall and early winter (Rosenfield & Baxter 2007), with peak spawning typically occurring in January and February of most years. Previous studies suggested that spawning in the Sacramento River occurs from just downstream of the confluence of the Sacramento and San Joaquin Rivers upstream to about Rio Vista and that spawning on the San Joaquin River extends from the confluence upstream to about Medford Island (Moyle 2002); more recent studies suggest hatching and early rearing occurs in a much broader region and higher salinity (2–12 ppt) than previously recognized (Grimaldo et al. 2017). Spawning likely also occurs in Suisun Marsh and the Napa River (CDFG 2009), and possibly in other tributaries to San Francisco Bay. Spawning occurs when water temperatures are between 7 and 15°C, with larvae hatching in 40 days at 7 degrees Celsius (°C) (Moyle 2002). Newly hatched Longfin Smelt larvae are surface-oriented and have little ability to control their position in the water column until their air bladder is developed at about 12 mm standard length (SL) at which point they undergo reverse diel vertical migrations (Bennett et al. 2002). It is believed that undergoing reverse diel vertical migrations allows larval Longfin Smelt to maintain their position on the axis of the estuary (Bennett et al. 2002). Juvenile Longfin Smelt move seaward by late summer and fall.

There are a number of threats that affect the Bay-Delta population of Longfin Smelt. One such threat is entrainment from water diversions. Water diversions, such as the SWP, CVP, and North Bay Aqueduct Barker Slough Pumping Plant, entrain all life stages of Longfin Smelt. Another threat to Longfin Smelt is the reduction of freshwater flow. Longfin Smelt population abundance increases significantly in high winter-spring outflow years suggesting that the flow of freshwater through the San Francisco estuary greatly affects survival, growth, and population levels of Longfin Smelt (Rosenfield & Baxter 2007). However, the mechanisms underlying why Longfin Smelt respond favorably in higher flow years remain unknown. Recent research indicates that population abundance may be responding to wet conditions from the tributaries throughout the San Francisco Estuary (Lewis et al. 2020). Other threats affecting Longfin Smelt survival are reduction in turbidity (Kimmerer et al. 2009, Thomson et al. 2010), decline in food resources (Sommer 2007), predation by nonnative predators (Sommer 2007, Rosenfield 2010), and increase in water temperatures and climate change (Brown et al. 2013, 2016).

The Bay-Delta population of Longfin Smelt has declined significantly since the 1980's (Moyle 2002, Rosenfield & Baxter 2007, Baxter et. al. 2010). The relative population size of Longfin Smelt in the San Francisco Estuary is measured by indices of abundance generated from different sampling programs. The abundance of age 0 and older fish is best indexed by the California Department of Fish and Wildlife (CDFW) Fall Midwater Trawl and Bay Study, while the abundance of larvae and young juveniles is best indexed by the CDFW 20-mm Survey. The relationship between these indices and actual population sizes is unknown. Currently, the Longfin Smelt is designated as a candidate for listing under the federal ESA (NMFS 2012), and has been listed as threatened under the CESA since June 26, 2009.

J1.1.8 California/San Joaquin Roach

California roach are small, thick-bodied fish found throughout the Sacramento-San Joaquin river drainage, including the Pit River and tributaries to Goose Lake in Oregon. In coastal drainages, they are native to the Navarro, Gualala, and Russian rivers; streams tributary to Tomales Bay, Pescadero Creek and, in the Monterey Bay drainage, San Lorenzo, Pajaro, and Salinas rivers (Moyle 2002). The Sacramento-San Joaquin roach, a distinct population within the California roach "complex" (Moyle 2002), is found within the Sacramento and San-Joaquin River drainages, except Pit River, as well as tributaries to San Francisco Bay. They are commonly found in small to medium sized foothill rivers and their present distribution is confined to rivers upstream of large Central Valley reservoirs or tributaries that are not affected by the CVP or SWP operations. Consequently, California roach are not included in the analysis of effects.

J1.1.9 Sacramento Perch

Sacramento perch are a CDFW Species of Special Concern and were historically abundant predators throughout the Central Valley of California, where they occupied sloughs, lakes, and slow moving rivers. Today they are rare in their native waters, but may still exist in Clear Lake, as well as in some farm ponds and reservoirs (Crain and Moyle 2011). They have been widely introduced throughout California including in Owens Lake, the upper Klamath basin, upper Pit River watershed and Walker River watershed, (Moyle 2002). The only two native populations that were present in the area of analysis were in the Alameda Creek drainage, and are currently thought to be extirpated (Crain and

Moyle 2011). These habitats would not be affected by the project alternatives. Consequently, Sacramento perch are not included in the analysis of effects.

J1.1.10 Pacific Lamprey

The Pacific lamprey, a CDFW Species of Special Concern are anadromous, beginning their migration into freshwater towards upstream spawning areas primarily between early March and late June (Moyle 2002). Most upstream migration occurs at night and occurs in pulses. Spawning habitat requirements are thought to be similar to those of salmonids. There is some evidence that lamprey in larger river systems, such as the Klamath and Eel Rivers, have distinct runs similar to Chinook salmon (Moyle 2002). Both sexes contribute to nest construction by removing larger stones from a gravelly substrate, creating a shallow depression. These simple nests occur in gravelly substrata with moderately swift current, water temperatures typically of 12-18 °C, and at a depth of 30-150 centimeters (Moyle 2002). External fertilization of eggs occurs just in front of the nest and are then washed into the nest. Fecundity is unknown. Spawning is repeated until both individuals are spent. Adults typically die after spawning. The eggs hatch into ammocoetes after approximately 19 days at 15 °C, spend a short time in the nest, and then drift downstream to suitable area in sand or mud (Moyle 2002).

Ammocoetes remain in freshwater for approximately 5 to 7 years, where they bury into silt and mud and feed on algae, organic material, and microorganisms. Ammocoetes change locations during this stage. Ammocoetes begin metamorphosis into macropthalmia (juveniles) when they reach 14-16 centimeters total length. Downstream migration begins upon completion of this metamorphosis, generally coinciding with high flow events in winter and spring (Moyle 2002).

Adults spend 3-4 years in the ocean in British Columbia, but this length is thought to be shorter in more southern areas (Moyle 2002). Adult remain close to the mouths of the rivers from which they came, likely because their prey is most abundant in estuaries and other coastal areas (Moyle 2002). Pacific lamprey are thought to be preyed upon in the ocean by sharks, other fish, otters, seals, and sea lions (Moyle 2002). Pacific lamprey habitat would not be affected by the project alternatives. Consequently, Pacific lamprey are not included in the analysis of effects.

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Appendix J2: Operational Impacts on Aquatic Resources

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Appendix J2 Operational Impacts on Aquatic Resources

This section analyzes the impacts to special-status aquatic resources due to changes in hydrologic operations associated with each alternative.

J2.1 Methods

Operational impacts to special-status fishes in the Delta were evaluated for Alternatives 2 and 3.

J2.1.1 Operational Impacts to Delta Fishes

Extensive modeling of hydrologic conditions was performed using CalSim II to provide a quantitative basis from which to assess potential operational effects of the project alternatives on fisheries resources and aquatic habitats in the Delta. Hydrologic indicators (or parameters) for habitat quality in the Delta that were used in this analysis include Sacramento River flow, Delta outflow, low salinity zone location (X2[1]), Old and Middle River flows, and Delta exports.

Operational impacts would be triggered by changes in hydrology associated with changes in operations. Extensive modeling of hydrologic conditions was performed using CalSim II to provide a quantitative basis from which to assess potential operational effects of the project alternatives on fisheries resources and aquatic habitats in the Delta. CalSim II is a water resources simulation model that simulates the Central Valley Project (CVP) and State Water Project (SWP) operations, as well as other major water supply operations in the Central Valley through optimization. It provides a system-wide hydrologic and operational approach for planning and impact analyses for the Sacramento River, San Joaquin River, and the Delta. CalSim II is widely used to determine the reliability of CVP and SWP water deliveries, as well as to support water resources studies, such as water-right applications for the State Water Resources Control Board (SWRCB), California Environmental Quality Act (CEQA) compliance, and National Environmental Policy Act (NEPA) compliance, to estimate potential changes in surface water resources.

Because the San Luis Reservoir is part of the CVP and SWP, environmental protection would be provided in the action alternative through operations consistent with applicable laws, regulations, biological opinions (BOs), and court orders in place at the time the intake would become operational and long-term operations of equipment would remain subject to applicable permitting processes.

Hydrologic indicators (or parameters) for habitat quality that were used in this analysis include Sacramento River flow, Delta outflow, X2, Old and Middle River flows, and Delta exports.

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[1] X2 is the location of the tidally averaged 2 parts per thousand (ppt) salinity isohaline at the channel bottom, measured as distance in kilometers (km) from the Golden Gate Bridge (Jassby et al. 1995).

J2.1.1.1 Sacramento River Flow

Flow within the Sacramento River has been identified as an important factor driving the life history of numerous listed fishes. Flow influences the survival of emigrating juvenile Chinook salmon *(Oncorhynchus tshawytscha)*, facilitates downstream transport of planktonic fish eggs and larvae, such as delta smelt *(Hypomesus pacificus)* and longfin smelt *(Spirinchus thaleichthys)*, striped bass *(Morone saxatilis)*, and American shad (*Alosa sapidissima*), and supports seasonal floodplain inundation that has been identified as important habitat for successful spawning and larval rearing by species, such as Sacramento splittail *(Pogonichthys macrolepidotus)*, and as seasonal foraging habitat for juvenile Chinook salmon and steelhead *(O. mykiss)*. Sacramento River flows are also important in the transport of organic material and nutrients from the upper regions of the watershed downstream into the Delta. A reduction in Sacramento River flow as a result of water operations, depending on the season and magnitude of change, could adversely affect habitat conditions for both resident and migratory fish species.

The potential effect of flow changes in the Sacramento River at Hood on fish habitat within the Bay-Delta as a result of the proposed project were evaluated. It was assumed that model-predicted negative changes in the average monthly flows less than 5% relative to the basis-of-comparison would not be expected to result in a significant effect on habitat quality or availability, or the transport mechanisms provided by Sacramento River flow, on resident or migratory fish or the zooplankton and phytoplankton that they rely on for a food resource. A negative change of 5 % was used because it corresponds to a small magnitude of change and also accounts for model error (or noise).

J2.1.1.2 Delta Outflow

Water development has changed the volume and timing of freshwater flows through the Bay-Delta. Over the past several decades, the volume of the Bay-Delta's freshwater supply has been reduced by upstream diversions, in-Delta use, and Delta exports. As a result, the proportion of Delta outflow depleted by upstream and Delta diversions has grown substantially. In wet years, diversions reduce outflow by 10% to 30%. In dry years, diversions may reduce outflow by more than 50%.

Water development has also altered the seasonal timing of flows passing into and through the Bay-Delta. Flows have decreased in April, May, and June and have increased slightly during the summer and fall (San Francisco Estuary Partnership 2015). Seasonal flows influence the transport of eggs and young organisms (e.g., zooplankton, fish eggs, larvae) through the Delta and into San Francisco Bay. Flows during the months of April, May, and June play an especially important role in determining the reproductive success and survival of many estuarine species, including salmon, striped bass, American shad, delta smelt, longfin smelt, Sacramento splittail, and others (Stevens et al. 1985, Meng and Moyle 1995).

It was assumed that model-predicted negative changes in the average monthly flows that were less than 5% relative to the basis-of-comparison would not be expected to result in a significant effect on habitat quality or availability and also accounts for model error (or noise). It would also not be expected to result in a significant effect on the transport mechanisms provided by Delta outflow on resident or migratory fish or the zooplankton and phytoplankton on which they rely for a food resource.

J2.1.1.3 Low Salinity Zone and X2

The transition area between saline waters and fresh water, frequently referred to as the low salinity zone (LSZ), is located within Suisun Bay and the western Delta. The LSZ has also been associated with the entrapment zone, a region of the Bay-Delta characterized by higher levels of particulates, higher abundances of several types of organisms, and a turbidity maximum. It is commonly associated with the position of X2, but actually occurs over a broader range of salinities (Kimmerer 2002). Originally, the primary mechanism responsible for this region was thought to be gravitational circulation, a circulation pattern formed when freshwater flows seaward over a more dense, landward-flowing marine tidal current. However, studies have shown that gravitational circulation does not occur in the entrapment zone in all years, nor is it always associated with X2 (Burau et al. 1998). In addition, bottom topography may play an important role (Schoellhamer 2001).

Delta outflow and tides establishes the location of the LSZ in the Delta, an area that historically has had high prey densities and other favorable habitat conditions for rearing juvenile delta smelt, striped bass, and other fish species (Kimmerer 2004). The LSZ is often referenced by X2, which is the distance upstream, in kilometers (km), from the Golden Gate Bridge where tidally averaged salinity is equal to 2 parts per thousand (ppt) (Kimmerer 2004). The best combination of habitat factors for some aquatic species is believed to occur when X2 is located downstream from the confluence of the Sacramento and San Joaquin rivers. When Delta outflow is low, X2 moves eastward and is located in the relatively narrow channel of these rivers; at higher outflows, it moves downstream (westward) into more open waters with larger area.

Historically, X2 has varied between San Pablo Bay (river km 50) during high Delta outflow and Rio Vista (River km 100) during low Delta outflow. In recent years, it has typically been located between approximately Honker Bay and Sherman Island (River kms 70 to 85). X2 is controlled directly by the volume of Delta outflow relative to tidal flows, although changes in X2 lag behind changes in outflow. When X2 is located in the more open bays, significantly more outflow is needed to move X2 small distances than when X2 is located in more narrow channels. Minor modifications in outflow do not greatly alter X2.

Jassby et al. (1995) showed that when X2 is in the vicinity of Suisun Bay, several estuarine organisms tend to show increased abundance. However, it is by no means certain that X2 has a direct effect on any of the species. The observed correlations may result from a close relationship between X2 and other factors that affect these species.

Operations of upstream storage reservoirs have the potential to affect the location of X2 as a result of changes in freshwater flows from the upstream tributaries through the Delta. To evaluate changes in habitat quantity and quality for estuarine species, a significance criterion of a model-predicted upstream change in X2 location within 1 km of the basis-of-comparison condition was considered to be less than significant and also accounts for model error (or noise). The criterion was applied to a comparison of hydrologic model results for basis-of-comparison conditions and project alternative, by month and water year.

J2.1.1.4 Old and Middle River Flows

Net reverse flows in the central and south Delta occur when Delta exports and agricultural demands exceed San Joaquin River inflow plus Sacramento River inflow through the Delta-Mendota Canal (DMC), Georgiana Slough, and Three Mile Slough. While Old and Middle Rivers experience twice daily tidal flow reversals on the order of about plus and minus 30,000 cubic feet per second (cfs), net reverse flow condition occurs within Old and Middle rivers as the rate of water diverted at the CVP and SWP export facilities exceeds tidal and downstream flows within the central region of the Delta.

Net reverse flows in Old and Middle rivers, resulting from low San Joaquin River inflows and increased exports to the CVP and SWP, have been identified as a potential cause of increased delta smelt mortality at the CVP and SWP fish facilities within recent years (Grimaldo et al. 2009). Results of analyses of the relationship between the magnitude of reverse flows in Old and Middle rivers and salvage (fish collected at the pumping facilities for release back into the Delta) of delta smelt shows a substantial increase in salvage as reverse flows exceed approximately -5,000 cfs particularly when turbidities exceed about 12 NTU (Grimaldo et al. 2009). Concerns regarding reverse flows in Old and Middle rivers have also focused on planktonic egg and larval stages of striped bass, Sacramento splittail, and on Chinook salmon smolts, in addition to delta smelt and longfin smelt. Although these species do not spawn to a significant extent in the south Delta, eggs and larvae may be transported into the area by net reverse flows in Old and Middle rivers. As discussed previously, these early life stages are more vulnerable to entrainment (fish lost from diversions or exports) because they have poor swimming capabilities and are too small to be effectively screened from export waters.

For most fish species, habitat quality in the south Delta is believed to be poor (Feyrer 2004, Feyrer and Healey 2003, Feyrer et al. 2007, Monsen et al. 2007). Nobriga et al. (2008) showed that very low summer abundances of delta smelt in the south Delta are related to significantly higher water temperatures and water clarity compared with other areas of the Delta. Increased water clarity may increase predation risks and reduce feeding success of planktivorous fish such as delta smelt. Entrainment risk is also much higher in the south Delta because of the large volumes of water exported by the Jones and Banks pumping plants (Kimmerer 2004). In experimental releases, survival of fall-run Chinook salmon smolts migrating from the San Joaquin River was lower for smolts moving through the Delta via the channels south of the San Joaquin River than for those remaining in the river channel (Brandes and McLain 2001). More recent studies using acoustically tagged salmon have shown equally poor survival through either route, regardless of flow rates; the route with the greatest survival was fish salvaged at the CVP facilities and transported in trucks through the Delta (Buchanan et al. 2018). However, the consistent trend is that when the fish have an increased travel time, they have a lower probability of surviving (San Joaquin River Group Authority 2010).

Old and Middle river net flows were calculated for project action alternative. The most biologically sensitive period when the potential effects of reverse flows could affect delta smelt, Chinook salmon, and many other species extends from the late winter through early summer. It was assumed that model-predicted negative changes in the average monthly Old and Middle flows that were less than 5% relative to the basis-of-comparison would not be expected to result in a significant effect on entrainment vulnerabilities on resident or migratory fish or the zooplankton and phytoplankton on which they rely for a food resource and also accounts for model error (or noise).

J2.1.1.5 Delta Exports

Increased exports could increase the risk of entrainment and salvage of resident and migratory fish present in the south Delta, which may include adult and juvenile delta smelt and longfin smelt, juvenile Chinook salmon, steelhead, striped bass, and other species of fish, as well as macroinvertebrates and nutrients. Increased exports during drier water years in the summer could result in an increased risk of entrainment and salvage of resident warm-water fish such as striped bass, threadfin shad *(Dorosoma petenense)*, catfish, and others during the warmer summer months (July through August). Increased exports could also increase the entrainment and removal of phytoplankton, zooplankton, macroinvertebrates, organic material, and nutrients from the Delta.

Positive changes in the volume of water exported at the CVP and SWP facilities were assumed to result in a direct proportional increase in the risk of fish being entrained and salvaged at the facilities. It was assumed that model-predicted positive changes in the average monthly Delta exports that were less than 5% relative to the basis-of-comparison would not be expected to result in a significant (detectable increase in take) effect on entrainment on resident or migratory fish or the zooplankton and phytoplankton on which they rely for a food resource and also accounts for model error (or noise).

J2.2 Results

J2.2.1 Alternative 2

For Alternative 2, the Non-Structural Alternative, CalSim II modeling results indicate there would be no changes to the Sacramento River flow or to the location of the X2 compared to the No Project/No Action Alternative, while Delta Outflow would change by less than 2%. Delta exports either remained the same or decreased for Alternative 2 versus the No Project/No Action Alternative for most months and water year types, indicating beneficial impacts for fish. This decrease in exports indicates slightly more water would be available for fish and their food resources and would be beneficial for both. Similarly, modeled differences in Old and Middle River flows were positive, indicating less negative Old and Middle River flows under Alternative 2 versus the No Project/No Action Alternative. Therefore, increases to Old and Middle River flows are expected to be beneficial to fish as a result of more retained water within the rivers, and lessened entrainment risk due to less flow moving towards the export facilities.

J2.2.1.1 Sacramento River Flow

Under the Non-Structural Alternative, Sacramento River flow at Hood does not change relative to the No Project/No Action Alternative (Table 1).

Table 1. Modeled Difference in Sacramento River Flow between Non-Structural Alternative and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
BN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.1.2 Delta Outflow

Modeled Delta outflow for the Non-Structural Alternative changes by less than 2% in all months of all water-year types compared to the No Project/No Action Alternative (Table 2). During most months of most years, Delta outflows remain relatively unchanged[2].

Table 2. Modeled Difference in Delta Outflow between Non-Structural Alternative and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.30%	0.09%	0.51%	0.11%	0.25%	0.45%	0.15%	-0.02%	0.00%	0.00%	0.00%	0.00%
AN	0.00%	0.00%	0.00%	0.37%	0.16%	0.40%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%
BN	0.00%	1.65%	0.86%	1.14%	0.99%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D	0.00%	0.00%	0.00%	0.00%	0.74%	0.94%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
C	0.00%	0.00%	0.00%	0.00%	0.97%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.1.3 Low Salinity Zone and X2

The modeled X2 location does not shift between the No Project/No Action Alternative conditions and the Non-Structural Alternative (Table 3).

Table 3. Modeled Difference in Position of LSZ (X2) between Non-Structural Alternative and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.1.4 Old and Middle River Flows

Modeled negative differences in Old and Middle River flows were less than 5% for all months of all water years, except for February in wet and below normal water years and March in wet, above normal, and dry water years, where the flows became less negative (Table 4). Increases to Old and Middle River flows are expected to be beneficial to fish as a result of more retained water within the rivers, and reduced entrainment risk due to less flow moving towards the export facilities.

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[2] Relatively unchanged means that the modeled value is below the limit that represents an effect, as presented in Section J2.1, Methods, for the evaluation of the hydrologic parameter.

Table 4. Modeled Difference in Old and Middle River Flows between Non-Structural Alternative and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.00%	0.00%	3.71%	4.15%	9.59%	41.03%	2.78%	0.00%	0.00%	0.00%	0.00%	0.00%
AN	0.00%	0.00%	0.00%	2.19%	1.91%	7.60%	0.84%	0.00%	0.00%	0.00%	0.00%	0.00%
BN	0.00%	0.00%	0.00%	2.77%	7.44%	0.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D	0.00%	0.00%	0.00%	0.00%	3.51%	5.99%	-0.04%	0.00%	0.00%	0.00%	0.00%	0.00%
C	0.00%	0.00%	0.00%	0.00%	2.87%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 5. Modeled Old and Middle River Flows under No Project/No Action Alternative Conditions (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,931	-7,761	-5,140	-2,171	-1,938	-805	-1,440	-1,928	-4,405	-8,363	-10,148	-3,712
AN	-4,250	-6,662	-6,355	-4,284	-3,640	-2,711	-3,051	-3,251	-4,862	-8,171	-9,883	-2,778
BN	-4,307	-7,695	-7,411	-4,747	-4,663	-3,311	-2,745	-3,125	-4,951	-8,984	-9,155	-7,360
D	-4,106	-6,508	-6,666	-4,617	-4,807	-3,287	-2,414	-2,892	-4,740	-6,938	-4,262	-5,757
C	-3,767	-4,324	-4,567	-4,324	-4,432	-3,030	-1,698	-1,752	-2,412	-2,546	-2,400	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 6. Modeled Old and Middle River Flows under Non-Structural Alternative (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,931	-7,761	-4,949	-2,081	-1,752	-475	-1,400	-1,928	-4,405	-8,363	-10,148	-3,712
AN	-4,250	-6,662	-6,355	-4,190	-3,570	-2,505	-3,025	-3,251	-4,862	-8,171	-9,883	-2,778
BN	-4,307	-7,695	-7,411	-4,615	-4,316	-3,285	-2,745	-3,125	-4,951	-8,984	-9,155	-7,360
D	-4,106	-6,508	-6,666	-4,617	-4,639	-3,090	-2,415	-2,892	-4,740	-6,938	-4,262	-5,757
C	-3,767	-4,324	-4,567	-4,324	-4,305	-3,030	-1,698	-1,752	-2,412	-2,546	-2,400	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.1.5 Delta Exports

Modeled Delta exports increase by less than 5% in most months of most water-year types for the Non-Structural Alternative compared to the No Project/No Action Alternative (Table 7). A decrease in Delta exports of 5.10% during February of below normal water years is expected to be slightly beneficial to fish species and their food resources due to additional water being available (Table 7). During most months of most years, Delta exports remain relatively unchanged.

Table 7. Modeled Difference in Delta Exports between Non-Structural Alternative and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.37%	-0.12%	-3.14%	-1.17%	-2.65%	-4.41%	-0.94%	0.10%	0.00%	0.00%	0.00%	0.00%
AN	0.00%	0.00%	0.00%	-2.53%	-1.43%	-3.51%	-0.41%	0.00%	0.00%	0.00%	0.00%	0.00%
BN	0.00%	-1.22%	-0.97%	-3.05%	-5.10%	-0.53%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D	0.00%	0.00%	0.00%	0.00%	-2.71%	-4.09%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
C	0.00%	0.00%	0.00%	0.00%	-2.29%	-0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.2 Alternative 3

Alternative 3 includes six subalternatives (See Chapter 2 and Appendix B for details on alternatives). The primary sub-alternatives include CVP-only storage, CVP/SWP split storage, and investor-directed storage. The investor-directed storage subalternative is composed of the following four operational configurations (see Chapter 2 and Appendix B for details on operational configurations):

- Configuration A: Maximum Carried-Over Quantity – 180 thousand acre-feet (TAF), delivery 1
- Configuration B: Maximum Carried-Over Quantity – 180 TAF, delivery 2
- Configuration C: Maximum Carried-Over Quantity – 310 TAF, delivery 1
- Configuration D: Maximum Carried-Over Quantity – 310 TAF, delivery 2

Across all Alternative 3 subalternatives, CalSim II modeling results indicate that there are only slight changes to flows and location of the LSZ resulting from changes in Delta water operations compared to the No Project/No Action Alternative. Across all subalternatives, there are only slight changes (<2%) in modeled Sacramento River flow and Delta outflow across all months and water years compared to the No Project/No Action Alternative (Table 8). Likewise, the modeled location of X2 only differed by 0.1 km at most across all months and water years for all subalternatives compared to the No Project/No Action Alternative (Table 8).

Across all Alternative 3 subalternatives, modeled Delta export flow and Old and Middle River flow differences from the No Project/No Action Alternative are less than 5% for most months and water years, with mean differences across all months and water years less than 1% for each subalternative (Table 1). However, modeled differences in Delta exports from the No Project/No Action Alternative were above 5% for Investor-Directed Storage Configurations A (5.6% max) and B (5.6% max) during March and April under the wet water year type (Table 8). Similarly, modeled differences in Old and Middle River flows from the No Project/No Action Alternative were above 5%for all subalternatives (18.8% max) during the months of February through April in above normal or wet water year types (Table 8). The months that exceed the 5% threshold for Old and Middle River flow have values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species (See Methods section above for details).

Table 8. Maximum and Mean Monthly Change in Water Flows and Low Salinity Zone Location for All Alternative 3 Options Compared with No Project/No Action Alternative Conditions

	CVP-Only		CVP/SWP		A		B		C		D	
	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean
Sacramento River Flow (%)	0.9	0.0	1.7	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0
Delta Outflow (%)	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0
X2 (km)	0.1	0.0	+/-0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Old and Middle River Flows (%)	18.8	0.8	17.7	0.9	18.8	0.8	18.8	0.8	18.8	0.8	18.8	0.8
Delta Exports (%)	4.7	0.5	4.0	0.4	5.6	0.6	5.6	0.6	3.7	0.2	3.7	0.2

Max = maximum change across all months of all water years
Mean = mean across all months of all water years
All numbers rounded to first decimal place

J2.2.2.1 CVP-only Storage

For the CVP-only storage option, the modeled location of X2 differs less than 1 km compared to the No Project/No Action Alternative across all months and water years. For Sacramento River flow, Delta outflow, and Delta exports, modeled flows differ less than 5% compared to the No Project/No Action Alternative across all months and water years. Modeled Old and Middle River flows differ greater than 5% compared to the No Project/No Action Alternative during wet and above normal water year types during February through April. However, Old and Middle River flow during these months have values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species.

Sacramento River Flow Modeled Sacramento River flow at Hood differs by less than 1% on average across all months of all water-year types for CVP-only storage compared to the No Project/No Action Alternative (Table 9). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 9. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (CVP-only Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.13%	0.22%	0.18%	-0.01%	-0.01%	0.01%	0.00%	0.07%	0.00%	-0.70%	0.07%	-0.20%
AN	-0.18%	0.12%	-0.19%	-0.05%	0.07%	0.01%	0.00%	-0.01%	0.19%	-0.07%	0.14%	-0.09%
BN	-0.03%	0.46%	-0.12%	-0.36%	0.06%	-0.05%	-0.42%	-0.18%	0.02%	0.86%	-0.54%	0.52%
D	-0.08%	0.05%	0.59%	-0.06%	-0.01%	0.14%	0.03%	-0.09%	0.04%	0.07%	0.28%	-0.18%
C	0.06%	-0.01%	-0.01%	0.18%	0.01%	0.09%	0.01%	0.02%	0.01%	0.03%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for the CVP-only storage option changes by less than 1%in all months of all water-year types compared to the No Action/No Project Alternative (Table 10). During most months of most years, Delta outflows remain relatively unchanged.

Table 10. Modeled Difference in Delta Outflow between Dam Raise Alternative (CVP-only Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.74%	0.18%	0.12%	-0.02%	-0.05%	-0.13%	-0.55%	-0.08%	0.03%	-0.32%	-0.02%	-0.63%
AN	-0.69%	-0.72%	0.00%	-0.06%	-0.37%	-0.03%	-0.26%	-0.67%	0.18%	0.11%	0.00%	0.06%
BN	0.03%	0.51%	-0.14%	-0.40%	0.07%	-0.05%	0.06%	-0.15%	0.10%	0.83%	0.13%	0.24%
D	0.00%	0.18%	0.33%	0.21%	-0.01%	0.14%	-0.01%	-0.01%	0.01%	0.08%	-0.01%	-0.22%
C	0.00%	0.00%	-0.02%	0.18%	0.03%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.06%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For the CVP-only storage, modeled X2 location changes by no more than 0.09 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 11). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 11. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (CVP-only Storage) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.07	0.00	-0.06	-0.03	0.00	0.00	0.01	0.05	0.03	0.01	0.04	0.03
AN	-0.07	0.00	0.09	0.01	0.02	0.01	0.00	0.02	0.06	0.02	-0.02	-0.01
BN	0.00	-0.01	-0.03	-0.01	0.07	0.02	0.01	0.00	0.01	0.00	-0.07	-0.06
D	0.01	0.00	-0.01	-0.03	-0.05	-0.02	-0.02	-0.01	0.00	0.00	-0.01	0.00
C	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows In most months of most water-year types, modeled negative flow changes of less than 4%occur to Old and Middle Rivers flows for the CVP-only storage option compared to the No Project/No Action Alternative (Table 12). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April. However, Old and Middle River flow during these months for both the CVP-only and No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 13). In addition, project operations would be subject to all Old and Middle River requirements in the then current biological opinions and incidental take permits that might impose less negative Old and Middle River flows during times when listed species were at greater risk of entrainment.

Table 12. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (CVP-only Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1.44%	-0.17%	0.00%	-0.41%	-0.75%	-14.37%	-18.76%	-2.26%	0.10%	1.20%	-0.13%	-0.98%
AN	-0.50%	-1.23%	0.66%	-0.08%	-8.75%	-0.25%	-2.36%	-3.08%	-0.24%	0.30%	-0.22%	0.63%
BN	0.12%	-0.34%	0.07%	0.00%	0.00%	0.00%	2.59%	0.24%	0.09%	-1.09%	0.87%	-0.65%
D	0.18%	0.04%	-0.74%	0.89%	0.00%	0.00%	-0.27%	0.33%	-0.11%	-0.07%	-0.59%	0.16%
C	-0.13%	0.01%	0.00%	-0.16%	0.04%	-0.40%	-0.45%	-0.12%	-0.03%	-0.14%	0.10%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 13. Modeled Old and Middle River Flows under Dam Raise Alternative (CVP-only Storage) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,860	-7,774	-5,140	-2,180	-1,953	-920	-1,710	-1,972	-4,400	-8,262	-10,161	-3,748
AN	-4,272	-6,744	-6,313	-4,287	-3,958	-2,718	-3,123	-3,352	-4,873	-8,146	-9,905	-2,760
BN	-4,302	-7,721	-7,406	-4,747	-4,663	-3,311	-2,674	-3,118	-4,946	-9,083	-9,076	-7,408
D	-4,099	-6,505	-6,716	-4,576	-4,807	-3,287	-2,421	-2,882	-4,746	-6,943	-4,287	-5,748
C	-3,772	-4,323	-4,567	-4,331	-4,430	-3,042	-1,706	-1,754	-2,413	-2,550	-2,398	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 5% in all months of all water-year types for the CVP-only storage option compared to the No Project/No Action Alternative (Table 14). During most months of most years, Delta exports remain relatively unchanged.

Table 14. Modeled Difference in Delta Exports between Dam Raise Alternative (CVP-only Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.83%	0.15%	1.01%	1.64%	0.32%	4.67%	3.57%	0.66%	-0.06%	-1.05%	0.13%	0.78%
AN	0.42%	1.09%	-0.53%	1.16%	4.19%	1.29%	2.76%	1.89%	0.23%	-0.31%	0.23%	-0.52%
BN	-0.09%	0.30%	2.16%	-2.00%	0.44%	3.26%	-2.82%	-0.18%	-0.09%	1.18%	-0.89%	0.61%
D	-0.14%	-0.04%	0.66%	-0.70%	0.83%	0.99%	-0.38%	-0.46%	0.12%	0.08%	0.66%	-0.15%
C	0.11%	-0.01%	0.00%	0.13%	-0.03%	2.17%	0.33%	0.10%	0.05%	0.22%	-0.12%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.2.2 CVP/SWP Split Storage

For the CVP-only/SWP split storage option, the modeled location of X2 differs less than 1 km compared to the No Project/No Action Alternative across all months and water years. For Sacramento River flow, Delta outflow, and Delta exports, modeled flows differ less than 5%

compared to the No Project/No Action Alternative across all months and water years. Modeled Old and Middle River flows differ greater than 5% compared to the No Project/No Action Alternative during wet and above normal water year types during February through April. However, Old and Middle River flow during these months had values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species.

Sacramento River Flow With CVP/SWP split storage, the river flow changes by less than 2%in all months of all water-year types compared to the No Project/No Action Alternative (Table 15). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 15. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (CVP/SWP Split Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.19%	0.08%	0.00%	-0.01%	-0.01%	-0.01%	0.00%	0.00%	0.05%	-0.64%	-0.24%	0.51%
AN	0.04%	-0.08%	-0.11%	-0.08%	0.03%	-0.01%	0.00%	0.00%	0.07%	-0.26%	0.23%	0.11%
BN	0.07%	0.35%	-0.01%	-0.09%	0.03%	0.00%	-0.40%	-0.11%	0.04%	1.00%	-0.82%	0.44%
D	-0.01%	-0.26%	0.05%	0.02%	0.01%	0.07%	0.01%	-0.02%	-0.67%	0.18%	1.70%	0.03%
C	-0.09%	0.01%	0.14%	-0.11%	0.43%	0.09%	0.02%	0.01%	-0.08%	0.15%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for the CVP/SWP split storage option changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 16). During most months of most years, Delta outflows remain relatively unchanged.

Table 16. Modeled Difference in Delta Outflow between Dam Raise Alternative (CVP/SWP Split Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.14%	0.03%	-0.01%	-0.05%	-0.03%	-0.19%	-0.46%	-0.10%	0.08%	-0.52%	-0.01%	0.08%
AN	-0.72%	-0.65%	-0.01%	-0.07%	-0.30%	-0.06%	-0.42%	-0.37%	0.08%	-0.33%	0.45%	-0.19%
BN	-0.04%	0.55%	-0.02%	-0.10%	0.05%	0.00%	0.05%	-0.06%	0.07%	0.88%	-0.03%	0.39%
D	0.13%	0.24%	0.09%	-0.02%	0.00%	0.06%	-0.06%	-0.02%	0.00%	0.07%	-0.04%	0.05%
C	0.00%	0.00%	0.05%	-0.24%	0.35%	-0.05%	0.01%	0.00%	0.00%	0.04%	0.00%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For the CVP/SWP split storage, modeled X2 location changes by no more than 0.08 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 17). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 17. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (CVP/SWP Split Storage) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.01	0.00	-0.01	0.00	0.00	0.00	0.01	0.05	0.03	0.00	0.04	0.03
AN	-0.08	-0.01	0.08	0.01	0.02	0.00	0.00	0.03	0.04	0.01	0.03	0.00
BN	0.00	0.00	-0.03	-0.02	0.01	0.00	0.00	-0.01	0.00	0.00	-0.08	-0.06
D	0.02	0.01	-0.01	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
C	0.00	0.00	0.00	0.00	0.02	-0.05	-0.02	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows In most months of most water-year types, modeled negative flow changes of less than 5% occur to Old and Middle Rivers flows for the CVP/SWP split storage option compared to the No Project/No Action Alternative (Table 18). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April. However, Old and Middle River flow during these months for the CVP/SWP and No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 19).

Table 18. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (CVP/SWP Split Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.25%	-0.05%	0.00%	-2.24%	-0.63%	-17.70%	-15.49%	-1.76%	0.13%	0.85%	0.36%	-1.60%
AN	-1.01%	-0.70%	0.38%	0.01%	-5.99%	-0.18%	-3.79%	-1.67%	-0.08%	0.23%	-0.14%	-1.16%
BN	-0.22%	-0.15%	-0.01%	0.00%	0.00%	0.00%	2.49%	0.24%	0.00%	-1.35%	1.23%	-0.46%
D	0.20%	0.60%	0.00%	-0.14%	-0.03%	0.00%	-0.46%	-0.01%	1.92%	-0.29%	-3.53%	0.02%
C	0.18%	-0.01%	-0.24%	-0.17%	-0.41%	-0.52%	-0.44%	-0.06%	0.30%	-0.43%	0.03%	0.01%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 19. Modeled Old and Middle River Flows under Dam Raise Alternative (CVP/SWP Split Storage) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,943	-7,765	-5,140	-2,220	-1,950	-947	-1,663	-1,962	-4,399	-8,292	-10,111	-3,771
AN	-4,293	-6,709	-6,330	-4,284	-3,858	-2,716	-3,166	-3,306	-4,866	-8,152	-9,897	-2,810
BN	-4,317	-7,706	-7,412	-4,747	-4,663	-3,311	-2,677	-3,118	-4,951	-9,106	-9,043	-7,395
D	-4,098	-6,469	-6,666	-4,623	-4,809	-3,287	-2,425	-2,892	-4,650	-6,958	-4,412	-5,756
C	-3,760	-4,324	-4,578	-4,331	-4,450	-3,046	-1,706	-1,753	-2,405	-2,557	-2,400	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 4% in all months of all water-year types for the CVP/SWP split storage option compared to the No Action/No Project Alternative (Table 20). During most months of most years, Delta exports remain relatively unchanged.

Table 20. Modeled Difference in Delta Exports between Dam Raise Alternative (CVP/SWP Split Storage) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.20%	0.04%	0.33%	0.53%	0.28%	3.84%	1.91%	0.57%	-0.08%	-0.74%	-0.35%	1.28%
AN	0.84%	0.62%	-0.31%	0.94%	2.65%	0.90%	3.58%	1.02%	0.08%	-0.24%	0.15%	0.98%
BN	0.17%	0.13%	1.27%	-1.71%	0.69%	1.57%	-2.91%	-0.18%	0.00%	1.46%	-1.27%	0.44%
D	-0.16%	-0.52%	0.00%	0.11%	0.72%	-0.21%	0.24%	0.01%	-2.09%	0.33%	3.91%	-0.01%
C	-0.15%	0.01%	0.21%	0.14%	0.33%	2.26%	0.33%	0.05%	-0.40%	0.65%	-0.03%	-0.01%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

J2.2.2.3 Investor-Directed Storage

For the investor-directed storage option, the modeled location of X2 differs less than 1 km compared to the No Project/ No Action Alternative across all months and water years. For Sacramento River flow and Delta outflow, modeled flows differ less than 5% compared to the No Project/No Action Alternative across all months and water years. For Delta Exports, modeled flows differ less than 5% compared to the No Action/No Project Alternative across most months of most water years. During wet water years in March and April they exceed the 5% threshold (5.60%), but because this exceedance occurs during wet water years, the flow impacts to listed fish species should be minimized. Modeled Old and Middle River flows differ greater than 5% compared to the No Project/No Action Alternative during wet and above normal water year types during February through April. However, Old and Middle River flows during these months had values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species.

Maximum Carried-Over Quantity – 180 TAF For Maximum Carried-Over Quantity – 180 TAF of the investor-directed storage option, the modeled location of X2 differs less than 1 km compared to the No Project/No Action Alternative across all months and water years. For Sacramento River flow and Delta outflow, modeled flows differ less than 5% compared to the No Project/No Action Alternative across all months and water years. Modeled Old and Middle River flows differ greater than 5% compared to the No Project/No Action Alternative during wet and above normal water year types during February through April. Modeled Delta exports differ greater than 5%compared to the No Project/No Action Alternative during wet water years in March and April. However, Old and Middle River flows and Delta exports during these months have values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species.

Configuration A For Configuration A, flows in the Sacramento River and Delta outflow change less than 1% from the No Project/No Action Alternative Condition, while X2 moves no more than 0.09 km downstream or upstream compared to the No Project/No Action Alternative. Old and Middle River flows change greater than 5% during wet and above normal water years during February through April, but the overall reverse flows do not exceed -5,000 cfs during that same time. During wet years in March through April, modeled exports change no more than 5.6%. While these months exceed the 5% threshold, they occur during wet water years when flow impacts to listed fish species should be minimized.

Sacramento River Flow With Configuration A, the river flow changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 21). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 21. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (Investor-Directed Storage Configuration A) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.13%	0.22%	0.18%	-0.01%	-0.01%	0.01%	0.00%	0.07%	0.00%	-0.70%	0.07%	-0.20%
AN	-0.18%	0.12%	-0.19%	-0.05%	0.07%	0.01%	0.00%	-0.01%	0.19%	-0.07%	0.14%	-0.09%
BN	-0.03%	0.46%	-0.12%	-0.36%	0.06%	-0.05%	-0.42%	-0.18%	0.02%	0.86%	-0.54%	0.52%
D	-0.08%	0.05%	0.59%	-0.06%	-0.01%	0.14%	0.03%	-0.09%	0.04%	0.07%	0.28%	-0.18%
C	0.06%	-0.01%	-0.01%	0.18%	0.01%	0.09%	0.01%	0.02%	0.01%	0.03%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for Configuration A changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 22). During most months of most years, Delta outflows remain relatively unchanged.

Table 22. Modeled Difference in Delta Outflow between Dam Raise Alternative (Investor-Directed Storage Configuration A) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.74%	0.18%	0.12%	-0.02%	-0.05%	-0.13%	-0.55%	-0.08%	0.03%	-0.32%	-0.02%	-0.63%
AN	-0.69%	-0.72%	0.00%	-0.06%	-0.37%	-0.03%	-0.26%	-0.67%	0.18%	0.11%	0.00%	0.06%
BN	0.03%	0.51%	-0.14%	-0.40%	0.07%	-0.05%	0.06%	-0.15%	0.10%	0.83%	0.13%	0.24%
D	0.00%	0.18%	0.33%	0.21%	-0.01%	0.14%	-0.01%	-0.01%	0.01%	0.08%	-0.01%	-0.22%
C	0.00%	0.00%	-0.02%	0.18%	0.03%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.06%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For Configuration A, modeled X2 location changes by no more than 0.09 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 23). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 23. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (Investor-Directed Storage Configuration A) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.07	0.00	-0.06	-0.03	0.00	0.00	0.01	0.05	0.03	0.01	0.04	0.03
AN	-0.07	0.00	0.09	0.01	0.02	0.01	0.00	0.02	0.06	0.02	-0.02	-0.01
BN	0.00	-0.01	-0.03	-0.01	0.07	0.02	0.01	0.00	0.01	0.00	-0.07	-0.06
D	0.01	0.00	-0.01	-0.03	-0.05	-0.02	-0.02	-0.01	0.00	0.00	-0.01	0.00
C	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows Configuration A of the investor-directed storage option results in negative changes of less than 4% change in reverse flows compared to the No Project/No Action Alternative for most months in most water-year types (Table 24). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April, however, Old and Middle River flow during these months for Configuration A and the No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 25).

Table 24. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (Investor-Directed Storage Configuration A) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1.44%	-0.17%	0.00%	-0.41%	-0.75%	-14.37%	-18.76%	-2.26%	0.10%	1.20%	-0.13%	-0.98%
AN	-0.50%	-1.23%	0.66%	-0.08%	-8.75%	-0.25%	-2.36%	-3.08%	-0.24%	0.30%	-0.22%	0.63%
BN	0.12%	-0.34%	0.07%	0.00%	0.00%	0.00%	2.59%	0.24%	0.09%	-1.09%	0.87%	-0.65%
D	0.18%	0.04%	-0.74%	0.89%	0.00%	0.00%	-0.27%	0.33%	-0.11%	-0.07%	-0.59%	0.16%
C	-0.13%	0.01%	0.00%	-0.16%	0.04%	-0.40%	-0.45%	-0.12%	-0.03%	-0.14%	0.10%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 25. Modeled Old and Middle River Flows under Dam Raise Alternative (Investor-Directed Storage Configuration A) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,860	-7,774	-5,140	-2,180	-1,953	-920	-1,710	-1,972	-4,400	-8,262	-10,161	-3,748
AN	-4,272	-6,744	-6,313	-4,287	-3,958	-2,718	-3,123	-3,352	-4,873	-8,146	-9,905	-2,760
BN	-4,302	-7,721	-7,406	-4,747	-4,663	-3,311	-2,674	-3,118	-4,946	-9,083	-9,076	-7,408
D	-4,099	-6,505	-6,716	-4,576	-4,807	-3,287	-2,421	-2,882	-4,746	-6,943	-4,287	-5,748
C	-3,772	-4,323	-4,567	-4,331	-4,430	-3,042	-1,706	-1,754	-2,413	-2,550	-2,398	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 5% for most months of most water-year types for Configuration A for the investor-directed storage option compared to the No Project/No Action Alternative (Table 26). During March and April of wet water years only, exports change by less than 5.60% (Table 26).

Table 26. Modeled Difference in Delta Exports Between Dam Raise Alternative (Investor-Directed Storage Configuration A) and No Project/No Action Alternative Conditions (% Change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1.11%	0.28%	0.88%	1.28%	0.16%	5.52%	5.22%	2.22%	0.01%	0.58%	0.31%	0.57%
AN	-0.76%	1.07%	-0.55%	1.13%	4.48%	1.43%	3.00%	1.88%	-0.07%	0.19%	0.44%	0.42%
BN	0.85%	0.30%	2.22%	-2.20%	0.95%	4.66%	-2.08%	0.11%	0.68%	1.79%	-1.41%	0.92%
D	-0.59%	-0.02%	0.61%	-0.03%	0.83%	0.43%	-0.42%	-0.86%	-0.25%	-0.28%	0.26%	-0.20%
C	0.11%	0.00%	0.14%	0.12%	-0.05%	1.60%	0.30%	-0.36%	0.00%	0.26%	0.00%	-0.06%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Configuration B For Configuration B of the Investor-Directed Storage Subalternative, flows in the Sacramento River and Delta outflow change less than 1% from the No Project/No Action Alternative Condition, while X2 moves no more than 0.09 km downstream or upstream compared to the No Project/No Action Alternative Condition. Old and Middle River flows change greater than 5% during wet and above normal water years during February through April, but the overall reverse flows do not exceed -5000 cfs during that same time. During wet years in March through April, modeled exports change no more than 5.6%. While these months exceed the 5% threshold, they occur during wet water years when flow impacts to listed fish species should be minimized.

Sacramento River Flow With Investor-Directed Storage Configuration B, the river flow changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 27). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 27. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (Investor-Directed Storage Configuration B) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.13%	0.22%	0.18%	-0.01%	-0.01%	0.01%	0.00%	0.07%	0.00%	-0.70%	0.07%	-0.20%
AN	-0.18%	0.12%	-0.19%	-0.05%	0.07%	0.01%	0.00%	-0.01%	0.19%	-0.07%	0.14%	-0.09%
BN	-0.03%	0.46%	-0.12%	-0.36%	0.06%	-0.05%	-0.42%	-0.18%	0.02%	0.86%	-0.54%	0.52%
D	-0.08%	0.05%	0.59%	-0.06%	-0.01%	0.14%	0.03%	-0.09%	0.04%	0.07%	0.28%	-0.18%
C	0.06%	-0.01%	-0.01%	0.18%	0.01%	0.09%	0.01%	0.02%	0.01%	0.03%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for the investor-directed Configuration B changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 28). During most months of most years, Delta outflows remain relatively unchanged.

Table 28. Modeled Difference in Delta Outflow between Dam Raise Alternative (Investor-Directed Storage Configuration B) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.74%	0.18%	0.12%	-0.02%	-0.05%	-0.13%	-0.55%	-0.08%	0.03%	-0.32%	-0.02%	-0.63%
AN	-0.69%	-0.72%	0.00%	-0.06%	-0.37%	-0.03%	-0.26%	-0.67%	0.18%	0.11%	0.00%	0.06%
BN	0.03%	0.51%	-0.14%	-0.40%	0.07%	-0.05%	0.06%	-0.15%	0.10%	0.83%	0.13%	0.24%
D	0.00%	0.18%	0.33%	0.21%	-0.01%	0.14%	-0.01%	-0.01%	0.01%	0.08%	-0.01%	-0.22%
C	0.00%	0.00%	-0.02%	0.18%	0.03%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.06%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For the investor-directed storage Configuration B, modeled X2 location changes by no more than 0.09 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 29). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 29. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (Investor-Directed Storage Configuration B) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.07	0.00	-0.06	-0.03	0.00	0.00	0.01	0.05	0.03	0.01	0.04	0.03
AN	-0.07	0.00	0.09	0.01	0.02	0.01	0.00	0.02	0.06	0.02	-0.02	-0.01
BN	0.00	-0.01	-0.03	-0.01	0.07	0.02	0.01	0.00	0.01	0.00	-0.07	-0.06
D	0.01	0.00	-0.01	-0.03	-0.05	-0.02	-0.02	-0.01	0.00	0.00	-0.01	0.00
C	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows Configuration B of the investor-directed storage option results in negative changes less than 4% in reverse flows compared to the No Project/No Action Alternative for most months in most water-year types (Table 30). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April, however, Old and Middle River flow during these months for Configuration B and the No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 31).

Table 30. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (Investor-Directed Storage Configuration B) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1.44%	-0.17%	0.00%	-0.41%	-0.75%	-14.37%	-18.76%	-2.26%	0.10%	1.20%	-0.13%	-0.98%
AN	-0.50%	-1.23%	0.66%	-0.08%	-8.75%	-0.25%	-2.36%	-3.08%	-0.24%	0.30%	-0.22%	0.63%
BN	0.12%	-0.34%	0.07%	0.00%	0.00%	0.00%	2.59%	0.24%	0.09%	-1.09%	0.87%	-0.65%
D	0.18%	0.04%	-0.74%	0.89%	0.00%	0.00%	-0.27%	0.33%	-0.11%	-0.07%	-0.59%	0.16%
C	-0.13%	0.01%	0.00%	-0.16%	0.04%	-0.40%	-0.45%	-0.12%	-0.03%	-0.14%	0.10%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 31. Modeled Old and Middle River Flows under Dam Raise Alternative (Investor-Directed Storage Configuration B) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,860	-7,774	-5,140	-2,180	-1,953	-920	-1,710	-1,972	-4,400	-8,262	-10,161	-3,748
AN	-4,272	-6,744	-6,313	-4,287	-3,958	-2,718	-3,123	-3,352	-4,873	-8,146	-9,905	-2,760
BN	-4,302	-7,721	-7,406	-4,747	-4,663	-3,311	-2,674	-3,118	-4,946	-9,083	-9,076	-7,408
D	-4,099	-6,505	-6,716	-4,576	-4,807	-3,287	-2,421	-2,882	-4,746	-6,943	-4,287	-5,748
C	-3,772	-4,323	-4,567	-4,331	-4,430	-3,042	-1,706	-1,754	-2,413	-2,550	-2,398	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 5% for most months of most water-year types for Configuration B for the investor-directed storage option compared to the No Project/No Action Alternative (Table 32). During March and April of wet water years only, exports change by less than 5.60% (Table 32).

Table 32. Modeled Difference in Delta Exports between Dam Raise Alternative (Investor-Directed Storage Configuration B) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1.11%	0.28%	0.88%	1.28%	0.16%	5.52%	5.22%	2.22%	0.01%	0.58%	0.31%	0.57%
AN	-0.76%	1.07%	-0.55%	1.13%	4.48%	1.43%	3.00%	1.88%	-0.07%	0.19%	0.44%	0.42%
BN	0.85%	0.30%	2.22%	-2.20%	0.95%	4.66%	-2.08%	0.11%	0.68%	1.79%	-1.41%	0.92%
D	-0.59%	-0.02%	0.61%	-0.03%	0.83%	0.43%	-0.42%	-0.86%	-0.25%	-0.28%	0.26%	-0.20%
C	0.11%	0.00%	0.14%	0.12%	-0.05%	1.60%	0.30%	-0.36%	0.00%	0.26%	0.00%	-0.06%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Maximum Carried-Over Quantity – 310 TAF For Maximum Carried-Over Quantity – 310 TAF of the investor-directed storage option, the modeled location of X2 differs less than 1 km compared to the No Project/No Action Alternative across all months and water years. For Sacramento River flow, Delta outflow and Delta exports, modeled flows differ less than 5% compared to the No Project/No Action Alternative across all months and water years. Modeled Old and Middle River flows differ greater than 5% compared to the No Project/No Action Alternative during wet and above normal water year types during February through April. However, Old and Middle River flows during these months have values well below (less negative) than the -5,000 cfs threshold believed to have deleterious effects to listed fish species.

Configuration C For Configuration C of the Investor-Directed Storage Subalternative, flows in the Sacramento River, Delta outflow, and Delta exports change less than 4% from the No Project/No Action Alternative Condition, while X2 moves no more than 0.09 km downstream or upstream compared to the No Project/No Action Alternative Condition. Old and Middle River flows change greater than 5% during wet and above normal water years during February through April, but the overall reverse flows do not exceed -5000 cfs during that same time.

Sacramento River Flow With investor-directed storage, Configuration C, the river flow changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 33). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 33. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (Investor-Directed Storage Configuration C) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.13%	0.22%	0.18%	-0.01%	-0.01%	0.01%	0.00%	0.07%	0.00%	-0.70%	0.07%	-0.20%
AN	-0.18%	0.12%	-0.19%	-0.05%	0.07%	0.01%	0.00%	-0.01%	0.19%	-0.07%	0.14%	-0.09%
BN	-0.03%	0.46%	-0.12%	-0.36%	0.06%	-0.05%	-0.42%	-0.18%	0.02%	0.86%	-0.54%	0.52%
D	-0.08%	0.05%	0.59%	-0.06%	-0.01%	0.14%	0.03%	-0.09%	0.04%	0.07%	0.28%	-0.18%
C	0.06%	-0.01%	-0.01%	0.18%	0.01%	0.09%	0.01%	0.02%	0.01%	0.03%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for the investor-directed storage Configuration C changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 34). During most months of most years, Delta outflows remain relatively unchanged.

Table 34. Modeled Difference in Delta Outflow between Dam Raise Alternative (Investor-Directed Storage Configuration C) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.74%	0.18%	0.12%	-0.02%	-0.05%	-0.13%	-0.55%	-0.08%	0.03%	-0.32%	-0.02%	-0.63%
AN	-0.69%	-0.72%	0.00%	-0.06%	-0.37%	-0.03%	-0.26%	-0.67%	0.18%	0.11%	0.00%	0.06%
BN	0.03%	0.51%	-0.14%	-0.40%	0.07%	-0.05%	0.06%	-0.15%	0.10%	0.83%	0.13%	0.24%
D	0.00%	0.18%	0.33%	0.21%	-0.01%	0.14%	-0.01%	-0.01%	0.01%	0.08%	-0.01%	-0.22%
C	0.00%	0.00%	-0.02%	0.18%	0.03%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.06%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For the investor-directed storage Configuration C option, modeled X2 location changes by no more than 0.09 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 35). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 35. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (Investor-Directed Storage Configuration C) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.07	0.00	-0.06	-0.03	0.00	0.00	0.01	0.05	0.03	0.01	0.04	0.03
AN	-0.07	0.00	0.09	0.01	0.02	0.01	0.00	0.02	0.06	0.02	-0.02	-0.01
BN	0.00	-0.01	-0.03	-0.01	0.07	0.02	0.01	0.00	0.01	0.00	-0.07	-0.06
D	0.01	0.00	-0.01	-0.03	-0.05	-0.02	-0.02	-0.01	0.00	0.00	-0.01	0.00
C	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows Configuration C of the investor-directed storage option results in negative changes of less than 4% in reverse flows compared to the No Project/No Action Alternative for most months in most water-year types (Table 36). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April, however, Old and Middle River flow during these months for Configuration C and the No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 37).

Table 36. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (Investor-Directed Storage Configuration C) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1.44%	-0.17%	0.00%	-0.41%	-0.75%	-14.37%	-18.76%	-2.26%	0.10%	1.20%	-0.13%	-0.98%
AN	-0.50%	-1.23%	0.66%	-0.08%	-8.75%	-0.25%	-2.36%	-3.08%	-0.24%	0.30%	-0.22%	0.63%
BN	0.12%	-0.34%	0.07%	0.00%	0.00%	0.00%	2.59%	0.24%	0.09%	-1.09%	0.87%	-0.65%
D	0.18%	0.04%	-0.74%	0.89%	0.00%	0.00%	-0.27%	0.33%	-0.11%	-0.07%	-0.59%	0.16%
C	-0.13%	0.01%	0.00%	-0.16%	0.04%	-0.40%	-0.45%	-0.12%	-0.03%	-0.14%	0.10%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 37. Modeled Old and Middle River Flows under Dam Raise Alternative (Investor-Directed Storage Configuration C) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,860	-7,774	-5,140	-2,180	-1,953	-920	-1,710	-1,972	-4,400	-8,262	-10,161	-3,748
AN	-4,272	-6,744	-6,313	-4,287	-3,958	-2,718	-3,123	-3,352	-4,873	-8,146	-9,905	-2,760
BN	-4,302	-7,721	-7,406	-4,747	-4,663	-3,311	-2,674	-3,118	-4,946	-9,083	-9,076	-7,408
D	-4,099	-6,505	-6,716	-4,576	-4,807	-3,287	-2,421	-2,882	-4,746	-6,943	-4,287	-5,748
C	-3,772	-4,323	-4,567	-4,331	-4,430	-3,042	-1,706	-1,754	-2,413	-2,550	-2,398	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 4% in all months of all water-year types for the CVP-only storage option compared to the No Project/No Action Alternative (Table 38). During most months of most years, Delta exports remain relatively unchanged.

Table 38. Modeled Difference in Delta Exports between Dam Raise Alternative (Investor-Directed Storage Configuration C) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1.29%	0.14%	-0.30%	-1.14%	-0.35%	1.64%	3.68%	2.43%	0.01%	0.58%	0.31%	0.57%
AN	-0.76%	1.07%	-0.55%	0.80%	2.52%	0.94%	2.37%	1.88%	-0.07%	0.19%	0.44%	0.42%
BN	0.85%	0.30%	0.32%	-2.92%	-1.40%	0.92%	-2.05%	0.11%	0.68%	1.79%	-1.41%	0.92%
D	-0.59%	-0.02%	0.61%	-0.03%	0.38%	-1.40%	-0.21%	-0.86%	-0.25%	-0.28%	0.26%	-0.20%
C	0.11%	0.00%	0.14%	0.12%	-0.05%	0.92%	0.30%	-0.36%	0.00%	0.26%	0.00%	-0.06%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Configuration D For Configuration D, of the Investor-Directed Storage Subalternative, flows in the Sacramento River, Delta outflow, and Delta exports change less than 4% from the No Project/No Action Alternative Condition, while X2 moves no more than 0.09 km downstream or upstream compared to the No Project/No Action Alternative Condition. Old and Middle River flows change greater than 5% during wet and above normal water years during February through April, but the overall reverse flows do not exceed -5,000 cfs during that same time.

Sacramento River Flow With investor-directed storage, Configuration D, the river flow changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 39). During most months of most years, Sacramento River flows remain relatively unchanged.

Table 39. Modeled Difference in Sacramento River Flow between Dam Raise Alternative (Investor-Directed Storage Configuration D) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.13%	0.22%	0.18%	-0.01%	-0.01%	0.01%	0.00%	0.07%	0.00%	-0.70%	0.07%	-0.20%
AN	-0.18%	0.12%	-0.19%	-0.05%	0.07%	0.01%	0.00%	-0.01%	0.19%	-0.07%	0.14%	-0.09%
BN	-0.03%	0.46%	-0.12%	-0.36%	0.06%	-0.05%	-0.42%	-0.18%	0.02%	0.86%	-0.54%	0.52%
D	-0.08%	0.05%	0.59%	-0.06%	-0.01%	0.14%	0.03%	-0.09%	0.04%	0.07%	0.28%	-0.18%
C	0.06%	-0.01%	-0.01%	0.18%	0.01%	0.09%	0.01%	0.02%	0.01%	0.03%	-0.01%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Outflow Modeled Delta outflow for the investor-directed storage Configuration D changes by less than 1% in all months of all water-year types compared to the No Project/No Action Alternative (Table 40). During most months of most years, Delta outflows remain relatively unchanged.

Table 40. Modeled Difference in Delta Outflow between Dam Raise Alternative (Investor-Directed Storage Configuration D) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.74%	0.18%	0.12%	-0.02%	-0.05%	-0.13%	-0.55%	-0.08%	0.03%	-0.32%	-0.02%	-0.63%
AN	-0.69%	-0.72%	0.00%	-0.06%	-0.37%	-0.03%	-0.26%	-0.67%	0.18%	0.11%	0.00%	0.06%
BN	0.03%	0.51%	-0.14%	-0.40%	0.07%	-0.05%	0.06%	-0.15%	0.10%	0.83%	0.13%	0.24%
D	0.00%	0.18%	0.33%	0.21%	-0.01%	0.14%	-0.01%	-0.01%	0.01%	0.08%	-0.01%	-0.22%
C	0.00%	0.00%	-0.02%	0.18%	0.03%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.06%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Low Salinity Zone and X2 For the investor-directed storage Configuration D option, modeled X2 location changes by no more than 0.09 km compared to the No Project/No Action Alternative for all months of all water-year types (Table 41). During most months of most years, the position of the LSZ remains relatively unchanged.

Table 41. Modeled Difference in Position of LSZ (X2) between Dam Raise Alternative (Investor-Directed Storage Configuration D) and No Project/No Action Alternative Conditions (km change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.07	0.00	-0.06	-0.03	0.00	0.00	0.01	0.05	0.03	0.01	0.04	0.03
AN	-0.07	0.00	0.09	0.01	0.02	0.01	0.00	0.02	0.06	0.02	-0.02	-0.01
BN	0.00	-0.01	-0.03	-0.01	0.07	0.02	0.01	0.00	0.01	0.00	-0.07	-0.06
D	0.01	0.00	-0.01	-0.03	-0.05	-0.02	-0.02	-0.01	0.00	0.00	-0.01	0.00
C	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Old and Middle River Flows Configuration D of the investor-directed storage option results in a less than negative 4% change in reverse flows compared to the No Project/No Action Alternative for most months in most water-year types (Table 42). Modeled Old and Middle River flows differ greater than negative 5% during wet and above normal water year types during February through April, however, Old and Middle River flow during these months for Configuration D and the No Project/No Action Alternative have values well below (less negative than) the -5,000 cfs threshold believed to have deleterious effects to listed fish species (Tables 5 and 43).

Table 42. Modeled difference in Old and Middle River Flows between Dam Raise Alternative (Investor-Directed Storage Configuration D) and No Project/No Action Alternative Conditions (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1.44%	-0.17%	0.00%	-0.41%	-0.75%	-14.37%	-18.76%	-2.26%	0.10%	1.20%	-0.13%	-0.98%
AN	-0.50%	-1.23%	0.66%	-0.08%	-8.75%	-0.25%	-2.36%	-3.08%	-0.24%	0.30%	-0.22%	0.63%
BN	0.12%	-0.34%	0.07%	0.00%	0.00%	0.00%	2.59%	0.24%	0.09%	-1.09%	0.87%	-0.65%
D	0.18%	0.04%	-0.74%	0.89%	0.00%	0.00%	-0.27%	0.33%	-0.11%	-0.07%	-0.59%	0.16%
C	-0.13%	0.01%	0.00%	-0.16%	0.04%	-0.40%	-0.45%	-0.12%	-0.03%	-0.14%	0.10%	0.00%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Table 43. Modeled Old and Middle River Flows under Dam Raise Alternative (Investor-Directed Storage Configuration D) (cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-4,860	-7,774	-5,140	-2,180	-1,953	-920	-1,710	-1,972	-4,400	-8,262	-10,161	-3,748
AN	-4,272	-6,744	-6,313	-4,287	-3,958	-2,718	-3,123	-3,352	-4,873	-8,146	-9,905	-2,760
BN	-4,302	-7,721	-7,406	-4,747	-4,663	-3,311	-2,674	-3,118	-4,946	-9,083	-9,076	-7,408
D	-4,099	-6,505	-6,716	-4,576	-4,807	-3,287	-2,421	-2,882	-4,746	-6,943	-4,287	-5,748
C	-3,772	-4,323	-4,567	-4,331	-4,430	-3,042	-1,706	-1,754	-2,413	-2,550	-2,398	-3,636

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

Delta Exports Modeled Delta exports increase by less than 4% in all months of all water-year types for the CVP-only storage option compared to the No Project/No Action Alternative (Table 44). During most months of most years, Delta exports remain relatively unchanged.

Table 44. Modeled Difference in Delta Exports between Dam Raise Alternative (Investor-Directed Storage Configuration D) and No Project/No Action Alternative Conditions and (% change)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1.29%	0.14%	-0.30%	-1.14%	-0.35%	1.64%	3.68%	2.43%	0.01%	0.58%	0.31%	0.57%
AN	-0.76%	1.07%	-0.55%	0.80%	2.52%	0.94%	2.37%	1.88%	-0.07%	0.19%	0.44%	0.42%
BN	0.85%	0.30%	0.32%	-2.92%	-1.40%	0.92%	-2.05%	0.11%	0.68%	1.79%	-1.41%	0.92%
D	-0.59%	-0.02%	0.61%	-0.03%	0.38%	-1.40%	-0.21%	-0.86%	-0.25%	-0.28%	0.26%	-0.20%
C	0.11%	0.00%	0.14%	0.12%	-0.05%	0.92%	0.30%	-0.36%	0.00%	0.26%	0.00%	-0.06%

Sac Yr Type = Sacramento River Water Year Type; W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix K1: B. F. Sisk Dam Safety of Dams Modification Project Biological Survey Report 2018

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Draft

B.F. SISK SAFETY OF DAMS MODIFICATION PROJECT

Biological Survey Report

Prepared for
U.S. Bureau of Reclamation
California Department of Water Resources

October 2018

Draft

B.F. Sisk Dam Safety of Dams Modification Project

Biological Survey Report

Prepared for
U.S. Bureau of Reclamation
California Department of Water Resources

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Introduction

1.1 Background and Purpose

B.F. Sisk Dam is part of the San Luis Joint-Use Complex, which was designed and constructed by the federal government and is operated and maintained by the California Department of Water Resources (DWR). The complex was constructed to provide supplemental irrigation water storage for the federal Central Valley Project (CVP) and storage of municipal and industrial water for the California State Water Project (SWP).

The dam impounds San Luis Reservoir, which, with a total water storage capacity of more than 2 million acre-feet, is one of the largest off-channel storage facilities in the country and a key component of the water supply system in California. Water is lifted into the reservoir for storage by the Gianelli Pumping–Generating Plant from the California Aqueduct and is diverted from the Delta-Mendota Canal via O'Neill Forebay.

The dam and reservoir are located in an area of high potential for severe earthquake loading from active faults. A recent series of studies and analyses, including a probabilistic seismic analysis completed in 2006, determined that corrective actions were justified at B.F. Sisk Dam to reduce risk to the downstream public. The U.S. Bureau of Reclamation (Reclamation) and DWR seek to mitigate potential safety concerns identified in previous and ongoing studies by modifying water retention structures at B.F. Sisk Dam in order to reduce the seismic, static, and hydrologic risk.

The project will involve two main components: stability berms (buttresses) and a dam raise. Project construction will require a large amount (on the order of between 2 million and 20 million cubic yards) of earth material, all of which would be obtained from a number of borrow sites within the project boundary.

This report presents the findings of focused vegetation and wildlife surveys performed in September 2018 to identify the potential presence and distribution of special-status plant and wildlife species, and natural communities in the project footprint for the B.F. Sisk Safety of Dams Modification Project (project). The intent and scope of this document is to characterize sensitive biological resources in the area where the proposed project will be implemented, and those resources that may be affected by the project.

1.2 Study Area Location

The study area for the B.F. Sisk Safety of Dams Modification Project is located on the west side of California's Central Valley, near the community of Santa Nella, approximately 12 miles west of Los Banos. It is located in the San Luis Dam, California 7.5-minute U.S. Geological Survey quadrangle. The 3,905-acre "study area" described in this report includes the immediate footprint of proposed facilities, access routes, construction staging areas, borrow areas, and other lands that may be accessed to complete the project (see Figure 1-1).[1]

1.3 Summary of Biological Survey Findings

Biological surveys performed by ESA biologists for the B.F. Sisk Safety of Dams Modification Project included a combination of walking surveys to identify and characterize vernal pool branchiopod habitat, elderberry shrubs, and small mammal burrows; day and nighttime aquatic surveys to document amphibian use; fixed point surveys to characterize site use by songbirds and raptors, including tricolored blackbird, Swainson's hawk, and burrowing owl; day and nighttime driving surveys to identify use by reptiles, raptors, and mammals; and the use of baited camera stations to study large carnivores, including American badger and San Joaquin kit fox. In addition, a single emergence and acoustic bat survey was performed. The findings of these surveys are summarized below.

Vernal Pool Branchiopods. Three pool areas comprising a total of eight pools were identified that may support the federally listed vernal pool fairy shrimp or vernal pool tadpole shrimp. One area includes an alkali pool located on grasslands near the dam face and the other areas occur north of the DWR maintenance yard. One of these features was mapped as a seasonal wetland in the 2018 wetland delineation and the other features are non-wetland areas that may support listed branchiopods. No vernal pool branchiopod habitat was identified outside of the areas immediately below B.F. Sisk Dam or near the DWR maintenance yard.

Valley Elderberry Longhorn Beetle. Forty (40) elderberry shrubs were identified in the study area with stems greater than 1-inch diameter, principally located near Basalt Quarry. No evidence of valley elderberry longhorn beetle presence, such as larval exit holes or adult beetles, was observed on any of the generally poor-to-fair health shrubs. Shrubs occurred in 5 general stands. The largest elderberry/buffaloberry stand northwest of Basalt Quarry numbered greater than 25 shrubs. Four smaller stands were found in the Basalt Quarry area comprising at least 10 shrubs. Aside from these occurrences, elderberries were not identified elsewhere in the study area. However, two elderberry shrubs occur several feet outside the study area, at the sewage holding ponds located 0.5-mile northeast of Basalt Campground.

California Tiger Salamander. Two potential aquatic breeding sites for California tiger salamander were identified in the study area and three such features were identified within 1.2 miles; generally west, south and southeast of Basalt Quarry. The California tiger salamander may be encountered in select upland and aquatic areas south of the reservoir. Aquatic habitat that may support breeding California tiger salamander does not occur west of B.F. Sisk Dam or in the Medeiros Use Area.

California Red-legged Frog. The California red-legged frog was previously not known or expected in the study area. For the current assessment, focused daytime surveys were performed at all perennial aquatic sites in the study area to assess habitat conditions, and nighttime surveys

[1] Note that figures are provided at the end of each chapter.

were performed at Willow Spring and Domengine Spring. A California red-legged frog breeding population was identified at Willow Spring, on the edge of the study area and can likely be avoided by the project. California red-legged frogs may be encountered in select areas south of the reservoir and precautions are warranted to avoid impacts to this species. Potential breeding habitat for this species was also identified at four ephemeral and perennial ponds located between 0.3 and 1.2 miles from Basalt Quarry. This species is not expected near Basalt Campground, below B.F. Sisk Dam, or at the Medeiros Use Area.

Burrowing Owl and Swainson's Hawk. Despite extensive surveys, no burrowing owls, active owl burrows, or burrowing owl sign were identified in the study area. Annual grasslands in the Medeiros Use Area and throughout the study area provide high quality foraging and breeding habitat for this species

Swainson's hawks were not identified during the survey, possibly due to the late season timing of the field review. Potential Swainson's hawk nesting habitat occurs in the Medeiros Use Area eucalyptus grove, and near Basalt Campground (both documented in the California Natural Diversity Database), and in trees below B.F. Sisk Dam. Grasslands throughout the study area provide potential foraging habitat.

American Badger and San Joaquin Kit Fox. Spotlighting surveys and camera scent stations were used to identify American badger and San Joaquin kit fox in the study area. The San Joaquin kit fox was not detected during surveys. However, kit foxes are expected to use grassland portions of the study area on an intermittent and irregular basis.

State Park rangers anecdotally report American badgers south of the reservoir, north of Basalt Quarry. The CNDDB also reports badgers in the Medeiros Use Area. During surveys, a badger was observed near the intersection of Basalt Road and Gonzaga Road and a badger skull was found in a cattail marsh area below B.F. Sisk Dam. This species is expected in annual grasslands throughout the study area.

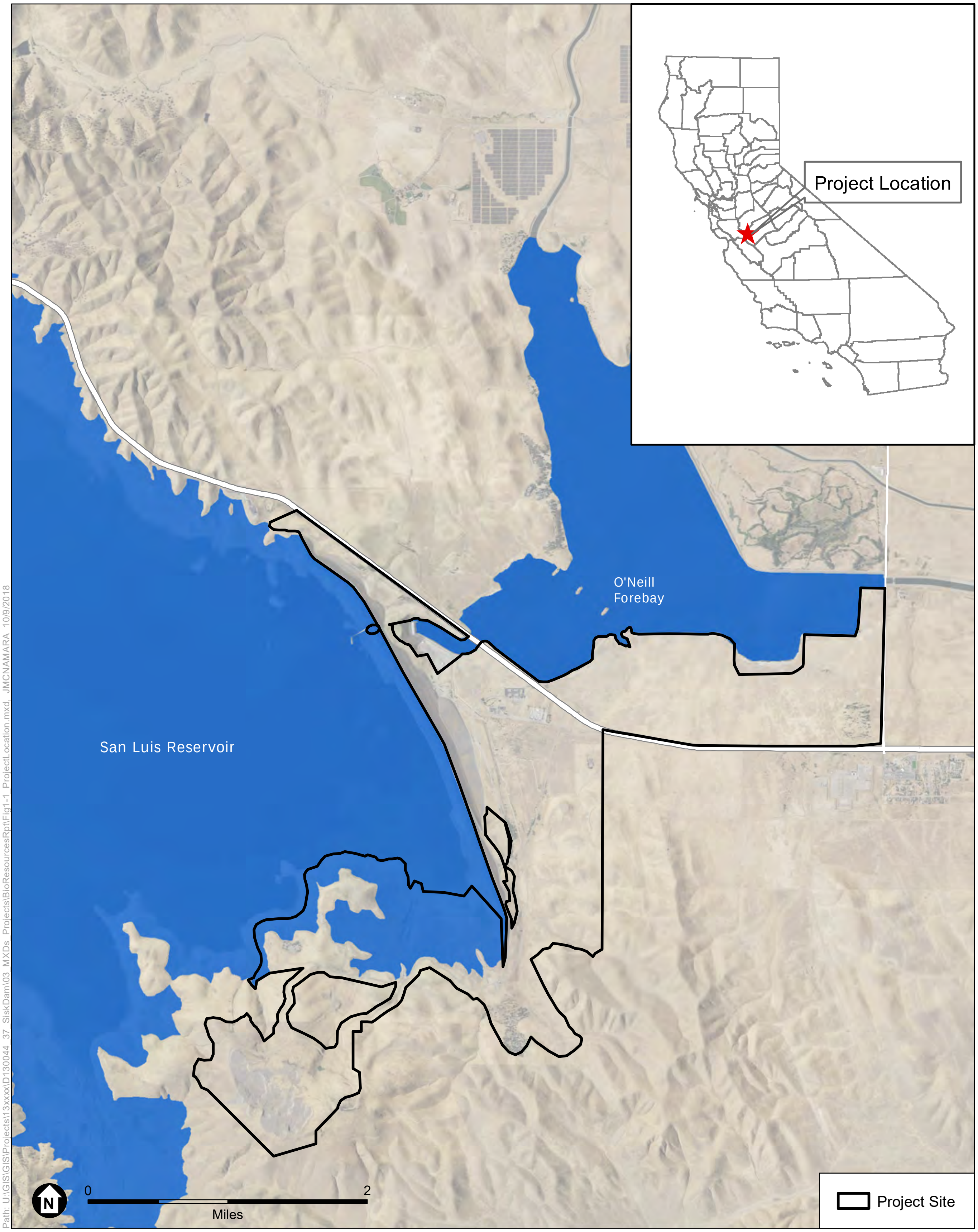
Bat Species. A bat habitat assessment was performed throughout the study area and nighttime emergence surveys were done at a concrete tunnel structure located near the Basalt Quarry. Acoustic surveys verified the presence of three bat species. Yuma myotis and Mexican free-tailed bat roosting was verified in the concrete tunnel. A second concrete structure near Basalt Quarry also provides roosting habitat for these species. In addition, the western red bat was detected during surveys and may roost in foliage at day use areas throughout the study area.

Special-Status Plants. Several areas were identified where future in-season botanical surveys are warranted to search for rare plants. These include alkali grasslands near the dam face and grasslands located north of the DWR maintenance yard (same areas described for vernal pool branchiopods). The construction area for B.F. Sisk Dam was reviewed using aerial photographs from the mid-1960s, and areas that were not subject to earth disturbance or borrow activities during construction may provide potential for the occurrence of rare plant species.

Species Not Identified. No high quality aquatic habitat was identified in the study area that would support western pond turtle. The pond at Willow Spring provides low to moderate quality habitat, but turtles were not observed at this location during repeated surveys. This species is unlikely to be encountered.

No San Joaquin coachwhip were identified during surveys. However, habitat for this species is present throughout grasslands in the study area.

No tricolored blackbirds were identified during the survey, possibly due to the late season timing of the field review. Habitat for tricolored blackbird is present in cattail stands below the dam and at Willow Spring, though use of these areas is not known.



SOURCE: USDA, 2016; CDFW, 2018; USFS, 2017; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 1-1
Location of Project and Project Study Area

ESA

CHAPTER 2
Vernal Pool Branchiopods

2.1 Summary of Findings

This chapter presents the results of a focused site assessment that was performed for listed branchiopod[2] species that occur in the regional vicinity of the study area. These species include the federally-listed threatened vernal pool fairy shrimp (*Branchinecta lynchi*) and federally-listed endangered vernal pool tadpole shrimp (*Lepidurus packardi*). An occurrence of longhorn fairy shrimp (*Branchinecta longiantenna*) is generally mapped in a 4-quadrangle, 13-mile by 17-mile area that includes the entirety of the Gustine, Stevinson, Ingomar, and San Luis Ranch USGS quadrangles. The species occurrence is in association with alkali habitat at the San Luis National Wildlife Refuge (San Luis NWR), greater than 10 miles northeast of the study area (CDFW, 2018). Similarly, the Conservancy fairy shrimp (*Branchinecta conservatio*) is documented greater than 10 miles from the study area. Neither longhorn fairy shrimp nor Conservancy fairy shrimp are expected in the study area due to their limited distribution and restricted habitat requirements (USFWS, 2007). The site assessment finds that potential aquatic habitat for the vernal pool fairy shrimp and vernal pool tadpole shrimp occurs in several areas within the project study area. These findings are summarized in **Table 2-1**.

TABLE 2-1
SUMMARY OF LISTED BRANCHIOPOD HABITAT

Area	Habitat Suitability [a]
Six Pools North of DWR Maintenance Yard (Fig. 2-2)	High quality habitat for VPFS and VPTS occurs in six seasonal alkali pools. Ostracod shells and algal mats are present, with *Eryngium* sp. and *Atriplex*. and American pillwort (*Pilularia americana*).
One Pool West of DWR Maintenance Yard (Fig. 2-2)	Single, moderate quality pool with evidence of algal mats and *Eryngium* sp.
One Pool in Grasslands Below B.F. Sisk Dam (Fig. 2-3)	Single, moderate quality pool with evidence of algal mats and saltgrass (*Distichlis spicata*).

[a] VPFS = vernal pool fairy shrimp; VPTS = vernal pool tadpole shrimp

Source: ESA

[2] The term "branchiopod" describes the taxonomic group of crustaceans that includes both fairy shrimp and tadpole shrimp.

2.2 Species Accounts

Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp is endemic to the grasslands of the central valley, the Central Coast Mountain range, and South Coast Mountains, occurring in a variety of habitats. This species is described from high quality clear-water sandstone depressions and grassy swales, but also occurs in abundance in unvegetated roadside depressions and tire ruts.

The nearest vernal pool fairy shrimp record is a 1993 observation from San Luis NWR, approximately 13 miles northeast of the study area (CDFW, 2018). This species is well described from alkali sink and alkali grassland habitats, as found in the San Luis NWR. The study area is not within designated critical habitat for this species.

Typical habitat for vernal pool fairy shrimp includes vernal pools and seasonal wetlands within relatively undisturbed annual grasslands, seasonal wetlands, or wet depressions. The vernal pool fairy shrimp persists in some of the shortest-lived pools of any listed fairy shrimp species. In the warmer spring months this species can reproduce in pools that persist for as few as three to four weeks (USFWS, 1994; 2003; 2005a; 2005b; 2006).

Vernal Pool Tadpole Shrimp

The vernal pool tadpole shrimp is endemic to grasslands in the central valley, occurring at scattered localities in the San Joaquin Valley from San Joaquin County to Madera County (CDFW, 2018). No vernal pool tadpole shrimp occurrences are known or reported within 10 miles of the study area. The majority of populations occur in the Sacramento Valley, though an isolated population also occurs in the east San Francisco Bay Area near the City of Fremont. The nearest record is a 2003 observation 10.7 miles east of the study area (CDFW, 2018).

The vernal pool tadpole shrimp has been documented from a variety of seasonally ponding habitats, including vernal pools, alkali pools, roadside ditches, and tire ruts (Belk and Eriksen, 1999). This species tolerates a range of habitat conditions, from barren pools to well-vegetated sites. Pools range in size from small puddles measuring a few square meters to seasonal lakes that cover several acres. This species tolerates turbidity conditions ranging from relatively clear water to highly turbid pools USFWS, 1994; 2003; 2005a; 2005b; 2006)

2.3 Survey Methods

ESA senior wildlife biologist and fairy shrimp specialist Brian Pittman, CWB, was the lead biologist for large branchiopod site assessment. Mr. Pittman has held a USFWS 10a(1)(A) recovery permit for listed branchiopods since 2000 (Recovery Permit #TE-027422-5). Focused surveys of the study area were performed by B. Pittman and Kelly Bayne from September 10 to 14, 2018.

Because branchiopod habitat can vary widely between seasons and years, and it is easily overlooked during the dry season, the USFWS has not issued formal guidance in identifying potential habitat for listed branchiopods during the dry season. In the absence of formal guidance, this assessment presents the best judgment of ESA's large branchiopod specialists B. Pittman and K. Bayne in describing the potential distribution of listed brachiopods within the study area. In addition, the USFWS generally considers that listed branchiopods within 250 feet of a proposed action may be subject to direct or indirect effects; hence, this assessment considered, the potential occurrence of habitat within 250 feet from the study area boundaries.

As part of this evaluation, the following actions were performed to identify potential habitat for listed branchiopods on or near the B.F. Sisk Safety of Dams Modification Project:

- A review of aerial photographs on Google Earth from August 1998 through March 2018 showing the extent of potential habitat, grading and site uses.

- A review of historical and recent large branchiopod distribution records from the California Natural Diversity Database (CNDDB) (CDFW, 2018) and scientific literature to create a list of special status fairy shrimp species that may occur at the site (**Figure 2-1**).

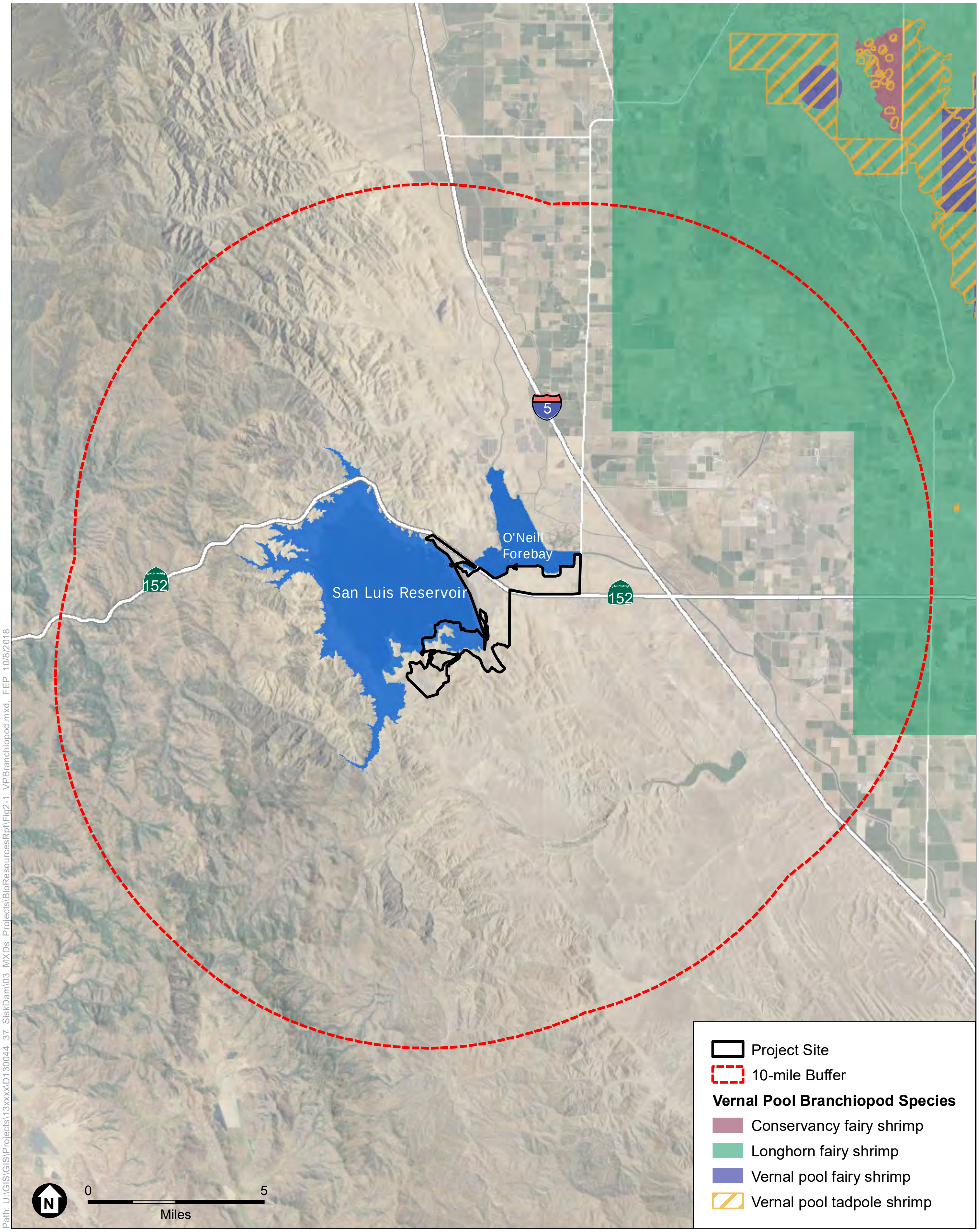
- A focused habitat assessment survey that included direct review of upland and aquatic habitat on the study site. Walking transects were performed in areas of interest to characterize aquatic features.

The focused site assessment survey included identification and mapping of appropriate seasonal pools in the study area.

2.4 Survey Results

Potential listed branchiopod habitat was identified in two general areas comprised of seven small pools north of the California Department of Water Resources (DWR) maintenance yard, and one area below B.F. Sisk Dam (see **Figures 2-2** and **2-3**). Each of these features is considered to provide potential habitat based on observed hydrologic indicators and ponding depth, the absence of flow-through water, alkali conditions, algal matting, the presence of aquatic invertebrates. Based on these indicators, each of the four observed features that were characterized as potential habitat during this dry season assessment are estimated to pond greater than 3 to 6 weeks out of the year, which is sufficient to support the life cycle of vernal pool fairy shrimp and vernal pool tadpole shrimp.

Neither vernal pool fairy shrimp nor vernal pool tadpole shrimp are reported within 10 miles of the study area and no other listed branchiopods occur within 10 miles of the study area. However, based on the presence of potentially suitable habitat, there is a moderate likelihood that these species occur within one or more of the aquatic depression features that were identified occur on-site. The largest of these features located north of the DWR office measures approximately 75 feet by 150 feet and may pool to an average depth of 6- to 8-inches, with a maximum depth estimated at between 14 and 16 inches (**Figure 2-4**). Ostracod shells and algal mats, both indicators of long-standing ponded water during winter, were evident in this and other observed pools (**Figure 2-5**). These indicators show adequate ponding capacity to support vernal pool fairy shrimp maturation.



SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 2-1
Occurrences of Listed Vernal Pool Branchiopods
within 10 miles of the B.F. Sisk Dam Project Study Area

ESA

SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 2-2
Location of Potential Vernal Pool Branchiopod Habitat

ESA

SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 2-3

Location of Potential Vernal Pool Branchiopod Habitat

ESA

Source: ESA

Figure 2-4

Seasonal Pools North of the DWR Maintenance Yard may Support Large Branchiopods; Algae Mats, Soil Cracking and Ostracod Shells are Present

Photo date: September 12, 2018

Source: ESA

Figure 2-5

Detail of Pools North of the DWR Maintenance Yard, showing Algae Growth (Top); and Two Pools in the Vicinity (Bottom)

Photo date: September 12, 2018

CHAPTER 3
Valley Elderberry Longhorn Beetle

3.1 Summary of Findings

This chapter summarizes the findings of a focused site assessment that was performed by Environmental Science Associates biologists for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) within the study area. The purpose for the 2018 VELB survey was to identify potential VELB habitat that may be affected by proposed future actions in the study area.

The site assessment found 40 elderberry shrubs in the study area with stems greater than 1-inch diameter, principally located near the Basalt Quarry area. However, no evidence of VELB presence such as larval exit holes or adult beetles were observed on any of the generally poor-to-fair health elderberry shrubs. The VELB is considered to have a low potential to occur on inspected plants and a low to moderate potential to occur on approximately 5 to 10 inaccessible elderberry shrubs. These findings are summarized in **Table 3-1**, below.

TABLE 3-1
SUMMARY OF ELDERBERRY SHRUB FINDINGS

Stem Size	Total Number of Stems
1 to 3 inches Diameter	42
3 to 5 inches Diameter	63
> 5 inches Diameter	16
Total Stems with VELB Exit Holes	0
Shrubs Not Reviewed for Exit Holes	4 shrubs, numerous stems
Total Stems within Riparian Habitat	0

SOURCE: ESA

3.2 Species Account

Valley elderberry longhorn beetles are unique insects that spend most of their lives within the stems of elderberry (*Sambucus* spp.) trees and shrubs. Females lay their eggs within the bark, where larvae hatch and bore into the stems. Larvae remain within the stems for one to two years. In March, when the elderberries begin to flower, they pupate and emerge as adults. Mating usually occurs in June. Often, the only indicators of their presence are the distinctive small oval-shaped openings that are left after larvae pupate and emerge (U.C. Berkeley, 2005; USFWS, 2018).

Valley elderberry longhorn beetles utilize elderberry shrubs with a minimum stem diameter of at least 1 inch (at ground level) (USFWS, 2005). In the Central Valley, elderberry shrubs are fairly common in riparian forests and adjacent uplands (U.C. Berkeley, 2005). Elderberry shrubs are typically found growing in association with other riparian species, but they also occur as isolated shrubs in upland areas.

Western Merced County is within the described potential range of the VELB (USFWS, 1999), with one reported occurrence in the western portion of the county (CDFW, 2018). Critical habitat for VELB is designated along the American River in Sacramento County, more than 50 miles from the study area (USFWS, 2002). The nearest documented VELB occurrence to the study area is a 1987 collection of two adult beetles from North Fork Los Banos Creek, about 5.3 miles southeast of the Basalt Campground (CDFW, 2018). No other occurrences are reported within 20 miles of the study area.

3.3 Survey Methods

VELB habitat surveys were conducted from September 10 to 13, 2018 by ESA biologists Even Holmboe, Julie McNamara, K. Bayne, and B. Pittman. The survey focused on identifying elderberry shrubs within borrow and construction areas within the project study area shown in Figure 1-1. ESA biologists identified and inspected all elderberry shrubs and recorded the number of stems measuring at least a 1-inch in diameter at the base. Data collected for each shrub included the number of stems, diameter class, whether or not they had exit holes. No identified shrubs were located within riparian habitat, therefore, such information was not collected.

3.4 Survey Results

The survey focused on elderberry shrubs within the study area shown in Figure 1-1 and areas within 250 feet. The Basalt Quarry area contained the largest concentration of elderberry shrubs. A large mixed elderberry stand was identified northwest of Basalt Quarry, numbering greater than 25 shrubs. Shrub locations are shown in **Figures 3-1 and 3-2**. Data on stem size and the presence of valley elderberry longhorn beetle (VELB) activity (i.e., presence of exit holes) is shown in **Table 3-2**. No VELB activity was noted; however, due to the extremely dense structure within the largest identified mixed elderberry stand, perhaps five to ten shrubs could not be closely inspected to ascertain potential VELB activity.

In addition, a smaller elderberry stand was noted comprising nine shrubs (Figure 3-1a). Aside from these occurrences, elderberries are not present elsewhere in the study area. A single elderberry shrub was found several feet outside the study area, at the sewage holding ponds located 0.5-mile northeast of the Basalt Campground. The characteristics of identified shrubs are presented in Table 3-2.

TABLE 3-2
ELDERBERRY SHRUB CHARACTERISTICS

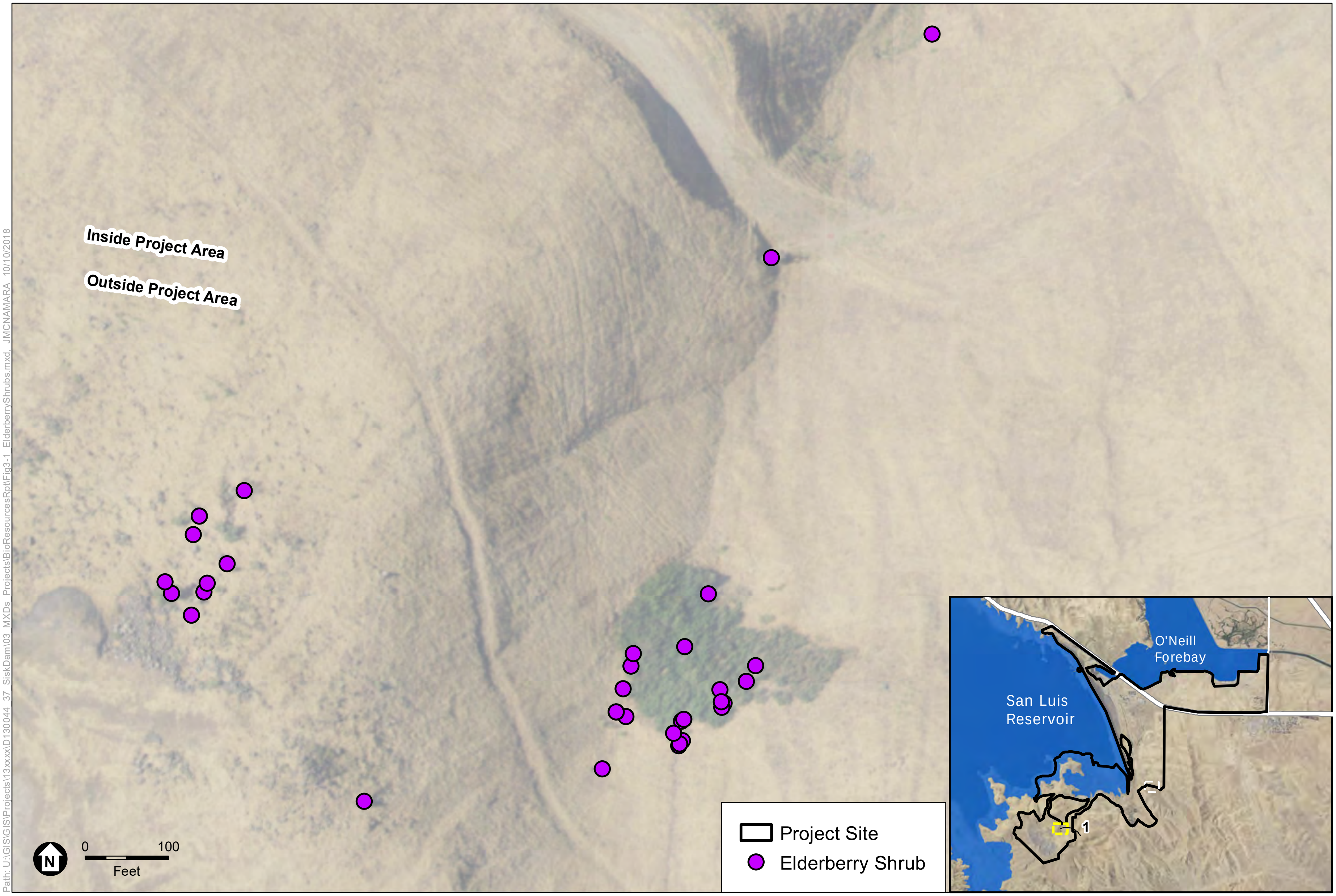
Shrub Number	Number of Stems by Size Class			Canopy Diameter in Feet	General Health	Presence of Exit Holes or other VELB Evidence
	1”-3”	3” to 5”	>5”			
1		4	2	15	Fair	None
2		2		8	Fair	None
3			3	14	Poor	None
4				12	Poor	None
5	1			4	Poor	None
6		9		14	Poor	None
7	4			10	Poor	None
8		1		5	Fair	None
9		2	2	12	Poor	None
10	4			8	Poor	None
11	5			8	Poor	None
12		2		8	Poor	None
13		1	2	10	Fair	None
14	1	1	1	10	Fair	None
15	1			6	Fair	None
16	1			6	Fair	None
17	2			6	Fair	None
18		3		5	Fair	None
19			1	5	Inaccessible	N/A
20		12 (estimated)	2	45	Inaccessible	N/A
21		10 (estimated)		20	Inaccessible	N/A
22			1	10	Inaccessible	N/A
23			1	10	Fair	N/A
24	2			8	Fair	None
25		2		8	Fair	None
26		1		5	Fair	None
27		2		6	Fair	None
28	3			7	Fair	None
29	2			10	Fair	None

TABLE 3-2
ELDERBERRY SHRUB CHARACTERISTICS (CONTINUED)

Shrub Number	Number of Stems by Size Class			Canopy Diameter in Feet	General Health	Presence of Exit Holes or other VELB Evidence
	1”-3”	3” to 5”	>5”			
30	5	3		10	Fair	None
31	5	1		9	Fair	None
32	1			3	Poor	None
33	2			5	Poor	None
34	1	1		10	Fair	None
35		2		8	Fair	None
36	1			2	Poor	None
37			1	17	Poor	None
38			6	6	Poor	None
39	1		1	1	Poor	None

SOURCE: ESA

A single VELB occurrence is reported within 20 miles of the study area: a 1987 species collection from North Fork Los Banos Creek, about 5.3 miles southeast of the Basalt Campground (CDFW, 2018). Each of the elderberry shrubs observed during the assessment are growing on dry slopes and were considered to be in generally poor health conditions. Upon reviewing 39 elderberry plants, no VELB exit holes were observed on any of the inspected plants. An additional four shrubs were identified but could not be inspected due to access limitations. These shrubs could potentially support VELB. If VELB were present within identified elderberry shrub thickets, evidence of their presence would have been evident on the inspected plants. This species is considered to have a low potential to occur on inspected plants and a low to moderate potential to occur on inaccessible elderberry shrubs.



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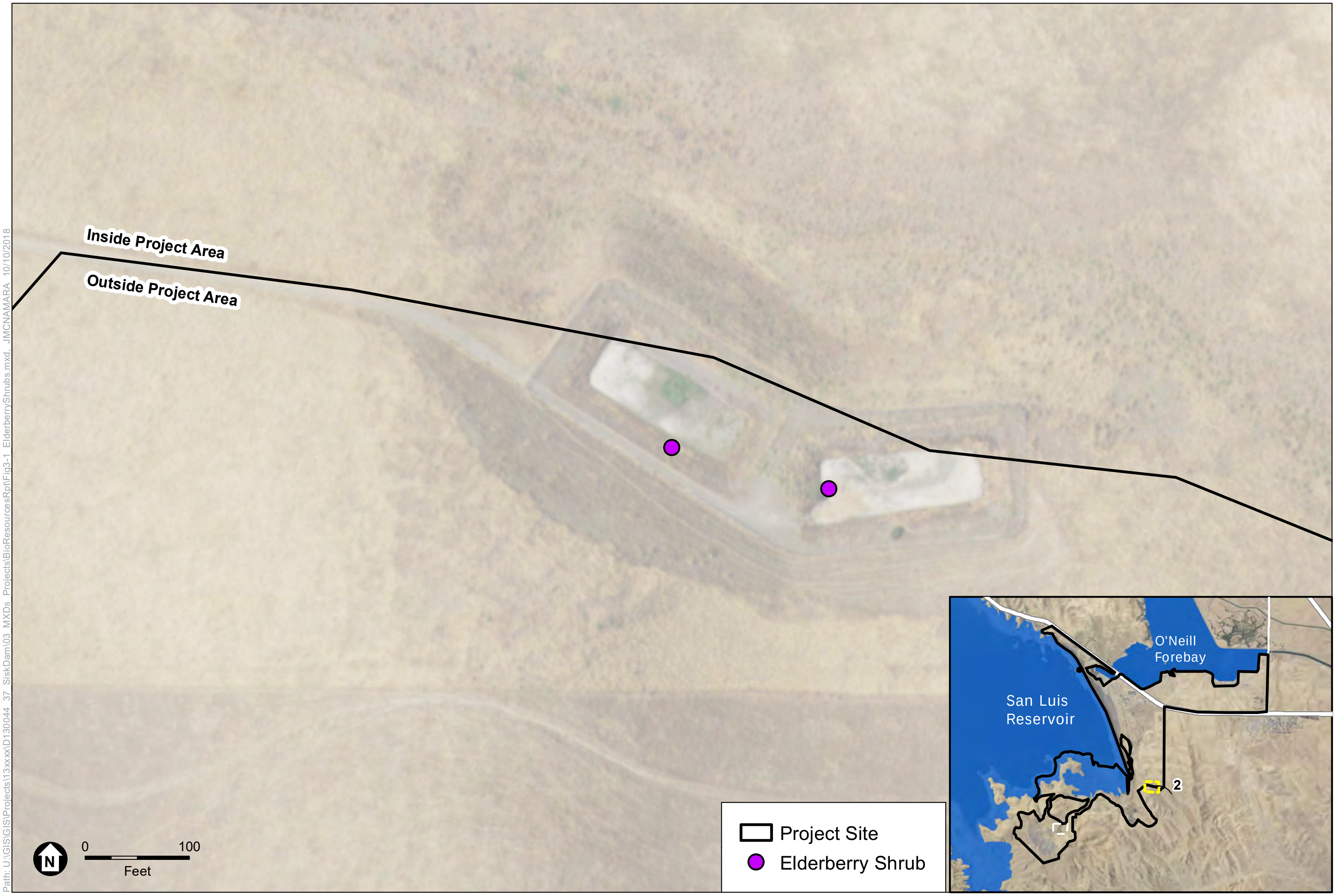
SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 3-1
Location of Elderberry Shrubs
in the B.F. Sisk Dam Project Study Area

ESA



SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 3-2
Location of Elderberry Shrubs
in the B.F. Sisk Dam Project Study Area

ESA

Source: ESA

Figure 3-3

Individual and Clumped Elderberry Shrubs were Identified in Poor to Moderate Health near the Basalt Quarry Area

Photo date: September 13, 2018

Source: ESA

Figure 3-4

Two Views of the Mixed Elderberry Thicket near the Basalt Quarry

Photo date: September 13, 2018

CHAPTER 4
California Tiger Salamander

4.1 Summary of Findings

A focused review was performed by ESA biologists within the study area to examine potential breeding habitat for the California tiger salamander (*Ambystoma californiense*). This review considered the sites described in a North State Resources, Inc. (NSR) (2010a) California tiger salamander site assessment, and additionally considered two off-site stock ponds in the regional vicinity. Potential California tiger salamander breeding habitat was identified in two locations in the study area, both near Basalt Quarry, and at two sites located to the south. The potential on-site breeding areas include Willow Spring stock pond located north of Basalt Quarry and a seasonal pool in the same general vicinity. Potential off-site aquatic breeding habitat was identified at three locations: a spring-fed stock pond located 0.8-mile southeast of Basalt Quarry (Off-site Pond #1); a seasonal impoundment approximately 0.6-mile south of Basalt Campground (Off-site Pond #2); and stock ponds located 0.3-mile and 1.2-miles west of Basalt Quarry (Off-site Ponds #3, and #4, respectively). The Willow Spring stock pond provides high quality breeding habitat for the California tiger salamander and is a possible source of adult tiger salamanders that have been anecdotally reported in the Basalt Use Area (U.S. Bureau of Reclamation and California Department of Parks and Recreation, 2005).

A full species account for the California tiger salamander was provided in NSR (2010a) and is not repeated in this report.

4.2 Survey Methods

California tiger salamander specialist B. Pittman, CWB, was the lead surveyor for the assessment, with assistance from species experts K. Bayne and E. Holmboe. Mr. Pittman holds a USFWS 10a(1)(A) recovery permit for California tiger salamander. Aquatic features in the study area were reviewed on by the above personnel on September 10 to 13, 2018, with assistance from wildlife biologist J. McNamara.

In advance of the survey, ESA biologists performed the following tasks:

- Review of aerial photographs on Google Earth from August 1998 through March 2018 to examine the ponding characteristics of aquatic sites and locations of perennial water.
- Examine the NSR (2010a) California tiger salamander site assessment report to locate prior survey areas, pond locations, and ascertain ponding conditions.

- A review of historical and recent California tiger salamander distribution records from the California Natural Diversity Database (CNDDB) (CDFW, 2018) and scientific literature (**Figure 4-1**).

Following this desktop review, a daytime field review was performed of select aquatic sites to examine their size, ponding characteristics, and seasonal hydrology. The day survey included direct review of aquatic sites using the methodology described in the 2003 *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or A Negative Finding of the California Tiger Salamander*, jointly issued by the USFWS and CDFW (USFWS, 2003). The habitat assessment prepared by NSR was relied upon for the descriptions of all habitat features in the study area; excepting two that that provide potential breeding habitat.

4.3 Survey Results

Two potential aquatic breeding sites for California tiger salamander were identified in the study area (**Figures 4-2 and 4-3**), and two such features were identified outside of the study area, southeast of the Basalt Quarry and Basalt Campground area (**Figure 4-4**; also see **Figure 5-4**). The first two sites are within B.F. Sisk Safety of Dams Modification Project area and the other two are within the typical movement range of the California tiger salamander. Three of the features directly reviewed, and the fourth off-site area is considered to provide potential breeding habitat based on a review of aerial photographs and review using binoculars from approximately 0.25-mile. These sites are further described in **Table 4-1**.

The California tiger salamander has not been verified within the Study Area; however, has been anecdotally described from the Basalt Use Area (U.S. Bureau of Reclamation and California Department of Parks and Recreation, 2005).

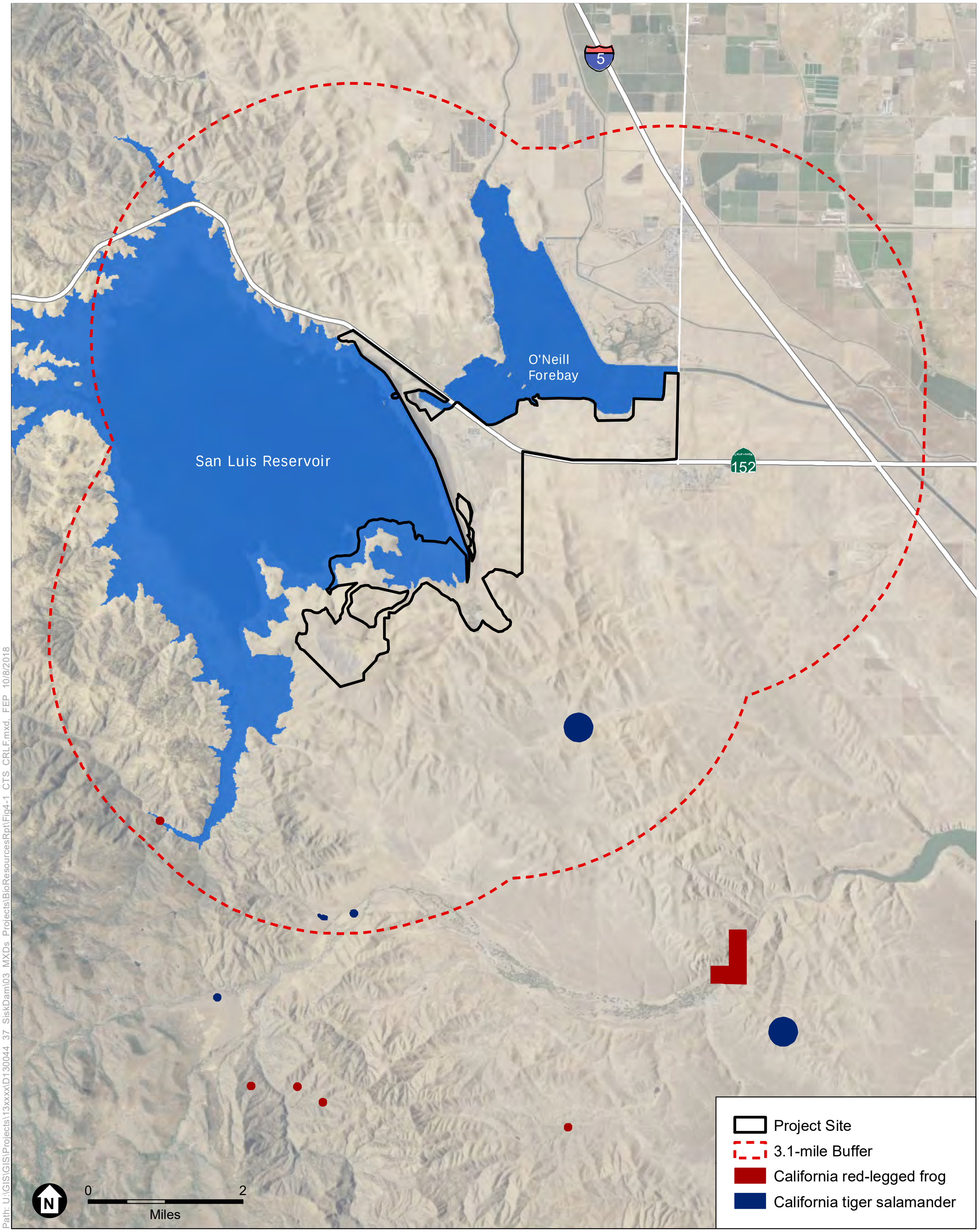
The California tiger salamander should be presumed to use Willow Spring pond, which additionally supports California red-legged frog breeding. In areas where the range of the California tiger salamander and California red-legged frog overlap, numerous accounts of sympatry are often reported from perennial and ephemeral ponds (Alvarez et al., 2013). California tiger salamanders should also be presumed to breed in each of the other three sites noted in this assessment, unless separate field surveys verify the absence of appropriate ponding conditions during a normal rainfall year. Based on resource agency guidance, this species has bene described in upland habitat up to 2 km (1.24 miles) from aquatic breeding sites under optimal movement conditions. Aside from the steep topography of the area, there are no barriers to California tiger salamander movement into or within the study area.

TABLE 4-1

POTENTIAL CALIFORNIA TIGER SALAMANDER BREEDING SITES

Pond Identification	Size	Habitat Conditions	Hydrology
Willow Spring Pond	0.17 acre	Spring-fed stock pond with dense cattails in the center surrounded by a broad ring of aquatic habitat. Duckweed seasonally provides cover within ponded areas. An extensive California ground squirrel colony is present upslope from the pond, providing hundreds of potential refuge burrows. California red-legged frog present at this site.	Perennial water; greater than 1.5 feet in numerous locations
Basalt Quarry Pond	0.04 acre	Seasonal impoundment perched on the hillside. Numerous small mammal burrows on the surrounding hillside. No emergent vegetation.	Seasonal pond that appears to have borderline hydrology to support the CTS aquatic life cycle. The upslope area is seasonally wet from natural seepage and may sustain suitable aquatic breeding conditions.
Off-site Pond #1; 0.8-mile Southeast of Basalt Quarry	0.15 acre	Seasonal impoundment perched on the hillside. Numerous ground squirrel burrows on the surrounding hillside. Feature is fed by an upslope spring that lengthens the duration of ponding. No emergent vegetation Subject to cattle grazing. Also considered potential for California red-legged frog.	Seasonal pond that retains water into summer months. An upslope seep provides shallow year-round pooled water in cattle hoof depressions.
Off-site Pond #2; 0.6-mile south of Basalt Campground	0.18 acre	Seasonal impoundment that could not be reached for surveys, but appears to provide appropriate conditions of breeding. No emergent vegetation; grazed.	Seasonal pond that retains water into summer months.
Off-site Pond #3; 0.3-mile west of Basalt Quarry	0.08 acre	Seasonal impoundment that could not be reached for surveys, but appears to provide appropriate conditions of breeding. No emergent vegetation; grazed.	Seasonal pond that retains water into summer months.
Off-site Pond #4; 1.2-miles west of Basalt Quarry	0.50 acre	Perennial impoundment that could not be reached for surveys, but appears to provide appropriate conditions of breeding. Extensive cattail growth; grazed.	Perennial water

Source: ESA

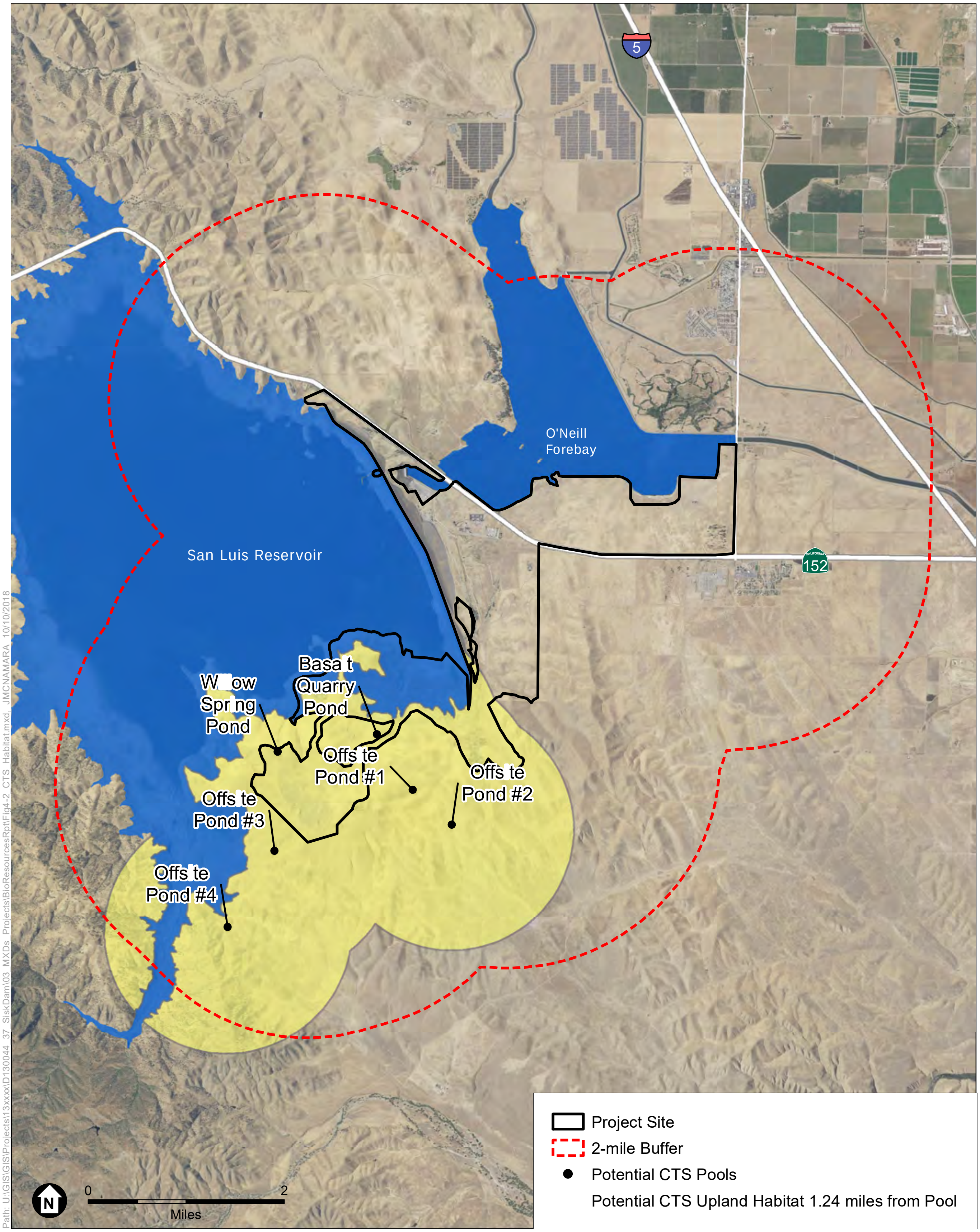


SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 4-1
Occurrences of California Tiger Salamander and California Red-legged Frog within 3.1 miles (5 km) of the B.F. Sisk Dam Project Area

ESA



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SOURCE: USDA, 2016; CDFW, 2018; USFS, 2017; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 4-2
Location of Potential California Tiger Salamander Habitat
within 2 miles of the B.F. Sisk Dam Study Area

ESA

Source: ESA

Figure 4-3

Potential California Tiger Salamander Breeding Habitat at Willow Spring Pond (top) and "Basalt Quarry Pond" (bottom)

Photo date: September 13, 2018

Source: ESA

Figure 4-4

Potential California Tiger Salamander Breeding Pools at Off-site Pond #1, 0.8-mile Southeast of Basalt Quarry (top) and Off-site Pond #2, 0.6-mile South of Basalt Campground (bottom). Photo date: September 13, 2018

CHAPTER 5
California Red-legged Frog

5.1 Summary of Findings

A focused review was performed by ESA biologists within the study area to examine perennial aquatic sites as potential California red-legged frog (*Rana draytonii*) habitat. This review considered the sites described in a North State Resources, Inc. (NSR) (2010b) California red-legged frog habitat assessment, and additionally considered one off-site stock pond in the regional vicinity. During non-protocol day and night spotlighting surveys, a California red-legged frog population was detected in the study area at the Willow Spring pond located north of Basalt Quarry. Potential high quality aquatic breeding habitat was also identified in a spring-fed stock pond, Off-site Pond #1 located 0.63-mile northeast of the Basalt Hill summit, and Off-site Pond #3 located 0.3-mile west of Basalt Quarry. The survey confirmed NSR (2010b) findings that California red-legged frogs are unlikely to be encountered in other aquatic habitat within the study area such as below the dam or at the Medeiros Use Area. Aquatic habitat associated with Domengine Spring, near Basalt Campground, was also surveyed and is considered unlikely to support this species. A full species account for the California red-legged frog was provided in NSR (2010b) and is not repeated in this report.

5.2 Survey Methods

California red-legged frog specialists K. Bayne and B. Pittman, CWB, were the lead surveyors for the assessment. Ms. Bayne and Mr. Pittman each hold USFWS 10a(1)(A) recovery permits for California red-legged frog. Focused day and nighttime surveys of aquatic features in the study area were performed by B. Pittman, K. Bayne, J. McNamara, and E. Holmboe from September 10 to 13, 2018.

In advance of the survey, ESA biologists performed the following tasks:

- Review of aerial photographs on Google Earth from August 1998 through March 2018 to examine the ponding characteristics of aquatic sites and locations of perennial water.
- Examine the 2010 NSR habitat assessment report to locate prior survey areas, pond locations, and ascertain ponding conditions.
- A review of historical and recent California red-legged frog distribution records from the California Natural Diversity Database (CNDDB) (CDFW, 2018) and scientific literature.

Following this desktop review, day and nighttime field surveys were performed at select aquatic sites. The day survey included direct review of upland and aquatic habitat at perennial aquatic sites to verify on-site aquatic habitat and survey for amphibian populations. Surveyors used the visual-encounter survey method, as described in the USFWS (2005) survey protocol. This method entails walking the survey area while repeatedly scanning and listening for amphibians.

Day surveys were conducted on September 10-13, 2018 between 9 am and 5 pm. Night surveys were conducted at two locations on September 13, 2018 between 2040 hours to 2200 hours. Surveys were performed under optimal visibility and weather conditions, under dry, calm and relatively warm conditions. Wind speed was generally under 2 to 3 mph and the air temperature ranged from 70 to 75 degrees Fahrenheit. All encountered amphibians were identified with 100 percent certainty. During night surveys, each surveyor used a 230-lumen Nite Lite Wizard II LED headlamp (a 6-volt, a Service-approved light for California red-legged frog surveys) and 10x42 binoculars.

5.3 Survey Results

The CNDDB reports the nearest California red-legged frog as approximately 6 miles to the east and 5 miles to the south of the study area. In addition, the NSR (2010b) habitat assessment concluded no potential for species occurrence in the study area. Perennial water seepage drains below B.F. Sisk Dam were reviewed for their potential to provide California red-legged frog habitat. Aquatic habitat is present in some features, as noted in the NSR (2010b) report; however, these perennial aquatic sites are either small, provide no cover for frogs, or are isolated and not considered accessible to red-legged frogs.

Based on the desktop review and daytime review of field sites, nighttime surveys were performed at two high quality perennial aquatic sites: Willow Spring and Domengine Spring. A California red-legged frog breeding population was identified during surveys at the Willow Spring stock pond (37.02791N, -121.10020W) (**Figures 5-1, 5-2, and 5-3**). One adult and eight subadult California red-legged frogs were identified in the pond during the night survey. Details for this occurrence are provided in the CNDDB reporting form in **Appendix A**.

In addition, potential habitat for this species was identified during daytime surveys in a spring-fed stock pond located approximately 0.63-mile northwest of the Basalt Hill summit (see Figures 5-1 and 5-3). This seasonal pond is fed by a perennial spring. It is believed that the pond may serve as a suitable California red-legged frog breeding site, drying by mid-summer. The adjacent spring provides year-round non-breeding aquatic habitat that, in combination with the pond and regionally-occurring California red-legged frog populations, could support a breeding population. This pond is located outside of the B.F. Sisk Safety of Dams Modification Project area, on grazing land owned by Reclamation.

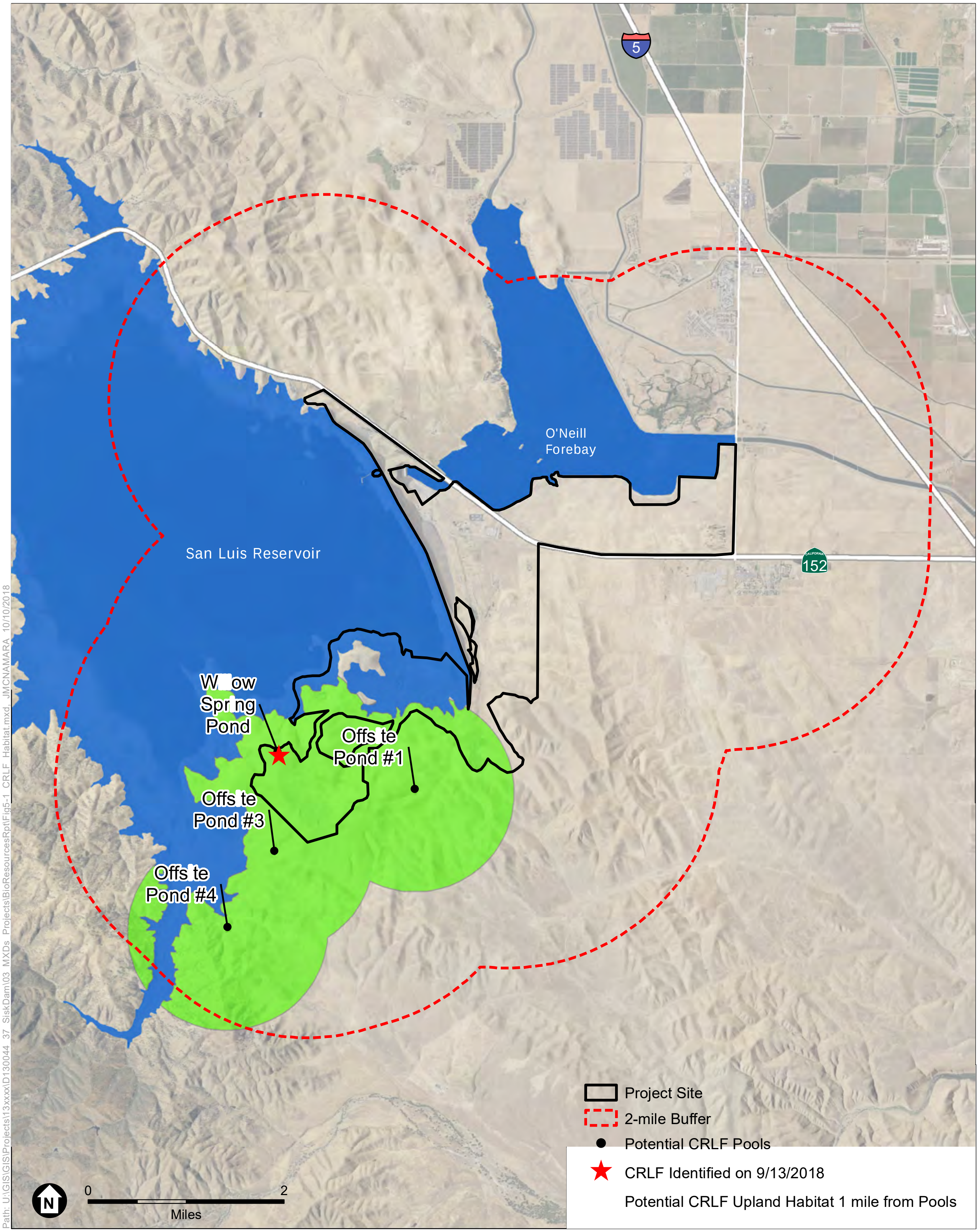
TABLE 5-1

POTENTIAL CALIFORNIA RED-LEGGED FROG BREEDING SITES

Pond Identification	Size	Habitat Conditions	Hydrology
Willow Spring Pond	0.17 acre	Spring-fed stock pond with dense cattails in the center surrounded by a broad ring of aquatic habitat. California red-legged frog present at this site.	Perennial water; greater than 1.5 feet in numerous locations
Off-site Pond #1; 0.8-mile Southeast of Basalt Quarry	0.15 acre	Seasonal impoundment perched on the hillside. Numerous ground squirrel burrows on the surrounding hillside. Feature is fed by an upslope spring that lengthens the duration of ponding. No emergent vegetation Subject to cattle grazing. Also considered potential for California tiger salamander.	Seasonal pond that retains water into summer months. An upslope seep provides shallow year-round pooled water in cattle hoof depressions.
Off-site Pond #3; 0.3-mile west of Basalt Quarry	0.08 acre	Seasonal impoundment that could not be reached for surveys, but appears to provide appropriate conditions for breeding. No emergent vegetation; grazed.	Seasonal pond that retains water into summer months.
Off-site Pond #4; 1.2-miles west of Basalt Quarry	0.50 acre	Perennial impoundment that could not be reached for surveys, but appears to provide appropriate conditions of breeding. Extensive cattail growth; grazed. High likelihood of species' presence.	Perennial water; depth unknown

Source: ESA

Based on survey findings, the California red-legged frog may be encountered in select aquatic sites and surrounding upland habitat near Basalt Quarry, south of the reservoir. This species could potentially enter active work areas both from the Willow Spring pond to the north of the work area, or from Off-site Pond #1 or Pond #3 to the south and west of the study area (if present at these locations). Hence, precautions are warranted to avoid impacts to this species.



SOURCE: USDA, 2016; CDFW, 2018; USFS, 2017; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 5-1
Location of Known and Potential California Red-legged Frog
Habitat within 2 miles of the B.F. Sisk Dam Study Area

ESA

Source: ESA

Figure 5-2

Surveyed Habitat in the Study Area included Two Spring-fed Drainages: Domengine Spring near Basalt Campground (top) and Willow Spring Pond (bottom). Photo date: September 12, 2018

Source: ESA

Figure 5-3
A Breeding Population of California Red-legged Frogs was Detected at the Willow Spring Pond. Photos show an Adult Frog (top) and Subadult Frog (bottom).
Photo date: September 13, 2018

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 5-4

Two Views of Potential CRLF Habitat in a Spring-fed Off-site Pond #1, 0.63-mile Northwest of the Basalt Hill Summit. Top Photo Shows Perennial Standing Water.
Photo date: September 13, 2018

CHAPTER 6
Burrowing Owl and Swainson's Hawk

6.1 Summary of Findings

This chapter presents the results of a habitat assessment for burrowing owl (*Athene cunicularia*) and Swainson's hawk (*Buteo swainsoni*) within the study area defined in Chapter 1. The purpose of the habitat assessment is to identify active and potential burrowing owl and Swainson's hawk foraging and nesting habitat.

To summarize survey findings, no burrowing owls, active burrows, or burrowing owl sign was identified in the study area. In addition, State Parks employees do not report any recent burrowing owl sightings in the study area. Low annual grassland habitat with extensive ground squirrel burrows occurs throughout the area below the dam and provides high quality nesting and foraging habitat for this species. Annual grasslands near the Medeiros Use Area and throughout the study area provide intermittent, high quality habitat for this species.

No Swainson's hawks were observed during surveys, possibly due to the late, post-migration survey timing. The CNDDB reports recent nesting in two trees stands in the Medeiros Use Area grassland area and trees near Basalt Campground. Individual tree and tree stands in the Medeiros Use Area and similar habitat west of SR 152 provide suitable foraging habitat for Swainson's hawk.

6.2 Species Accounts

Burrowing Owl

Western burrowing owls are relatively small, semicolonial owls, and are mostly residents of open dry grasslands and desert areas. These owls use burrows excavated by ground squirrels and other small mammals during the breeding and non-breeding season. In areas where the number and availability of natural burrows is limited, owls may occupy human-made burrows such as drainage culverts, cavities under piles of rubble, discarded pipe, and other tunnel-like structures (Zeiner et al., 1990a). Burrowing owls hunt from perches and are opportunistic feeders. They consume arthropods, small mammals (e.g., meadow voles), birds, amphibians, and reptiles. Insects are often taken during the day, while small mammals are taken at night (Zeiner et al., 1990a).

The CNDDB (2018) confirms a local burrowing owl record from 2003, with two wintering owls observed about one mile southeast of the California Department of Forestry and Fire Protection (CAL FIRE) station, near the intersection of Basalt Road and Gonzaga Road. Twelve additional occurrences are reported by the CNDDB within 10 miles of the study area (**Figure 6-1**). Burrowing owl nesting has not been observed or reported in the study area.

Swainson's Hawk

This large migratory hawk nests throughout North America and winters in southern South America. Swainson's hawks begin arriving in California in late February and depart for their wintering grounds in early September (Woodbridge, 1998). Nests are typically constructed in sturdy trees within or near agricultural lands, riparian corridors, and roadside trees. Nests are composed of a platform of sticks, bark, and fresh leaves. Swainson's hawks reside in the Central Valley from March through October, with eggs typically laid in April and early May (peaking in late April).

The Swainson's hawk nesting range is restricted to portions of the Central Valley and Great Basin regions, where suitable habitat is still present. The highest density currently is in the Central Valley, between Sacramento and Modesto, and in the northern San Joaquin Valley (Woodbridge, 2004).

The CNDDB reports Swainson's hawk nesting in the study area, with three active nest sites reported in 2006 including two in Medeiros Use Area grasslands and one at Basalt Campground. Additionally, numerous Swainson's hawk nesting attempts are reported at the O'Neill Forebay Wildlife Area managed by CDFW from 2001 top 2015 (CDFW, 2018).

6.3 Survey Methods

The burrowing owl survey and habitat assessment was performed from September 10 to 13, 2018 by ESA biologists E. Holmboe, K. Bayne, and B. Pittman, with assistance from J. McNamara. The lead surveyors each have more than a 15 years of focused burrowing owl and Swainson's hawk survey experience.

In advance of the survey, ESA biologists performed the following tasks:

- A review of aerial photographs on Google Earth from August 1998 through March 2018 to examine nesting areas and review off-site nesting areas.
- An inventory of historical and recent burrowing owl and Swainson's hawk occurrence records from the California Natural Diversity Database (CNDDB) (CDFW, 2018) and scientific literature (**Figure 6-1**).

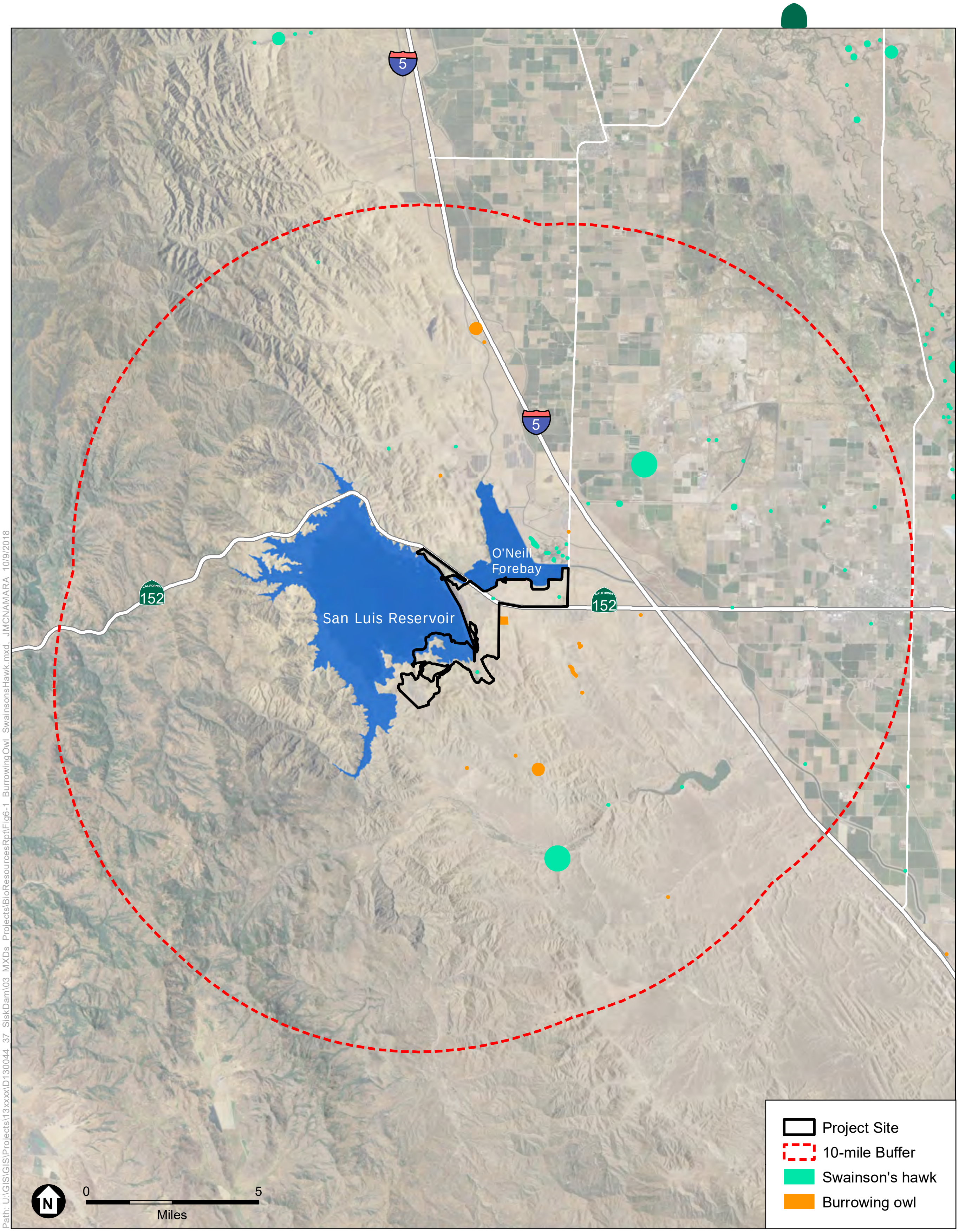
The burrowing owl assessment followed the survey guidelines described in the California Department of Fish and Wildlife (CDFW) Staff Report on Burrowing Owl Mitigation (herein referred to CDFW Staff Report) (CDFW, 2012). The description of habitat conditions in the study area includes an assessment of the presence and extent of potential burrowing owl nesting habitat (burrows) and foraging habitat (annual grasslands). The work completed and described in this report fulfills the Habitat Assessment and Reporting criteria as described in the CDFW Staff Report (CDFW, 2012).

The Swainson's hawk habitat assessment was performed outside of CDFW's recommended survey period for this species, which generally runs from April 1 through July 15 (CDFW, 2010). Birds were likely Hence, a survey for individual birds could not be performed. Surveyors reviewed individual trees and tree groves for evidence of nesting and recorded evidence of nesting great homed owls, red-tailed hawks, red-shouldered hawks and other potentially competitive species.

6.4 Survey Results

Potential burrowing owl nesting and foraging habitat was identified in grasslands throughout the study area; however, no evidence of burrowing owl presence was noted during transect surveys within the highest quality habitat areas. Based on the field review, the distribution of potential burrowing owl nesting habitat is shown in **Figure 6-2**.

While Swainson's hawk nesting was not observed in the study area, eucalyptus, cottonwoods and other trees provide potential nesting habitat. Grasslands throughout the study area provide potential foraging habitat. The distribution of potential Swainson's hawk nesting and foraging habitat is also shown in Figure 6-2.

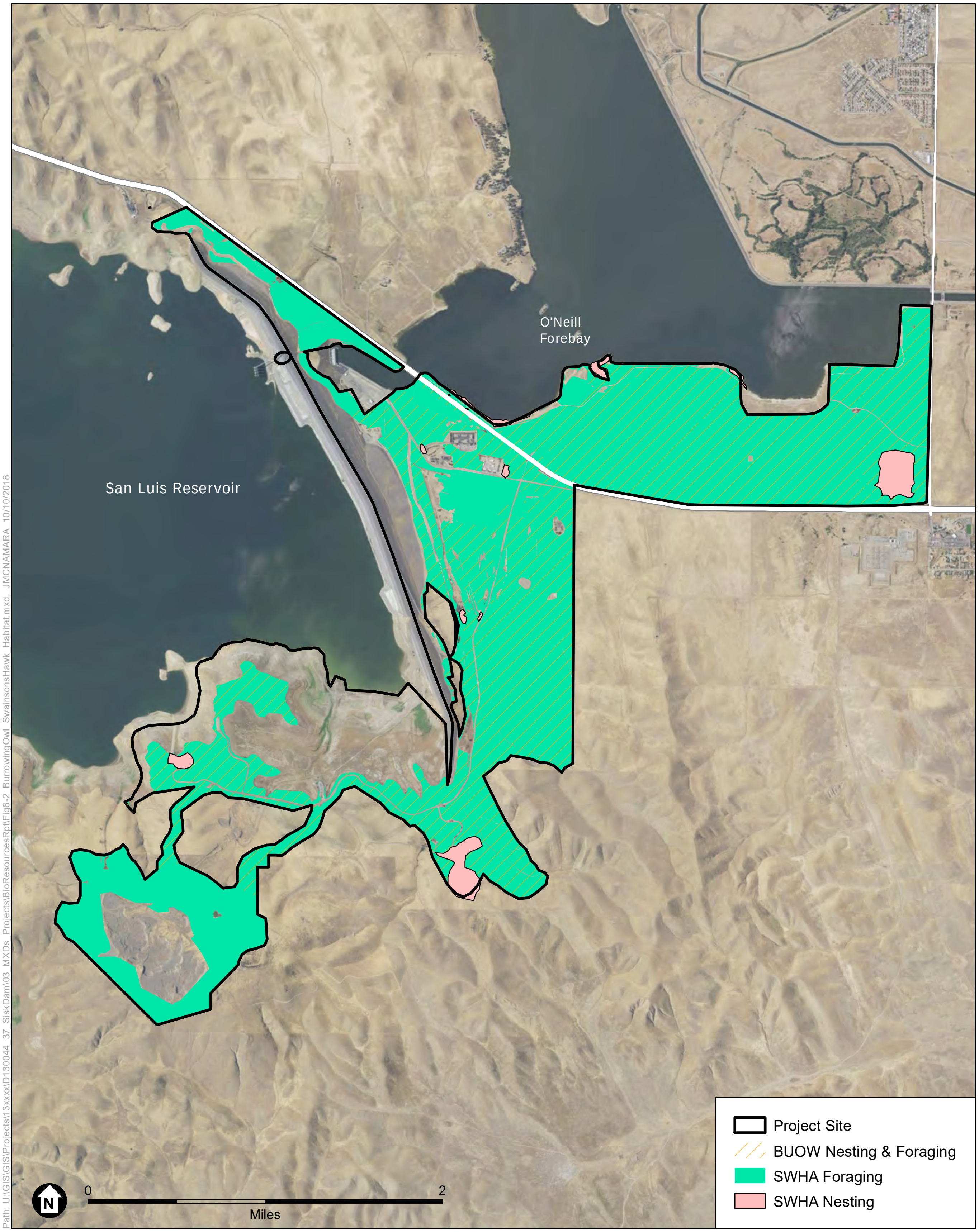


SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 6-1
Occurrences of Burrowing owl and Swainson's Hawk within 10 miles of the B.F. Sisk Dam Project Study Area

ESA



Path: U:\GIS\GIS\Projects\13xxxx\D130044 37 SiskDam\03 MXDs Projects\BioResourcesRpt\Fig6-2 BurrowingOwl SwainsonsHawk Habitat.mxd, JMCNAMARA 10/10/2018

SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 6-2
Location of Potential Burrowing Owl and Swainson's Hawk Habitat in the B.F. Sisk Dam Project Study Area

ESA

Source: ESA

Figure 6-3

Much of the Study Area Supports Annual Grasslands that are Suitable for Burrowing Owl Nesting; seen from atop B.F. Sisk Dam looking toward O'Neill Forebay (top) and in Greater Detail (bottom). Photo date: September 12, 2018

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 6-4

Grasslands in the Medeiros Use Area are Suitable for Burrowing Owl Nesting. The CNDDB Reports Recent Swainson's Hawk Nesting in the Eucalyptus Grove in this Area. Photo date: September 12, 2018

CHAPTER 7
American Badger and San Joaquin Kit Fox

7.1 Summary of Findings

Spotlighting surveys were conducted on four consecutive nights in September 2018, totaling 10 survey hours within the study area (2.5 hours each). Surveys resulted in the identification of 94 animals in the study area comprising 10 identified species, and one unidentified canid that was observed at a great distance. San Joaquin kit were not observed during the spotlighting survey. An American badger was detected during spotlighting surveys near the intersection of Basalt Road and Gonzaga Road.

Neither American badger nor San Joaquin kit fox were identified at 12 camera scent stations that were established throughout the study area.

7.2 Species Accounts

American Badger

American badgers are rather large, robust, short-legged mammals with broad bodies. They have a short bushy tail, small eyes and ears, shaggy grayish fur, and distinct white and black markings on the face. Badger front feet are large, with claws measuring about 1-inch long that are used for digging. Badgers prey primarily on gophers, ground squirrels, marmots, and kangaroo rats, but will also eat a variety of other animals, including mice, woodrats, reptiles, birds and their eggs, bees and other insects. In California, American badgers occupy a diversity of habitats. Grasslands, savannas, and mountain meadows near the timberline are preferred, though they can be found in deserts as well. The principal requirements seem to be sufficient food, friable soils, and relatively open, uncultivated ground.

In California, badgers range throughout the state, except for the humid coastal forests of northwestern California in Del Norte County and the northwestern portion of Humboldt County (Williams, 1986).

This species is expected to occur in moderate densities in grassland habitats throughout the study area, with individuals observed during the survey below the dam, and anecdotally reported by State Parks staff in the Basalt Day Use area, north of Basalt Quarry.

San Joaquin Kit Fox

The San Joaquin kit fox is a permanent resident of arid grasslands and open scrubland, where friable soils are present. Dens are required year-round for reproduction, shelter, temperature regulation, and protection from predators (USFWS, 1998). Historically their habitat included native alkali marsh and saltbush scrub of the valley floor, but the availability of such habitats has diminished markedly due to agricultural conversion. Grasslands with friable soils are considered the principal habitat for denning, foraging, and dispersal, while open woodland areas and agricultural lands provide foraging and dispersal habitat. Kit foxes will use habitats that have been extensively modified by humans, including grasslands and scrublands with active oil fields, wind turbine fields, and agricultural matrices (USFWS, 1998).

San Joaquin kit fox diet characteristics vary subtly in the northern portion of their range from other portions of their range. In the Altamont region, the kit fox diet varies seasonally and by locality based on local prey availability. While kangaroo rats (*Dipodomys* spp.) are an important component of the kit fox diet in their southern range, kit foxes in the Altamont region preferentially prey upon California ground squirrel, insects, cottontails (*Sylvilagus audubonі*), black-tail jackrabbits (*Lepus californicus*), and small rodents such as voles, rats and mice (Hall, 1983; Orloff et al., 1986). Other prey that may be taken opportunistically includes ground-nesting birds, reptiles, and insects (Laughlin, 1970).

San Joaquin kit foxes occur only in and around the Central Valley, inhabiting open habitat in the San Joaquin Valley and surrounding foothills. Kit fox population densities are greatest in the southern portion of their range. Kit fox populations in the northern portion of their range are highly fragmented and sparsely distributed, where foxes occupy foothill grasslands because much of their former habitat on the valley floor has been eliminated.

At least 24 San Joaquin kit fox sightings area reported within 10 miles of the study area (CDFW, 2018), including multi-year observations of numerous individuals. Within 0.75 to 5.5 miles to the south of the study area, a single CNDDB occurrence includes sightings of 185 individuals between 1984 to 2005 (**Figure 7-1**). The next nearest sighting to the south describes 291 individuals observed from 1972 to 2003 (CDFW, 2018). Most of the recently documented kit fox sightings are pre-2005, and occur south and southeast of the study area, with scattered occurrences to the northeast (Figure 7-1).

7.3 Survey Methods

A detailed San Joaquin Kit Fox Evaluation report prepared by North State Resources (2010c) characterized the quality and distribution of potential habitat for his species in the study area, and the location of spotlighting activities in the regional area. The habitat characterization describes present-day conditions within the study area and surrounding region. The present non-protocol survey and site assessment was performed to identify the potential presence of large carnivores, including San Joaquin kit fox and American badger, through spotlighting surveys and the placement of camera scent stations.

Spotlighting Surveys. Spotlighting surveys were conducted each night between Monday, September 10 and Thursday, September 13 following the following the CDFW Region 4 Approved Survey Methodologies for Sensitive Species (1990). Surveys began each night between 1930 hours and 2000 hours and continued for 2 to 3 hours. Weather conditions during the surveys were optimal, with wind speed generally under 2 to 3 mph and air temperature ranging from 70 to

75 degrees Fahrenheit. The moon phase was new moon on September 10, and waxing crescent for other survey days.

One team of two to four biologists conducted the surveys. Survey personnel are identified in Table 7-1. Surveys were performed from paved and dirt roads within the study area, with the vehicle survey routes shown in **Figure 7-2**. A high-clearance vehicle was used to ensure unobstructed views of the surrounding areas. Surveyors used two high-output (1,000,000-candlepower) spotlight per vehicle. Survey routes were driven at speeds under 10 miles per hour.

TABLE 7-1
SPOTLIGHTING PERSONNEL

Survey Date	Lead Biologists	Assistant
September 10, 2018	Brian Pittman	Julie McNamara
September 11, 2018	Brian Pittman	Julie McNamara
September 12, 2018	Brian Pittman Even Holmboe Kelly Bayne	Julie McNamara
September 13, 2018	Brian Pittman Even Holmboe Kelly Bayne	Julie McNamara

Wildlife species that were identified during surveys were identified using 10x42 power binoculars, and their locations were generally recorded on data sheets. All wildlife observations were confirmed by multiple observers.

Camera Stations. Camera stations were established at twelve locations situated throughout the study area (Figure 7-2). The 1999 USFWS survey protocol recommends using a minimum density of 8 cameras per 640 acres. Due to the large size of the study area, cameras could not be placed at the recommended number. Hence, the survey was intended to be informational in nature and not intended as a presence-absence survey. Cameras were operated for four nights, with four cameras relocated during the survey to coincide with small mammal activity identified during spotlighting surveys.

Each camera station consisted of four Cabela's Outfitter 14MP infrared trail cameras and four Wildgame Innovations 14MP infrared trail cameras. Each camera was mounted to a wooden stake and baited with cat foot. Cameras were set up to high resolution and moderate sensitivity, with a series of three photos taken for each trigger event. The camera delay was set to 1 minute between successive trigger events. The date and time of each photograph was digitally stamped on the photograph.

7.3 Survey Results

Spotlighting Surveys. Spotlighting surveys were conducted on four consecutive nights in September 2018, totaling 10 survey hours within the study area (2.5 hours each). Surveys resulted in the identification of 94 animals in the study area comprising 10 identified species, and one unidentified canid that was observed at a great distance (**Table 7-2**). San Joaquin kit were not observed during the spotlighting survey. An American badger was detected during spotlighting surveys near the intersection of Basalt Road and Gonzaga Road. Details for this occurrence are provided in the CNDDB reporting form in **Appendix A**.

No other special-status wildlife species were observed during spotlighting surveys.

Tule elk (*Cervus canadensis nannodes*) were the most abundant mammal observed during surveys, followed by black-tailed jack rabbit (*Lepus californicus*) and Audubon's cottontail (*Sylvilagus audubonii*). Adult and juvenile coyote (*Canis latrans*) were noted during surveys south and west of SR 152; though this species was not identified in Medeiros Use Area grasslands.

One small canid was observed in the western portion of the Medeiros Use Area grasslands, but was observed from a distance (greater than 0.25-miles) and could not be confirmed to species. Due to the animal's distance from the observation point, only the eye shine and faint outline were observed. But its small size and gait were suggestive of a fox species and not a coyote.

Camera Stations. A total of 32 camera station nights were deployed during the survey effort comprised of eight cameras over the course of 4 nights. All eight cameras were set up on September 10, 2018 and operated for three days. Following the identification of an unidentified canid species during spotlighting surveys in the Medeiros Use Area, four cameras were subsequently moved to areas where small mammal activity was noted.

Cameras were set up on September 10 and taken down on September 14, 2018. During this period, camera stations detected common raven, raccoon, black-tailed jackrabbit, California ground squirrel, domestic cat, striped skunk, black-tailed deer, and small birds, as shown in **Table 7-3** and **Figures 7-3, 7-4, 7-5, and 7-6**. Neither San Joaquin kit fox nor American badger were observed during camera surveys.

TABLE 7-2

WILDLIFE OBSERVATIONS DURING SPOTLIGHTING SURVEYS

Species Name	Sept. 10	Sept. 11	Sept. 12	Sept. 13	Total # Observations
American badger *Taxidea taxus*	0	0	0	1	1
Tule elk *Cervus canadensis nannodes*	10+	10+	10+	10+	40+
Black-tailed jack rabbit *Lepus californicus*	10+	10+	1	10+	30+
Barn owl *Tyto alba*	1	1	1	1	4
Great horned owl *Bubo virginianus*	2	0	0	0	2
Coyote *Canis latrans*	4	1	0	1	6
Audubon's cottontail *Sylvilagus audubonii*	10+	0	1	1	12+
Black-tailed deer *Odocoileus hemionus*	0	2	0	4	6
Raccoon *Procyon lotor*	1	0	0	0	1
Domestic cat *Felis catus*	0	0	1	0	1
Unknown canid[a]	0	0	1	0	1

[a] The unidentified canid was observed in western portion of the Medeiros Use Area on September 12, 2018. Two trail cameras were subsequently deployed to this area, but species identification could not be confirmed.

Source: ESA

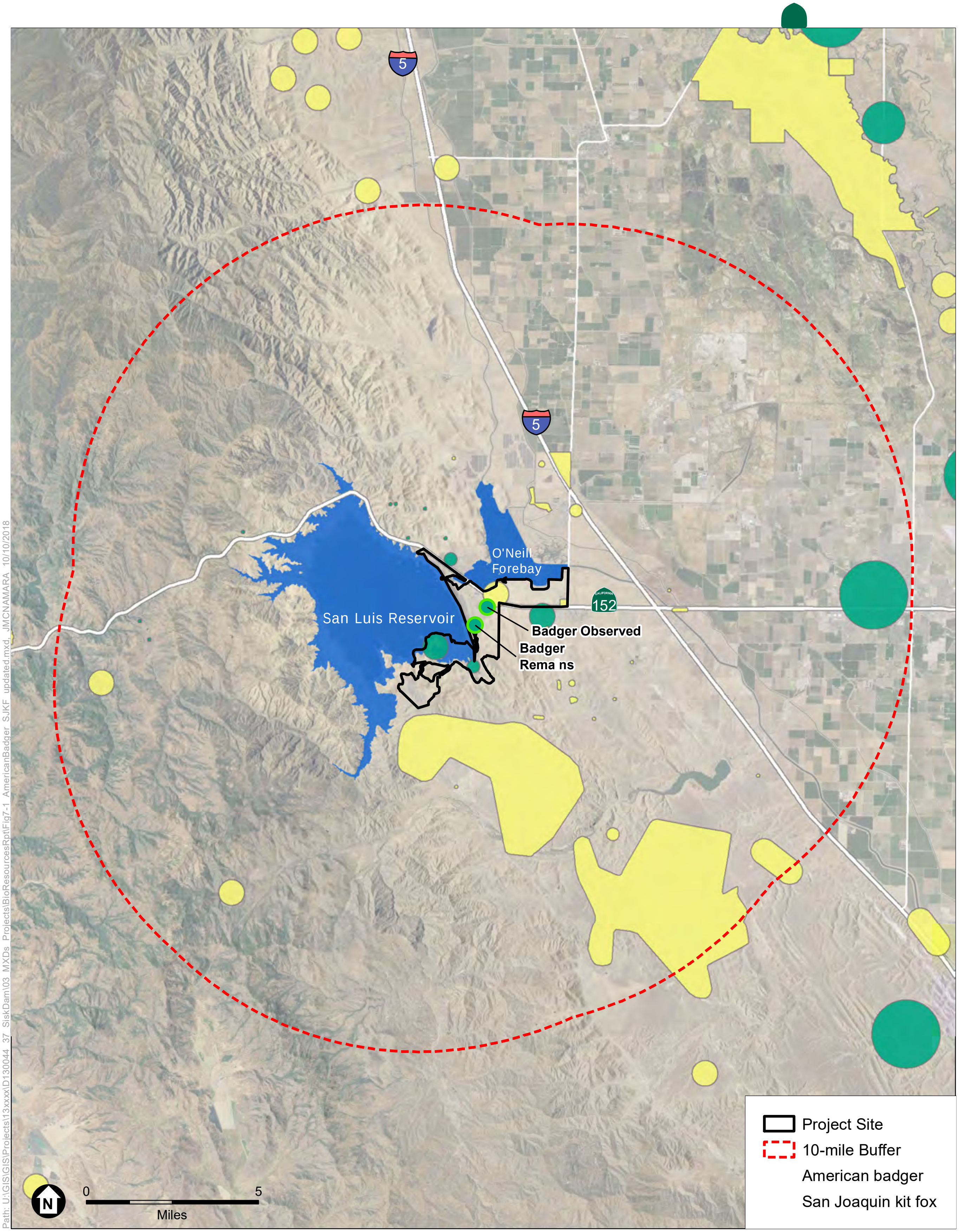
TABLE 7-3

SUMMARY OF WILDLIFE OBSERVATIONS DURING SPOTLIGHTING SURVEYS

Camera Station	Survey Dates	Number of Survey Days	Results
1	Sept. 10-14	4	Common raven, raccoon
2	Sept. 10-13	3	Black-tailed jackrabbit, red-tailed hawk, common raven, California ground squirrel, western meadowlark, small rodents
3	Sept. 10-14	4	Raccoon, striped skunk, domestic cat, coyote
4	Sept. 10-14	3	Black-tailed deer, meadowlark, violet-green swallow, loggerhead shrike
5	Sept. 10-13	3	No observations
6	Sept. 10-13	3	No observations
7	Sept. 10-14	4	No observations
8	Sept. 10-14	4	No observations
9	Sept. 13-14	1	No observations
10	Sept. 13-14	1	No observations
11	Sept. 13-14	1	No observations
12	Sept. 13-14	1	No observations

[a] The unidentified canid was observed in western portion of the O’Neill Forebay grasslands

Source: ESA



SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 7-1
Occurrences of American Badger and San Joaquin Kit Fox within 10 miles of the B.F. Sisk Dam Project Study Area

ESA

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SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 7-2
Location of Camera Stations and Spotlighting Survey Routes

ESA

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 7-3

One Station Examined Wildlife Movement across the B.F. Sisk Dam (top); as Noted in the NSR (2010c) Report, Potential Kit Fox Dens occur Throughout the Study Area.
Photo date: September 10, 2018

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 7-4

Camera Station Photos Showing a Black-tailed Jackrabbit at Station 2 and Coyote at Station 3. Photo dates: September 11 and 14, 2018

Source: ESA

Figure 7-5

Camera Station Photos Showing a Striped Skunk and Domestic Cat at Station 3

Photo dates: September 12 and 13, 2018

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 7-6

Camera Station Photos Showing a Raccoon at Station 3 and Black-tailed Deer at Station 4. Photo dates: September 12, 2018

CHAPTER 8
Special-Status Bats

8.1 Summary of Findings

This chapter details the findings of a special-status bat habitat assessment that was performed in the study area from September 10 to 14, 2018, and nighttime emergence surveys and acoustic monitoring that were performed at a concrete tunnel structure located near the Basalt Quarry on September 11, 2018. The assessment found potential tree roosting habitat for the western red bat (*Lasiurus blossevillii*) in day use areas and other locations in the study area. Yuma myotis (*Myotis yumanensis*) and Mexican free-tailed bat (*Tadarida brasiliensis*) roosting was verified in a cavernous concrete structure near the Basalt Quarry, though the structure itself will not be subject to direct project impacts. Potential bat roosting was identified in a second, similar concrete structure within the study area near the quarry.

8.2 Survey Methods

Daytime roost assessment surveys were performed on September 10-13, 2018 by E. Holmboe, with assistance from B. Pittman, K. Bayne, and J. McNamara. Structures within the study area were examined, including all crevices, cavities, and entrances, and other potential roost features to identify evidence of past or present bat activity, including staining, characteristic odor, fecal pellets, and live bats. In addition, eucalyptus, cottonwood, Chinese pistache, and other trees were examined within the Basalt Day Use Area and Basalt Campground, and in the Medeiros Use Area to identify suitable bat roost habitat in the form of cavities, crevices and exfoliating bark.

Bat emergence surveys and nighttime acoustic monitoring were performed on September 12, 2018, at a single man-made cave located north of Basalt Quarry (**Figures 8-1 and 8-2**). E. Holmboe was lead biologist for the nighttime bat emergence survey, with assistance from B. Pittman and J. McNamara. This site was selected for emergence surveys because bat sign was noted and bats were observed in crevices during daytime surveys using a 230-lumen Nite Lite Wizard II LED headlamp and 10x42 binoculars.

Bat emergence survey was performed between 1930 hours and 2030 hours on September 12, 2018. Surveys were performed under optimal visibility and weather conditions, under dry, calm and relatively warm conditions. Wind speed was generally under 2 to 3 mph with an air temperature of 85 degrees Fahrenheit.

Acoustic surveys were concurrently performed using a Wildlife Acoustics EM3+ bat detector. Acoustic data was post-processed using Sonobat version 3.2.1 to identify calls to species.

8.3 Survey Results

The Wildlife Acoustics EM3+ bat detector survey was performed at a single man-made cave for a single night survey. The meter identified a total of 951 bat call files and identified three species with 99% to 100% likelihood of presence.

The assessment found potential tree roosting habitat for the western red bat (*Lasiurus blossevillii*) in day use areas and other locations in the study area, as shown in Figure 8-1. Yuma myotis (*Myotis yumanensis*) and Mexican free-tailed bat (*Tadarida brasiliensis*) roosting was verified in a cavernous concrete structure near the Basalt Quarry, though the structure itself will not be subject to direct project impacts. Potential roosting by Yuma myotis and Mexican free-tailed bat are suspected at a second, similar concrete structure within the study area near the quarry. This location of all features discussed in this chapter is shown in Figure 8-1.

SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 8-1
Location of Special-status Bat Habitat in the Study Area

ESA

Source: ESA

Figure 8-2

Two Cavernous Features in the Basalt Quarry Area Support Bat Roosts. Monitoring at the Tunnel (top) Confirmed Yuma Myotis and Mexican Free-tailed Bat Roosting.

Photo date: September 12, 2018

B.F. Sisk Safety of Dams Modification Project. 130314.04

Source: ESA

Figure 8-3

Individual Trees and Tree Stands at the Medeiros Use Area, Basalt Day Use Area, Basalt Campground, and Below B.F. Sisk Dam Provide Bat Roosting Habitat

Photo date: September 12, 2018

CHAPTER 9

Vegetation Communities and Special-Status Plants

9.1 Natural Communities

This chapter provides the environmental baseline for natural communities and special-status plant species in the study area. During the survey, natural communities and habitat types were identified within the study area, including sensitive plant communities. These communities and habitat types include lacustrine, freshwater emergent wetland, seasonal wetland, blue elderberry stands, coyote brush scrub, purple needlegrass grasslands, annual grasslands, ornamental, valley foothill riparian, and developed/disturbed habitat.

The natural community classification presented herein is based on direct field observations, prior habitat mapping for the San Luis Low Point Improvement Project and the B.F. Sisk Safety of Dams Modification Project, and the state's standard for alliance-level vegetation classification, A Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens, 2009). The distribution of vegetation communities in the Study Area is presented in **Figure 9-1** and the extent of each natural community or habitat type (for non-vegetated areas) is presented in **Table 9-1**.

TABLE 9-1

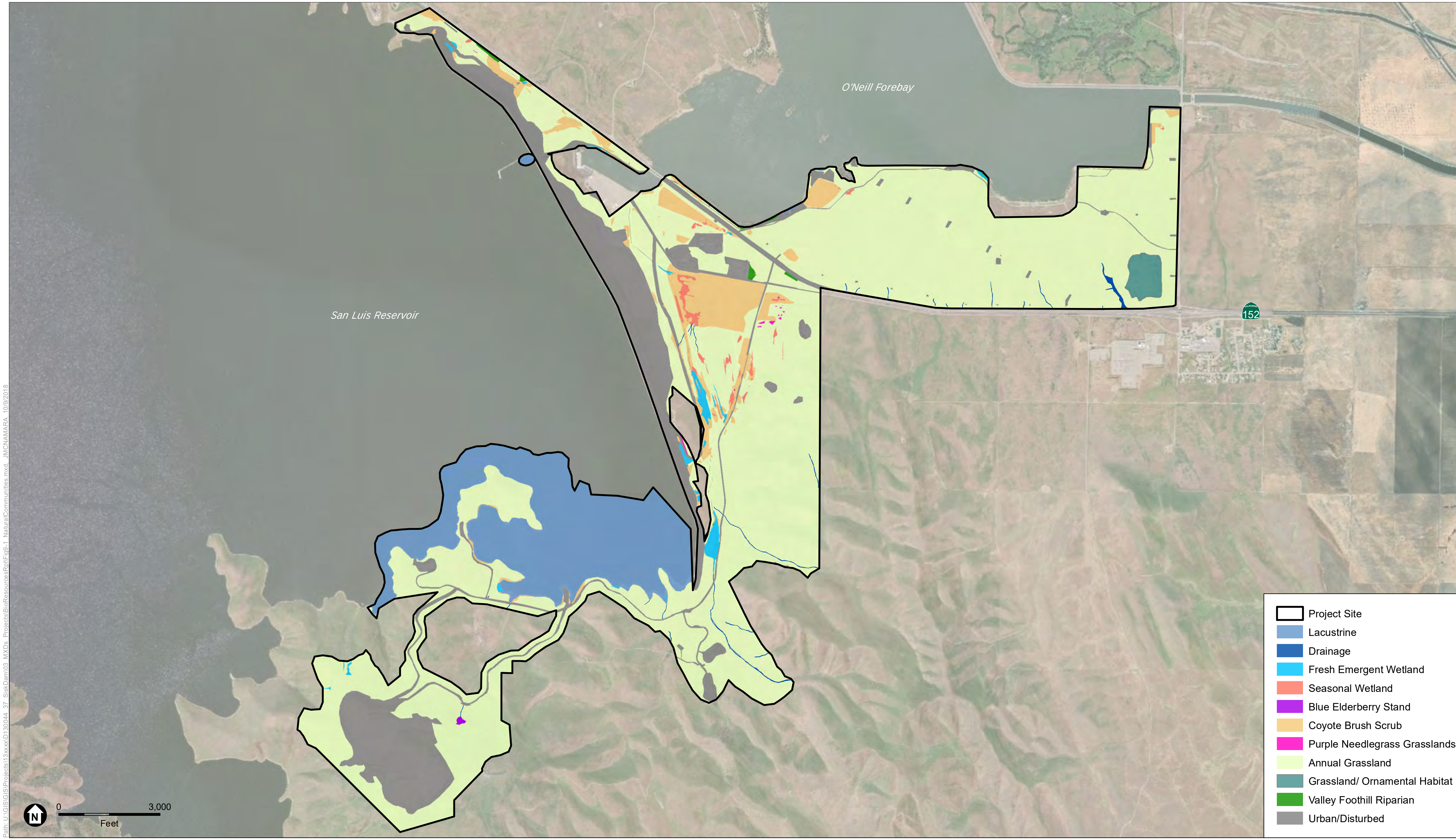
NATURAL COMMUNITY ACREAGE IN THE STUDY AREA

NATURAL COMMUNITY		AREA (ACRES)
Lacustrine		523.0
Drainage		4.6
Freshwater Emergent Wetland		24.1
Seasonal Wetland		16.8
Blue Elderberry		0.89
Coyote Brush Scrub		189.3
Purple Needlegrass Grassland		1.54
Annual Grassland		2552.9
Grassland/Ornamental Tree		28.3
Valley Foothill Riparian		3.2
Urban/Disturbed		605.4
	Total Area	**3,952.3**

SOURCE: ESA

9.2 Special-status Plants

Due to the late timing of ecological surveys performed in September 2018, focused in-season surveys for special-status plants could not be performed. A key objective of the survey was the identification of areas may support special-status plants. As shown in **Figure 9-2**, much of the study area was not disturbed during the 1963 to 1968 construction of B.F. Sisk Dam. Surveyors observed small pockets of unique habitats in scattered locations throughout the study area where native grasses and forbs persist, and where special-status plants may be encountered. Plant species identified during surveys are presented in **Appendix B**. Such habitats include purple needlegrass grasslands, annual grasslands, seasonal wetlands, some of which are slightly alkaline. Based on the September 2018 field review, areas that should be evaluated during appropriately-timed botanical surveys are shown in **Figure 9-3**. Focused botanical surveys should include purple needlegrass grasslands, annual grasslands, and seasonal wetlands.

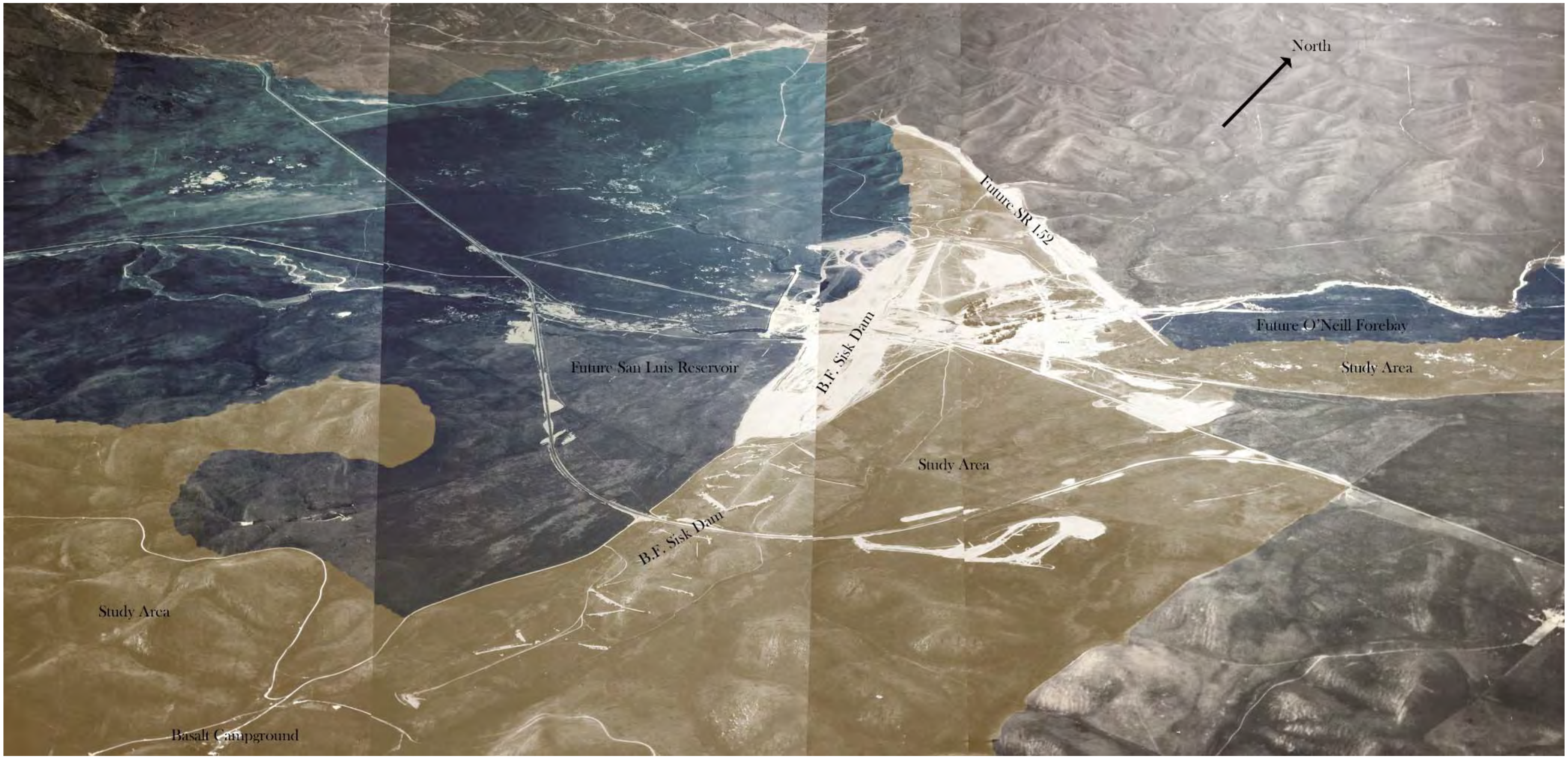


SOURCE: USDA, 2016; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 9-1
Distribution of Natural Communities
In the Study Area

ESA



Source: ESA

Figure 9-2

Aerial Photo Composite of B.F. Sisk Dam Under Construction, ca. 1965.
Presently Inundated Areas Are Approximately Shown in Blue. Undisturbed Portions of the Study Area, Shaded in Sepia, Informed the Assessment of Potential Rare Plant Distribution Shown in Figure 9-3

SOURCE: USDA, 2016; CDFW, 2018; CDM, 2018; ESA, 2018

B.F. Sisk Dam Safety of Dams Modification Project

Figure 9-3
Location of Potential Special-status
Plant Habitat in the Study Area

ESA

CHAPTER 10
Other Considered Wildlife Species

10.1 Introduction

During field surveys, specific attention was given to the identification of habitat for western pond turtle (*Actinemys marmorata*), San Joaquin coachwhip (*Masticophis flagellum ruddocki*), tricolored blackbird (*Agelaius tricolor*). These species were not detected during surveys; however, potential habitat for each was identified within the study area, as described below.

10.2 Western Pond Turtle

Western pond turtles are moderate-sized aquatic turtles that feed on plants, insects, worms, amphibians, crustaceans, and carrion. Mating usually occurs in late April or early May, but may occur year-round. Hatchling turtles are thought to emerge from the nest and move to aquatic sites in the spring (Jennings and Hayes, 1994; Stebbins, 2003; Zeiner et al., 1988).

Western pond turtles are commonly found in ponds, lakes, marshes, rivers, streams, and irrigation ditches with rocky or muddy substrates surrounded by aquatic vegetation. These watercourses usually are within woodlands, grasslands, and open forests, between sea level and 6,000 feet in elevation. Turtles bask on logs or other objects when water temperatures are lower than air temperatures. Nests are located at upland sites, often up to 0.25-mile from an aquatic site (Jennings and Hayes, 1994; Stebbins, 2003; Zeiner et al., 1988).

Pond turtles are not reported within San Luis Reservoir and are not expected to regularly occur in this waterbody. Pond turtles are reported within at Los Banos Reservoir, 5.8 miles south of the study area, and in stock ponds located west of San Luis Reservoir, about 5 miles west of the study area (CDFW, 2018). Within the study area, no aquatic features or drainages are known to support western pond turtle. The perennial seep-fed pond at Willow Spring provides moderate quality habitat for this species. Pond turtles were not observed at this location during two surveys of this area, and basking habitat is limited in this pond due to extensive cattail growth. This species has a low to moderate potential to occur at the Willow Spring pond.

10.3. San Joaquin Coachwhip

San Joaquin coachwhips are energetic diurnal foragers. They become active later in the spring than other snakes, and are mostly active during warm periods of the day. They forage primarily on lizards, bird eggs and young, and small mammals, occasionally foraging on carrion. Mating is thought to occur in May, and oviposition in June or early July. Life history information on this subspecies is poorly known and much information has been taken from similar subspecies (Jennings and Hayes, 1994).

The San Joaquin coachwhip uses open, dry areas with little or no tree cover. In the western San Joaquin Valley, they occur in valley grassland and saltbush scrub associations and are known to climb shrubs and bushes to view prey and potential predators. They use small mammal burrows for refuge and probably for egg-laying sites as well (Jennings and Hayes, 1994).

San Joaquin coachwhips range from the eastern edge of the San Joaquin Valley from Colusa County southward to Kern County and into the inner South Coast Ranges, with an isolated population in the Sutter Buttes. Western Merced County is within the documented range of the San Joaquin coachwhip, with eleven reported sightings in the western portion of the county. Seven records were reported in 1985 and 1988 near Los Banos Reservoir and Los Banos Creek, about 4 to 7 miles south of the study area. The study area and surrounding grasslands provides suitable open grassland habitat for San Joaquin coachwhips and this species can be expected at low densities in grassland habitat throughout the study area.

10.4 Tricolored Blackbird

The tricolored blackbird is a state-listed threatened species. This species is common throughout the Central Valley and coastal areas south of Sonoma County. They may occur during the breeding and nonbreeding season, sometimes within groups of red-winged blackbird (*Agelaius phoeniceus*).

Tricolored blackbirds are a colonial nesting species that construct their nests in dense vegetation in and near freshwater wetlands. When nesting, tricolored blackbirds generally require freshwater wetland areas large enough to support colonies of 50 pairs or more. They prefer freshwater emergent wetlands with tall, dense cattails or tules for nesting, but also breed in thickets of willow, blackberry, wild rose, or tall herbs. During the nonbreeding season, flocks are highly mobile and forage in grasslands, croplands, and wetlands (Zeiner et al., 1990a).

Tricolored blackbirds are often a sporadic resident species that may breed in different locations in successive years. The CNDDB describes four tricolored blackbird occurrences within the study area, with 25 nesting pairs documented in 2005 near Domengine Spring; 150 non-nesting adults reported in 1998 near the reservoir edge north of Basalt Quarry; more than 500 birds observed in 2006 and 2007 on the south shore of O'Neill Forebay; and consistent nesting reported in cattail marsh areas below B.F. Sisk Dam, consisting of 100 to 5,000 adults per year from 1998 to 2012.

Though not observed during surveys, seasonal wetlands and other aquatic habitat in the study area provide suitable nesting habitat for this species during both the breeding and nonbreeding season.

CHAPTER 11
References and Report Preparation

11.1 References

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5.2 Document Preparation

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APPENDIX A
CNDDB Reporting Forms

California Native Species Field Survey Form

Mail to:
Natural Diversity Database
California Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95814

For Office Use Only	
Source Code_______________	Quad Code_____________
Elm Code_______________	Occ. No.____________
EO Index No.____________	Map Index No.________

Date of Field Work: ***09-13-2018***
month (mm) - date (dd) - year (yyyy)

Scientific Name: Rana draytonii

Common Name: California red-legged frog

Species Found? ☒ **Yes** ☐ **No** ______________ If not, why?

Total No. of Individuals:)

Subsequent visit? ☐ **Yes** ☒ **No**

Existing NDDB occurrence:______________ ☒ **No** ☐ **Unk.**
If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman
Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954
Email address: bpittman@esassoc.com
Phone: 707-795-0915

Plant Information

Phenology: ________ % vegetative ________ % flowering ________ % fruiting

Animal Information

Age Structure: 1 # adults 8 # juveniles ____ # unknown

☒ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map)	
County: Merced	*Landowner / manager*: State Parks
Quad Name: San Luis Dam, CA	*Elevation*: 959 ft
T 2 S R 3 E NE ¼ of NW ¼ of Section	T R ¼ of ¼ of Section
UTM: Zone 10	*Point Accuracy*: 3 Meters
Source: Garmin ETrex/Google Earth	*Datum*: NAD 83
Site Coordinates: UTM: 4099656N, 668984E	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Habitat includes a perennial, spring-fed cattle stock pond measuring 90' by 140' within the San Luis State Recreation Area. The water source for the impoundment is formally named "Willow Spring" on the USGS San Luis Dam 7.5-minute quadrangle. The center of the pond has dense cattails surrounded by a broad, 8' to 10' wide ring of aquatic habitat. Duckweed seasonally provides cover within ponded areas. Pond water levels were at full capacity and spilling when observed in September 2018, with water depth of approximately 1.5' in numerous locations.
Other rare species?

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor
Current / surrounding land use: Grazing land. Upslope rock quarry site to the south.
Visible Disturbances / possible threats: Construction activities from the proposed B.F. Sisk Dam Safety Project may pose a short-term hazard to moving adults and juveniles; though the spring and pond will likely be unaffected.
Comments: One adult California red-legged frog and eight subadults were identified in the pond on September 13, 2018. No other amphibians were observed during the survey.

Determination: (check one or more, and fill in blanks)
- ☐ **Keyed (cite reference):**
- ☐ **Compared with specimen housed at:**
- ☐ **Compared with photo / drawing in:**
- ☐ **By another person:**
- ☐ **Other: Verified by B. Pittman and Kelly Bayne**

Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☒
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments: Survey Report Figures 5-1, 5-2, and 5-3

California Native Species Field Survey Form

Mail to:
Natural Diversity Database
California Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95814

For Office Use Only
Source Code_______________ Quad Code_____________
Elm Code_______________ Occ. No.____________
EO Index No.____________ Map Index No.________

Date of Field Work: ***09-12-2018***
month (mm) - date (dd) - year (yyyy)

Scientific Name: Taxidea taxus

Common Name: American badger

Species Found? ☒ **Yes** ☐ **No** ____________ If not, why?

Total No. of Individuals:)

Subsequent visit? ☐ **Yes** ☒ **No**

Existing NDDB occurrence:______________ ☒ **No** ☐ **Unk.**
If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman
Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954
Email address: bpittman@esassoc.com
Phone: 707-795-0915

Plant Information

Phenology: ____________ ____________ ____________
% vegetative % flowering % fruiting

Animal Information

Age Structure: 1 ____________ ____________
\# adults # juveniles # unknown

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map)

County: Merced	*Landowner / manager*: State Parks
Quad Name: San Luis Dam, CA	*Elevation*: 297 ft
T 2 S R 3 E NE ¼ of NW ¼ of Section	T R ¼ of ¼ of Section
UTM: Zone 10	*Point Accuracy*: 50 Meters
Source: Garmin ETrex/Google Earth	*Datum*: NAD 83
Site Coordinates: UTM: 4102943N, 673181E	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Annual grassland comprises the majority of terrestrial habitat below B.F. Sisk Dam. Grasslands below the dam are well grazed by tule elk and consist of short non-native annual grasses interspersed with coyote brush and forbs. Extensive small mammal activity is evident within the grassland, with California ground squirrel as a major species. Dominant vegetation species are wild oat (*Avena fatua*) and soft chess (*Bromus hordeaceus*).
Other rare species?

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor
Current / surrounding land use: State Parks SRA grazed by tule elk. The badger was observed 0.8 miles east of B.F. Sisk Dam.
Visible Disturbances / possible threats: Construction activities from the proposed B.F. Sisk Dam Safety Project may pose a short-term hazard to moving badgers.
Comments: One adult badger was observed while spotlighting from Basalt Road, 50 feet east of the road and approximately 200 feet south of the intersection with Gonzaga Road. No photographs were taken of the individual.

Determination: (check one or more, and fill in blanks)
☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☐ **Other: Verified by B. Pittman, Kelly Bayne, and Even Holmboe**

Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☐
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments: Survey Report Figure 7-1

APPENDIX B

Plant and Wildlife Species Observed During Surveys

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TABLE B-1

WILDLIFE SPECIES OBSERVED IN THE STUDY AREA, SEPTEMBER 10-14, 2018

COMMON NAME	SCIENTIFIC NAME
AMPHIBIANS	
California toad	*Anaxyrus boreas* ssp. *halophilus*
Sierran treefrog	*Pseudacris sierra*
California red-legged frog	*Rana draytonii*
REPTILES	
gopher snake	*Pituophis catenifer*
western fence lizard	*Sceloporus occidentalis*
BIRDS	
red-shouldered hawk	*Accipiter striatus*
spotted sandpiper	*Actitis macularius*
western grebe	*Aechmophorus occidentalis*
red-winged blackbird	*Agelaius phoeniceus*
mallard	*Anas platyrhynchos*
western scrub-jay	*Aphelocoma californica*
great blue heron	*Ardea herodias*
great horned owl	*Bubo virginianus*
cattle egret	*Bubulcus ibis*

TABLE B-1 (CONTINUED)

WILDLIFE SPECIES OBSERVED IN THE STUDY AREA; SEPTEMBER 10-14, 2018

COMMON NAME	SCIENTIFIC NAME
red-tailed hawk	*Buteo jamaicensis*
least sandpiper	*Calidris minutilla*
Anna’s hummingbird	*Calypte anna*
turkey vulture	*Cathartes aura*
killdeer	*Charadrius vociferus*
northern harrier	*Circus hudsonius*
American crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
snowy egret	*Egretta thula*
Horned lark	*Eremophila alpestris*
Brewer's blackbird	*Euphagus cyanocephalus*
prairie falcon	*Falco mexicanus*
American kestrel	*Falco sparverius*
American coot	*Fulica americana*
greater roadrunner	*Geococcyx californianus*
bald eagle	*Haliaeetus leucocephalus*
loggerhead shrike	*Lanius ludovicianus*
western gull	*Larus occidentalis*
gull sp.	*Larus sp.*

TABLE B-1 (CONTINUED)

WILDLIFE SPECIES OBSERVED IN THE STUDY AREA; SEPTEMBER 10-14, 2018

COMMON NAME	SCIENTIFIC NAME
belted kingfisher	*Megaceryle alcyon*
common merganser	*Mergus merganser*
northern mockingbird	*Mimus polyglottos*
brown-headed cowbird	*Molothrus ater*
ruddy duck	*Oxyura jamaicensis*
osprey	*Pandion haliaetus*
English sparrow	*Passer domesticus*
American white pelican	*Pelecanus erythrorhynchos*
double-crested cormorant	*Phalacrocorax auritus*
yellow-billed magpie	*Pica nuttalli*
pied-billed grebe	*Podilymbus podiceps*
black phoebe	*Sayornis nigricans*
yellow warbler	*Setophaga petechia*
Forster's tern	*Sterna forsteri*
Eurasian collared dove	*Streptopelia decaocto*
western meadowlark	*Sturnella neglecta*
tree swallow	*Tachycineta bicolor*
violet green swallow	*Tachycineta thalassina*
greater yellowlegs	*Tringa melanoleuca*

TABLE B-1 (CONTINUED)

WILDLIFE SPECIES OBSERVED IN THE STUDY AREA; SEPTEMBER 10-14, 2018

COMMON NAME	SCIENTIFIC NAME
barn owl	*Tyto alba*
mourning dove	*Zenaida macroura*
MAMMALS	
Coyote	*Canus latrans*
Tule elk	*Cervus canadensis nannodes*
black-tailed jackrabbit	*Lepus californicus*
western red bat	*Lasirurs blossevillii*
Yuma myotis bat	*Myotis yumanensis*
California ground squirrel	*Otospermophilus beecheyi*
black-tailed deer	*Odocoileus hemionus*
Audubon’s cottontail	*Sylvilagus audubonii*
Mexican free-tailed bat	*Tadarida brasiliensis*
American badger	*Taxidea taxus*
Botta’s pocket gopher	*Thomomys bottae*

TABLE B-2

PLANT SPECIES OBSERVED IN THE STUDY AREA, SEPTEMBER 10-14, 2018

PLANT FAMILY	COMMON NAME	*SCIENTIFIC NAME*
Adoxaceae	blue elderberry	*Sambucus nigra* ssp. *caerulea*
Amaranthaceae	prickly Russian thistle	*Salsola tragus*
Apiaceae	fennel	*Foeniculum vulgare*
Apocynaceae	narrowleaf milkweed	*Asclepias fascicularis*
Asteraceae	coyote brush	*Baccharis pilularis*
	mule fat	*Baccharis salicifolia*
	glandular big tarweed	*Blepharizonia laxa*
	Italian thistle	*Carduus pycnocephalus*
	yellow star-thistle	*Centaurea solstitialis*
	Fitch's spikeweed	*Centromadia fitchii*
	stinkwort	*Ditrichia gravendens*
	western goldenrod	*Euthamia occidentalis*
	gumplant	*Grindelia* sp.
	bristly oxtongue	*Helminthotheca ichioides*
	telegraphweed	*Heterotheca grandiflora*
	yellow tarweed	*Holocarpha virgata*
	prickly lettuce	*Lactuca serriola*
	Mediterranean milk thistle	*Silybum marianum*
	wirelettuce	*Stephanomeria* sp.

TABLE B-2 (CONTINUED)

PLANT SPECIES OBSERVED IN THE STUDY AREA, SEPTEMBER 10-14, 2018

PLANT FAMILY	COMMON NAME	*SCIENTIFIC NAME*
Asteraceae	rough cocklebur	*Xanthium strumarium*
Boraginaceae	salt heliotrope	*heliotropium curassavicum*
Brassicaceae	field mustard	*Brassica rapa*
	mustard	*Hirschfeldia* sp.
	Perennial pepperweed	*Lepidium latifolium*
	wild radish	*Raphanus sativus*
Calitrichaceae	twoheaded water-starwort	*Callitriche heterophylla*
Casuarinaceae	Australian pine	*Casuaria sp.*
Convolvulaceae	field bindweed	*Convolvulus arvensis*
Cyperaceae	purua grass	*Bolboschoenus maritimus*
	sedge	*Cyperus* sp.
Elaeagnaceae	buffaloberry	*Shepherdia argentea*
Euphorbiaceae	doveweed	*Croton setigerus*
Fabaceae	honey mesquite	*Prosopis glandulosa*
Fagaceae	coast live oak	*Quercus agrifolia*
	blue oak	*Quercus douglasii*
	valley oak	*Quercus lobata*
	interior live oak	*Quercus wislizeni*
Frankeniaceae	alkali heath	*Frankenia grandiflora*

TABLE B-2 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA, SEPTEMBER 10-14, 2018

PLANT FAMILY	COMMON NAME	*SCIENTIFIC NAME*
Geraniaceae	broadleaf filaree	*Erodium botrys*
	dove's-foot crane's bill	*Geranium molle*
Lamiaceae	black sage	*Salvia melifera*
	vinegarweed	*Trichostemma lanceolata*
Marsileaceae	American pillwort	*Pilularia americana*
Myrtaceae	blue gum eucalyptus	*Eucalyptus globulus*
	eucalyptus	*Eucalyptus* sp.
Phytolaccaceae	pokeweed	*Phytolacca decandra*
Pinaceae	stone pine	*Pinus pinea*
Plantaginaceae	buck's-horn plantain	*Plantago coronopus*
Poaceae	common wild oat	*Avena fatua*
	stiff brome	*Brachypodium distachyon*
	ripgut brome	*Bromus diandrus*
	soft brome	*Bromus hordeaceus*
	foxtail brome	*Bromus Madritensis*
	Bermuda grass	*Cynodon dactylon*
	salt grass	*Distichlis spicata*
	Italian ryegrass	*Festuca perennis*
	hare barley	*Hordeum murinum*

TABLE B-2 (CONTINUED)

PLANT SPECIES OBSERVED IN THE STUDY AREA, SEPTEMBER 10-14, 2018

PLANT FAMILY	**COMMON NAME**	***SCIENTIFIC NAME***
Poaceae	sprangletop	*Leptochloa* sp.
	purple needlegrass	*Nassalla pulchra*
	dallis grass	*Paspalum dilatatum*
	bulbous bluegrass	*Poa bulbosa*
	annual beard grass	*Polypogon monspeliensis*
Polygonaceae	curly dock	*Rumex crispus*
Roseaceae	*Holly-leaved cherry*	*Prunus ilicifolia*
Salicaceae	Fremont cottonwood	*Populus fremontii*
	narrowleaf willow	*Salix exigua*
Salicaceae	willow	*Salix* sp.
Scrophulariaceae	mullein	*Verbascum* sp.
Solanaceae	sacred datura	*Datura wrighti*
	tobacco tree	*Nicotiana glauca*
Typhaceae	narrowleaf cattail	*Typha angustifolia*
	Broadleaf cattail	*Typha latifolia*

Source: ESA

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix K2: B.F. Sisk Dam Raise and Reservoir Expansion Project Biological Survey Report 2020

DRAFT

B.F. SISK DAM RAISE PROJECT

Biological Survey Report
Merced County, California

Prepared for
CDM Smith Incorporated &
San Luis and Delta-Mendota Water Authority

May 2020

DRAFT

B.F. SISK DAM RAISE PROJECT

Biological Survey Report
Merced County, California

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May 2020

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D201901099

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Acronyms and Other Abbreviations

CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRPR	California Rare Plant Rank
DPS	Distinct Population Segment
ESA	Environmental Science Associates
FESA	federal Endangered Species Act
IC 1	unnamed intermittent channel 1
MBTA	Migratory Bird Treaty Act
NMFS	National Marine Fisheries Service
SR	State Route
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The United States Department of the Interior, Bureau of Reclamation, the California Department of Water Resources, and the San Luis & Delta-Mendota Water Authority are considering multiple alternatives to improve the reliability of the water supply from San Luis Reservoir. In support of the effort to evaluate a water crest raise of 10 feet, this report describes the biological resources that occur within 61.60 acres of construction areas at State Route 152 and Dinosaur Point, and at an approximately 382.89-acre strip along the edge of the reservoir in Merced County, California.

Vegetation communities and wildlife habitat in the Study Area include: annual grasslands, blue oak woodlands, California sycamore woodland, California sagebrush scrub, urban, intermittent channel, ephemeral channel, freshwater emergent, seep, and lacustrine. Ponds, which are not directly located in the Study Area, are also discussed because of their importance in providing aquatic breeding and non-breeding habitat for special-status species. Potential federal and state jurisdictional wetlands were identified within the Study Area.

A total of 20 special-status species were identified as having moderate to high potential to occur in the Study Area. These include the following wildlife species: San Joaquin coachwhip, California tiger salamander, tricolored blackbird, golden eagle, western burrowing owl, Swainson's hawk, ferruginous hawk, northern harrier, prairie falcon, bald eagle, American badger, and San Joaquin kit fox. In addition, western pond turtle and California red-legged frog were identified at various locations within the Study Area during March 2020 reconnaissance-level surveys. Special-status plants with potential to occur include Lemmon's jewelflower, Hospital Canyon larkspur, spiny-sepaled button-celery, arcuate bush-mallow, Hall's bush mallow, and chaparral ragwort.

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CHAPTER 1
Introduction

1.1 Background and Purpose

The United States Department of the Interior, Bureau of Reclamation, the California Department of Water Resources, and the San Luis & Delta-Mendota Water Authority are considering multiple alternatives to improve water supply reliability from San Luis Reservoir. Previous studies have evaluated alternatives addressing water quality issues, including reservoir expansion (San Luis Low Point Improvement Project), and multiple alternatives addressing dam safety risk (B.F. Sisk Dam Safety of Dams Modification Project).

In support of the effort to evaluate a water crest raise of 10 feet, this report describes the biological resources that would be affected by increased water levels and construction improvements that would accompany the water raise. This report presents the findings of reference vegetation, wildlife, and wetland surveys that identify the potential presence and distribution of common and special-status plant and wildlife species, sensitive natural communities, and federally and state-regulated waters and wetlands. The intent and scope of this document is to characterize biological resources in the new inundation area of San Luis Reservoir and characterize biological resources constraints that may affect the use of the site.

The biological Study Area, as described in this report, consists of areas on the edge of San Luis Reservoir that would be inundated by the 10-foot increase in water crest level, as well as construction improvements to facilities at the Dinosaur Point boat launch and State Route (SR) 152 at Cottonwood Bay. The water elevation would increase by 10 feet from the existing elevation, 544 feet, to 554 feet above mean sea level. The surveys included an additional study buffer of 100 feet in which the presence of biological resources was characterized for most wildlife. Ponds that could support special-status species were assessed up to 1 mile from the inundation footprint.

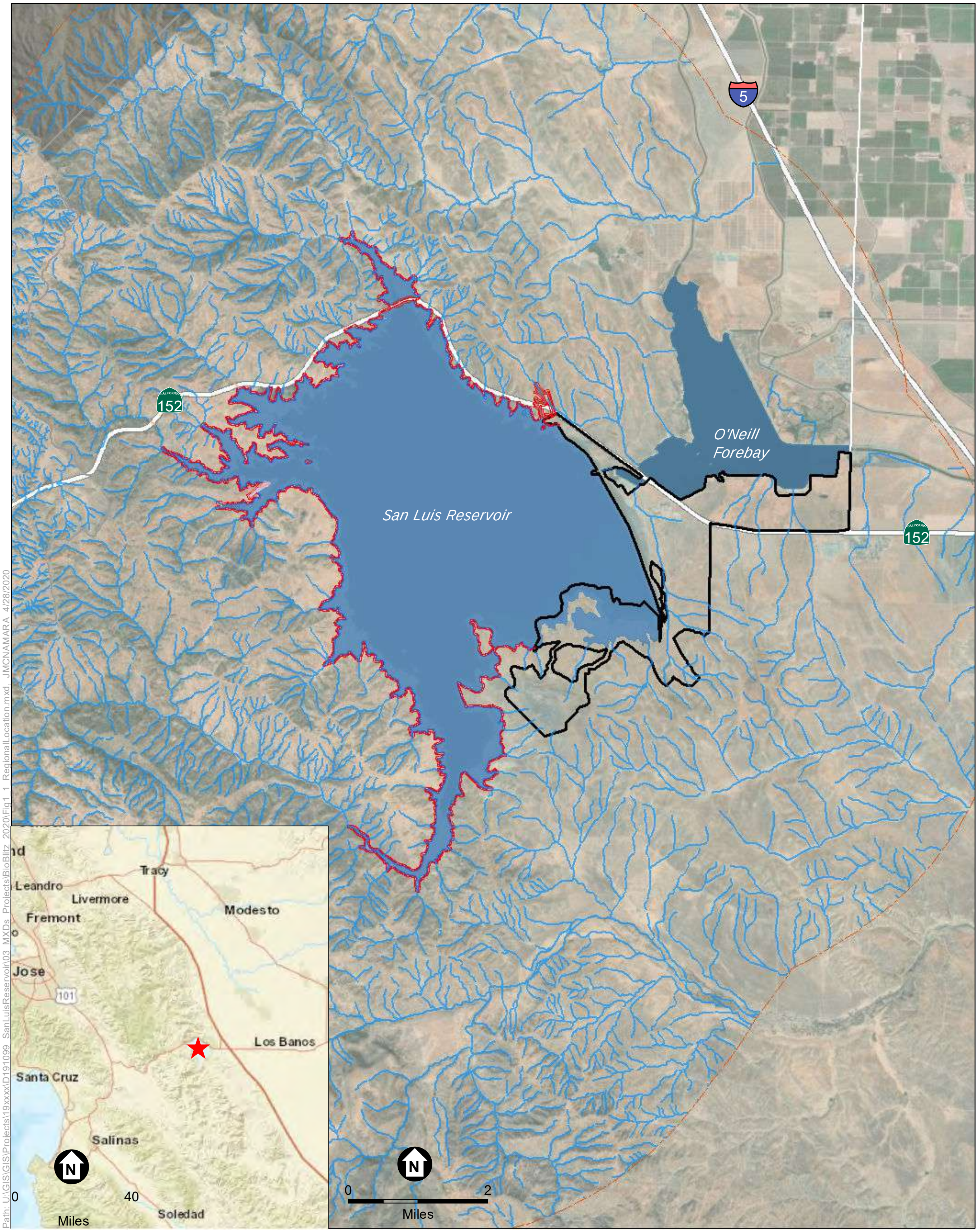
This report incorporates the findings of the representative biological surveys, which were reconnaissance in level and were conducted in March 2020.

1.2 Property Location

The Study Area is located in Merced County, in the Pacheco Pass United States Geological Survey (USGS) 7.5-minute quadrangle, and is positioned mostly south of SR 152 and west of Interstate 5, in the far northwestern portion of the county (**Figure 1-1**). Situated on the eastern slopes of the Diablo Range of the California Coast Ranges, the Study Area consists of steep hills and valleys, with some rocky cliffs to the west progressing to rolling slopes and grasslands on more flat terrain toward the east.

The Study Area includes the shoreline of San Luis Reservoir, excluding areas examined for the B.F. Sisk Dam Safety of Dams Modification Project, located between the 544-foot contour (current reservoir elevation at full capacity) and the 554-foot contour. The immediate area surrounding San Luis Reservoir includes federally owned lands that are leased to the California Department of Parks and Recreation for use as designated State Recreation Areas. Some private lands within the Study Area would also be subject to inundation. State parks, wildlife areas, and open cattle pastures occur beyond the immediate area surrounding San Luis Reservoir (**Figure 1-2**). SR 152 runs along and through the northern portion of the reservoir and between O'Neill Forebay and San Luis Reservoir.

The Dinosaur Point Use Area is located on the west side of San Luis Reservoir, at the end of Dinosaur Point Road, and contains a boat launch, parking, and picnic area (Figure 1-2). North of Dinosaur Point Road is the San Luis Wildlife Area, which is managed by California Department of Fish and Wildlife (CDFW) and is designated for hiking, bird-watching, and hunting. South of Dinosaur Point Road is Pacheco State Park.



SOURCE: ESA, 2020; National Hydrology Dataset, 2020;

Imagery-ESRI, 2020

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2020 Study Area		Water Flowline
Dinosaur Point Boat Launch	100 foot Buffer	Pipeline
Inundation Area	Safety of Dams Study Area	Stream/River
State Route 152 Modifications	5 mile Buffer	

Figure 1-1
Regional Location

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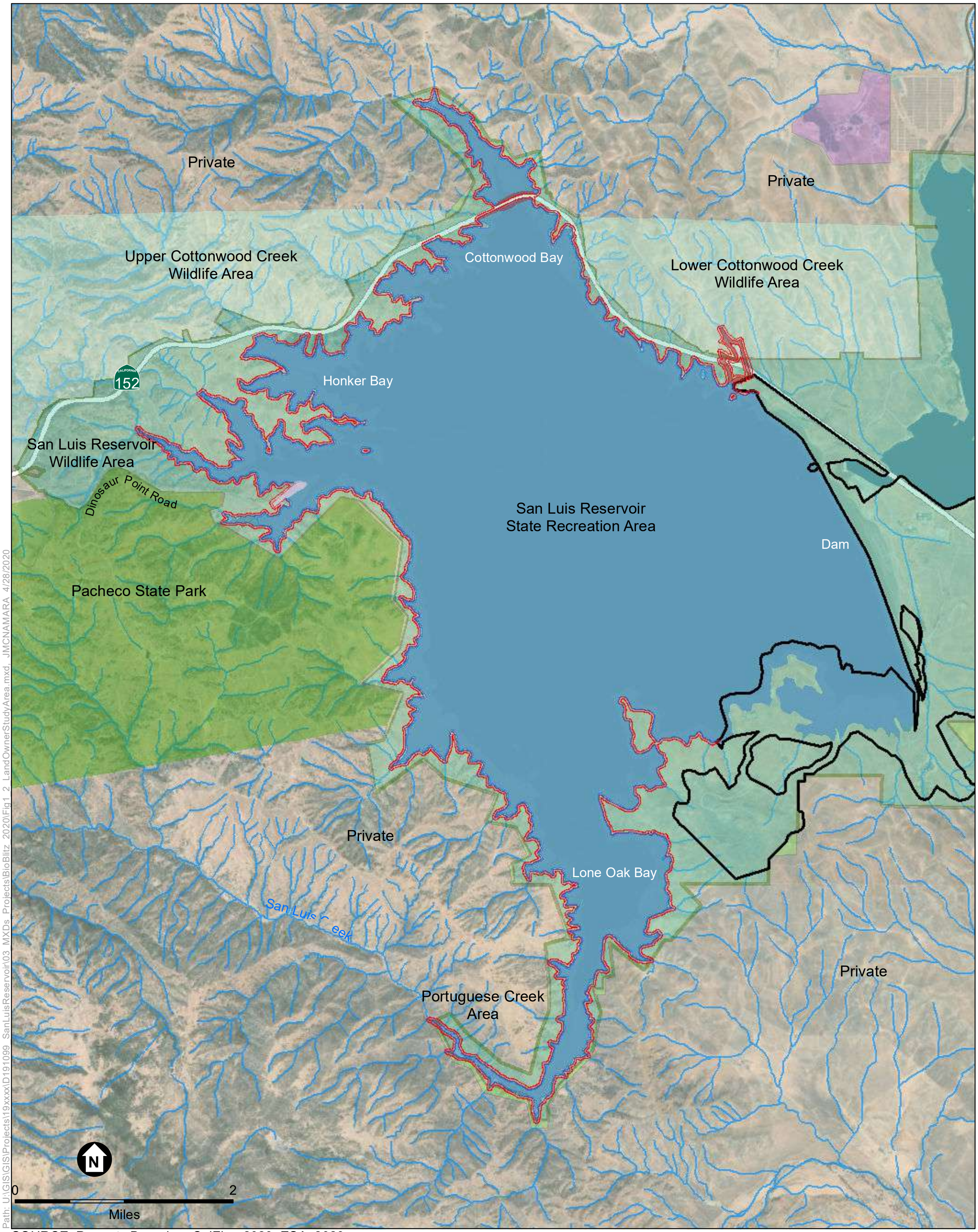

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SOURCE: Property Boundary-CalFire, 2020; ESA, 2020;

National Hydrology Dataset, 2020;

Imagery-ESRI, 2020

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2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

- Bureau of Reclamation
- California Department of Fish and Wildlife
- California Department of Parks and Recreation
- California Department of Water Resources
- Department of Defense

Water Flowline
- Pipeline
- Stream/River

Figure 1-2
Land Ownership Adjacent
to the Study Area

1.3 Regulatory Context

Biological resources in the Study Area may fall under the jurisdiction of various regulatory agencies and be subject to their regulations. In general, the greatest legal protections are provided for plant and wildlife species that are formally listed by the federal or state government. The following regulations and agencies are commonly associated with projects that have the potential to affect biological resources:

- Federal Endangered Species Act (FESA)
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Clean Water Act, Section 404
- California Endangered Species Act (CESA)
- California Fish and Game Code Sections 3500–3705, Migratory Bird Protection
- Native Plant Protection Act
- California Fish and Game Code Section 1600, Lake or Streambed Alterations
- Porter-Cologne Water Quality Control Act
- California Environmental Quality Act (CEQA) Guidelines Section 15380

These regulations are presented and discussed in **Attachment A**.

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CHAPTER 2
Methods

2.1 Study Area

The term *Study Area* in this report specifically refers to 382.89 acres along the edge of San Luis Reservoir that would be inundated by the increase in water crest elevation and 61.60 acres of lands at Dinosaur Point that includes the Dinosaur Point Boat Launch and Pacheco Pumping Plant berm. Three areas at SR 152 were also reviewed, including at Cottonwood Bay, the East Dike saddle, located approximately 1,300 feet north of the main dam embankment (near the Romero Visitor Center), and a small highway fill area approximately 2,100 feet southeast of Cottonwood Bay. These areas were used as the starting point to define the biological survey area; however, in practical terms, biological resources have varied sensitivity to disturbance, and a somewhat larger area was considered for many species.

The Study Area for special-status plants and vegetation communities focused on the immediate Study Area; however, areas of potential habitat for special-status wildlife were also considered up to 100 feet beyond the Study Area (**Figure 2-1**). Ponds that could potentially support special-status species were analyzed at a buffer of up to one mile.

2.2 Survey Methodology

2.2.1 Survey Dates and Personnel

Environmental Science Associates (ESA) wildlife biologists Brian Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang conducted representative reconnaissance-level surveys of the Study Area March 16–19, 2020. The surveys were conducted to observe and characterize vegetation communities in the Study Area and to assess habitat quality and the potential for common and special-status wildlife species and special-status plant species.

California red-legged frog specialists Kelly Bayne and Brian Pittman, CWB, were the lead surveyors for the frog habitat assessment. Dip net surveys for California red-legged frog were performed with advance approval from the United States Fish and Wildlife Service (USFWS) under Ms. Bayne's and Mr. Pittman's USFWS 10a(1)(A) recovery permits (#TE-185595 and TE-027422, respectively).

An aquatic resource delineation (ESA 2020) and reconnaissance-level special-status plant survey was conducted by ESA Botanists Chuck Hughes and Joseph Sanders on March 16–19, 2020. All surveys conducted in March 2020 are a representative sample of the Study Area and should not be considered complete coverage of the Study Area. Cottonwood Bay, in the north arm of San Luis Reservoir, is private property and ESA was not able to obtain access for surveys because inclement weather conditions resulted in poor road access. This area was surveyed remotely via Google Earth and aerial imagery.

2.2.2 Habitat and Vegetation Surveys

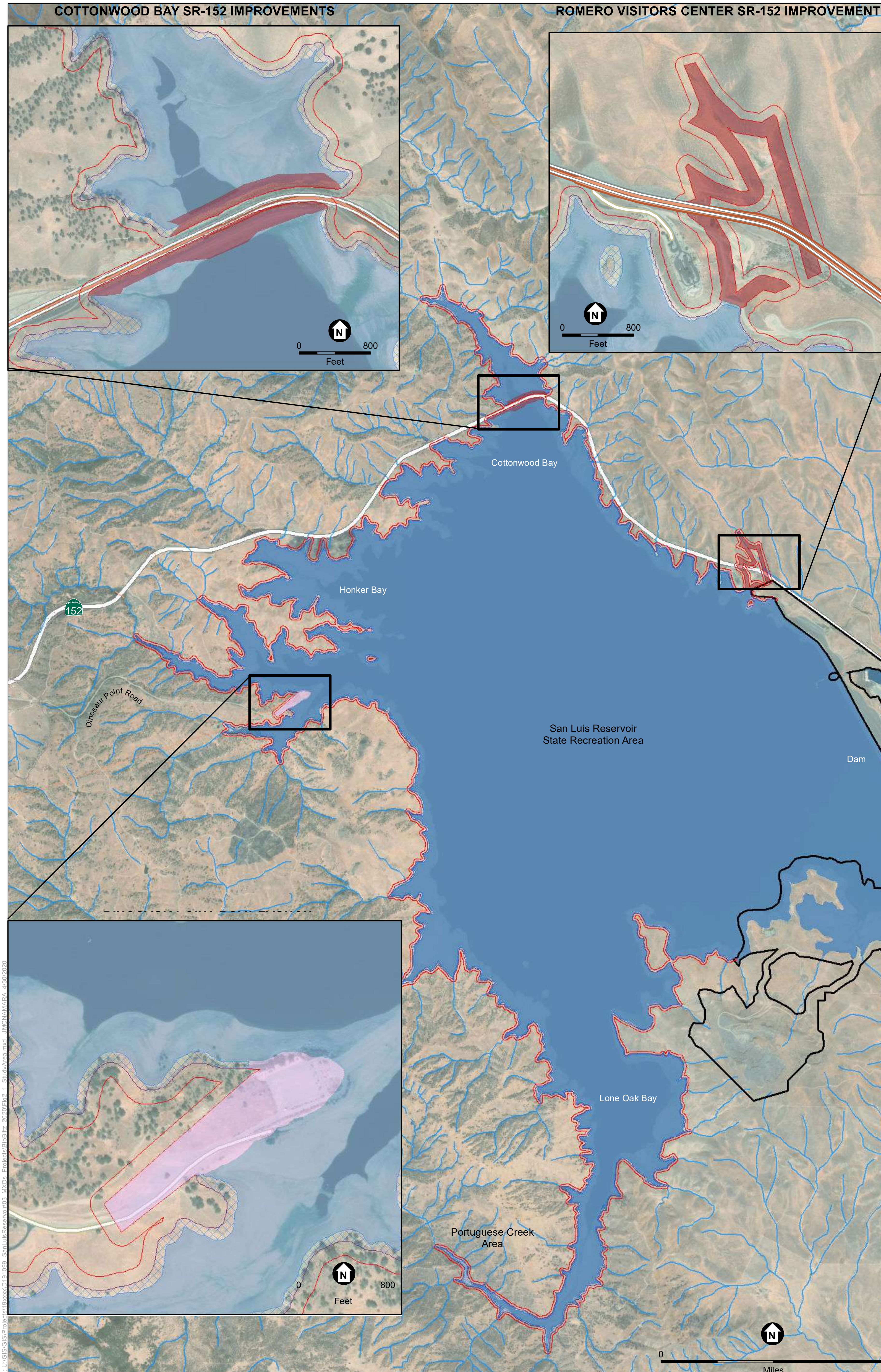
No protocol-level rare plant surveys were performed as part of the 2020 surveys. Botanical surveys were reconnaissance in nature to identify the potential locations of habitat for rare plants and determine which species have the potential to occur in the Study Area. Plant species observed in the Study Area in March 2020 are listed in **Attachment B, Table B-1**. Plant communities were characterized for their potential to occur within the Study Area and buffer (**Attachment C, Table C-1**).

Potential federal and state jurisdictional wetlands were identified within the Study Area.

2.2.3 Wildlife Surveys

No focused (i.e., protocol-level) surveys for the B.F. Sisk Dam Raise Project were conducted in March 2020. Wildlife surveys of the Study Area were performed by ESA biologists Brian Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang March 16–19, 2020. Wildlife species observed in the Study Area during these surveys are listed in **Attachment D, Table D-1**. Wildlife surveys cataloged all common and special-status wildlife species observed within the Study Area or nearby, and determined the potential presence of suitable habitat for special-status wildlife species (Attachment C, **Table C-2**).

During each survey, biologists were dropped off by boat and surveyed accessible locations in the Study Area on foot to assess habitat features that support wildlife species. Wildlife species were documented when encountered. When access was possible, biologists walked up to about one-half mile to investigate the suitability of seasonal and perennial ponds to support special-status species. Ponds beyond this distance or on private property were reviewed using aerial imagery.



SOURCE: ESA, 2020; National Hydrology Dataset, 2020;

Imagery-ESRI, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report

ESA

Figure 2-1
Study Area and
Survey Buffers

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2.3 Review of Background Information

Existing biological survey data were available for the Study Area from previous studies for San Luis Reservoir. The following are the main documents used for this report:

- United States Department of the Interior, Bureau of Reclamation, and California Department of Water Resources. 2019. *B.F. Sisk Dam Safety of Dams Modification Project Final Environmental Impact Statement/Environmental Impact Report.* State Clearinghouse #2009091004. August 2019.
- Environmental Science Associates. 2018. *B.F. Sisk Safety of Dams Modification Project: Biological Survey Report.* Prepared for United States Department of the Interior, Bureau of Reclamation, and California Department of Water Resources. October 2018.
- United States Department of the Interior, Bureau of Reclamation, and Santa Clara Valley Water District. 2019. *San Luis Low Point Improvement Project: Draft Environmental Impact Statement/Environmental Impact Report.* State Clearinghouse #2002082020. July 2019.
- Environmental Science Associates. 2019. *Pacheco Reservoir Expansion Project: Biological Survey Report.* Prepared for United States Department of the Interior, Bureau of Reclamation, and Santa Clara Valley Water District.

Before performing field surveys, ESA biologists reviewed publicly available and subscription-based biological resource data. In part, the field surveys confirmed the general accuracy of the publicly available data.

The following data sources assisted in this analysis:

- USGS topographic maps (Pacheco Pass and surrounding eight quadrangles)
- Historic and current aerial imagery (Google Earth 2020).
- California Wildlife Habitat Relationships database (CDFW 2020a).
- CDFW California Natural Diversity Database (CNDDB) (CDFW 2020b).
- The California Native Plant Society (CNPS) online database (CNPS 2020).
- A USFWS Information for Planning and Consultation species list (USFWS 2020).

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CHAPTER 3
Environmental Setting

This chapter provides the environmental baseline for natural communities and habitats, wetlands, and special-status plant and wildlife species in the Study Area.

3.1 Natural Communities and Associated Wildlife Habitats

Ten habitat types were identified within the Study Area and the 100-foot buffer. They can be divided into two main classifications: uplands and aquatic habitats.

Natural communities are assemblages of plant species that occur together in the same area and are defined by species composition and relative abundance. The natural community classification presented herein is based on field observations and the current California Natural Community List maintained by CDFW (2019) at the alliance level. Plant communities generally correlate with wildlife habitat types; wildlife habitats were classified and evaluated using *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988). The distribution of vegetation communities in the Study Area is presented in **Figure 3-1** and in **Attachment E,** *Detailed Mapbook of Habitat Mapping in the Study Area*.

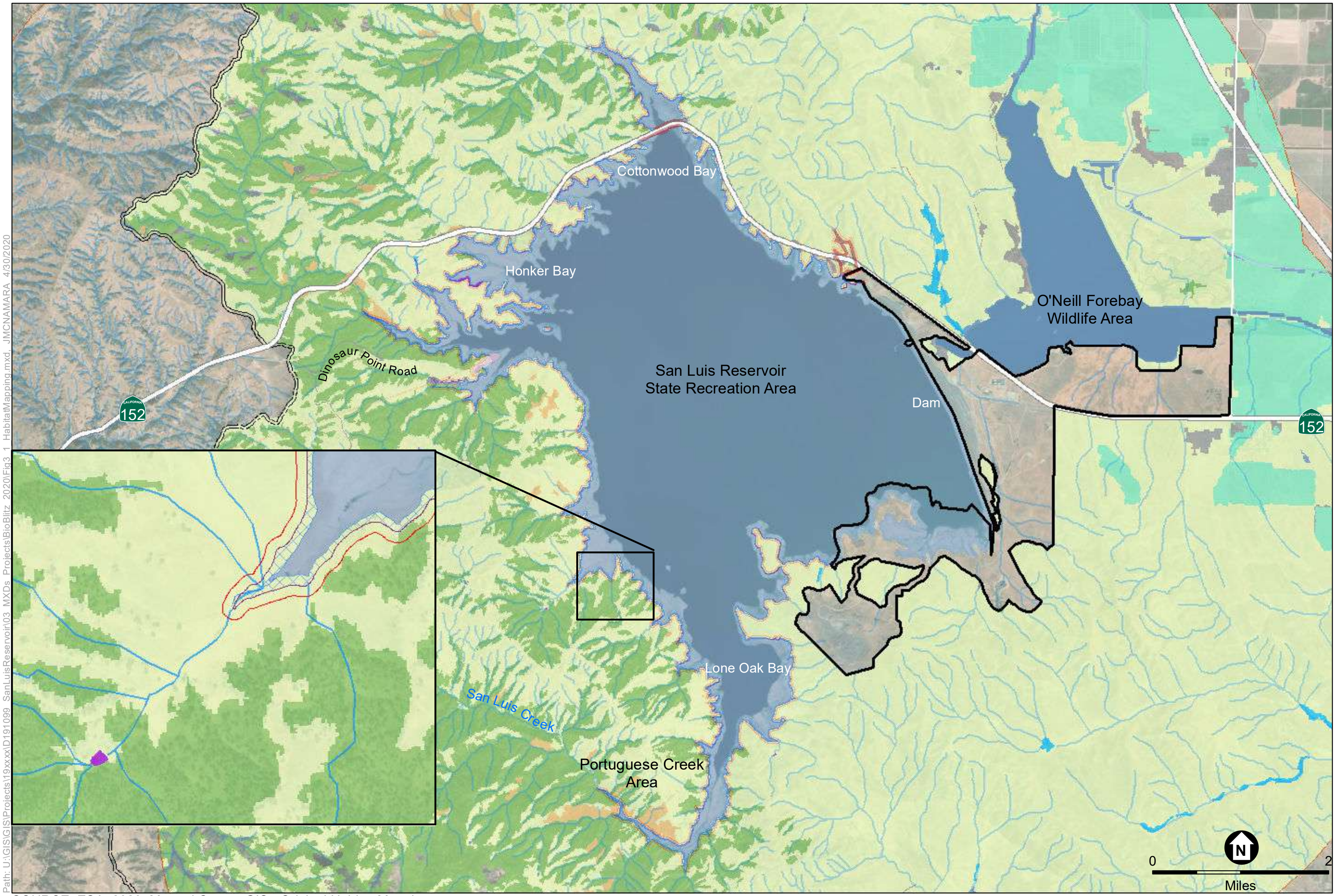
Table 3-1 provides a summary and acreages of the habitat types in the Study Area. Note that the acreages presented exclude the 100-foot buffer. Ponds are included in the discussion of habitats, as they relate to wildlife species, but they are not located within the Study Area. Commonly occurring wildlife are identified for each habitat type.

3.1.1 Annual Grassland

Description

Annual grassland composes the majority of the terrestrial habitat in the San Luis Reservoir region. Annual grassland corresponds to the wild oats and annual brome grassland (*Avena* spp.–*Bromus* spp.) alliance recognized by CDFW (2019). Most of the east side of the Study Area consists of annual grassland. Most grassland areas have not been grazed recently and are dominated by tall non-native annual grasses interspersed with forbs.

The annual grassland is heavily invaded by non-natives overall, but natives are still common in some areas, particularly in rockier areas. Dominant plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.).



SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping,

Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- 5 mile Buffer
- Safety of Dams Study Area
- County Line

Water Flowline
- Pipeline
- Stream/River

Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Ephemeral Channel
- Intermittent Channel
- Emergent Wetland
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

* A detailed mapbook of vegetation communities in the Study Area can be found in the Attachments.

ESA

B.F. Sisk Dam Raise Project - Biological Survey Report

Figure 3-1
Vegetation Communities
in the Study Area

TABLE 3-1
HABITAT TYPES BY ACREAGES

Habitat Type	Acreage[1]
Annual Grassland	336.34
Perennial Grassland	3.95
Blue Oak Woodland	55.13
California Sycamore Woodland	0.36
California Sagebrush Scrub	4.21
Urban	26.20
Aquatic Features	
Pond	0.12
Intermittent Channel	3.37
Ephemeral Channel	0.86
Freshwater Emergent	1.19
Seep	0.04
Lacustrine	12.79
Total	**444.55**

SOURCE:
Data compiled by Environmental Science Associates in 2020

[1] Geographic information system calculations may not reflect exact acreage of study area due to rounding.

Native perennial purple needlegrass (*Stipa pulchra*), a CDFW sensitive natural community, is present in low abundance in some grassland areas, totaling 3.95 acres. Patches of native perennial Stanislaus milkvetch (*Astragalus oxyphysus*) are also present, particularly in the more eastern portions of the study area. Isolated trees and shrubs occur in the grassland. **Figure 3-2** provides representative photos of Study Area grasslands. Annual grassland is not a sensitive natural community (CDFW 2019).

Wildlife Habitat Relationships with Annual Grassland

Annual grassland provides little cover for wildlife, yet numerous species forage and several species breed in this habitat. Some areas of grasslands in the Study Area are seasonally grazed. Grasslands attract reptiles and amphibians such as western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), and western rattlesnake (*Crotalus viridis*).

Bird species that nest in grasslands include northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), western meadowlark (*Sturnella neglecta*), and California horned lark (*Eremophila alpestris*). Birds that commonly forage in grasslands include turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), and golden eagle (*Aquila chrysaetos*).

Common small mammals expected in the Study Area include western harvest mouse (*Reithrodontomys megalotis*), California ground squirrel (*Otospermophilus beecheyi*), California vole (*Microtus californicus*), Botta's pocket gopher (*Thomomys bottae*), desert cottontail (*Sylvilagus audubonii*), and black-tailed jackrabbit (*Lepus californicus*).

Source: Environmental Science Associates

Figure 3-2
Typical Annual Grassland Habitat in the Study Area
Photo dates: March 18 and 19, 2020

Grasslands are important foraging grounds for aerial and ground-foraging insect eaters such as *Myotis* bat species and pallid bat (*Antrozous pallidus*). Larger mammal species such as tule elk (*Cervus canadensis nannodes*), black-tailed deer (*Odocoileus hemionus columbianus*), coyote (*Canis latrans*), and San Joaquin kit fox (*Vulpes macrotis mutica*) may use grasslands in the Study Area.

3.1.2 Blue Oak Woodland

Description

Blue oak woodlands tend to occur on the west side of the Study Area. They are dominated by blue oak (*Quercus douglasii*), with California buckeye (*Aesculus californica*) trees occurring in lower abundance, mostly on northern aspect slopes. Trees are well-spaced and in most places lack a shrub understory. The herb layer is similar to the grassland community, except that in general there is a higher component of native species. **Figure 3-3** provides representative photos of woodlands and forests.

Some associations of blue oak woodland are sensitive natural communities. The CDFW (2019) list was reviewed; none of the sensitive associations occur in the Study Area because some of the co-dominant species either do not occur in the Study Area at all, or occur only in low abundance.

Wildlife Habitat Relationships with Blue Oak Woodland

Animals within blue oak woodlands in the Study Area are those that rely heavily on acorns, such as the acorn disseminators western scrub jay (*Aphelocoma californica*), acorn woodpecker (*Melanerpes formicivorus*), and western gray squirrel (*Sciurus griseus*). Wild turkey (*Meleagris gallopavo*), California quail (*Callipepla californica*), dusky-footed woodrat (*Neotoma fuscipes*), feral pig (*Sus scrofa*), and black-tailed deer use acorns as a major food source.

Chestnut-backed chickadee (*Poecile rufescens*), oak titmouse (*Baeolophus inornatus*), Hutton's vireo (*Vireo huttoni*), dark-eyed junco (*Junco hyemalis*), ash-throated flycatcher (*Myiarchus tuberculifer*), brown creeper (*Certhia americana*), northern flicker (*Colaptes auratus*), Lawrence's goldfinch (*Carduelis lawrencei*), and lesser goldfinch (*Spinus psaltria*), also nest in woodland habitat. Cavity nesters include great horned owl (*Bubo virginianus*), western bluebird (*Sialia mexicana*), and ash-throated flycatcher. Special-status birds such as Cooper's hawk (*Accipiter cooperii*) and sharp-shinned hawk (*Accipiter striatus*) are known to nest in this habitat classification; and pallid bat, also a special-status species, inhabits cismontane woodlands.

Many amphibians and reptiles are found on the forest floor where moisture is retained under fallen wood and in tree crevices. Among these species are arboreal salamander (*Aneides lugubris*), Pacific slender salamander (*Batrachoseps pacificus*), ensatina (*Ensatina eschscholtzii*), and Sierran treefrog (*Pseudacris sierra*). Reptiles include western fence lizard, southern alligator lizard (*Elgaria multicarinata* ssp. *multicarinata*), ringneck snake (*Diadophis punctatus*), western skink (*Eumeces skiltonianus*), rubber boa (*Charina bottae*), pacific gopher snake (*Pituophis catenifer catenifer*), western rattlesnake (*Crotalus viridis helleri*), California kingsnake (*Lampropeltis zonata*), and sharp-tailed snake (*Contia tenuis*). Wildlife species observed during the field surveys are listed in Attachment D, Table D-1.

Source: Environmental Science Associates

Figure 3-3
Typical Blue Oak Woodland Habitats in the Study Area
Photo date: March 16, 2020

3.1.3 California Sycamore Woodland

Description

California sycamore woodland occurs in two limited areas in the study area: along San Luis Creek and an unnamed intermittent channel (channel IC 1). California sycamore (*Platanus racemosa*) is the dominant tree. Along San Luis Creek the sycamores are widely spaced, few other trees are present along the margins of the creek, and the understory is similar to that of annual grassland. Along IC 1, the sycamores exist with an understory of willows (*Salix* sp.) and mule fat (*Baccharis salicifolia*) providing more shade to the creek. California sycamore woodland is a sensitive natural community (CDFW 2019). **Figure 3-4** provides a representative photo of California sycamore woodland.

Wildlife Habitat Relationships with California Sycamore Woodland

California sycamore woodland habitat in the Study Area is not extensive and runs adjacent to San Luis Creek. Therefore, wildlife expected to use this habitat include species similar to those that use blue oak woodlands and annual grasslands, but may also use or need an aquatic feature for their life cycle. Amphibians may use the overhanging roots as refuge. Avian species such as belted kingfisher (*Megaceryle alcyon*) may use sycamores as perches for hunting.

3.1.4 California Sagebrush Scrub

Description

Chaparral in the Study Area is dominated by California sagebrush (*Artemisia californica*). California buckwheat (*Eriogonum fasciculatum*) and chamise (*Adenostoma fasciculatum*) are present in lower abundance. Trees are isolated and uncommon. The herb layer is sparse and non-native annual grasses are a substantial component. Figure 3-4 provides a representative photo of chaparral.

Some associations of California sagebrush scrub are sensitive natural communities. The CDFW (2019) list was reviewed; none of the sensitive associations occur within the Study Area because some of the co-dominant species either do not occur in the Study Area at all or occur only in low abundance.

Wildlife Habitat Relationships with California Sagebrush Scrub

California sagebrush habitat provides cover for wildlife including desert, western rattlesnake, coyote, and special-status San Joaquin coachwhip (*Masticophis flagellum*).

Source: Environmental Science Associates

B.F. Sisk Dam Raise Project

Figure 3-4

California Sycamore Woodland (top) and California Sagebrush Scrub (bottom).
Photo date: March 17, 2020

3.1.5 Pond

Description

Pond habitat in the Study Area includes any aquatic habitat that contains relatively slow-moving to stagnant perennial water up to about 5 acres in size. These ponds can result from either human manipulation or a natural process and include bermed ponds within existing perennial streams, stock ponds, and natural ponds disconnected from any aboveground water sources. Often these ponds do not contain a complex vertical structure, but they can contain some aquatic vegetation or woody debris. Associated plants can include cattail (*Typha* sp.), curly dock (*Rumex crispus*), clustered dock (*Rumex conglomeratus*), and rough cocklebur (*Xanthium strumarium*). Some ponds are used as stock ponds (water sources for cattle), as indicated by their low vegetative cover and the presence of hoof prints, while others appear to have cattle access. Representative photographs of the pond classification in the Study Area are presented in **Attachment F**.

Wildlife Habitat Relationships with Ponds

Ponds provide habitat for species that either live in them or use them for breeding or foraging. These species include California newt (*Taricha torosa*) and occasionally western pond turtle (*Actinemys marmorata*). One western pond turtle was observed at a perennial pond within the current reservoir footprint above San Luis Creek (**Attachment G**).

A few ponds in the Study Area also provide potential breeding habitat for California tiger salamander (*Ambystoma californiense*) and/or California red-legged frog (*Rana draytonii*), which are discussed in the following sections. Ponds with dense enough emergent vegetation provide habitat for the special-status tricolored blackbird (*Agelaius tricolor*).

3.1.6 Freshwater Emergent Wetland

Description

Emergent wetlands are a small component of the Study Area, mostly occurring downhill from seeps or stock ponds. Many of the stock ponds are uphill and outside of the Study Area. They impound water well into the dry season and leak water downhill into the emergent wetlands.

The emergent wetlands are dominated by perennial hydrophytic vegetation including Baltic rush (*Juncus balticus*), iris-leaved rush (*J. xiphioides*), cattail (*Typha* sp.), hedge-nettle (*Stachys ajugoides*), dock (*Rumex* sp.), and rye grass (*Festuca perennis*). Soils are hydrophytic. Surface water, or saturation in the upper 12 inches of the soil, was present in most of the emergent wetlands during the March 2020 surveys. **Figure 3-5** provides a representative photo of freshwater emergent wetlands.

Wildlife Habitat Relationships with Freshwater Emergent Wetlands

Emergent wetlands are important foraging and breeding habitat for many species of waterbirds: wading birds such as great egret (*Ardea alba*); waterfowl including green-winged teal (*Anas crecca*), mallard (*A. platyrhynchos*), and American coot (*Fulica americana*); shorebirds

Source: Environmental Science Associates

Figure 3-5
Freshwater Emergent Wetlands (top) and Seep (bottom) Habitats in the Study Area.
Photo date: March 19, 2020

including killdeer (*Charadrius vociferous*), black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and American avocet (*Recurvirostra americana*); and passerines including Brewer's blackbird (*Euphagus cyanocephalus*), red-winged blackbird (*Agelaius phoeniceus*), brown-headed cowbird (*Molothrus ater*), and American pipit (*Anthus rubescens*). Emergent wetlands provide wildlife habitat similar to that provided by ponds.

3.1.7 Seeps

Description

Seeps are a small component of the Study Area. Areas mapped as seeps were categorized by locations where groundwater appeared to be expressing at the surface, and not merely collecting or flowing from uphill runoff. The USGS topographic quadrangle map names two of the seeps as springs: Coyote Spring and La Baig Spring. Figure 3-5 provides a representative photo of seep habitat.

Like emergent wetlands, seeps are dominated by perennial hydrophytic vegetation. Soils are hydrophytic. Surface water, or saturation in the upper 12 inches of the soil, was present in most of the emergent wetlands during the March 2020 surveys.

Wildlife Habitat Relationships with Seeps

Wildlife species associated with seeps are similar to those associated with freshwater emergent wetlands. The seeps may provide water for wildlife farther into the dry season than the emergent wetlands.

3.1.8 Intermittent Channels

Description

Intermittent channels have flowing water seasonally. Groundwater is the primary component of flow, and runoff from precipitation is a supplemental flow source. Intermittent channels are generally dry by the mid to late summer. Three of the intermittent channels in the Study Area are named San Luis Creek, Portuguese Creek, and Cottonwood Creek.

San Luis Creek, the largest intermittent channel in the Study Area, was flowing during the March 2020 surveys. This creek has a bed composed mostly of cobble and gravel. San Luis Creek is large enough to support a narrow band of California sycamores (*Platanus racemosa*) that grow along the reach in the Study Area.

Portuguese Creek has a bed composed primarily of boulders and cobble, and was flowing during the March 2020 surveys. The creek bed is mostly unvegetated, but sparse perennial hydrophytic vegetation occurs, mostly mule fat. There is no riparian corridor outside of the creek bed and bank.

Cottonwood Creek, at the far northern end of San Luis Reservoir, drains into the Cottonwood Bay area. Cottonwood Creek appears to have a bed composed primarily of bedrock and cobble. No woody riparian vegetation is visible along the creek in the Study Area.

Intermittent channel 1 (IC 1), the largest unnamed channel in the Study Area, is located slightly north of Dinosaur Point Road. IC 1 has a bed composed of cobble and gravel. It was flowing during the March 2020 surveys. The creek bed is mostly unvegetated, but occasional woody riparian species do occur. IC 1 is large enough in the Study Area to support a narrow band of riparian vegetation. The riparian vegetation is dominated by California sycamore, is relatively dense, and shades much of the channel.

The other intermittent channels in the Study Area are smaller than the four described separately above. They generally have a bed composed of either scoured rock or thick mud. Several are downhill from stock ponds that appear to leak water into the channels well into the dry season in some years. In addition, the USGS topographic quadrangle maps show numerous springs in the small watersheds west of the reservoir. **Figure 3-6** provides a representative photo of an intermittent channel.

Wildlife Habitat Relationships with Intermittent Channels

Wildlife associated with intermittent channels include amphibians, such as California red-legged frog, that may use the channels during the wet season for dispersal and foraging. Mammals may also use intermittent channels for dispersal and access to water during the spring into the summer. Avian species likely use intermittent channels for foraging.

3.1.9 Ephemeral Channels

Description

Ephemeral channels flow sporadically and temporarily in response to precipitation during the wet season, but their flow is too brief to support a riparian community. Groundwater is not a component of flow. The ephemeral channels were dry during the March 2020 surveys. Most of the ephemeral channels have beds of scoured soil, and many are on very steep slopes above the reservoir. Figure 3-6 provides a representative photo of an intermittent channel.

Wildlife Habitat Relationships with Ephemeral Channels

Wildlife species associated with ephemeral channels are similar to those associated with intermittent channels. This community provides less access to water for wildlife because it flows only sporadically, in response to precipitation.

3.1.10 Lacustrine

Description

Lacustrine habitat in the Study Area includes San Luis Reservoir. This natural community is used for large, permanent bodies of water that do not support emergent vegetation and are not subject to tidal exchange; these water bodies include lakes, ponds, oxbows, gravel pits, and flooded islands.

Pond plant associates may be present along the edges of the reservoir in low-water years and where the water is shallow.

Source: Environmental Science Associates

B.F. Sisk Dam Raise Project

Figure 3-6

Intermittent Channel (top) and Ephemeral Channel (bottom) in the Study Area.
Photo dates: March 17 and 16, 2020

3.1.11 Disturbed/Urban

Description

Urban/disturbed areas include the boat ramp, facilities, roads, and roadsides. These areas have either maintained landscapes or ruderal vegetation.

Wildlife Habitat Relationships with Disturbed/ Urban

Developed areas provide limited habitat for wildlife. However, bird species typically 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 (*Procyon lotor*).

3.2 Potential Waters of the United States

The intermittent/ephemeral channels, freshwater emergent wetland, and seeps are a special-status natural community because they are potential waters of the United States and state subject to regulation by the United States Army Corps of Engineers and the Central Valley Water Quality Control Board. These areas are depicted in **Figure 3-7**.

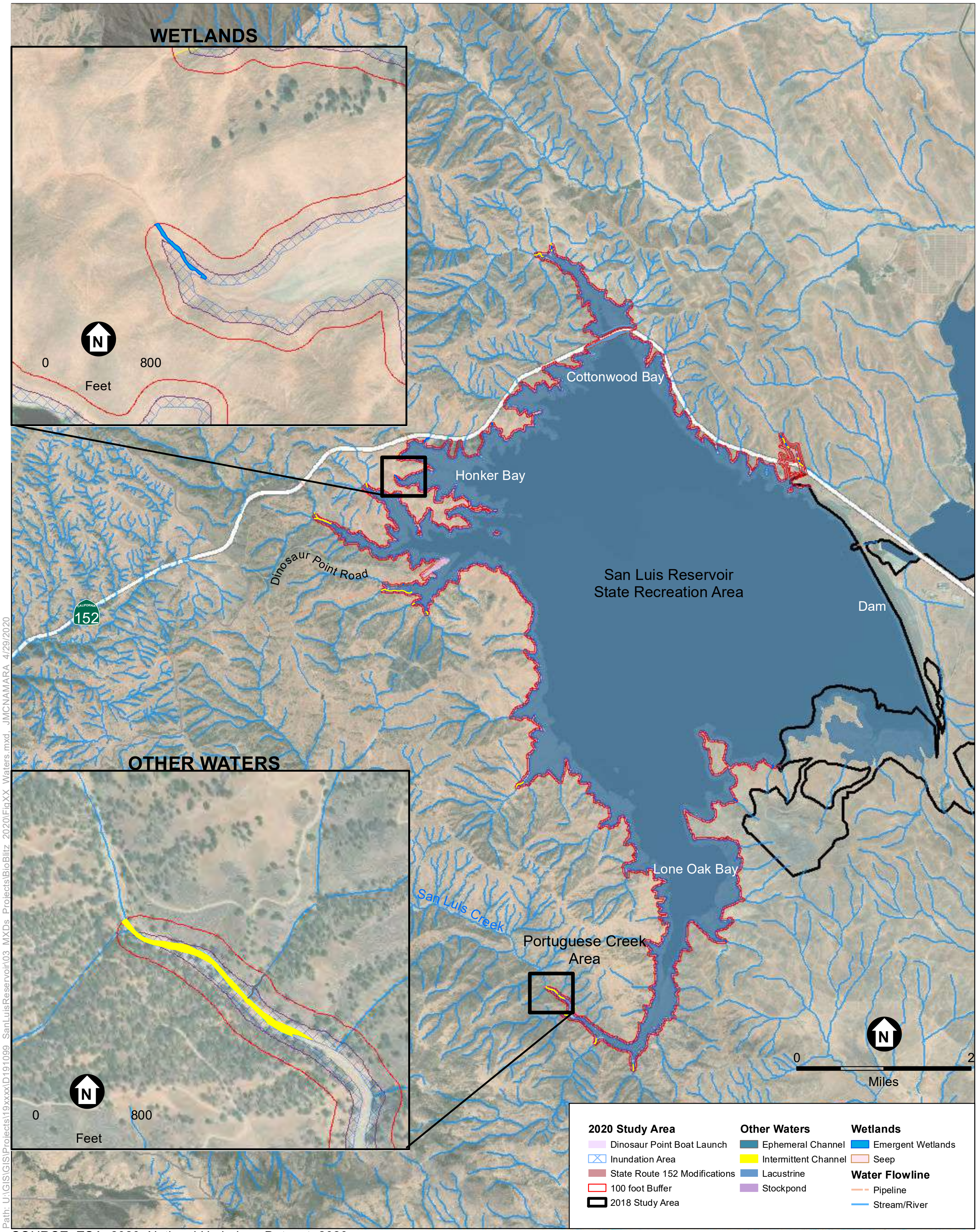
3.3 Special-Status Species

Several species known to occur in or near the Study Area are protected by federal and/or state endangered species laws, or have been designated as Species of Special Concern by CDFW. In addition, Section 15380(b) of the CEQA Guidelines defines rare, endangered, or threatened species that are not included in any listing.[1] Species recognized under these terms are collectively referred to as *special-status species*.

A list of special-status wildlife and plant species with potential to occur in or near the Study Area was compiled from nine-quadrangle searches of the CNDDB (CDFW 2020b) and CNPS's Rare Plant Inventory (CNPS 2020); a search of the USFWS Information for Planning and Consultation database (USFWS 2020); and review of biological literature of the region for the following 7.5-minute USGS topographic quadrangles:

Mustang Peak	Crevison Peak	Howard Ranch
Pacheco Peak	Pacheco Pass	San Luis Dam
Three Sisters	Mariposa Peak	Los Banos Valley

1 For example, vascular plants listed as rare or endangered or as Rare Plant Rank 1 or 2 by CDFW are considered to meet the requirements of CEQA Guidelines Section 15380(b).



SOURCE: ESA, 2020; National Hydrology Dataset, 2020;

Imagery-ESRI, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report **Figure 3-7**

Potential Waters of the United States

ESA

From the full list of species, each species was individually assessed based on habitat requirements and distribution relative to the vegetation communities present in and around the Study Area, and on the results of previous surveys and assessments. Special-status fish species are not analyzed in this report and do not occur in the Study Area. Comprehensive lists of the special-status plant and wildlife species considered in the analysis are provided in Attachment C and **Attachment H**. The species with moderate or high potential to occur in the Study Area are described below in greater detail.

Figure 3-8 presents a map of CNDDB special-status species occurrences within 5 miles of the Study Area. A total of 20 special-status plants and wildlife species were identified as having moderate or high potential to occur in or near the Study Area. The special-status plants include Lemmon's jewelflower, Hospital Canyon larkspur, spiny-sepaled button-celery, arcuate bush-mallow, Hall's bush mallow, and chaparral ragwort. The special-status wildlife species include San Joaquin coachwhip, California tiger salamander, tricolored blackbird, golden eagle, western burrowing owl, Swainson's hawk, ferruginous hawk, northern harrier, prairie falcon, bald eagle, American badger, and San Joaquin kit fox. Western pond turtles and California red-legged frogs were present in the Study Area during the March 2020 reconnaissance-level surveys.

3.3.1 Special-Status Plants

Lemmon's Jewelflower

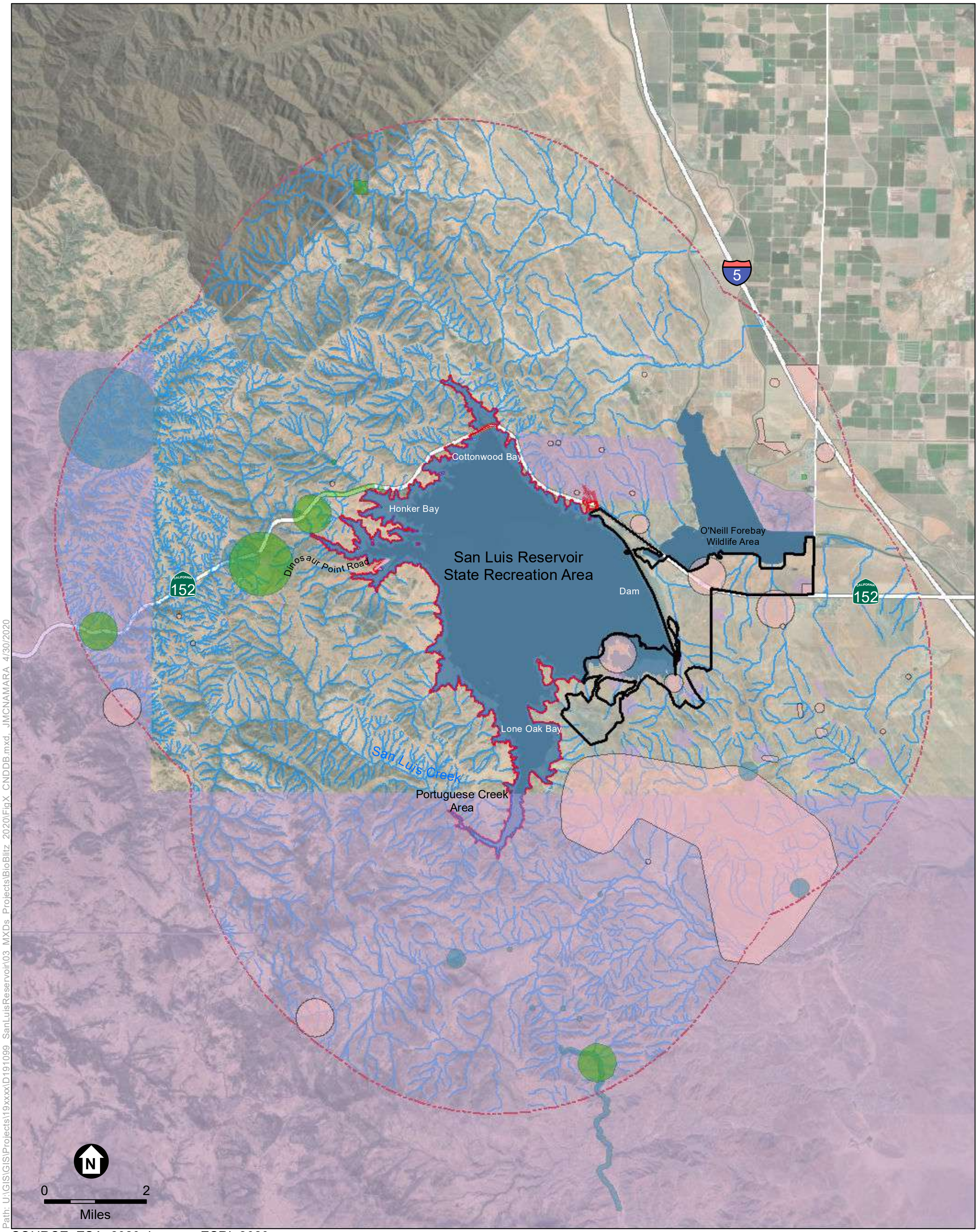
Lemmon's jewelflower (*Caulanthus lemmonii*) is not listed under the FESA or CESA. It has a California Rare Plant Rank (CRPR) of 1B.2.

Lemmon's jewelflower is an annual herb found in pinyon and juniper woodland, chaparral, and valley and foothill grassland from 250 to 5,200 feet in elevation. The blooming period is from February through May. It is known from the Bay Area, San Joaquin Valley, and south Coast Ranges (CNPS 2020; Jepson 2020). There is one record in the vicinity of San Luis Reservoir (CNDDB Occurrence #48). The record is a 1986 collection about 5.4 miles to the southeast. The habitat is described as an exposed south-facing conglomerate rock outcrop on middle and lower slopes along a creek (CCH 2020).

Some of the soils in the study area have conglomerate as the parent material. Rock outcrops or areas of thin soil over bedrock in the Study Area, especially in drier areas such as grassland, chaparral, and south-facing slopes, provide potential habitat for Lemmon's jewelflower. Lemmon's jewelflower has moderate potential to occur in the Study Area. During the reconnaissance survey, several rock outcrops were inspected for special-status plants in general and Lemmon's jewelflower was not observed.

Hospital Canyon Larkspur

Hospital Canyon larkspur (*Delphinium californicum* ssp. *interius)* is not listed under the FESA or CESA. It has a CRPR of 1B.2.



SOURCE: ESA, 2020; Imagery-ESRI, 2020; CDFW, 2020; USFWS, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report

2020 Study Area

- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- 5-mile Buffer
- Safety of Dams Study Area
- Plants
- Amphibians and Reptiles
- Birds
- Mammals

ESA

Figure 3-8
CNDDB Occurrence Records within 5-miles of the Study Area

Hospital Canyon larkspur is a perennial herb found in chaparral openings, mesic cismontane woodland, and coastal scrub from 600 to 3,600 feet in elevation. The blooming period is from April through June. It is known from the Bay Area and inner south Coast Ranges (CNPS 2020; Jepson 2020). There is one record in the vicinity of San Luis Reservoir (CNDDB Occurrence #3). The occurrence is about 3.5 miles to the north and based on a 1995 collection (CCH 2020). The habitat is described as a "canyon bottom setting bordering woodland" downhill from a spring. The woodland is described with California buckeye and holly leaf cherry (*Prunus ilicifolia*).

Chaparral and woodland in the Study Area, especially in more mesic areas such as north-facing slopes or areas near intermittent creeks or seeps, provide potential habitat for Hospital Canyon larkspur. Hospital Canyon larkspur has moderate potential to occur in the Study Area. This species was not observed during the reconnaissance survey.

Spiny-Sepaled Button-Celery

Spiny-sepaled button-celery (*Eryngium spinosepalum*) is not listed under the FESA or CESA. It has a CRPR of 1B.2.

Spiny-sepaled button-celery is a biennial to perennial herb found in vernal pools, swales, and ditches of valley and foothill grassland from 250 to 3,200 feet in elevation. The blooming period is from April through June. It is known from the San Joaquin Valley and southern Sierra Nevada foothills (CNPS 2020; Jepson 2020). There are two records in the vicinity of San Luis Reservoir (CNDDB Occurrences #91 and #103). Occurrence #103 is about 4 miles to the east near Santa Nella on clay soil in grassland. Occurrence #91 is based on a 2010 collection in the Study Area, although the CNDDB record is mapped along SR 152 (CCH 2020). The elevation of the collection was reported at 545 feet, very near the elevation of the San Luis Reservoir spillway (544 feet). The habitat of the collection was described as grassland, with species associates that are common in the study area, and also just below the Study Area at the highest elevations reached by the water surface when the reservoir is full.

Eryngium was observed in another area during the reconnaissance survey. The specimens were observed near a swale in a grassy area a few feet above the spillway elevation. They were not in or near bloom and could not be identified to species. Spiny-sepaled button-celery is differentiated from common *Eryngium* species that also occur in the area, primarily on floral and fruit characteristics.

The habitat described for the location of the 2010 collection is common in the study area. Spiny-sepaled button-celery and *Eryngium* in general tend to occur in areas of seasonally mesic conditions. The 2010 collection is along the reservoir margin. It is possible that spiny-sepaled button-celery occurs in multiple locations along the reservoir margin, as there is nothing unique about the habitat or location where the collection was made. Spiny-sepaled button-celery has high potential to occur in the Study Area.

Arcuate Bush-mallow

Arcuate bush-mallow (*Malacothamnus arcuatus*) is not listed under the FESA or CESA. It has a CRPR of 1B.2. Arcuate bush-mallow is recognized at the species level by CNPS, but Jepson (2020) treats it as a synonym of *M. fasciculatus*.

Arcuate bush-mallow is a perennial evergreen shrub found in open chaparral and cismontane woodland from 250 to 1,200 feet in elevation. The blooming period is from April through September. There are no CNDDB records near the Study Area. There are multiple collection records of *M. fasciculatus* from 1894 to 1950 in the vicinity of Pacheco Pass, approximately 1 mile west of the Study Area (CCH 2020). Some subspecies of *M. fasciculatus* circumscribe the taxon described as *M. arcuatus* by CNPS and previous authors. The older collections of *M. fasciculatus* near Pacheco Pass do not report a subspecies.

The Study Area, especially chaparral and the edges of woodland, could provide potential habitat for arcuate bush-mallow. Arcuate bush-mallow has moderate potential to occur in the Study Area. Arcuate bush-mallow was not observed during the reconnaissance survey.

Hall's Bush-mallow

Hall's bush-mallow (*Malacothamnus hallii*) is not listed under the FESA or CESA. It has a CRPR of 1B.2.

Hall's bush-mallow is a perennial evergreen shrub found in open chaparral and cismontane woodland from 30 to 2,500 feet in elevation. The blooming period is from April through October. It is known from the north Coast Ranges, Bay Area, San Joaquin Valley, Sierra Nevada foothills, and central high Sierra Nevada (CNPS 2020; Jepson 2020).

There are seven records of Hall's bush-mallow in the vicinity of San Luis Reservoir:

- One occurrence (CNDDB #1) is about 4 miles to the south from 1986, at a seep in grassland on a south-facing slope.
- One occurrence (CNDDB #48), from 2016, is about 0.7 mile to the north in the Cottonwood Creek Wildlife Area.
- Three occurrences (CNDDB #2, 3, 18) along SR 152 west of the Study Area encompass several historical collections from the 1800s until 1950.
- One occurrence (CNDDB #33) is just south of SR 152, about 0.3 mile from the study area. There are two collections from that location, from 1994 and 1995. The habitat is described as "open chaparral on sedimentary rocks" and "open slope" (CCH 2020).
- The last occurrence (CNDDB #39) is very near the study area, but there are some uncertainties regarding the precise location. The occurrence is based on a 2002 collection. The CNDDB mapped the occurrence around a pull-off along SR 152. The pull-off is about 250 feet from the Study Area. The coordinates in CCH (2020) place the location below the San Luis Reservoir spillway's elevation (which is not consistent with the species' biology), but the reported elevation is 662 feet, which is even higher than SR 152 at the pull-off. The likely location is one of two small hills between SR 152 and the reservoir, adjacent to the

pull-off. Both hills rise to at least 662 feet and are within walking distance of the pull-off. That location would place the collection no more than a few hundred feet from the Study Area.

The portion of one of the hills that is within the Study Area was walked during the reconnaissance survey; Hall's bush-mallow was not observed. The hill is covered in grassland, and no chaparral or woodland is present. Hall's bush-mallow could be present higher on the hill outside the Study Area. Much of the Study Area provides potential habitat, and because of the number and proximity of records, the potential for Hall's bush-mallow to occur is high.

Chaparral Ragwort

Chaparral ragwort (*Senecio aphanactis*) is not listed under the FESA or CESA. It has a CRPR of 2B.2.

Chaparral ragwort is an annual herb found in dry, open, rocky areas of chaparral, cismontane woodland, and coastal scrub from 50 to 2,650 feet in elevation. The blooming period is from January through April, and sometimes into May. It is known from the Bay Area, the central and south coast, south Coast Ranges, and Channel Islands (CNPS 2020; Jepson 2020). There are no CNDDB records in the vicinity of the Study Area. There are two collection records approximately 11 miles southeast of the Study Area, from 1938 and 2003. The 2003 record describes the habitat as conglomerate outcrops.

Some of the soils in the Study Area have conglomerate as the parent material. Rock outcrops or areas of thin soil over bedrock in the Study Area, especially in drier areas such as grassland and chaparral, provide potential habitat for chaparral ragwort. Chaparral ragwort is usually less than 7 inches tall and would be unlikely to occur in areas of dense non-native grasses. Chaparral ragwort has a moderate potential to occur in the Study Area. During the reconnaissance survey, several rock outcrops were inspected for special-status plants in general and chaparral ragwort was not observed.

Sylvan Microseris

Sylvan microseris (*Microseris sylvatica*) is not listed under the FESA or CESA. It has a CRPR of 4.2. CRPR 3 or 4 plants are not evaluated in the San Luis Reservoir State Recreation Area General Plan Environmental Impact Statement/Environmental Impact Report (Reclamation 2013) or in Attachment G of this report. Sylvan microseris is discussed here because it was found in the Study Area during the reconnaissance survey.

Sylvan microseris is a perennial herb found in chaparral, cismontane woodland, Great Basin scrub, pinyon and juniper woodland, and serpentine valley and foothill grassland from 150 to 5,000 feet in elevation. The blooming period is from March through June. It is known from the inner north Coast Ranges, Bay Area, Sacramento Valley, south Coast Ranges, Sierra Nevada foothills, southern high Sierra Nevada, Tehachapi Mountains, western Transverse Ranges, Mojave Desert, and desert mountains (CNPS 2020; Jepson 2020).

Oak woodlands and chaparral in the Study Area provide potential habitat for sylvan microseris. There are no serpentine areas. Sylvan microseris was found in two locations in the southwestern portion of the Study Area. Hundreds of individuals were observed.

CRPR Rank 4 plants may qualify for consideration as endangered, rare, or threatened species pursuant to California Code of Regulations Title 14, Section 15380 if the species can be shown to meet the criteria. CNPS (2020) identifies the following considerations that may be appropriate for evaluating Rank 4 plants: (1) the type locality, (2) populations at the periphery of a species' range, (3) areas where the taxon is especially uncommon, (4) areas where the taxon has sustained heavy losses, and (5) populations exhibiting unusual morphology or occurring on unusual substrates. Each of these items is considered below.

(1) The type specimen for sylvan microseris is an 1848 collection with a locality description of "Sacramento" (CCH 2020). The project would not affect the type locality.

(2) The range extends from the north Coast Ranges, Sacramento Valley, and northern Sierra Nevada foothills in the north to the Transverse Ranges and Mojave Desert in the south (Jepson 2020). The range includes mountains and foothills on both sides of the San Joaquin Valley. The occurrence in the Study Area is not at the periphery of the species' range.

(3) There are three collections regionally near San Luis Reservoir and more extending both north and south through the south Coast Ranges (CCH 2020). The pattern of collection records does not indicate that the species is especially uncommon in this portion of the range relative to other portions of the range.

(4) Most of the collections in the south Coast Ranges are in remote areas where there is little or no development pressure. There is no evidence that the species has sustained heavy losses regionally.

(5) The occurrences observed in the Study Area were growing in the grassy understory of open blue oak woodland. The substrate was typical of the Study Area and the region. Individuals appeared to have morphology characteristic of the species.

The occurrence of sylvan microseris in the Study Area does not meet the criteria for endangered, rare, or threatened under California Code of Regulations Title 14, Section 15380(b). The project would result in impacts on some sylvan microseris individuals that are growing within 10 vertical feet of the current maximum surface elevation. Most observed individuals in the occurrence, both inside and outside the Study Area, are higher than the area of project impacts.

3.3.2 Special-Status Wildlife Species

Western Pond Turtle

Western pond turtle (*Actinemys marmorata*) is considered a California Species of Special Concern by CDFW.

Western pond turtles are commonly found in ponds, lakes, marshes, rivers, streams, and irrigation ditches with rocky or muddy substrates surrounded by aquatic vegetation. These watercourses usually are within woodlands, grasslands, and open forests, at elevations between sea level and 6,000 feet. Turtles bask on logs or other objects when water temperatures are lower than air temperatures. Nests are located at upland sites, often up to 0.25 mile from an aquatic site (Jennings and Hayes 1994; Stebbins 2003; Zeiner et al. 1988).

The western pond turtle is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and absent from desert regions, except in the Mojave Desert along the Mojave River and its tributaries. The species' elevation range extends from near sea level to 4,690 feet (1,430 meters).

The CNDDB (CDFW 2020b) reports nine occurrences of western pond turtle within 5 miles of the Study Area, occurring primarily on the west side of San Luis Reservoir in Pacheco State Park, south of Dinosaur Point Road. Additionally, in 2004, western pond turtle was reported in the Portuguese Creek Area in the southern arm of the reservoir. During the March 2020 reconnaissance-level surveys, this species was observed in Pond 18 in the Portuguese Creek Area. This species has the potential to occur in other major drainages and associated uplands areas in the Study Area.

San Joaquin Coachwhip

San Joaquin coachwhip (*Coluber flagellum ruddock*) is considered a California Species of Special Concern by CDFW.

San Joaquin coachwhip inhabits open, dry, treeless areas with little or no cover, including valley grasslands and saltbush scrub. This species avoids areas with dense vegetation where it cannot move quickly, such as mixed oak chaparral woodland. San Joaquin coachwhip takes refuge in rodent burrows, under shaded vegetation and beneath surface objects. This species feeds on small mammals including bats, nesting and adult birds, bird eggs, lizards, snakes, amphibians, and carrion. San Joaquin coachwhips emerge from winter sites in late April to May, breed in May, and lay clutches of eggs in early June to July.

San Joaquin coachwhip is endemic to California, ranging from Arbuckle in the Colusa County portion of the Sacramento Valley southward to the Grapevine in the Kern County portion of the San Joaquin Valley, and westward into the inner South Coast Ranges (Calherp 2020).

The CNDDB (CDFW 2020b) reports one occurrence within 5 miles of the Study Area, on the southeast side of San Luis Reservoir, dated 1985. CNDDB Occurrence record #19 states that one adult was observed in annual non-native grasslands. This species was not observed during the March 2020 reconnaissance-level surveys. The Study Area provides suitable habitat in annual grasslands that have a low density of trees and shrubs, along with small-mammal burrows. Therefore, this species has moderate potential to occur in the Study Area.

California Tiger Salamander

California tiger salamander (*Ambystoma californiense*) is a federally listed and state-listed as threatened. Critical habitat was designated for the Central California Distinct Population Segment (DPS) in 2005. The Study Area is not within federally designated critical habitat for this species. Critical habitat lies approximately 1 mile south of the Portuguese Creek Area on Los Banos Creek and surrounding grasslands.

California tiger salamander is principally an upland species found in annual grasslands and in the grassy understory of valley-foothill hardwood habitats in central and Northern California. They require underground refuges (usually ground squirrel or other small-mammal burrows), where they aestivate[2] for the majority of their annual cycle. Between December and February, when seasonal ponds begin to fill, adult California tiger salamanders engage in mass migrations to aquatic sites during a few rainy nights and are explosive breeders (Barry and Shaffer 1994). After breeding, eggs are laid in seasonal and perennial water sources such as vernal pools, streams, and stock ponds. Common breeding sites include stock ponds and vernal pools, while streams are rarely used (Stebbins 2003; Zeiner et al. 1988; Petranka 1998).

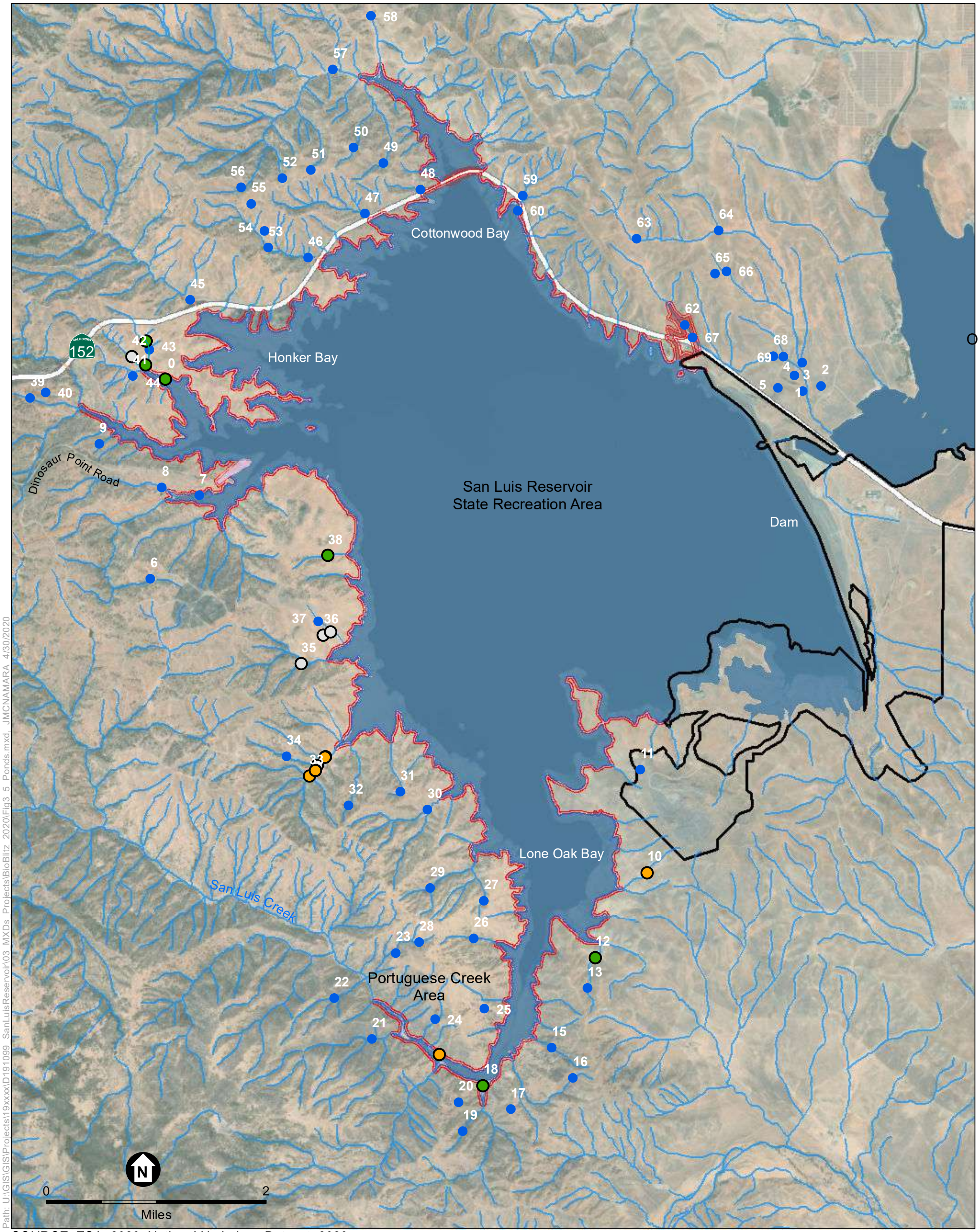
During drought years when ponds do not form, adults may spend the entire year in upland environments, while juveniles may spend 4 to 5 years in their upland burrows before reaching sexual maturity and breeding for the first time (Petranka 1998; Trenham et al. 2000). Adult tiger salamanders swiftly disperse after breeding and have been documented to migrate up to 423 feet (129 meters) the first night after leaving a breeding pond (Loredo and Van Vuren 1996). Adult California tiger salamanders readily aestivate in grasslands near ponds and at great distances from breeding ponds. Adults are known to regularly travel distances greater than 0.62 mile (1 kilometer) from breeding ponds and have been documented at distances of 1.2 miles (2 kilometers) or more (Orloff 2007).

California tiger salamanders occur in suitable habitat across central and Northern California. Currently, they range from Kings and Tulare Counties north to Butte County in the Central Valley, and from Santa Barbara County north to Sonoma County along the coast (Zeiner et al. 1988). It is estimated that they have disappeared from nearly 55 percent of their historic range (Stebbins 2003).

The CNDDB (CDFW 2020b) reports six California tiger salamander sightings within 5 miles of the Study Area, with the most recent sighting dated 2015. CNDDB Occurrence record #1225, located 4.6 miles west of the Study Area, states that habitat is an impounded body of water that is fed by a permanent water seep. Three CNDDB records (Occurrences #136, #137, and #138) occur within the critical habitat approximately 1 mile south of the Study Area, dated 1985. Habitat is a stock pond surrounded by oak savanna.

Ponds within one mile of the Study Area were identified before the March 2020 reconnaissance-level surveys from aerial imagery. Based on this desktop review, the entire Study Area is within the potential movement capabilities of California tiger salamander. During the surveys, when access was possible, biologists walked up to one-half mile to investigate potential breeding ponds for California tiger salamander and California red-legged frog. **Table 3-2** identifies the locations of the assessed ponds relative to the Study Area, with details about each pond's likelihood of providing California tiger salamander breeding habitat (see also **Figure 3-9**).

2 *Aestivation* is a state of dormancy similar to hibernation that occurs during the summer and fall.



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SOURCE: ESA, 2020; National Hydrology Dataset, 2020; Imagery-ESRI, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

- Potential Ponds

Ponds Assessed
- CRLF Present
- Potential Breeding Pond
- Dry

Water Flowline
- Pipeline
- Stream/River

ESA

Figure 3-9
Potential Ponds for Special-status Species

TABLE 3-2
PONDS ASSESSED FOR POTENTIAL BREEDING SITES FOR SPECIAL-STATUS SPECIES

Pond Identification	Estimated Maximum Size	Location to Study Area	Potential Species Habitat	Habitat Conditions	Hydrology
Within the Study Area					
Northwest Reservoir Pond (Pond 44)	0.09 acre	Within the Study Area	CRLF, CTS	Emergent vegetative cover along edge of pond, surrounded by annual grasslands.	Open water that is approximately 2 to 3 feet deep. Pond connected via culvert to Pond 43.
Within the Current Inundation Area					
Northwest Reservoir Pond (Pond 0)	0.05 acre	Within current inundation area	--	Emergent vegetative cover with willows along edge of pond. Surrounded by annual grasslands. Subject to active cattle grazing. Inundation by San Luis Reservoir makes pond unsuitable for CTS/CRLF breeding	Open water that is approximately 4 to 6 feet deep or deeper. Pond is approximately 120 feet by 60 feet.
Portuguese Creek Pond (Pond 18)	0.44 acre	Within current inundation area	**Non-breeding CRLF, , western pond turtle present**	Stock pond with dead willow trees along the edges with minimal emergent vegetative cover. An unidentified large ranid frog, likely a California red-legged frog, jumped into the pond when biologists arrived. Bullfrogs were not observed in the watershed. Two western pond turtles were seen basking. A dead red-eared slider was found in the pond as well. Pond is surrounded by steep annual grasslands. Inundation by San Luis Reservoir makes pond unsuitable for CTS/CRLF breeding	Shallow-edged stock pond that is approximately 10 feet deep. Pond is approximately 80 feet by 250 feet.
San Luis Creek	Seasonal creek	Within current inundation area	**Non-breeding CRLF present**	CRLF was captured likely using San Luis Creek as a means of dispersal. Found in small pool just out of the main flow of water. Small adult approximately 2.8 inches (72 millimeters) from snout to vent. Surrounding habitat is grasslands with upland scrub.	Small protected pool approximately 2 feet deep.
Outside the Study Area					
Lone Oak Bay Stock Pond (Pond 10)	0.05 acre	Outside the Study Area	**CRLF present**	Stock pond with minimal vegetative cover along the edges of the pond. Pond was almost 100% covered with algae. Four small adult frogs were captured. They measured between 1.8 and 2.2 inches (45 and 55 mm) from snout to vent. Surrounding habitat was steep rocky annual grasslands. Subject to active cattle grazing. Numerous ground squirrel burrows on surrounding hills.	Stock pond is approximately 4 to 10 feet deep. Pond is approximately 70 feet by 60 feet.

TABLE 3-2 (CONTINUED)
PONDS ASSESSED FOR POTENTIAL BREEDING SITES FOR SPECIAL-STATUS SPECIES

Pond Identification	Estimated Maximum Size	Location to Study Area	Potential Species Habitat	Habitat Conditions	Hydrology
Lone Oak Bay Pond (Pond 12)	0.39 acre	Outside the Study Area	CRLF, tricolored blackbird	Stock pond with shallow edges with ring of dense cattails in middle of pond. Nesting red-winged blackbirds present. Surrounded by grazed annual grasslands. Numerous ground squirrel burrows on surrounding hills.	Stock pond is approximately 4 to 6 feet deep. Pond is approximately 35 feet by 120 feet.
West Reservoir Pond (Pond 33)	0.35 acre	Outside the Study Area	**CRLF present**	Stock pond with shallow edge. The north and east edges had emergent vegetative cover. Fifteen small adults found in main pond. They measured approximately 2.8 to 3.1 inches (70 to 80 mm) from snout to vent. Surrounded by blue oak woodlands, annual grasslands, and California sagebrush scrub.	Stock pond is approximately 6 to 8 feet deep. Pond is approximately 120 feet by 140 feet.
West reservoir drainage below Pond 33	Seasonal creek	Outside the Study Area	**CRLF present**	Two dead and one live CRLF were captured in the drainage below Pond 33. Oil sheen was seen on the surface of the water. The dead CRLFs measured approximately 1.2 to 2.2 inches (30 to 55 mm) from snout to vent. The live CRLF was approximately 1.2 to 1.4 inches (30 mm to 35 mm) from snout to vent. Drainage was surrounded by annual grasslands and blue oak woodlands. Subject to active cattle grazing.	Drainage water was less than 1 foot deep and almost stagnant. Pools were formed and ranged from less than 1 foot deep to 3 feet deep.
South of Dinosaur Point Boat Launch Pond (Pond 38)	0.07 acre	Outside the Study Area	CRLF, CTS	Stock pond with shallow edges and no emergent vegetative cover. Subject to cattle grazing. Surrounded by annual grasslands and oak scrub.	Stock pond that is approximately 2-3 feet deep. Pond is approximately 35 feet by 70 feet.
Northwest reservoir drainage (Pond 43)	1.13 acre	Outside the Study Area	Tricolored blackbird	Shallow drainage that is connected to Pond 44. Dense emergent vegetative cover and cattails. Red-winged blackbirds present. Surrounded by annual grasslands.	Drainage no deeper than 1 foot throughout until pooling up at Pond 44.

SOURCE: Data compiled by Environmental Science Associates in 2020
CRLF = California red-legged frog; CTS = California tiger salamander

California tiger salamanders were not observed during the March 2020 reconnaissance-level surveys. Based on the assessment findings, Pond 44 in the northwest area of San Luis Reservoir may provide suitable breeding habitat. Several other ponds adjacent to the Study Area may also provide suitable breeding habitat (Table 3-2). Suitable refugia in the form of small-mammal burrows occur throughout the Study Area. Therefore, California tiger salamander has moderate potential to occur in portions of the Study Area.

California Red-Legged Frog

California red-legged frog (*Rana draytonii*) is a federally listed threatened species with revised critical habitat designated in 2010. A recovery plan for California red-legged frog was finalized in 2002 (USFWS 2002). The Study Area is within federally designated critical habitat for this species. The entire west side of San Luis Reservoir from Cottonwood Bay to San Luis Creek is considered critical habitat for California red-legged frog.

California red-legged frog is a largely aquatic frog that is found at ponds and slow-moving streams with permanent or semi-permanent water, using vegetated shorelines or creek banks for cover and open water sites for reproduction. California red-legged frogs opportunistically migrate into upland habitats during normal dispersal and may aestivate in upland environments when aquatic sites are unavailable or environmental conditions are inhospitable. If aquatic sites are unavailable, they shelter from dehydration in a variety of refuges, including under boulders and downed wood, and in desiccation cracks of dry ponds (Alvarez 2004) and moist leaf litter or small-mammal burrows (USFWS 2010a).

California red-legged frogs generally lay their eggs on emergent vegetation in standing or slow-moving water, but they are known to breed in unvegetated pools (USFWS 2005). After hatching, the herbivorous larvae take 3.5 months (Storer 1925) to 13 months (Fellers et al. 2001) to mature, depending on water temperatures. Adults will consume essentially any invertebrate or vertebrate prey they can capture (Jennings and Hayes 1994; USFWS 2005; Zeiner et al. 1988). California red-legged frog is subject to predation by aquatic invertebrates, fish, amphibians, snakes, mammals, and larger birds.

Historically, California red-legged frogs were distributed along the coast from southern Mendocino County and inland from Redding, Shasta County southward to northwestern Baja California, Mexico (Jennings and Hayes 1994). Currently, this species occurs in isolated portions of the Sierra Nevada, northern Coast Ranges, and northern Transverse Ranges. It was believed to be extirpated from the southern Transverse and Peninsular Ranges until recently, when two populations were discovered.

The CNDDB (CDFW 2020b) reports 36 California red-legged frog sightings within 5 miles of the Study Area, with the most recent dated 2017. The majority of these sightings occur on the west side of San Luis Reservoir in Pacheco State Park and the San Luis Reservoir Wildlife Area. The sightings are congregated to the north and south of Dinosaur Point Road. CNDDB Occurrence Record #316 states that two adult frogs were observed in the Portuguese Creek Area, which is fed by San Luis Creek, dated 1999.

Table 3-2 identifies the locations of the assessed ponds relative to the Study Area and provides details about each pond's likelihood of providing California red-legged frog breeding habitat. Based on this desktop review, the entire Study Area is within the potential movement capabilities of California red-legged frog. During the March 2020 reconnaissance-level surveys, this species was observed at two ponds (Ponds 10 and 33), in the drainage below Pond 33, and in San Luis Creek (Table 3-2; Figure 3-9). All of these locations are located outside of the Study Area, but near or within the current inundation area. The California red-legged frog was observed in San Luis Creek and suspected to be using the area for dispersal. During the March 2020 surveys, an unidentified large ranid—likely a California red-legged frog—jumped into Pond 18 when biologists approached; bullfrogs were not identified in the watershed during surveys. Only one pond, Pond 44, is located in the Study Area and provides suitable breeding habitat, although numerous ponds surrounding the Study Area provide suitable breeding habitat and aquatic non-breeding habitat. The nearby rolling hills of non-native annual grasslands in and adjacent to the Study Area provide high-quality upland habitat for this species. Reservoir construction would affect an estimated 207.77 acres within designated critical habitat. Within this area, 18.3 acres are developed and do not support primary constituent elements for California red-legged frog, 30.57 acres are within the construction footprint, and 158.90 acres are within the future inundation footprint.

Tricolored Blackbird

Tricolored blackbird (*Agelaius tricolor*) is state listed as threatened.

Tricolored blackbirds usually nest in large flocks, with greater than 50 breeding pairs, in dense vegetation near water or by emergent wetlands. Nesting sites are typically associated with cattails, tules, willows, blackberry, and wild rose. Nests can be built a few centimeters above the ground or water level to 2 meters high. Nesting typically occurs from April to July, although it may extend later into the year. In the Sacramento Valley, breeding has been observed as late as October and November. During the non-breeding season, tricolored blackbirds can be found foraging in open habitats such as croplands and grassy fields. Their diet consists mostly of grains, but insects are occasionally eaten as well.

Tricolored blackbird is largely found in the Central Valley, extending into the south Coast Ranges from Monterey County south. Populations are also documented from the Peninsular Range near San Diego County and extreme Northern California.

The CNDDB (CDFW 2020b) reports seven tricolored blackbird sightings within 5 miles of the Study Area, with the most recent dated 2012. These records are all located on the east side of San Luis Reservoir. CNDDB Occurrence Record #34920 is located in the Study Area near the Basalt Area. The record states that 150 adults were observed using a marsh area surrounded by grasslands. During the March 2020 reconnaissance-level surveys, this species was observed at the State Parks Station near Basalt Campground in the Basalt Area. About a dozen non-breeding individuals were present. The Study Area provides suitable nesting habitat for tricolored blackbird. Therefore, this species has a high potential to occur locally, although potential breeding habitat in the Study Area is considered limited.

Golden Eagle

Golden eagle (*Aquila chrysaetos*) is a state fully protected species, is a USFWS Bird of Conservation Concern, and is protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Golden eagle is uncommon throughout California. It ranges from sea level to approximately 12,575 feet (3,833 meters) above mean sea level, using habitats in rolling foothills, mountain areas, sage-juniper flats, and desert. Grasslands, deserts, savannas, and early successional stages of forest and shrub habitats provide necessary foraging habitat. Golden eagles feed on lagomorphs, large rodents, birds, reptiles, and carrion. They often hunt in pairs, working cooperatively to bring down prey. Nests are placed on cliffs or large trees and are used for nesting in successive years. Golden eagles prefer to nest in open habitats with canyons and escarpments. Breeding occurs from late January through August (Beebe 1974).

The CNDDB (CDFW 2020b) has no reports of nesting golden eagles within 5 miles of the Study Area. During the March 2020 reconnaissance-level surveys, an eagle pair was observed in the Portuguese Creek Area of San Luis Reservoir. Additionally, golden eagle individuals were seen foraging at various locations throughout the reservoir. The Study Area provides suitable nesting habitat and the surrounding undeveloped parcels provide suitable foraging habitat. Therefore, this species has high potential to occur.

Western Burrowing Owl

Western burrowing owl (*Athene cunicularia*) is considered a California Species of Special Concern by CDFW. Although this designation does not provide formal protection for the species or its habitat under the FESA or the CESA, potential impacts on burrowing owls and their nests fall under the jurisdiction of the Migratory Bird Treaty Act, CEQA, and Sections 3500, 3503.5, and 3800 of the Fish and Game Code.

Burrowing owl is a small, ground-nesting bird that is predominantly nocturnal but is also active during the day. Burrowing owls are found in a variety of habitats that include annual grasslands with mammal burrows. Burrowing owls require low vegetative cover and adequate perch sites from which to forage and to act as lookout points for predators. Burrowing owls also require level to gently sloping areas (Haug et al. 1993; Dechant et al. 2003). Specifically, breeding habitat includes annual grasslands, shortgrass prairie, pastures, hayfields, and fallow fields (Dechant et al. 2003). Burrowing owls also occur in a variety of urban and agricultural habitats: areas adjacent to roads and railroads, irrigation ditches, golf courses, airports, university campuses, and vacant dirt lots where grasses are regularly mowed (Coulombe 1971; Thomsen 1971; Collins and Landry 1977; Trulio 1995; Dechant et al. 2003).

Burrowing owls are opportunistic feeders. Their diet consists primarily of arthropods (e.g., spiders, beetles, grasshoppers, crickets, earwigs, crustaceans), in addition to small mammals (e.g., voles, mice, pocket mice, kangaroo rats) and birds (e.g., blackbirds, horned larks, mourning doves) and, to a lesser extent, reptiles and amphibians (Haug and Oliphant 1990).

Burrow availability is a major factor in defining suitable burrowing owl habitat (Coulombe 1971; Green and Anthony 1989). Most importantly, western burrowing owls require the presence of a mammal burrow or cavity (natural or human-made) that is the appropriate size for a nest burrow. Although western burrowing owls can excavate holes where burrowing mammals are absent, they rarely do so (Thomsen 1971). Throughout California, western burrowing owls primarily use California ground squirrel burrows. Burrowing owls also use human-made cavities for nest burrows. Examples include pipes, culverts, rock piles, concrete debris, and artificial burrows.

Burrowing owls range from the southern portions of the western Canadian provinces through southern Mexico and western Central America. They are also found in Florida and many Caribbean islands. In South America, they are patchy in the northwest and through the Andes, but widely distributed from southern Brazil to Patagonia and Tierra del Fuego. Burrowing owls are year-round residents in most of their range. Birds that breed in Canada and the northern United States usually migrate south to Mexico and the southern U.S. during winter months.

Burrowing owls tend to stay close to the nest burrow during the day and forage farther from the nest between dusk and dawn (Haug 1985; Haug and Oliphant 1990). According to a study conducted in California's Central Valley, average home range size during the breeding season varied between 242 and 343 acres (98 and 139 hectares) (Gervais et al. 2003). Although home range includes the nest territory and overall foraging areas, most foraging efforts of male owls tend to be concentrated within 1,968.5 feet (600 meters) of the nest (Gervais et al. 2003; Rosenberg and Haley 2004).

Burrowing owls are year-round residents in much of California (Shuford and Gardali 2008). Relatively little is known about migration routes, times, and wintering areas (Haug et al. 1993). However, observations indicate that populations of western burrowing owl in the northernmost and highest-elevation portions of the species' range are migratory. The migratory individuals leave their breeding grounds in the fall, around September or October, and return to the same or nearby burrows each spring, around March or April (Center for Biological Diversity 2003; Klute et al. 2003). Wintering areas include Arizona, California, New Mexico, Oregon, Texas, and Mexico south to western Panama (Klute et al. 2003).

California supports a large wintering population of burrowing owls. Many of the wintering individuals are assumed to come from snow-covered areas where burrows and food are inaccessible (Center for Biological Diversity 2003).

The primary threats to western burrowing owl across its North American range are habitat loss and fragmentation, resulting primarily from intensive agricultural and urban development, and habitat degradation caused by declining populations of colonial burrowing mammals and non-native grasses (Dechant et al. 2003). Other human-made threats to burrowing owl populations include vehicle collisions, destruction of burrows by disking or grading, increased predation by feral dogs and cats, shooting, and harassment.

The CNDDB (CDFW 2020b) reports nine occurrences within 5 miles of the Study Area, occurring predominantly on the east side of San Luis Reservoir. The most recent CNDDB occurrence record—#2006, dated 2016—is located northwest of the Study Area. This record states that one adult was flushed from grazed annual grasslands at the confluence of steep hills and an alluvial plain, and retreated to a large burrow.

During the March 2020 reconnaissance-level surveys, this species was observed in the rocky annual grasslands near Pond 10 in Lone Oak Bay, the southeastern area of San Luis Reservoir. Habitat included steep rocky hills with actively grazed annual grasslands. The Study Area provides pockets of patchily distributed ground squirrel burrows, and grazed annual grasslands provide potential foraging habitat. Some grasslands in the Study Area would not provide suitable habitat based on the height of the grass and absence of burrows. Therefore, western burrowing owl has high potential to occur in the Study Area.

Swainson's Hawk

Swainson's hawk (*Buteo swainsoni*) is a state-listed threatened species.

Swainson's hawks are medium-sized opportunistic predators that feed on rodents, rabbits, bats, large arthropods, amphibians, reptiles, birds, and rarely, fish. This species arrives in California in late February and departs for wintering grounds in early September. Eggs are typically laid in April and early May. Swainson's hawks reside in a wide variety of open habitats, including prairies, grasslands, and intensively farmed areas. They nest on platforms of sticks, bark, fresh leaves in a tree, bush, or utility pole that is 4 to 100 feet above ground. Nests are usually constructed in riparian corridors adjacent to agricultural fields or pastures.

Swainson's hawks were historically distributed throughout the lowlands of California, absent only from the Sierra Nevada, north Coast Ranges, and Klamath Mountains, and portions of the Southern California deserts. Currently, the highest density occurs in the Central Valley, between Sacramento and Modesto, and in the northern San Joaquin Valley.

The CNDDB (CDFW 2020b) reports nine occurrences within 5 miles of the Study Area, with the most recent dated 2016 and predominantly occurring on the northeastern side of O'Neill Forebay. The two most recent CNDDB occurrence records, #2715 and #2716, are located northeast of the Study Area. These records state that the birds were nesting in a eucalyptus tree and in a small grove of oak trees, but surrounded by grasslands actively used for cattle grazing. This species was not observed during the March 2020 reconnaissance-level surveys. The Study Area provides suitable foraging grassland habitat along with potential suitable nesting locations. Therefore, Swainson's hawk has moderate potential to nest and forage in the Study Area.

Ferruginous Hawk

Ferruginous hawk (*Buteo regalis*) is not a listed species or a California Species of Special Concern, but this species is on a CDFW watch list.

Ferruginous hawk is a winter resident of California, with no breeding records throughout the state. This species is uncommon at lower elevations and in open grasslands in the Modoc Plateau, Central Valley, and Coast Ranges, but common in grasslands and agricultural areas in southwestern California (Garrett and Dunn 1981). Ferruginous hawk frequents open grasslands, sagebrush flats, desert scrub, and low foothills of surrounding valleys and fringes of pinyon-juniper habitats. They feed on lagomorphs, ground squirrels, and mice, but will also eat birds, reptiles, and amphibians. Ferruginous hawks roost in open areas, usually in a lone tree or a utility pole.

The CNDDB (CDFW 2020b) reports 15 wintering occurrences within 5 miles of the Study Area, with the most recent dated 2013 and predominantly occurring on the southeastern side of San Luis Reservoir. All of these records state that between one and five wintering individuals were observed in open grasslands. During the March 2020 reconnaissance-level surveys, this species was observed in the northwest area of San Luis Reservoir and at the Basalt Boat Launch in the southeastern area of the reservoir. The Study Area provides suitable foraging grassland habitat along with numerous roost and perch locations. The surrounding undeveloped parcels around the Study Area additionally provide foraging habitat. Minimal to no suitable nesting habitat for this species exists in the Study Area. Therefore, wintering ferruginous hawk has moderate potential to occur in the Study Area.

Northern Harrier

Northern harrier (*Circus hudsonius*) is considered a California Species of Special Concern by CDFW. Although this designation does not provide formal protection for the species or its habitat under the FESA or the CESA, potential impacts on northern harriers and their nests fall under the jurisdiction of the Migratory Bird Treaty Act, CEQA, and Sections 3500, 3503.5, and 3800 of the Fish and Game Code.

Northern harriers occur year-round in the Central Valley, along the coast, in the Sierra Nevada, and in northeastern California. They winter throughout California in suitable habitat including meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands, and very occasionally in wooded areas. Suitable foraging habitat consists of open areas, such as grassland or agricultural fields, where they can fly close to the ground. Northern harriers roost on the ground in tall grasses or emergent wetland species including cattails. Nesting habitat occurs primarily in marshes or emergent wetlands or along rivers or lakes, and occasionally in grasslands, grain fields, or on sagebrush flats. Nesting season occurs from April to September (Craighead and Craighead 1956).

The CNDDB (CDFW 2020b) reports three occurrences within 5 miles of the Study Area, with the most recent dated 2001. Two CNDDB occurrence records are located around O'Neill Forebay (Occurrences #41 and #42). The other record, Occurrence #39, is located on the west side of San Luis Reservoir directly adjacent to Dinosaur Point Road. This record states that two adults were observed breeding in steep annual grasslands. During the March 2020 reconnaissance-level surveys, this species was observed foraging in the grasslands at Honker Bay, in the northwestern arm of San Luis Reservoir. The Study Area provides suitable foraging grassland habitat along with potential suitable nesting locations at water sources with marsh vegetation. Therefore, northern harrier has moderate potential to occur in the Study Area.

Prairie Falcon

Prairie falcon (*Falco mexicanus*) is not a listed species or a California Species of Special Concern, but this species is on a CDFW watch list.

Prairie falcon is an uncommon permanent resident that ranges from southeastern deserts northwest throughout the Central Valley and along the inner Coast Ranges and Sierra Nevada. These birds can be found primarily using perennial grasslands, savannas, rangeland, some agricultural fields, and desert scrub. Prairie falcons feed on small mammals, some small birds, and reptiles. This species nests in open terrain with canyons, cliffs, escarpments, and rock outcrops. The nest is usually a scrape on a sheltered ledge or cliff overlooking a large area. Prairie falcons will use old raven or eagle nests.

The CNDDB (CDFW 2020b) reports 13 occurrences within 5 miles of the Study Area, with the most recent dated 1998. The occurrence records for this species are mapped as entire USGS 7.5-minute quadrangles. These quadrangles are located to the south, southwest, and west of the Study Area. The CNDDB provides few to no details about habitat use for these records. This species was not observed during the March 2020 reconnaissance-level surveys. The Study Area provides suitable foraging grassland habitat and forages in the undeveloped parcels surrounding the Study Area. The Study Area is within the known wintering range for this species. Therefore, prairie falcon has moderate potential to occur in the Study Area.

Bald Eagle

Bald eagle (*Haliaeetus leucocephalus*) is a state-listed endangered, state fully protected, and federally delisted species. This species is also protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act.

Bald eagles are permanent residents and uncommon winter migrants in California. Breeding is now mostly restricted to Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity Counties. This species is generally found near large bodies of water, or free-flowing rivers with abundant fish. Bald eagles require adjacent snags and perches near water for foraging and nesting. Bald eagles prefer eating fish, and they seek out aquatic habitats for foraging (Buehler 2000). However, they will feed opportunistically, feeding on a variety of mammals and birds. Typical nesting areas for bald eagles are in forested areas, relatively close (usually less than approximately 1.24 miles [2 kilometers]) to water. Their nest is a stick platform placed below the tree crown, 50 to 200 feet above ground. Breeding begins in February through July, with a peak in March to June.

The CNDDB (CDFW 2020b) reports one occurrence within 5 miles of the Study Area, dated 2011, located to the north near Cottonwood Bay. This occurrence record, #365, states that one adult was observed at a nest with eggs or young. During the March 2020 reconnaissance-level surveys, a bald eagle nest was identified outside of the Study Area near Pond 12, on the southwest side of San Luis Reservoir by Lone Oak Bay. The Study Area and reservoir provide suitable foraging habitat, along with potential suitable nesting locations in adjacent trees. Therefore, bald eagle has high potential to occur in the Study Area.

Other Nesting Birds

Fish and Game Code Sections 3503 and 3503.5 and the Migratory Bird Treaty Act protect raptors and passerines and their eggs and nests from incidental take. These protections apply to the special-status birds identified in Attachment B, Table B-2, and other common birds that may nest in or near the Study Area.

American Badger

American badger (*Taxidea taxus*) is considered a California Species of Special Concern by CDFW.

American badgers are uncommon, permanent residents throughout California, except in the northern North Coast area (Grinnell et al. 1937). They are most abundant in dry, open habitats including grassland and open woodland with friable soils. Suitable burrowing habitat requires dry, often sandy soil. American badgers frequently reuse old burrows, although some may dig a new den each night (Messick and Hornocker 1981). Badgers are carnivorous and eat fossorial rodents such as rats, mice, chipmunks, ground squirrels, and pocket gophers. Some will eat reptiles, insects, earthworms, eggs, birds, and carrion, with their diet shifting seasonally and yearly. American badgers breed in summer and early fall, with young born from March to April (Long 1973).

The CNDDB (CDFW 2020b) reports 11 occurrences within 5 miles of the Study Area, with the most recent dated 2014. These occurrences are predominantly located on the northeastern or east side of San Luis Reservoir. The most recent occurrence record, #493, is located west of San Luis Reservoir, just south of SR 152. This record states that one adult was observed using blue and valley oak savanna habitat with non-native annual grasslands. The habitat was actively used for cattle grazing. This species was not observed during the March 2020 surveys. The Study Area provides suitable grassland foraging habitat, along with suitable denning locations. Therefore, American badger has high potential to occur in the Study Area.

San Joaquin Kit Fox

San Joaquin kit fox (*Vulpes macrotis mutica*) is federally listed as endangered and state listed as threatened. Critical habitat has not been designated for this species.

San Joaquin kit fox is the smallest fox in North America, with an average body length of 20 inches and a weight of about 5 pounds. It is a member of the Canidae family, which includes dogs, wolves, and foxes. San Joaquin kit foxes are lightly built, with long legs and large ears. Their coat ranges from tan to buffy gray in the summer to silvery gray in the winter. Their belly is whitish and their tail is black-tipped.

The diet of the San Joaquin kit fox varies geographically, seasonally, and annually, based on the abundance of prey. In the southern part of the range, one-third of the kit fox's diet consists of kangaroo rats (*Dipodomys* spp.), pocket mice (*Perognathus* spp.), white-footed mice (*Peromyscus* spp.), and other nocturnal rodents (USFWS 2010b). In the northern portion of the range (San Joaquin, Alameda, and Contra Costa Counties), kit foxes most often prey on California ground squirrel (*Otospermophilus beecheyi*). Kit foxes also prey on black-tailed hare (*Lepus californicus*), San Joaquin antelope squirrel (*Ammospermophilus nelsoni*), desert cottontail (*Sylvilagus audubonii*), ground-nesting birds, and insects (USFWS 2010b).

Dens are used for temperature regulation, shelter from adverse weather, and protection from predators. Kit foxes either dig their own dens, use those constructed by other animals, or use human-made structures (culverts, abandoned pipelines, or banks in sumps or roadbeds). Kit foxes often change dens and many dens may be used throughout the year. However, evidence that a den is being used by kit foxes may be absent (USFWS 2010b).

Kit foxes can breed when they are 1 year old. Adult pairs stay together all year. During September and October, females begin to clean and enlarge their pupping dens. Mating occurs between December and March. Litters of two to six pups are born in February or March. Pups emerge from the den after about a month (USFWS 2010b).

San Joaquin kit fox is a permanent resident of arid grasslands and open scrubland, where friable soils are present. Historically the species' habitat included native alkali marsh and saltbush scrub of the valley floor, but the availability of such habitats has diminished markedly as a result of agricultural conversion. Grasslands with friable soils are considered the principal habitat for denning, foraging, and dispersal, while open oak woodlands provide lower quality foraging and dispersal habitat.

The availability of suitable den sites is a critical habitat requirement for San Joaquin kit foxes throughout the year, both as shelter and to escape predators. Individuals range over a broad area that may exceed several hundred acres, using 30 or more dens. During their normal movement, kit foxes may also traverse "non-habitat" areas that do not appear to provide obvious benefits to this species in terms of prey availability or den availability; however, the continued availability of such connectivity corridors is considered key to maintaining regional connectivity between kit fox populations.

San Joaquin kit foxes occur only in and around California's Central Valley, inhabiting open habitat in the San Joaquin Valley and surrounding foothills. Kit fox population densities are greatest in the southern portion of the species' range. Populations in the northern portion of the range are highly fragmented and sparsely distributed (Orloff et al. 1986).

In the northern portion of its range, kit fox is present primarily in foothill grasslands because much of the species' former habitat on the valley floor has been eliminated. The northern population has different habitat characteristics than the southern population. Orloff found that the northern population's habitats have steeper slopes than those of the southern population, with slopes of up to 40 degrees for the northern population and dens on slopes ranging from 2 to 14 percent (Orloff et al. 1986). Thus, slope is important to keep in mind when considering potential effects on kit fox and the suitability of mitigation lands for this species.

Kit foxes have been observed to use areas with low to moderate slopes (Morrell 1971, 1975; O'Farrell et al. 1980; O'Farrell and McCue 1981; Orloff et al. 1986). However, this species prefers to dwell and migrate on relatively flat or low-gradient slopes (e.g., less than 15 degrees) rather than on more extreme slopes (Orloff et al. 1986).

Most studies quantify only the slopes where dens are found, and do not quantify slopes in dispersal areas. Morrell (1971) studied kit fox in Kern County and found that most dens were on flat or gently sloping ground; some were on hillsides of up to 30 degrees. Dens on very steep slopes were rare. Koopman et al. (2001) conducted a telemetry study in Kern County and found that most kit foxes used slopes that were generally less than 6 degrees. The mean slope for movements was 3.3 degrees (range = 0 to 71 degrees), with only 0.9 percent of movements occurring on slopes greater than 6 degrees. A study at Camp Roberts in Monterey County showed that the average slope of hillsides with dens was 19 degrees (Reese et al. 1992).

The CNDDB (CDFW 2020b) reports 18 occurrences of San Joaquin kit fox within 5 miles of the Study Area, with the most recent dated 2005. These occurrences are predominantly located on the east side of San Luis Reservoir. The most recent occurrence records (#125, #127, and #211) are all located on the southeast side of the reservoir in annual grasslands. Two records report only one adult observed, while Occurrence Record #125 reports kit fox at this location since 1984 with natal dens. This species was not identified during the March 2020 reconnaissance-level surveys. The Study Area provides suitable grassland foraging habitat, potential prey throughout, and suitable denning locations. Burrows of suitable size were markedly absent during the March 2020 reconnaissance-level surveys, although the Study Area has connectivity to sparsely populated ranch lands to the northeast, east, and southeast. Therefore, San Joaquin kit fox has moderate potential to occur in the Study Area.

3.4 Critical Habitat for Listed Fish and Wildlife Species

USFWS defines the term *critical habitat* in the FESA as a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. **Figure 3-10** shows the locations of USFWS-designated critical habitat in and near the Study Area. The Study Area is within designated critical habitat for California red-legged frog. The entire west side of San Luis Reservoir from Cottonwood Bay to the San Luis Creek Area is considered critical habitat for this species. The Study Area does not include designated critical habitat for California tiger salamander.

SOURCE: ESA, 2020; National Hydrology Dataset, 2020; Imagery-ESRI, 2020; USFWS, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Critical Habitat
- California red-legged frog
- California tiger salamander

Water Flowline
- Pipeline
- Stream/River

ESA

Figure 3-10
USFWS Designated Critical Habitat in Proximity to the Study Area

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CHAPTER 4
References and Report Preparation

4.1 References

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Attachment A
Regulatory Context

ESA

ATTACHMENT A
Regulatory Context

Federal

U.S. Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) administers the Federal Endangered Species Act (FESA) (16 United States Code [USC] 153 et seq.), the Migratory Bird Treaty Act (MBTA) (16 USC 703–711), and the Bald and Golden Eagle Protection Act (16 USC 668). These regulations are described below.

Federal Endangered Species Act

Under the FESA, the Secretary of the Interior and Secretary of Commerce have joint authority to list a species as threatened or endangered (16 USC Section 1533[c]). Two federal agencies oversee the FESA: USFWS has jurisdiction over plants, wildlife, and resident fish, while the National Marine Fisheries Service (NMFS) has jurisdiction over anadromous fish and marine fish and mammals. Section 7 of the FESA mandates that federal agencies consult with USFWS and NMFS to ensure that federal agency actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species. The FESA prohibits the "take"[3] of any fish or wildlife species listed as threatened or endangered, including the destruction of habitat that could hinder species recovery.

Section 10 requires the issuance of an incidental take permit before any public or private action may be taken that could take an endangered or threatened species. The permit requires preparation and implementation of a habitat conservation plan that would offset the take of individuals that may occur, incidental to implementation of a proposed project, by providing for the protection of the affected species.

The FESA specifies that a federal agency reviewing a project within its jurisdiction must determine whether any federally listed threatened or endangered species may be present in the project area, and whether the proposed action will have a potentially significant impact on such species. The agency also must determine whether the proposed action is likely to jeopardize the continued existence of any species proposed to be listed under the FESA, or to result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC Sections 1536[3] and 1536[4]). No federal actions apply to the current Study Area.

3 *Take* is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct.

Critical Habitat

USFWS designates *critical habitat* for listed species under the FESA. Critical habitat designations are specific areas within the geographic region that are occupied by a listed species and are determined to be critical to the species' survival and recovery in accordance with the FESA. Federal entities issuing permits or acting as lead agencies must show that their actions do not negatively affect the critical habitat to the extent that it impedes the recovery of the species. The Study Area is not within designated critical habitat.

Migratory Bird Treaty Act

The MBTA (16 USC Sections 703–711) affirms and implements a commitment by the United States to four international conventions (with Canada, Mexico, Japan, and Russia) for the protection of a shared migratory bird resource. This law prohibits intentionally pursuing, hunting, taking, capturing, or killing migratory birds anywhere in the United States, unless and except as permitted by regulations. The law also applies to the intentional disturbance and removal of nests occupied by migratory birds or their eggs during the breeding season.

On December 22, 2017, the United States Department of the Interior redefined *incidental take* under the MBTA to state that "the MBTA's prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control."[4] Thus, the federal MBTA definition of *take* does not prohibit or penalize the incidental take of migratory birds that results from actions that are performed without motivation to harm birds. This interpretation differs from the prior federal interpretation of take, which prohibited all incidental take of migratory birds, whether intentional or incidental.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act, enforced by USFWS, makes it illegal to import, export, take (which includes molest or disturb), sell, purchase, or barter any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) or parts thereof.

United States Army Corps of Engineers

Clean Water Act, Section 404

The United States Army Corps of Engineers administers Section 404 of the Clean Water Act. Section 404 regulates activities in wetlands and "other waters of the United States." Wetlands are a subset of waters of the United States that are defined as follows in Code of Federal Regulations (CFR) Title 33, Section 328.3(a) and Title 40, Section 230.3(s) (33 CFR 328.3[a] and 40 CFR 230.3[s]):

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4 United States Department of the Interior. 2017. *The Migratory Bird Treaty Act Does Not Prohibit Incidental Take*. Office of the Solicitor, Memorandum (M-37050) to Secretary, Deputy Secretary, Assistant Secretary for Land and Minerals Management, and Assistant Secretary for Fish and Wildlife and Parks Department, December 22, 2017.

(1) All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide.

(2) All interstate waters including interstate wetlands. (Wetlands are defined by the federal government [33 CFR 328.3(b), 1991] as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances support, a prevalence of vegetation typically adapted for life in saturated soil conditions).

(3) All other waters—such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds—the use, degradation, or destruction of which could affect interstate or foreign commerce. This includes any waters with the following current or potential uses:

- That are or could be used by interstate or foreign travelers for recreational or other purposes,
- From which fish or shellfish are or could be taken and sold in interstate or foreign commerce, or
- That are used or could be used for industrial purposes by industries in interstate commerce.

(4) All impoundments of waters otherwise defined as waters of the United States under the definition.

(5) Tributaries of waters identified in paragraphs (1) through (4).

(6) Territorial seas.

(7) Wetlands next to waters identified in paragraphs (1) through (6).

(8) Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area’s status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding the Clean Water Act jurisdiction remains with the U. S. Environmental Protection Agency (328.3[a][8] added 58 CFR 45035, August 25, 1993).

Regulatory waters under the jurisdiction of the United States Army Corps of Engineers do not occur in the Study Area and would not be affected by proposed activities.

State

California Department of Fish and Wildlife

The California Department of Fish and Wildlife (CDFW) administers laws and programs designed to protect fish and wildlife resources under the Fish and Game Code, such as the California Endangered Species Act (CESA) (Fish and Game Code Section 2050 et seq.), Fully Protected Species (Section 3511), the Native Plant Protection Act (Sections 1900 to 1913), and the Lake or Streambed Alteration Agreement Program (Sections 1600 to 1616). These regulations are described below.

California Endangered Species Act

In 1984, the State of California implemented the CESA, which prohibits the take of state-listed endangered and threatened species, although habitat destruction is not included in the state's definition of take. Section 2090 requires state agencies to comply with endangered species protection and recovery laws and regulations and to promote conservation of these species. CDFW administers the act and authorizes take through California Fish and Game Code Section 2081 agreements (except for designated fully protected species; see below). Unlike its federal counterpart, the CESA also applies to candidate species that have been petitioned for listing.

Regarding listed rare and endangered plant species, CESA defers to the California Native Plant Protection Act (described below).

California Fish and Game Code Sections 3503, 3503.5, and 3513

Under these sections of the Fish and Game Code, the project operator is not allowed to conduct activities that would result in the take, possession, or destruction of any birds of prey; the take or possession of any migratory nongame bird; the take, possession, or needless destruction of the nest or eggs of any raptors or nongame birds; or the take of any nongame bird pursuant to Fish and Game Code Section 3800. Section 3513 adopts the United States Department of the Interior's take provisions under the MBTA.[5]

Native Plant Protection Act

California Fish and Game Code Section 1900–1913, also known as the Native Plant Protection Act, is intended to preserve, protect, and enhance endangered or rare native plants in California. The act directs CDFW to establish criteria for determining which native plants are endangered or rare. Under Section 1901, a species is considered *endangered* when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species is considered *rare* when, although not threatened with immediate extinction, it is in such small numbers throughout its range that it may become endangered. The act also directs the California Fish and Game Commission to adopt regulations governing the take, possession, propagation, or sale of any endangered or rare native plant.

Vascular plants that are identified as rare by CDFW, but that may have no designated status or protection under federal or state endangered species laws or regulations, are defined using the following California Rare Plant Ranks (CRPRs):

- **Rank 1A:** Plants presumed extinct.
- **Rank 1B:** Plants rare, threatened, or endangered in California and elsewhere.

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5 Assembly Bill 2627, introduced in February 2018, would amend Section 3513 of the Fish and Game Code relating to migratory birds. The bill would amend California law to clarify that the State of California may issue orders, rules, or regulations that are more protective of migratory nongame birds than the rules or policies set forth by the United States Department of the Interior. Assembly Bill 2627 would not, in itself, restore incidental take protection to migratory nongame birds in California.

- **Rank 2:** Plants rare, threatened, or endangered in California, but more numerous elsewhere.
- **Rank 3:** Plants about which more information is needed—a review list.
- **Rank 4:** Plants of limited distribution—a watch list.

In general, CRPR 1A, 1B, and 2 plants are considered to meet the criteria of California Environmental Quality Act (CEQA) Guidelines Section 15380, and effects on these species are considered "significant" in environmental impact reports. CRPR 1A, 1B or 2 plants also meet the definition of Section 1901, Chapter 10 (Native Plant Protection Act) and Sections 2062 and 2067 (California Endangered Species Act) of the California Fish and Game Code.

Lake or Streambed Alteration Program

CDFW regulates activities that would interfere with the natural flow of, or substantially alter, the channel, bed, or bank of a lake, river, or stream. Fish and Game Code Section 1602 requires that CDFW be notified of lake or stream alteration activities. If, after the notification is complete, CDFW determines that the activity may substantially adversely affect an existing fish and wildlife resource, CDFW is authorized to issue a streambed alteration agreement under Fish and Game Code Section 1603.

Requirements to protect the integrity of biological resources and water quality are often conditions of streambed alteration agreements. These requirements may include avoiding or minimizing the use of heavy equipment within stream zones, limiting work periods to avoid impacts on wildlife and fisheries resources, and restoring degraded sites or compensating for permanent habitat losses.

Species of Special Concern

CDFW maintains lists for candidate-endangered species and candidate-threatened species. California candidate species are afforded the same level of protection as listed species. California also designates *species of special concern*, which are species of limited distribution, declining populations, diminishing habitat, or unusual scientific, recreational, or educational value. These species do not have the same legal protection as listed species or fully protected species, but may be added to official lists in the future. CDFW intends the species of special concern list to be a management tool for consideration in future land use decisions.

State Water Resources Control Board

Porter-Cologne Water Quality Control Act

The State Water Resources Control Board, through its nine regional water quality control boards, regulates waters of the state through the California Clean Water Act (i.e., Porter-Cologne Water Quality Control Act). If the United States Army Corps of Engineers determines that wetlands or other waters are isolated waters and not subject to regulation under the federal Clean Water Act, the regional water quality control board may choose to exert its jurisdiction over these waters under the Porter-Cologne Water Quality Control Act as waters of the state.

CEQA Guidelines Section 15380

CEQA Guidelines Section 15380(b) provides that a species not on the federal or state list of legally protected threatened or endangered species may be considered rare or endangered if the species can be shown to meet certain specific criteria. These criteria have been modeled after the definition of the FESA and the section of the Fish and Game Code that discusses rare or endangered plants or animals. This section was included in the CEQA Guidelines primarily for situations in which a public agency is reviewing a project that may have a significant effect on a candidate species that has not yet been listed by CDFW or USFWS. CEQA provides the ability to protect species from potential project impacts until the respective agencies have the opportunity to designate the species' protection.

CEQA also specifies the protection of other locally or regionally significant resources, including natural communities or habitats. Although natural communities do not presently have legal protection, CEQA requires an assessment of such communities and potential project impacts. Natural communities identified as sensitive in the CNDDB are considered by CDFW to be significant resources and fall under the CEQA Guidelines for addressing impacts. Local planning documents such as general and area plans often identify natural communities.

Attachment B
Plant Species Observed in the Study Area in March 2020

ESA

ATTACHMENT B

Plant Species Observed in the Study Area in March 2020

TABLE B-1
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020

Plant Family	*Scientific Name*	Common Name
Adoxaceae	*Sambucus nigra* ssp. *caerulea*	blue elderberry
Agavaceae	*Chlorogalum pomeridianum* var. *pomeridianum*	common soaproot
Alliaceae	*Allium serra*	jeweled onion
Anacardiaceae	*Toxicodendron diversilobum*	poison oak
Apiaceae	*Apium graveolens*	garden celery
	Conium maculatum	poison hemlock
	Daucus pusillus	wild carrot
	Eryngium sp.	button celery
	Lomatium utriculatum	common lomatium
	Sanicula bipinnata	poison sanicle
	Sanicula bipinnatifida	purple sanicle
	Sanicula crassicaulis	Pacific sanicle
	Torilis arvensis	field hedge parsley
	Yabea microcarpa	California hedge parsley
Apocynaceae	*Asclepias fascicularis*	narrow leaf milkweed
Araceae	*Lemna* sp.	duckweed
Araliaceae	*Hydrocotyle ranunculoides*	floating marsh pennywort
Asteraceae	*Achyrachaena mollis*	soft blow wives
	Agoseris sp.	dandelion
	Artemisia californica	California sagebrush
	Artemisia douglasiana	mugwort
	Baccharis pilularis ssp. *pilularis*	coyote brush
	Baccharis salicifolia	mule fat
	Carduus pycnocephalus	Italian thistle
	Centaurea melitensis	Maltese star thistle
	Cirsium vulgare	bull thistle
	Corethrogyne filaginifolia	common sandaster
	Cotula coronopifolia	brass buttons
	Cynara cardunculus	artichoke thistle
	Dittrichia graveolens	stinkwort
	Ericameria linearifolia	interior goldenbush
	Grindelia camporum	common gumplant

**TABLE B-1 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020**

Plant Family	*Scientific Name*	Common Name
	Grindelia hirsutula	hairy gumweed
	Helminthotheca echioides	Bristly ox-tongue
	Hesperevax sparsiflora var. *sparsiflora*	few flowered evax
	Hypochaeris glabra	smooth cat's ear
	Hypochaeris radicata	hairy cat's ear
	Lasthenia californica subsp. *californica*	Clifornia goldfields
	Layia gallardioides	woodland layia
	Layia platyglossa	tidy tips
	Logfia filaginoides	California cottonrose
	Logfia gallica	narrowleaf cottonrose
	Matricaria discoidea	pineapple weed
	Micropus californicus	slender cottonweed
	Microseris acuminata	Sierra foothills microseris
	Microseris sylvatica	sylvan scorzonella
	Pseudognaphalium luteoalbum	Jersey cudweed
	Psilocarphus tenellus	slender wooly heads
	Senecio vulgaris	common groundsel
	Silybum marianum	milk thistle
	Sonchus asper	spiny sow thistle
	Sonchus oleraceus	sow thistle
	Taraxacum officinale	common dandelion
	Uropappus lindleyi	silver puffs
	Xanthium spinosum	spiny cocklebur
	Xanthium strumarium	rouch cocklebur
Boraginaceae	*Amsinckia intermedia*	common fiddleneck
	Amsinckia menziesii	small flowered fiddleneck
	Nemophila menziesii var. *atomaria*	baby blue eyes
	Nemophila parviflora var. *parviflora*	small flowered nemophila
	Phacelia sp.	phacelia
	Pholistoma auritum	fiesta flower
	Plagiobothrys canescens	valley popcorn flower
	Plagiobothrys fulvus	fulvous popcorn flower
	Plagiobothrys nothofulvus	rusty popcorn flower
Brassicaeae	*Athysanus pusillus*	dwarf athysanus
	Brassica nigra	black mustard
	Capsella bursa-pastoris	shepherd's purse
	Cardamine californica	bitter cress
	Cardamine oligosperma	Idaho bittercress
	Hirschfeldia incana	wild mustard
	Lepidium latifolium	perennial pepperweed
	Lepidium nitidum	shining pepper grass
	Nasturtium officinale	watercress
	Sinapis arvensis	charlock mustard
	Sisymbrium irio	London rocket

**TABLE B-1 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020**

Plant Family	*Scientific Name*	Common Name
	Thysanocarpus curvipes	common fringe pod
	Thysanocarpus laciniatus	narrow leaved lacepod
	Tropidocarpum gracile	slender tropidocarpum
Caryophyllaceae	*Cerastium glomeratum*	large mouse ears
	Sagina sp.	pearlwort
	Silene gallica	common catchfly
	Stellaria media	chickweed
Casuarinaceae	*Casuarina equisetifolia*	Australian pine tree
Chenopodiaceae	*Atriplex lentiformis*	big saltbush
	Atriplex semibaccata	Australian saltbush
	Chenopodium sp.	goosefoot
	Dysphania ambrosioides	Mexican tea
	Salsola tragus	tumbleweed
Cleomaceae	*Peritoma arborea* var. *globosa*	bladderpod
Convolvulaceae	*Calystegia* sp.	morning glory
Crassulaceae	*Crassula* sp.	pygmy weed
	Dudleya cymosa ssp. *paniculata*	canyon live forever
	Sedum sp.	stonecrop
Cucurbitaceae	*Marah fabacea*	California man-root
Cyperaceae	*Cyperus* sp.	nutsedge
	Eleocharis macrostachya	common spike rush
Euphorbiaceae	*Croton setiger*	turkey-mullein
	Euphorbia peplus	petty spurge
Fabaceae	*Acmispon americanus*	Spanish lotus
	Acmispon brachycarpus	short podded lotus
	Acmispon wrangelianus	Chilean trefoil
	Astragalus gambelianus	dwarf loco weed
	Astragalus oxyphysus	Stanislaus milkvetch
	Lathyrus vestitus	canyon sweet pea
	Lupinus albifrons	silver bush lupine
	Lupinus bicolor	miniature lupine
	Lupinus microcarpus	chick lupine
	Lupinus nanus	sky lupine
	Medicago polymorpha	bur clover
	Melilotus indicus	annual yellow sweetclover
	Prosopis glandulosa var. *torreyana*	Western honey mesquite
	Robinia pseudoacacia	black locust
	Trifolium albopurpureum	Indian clover
	Trifolium depauperatum	cowbag clover
	Trifolium microcephalum	maiden clover
	Trifolium oliganthum	few flowered clover
	Trifolium variegatum	white tipped clover
	Trifolium willdenovii	tomcat clover
	Vicia sativa	spring vetch

TABLE B-1 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020

Plant Family	***Scientific Name***	**Common Name**
	Vicia villosa	hairy vetch
Fagaceae	*Quercus douglasii*	blue oak
Geraniaceae	*Erodium botrys*	big heron bill
	Erodium brachycarpum	shortfruit stork's bill
	Erodium cicutarium	coastal heron's bill
	Erodium moschatum	musky stork's bill
	Geranium dissectum	cranesbill
Grossulariaceae	*Ribes quercetorum*	oak gooseberry
Juncaceae	*Juncus balticus*	wire rush
	Juncus bufonius	toad rush
	Juncus xiphioides	iris leaved rush
Lamiaceae	*Lamium amplexicaule*	giraffe head
	Marrubium vulgare	white horehound
	Pogogyne serpylloides	thyme leaf mesa mint
	Stachys sp.	hedge nettle
	Trichostema lanceolatum	vinegarweed
Lythraceae	*Lythrum hyssopifolia*	hyssop loosestrife
Malvaceae	*Sidalcea malviflora*	checker bloom
	Malvella leprosa	alkali mallow
Montiaceae	*Calandrinia menziesii*	red maids
	Claytonia perfoliata	miner's lettuce
	Montia fontana	water montia
Myrsinaceae	*Lysimachia arvensis*	scarlet pimpernel
Onagraceae	*Clarkia* sp.	clarkia
	Epilobium canum	California fuchsia
	Epilobium ciliatum	fringed willowherb
Orobanchaceae	*Castilleja attenuata*	valley tassels
	Castilleja exserta ssp. *exserta*	purple owl's clover
	Triphysaria eriantha	butter 'n' eggs
Papaveraceae	*Eschscholzia californica*	California poppy
Phrymaceae	*Diplacus aurantiacus*	sticky monkeyflower
	Erythranthe guttata	yellow monkey flower
Plantaginaceae	*Callitriche marginata*	winged water starwort
	Collinsia sparsiflora	few flowered collinsia
	Plantago erecta	California plantain
	Plantago lanceolata	narrow leaved plantain
	Veronica anagallis-aquatica	water speedwell
	Veronica arvensis	corn speedwell
Platanaceae	*Platanus racemosa*	California sycamore
Poaceae	*Avena barbata*	slender oat
	Avena fatua	wild oat
	Bromus diandrus	ripgut brome
	Bromus hordeaceus	soft brome
	Bromus rubens	red brome

TABLE B-1 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020

Plant Family	*Scientific Name*	Common Name
	Cynodon dactylon	Bermuda grass
	Elymus glaucus	blue wildrye
	Elymus triticioides	creeping wildrye
	Festuca microstachys	small fescue
	Festuca myuros	rattail sixweeks grass
	Festuca perennis	Italian ryegrass
	Hordeum marinum	seaside barley
	Hordeum murinum	foxtail barley
	Koeleria macrantha	June grass
	Melica californica	California melicgrass
	Poa annua	annual blue grass
	Poa secunda ssp. *secunda*	one sided blue grass
	Polypogon monspeliensis	rabbitsfoot grass
	Stipa pulchra	purple needlegrass
Polemoniaceae	*Leptosiphon bicolor*	true babystars
Polygonaceae	*Chorizanthe membranacea*	pink spineflower
	Eriogonum fasciculatum	California buckwheat
	Eriogonum nudum var. *auriculatum*	naked buckwheat
	Polygonum aviculare	prostrate knotweed
	Pterostegia drymarioides	fairy mist
	Rumex conglomeratus	clustered dock
	Rumex crispus	curly dock
Polypodiaceae	*Polypodium californicum*	California polypody
Primulaceae	*Primula clevelandii*	Padre's shooting star
	Primula hendersonii	mosquito bill
Pteridaceae	*Pellaea andromedifolia*	coffee fern
	Pentagramma triangularis	gold back fern
Ranunculaceae	*Clematis* sp.	clematis
	Delphinium sp.	larkspur
	Ranunculus californicus	common buttercup
	Ranunculus muricatus	spinyfruit buttercup
	Ranunculus occidentalis	Western buttercup
Rhamnaceae	*Rhamnus ilicifolia*	evergreen buckthorn
Rosaceae	*Adenostoma fasciculatum*	chamise
	Aphanes occidentalis	western lady's mantle
	Heteromeles arbutifolia	toyon
	Prunus ilicifolia	holly leaf cherry
	Rosa sp.	wild rose
Rubiaceae	*Galium aparine*	stickywilly
Rubiaceae	*Galium porrigens*	climbing bedstraw
Salicaceae	*Populus fremontii*	Fremont cottonwood
	Salix gooddingii	Goodding's willow
	Salix laevigata	red willow
Sapindaceae	*Aesculus californica*	California buckeye

**TABLE B-1 (CONTINUED)
PLANT SPECIES OBSERVED IN THE STUDY AREA IN MARCH 2020**

Plant Family	*Scientific Name*	Common Name
Saxifragaceae	*Lithophragma affine*	woodland star
	Micranthes californica	Greene's saxifrage
Scrophulariaceae	*Scrophularia californica*	California bee plant
Solanaceae	*Datura wrightii*	Jimsonweed
	Solanum umbelliferum	blue witch nightshade
Themidaceae	*Dipterostemon capitatus*	blue dicks
	Triteleia laxa	Ithuriel's spear
Typhaceae	*Typha latifolia*	broadleaf cattail
Urticaceae	*Urtica dioica*	stinging nettle
Valerianaceae	*Plectritis ciliosa*	long spurred plectritis
	Plectritis congesta ssp. *brachystemon*	shortspur seablush
Verbenaceae	*Phyla nodiflora*	common lippia
Violaceae	*Viola pedunculata*	California golden violet
Viscaceae	*Phoradendeon* sp.	mistletoe

Attachment C

Special-Status Species with Potential to Occur in the Study Area

ESA

ATTACHMENT C

Special-Status Species with Potential to Occur in the Study Area

TABLE C-1
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Invertebrates				
Vernal pool fairy shrimp	*Branchinecta lynchi*	**Fed:** FT **CA:** None	**General**: Endemic to the grasslands of the Central Valley, central coast mountains, and south coast mountains, in rain-filled pools. **Micro**: Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	**Absent:** No seasonal pools that would provide suitable habitat were identified within the inundation area. There are no CNDDB occurrences within 5 miles of the Study Area.
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	**Fed:** FT **CA:** None	**General**: Found in host plant along rivers and streams. Occurs from southern Shasta County to Fresno County. Project may be out of species' range according to USFWS. **Micro**: Only occurs on host plant, red or blue elderberry (*Sambucus* spp.).	**Low:** Several elderberry shrubs were identified surrounding the project area. The shrubs did not show any exit holes indicating the presence of this species. The entire study area was not surveyed; more elderberry shrubs may occur. There are no CNDDB occurrences within 5 miles of the Study Area.
Vernal pool tadpole shrimp	*Lepidurus packardi*	**Fed:** FE **CA:** None	**General**: Endemic to California's Great Central Valley, with the majority of the populations found in the Sacramento Valley. Found in a wide variety of ephemeral wetland habitats. **Micro**: Inhabit small, clear, well-vegetated vernal pools to highly turbid pools.	**Absent:** No seasonal pools that would provide suitable habitat were identified within the inundation area. There are no CNDDB occurrences within 5 miles of the Study Area.

TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Reptiles				
Western pond turtle	*Actinemys marmorata*	**Fed:** None **CA:** SSC	**General**: A thoroughly aquatic turtle of ponds, marshes, rivers, streams, and irrigation ditches with aquatic vegetation. **Micro**: Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat for egg-laying.	**Present:** This species was observed in Pond 18 within the Portuguese Creek Area, located at the south end of San Luis Reservoir and located within the inundation area; potential in other major drainages and associated upland areas. There are nine CNDDB occurrences within 5 miles of the Study Area, predominantly on the east side of San Luis Reservoir in Pacheco State Park. Also observed in the Portuguese Creek Area of San Luis Reservoir in 2004.
Blunt-nosed leopard lizard	*Gambelia sila*	**Fed:** FE **CA:** SE	**General**: Scarce resident of sparsely vegetated alkali and desert scrub habitats. Currently occurs at scattered sites in the San Joaquin Valley and adjacent foothills. **Micro**: Alkali flats, large washes, arroyos, canyons, and low foothills. Needs small-mammal burrows for reproduction.	**Absent:** The inundation area does not provide suitable alkali flats, arroyos, or other habitat to support this species. The Study Area is located at the northern end of this species' range. There are two CNDDB records within 5 miles of the Study Area, dated 1931 and 1970s.
San Joaquin coachwhip	*Coluber flagellum ruddocki*	**Fed:** None **CA:** SSC	**General**: Endemic to California, with range from Arbuckle in the Colusa County portion of the Sacramento Valley southward to the Grapevine in the Kern County portion of the San Joaquin Valley and westward into the inner South Coast Ranges. Open, dry, treeless areas with little to no cover, including valley grassland and saltbush scrub. Avoids dense vegetation. **Micro**: Needs rodent burrows for refuge or uses shaded vegetation and surface objects.	**Moderate:** The inundation area predominantly consists of annual grasslands with a relatively low density of trees. The occurrence of small-mammal burrows was in low abundance throughout the Study Area. Areas that had burrows could provide suitable habitat for this species. There is one CNDDB record located just over 5 miles south-southeast of San Luis Reservoir, dated 1985.

TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Coast horned lizard	*Phrynosoma blainvillii*	**Fed:** None **CA:** SSC	**General**: Grasslands, coniferous forests, woodlands, and chaparral with open areas and loose soil. Occurs north of the Bay Area and inland as far as Shasta Reservoir and south into Baja California. **Micro**: Open areas of sandy soil and low vegetation in valleys, foothills, and semiarid mountains.	**Low:** Few areas with sandy soil and low vegetation are present in the inundation area with surrounding habitat of annual grasslands and open areas in the Study Area. The Study Area is within the known range for this species. There are no CNDDB occurrences reported within 5 miles of the Study Area.
Giant garter snake	*Thamnophis gigas*	**Fed**: FT **CA**: ST	**General**: Historically ranged in the Sacramento and San Joaquin Valleys. Extirpated south of Fresno County. Associated with marshes and sloughs. Absent from larger rivers. **Micro**: Active mid-March through October. Extremely aquatic, rarely found away from water. Retreats to small-mammal burrows, crevices, and surface objects.	**Low:** No marshes or sloughs capable of supporting this species were identified in the inundation area. The current range of this species is located in the valley east of the Study Area. There are no CNDDB occurrences reported within 5 miles of the Study Area.
Amphibians				
California tiger salamander (central population)	*Ambystoma californiense*	**Fed**: FT **CA**: ST	**General**: Central Valley DPS listed as threatened. Santa Barbara and Sonoma Counties DPS listed as endangered. **Micro**: Needs underground refuges, especially ground squirrel burrows and vernal pools or other seasonal water sources, for breeding.	**High:** One pond in the Study Area has the potential to provide suitable breeding habitat for this species. Several other ponds adjacent to the Study Area may also provide suitable habitat for breeding. Suitable refugia burrows occur throughout the Study Area. There are six CNDDB records within 5 miles of the Study Area, the most recent dated 2015.
Foothill yellow-legged frog	*Rana boylii*	**Fed**: None **CA**: Candidate Threatened, SSC	**General**: Pacific Coast drainages and lower western slopes of the Sierra Nevada in a variety of habitats such as valley-foothill hardwood, valley-hardwood conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadows. **Micro**: Permanent water sources such as rivers and streams with a rocky substrate.	**Low:** No permanent river sources are located within the inundation area to support this species. There are four CNDDB records within 5 miles of the Study Area. Three are south of the reservoir on Los Banos Creek and one is north of the reservoir on Romero Creek.

**TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA**

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
California red-legged frog	*Rana draytonii*	**Fed**: FT **CA**: SSC	**General**: Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. **Micro**: Requires 11 to 20 weeks of permanent water for larval development. Must have access to aestivation habitat.	**Present:** This species was identified in two ponds adjacent to the Study Area with potential to occur in others; also detected within the Study Area in the San Luis Creek arm of San Luis Reservoir. There are 36 CNDDB records within 5 miles of the Study Area.
Western spadefoot	*Spea hammondii*	**Fed:** none **CA:** SSC	**General**: Breeds in ephemeral pools in open grassland habitat; remains underground for much of the year. **Micro**: Requires 2 to 18 weeks of standing water for larval development.	**Low:** There are no identified ephemeral pools in the inundation area to support this species. There are no CNDDB occurrences reported within 5 miles of the Study Area.
Birds				
Tricolored blackbird	*Agelaius tricolor*	**Fed:** None **CA:** ST	**General**: Highly colonial species, most numerous in the Central Valley and vicinity. Largely endemic to California. **Micro**: Requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of the colony.	**High (nesting):** About a dozen non-breeding individuals were identified near the Basalt Campground in the March 2020 surveys. Suitable habitat is present in the Study Area to support a nesting colony of this species. There are seven CNDDB records located within 5 miles of the Study Area, the most recent dated 2014.
Golden eagle	*Aquila chrysaetos*	**Fed:** BGEPA **CA:** SFP	**General:** Nests on cliffs or tall trees, breeding from late January to August with a peak from March to July. Preferred foraging habitat is annual grasslands that support small mammals such as rabbits and ground squirrels.	**High (nesting):** This species was identified in the San Luis Creek arm of San Luis Reservoir. Suitable nesting habitat for this species is present in the Study Area and surrounding undeveloped parcels. There are no CNDDB occurrences reported within 5 miles of the Study Area.
Western burrowing owl	*Athene cunicularia*	**Fed:** None **CA:** SSC	**General**: Open, dry, annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. **Micro**: Subterranean nester, dependent upon burrowing mammals, most notably the California ground squirrel.	**High:** This species was identified in the annual grasslands of Lone Oak Bay, adjacent to Pond 10, in the southeastern area of San Luis Reservoir. The Study Area provides suitable ground squirrel burrows for nesting, and the grasslands provide potential foraging habitat. There are nine CNDDB records within 5 miles of the Study Area, the most recent dated 2016.

TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Swainson's hawk	*Buteo swainsoni*	**Fed:** None **CA:** ST	**General**: Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannas, and agricultural or ranch areas. **Micro**: Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	**Moderate (nesting):** Swainson's hawk was not identified in the March 2020 surveys, although nesting has been documented near O'Neill Forebay. The inundation area provides suitable foraging habitat with potential suitable nesting locations. There are nine CNDDB records within 5 miles of the Study Area, the most recent dated 2016.
Ferruginous hawk	*Buteo regalis*	**Fed:** None **CA:** WL	**General**: Semiarid grasslands, rocky outcrops, and shallow canyons. **Micro**: Nests on rocky outcrops, hillsides, rock pinnacles, or in trees.	**Moderate (wintering only):** This species was identified in the March 2020 surveys. Annual grasslands provide suitable foraging habitat in the Study Area and the surrounding undeveloped parcels. Minimal suitable nesting habitat is present in the Study Area. The Study Area is within the known winter range for this species. There are 15 CNDDB records of wintering hawks within 5 miles of the Study Area, the most recent dated 2013.
Northern harrier	*Circus hudsonius*	**Fed:** None **CA:** SSC	**General**: Coastal salt and freshwater marsh. Nests and forages in grasslands, from salt grass in desert sinks to mountain ciénagas. **Micro**: Nests on the ground in shrubby vegetation, usually at marsh edges; nest is built of a large mound of sticks in wet areas.	**Moderate (nesting):** This species was identified in the March 2020 surveys. Suitable foraging habitat is present in the grasslands of the Study Area and the surrounding undeveloped parcels. Suitable nesting habitat is present in the Study Area, as it provides several water sources and marsh vegetation. There are three CNDDB records within 5 miles of the Study Area, the most recent dated 2001.
California horned lark	*Eremophila alpestris actica*	**Fed:** None **CA:** WL	**General:** Nests and forages in short-grass prairie, mountain meadow, coastal plain, fallow fields, and alkali flats.	**Moderate:** The Study Area is within the known yearlong range for this species, and numerous larks are seen during the winter near O'Neill Forebay. There are two CNDDB records within 5 miles of the Study Area, the most recent dated 2006.

**TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA**

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Prairie falcon	*Falco mexicanus*	**Fed:** None **CA:** WL	**General:** Mountainous areas along the coast of north Santa Barbara, Sierra Nevada, and others. Breeds in woodland, forest, and coastal habitats. **Micro:** Nest is a scrape on a depression or ledge in an open site. Will nest in old raven or eagle stick nest on human-made structures, and occasionally uses cavities of trees or snags or old nests of other raptors.	**Moderate:** Suitable foraging habitat is present in the grasslands in the Study Area and surrounding undeveloped parcels. The Study Area is within the species' known wintering range. There are 13 CNDDB records within 5 miles of the Study Area, the most recent dated 1998.
California condor	*Gymnogyps californianus*	**Fed:** FE **CA:** SE, SFP	**General:** Semi-arid, rugged mountain ranges surrounding the southern San Joaquin Valley, Coast Ranges, Tehachapi Mountains, and southern Sierra Nevada. Forages over open rangelands; roosts on cliffs and in large trees or snags. **Micro:** Nests in caves and crevices, behind rock slabs, or on large ledges on high sandstone cliffs. Nest often surrounded by dense brush.	**Low:** The Study Area is outside of the known range for this species. The Study Area does not provide suitable nesting habitat. There are no CNDDB occurrences reported within 5 miles of the Study Area.
Bald eagle	*Haliaeetus leucocephalus*	**Fed:** FD **CA:** SE, SFP	**General:** Large bodies of water, or free-flowing rivers abundant with fish. Requires adjacent snags and perches near water source for nesting and foraging. **Micro:** Dense old-growth, dominant trees with open branch work, and less than 40% canopy for nesting.	**High:** A bald eagle nest was identified in the March 2020 survey near Pond 12. San Luis Reservoir provides suitable foraging habitat. Adjacent trees provide suitable nesting habitat. There is one CNDDB records within 5 miles of the Study Area, the most recent dated 2011.
Mammals				
Pallid bat	*Antrozous pallidus*	**Fed:** None **CA:** SSC	**General**: A wide variety of habitats are occupied, including grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests. The species is most common in open, dry habitats with rocky areas for roosting. **Micro**: Roosts in buildings, caves, tree hollows, crevices, mines, and bridges.	**Low:** The Study Area provides suitable foraging habitat for this species. Little to no suitable habitat is present within the inundation area to support roosting. There are no CNDDB occurrences within 5 miles of the Study Area.

**TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA**

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
Townsend's big-eared bat	*Corynorhinus townsendii*	**Fed:** None **CA:** SSC	**General:** Found in all habitats except subalpine and alpine habitats, and may be found at any season throughout its range. **Micro:** Roosts in caves, mines, and tunnels with minimal disturbance, but can also be found in abandoned open buildings or other human-made structures. Recently detected in hollowed trees. Conspicuous rooster, sensitive to disturbance.	**Low.** The Study Area provides suitable foraging habitat for this species. Little suitable habitat is present within the inundation area to support roosting. There are no CNDDB occurrences within 5 miles of the Study Area.
Giant kangaroo rat	*Dipodomys ingens*	**Fed:** FE **CA:** SE	**General:** Scattered colonies along the west side of the San Joaquin Valley (Carrizo Plain, Panoche Valley). Found in fine sandy loam soils supporting sparse annual grass/forb vegetation. **Micro:** Level terrain and sandy loam soils needed for burrowing.	**Absent.** The Study Area is located north of the known range for this species. There are no CNDDB occurrences within 5 miles of the Study Area.
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	**Fed:** FE **CA:** SE	**General:** Alkali desert scrub and herbaceous habitats with scattered shrubs. Found in the southwestern San Joaquin Valley. **Micro:** Level terrain and sandy loam soils needed for burrowing.	**Absent.** The Study Area is located north of the known range for this species. There are no CNDDB occurrences within 5 miles of the Study Area.
Western mastiff bat	*Eumops perotis californicus*	**Fed:** None **CA:** SSC	**General:** Open, semi-arid to arid habitats. Conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban. **Micro:** Crevices in cliff faces, high buildings, trees, and tunnels required for roosting.	**Low.** The Study Area provides suitable foraging habitat for this species. Little to no suitable habitat is present within the inundation area to support roosting. There are no CNDDB occurrences within 5 miles of the Study Area.
American badger	*Taxidea taxus*	**Fed:** None **CA:** SSC	**General:** Dry, open grasslands with friable soil for dens.	**High:** Potential habitat is present in the grasslands of the Study Area. There are 11 CNDDB occurrences within 5 miles of the Study Area. Most records are located northeast or east of San Luis Reservoir.

TABLE C-1 (CONTINUED)
SPECIAL-STATUS WILDLIFE SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat and Seasonal Distribution in California	Likelihood of Occurrence
WILDLIFE				
San Joaquin kit fox	*Vulpes macrotis mutica*	**Fed:** FE **CA:** ST	**General:** Arid grasslands and open scrubland, where friable soils are present. Historically, habitat included native alkali marsh and saltbrush scrub. **Micro:** Grasslands with friable soils are principal habitat for denning and foraging. San Joaquin kit foxes will dig their own dens, use banks in sumps or roadbeds, use existing dens, or use human-made culverts and abandoned pipes.	**Moderate**: Suitable grassland foraging habitat is present in the Study Area. The Study Area has connectivity to sparsely populated ranch lands to the northeast, east, and southeast. Potential prey is present throughout the Study Area. Burrows of suitable size were markedly absent during the March 2020 reconnaissance-level surveys. There are 18 CNDDB occurrences within 5 miles of the Study Area, the most recent dated 2005.

SOURCES: CDFW 2020b; USFWS 2020; data compiled by Environmental Science Associates in 2020

CNDDB = California Natural Diversity Database; DPS = distinct population segment; USFWS = United States Fish and Wildlife Service
The special-status wildlife species included in this table were either observed in the Study Area by an Environmental Science Associates biologist, or contained within the query of the CNDDB or the USFWS Endangered Species List.

Status Codes:

Federal (USFWS):
BGEPA = Bald and Golden 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
FSC = former federal species of special concern (list is no longer maintained)
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
SR = listed as rare by the State of California (plants only)
SSC = California species of special concern
SC = California candidate for listing as endangered
SFP = California fully protected species
WL = watch list

Unless otherwise noted, “Habitat and Seasonal Distribution in California” information is derived from habitat requirements provided by the CNDDB.
Likelihood of occurrence evaluations: *Present* = the species has been observed in the Study Area; *high potential* = this species is expected to occur on-site or occurs locally in the area; *moderate potential* = suitable habitat exists in the Study Area; *low potential* = the Study Area is outside of the species’ described range or suitable habitat is absent.

TABLE C-2
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Heartscale	*Atriplex cordulata* var. *cordulata*	**Fed:** None **CA:** None **CRPR**: 1B.2	Saline or alkaline chenopod scrub, meadows and seeps, and sandy valley and foothill grassland. 0–500 meters. Blooms April through October.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline. Halophyte-dominated habitats were not observed.
Lost Hills crownscale	*Atriplex coronata* var. *vallicola*	**Fed:** None **CA:** None **CRPR**: 1B.2	Alkaline chenopod scrub, valley and foothill grassland, and vernal pools. 50–635 meters. Blooms April through September.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline. Halophyte-dominated habitats and vernal pools were not observed.
Brittlescale	*Atriplex depressa*	**Fed:** None **CA:** None **CRPR**: 1B.2	Clay and alkaline chenopod scrub, meadows and seeps, playas, valley and foothill grassland, and vernal pools. 1–320 meters. Blooms April through October.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline. Halophyte-dominated habitats, playas, and vernal pools were not observed.
Lesser saltscale	*Atriplex minuscula*	**Fed:** None **CA:** None **CRPR**: 1B.1	Sandy and alkaline chenopod scrub, playas, and valley and foothill grassland. 15–200 meters. Blooms May through October.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline. Halophyte-dominated habitats, playas, and vernal pools were not observed.
Big-scale balsamroot	*Balsamorhiza macrolepis*	**Fed:** None **CA:** None **CRPR**: 1B.2	Chaparral, cismontane woodland, and valley and foothill grassland. Sometimes found on serpentine or rocky areas. 45–1,555 meters. Blooms March through June.	**Low.** There are no serpentine substrates in the soil report and none were observed in the field. Many rock outcrops were inspected during the reconnaissance survey and this species was not found. The Study Area is near the edge of the range and there are no records nearby.
Mariposa pussypaws	*Calyptridium pulchellum*	**Fed:** FT **CA:** None **CRPR**: 1B.1	Sandy or gravelly, granitic chaparral or cismontane woodland. Known from the central Sierra Nevada. 400–1,100 meters. Blooms April through August.	**None.** There are no granitic substrates in the soil report and none were observed in the field. The Study Area is outside the range, and below the known elevation band, of this species.
Chaparral harebell	*Campanula exigua*	**Fed:** None **CA:** None **CRPR**: 1B.2	Rocky, and usually serpentine, sites in chaparral. 275–1,250 meters. Blooms May through June.	**Low.** There are some small rock outcrops or areas where bedrock is near the surface in areas of chaparral. There are no serpentine substrates in the soil report and none were observed in the field.
Lemmon's jewelflower	*Caulanthus lemmonii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Pinyon-juniper woodland, valley and foothill grassland. 80–1,580 meters. Blooms February through May.	**Moderate**. The nearest herbarium record (CNDDB Occurrence #48), from a nearby watershed, describes a conglomerate rock outcrop as the habitat.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Coyote ceanothus	*Ceanothus ferrisiae*	**Fed:** FE **CA:** None **CRPR**: 1B.1	Serpentine chaparral, coastal scrub, and valley and foothill grassland. 120–460 meters. Blooms January through May.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the limited range of this species.
Hispid salty bird's-beak	*Chloropyron molle* ssp. *hispidum*	**Fed:** None **CA:** None **CRPR**: 1B.1	Alkaline marshes and flats, meadows and seeps, playas, and valley and foothill grassland. 1–155 meters. Blooms June through September.	**None.** There are no alkaline or halophyte-dominated wetlands.
Mt. Hamilton fountain thistle	*Cirsium fontinale* var. *campylon*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine seeps in chaparral, cismontane woodland, and valley and foothill grassland. 100–890 meters. Blooms April through October, and sometimes as early as February.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the limited range of this species.
Mariposa clarkia	*Clarkia biloba* ssp. *australis*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine chaparral and cismontane woodland. Known from the central Sierra Nevada foothills. 300–1,460 meters. Blooms April through July.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the range of this species.
Beaked clarkia	*Clarkia rostrata*	**Fed:** None **CA:** None **CRPR**: 1B.3	Cismontane woodland and valley and foothill grassland. Known from the central Sierra Nevada foothills and adjacent San Joaquin Valley. 60–500 meters. Blooms April through May.	**None.** The Study Area is outside the range. There are no known collections west of SR 99.
San Francisco collinsia	*Collinsia multicolor*	**Fed:** None **CA:** None **CRPR**: 1B.2	Closed-cone coniferous forest and coastal scrub, sometimes on serpentine or moist sites. 30–250 meters. Blooms March through May, and sometimes as early as February.	**None.** No suitable habitats are present. There are no serpentine substrates in the soil report and none were observed in the field. There are no records as far inland as the Study Area.
Mariposa cryptantha	*Cryptantha mariposae*	**Fed:** None **CA:** None **CRPR**: 1B.3	Rocky, serpentine chaparral. Known from the northern and central Sierra Nevada foothills. 200–650 meters. Blooms April through June.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the range.
Hospital Canyon larkspur	*Delphinium californicum* ssp. *interius*	**Fed:** None **CA:** None **CRPR**: 1B.2	Openings in chaparral, mesic cismontane woodland, and coastal scrub. 195–1,095 meters. Blooms April through June.	**Moderate**. Chaparral and woodland in the Study Area, particularly low on slopes near the edge of larger creeks, may provide habitat. A collection record from a nearby watershed (CNDDB Occurrence #3) describes the habitat as "canyon bottom setting bordering woodland" downhill from a spring.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Recurved larkspur	*Delphinium recurvatum*	**Fed:** None **CA:** None **CRPR**: 1B.2	Poorly drained alkaline soils of chenopod scrub, cismontane woodland, and valley and foothill grassland. 3–790 meters. Blooms March through June.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed.
Yellow-lip pansy monkeyflower	*Diplacus pulchellus*	**Fed:** None **CA:** None **CRPR**: 1B.2	Vernally mesic clay soils of lower montane coniferous forest and meadows and seeps. Often in disturbed areas. Known from the northern and central Sierra Nevada foothills. 600–2,000 meters. Blooms April through July.	**None.** The Study Area is outside the range and below the elevation band.
Santa Clara Valley dudleya	*Dudleya abramsii* ssp. *setchellii*	**Fed:** FE **CA:** None **CRPR**: 1B.1	Rocky, serpentine cismontane woodland and valley and foothill grassland. 60–455 meters. Blooms April through October.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. Rarely collected as far inland as the Study Area.
Mariposa daisy	*Erigeron mariposanus*	**Fed:** None **CA:** None **CRPR**: 1A	Cismontane woodland, but suspected to have occurred in more specialized habitat. Known from the Sierra Nevada foothills. 600–800 meters. Blooms June through August.	**None.** The Study Area is outside the range.
Hoover's button-celery	*Eryngium aristulatum* var. *hooveri*	**Fed:** None **CA:** None **CRPR**: 1B.1	Vernal pools and seasonal wetlands, occasionally alkaline. 3–45 meters. Blooms in July, and sometimes in June or August.	**Low.** No vernal pools are present, and although soils may be moderately alkaline, there are no halophyte-dominated habitats. Rarely collected as far inland as the Study Area.
Spiny-sepaled button-celery	*Eryngium spinosepalum*	**Fed:** None **CA:** None **CRPR**: 1B.2	Vernal pools, swales, and ditches of valley and foothill grassland. 80–975 meters. Blooms April through June.	**High**. There is a 2010 collection record in the Study Area near State Route 152 (CNDDB Occurrence #91). The collection is very near the elevation of the San Luis Reservoir spillway, and may be occasionally but infrequently inundated.
Slender-stemmed monkeyflower	*Erythranthe filicaulis*	**Fed:** None **CA:** None **CRPR**: 1B.2	Vernally mesic cismontane woodland, lower and upper montane coniferous forest, and meadows and seeps. Known from the high central Sierra Nevada. 900–1,750 meters. Blooms April through August.	**None.** The Study Area is outside the range and below the elevation band.
Slender-stalked monkeyflower	*Erythranthe gracilipes*	**Fed:** None **CA:** None **CRPR**: 1B.2	Decomposed granitic chaparral, cismontane woodland, and lower montane coniferous forest. Often in burned or disturbed areas. Known from the central Sierra Nevada foothills. 500–1,300 m. Blooms April through June.	**None.** The Study Area is outside the range and there are no granite substrates.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
San Joaquin spearscale	*Extriplex joaquinana*	**Fed:** None **CA:** None **CRPR**: 1B.2	Alkaline chenopod scrub, meadows and seeps, playas, and valley and foothill grassland. 1–835 meters. Blooms April through June.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline. Halophyte-dominated habitats were not observed.
Fragrant fritillary	*Fritillaria liliacea*	**Fed:** None **CA:** None **CRPR**: 1B.2	Cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland. Heavy soils near coast, often on serpentine. 3–410 meters. Blooms February through April.	**None.** Outside the range, there are no known records as far inland as the Study Area.
Loma Prieta hoita	*Hoita strobilina*	**Fed:** None **CA:** None **CRPR**: 1B.1	Mesic, usually serpentine, areas of chaparral, cismontane woodland, and riparian woodland. 30–860 meters. Blooms May through July, and sometimes into October.	**Low.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is near the edge of the limited range of this species.
Legenere	*Legenere limosa*	**Fed:** None **CA:** None **CRPR**: 1B.1	Vernal pools, and sometimes other mesic areas or ponds. 1–880 meters. Blooms April through June.	**Low.** No vernal pools are present in the Study Area.
Madera leptosiphon	*Leptosiphon serrulatus*	**Fed:** None **CA:** None **CRPR**: 1B.2	Cismontane woodland and lower montane coniferous forest. Known from the southern Sierra Nevada and Tehachapi Mountains. 300–1,300 m. Blooms April through June.	**None.** Outside the range.
Mt. Hamilton coreopsis	*Leptosyne hamiltonii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Rocky, dry, exposed slopes of cismontane woodland. 550–1,300 meters. Blooms March through May.	**Low.** The Study Area may be outside the very limited range of this species.
Smooth lessingia	*Lessingia micradenia* var. *glabrata*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine chaparral, cismontane woodland, and valley and foothill grassland. Often found on gravelly roadcuts. 120–420 meters. Blooms July through November, and sometimes as early as April.	**None.** There are no serpentine substrates in the soil report and none were observed in the field.
Congdon's lomatium	*Lomatium congdonii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine chaparral and cismontane woodland. 300–2,100 meters. Blooms March through June.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the range.
Mariposa lupine	*Lupinus citrinus* var. *deflexus*	**Fed:** None **CA:** ST **CRPR**: 1B.2	Sandy, granitic chaparral and cismontane woodland. Known from the central Sierra Nevada foothills. 400–610 meters. Blooms April through May.	**None.** There are no granite substrates and the Study Area is outside the range.
Shaggyhair lupine	*Lupinus spectabilis*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine chaparral and cismontane woodland. Known from the central Sierra Nevada foothills. 260–825 meters. Blooms April through May.	**None.** There are no serpentine substrates in the soil report and none were observed in the field. The Study Area is outside the range.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Arcuate bush-mallow	*Malacothamnus arcuatus*	**Fed:** None **CA:** None **CRPR**: 1B.2	Open chaparral and cismontane woodland. 80–355 meters. Blooms April through September.	**Moderate**. The Study Area, especially chaparral, could provide suitable habitat, and there are potential old records nearby.
Hall's bush-mallow	*Malacothamnus hallii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Open chaparral and coastal scrub. 10–760 meters. Blooms May through September, and sometimes in April and October.	**High**. Chaparral provides habitat and there are several collection records from the last 30 years along State Route 152 near the Study Area.
Woodland woollythreads	*Monolopia gracilens*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine openings in broadleafed upland forest, chaparral, cismontane woodland, north coast coniferous forest, and valley and foothill grassland. 100–1,200 meters. Blooms March through July, and sometimes as early as February.	**None.** There are no serpentine substrates in the soil report and none were observed in the field.
Lime Ridge navarretia	*Navarretia gowenii*	**Fed:** None **CA:** None **CRPR**: 1B.1	Clay or serpentine in chaparral. 180–305 meters. Blooms May through June.	**Low**. There are no serpentine substrates in the soil report and none were observed in the field. Clay soils make up a very small percentage of the Study Area.
Shining navarretia	*Navarretia nigelliformis* ssp. *radians*	**Fed:** None **CA:** None **CRPR**: 1B.2	Cismontane woodland, valley and foothill grassland, vernal pools, and clay depressions. 65–1,000 meters. Blooms April through July, and sometimes as early as March.	**Low**. Clay soils make up a very small percentage of the Study Area and most of the Study Area has steep slopes.
Prostrate vernal pool navarretia	*Navarretia prostrata*	**Fed:** None **CA:** None **CRPR**: 1B.2	Mesic coastal scrub, meadows and seeps, alkaline valley and foothill grassland, and vernal pools. 3–1,210 meters. Blooms April through July.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed. No vernal pools are present.
Hairless popcorn-flower	*Plagiobothrys glaber*	**Fed:** None **CA:** None **CRPR**: 1A	Alkaline meadows and seeps, coastal salt marshes and swamps. Known from the central coast and Bay Area. 15–180 meters. Blooms March through May.	**None.** Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed. The Study Area is outside the limited range of this species.
California alkali grass	*Puccinellia simplex*	**Fed:** None **CA:** None **CRPR**: 1B.2	Alkaline vernally mesic sinks, flats, and lake margins of chenopod scrub, meadows and seeps, valley and foothill grasslands, and vernal pools. 2–930 meters. Blooms March through May.	**Low.** Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed. No vernal pools are present.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Sanford's arrowhead	*Sagittaria sanfordii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Shallow freshwater marshes and swamps. 0–650 meters. Blooms May through October, and sometimes into November.	**Low.** Some ponds near the reservoir margin may provide potential habitat. There are very few records outside the Central Valley.
Rock sanicle	*Sanicula saxatilis*	**Fed:** None **CA:** SR **CRPR**: 1B.2	Rocky ridges, or scree and talus in broadleafed upland forest, chaparral, and valley and foothill grassland. 620–1,175 meters. Blooms April through May.	**None.** The Study Area is outside the limited range of this species, and below the known elevation band.
Chaparral ragwort	*Senecio aphanactis*	**Fed:** None **CA:** None **CRPR**: 2B.2	Dry open rocky areas of chaparral, cismontane woodland, and coastal scrub. Sometimes alkaline habitats. 15–800 meters. Blooms January through April, and sometimes into May.	**Moderate**. Rocky areas of the Study Area could provide potential habitat.
Metcalf Canyon jewelflower	*Streptanthus albidus* ssp. *albidus* (= *S. glandulosus* var. *albidus)*	**Fed:** FE **CA:** None **CRPR**: 1B.1	Serpentine valley and foothill grassland. 45–800 meters. Blooms April through July.	**None.** There are no serpentine substrates in the soil report and none were observed in the field.
Most beautiful jewelflower	*Streptanthus albidus* ssp. *peramoenus* (= *S. glandulosus* var. *glandulosus)*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine or metamorphic chaparral, cismontane woodland, and valley and foothill grassland. Rocky, generally barren slopes. 95–1,000 meters. Blooms April through September, and sometimes also in March and October.	**Low.** There are no serpentine substrates in the soil report and none were observed in the field. Other rock outcrops in the Study Area may provide potential habitat.
Mt. Hamilton jewelflower	*Streptanthus callistus*	**Fed:** None **CA:** None **CRPR**: 1B.3	Open gravelly sedimentary scree of chaparral and cismontane woodland. Known from the Bay Area. 600–790 meters. Blooms April through May.	**None.** No habitat is present and the Study Area is outside the very limited range of this species.
Arburua Ranch jewelflower	*Streptanthus insignis* ssp. *lyonii*	**Fed:** None **CA:** None **CRPR**: 1B.2	Serpentine grassland and oak woodland. 230–850 meters. Blooms March through May.	**Low.** There are no serpentine substrates in the soil report and none were observed in the field.
slender-leaved pondweed	*Stuckenia filiformis* ssp. *alpina*	**Fed:** None **CA:** None **CRPR**: 2B.2	Shallow freshwater marshes and swamps. 300–2,150 meters. Blooms May through July.	**Low.** Some ponds near the reservoir margin may provide potential habitat.
Wright's trichocoronis	*Trichocoronis wrightii* var. *wrightii*	**Fed:** None **CA:** None **CRPR**: 2B.1	Alkaline meadows and seeps, marches and swamps, riparian forest, and vernal pools. 5–435 meters. Blooms May through September.	**None.** Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed. All known Northern California collections are near the bottom of the Central Valley.

TABLE C-2 (CONTINUED)
SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status	Habitat Requirements	Likelihood of Occurrence
PLANTS				
Two-fork clover	*Trifolium amoenum*	**Fed:** FE **CA:** None **CRPR**: 1B.1	Moist heavily soils of coastal bluff scrub, and valley and foothill grassland. Sometimes serpentine or disturbed areas. Known mostly from the northern Bay Area. 5–415 meters. Blooms April through June.	**None.** The Study Area is outside the range.
Santa Cruz clover	*Trifolium buckwestiorum*	**Fed:** None **CA:** None **CRPR**: 1B.1	Margins of gravelly areas in broadleafed upland forest, cismontane woodland, and coastal prairie. Known from the Bay Area. 105–610 meters. Blooms April through October.	**None.** The Study Area is outside the range. There are no known collections so far inland.
Saline clover	*Trifolium hydrophilum*	**Fed:** None **CA:** None **CRPR**: 1B.2	Salt marshes and swamps, mesic and alkaline valley and foothill grassland, and vernal pools. 0–300 meters. Blooms April through June.	**Low**. Some soils may be moderately alkaline, but none are strongly alkaline and none are poorly drained. Halophyte-dominated habitats were not observed. No vernal pools are present.

Sources: CNPS 2020; Jepson 2020; FNA 1993.

CNDDB = California Natural Diversity Database
Special-status plant species that were included in this table were either observed in the Study Area by an Environmental Science Associates botanist, or contained within the query of the CNDDB, United States Fish and Wildlife Service (USFWS) Endangered Species List, or California Native Plant Society.

Status Codes:

Federal (USFWS):
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
FSC = Former federal species of special concern (list is no longer maintained)
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
SR = Listed as rare by the State of California (plants only)
SSC = California species of special concern
SC = California candidate for listing as endangered
SFP = California fully protected species
WL = Watch list

California Rare Plant Rank (CRPR):
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

Unless otherwise noted, “Habitat and Seasonal Distribution in California” information is derived from habitat requirements provided by the Jepson Flora Project.
Likelihood of occurrence evaluations: *Present* = the species has been observed in the Study Area; *high potential* = this species is expected to occur on-site or occurs locally in the area; *moderate potential* = suitable habitat exists in the Study Area; *low potential* = the Study Area is outside of the species’ described range or suitable habitat is absent.

Attachment D

Wildlife Species Observed in the Study Area or Near Vicinity in March 2020

ATTACHMENT D

Wildlife Species Observed in the Study Area or Near Vicinity in March 2020

TABLE D-1
WILDLIFE SPECIES OBSERVED IN THE STUDY AREA OR NEAR VICINITY IN MARCH 2020

Common Name	Scientific Name	Notes
Amphibians		
California toad	*Anaxyrus boreas* ssp. *halophilus*	
California newt	*Taricha torosa*	
California red-legged frog	*Rana draytonii*	Found at Pond 33, southwest arm of reservoir
Western chorus frog	*Pseudacris triseriata*	
Reptiles		
Western pond turtle	*Actinemys marmorata*	Pond 18
Coastal garter snake	*Thamnophis elegans terrestris*	
Birds		
Western grebe	*Aechmophorus occidentalis*	
Red-winged blackbird	*Agelaius phoeniceus*	
Tricolored blackbird	*Agelaius tricolor*	
Cinnamon teal	*Anas cyanoptera*	
Mallard	*Anas platyrhynchos*	
California scrub jay	*Aphelocoma californica*	
Golden eagle	*Aquila chrysaetos*	
Great egret	*Ardea alba*	
Great blue heron	*Ardea herodias*	
Western burrowing owl	*Athene cunicularia*	
Lesser scaup	*Aythya affinis*	
Oak titmouse	*Baeolophus inornatus*	
Bufflehead	*Bucephala albeola*	
Common goldeneye	*Bucephala clangula*	
Red-tailed hawk	*Buteo jamaicensis*	
Ferruginous hawk	*Buteo regalis*	
Anna's hummingbird	*Calypte anna*	
Turkey vulture	*Cathartes aura*	
Killdeer	*Charadrius vociferus*	
Northern harrier	*Circus hudsonius*	
Northern flicker	*Colaptes auratus*	
American crow	*Corvus brachyrhynchos*	
Common raven	*Corvus corax*	
Common quail	*Coturnix coturnix*	

TABLE D-1 (CONTINUED)
WILDLIFE SPECIES OBSERVED IN THE STUDY AREA OR NEAR VICINITY IN MARCH 2020

Common Name	Scientific Name	Notes
White-tailed kite	*Elanus leucurus*	
Brewer's blackbird	*Euphagus cyanocephalus*	
American kestrel	*Falco sparverius*	
American coot	*Fulica americana*	
Bald eagle	*Haliaeetus leucocephalus*	Nest at Pond 12
Barn swallow	*Hirundo rustica*	
Loggerhead shrike	*Lanius ludovicianus*	
Herring gull	*Larus argentatus*	
Belted kingfisher	*Megaceryle alcyon*	
Acorn woodpecker	*Melanerpes formicivorus*	
California towhee	*Melozone crissalis*	
Common merganser	*Mergus merganser*	
Red-breasted merganser	*Mergus serrator*	
Northern mockingbird	*Mimus polyglottos*	
Ruddy duck	*Oxyura jamaicensis*	
Osprey	*Pandion haliaetus*	
Savannah sparrow	*Passerculus sandwichensis*	
American white pelican	*Pelecanus erythrorhynchos*	
American cliff swallow	*Petrochelidon pyrrhonota*	
Double-crested cormorant	*Phalacrocorax auritus*	
Yellow-billed magpie	*Pica nuttalli*	
Spotted towhee	*Pipilo maculatus*	
Horned grebe	*Podiceps auritus*	
Eared grebe	*Podiceps nigricollis*	
Pied-billed grebe	*Podilymbus podiceps*	
Say's phoebe	*Sayornis saya*	
Western meadowlark	*Sturnella neglecta*	
Violet-green swallow	*Tachycineta thalassina*	
Mourning dove	*Zenaida macroura*	
Golden-crowned sparrow	*Zonotrichia atricapilla*	
White-crowned sparrow	*Zonotrichia leucophrys*	
Mammals		
Coyote	*Canis latrans*	
Tule elk	*Cervus canadensis nannodes*	
Black-tailed jackrabbit	*Lepus californicus*	
Black-tailed deer	*Odocoileus hemionus*	
California ground squirrel	*Otospermophilus beecheyi*	
Raccoon	*Procyon lotor*	
Wild boar	*Sus scrofa*	
Desert cottontail	*Sylvilagus audubonii*	

Attachment E

Detailed Mapbook of Habitat Mapping in the Study Area

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Habitat Type
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- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

ESA

Attachment H
Vegetation Communities
in the Study Area

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

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2020 Study Area	Habitat Type			
Dinosaur Point Boat Launch	Agriculture	California Sagebrush Scrub	Intermittent Channel	Seep
Inundation Area	Annual Grasslands	California Sycamore Woodland	Lacustrine	Urban
State Route 152 Modifications	Blue Oak Woodland	Emergent Wetland	Pond	**Water Flowline**
100 foot Buffer		Ephemeral Channel	Purple Needle Grass	Pipeline
Safety of Dams Study Area				Stream/River

ESA

Attachment H
Vegetation Communities
in the Study Area

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B.F. Sisk Dam Raise Project - Biological Survey Report

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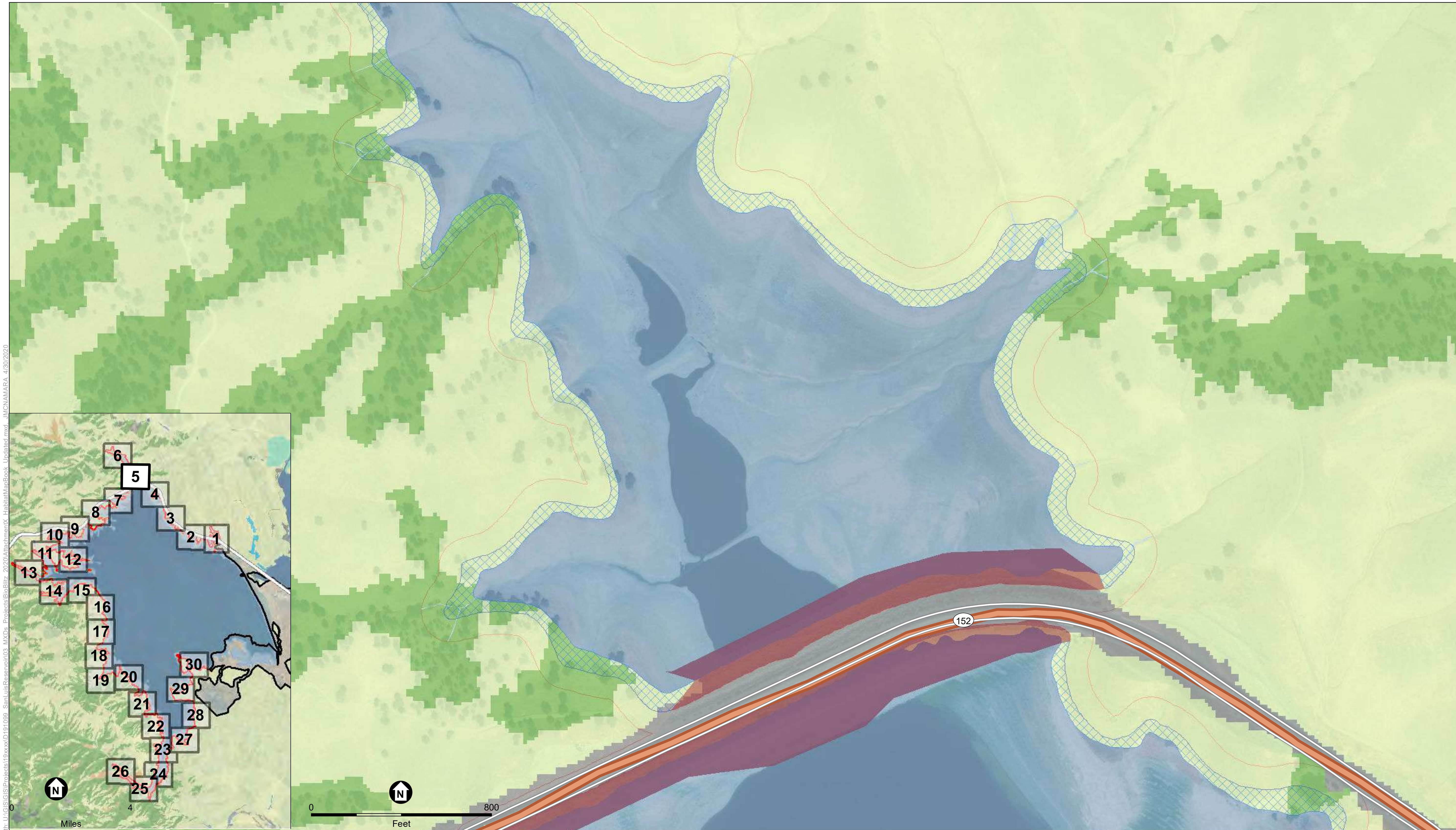

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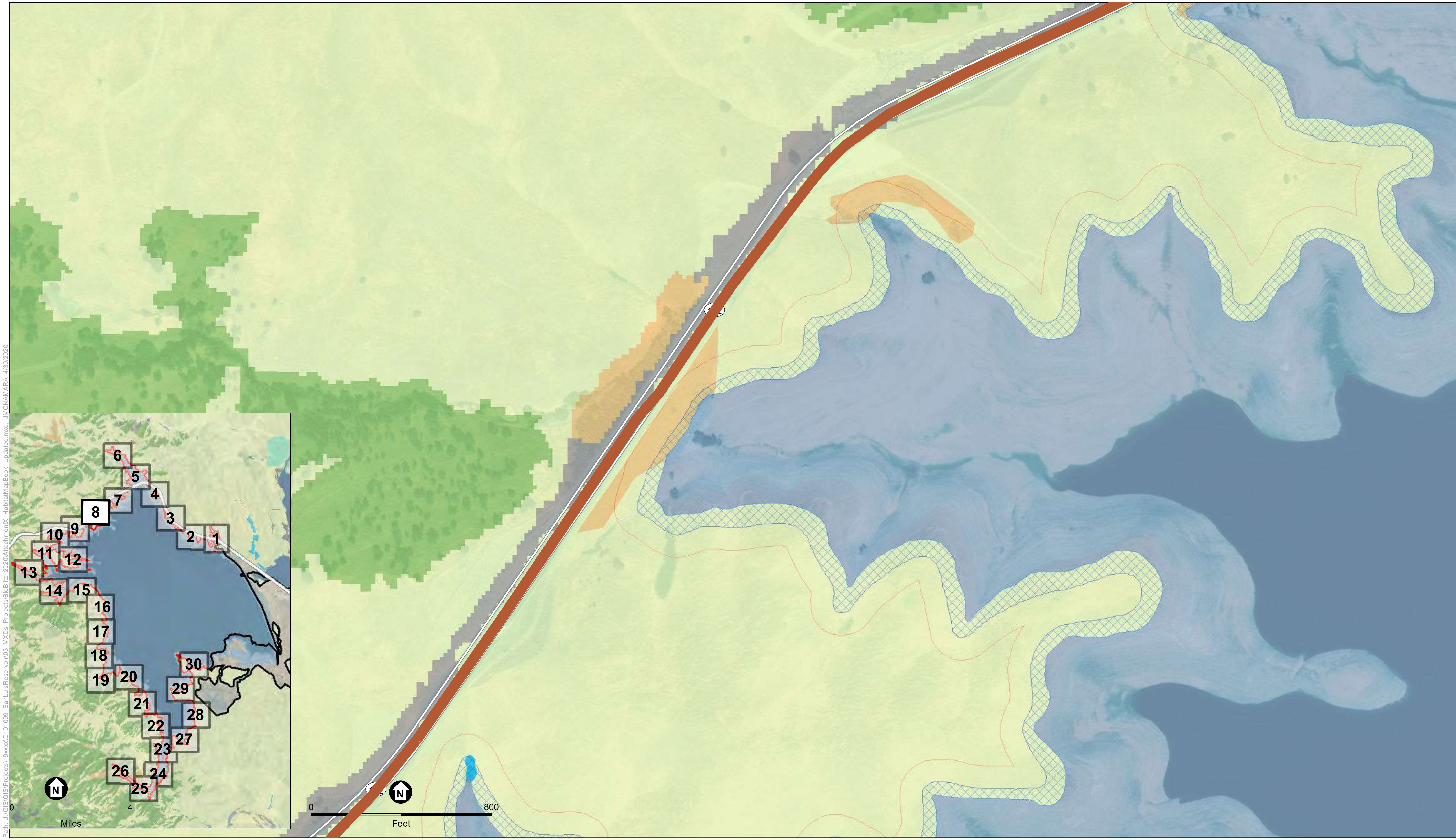

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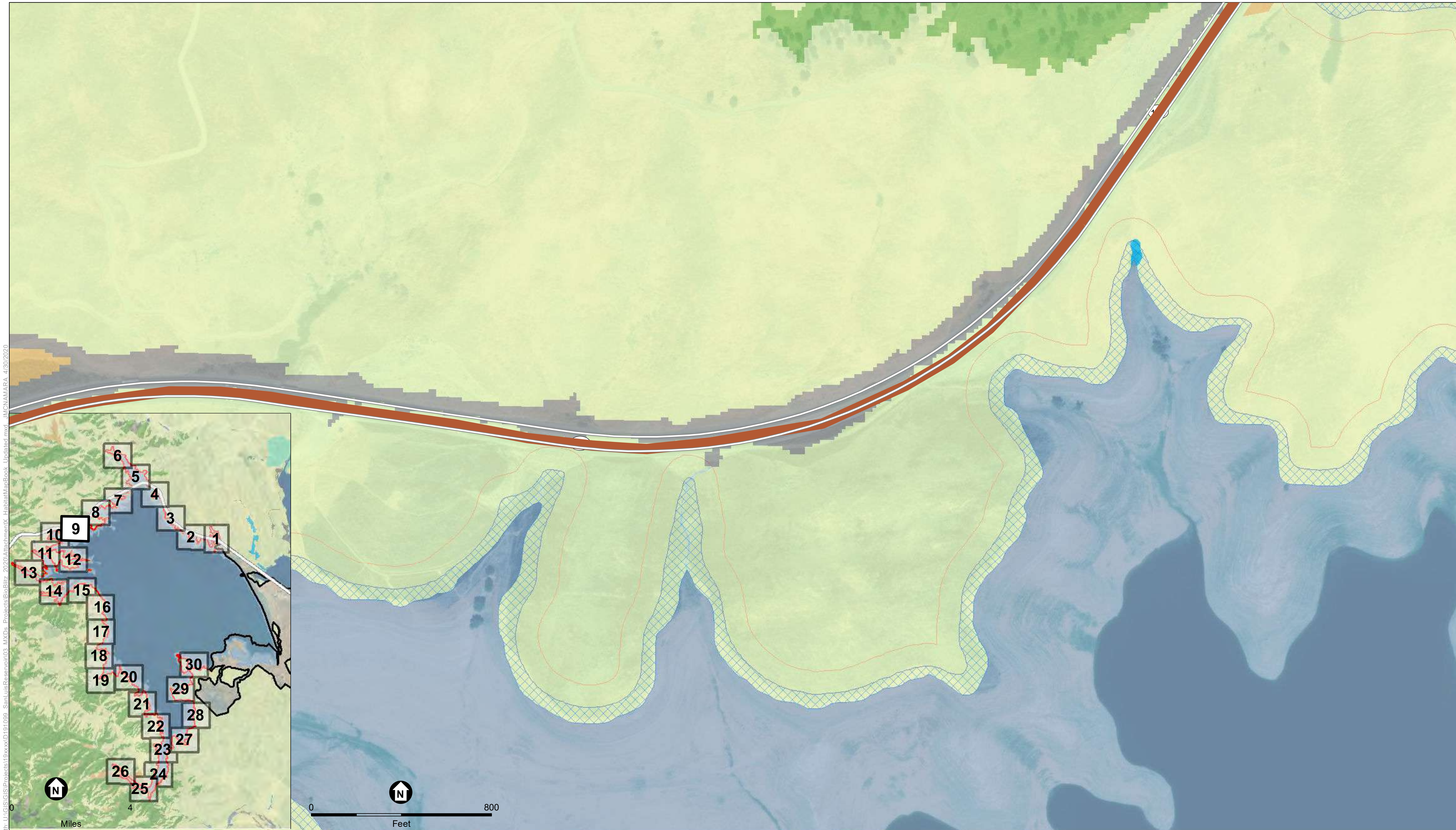

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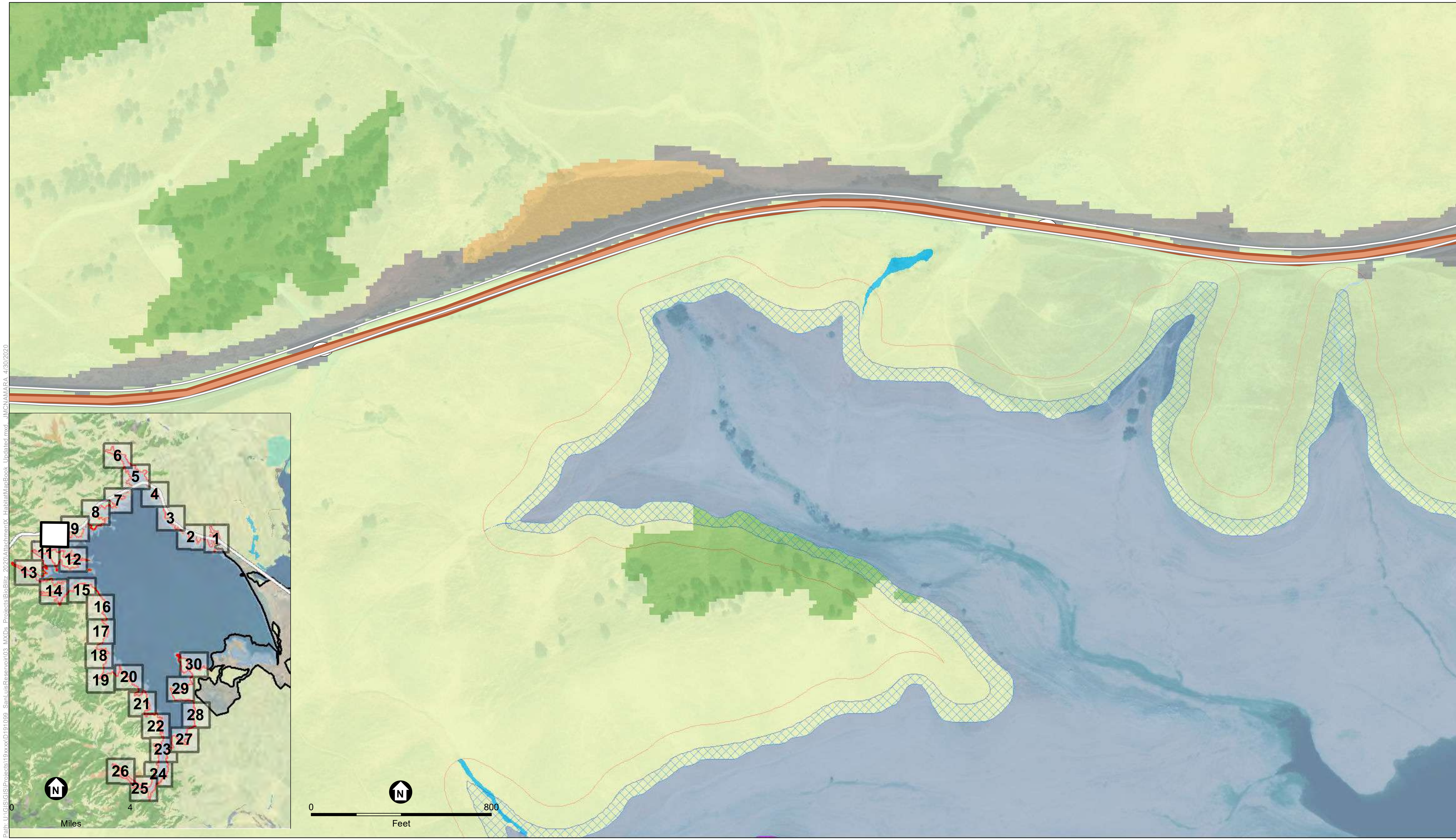

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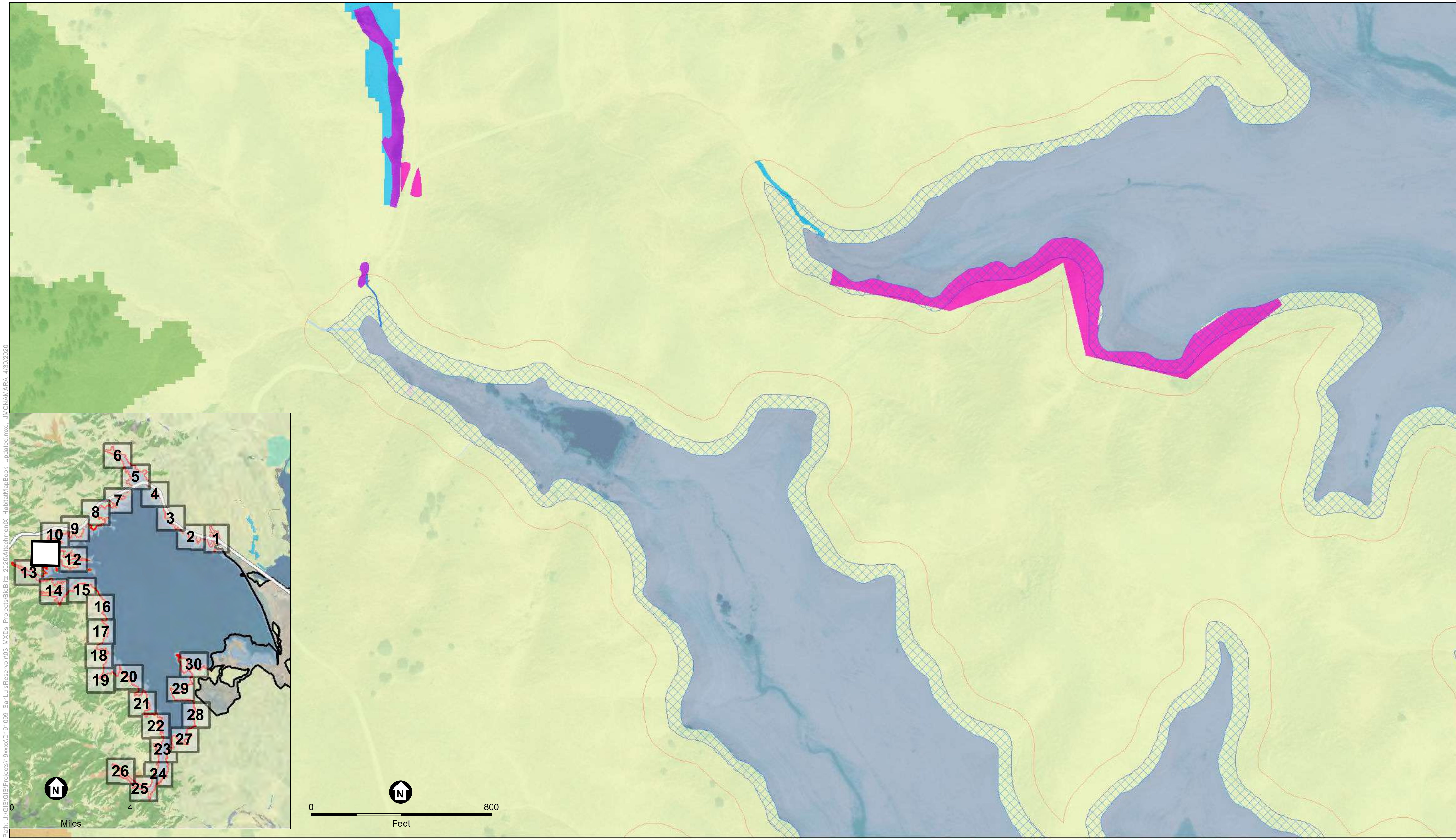

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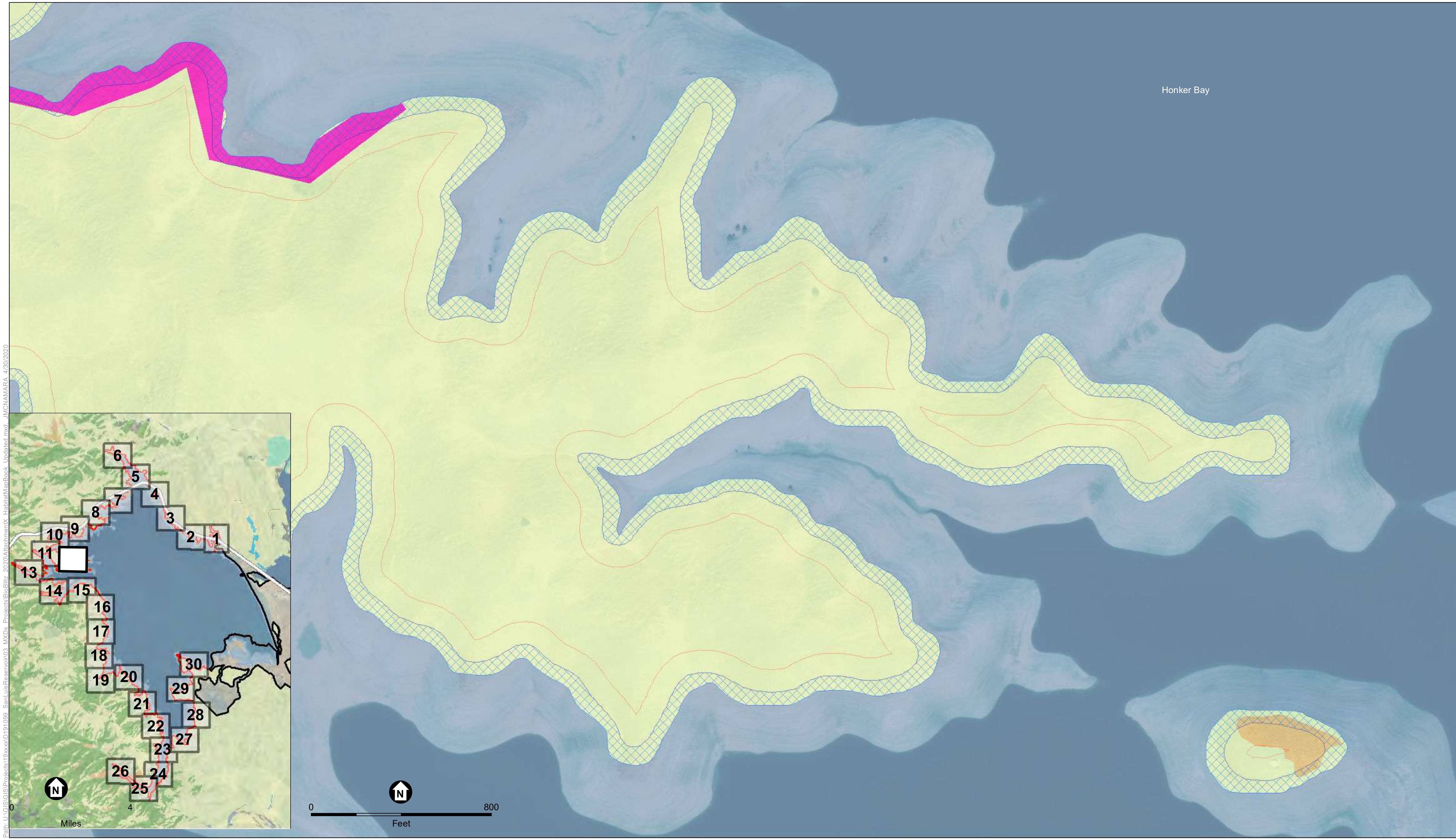

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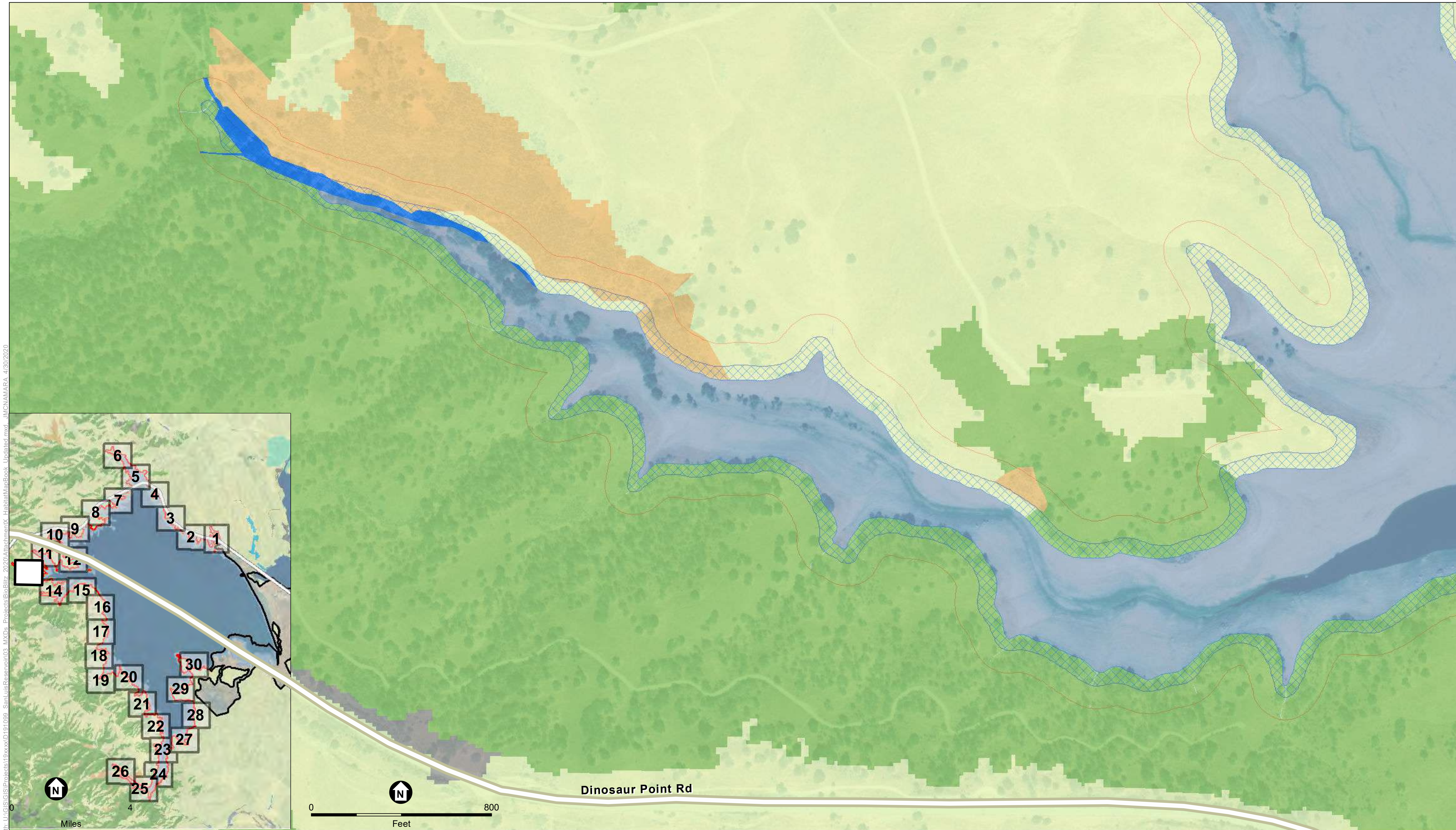

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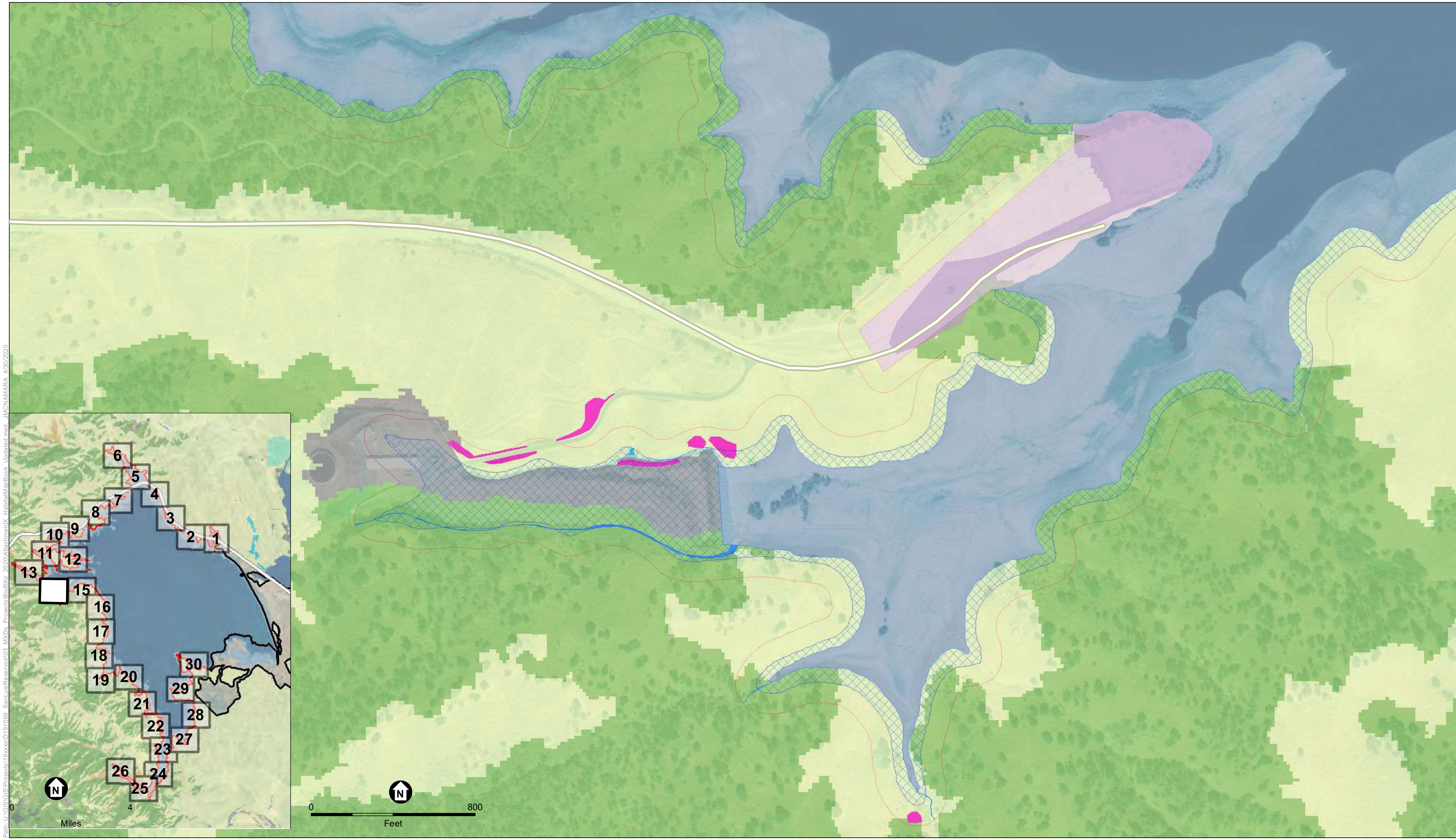

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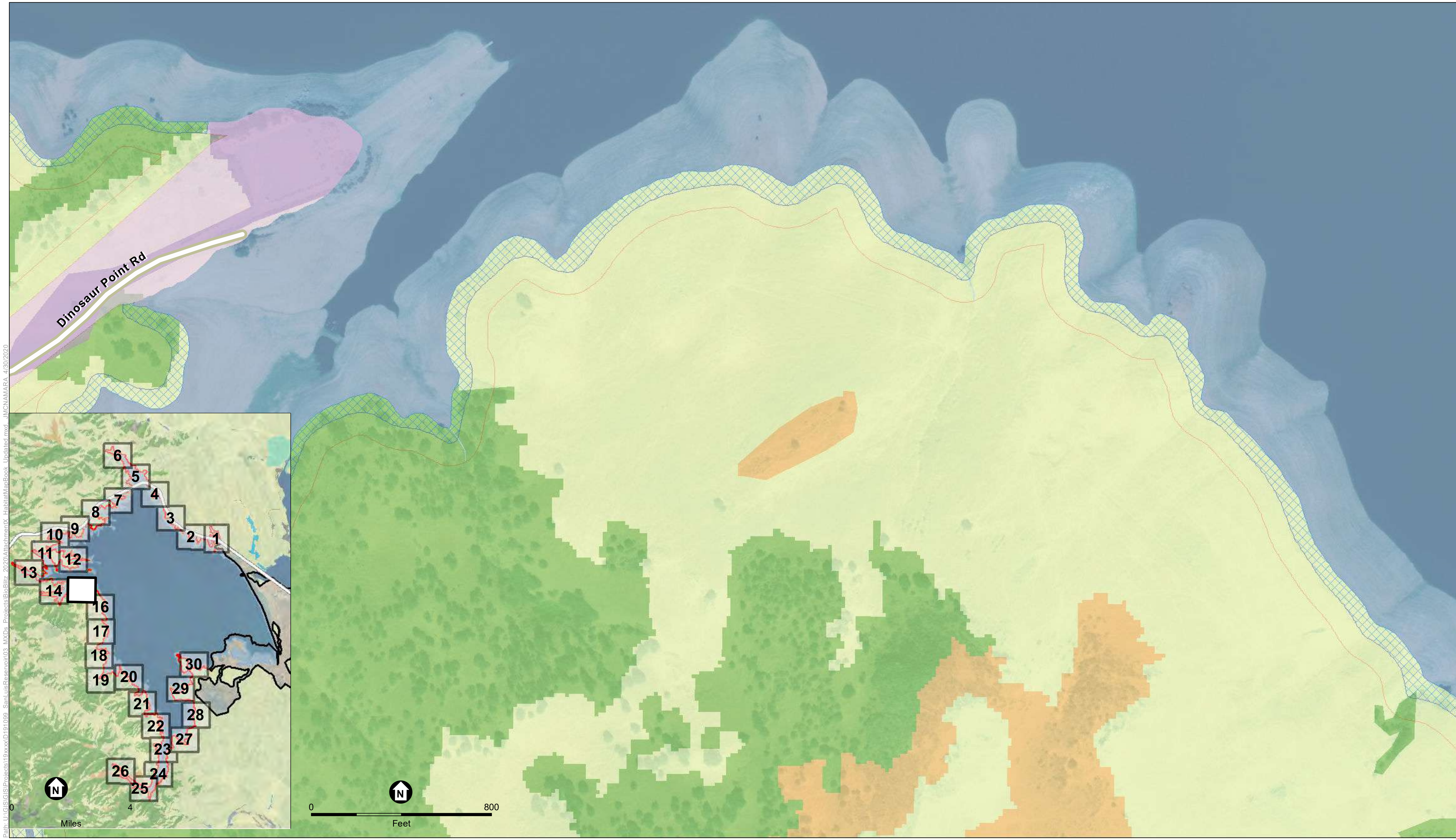

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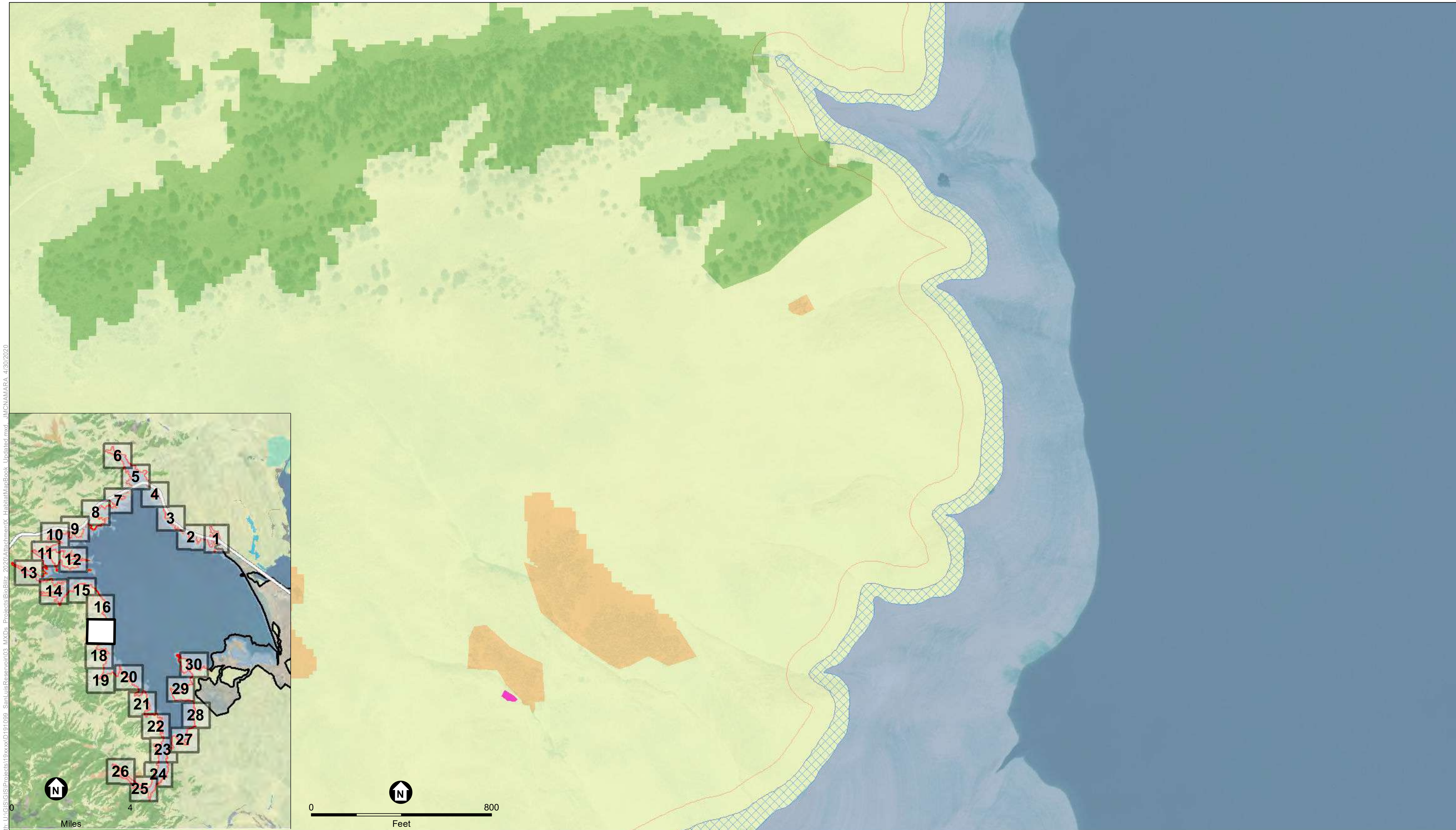

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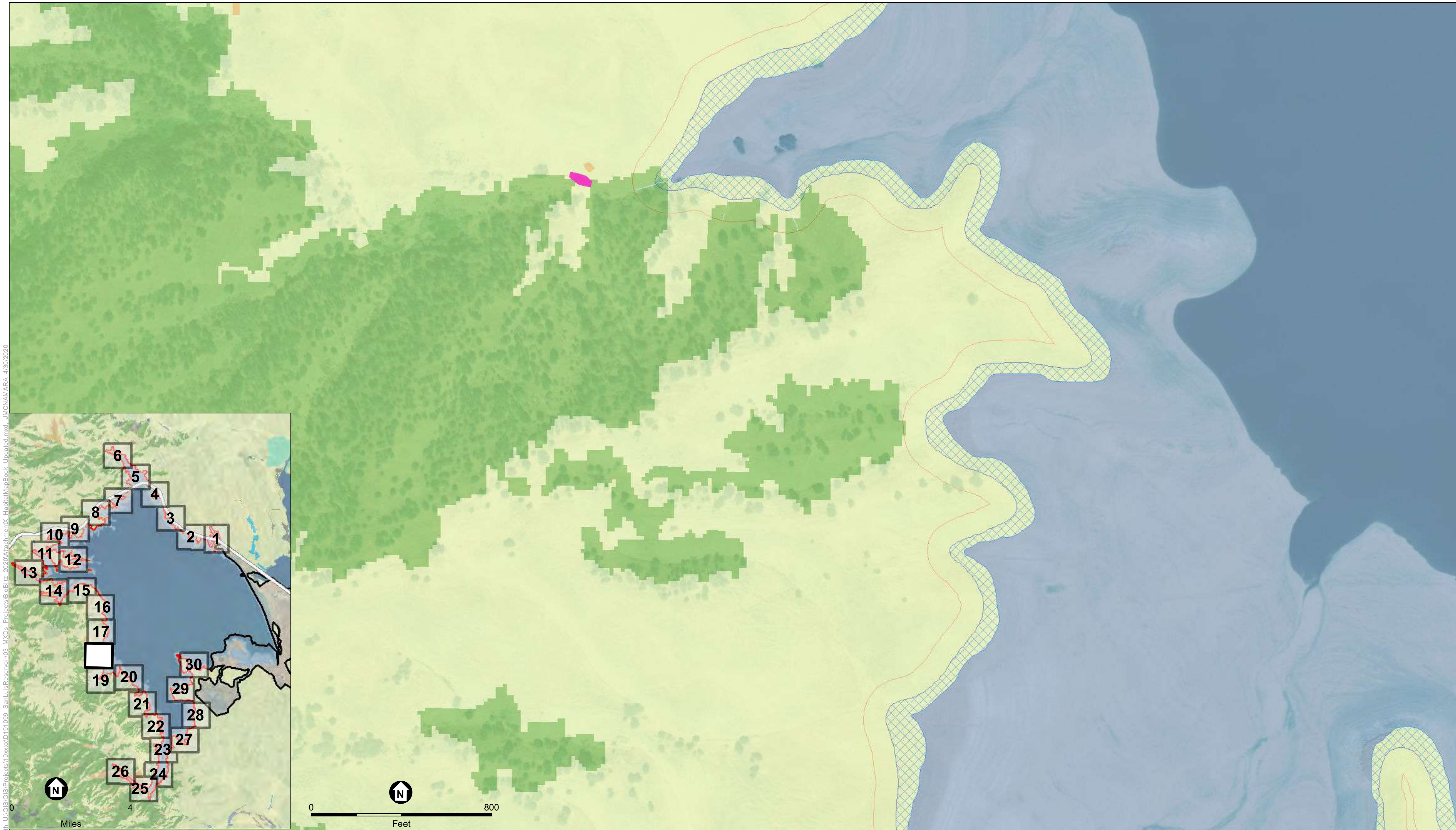

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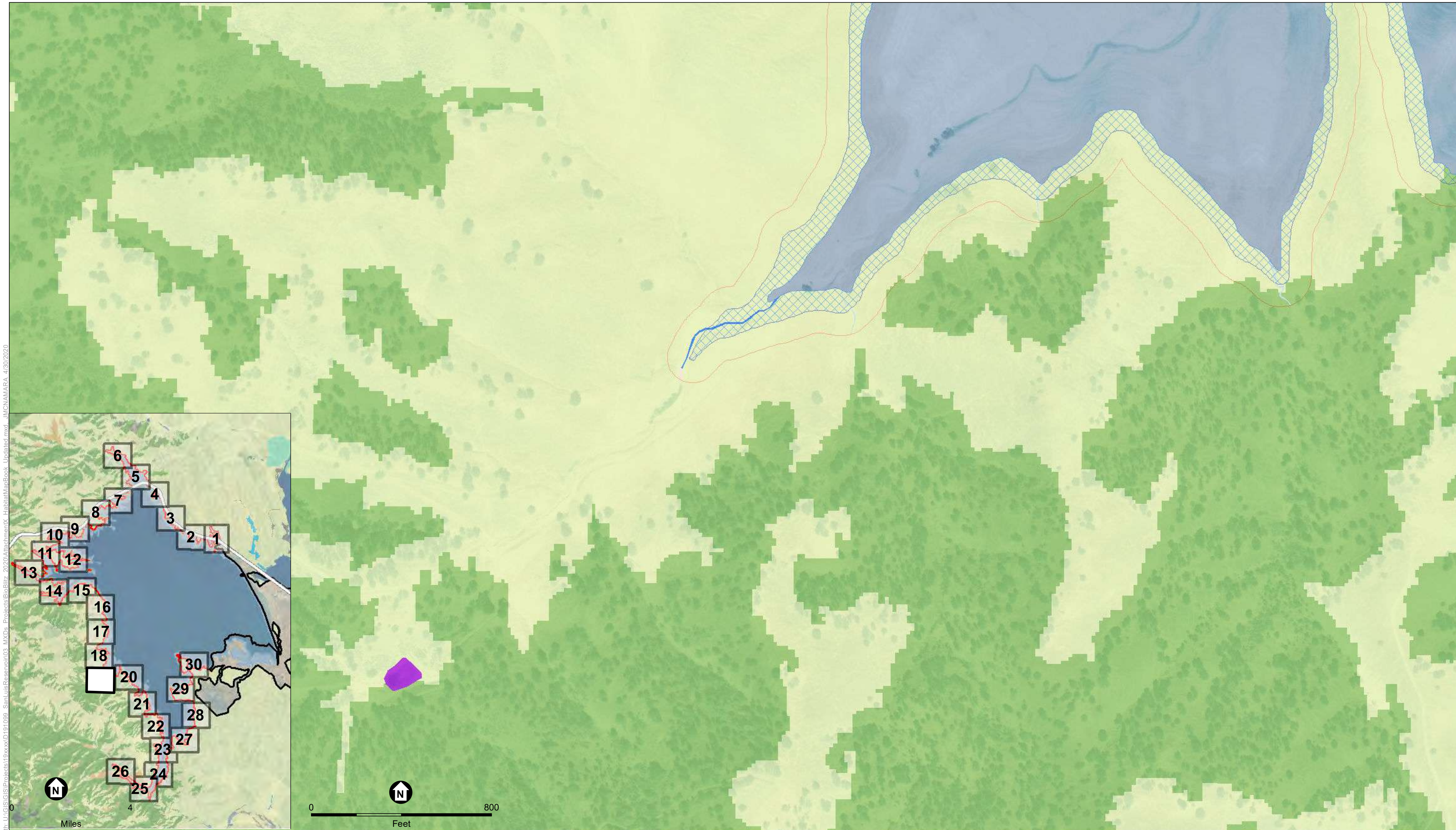

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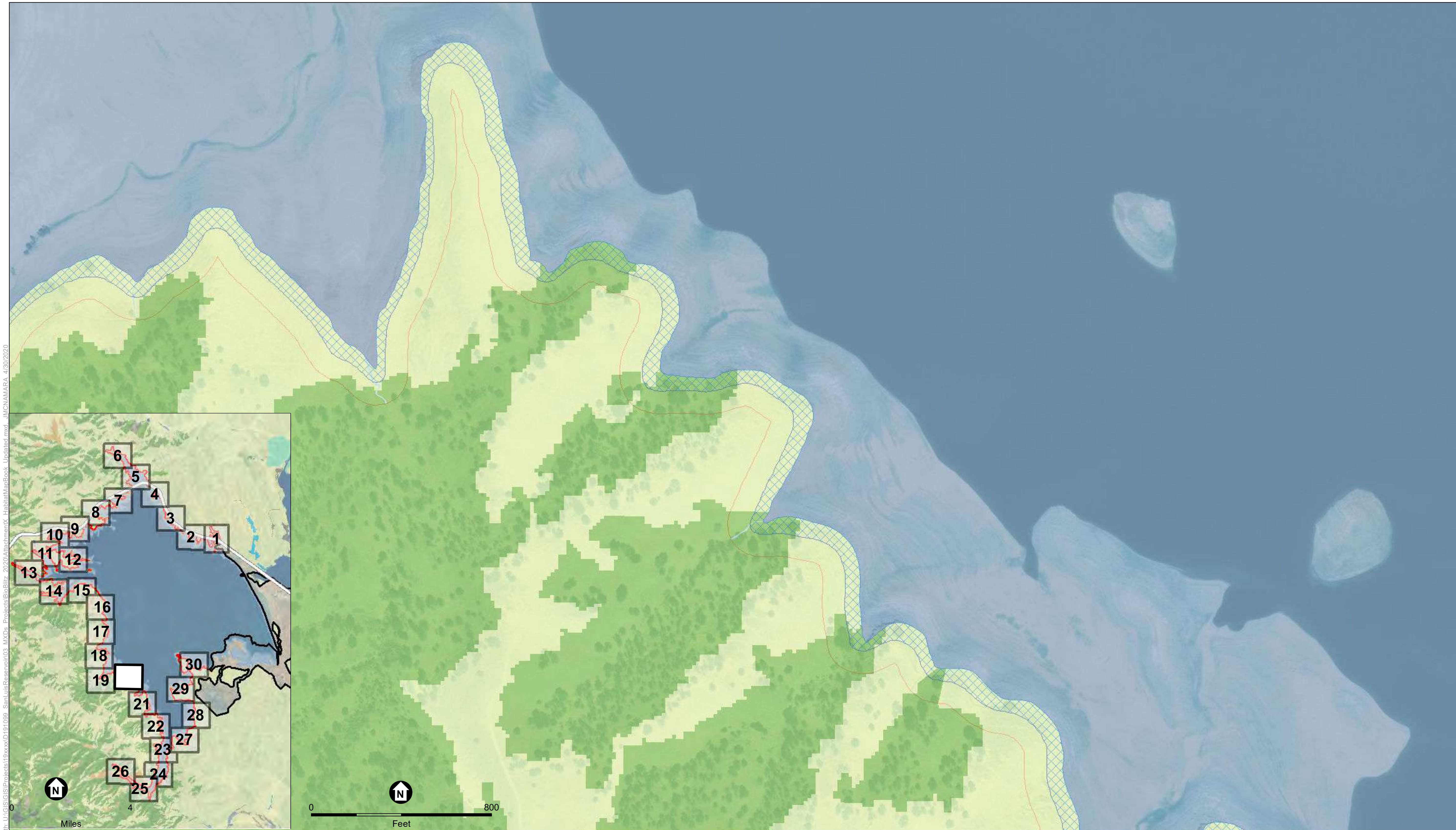

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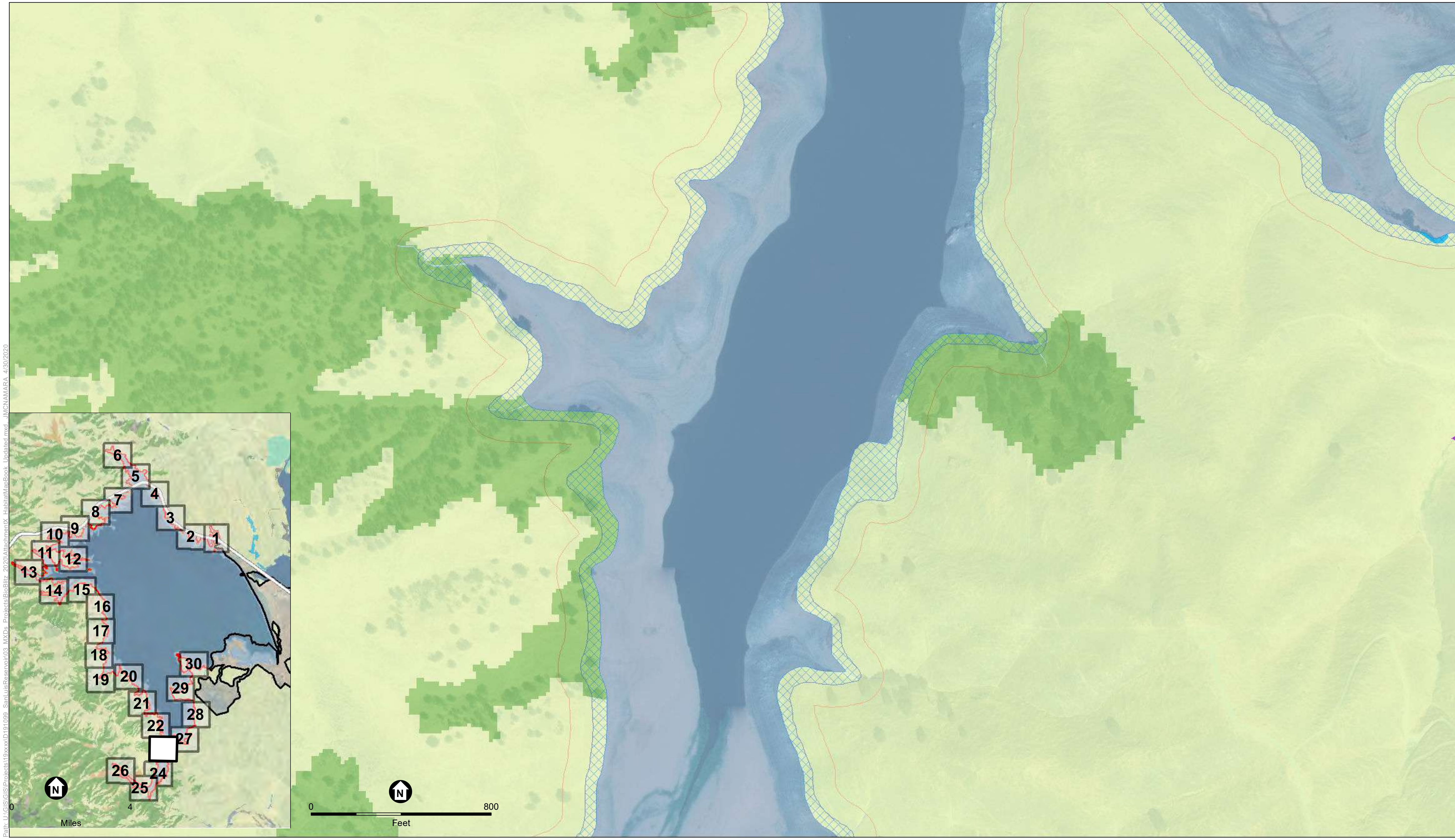

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Attachment H
Vegetation Communities
in the Study Area

ESA

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

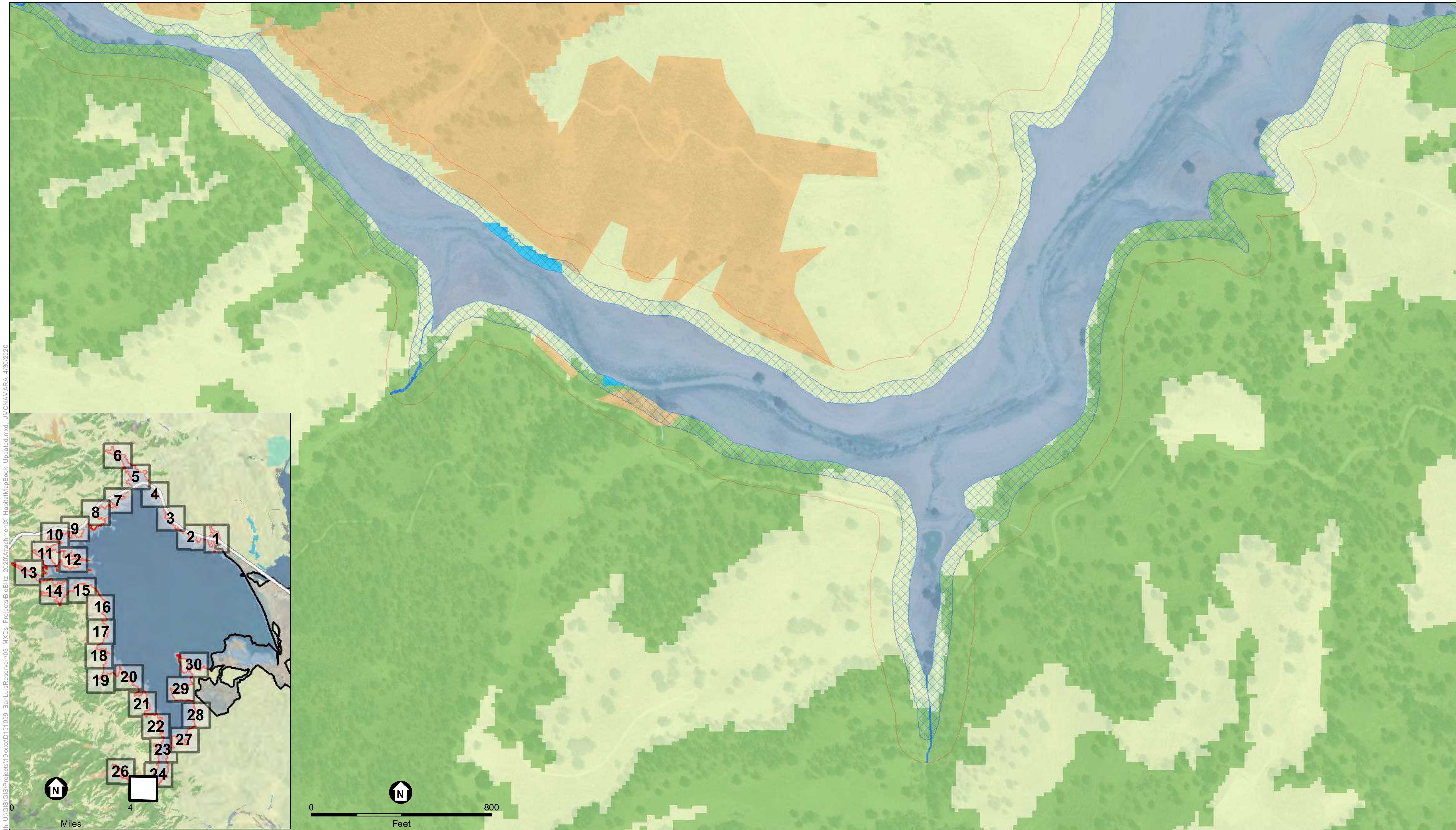
Habitat Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

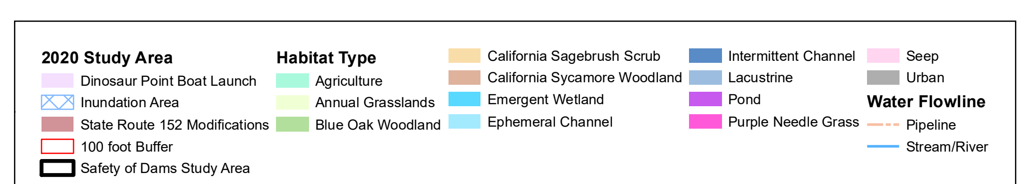
B.F. Sisk Dam Raise Project - Biological Survey Report

Attachment H
Vegetation Communities
in the Study Area

ESA



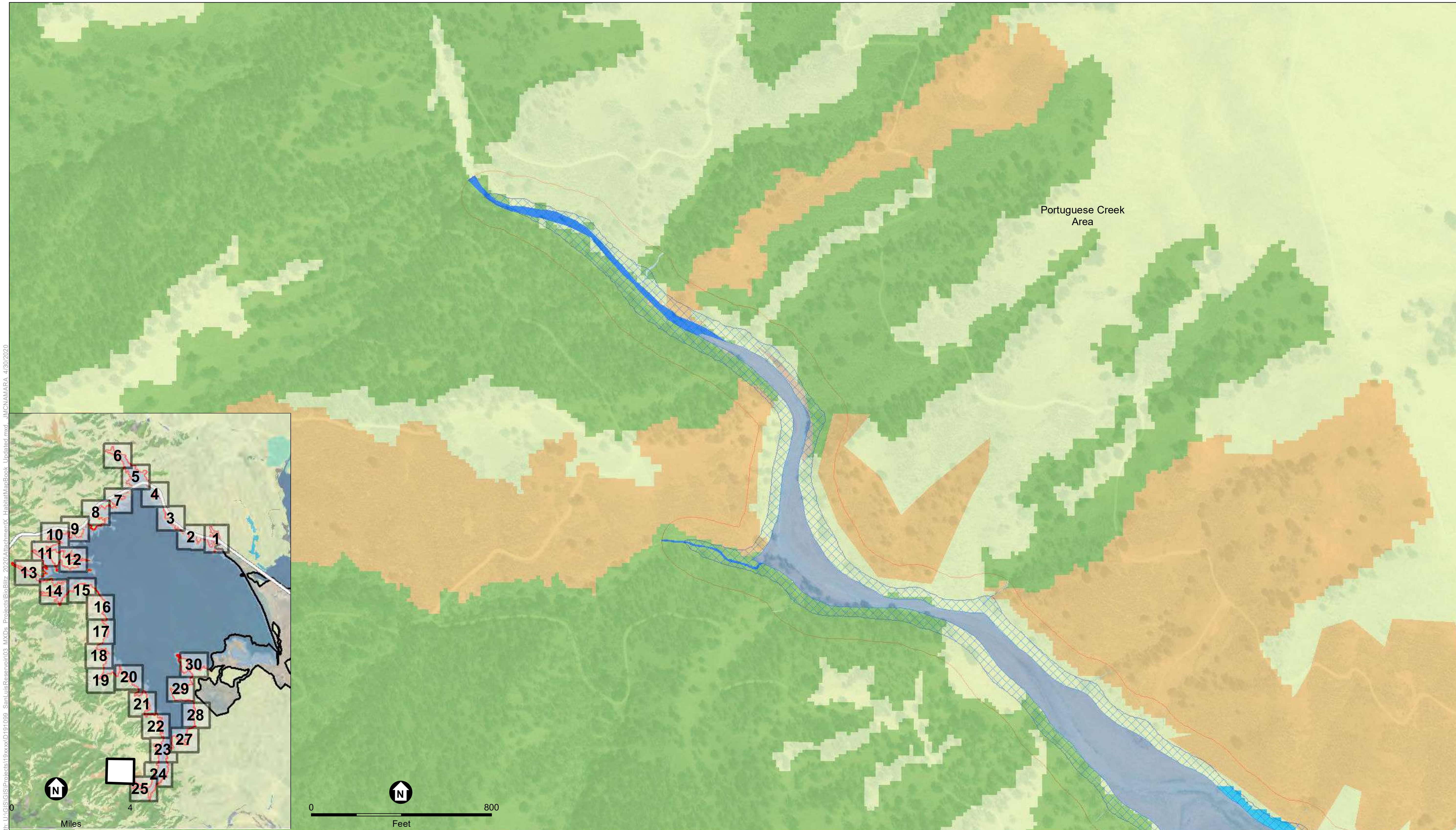
SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020



B.F. Sisk Dam Raise Project - Biological Survey Report

ESA

Attachment H
Vegetation Communities
in the Study Area



SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

B.F. Sisk Dam Raise Project - Biological Survey Report

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Habitat Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

ESA

Attachment H
Vegetation Communities
in the Study Area

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
Dinosaur Point Boat Launch
Inundation Area
State Route 152 Modifications
100 foot Buffer
Safety of Dams Study Area

Habitat Type
Agriculture
Annual Grasslands
Blue Oak Woodland
California Sagebrush Scrub
California Sycamore Woodland
Emergent Wetland
Ephemeral Channel
Intermittent Channel
Lacustrine
Pond
Purple Needle Grass
Seep
Urban

Water Flowline
Pipeline
Stream/River

ESA

B.F. Sisk Dam Raise Project - Biological Survey Report

Attachment H
Vegetation Communities
in the Study Area

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Habitat Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

ESA

B.F. Sisk Dam Raise Project - Biological Survey Report

Attachment H
Vegetation Communities
in the Study Area

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Habitat Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

ESA

B.F. Sisk Dam Raise Project - Biological Survey Report

Attachment H
Vegetation Communities
in the Study Area

B.F. Sisk Dam Raise Project - Biological Survey Report

SOURCE: ESA, 2020; Merced County GIS - Original Habitat Mapping, Imagery-ESRI, 2020

2020 Study Area
- Dinosaur Point Boat Launch
- Inundation Area
- State Route 152 Modifications
- 100 foot Buffer
- Safety of Dams Study Area

Habitat Type
- Agriculture
- Annual Grasslands
- Blue Oak Woodland
- California Sagebrush Scrub
- California Sycamore Woodland
- Emergent Wetland
- Ephemeral Channel
- Intermittent Channel
- Lacustrine
- Pond
- Purple Needle Grass
- Seep
- Urban

Water Flowline
- Pipeline
- Stream/River

ESA

Attachment H
Vegetation Communities
in the Study Area

Attachment F

Photographs of Ponds Assessed for California Red-Legged Frog and California Tiger Salamander Habitat

ESA

Source: Environmental Science Associates

B.F. Sisk Dam Raise Project

Attachment F—Photo 1

Northwest Reservoir Pond (Pond 44) (top) and surrounding grasslands habitat (bottom). Photo date: March 16, 2020

Source: Environmental Science Associates

Attachment F—Photo 2

Northwest Reservoir Pond (Pond 0) (top) and Northwest Reservoir Pond (Pond 43) (bottom). Photo date: March 16, 2020

Source: Environmental Science Associates

Attachment F—Photo 3

Portuguese Creek Pond (Pond 18) (top) and surrounding grassland habitat (bottom).

Photo date: March 17, 2020

Source: Environmental Science Associates

Attachment F—Photo 4

San Luis Creek drainage (top) and identified California red-legged frog (bottom).
Photo date: March 17, 2020

Source: Environmental Science Associates

Attachment F—Photo 5

Lone Oak Bay Stock Pond (Pond 10) (top) and identified California red-legged frog (bottom). Photo date: March 19, 2020

Source: Environmental Science Associates

Attachment F—Photo 6

Lone Oak Bay Pond (Pond 12) (top) and surrounding grassland habitat (bottom).
Photo date: March 17, 2020

Source: Environmental Science Associates

Attachment F—Photo 7

West Reservoir Pond (Pond 33) (top) and surrounding blue oak woodlands habitat (bottom). Photo date: March 17, 2020

Source: Environmental Science Associates

Attachment F—Photo 8

California red-legged frog found in the West Reservoir Drainage Below Pond 33 (top) and one of the dead California red-legged frogs found in the same drainage (bottom). Photo date: March 19, 2020

Source: Environmental Science Associates

Attachment F—Photo 9

South of Dinosaur Point Boat Launch Pond (Pond 38) (top) and surrounding annual grasslands and oak scrub (bottom). Photo date: March 19, 2020

Attachment G
California Natural Diversity Database Reporting Forms

ATTACHMENT G

California Natural Diversity Database Reporting Forms

Bald eagle, nesting

Burrowing owl

Western pond turtle

California red-legged frog (three localities)

Scientific Name: Athene cunicularia

Common Name: Western Burrowing Owl

Species Found? ☒ **Yes** ☐ **No** ______________ If not, why?

Total No. of Individuals:) 1

Subsequent visit? ☐ **Yes** ☒ **No**

Existing NDDB occurrence:______________ ☒ **No** ☐ **Unk.**
If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman
Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954
Email address: bpittman@esassoc.com
Phone: 707-795-0915

Plant Information

Phenology: ______ % vegetative ______ % flowering ______ % fruiting

Animal Information

Age Structure: 1 # adults ______ # juveniles ______ # unknown

☐ breeding ☒ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map) –
Attachment G- Figure 1

County: Merced	*Landowner / manager*: Private
Quad Name: San Luis Dam, CA	*Elevation*: 774 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 37.0121926, -121.101443672089	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Steep rolling hills with rocky grazed annual grassland adjacent to stock pond. Extensive small mammal activity is evident within the grassland, with California ground squirrel as a major species. Dominant plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.).
Other rare species? California red-legged frog was present at the stock pond adjacent to where the burrowing owl was found.

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor
Current / surrounding land use: Private ranch. Located 250 feet to the east of Bureau of Reclamation land. Land is used for active cattle grazing.
Visible Disturbances / possible threats: Cattle grazing and ranching activities.
Comments: One adult burrowing owl was flushed from a burrow.

Determination: (check one or more, and fill in blanks)
☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

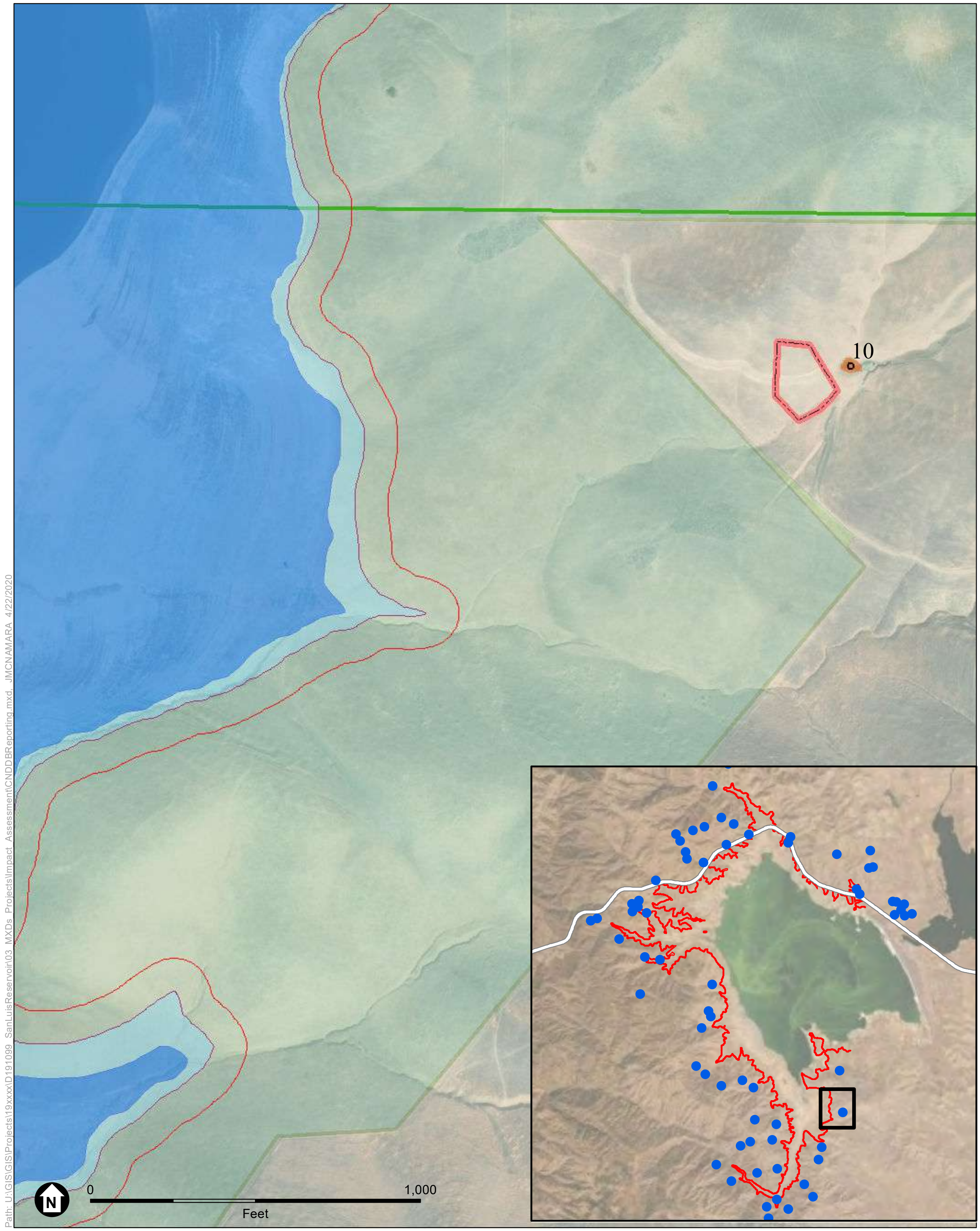
Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☐
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments:

1. *Attachment G- Figure 1 – Western Burrowing Owl and California Red-legged Frog Pond 10*
2. *Photographs of Habitat Surrounding where Burrowing Owl was Located Adjacent to Pond 10*



California Department of Fish and Wildlife - CNDDB Reporting

SOURCE: ESA, 2020; Imagery-ESRI, 2020

Land Ownership*
Bureau of Reclamation
California Department of Fish and Wildlife
California Department of Parks and Recreation
California Department of Water Resources
Department of Defense

Observed Location
Potential Pond

Status
CRLF Present
Potential Breeding Pond
Dry

B.F. Sisk Dam Raise Project Impact Area
Dinosaur Boat Launch
Inundation
SR 152
100 foot Buffer

*All land is private if it is not identifed into one of these categories.

ESA

Attachment G - Figure 1
Western Burrowing Owl and California Red-legged Frog
Pond 10

Source: ESA

Attachment G - Photo 1

Habitat Surrounding where Burrowing Owl was Observed Adjacent to Pond 10.

Photo date: March 19, 2020

Scientific Name: Haliaeetus leucocephalus

Common Name: Bald Eagle

Species Found? ☒ **Yes** ☐ **No** ____________ If not, why?

Total No. of Individuals:) 1

Subsequent visit? ☒ **Yes** ☐ **No**

Existing NDDB occurrence:______________ ☒ **No** ☐ **Unk.** If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman

Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954

Email address: bpittman@esassoc.com

Phone: 707-795-0915

Plant Information

Phenology: ______ % vegetative ______ % flowering ______ % fruiting

Animal Information

Age Structure: 1 # adults ______ # juveniles ______ # unknown

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☒ nesting ☐ other

Location (please also attach or draw map)
Attachment G- Figure 2

County: Merced	*Landowner / manager*: Private
Quad Name: San Luis Dam, CA	*Elevation*: 612 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 37.012193, -121.101444	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Nest is located in a large isolated eucalyptus tree. Gentle grazed rolling hills with annual grassland adjacent to stock pond. Extensive small mammal activity is evident within the grassland, with California ground squirrel as a major species. Dominant plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.).

Other rare species? None identified.

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor

Current / surrounding land use: Private ranch. Located 415 feet to the southeast of Bureau of Reclamation land. Land is used for active cattle grazing.
Visible Disturbances / possible threats: Cattle grazing and ranching activities.
Comments: One adult bald eagle was flushed from its nest when biologists approached Pond 12. It was seen foraging during the second visit the next day.

Determination: (check one or more, and fill in blanks)

☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

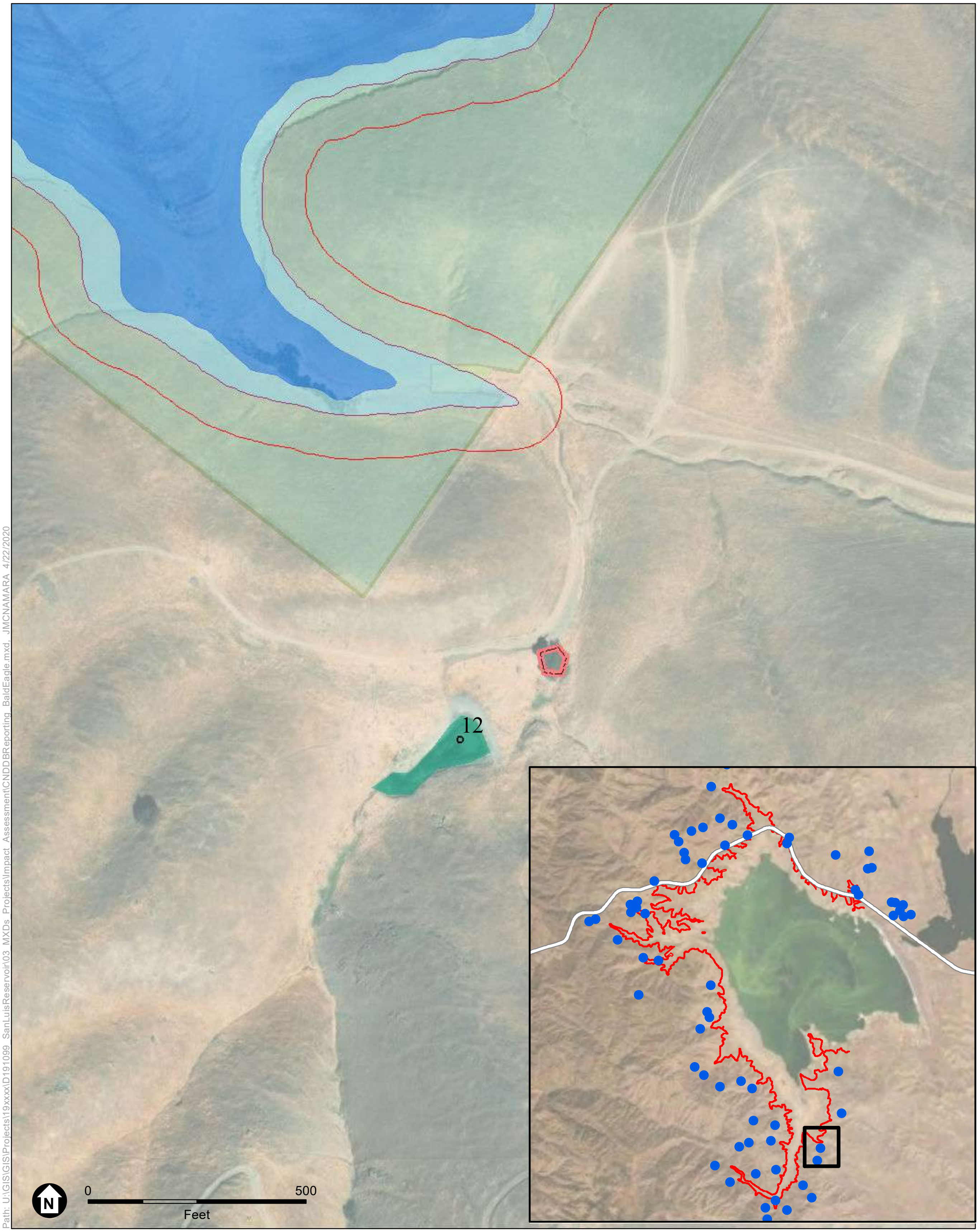
Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☐
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense? ☒ **yes** ☐ **no**

Attachments:

1. *Attachment G- Figure 2 – Bald Eagle Nest and Potential Special-status Species Pond 12*
2. *Bald Eagle Nest Located in Isolated Eucalyptus Tree and Surrounding Habitat Pond 12*



California Department of Fish and Wildlife - CNDDB Reporting

SOURCE: ESA, 2020; Imagery-ESRI, 2020

Land Ownership*
- Bureau of Reclamation
- California Department of Fish and Wildlife
- California Department of Parks and Recreation
- California Department of Water Resources
- Department of Defense

- Observed Location
- Potential Pond

Status
- CRLF Present
- Potential Breeding Pond
- Dry

B.F. Sisk Dam Raise Project Impact Area
- Dinosaur Boat Launch
- Inundation
- SR 152
- 100 foot Buffer

*All land is private if it is not identifed into one of these categories.

ESA

Attachment G - Figure 2
Bald Eagle at Pond 12

Source: ESA

Attachment G - Photo 2

Bald Eagle Nest located in Isolated Eucalyptus Tree (top), and Lone Oak Bay Pond (Pond 12) (bottom). Photo date: March 17, 2020

Scientific Name: Actinemys marmorata

Common Name: Western Pond Turtle

Species Found? ☒ **Yes** ☐ **No** ______________
If not, why?

Total No. of Individuals: 2

Subsequent visit? ☐ **Yes** ☒ **No**

Existing NDDB occurrence:______________ ☒ **No** ☐ **Unk.**
If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman
Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954
Email address: bpittman@esassoc.com
Phone: 707-795-0915

Plant Information

Phenology: ______ ______ ______
% vegetative % flowering % fruiting

Animal Information

Age Structure: 2 ______ ______
adults # juveniles # unknown

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☒ other

Location (please also attach or draw map)	
County: Merced	*Landowner / manager*: Federal Bureau of Reclamation
Quad Name: San Luis Dam, CA	*Elevation*: 545 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 36.98407, -121.127728	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Stock pond with dead willow trees along the edges with minimal emergent vegetative cover. Pond is surrounded by steep annual grasslands and blue oak woodlands. Dominant plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.). Shallow edged stock pond that is approximately 10 feet deep. Pond is approximately 80 feet by 250 feet.

Other rare species? An unidentified large ranid frog jumped into pond when biologists arrived; likely a California red-legged frog. Bullfrogs were not observed in the watershed.

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor
Current / surrounding land use: Federal Bureau of Reclamation land is grazed by tule elk and cattle.
Visible Disturbances / possible threats: Technically the pond is already located within the inundation area of San Luis Reservoir, although the reservoir is approximately 10 feet below its current capable inundation zone. The B.F. Sisk Dam Raise Project will increase the water level by 22 feet its current crest height eliminating
Comments: Two western pond turtles were seen basking. A dead red-eared slider was found in the pond as well.

Determination: (check one or more, and fill in blanks)
☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

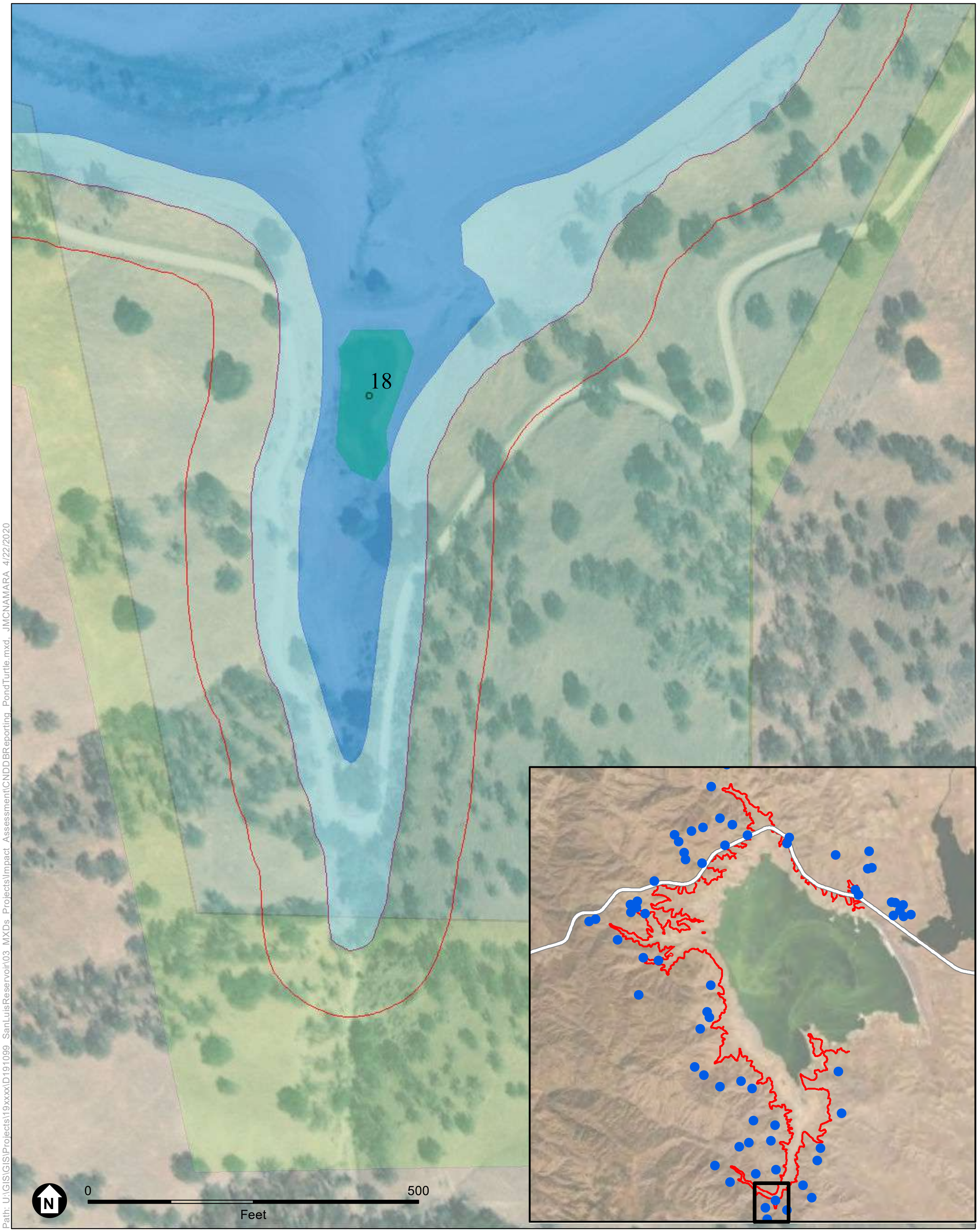
Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☒
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments:

1. *Attachment G- Figure 3 – Western Pond Turtle and Potential Special-status Species Pond 18*
2. *Portuguese Creek Pond 18 and Pond Turtles Basking on Downed Limb*



California Department of Fish and Wildlife - CNDDB Reporting

SOURCE: ESA, 2020; Imagery-ESRI, 2020

Land Ownership*
Bureau of Reclamation
California Department of Fish and Wildlife
California Department of Parks and Recreation
California Department of Water Resources
Department of Defense

Potential Pond

Status
CRLF Present
Potential Breeding Pond
Dry

B.F. Sisk Dam Raise Project Impact Area
Dinosaur Boat Launch
Inundation
SR 152
100 foot Buffer

*All land is private if it is not identifed into one of these categories.

ESA

Attachment G - Figure 3
Western Pond Turtle at Pond 18

Source: ESA

Attachment G - Photo 3

Portuguese Creek Pond (Pond 18) (top), and Pond Turtles Basking on Downed Limb (bottom). Photo date: March 17, 2020

Scientific Name: Rana draytonii

Common Name: California red-legged frog

Species Found? ☒ **Yes** ☐ **No** ____________

If not, why?

Total No. of Individuals: 1

Subsequent visit? ☐ **Yes** ☒ **No**

Existing CNDDB occurrence:______________ ☒ **No** ☐ **Unk.**

If yes, Occ. #

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman

Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954

Email address: bpittman@esassoc.com

Phone: 707-795-0915

Plant Information

Phenology: ________ ________ ________

% vegetative % flowering % fruiting

Animal Information

Age Structure: 1 (# adults) ____ (# juveniles) ____ (# unknown)

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☒ other

Location (please also attach or draw map)	
County: Merced	*Landowner / manager*: Federal Bureau of Reclamation
Quad Name: San Luis Dam, CA	*Elevation*: 546 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 36.988132, -121.13492	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
San Luis Creek flows into the Portuguese Creek Area where CRLF was found in a small pool just outside of the main flow of water. The small protected pool approximately 2 feet deep with surrounding habitat of annual grasslands with upland scrub/ chaparral. Dominant annual grassland plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.). Chaparral is dominated by California sagebrush (*Artemisia californica*), with California buckwheat (*Eriogonum fasciculatum*) and chamise (*Adenostoma fasciculatum*) in lower abundance. Blue oak trees are isolated and uncommon.

Other rare species?

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor

Current / surrounding land use: Water inundation and grazing land.

Visible Disturbances / possible threats: This portion of the drainage is located within the inundation area of San Luis Reservoir, although the reservoir is approximately 10 feet below its current capable inundation zone. The B.F. Sisk Dam Raise Project will increase the water level by 22 feet.

Comments: One adult California red-legged frog was captured in San Luis Creek, likely using the creek as a means of dispersal. Due to inundation, the creek does not provide breeding habitat for CRLF. Small adult, approximately 72mm from snout to vent length. Sex indeterminate.

Determination: (check one or more, and fill in blanks)

☐ **Keyed (cite reference):**

☐ **Compared with specimen housed at:**

☐ **Compared with photo / drawing in:**

☐ **By another person:**

☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

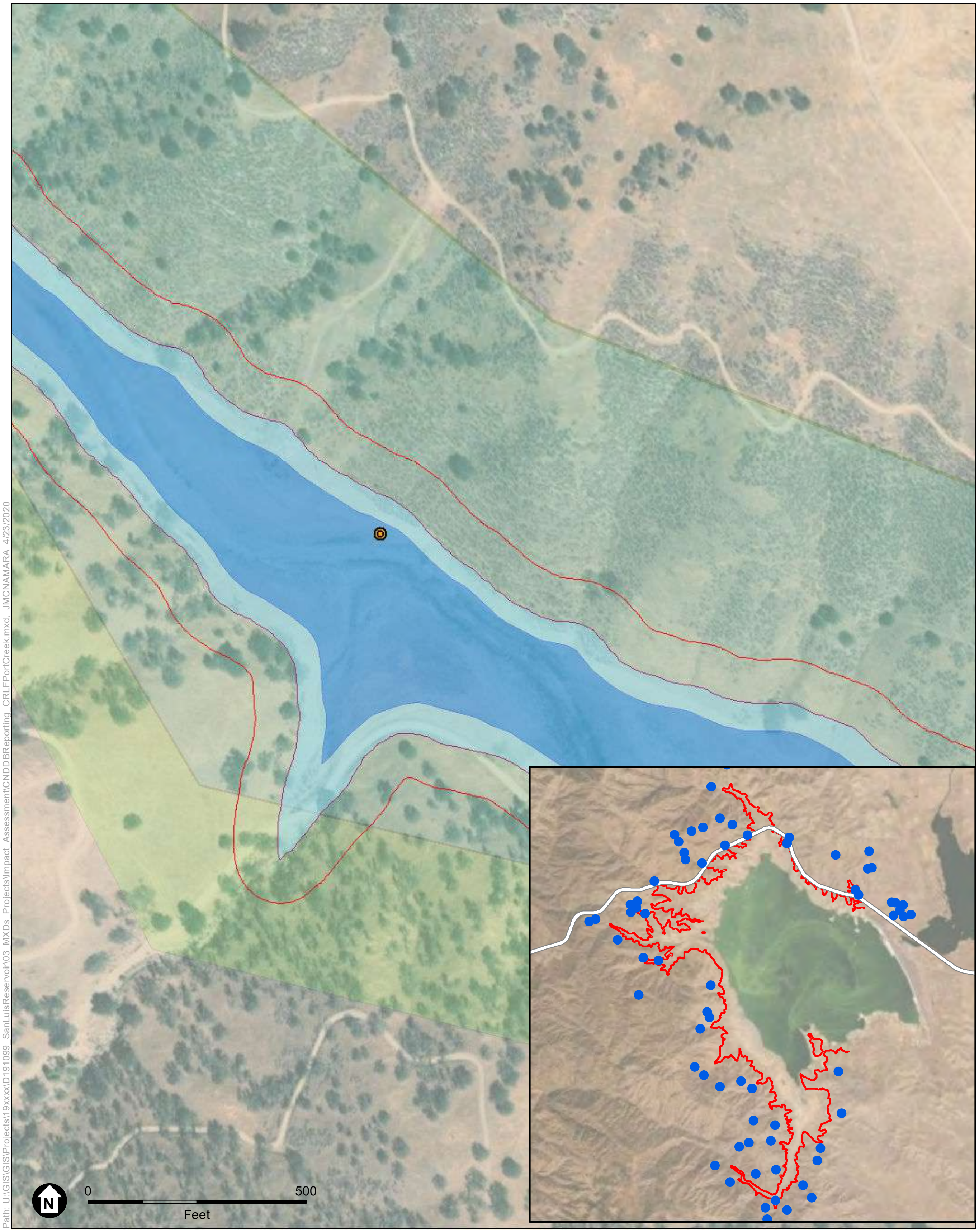
Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☒
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments:

1. *Attachment G- Figure 4 – California Red-legged Frog in San Luis Creek (Portuguese Creek Reservoir Drainage)*
2. *San Luis Creek in-stream pool and identified CRLF.*



California Department of Fish and Wildlife - CNDDB Reporting

SOURCE: ESA, 2020; Imagery-ESRI, 2020

Land Ownership*	Potential Pond	B.F. Sisk Dam Raise Project Impact Area
Bureau of Reclamation	**Status**	Dinosaur Boat Launch
California Department of Fish and Wildlife	CRLF Present	Inundation
California Department of Parks and Recreation	Potential Breeding Pond	SR 152
California Department of Water Resources	Dry	100 foot Buffer
Department of Defense		*All land is private if it is not identifed into one of these categories.

ESA

Attachment G - Figure 4
California Red-legged Frog in
San Luis Creek Off-channel Pool

Source: ESA

Attachment G - Photo 4

Off-channel pool in San Luis Creek where CRLF were found (top), and adult CRLF (bottom). Photo date: March 17, 2020

Scientific Name: Rana draytonii

Common Name: California red-legged frog

Species Found? ☒ **Yes** ☐ **No** ______________ If not, why?

Total No. of Individuals: 4

Subsequent visit? ☐ **Yes** ☒ **No**

Existing CNDDB occurrence: ______________ If yes, Occ. # ☒ **No** ☐ **Unk.**

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman

Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954

Email address: bpittman@esassoc.com

Phone: 707-795-0915

Plant Information

Phenology: ______ % vegetative ______ % flowering ______ % fruiting

Animal Information

Age Structure: 4 # adults ______ # juveniles ______ # unknown

☒ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map)
Attachment G- Figure 1

County: Merced	*Landowner / manager*: Private Land
Quad Name: San Luis Dam, CA	*Elevation*: 717 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 37.012312, -121.10093	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)
Pond was surrounded by steep rolling hills with rocky grazed annual grassland. Dominant plants include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.).
Stock pond with minimal vegetative cover along the edges of the pond. Pond was almost 100 percent covered with algae. Stock pond is approximately 4 to 10 feet deep. Pond is approximately 70 feet by 60 feet.

Other rare species? Western burrowing owl was present in the adjacent grasslands.

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor

Current / surrounding land use: Private ranch. Located 390 feet to the west of Bureau of Reclamation land. Land is used for active cattle grazing.
Visible Disturbances / possible threats: Cattle grazing, stock pond drying up.
Comments: Four small adult frogs were observed, estimated at approximately 45 mm to 55 mm snout to vent length

Determination: (check one or more, and fill in blanks)
☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☒
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense? ☒ **yes** ☐ **no**

Attachments:

1. ***See the above*** *Attachment G- Figure 1 – Western Burrowing Owl and California Red-legged Frog Pond 10*
2. *Photographs of Frog Captured at Pond 10 and Surrounding Habitat*

B. F. Sisk Dam Raise Project

Source: ESA

Attachment G - Photo 5

Lone Oak Bay Stock Pond (Pond 10) (top), and identified CRLF (bottom). Photo date: March 19, 2020

Scientific Name: Rana draytonii

Common Name: California red-legged frog

Species Found? ☒ **Yes** ☐ **No** ______ If not, why?

Total No. of Individuals: 18

Subsequent visit? ☐ **Yes** ☒ **No**

Existing CNDDB occurrence:______ If yes, Occ. # ☒ **No** ☐ **Unk.**

Collection? ☐ **Yes** ☒ **No** If yes, # and location:

Reporter: Brian Pittman

Address: Environmental Science Associates
1425 N. McDowell Blvd., Ste. 200
Petaluma, CA 94954

Email address: bpittman@esassoc.com

Phone: 707-795-0915

Plant Information

Phenology: ______ % vegetative ______ % flowering ______ % fruiting

Animal Information

Age Structure: 18 # adults ______ # juveniles ______ # unknown

☒ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location (please also attach or draw map)

County: Merced	*Landowner / manager*: Private
Quad Name: San Luis Dam, CA	*Elevation*: 653 ft
UTM: Zone 10	*Point Accuracy*: 10 Meters
Source: Collector App ISO/Google Earth	*Datum*: D-WGS_1984
Site Coordinates: DD: 37.024758, -121.156649 (pond center)	

Habitat Description (plant communities, dominants, associates, substrates/soils, aspects/slope)

Stock pond with shallow edge. The north and east edges had emergent vegetative cover. Surrounded by blue oak woodlands, annual grasslands and California sagebrush scrub. Blue oak woodlands are dominated by blue oak (*Quercus douglasii*) with California buckeye (*Aesculus californica*) trees occur in lower abundance. Herbaceous layer is annual grasslands. Dominant plants for annual grasslands include bromes (*Bromus* spp.), wild oat (*Avena* spp.), Italian ryegrass (*Festuca perennis*), clovers (*Trifolium* spp.), bur clover (*Medicago polymorpha*), and stork's bill (*Erodium* spp.). Chaparral is dominated by California sagebrush (*Artemisia californica*), with California buckwheat (*Eriogonum fasciculatum*) and chamise (*Adenostoma fasciculatum*) in lower abundance. Blue oak trees are isolated and uncommon. Stock pond is approximately 6 to 8 feet deep. Pond is approximately 120 feet by 140 feet.

Drainage below stock pond was surrounded by annual grasslands and blue oak woodlands. Drainage water was less than 1 foot deep and almost stagnant. Pools were formed and ranged from less than 1-foot-deep to 3 feet deep.

Other rare species?

Site Information Overall site quality: ☒ Excellent ☐ Good ☐ Fair ☐ Poor

Current / surrounding land use: Grazing land.

Visible Disturbances / possible threats: Ranching activities are the main threat. Biologists observed an oil sheen on the surface of the water in the drainage below Pond 33, in which two dead and one live CRLF were found. The cause of death was indeterminate.

Comments: Drainage CRLF: The dead CRLFs measured approximately 30 mm to 55 mm snout to vent. The live CRLF was approximately 30 mm to 35 mm snout to vent.
Stock Pond CRLF: 15 small adults found in main pond. They were estimated to measure approximately 70 to 80 mm snout to vent.

Determination: (check one or more, and fill in blanks)

☐ **Keyed (cite reference):**
☐ **Compared with specimen housed at:**
☐ **Compared with photo / drawing in:**
☐ **By another person:**
☒ **Other: Verified by B. Pittman, Kelly Bayne, Julie McNamara, and Joseph Huang**

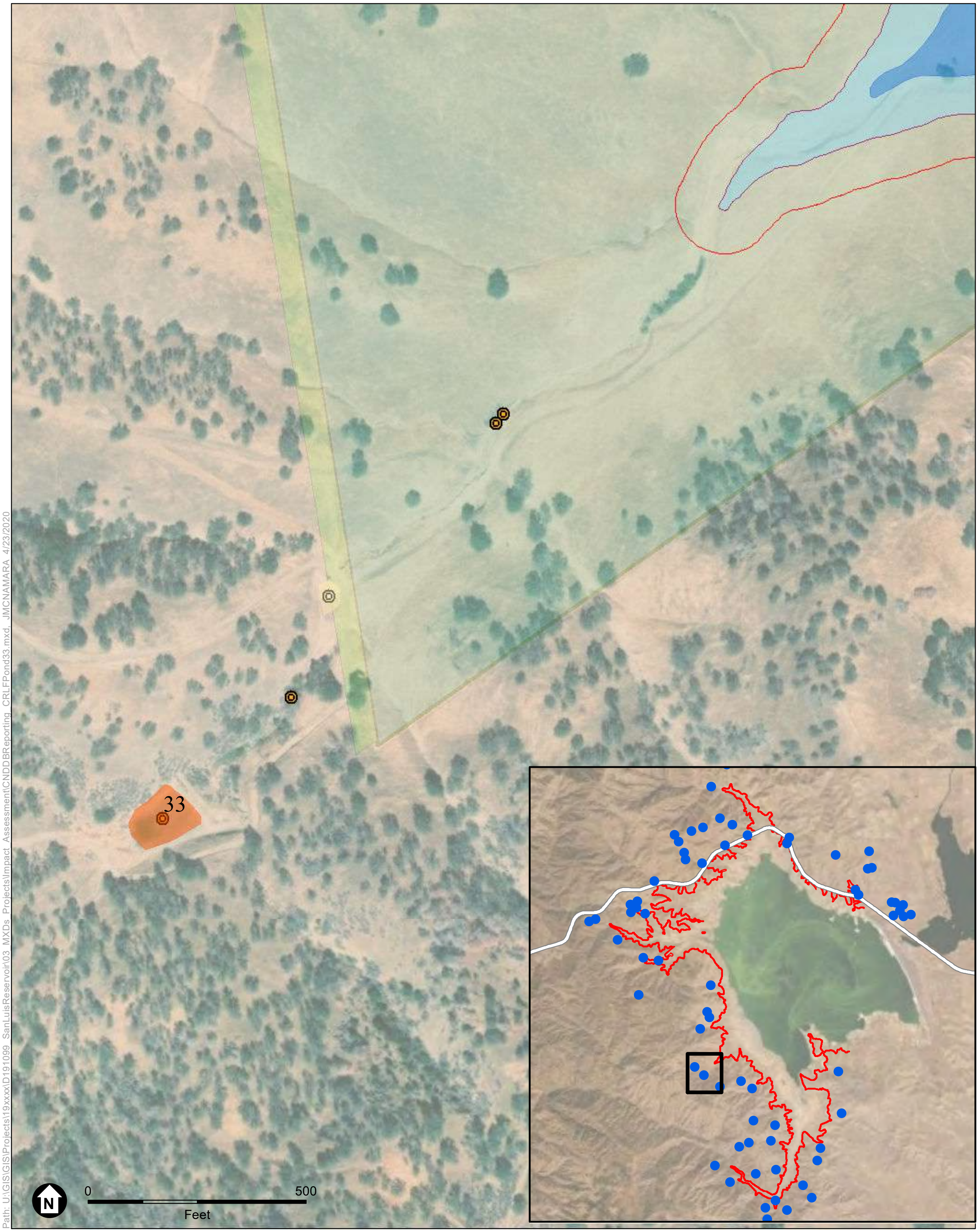
Photographs: (check one or more)

	Slide	Print
Plant / animal	☐	☒
Habitat	☐	☒
Diagnostic feature	☐	☐

May we obtain duplicates at our expense?
☒ **yes** ☐ **no**

Attachments:

1. *Attachment G- Figure 5 – California Red-legged Frog in Pond 33 and the Below Drainage*
2. *West Reservoir Pond (Pond 33) and surrounding blue oak woodlands habitat.*
3. *CRLF found in the West Reservoir Drainage Below Pond 33 and one of the dead CRLF found in the same drainage.*



California Department of Fish and Wildlife - CNDDB Reporting

SOURCE: ESA, 2020; Imagery-ESRI, 2020

Land Ownership*
- Bureau of Reclamation
- California Department of Fish and Wildlife
- California Department of Parks and Recreation
- California Department of Water Resources
- Department of Defense

- Potential Pond

Status
- CRLF Present
- Potential Breeding Pond
- Dry

B.F. Sisk Dam Raise Project Impact Area
- Dinosaur Boat Launch
- Inundation
- SR 152
- 100 foot Buffer

*All land is private if it is not identifed into one of these categories.

ESA

Attachment G - Figure 5
California Red-legged Frog in Pond 33 and the Below Drainage

Source: ESA

Attachment G - Photo 6

West Reservoir Pond (Pond 33) (top), and surrounding blue oak woodlands habitat (bottom). Photo date: March 17, 2020

Source: ESA

Attachment G - Photo 7

CRLF found in the West Reservoir Drainage Below Pond 33 (top), and one of the dead CRLF found in the same drainage (bottom). Photo date: March 19, 2020

Attachment H

United States Fish and Wildlife Service, California Department of Fish and Wildlife, and California Native Plant Society Special-Status Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: February 24, 2020
Consultation Code: 08ESMF00-2020-SLI-1123
Event Code: 08ESMF00-2020-E-03590
Project Name: San Luis Reservoir Expansion

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2020-SLI-1123

Event Code: 08ESMF00-2020-E-03590

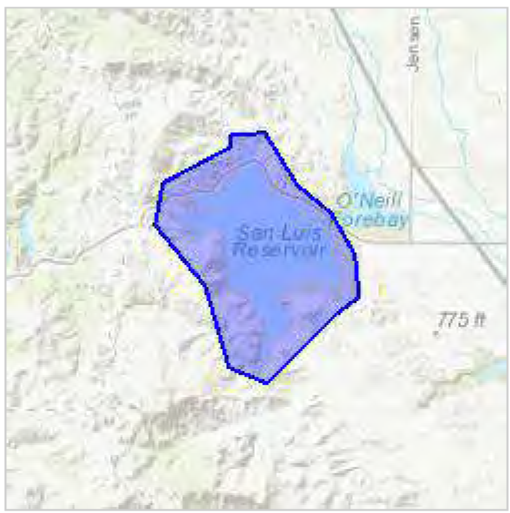
Project Name: San Luis Reservoir Expansion

Project Type: LAND - FLOODING

Project Description: D201901099.00

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/37.04730594678088N121.11916893714323W



Counties: Merced, CA

Endangered Species Act Species

There is a total of 12 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Fresno Kangaroo Rat *Dipodomys nitratoides exilis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5150 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/37/office/11420.pdf	Endangered
Giant Kangaroo Rat *Dipodomys ingens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6051	Endangered
San Joaquin Kit Fox *Vulpes macrotis mutica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2873	Endangered

Birds

NAME	STATUS
California Condor *Gymnogyps californianus* Population: U.S.A. only, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8193	Endangered

Reptiles

NAME	STATUS
Blunt-nosed Leopard Lizard *Gambelia silus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/625	Endangered
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/205/office/11420.pdf	Threatened
California Tiger Salamander *Ambystoma californiense* Population: U.S.A. (Central CA DPS) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
California Red-legged Frog *Rana draytonii* https://ecos.fws.gov/ecp/species/2891#crithab	Final

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Mustang Peak (3712123) OR Crevison Peak (3712122) OR Howard Ranch (3712121) OR Pacheco Peak (3712113) OR Pacheco Pass (3712112) OR San Luis Dam (3712111) OR Three Sisters (3612183) OR Mariposa Peak (3612182) OR Los Banos Valley (3612181))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G2G3	S1S2	SSC
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Campanula exigua chaparral harebell	PDCAM020A0	None	None	G2	S2	1B.2
Caulanthus lemmonii Lemmon's jewelflower	PDBRA0M0E0	None	None	G3	S3	1B.2
Circus hudsonius northern harrier	ABNKC11011	None	None	G5	S3	SSC
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Delphinium californicum ssp. interius Hospital Canyon larkspur	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T4Q	S4	WL
Eryngium spinosepalum spiny-sepaled button-celery	PDAPI0Z0Y0	None	None	G2	S2	1B.2
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3S4	SSC
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S4	WL
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Malacothamnus hallii Hall's bush-mallow	PDMAL0Q0F0	None	None	G2	S2	1B.2
Masticophis flagellum ruddocki San Joaquin coachwhip	ARADB21021	None	None	G5T2T3	S2?	SSC
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia gowenii Lime Ridge navarretia	PDPLM0C120	None	None	G1	S1	1B.1
Navarretia nigelliformis ssp. radians shining navarretia	PDPLM0C0J2	None	None	G4T2	S2	1B.2
North Central Coast Drainage Sacramento Sucker/Roach River North Central Coast Drainage Sacramento Sucker/Roach River	CARA2623CA	None	None	GNR	SNR	
Perognathus inornatus San Joaquin Pocket Mouse	AMAFD01060	None	None	G2G3	S2S3	
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Streptanthus insignis ssp. lyonii Arburua Ranch jewelflower	PDBRA2G0Q1	None	None	G3G4T2	S2	1B.2
Sycamore Alluvial Woodland Sycamore Alluvial Woodland	CTT62100CA	None	None	G1	S1.1	
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	

Record Count: 36

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

17 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3712123, 3712122, 3712121, 3712113, 3712112, 3712111, 3612183 3612182 and 3612181;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Acanthomintha lanceolata	Santa Clara thorn-mint	Lamiaceae	annual herb	Mar-Jun	4.2	S4	G4
Campanula exigua	chaparral harebell	Campanulaceae	annual herb	May-Jun	1B.2	S2	G2
Clarkia breweri	Brewer's clarkia	Onagraceae	annual herb	Apr-Jun	4.2	S4	G4
Convolvulus simulans	small-flowered morning-glory	Convolvulaceae	annual herb	Mar-Jul	4.2	S4	G4
Cryptantha rattanii	Rattan's cryptantha	Boraginaceae	annual herb	Apr-Jul	4.3	S4	G4
Delphinium californicum ssp. interius	Hospital Canyon larkspur	Ranunculaceae	perennial herb	Apr-Jun	1B.2	S3	G3T3
Eryngium spinosepalum	spiny-sepaled button-celery	Apiaceae	annual / perennial herb	Apr-Jun	1B.2	S2	G2
Fritillaria agrestis	stinkbells	Liliaceae	perennial bulbiferous herb	Mar-Jun	4.2	S3	G3
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	Mar-May	4.2	S3	G3
Lessingia tenuis	spring lessingia	Asteraceae	annual herb	May-Jul	4.3	S4	G4
Malacothamnus arcuatus	arcuate bush-mallow	Malvaceae	perennial evergreen shrub	Apr-Sep	1B.2	S2	G2Q
Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial evergreen shrub	(Apr)May-Sep(Oct)	1B.2	S2	G2
Navarretia gowenii	Lime Ridge navarretia	Polemoniaceae	annual herb	May-Jun	1B.1	S1	G1

Navarretia nigelliformis ssp. radians	shining navarretia	Polemoniaceae	annual herb	(Mar)Apr-Jul	1B.2	S2	G4T2
Piperia michaelii	Michael's rein orchid	Orchidaceae	perennial herb	Apr-Aug	4.2	S3	G3
Puccinellia simplex	California alkali grass	Poaceae	annual herb	Mar-May	1B.2	S2	G3
Streptanthus insignis ssp. lyonii	Arburua Ranch jewelflower	Brassicaceae	annual herb	Mar-May	1B.2	S2	G3G4T2

Suggested Citation

California Native Plant Society, Rare Plant Program. 2020. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 24 February 2020].

Questions and Comments

rareplants@cnps.org

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix L: Recreation Supporting Information

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Appendix L Recreation Supporting Information

This appendix presents the existing environmental setting for recreation resources and opportunities with the potential to be affected by the proposed alternatives.

L.1 Area of Analysis

The recreation area of analysis includes recreation resources with the potential to be affected by proposed restrictions or construction of the action alternative. The recreation facilities included in this analysis are the San Luis Reservoir and the San Luis Reservoir State Recreation Area (SRA) in Merced County.

Figure 1 shows the recreation area of analysis including San Luis Reservoir and the San Luis Reservoir SRA, Pacheco State Park (SP) and nearby recreational facilities.

The San Luis Reservoir SRA lies along State Route (SR) 152, in Merced County, 13 miles northwest of the City of Los Banos, ten miles southeast of the City of Gustine, thirty-eight miles east of the City of Gilroy, and two miles west of the unincorporated Town of Santa Nella. It is accessible via Interstate 5 (I-5), or from SR 33 to SR 152 (United States Department of the Interior, Bureau of Reclamation [Reclamation] and California Department of Parks and Recreation [CDPR] 2013). The San Luis Reservoir SRA spans approximately 27,000 acres and includes major facilities such as the San Luis Reservoir, O'Neill Forebay, and Los Banos Reservoir, as well as several other federal and state-owned lands and facilities (Reclamation and CDPR 2013). Although, Los Banos Reservoir is not included in the area of analysis in other sections of this document, it is included in the recreation analysis as it is a part of the San Luis SRA.

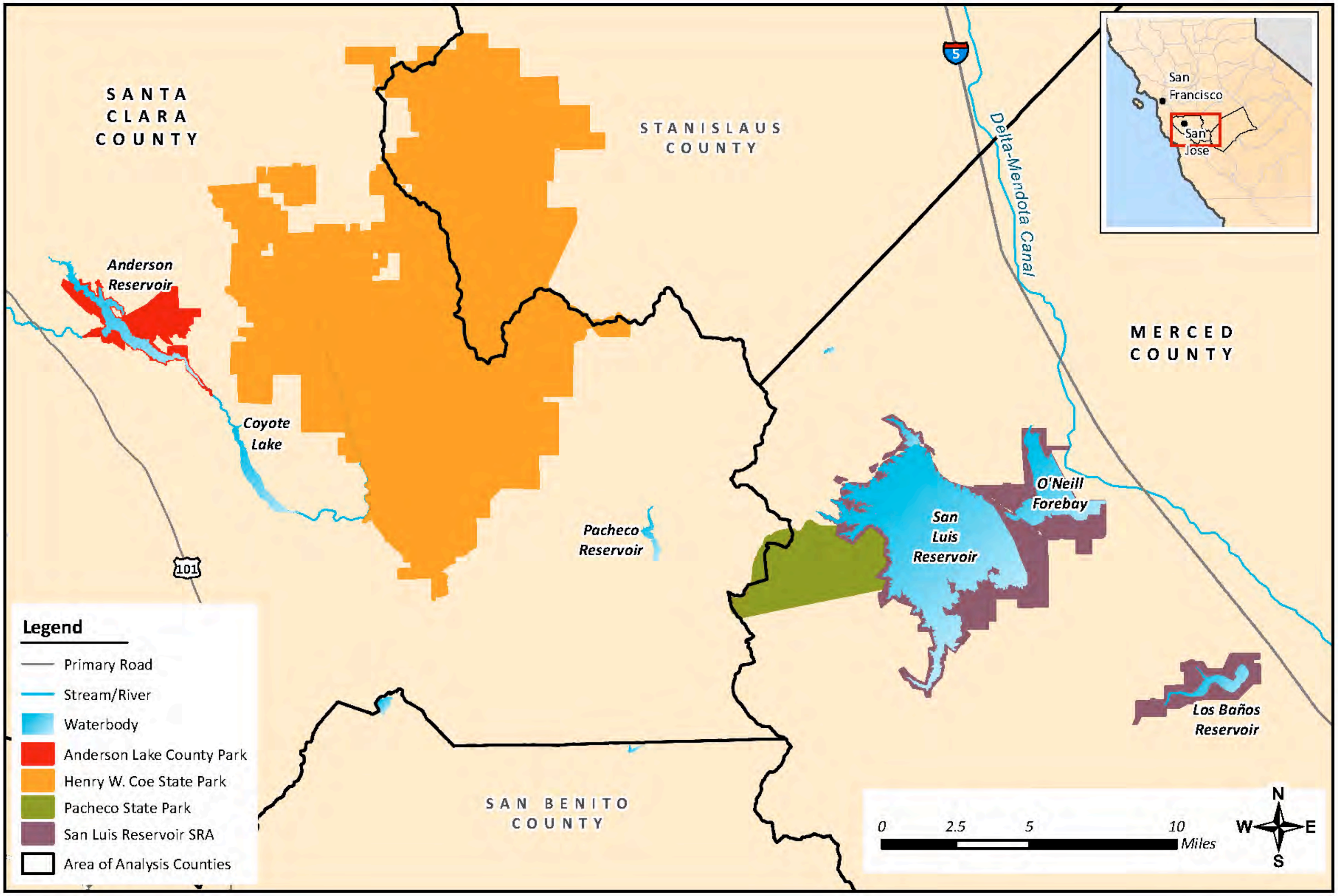


Figure 1. Recreation Area of Analysis (the San Luis Reservoir SRA and Pacheco State Park)

L.2 Affected Environment/ Environmental Setting

The San Luis Reservoir was constructed in 1967 as part of the California State Water Project (SWP) and Central Valley Project (CVP) systems to store and deliver water. The San Luis Reservoir SRA was developed later, 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 use areas,[1] Basalt, Dinosaur Point, Los Banos Creek, Medeiros, and San Luis Creek, and one minor use area for off-highway vehicle (OHV) use (see Figure 2 below). There are two additional areas designated for wildlife; both allow for hunting and backcountry hiking, along with nature study activities. The primary activities at each use area vary but, collectively, the San Luis Reservoir SRA provides opportunities for boating, swimming, windsurfing, camping, and fishing (Reclamation and CDPR 2013). See Table 1 for a detailed description of each use area's primary recreation facilities and opportunities.

Table 1. San Luis Reservoir SRA Use Areas

Use Area	Picnicking	Camping		Fishing	Boating/ Water Sports	Boat Ramps	Swimming	Trails	Horseback Riding	Day Use	Toilets	Showers	Other
		# of Sites	RV										
Basalt	X	79	X	X	X	X	X	X		X	X	X	Eight ADA accessible campsites, fish cleaning station, storage lockers, proximity to grocery store and laundry facility.
Dinosaur Point		0		X	X	X	X			X	X		Excellent lake access, parking for 123 vehicles, 5 shade ramadas, public telephone, street luge, and bicycling.
Los Banos Creek	X	14		X	X	X	X	X	X	X	X		All campsites include shade ramadas, equestrian trails, and parking for 40 vehicles with trailers.

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

Use Area	Picnicking	Camping		Fishing	Boating/ Water Sports	Boat Ramps	Swimming	Trails	Horseback Riding	Day Use	Toilets	Showers	Other
		# of Sites	RV										
Medeiros	X	400	X	X	X	X	X			X	X		50 campsites with shade ramadas, picnic tables, and barbecues and approximately 350 primitive campsites for tents and RVs.
San Luis Creek	X	53	X	X	X	X	X	X		X	X		Six ADA accessible campsites, the only ADA accessible trail, two group campsites, two large beaches, irrigated lawns, fish cleaning station, changing area, and parking for 171 vehicles with trailers or 390 without.

Source: CDPR 2011, Reclamation and CDPR 2013.
Key: ADA= Americans with Disabilities Act; RV = Recreational Vehicle

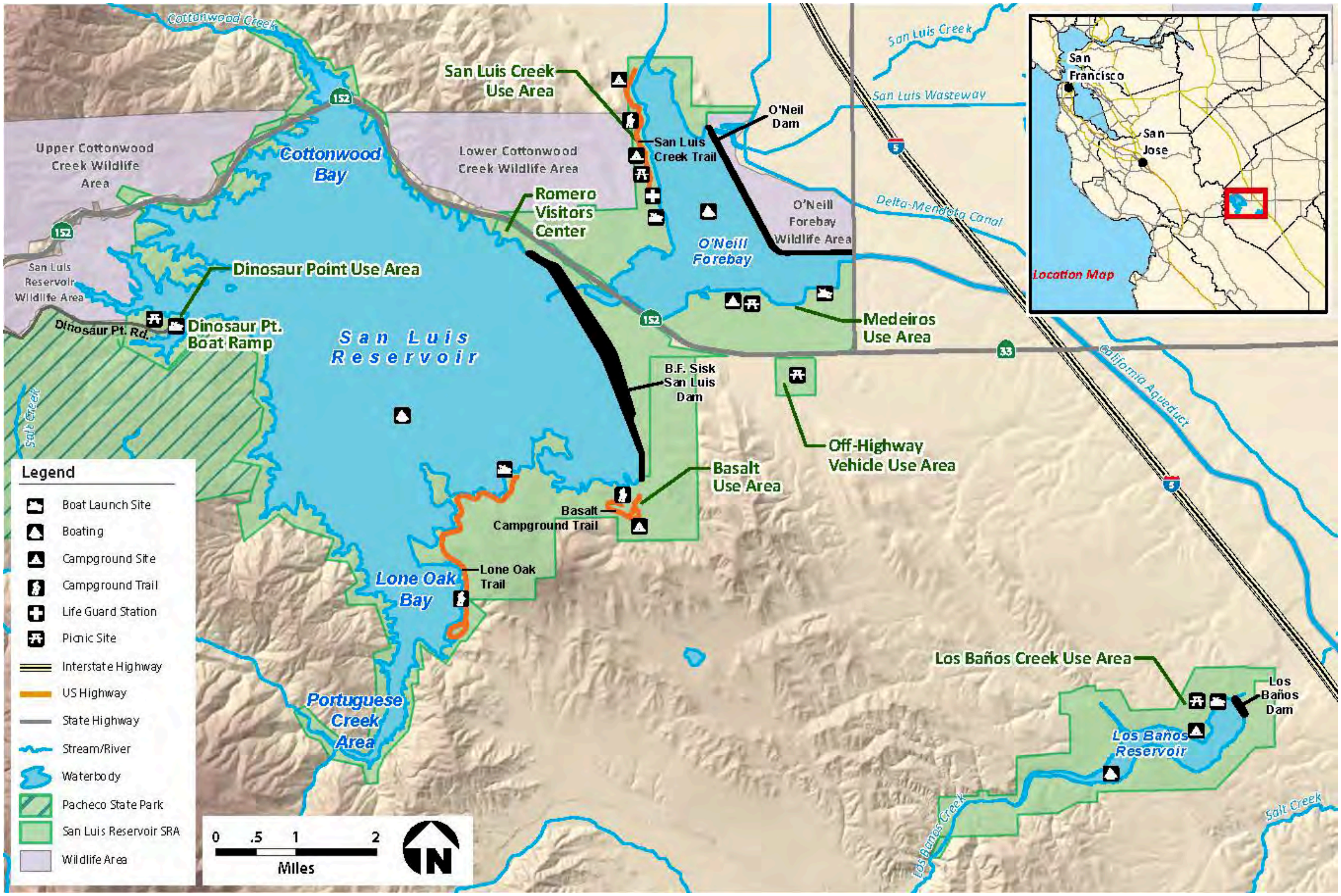
L.2.1 Park Access

The San Luis Reservoir SRA provides multiple points of access to allow visitors to reach its various use areas. From I-5, visitors can enter the park at Canyon Road to access the Los Banos Creek Use Area. From both SR 33 and SR 152, visitors can access the O'Neill Forebay, as well as the Medeiros and San Luis Creek use areas. SR 152 also provides visitor access to both the Basalt Use Area and OHV area via Basalt and Gonzaga Roads. The Dinosaur Point Use Area can also be accessed via SR 152, at the Romero Visitor Center and the Dinosaur Point Road entrance (CDPR 2006). Dinosaur Point Road also provides primary public access to Pacheco SP.

L.2.2 Camping and Picnicking Facilities

The San Luis Reservoir SRA has four campgrounds that provide over 540 campsites for visitor use. The San Luis Reservoir SRA consists of two developed campgrounds, at the Basalt and San Luis Creek use areas, that provide 132 campsites. The Basalt campgrounds are the most developed, including toilets, showers, boat ramps, a fish cleaning station, trail access, designated picnic areas, and American with Disabilities Act (ADA) accessible camping accommodations. The only other available ADA accessible campgrounds include six sites at the San Luis Creek Use Area. The two group campsites at San Luis Creek Use Area can accommodate up to 30 and 60 campers, respectively. Other campgrounds, including those at the Medeiros and Los Banos Creek use areas, are underdeveloped with minimal amenities.

Most undeveloped campsites still provide some shade, picnic areas and toilets. No campground accommodations are offered at the Dinosaur Point Use Area (CDPR 2011, Reclamation and CDPR 2013). Figure 2 presents the park's existing camping facilities.



Source: CDPR 2011 and 2006

Figure 2. San Luis Reservoir SRA Use Area Map

All campgrounds include some capacity for picnicking. The San Luis Reservoir SRA also offers five group picnic sites along the O'Neill Forebay shoreline, with day use accommodations in both the North and South Beaches. An additional 200 picnic sites are available along San Luis Creek (CDPR 2020).

L.2.3 Boating and Water-Related Recreation Opportunities

Boating and other water sports, such as jet skiing and windsurfing, are allowed from sunrise to sunset on San Luis Reservoir, O'Neill Forebay, and Los Banos Creek Reservoir (CDPR 2011). There are boat ramps at all five use areas (Reclamation and CDPR 2013). Within the San Luis Reservoir, boats can be launched at the Dinosaur Point and Basalt boat ramps. Boaters can launch at the San Luis Creek Use Area; however, boats are prohibited at its North Beach. The Los Banos Creek Reservoir, separate from the main San Luis Reservoir and O'Neill Forebay system, has its own boat ramp (CDPR 2011). Within the San Luis Reservoir SRA, boating poses some risks due to existing shallow areas and potential hazards during reservoir drawdown periods. Heavy winds also pose as a hazard in the San Luis Reservoir SRA and can inhibit boating conditions (CDPR 2020).

L.2.4 Swimming Opportunities

The only area designated for recreational swimming is in the roped area of the San Luis Creek's North Bend area. Swimming is allowed throughout the park outside of the designated area. No lifeguards are on duty in the park and swimmers are cautioned to be aware of boats on the water (CDPR 2011).

L.2.5 Fishing Opportunities

Fishing is a popular recreation activity at the San Luis Reservoir, O'Neill Forebay, and Los Banos Creek Reservoir. Fishing derbies are often held at the O'Neill Forebay for bass, crappie and bluegill (Reclamation and CDPR 2013). Overnight fishing is permitted in specific areas within the San Luis Creek Use Area, but is restricted within the campgrounds. The Medeiros Use Area allows overnight fishing at its campgrounds (CDPR 2011).

L.2.6 Hiking Opportunities

The San Luis Reservoir SRA provides hiking opportunities at the Basalt, Los Banos Creek, and San Luis Creek use areas. Hiking opportunities are also available at the two designated wildlife use areas. The Basalt Use Area includes two formally designated trails, the Basalt Campground Trail (1.5 mile loop), and the Lone Oak Trail (6 miles round trip). The San Luis Creek trail is the only ADA compliant trail in the SRA (CDPR 2011, Reclamation and CDPR 2013).

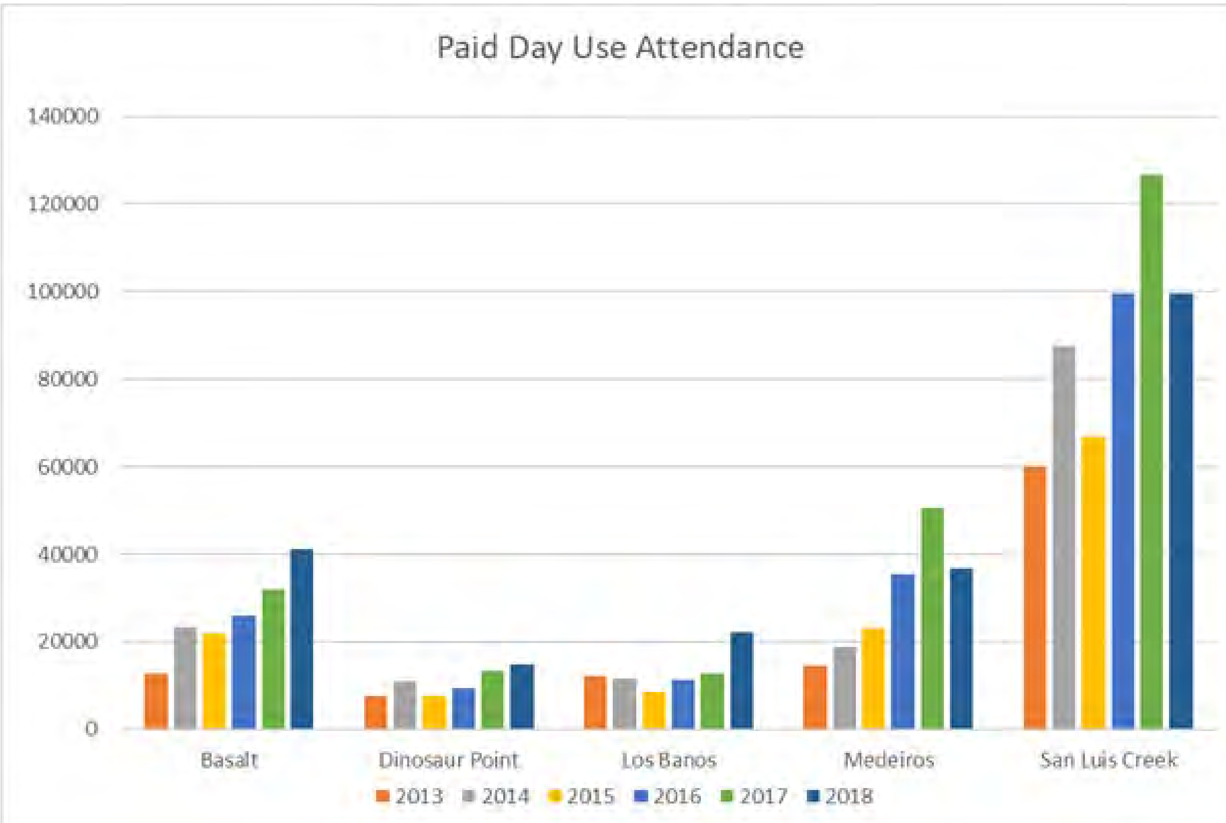
L.2.7 Hunting Opportunities

During hunting season, hunting is allowed at the San Luis Reservoir, O'Neill Forebay, and Los Banos Reservoir. Hunting is also allowed in the two designated wildlife use areas. Hunting is not allowed within 500 feet of campgrounds, picnic areas, or dam and water structures (CDPR 2011).

L.2.8 Visitor Attendance

The CDPR has collected visitor attendance data for the San Luis Reservoir SRA by use area for the years 2013 to 2016. Data are broken down by paid day use, free day use, overnight use and the number of boats launched. Figures 3 to 5 show visitor attendance trends within the San Luis Reservoir SRA use areas.

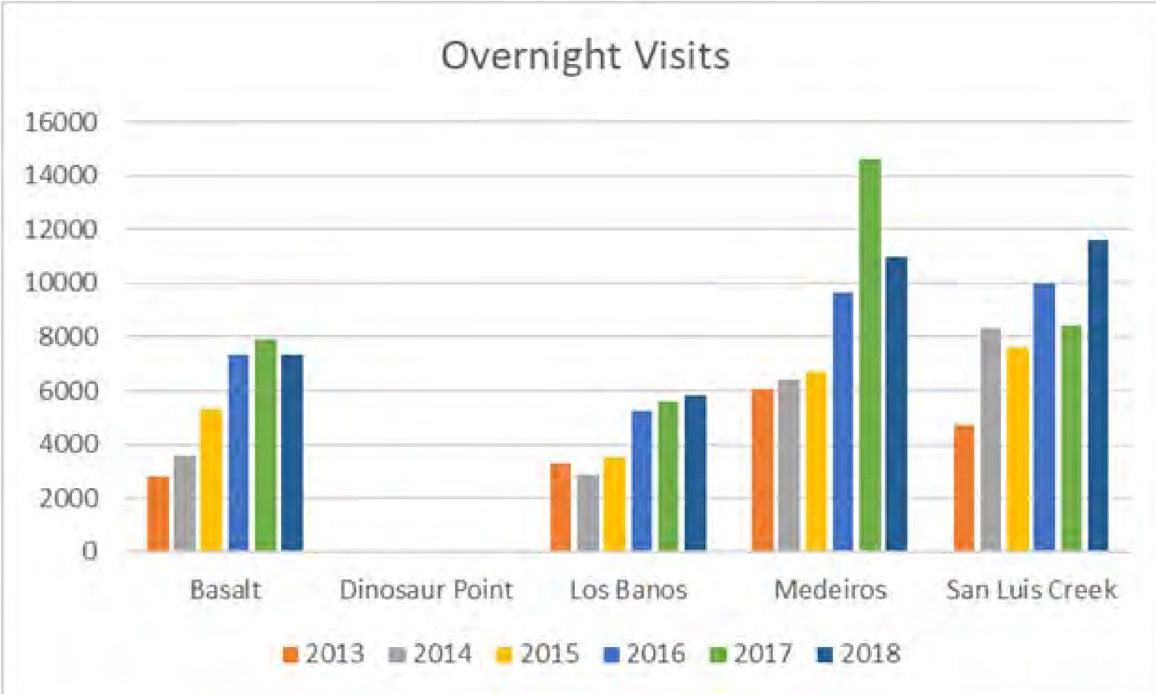
Figure 3 shows the paid visitor rate trends for the San Luis Reservoir SRA five use areas. The San Luis Reservoir SRA hosted approximately 210,000 paid visitors in 2018. Of those visitors, the majority visit the area to utilize the recreation resources at the San Luis Creek, Basalt and Medeiros use areas. Historically, the San Luis Creek Use Area has been the most popular. Table 1 shows that the San Luis Creek Use Area provides more recreation opportunities when compared to all the use areas. Free day use rate trends are similar to those of paid day use.



Source: CDPR 2018.

Figure 3. San Luis Reservoir SRA Paid Visitor Rates

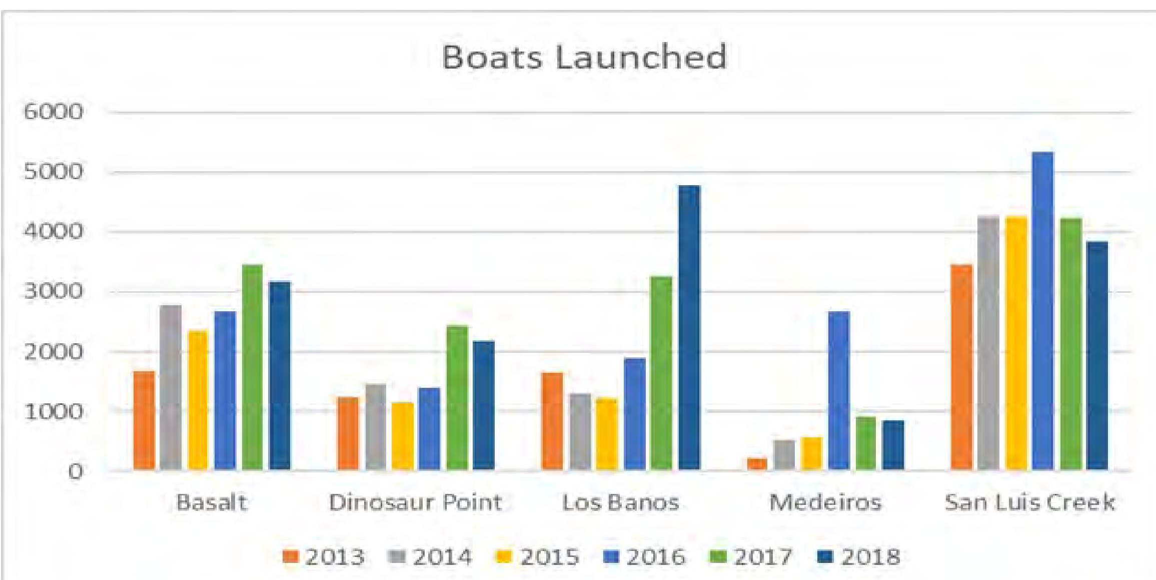
Figure 4 shows the overnight visitor rate trends for four of the five San Luis Reservoir SRA use areas. The Dinosaur Point Use Area does not offer camping accommodations; therefore, visitors are not allowed to use its facilities overnight. Overnight use is greatest at the San Luis Creek Use Area; however, the Basalt and Medeiros use areas are also commonly utilized for overnight camping. Table 1 shows that these three use areas offer many campsites and the only recreational vehicle (RV) accommodations.



Source: CDPR 2018.

Figure 4. San Luis Reservoir SRA Overnight Visitor Rates

Figure 5 shows the boat ramp utilization trends for the five San Luis Reservoir SRA use areas. Boat ramps are at all five use areas. On average, the San Luis Creek Use Area has the most consistently used boat ramp. In recent years, the Los Banos Creek Use Area boat ramp has been increasingly utilized, with almost 5,000 boats launched in 2018. Approximately 14,800 boat launches occurred in 2018 within the San Luis Reservoir SRA.



Source: CDPR 2018.

Figure 5. San Luis Reservoir SRA Boat Launches

L.3 Recreation Analysis

Construction activities associated with Alternatives 1 and 3 would take place in the same location and during the same construction period. Basalt and Medeiros use areas have been identified for construction staging and borrow areas for both alternatives. Each use area provides camping, picnicking, fishing, and swimming opportunities. Figure 6 shows the extent of the recreational impacts due to the construction proposed under Alternatives 1 and 3. In Basalt Use Area, Basalt Campground Trail and a portion of Lone Oak Trail (approximately 930 feet, 3 %) would fall within the construction staging areas and would be closed to the public during construction. Alternative 2 does not include construction.

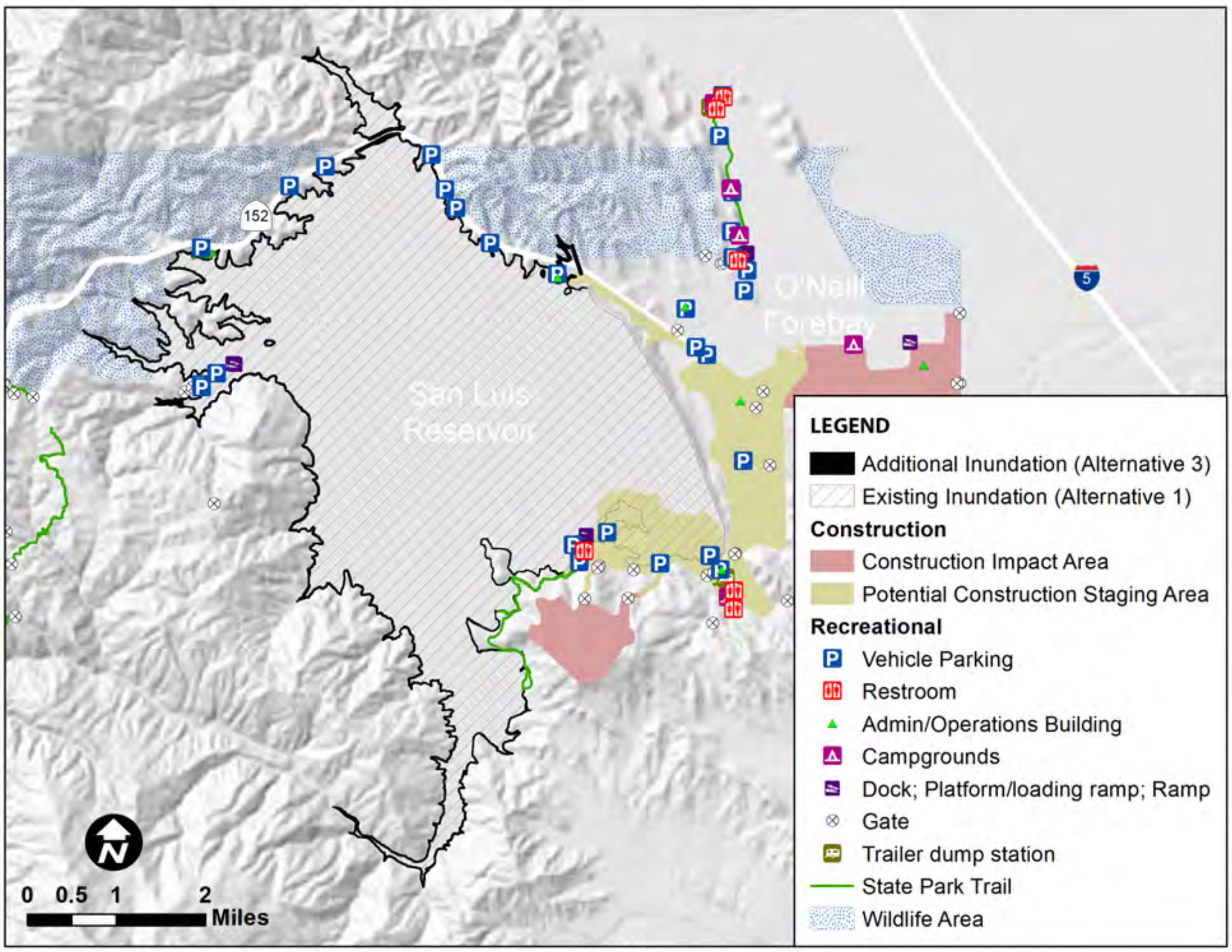


Figure 6. Recreational Impacts Due to Construction at San Luis Reservoir

Under Alternative 3, reservoir operations would result in the inundation of an additional 445 acres of lands that are not inundated when the reservoir fills to capacity under existing conditions. Table 11 summarizes the inundation that occurs under existing operations and the additional inundation expected due to operations of the dam raise alternative. According to existing data, the increase in water levels and inundated areas resulting from project operations would impact four additional existing recreational facilities and could inundate approximately 8,308 feet (1.6 miles) of recreational routes (trails and roads) in addition to the inundation that would occur under existing conditions. The majority of impacted lands are federally- or state-owned foothill pasture lands.

Table 11. Inundation at Maximum Surface Elevation at San Luis Reservoir

Impact Type	Without Project	With Project	Measurement Unit
Recreational Facility	4	4	Tally
Boat Ramp/ Dock	4	-	Tally
Vehicle Parking and Picnic Area	-	4	Tally
Recreational Route	29,089	8,308	Feet
Trails	205	2,804	Feet
Basalt Use Area	29	2,298	Feet
Dinosaur Point Use Area	-	-	Feet
Roads	28,884	5,503	Feet
Basalt Use Area	1,481	-	Feet
Dinosaur Point Use Area	1,650	3,803	Feet
Park Property - San Luis Reservoir SRA	20,211	655	Acres
Land Ownership - Fed/State	12,815	404	Acres
Land Ownership - Private	35	41	Acres
Land Use - Foothill Pasture	12,850	445	Acres

Figure 7 shows the anticipated impacts associated with increased inundation at and around Basalt Use Area. As shown, project operation could result in the inundation of approximately 2,298 feet of the Lone Oak Trail in Basalt Use Area. Based on the inundation mapping, the project would result in no additional inundation at the boat launch. However, because the top of the boat launch is less than a mile from the inundation that would occur under existing conditions (i.e., No Project/No Action Alternative), reservoir water fluctuations due to the operation of Alternative 3 could impact the boat launch. Therefore, modifications to Goosehead Point Boat Launch are included under Alternative 3.

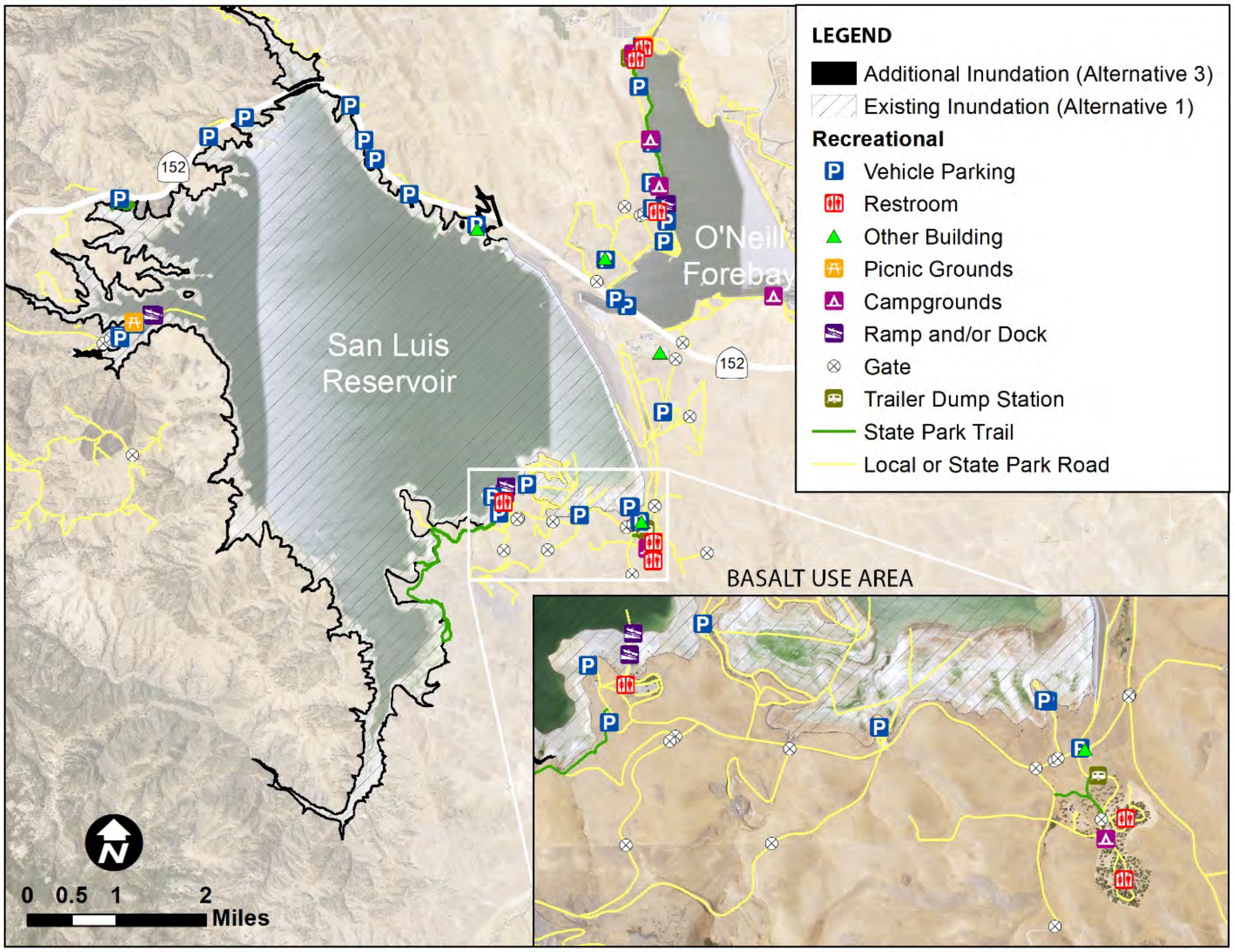


Figure 7. Inundation at San Luis Reservoir – Impacts to Basalt Use Area

Dinosaur Point Boat Launch would be inundated under existing conditions (i.e., Alternative 1). Figure 8 shows the anticipated impacts associated with increased inundation at and around Dinosaur Point Use Area. As shown, project operation could result in the inundation of three parking areas, a picnic area, and an additional 3,803 feet of roads in Dinosaur Use Area. Therefore, Alternative 3 includes modifications to Dinosaur Point Boat Launch, including the parking areas, to minimize the potential reduction in recreational use at the site.

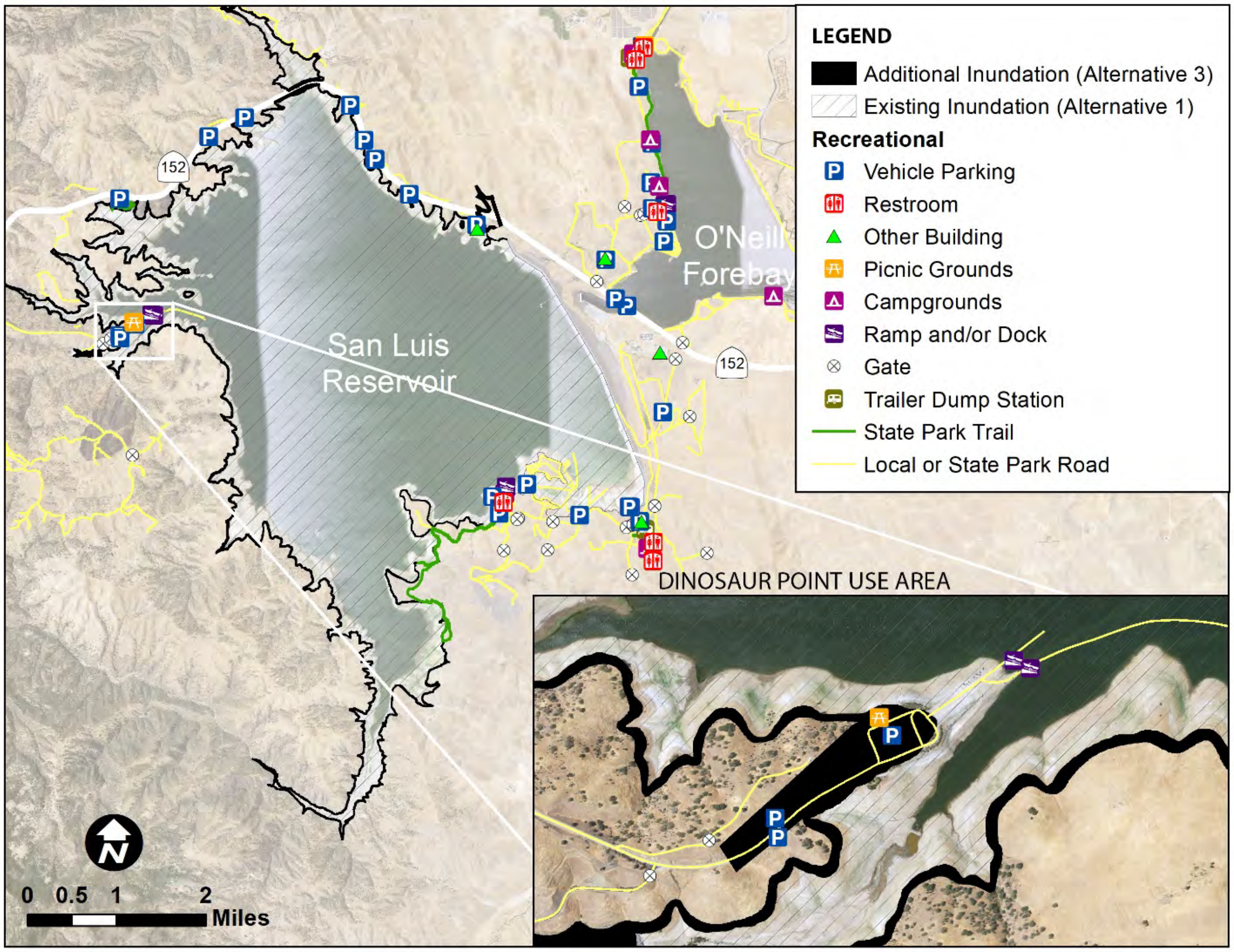


Figure 8. Inundation at San Luis Reservoir – Impacts to Dinosaur Point Use Area

Figures 9 and 10 illustrate the land use and land ownership at San Luis Reservoir and the surrounding areas.

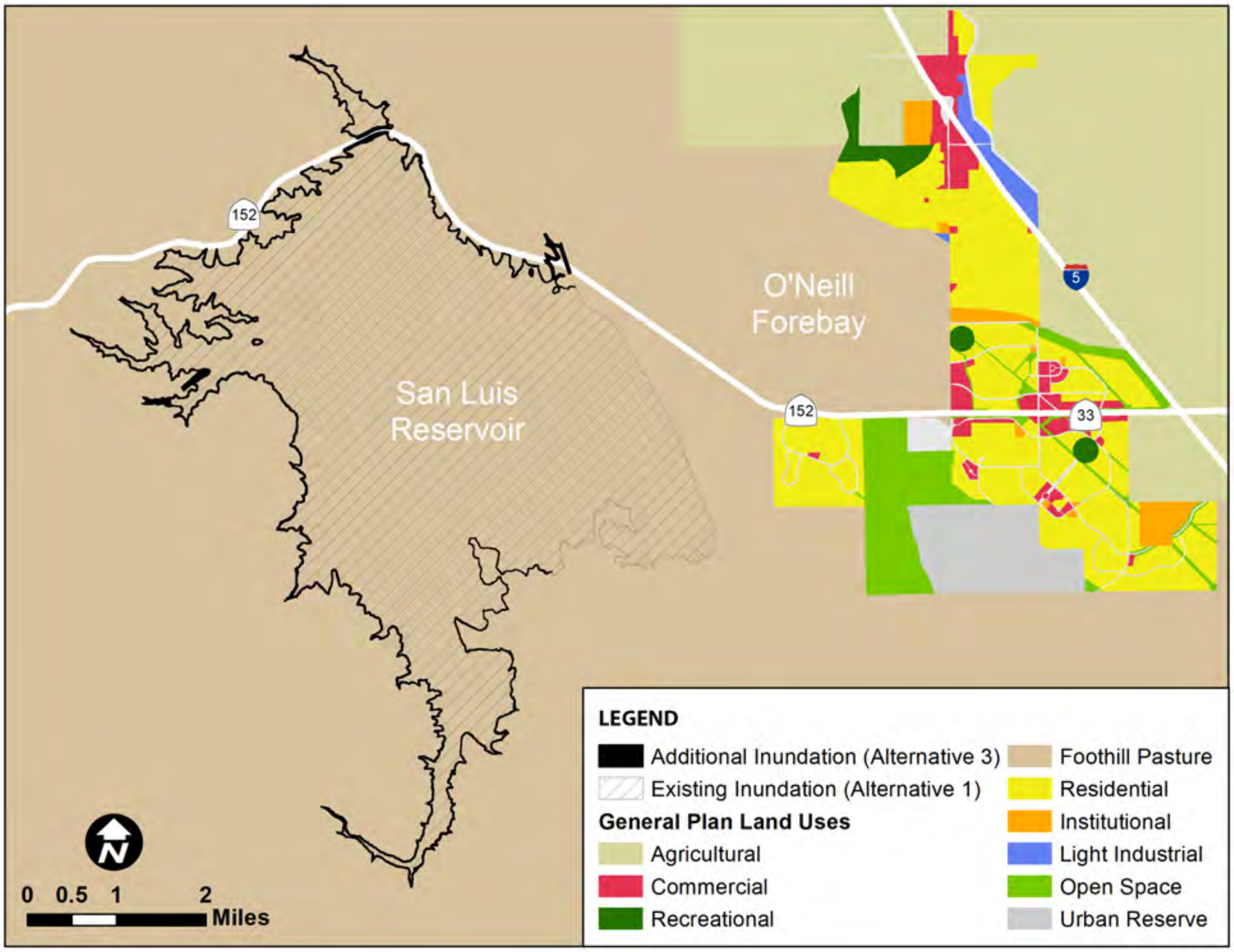


Figure 9. Inundation at San Luis Reservoir – Impacted Land Use

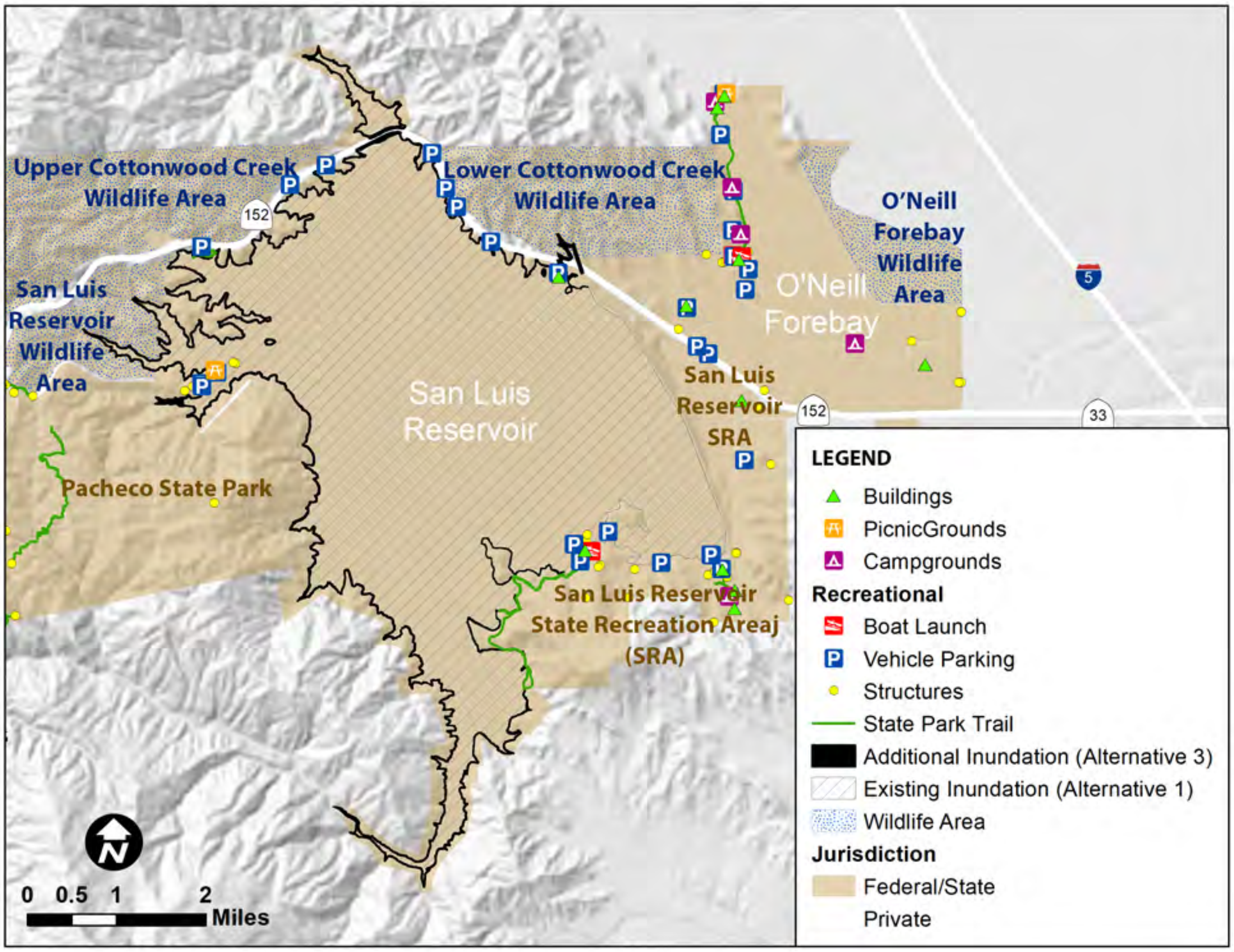


Figure 10. Inundation at San Luis Reservoir – Impacted Landowners

L.4 References

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix M: Cultural Resources Report

Cultural Resources Report for the B.F. Sisk Dam Raise Project, Merced County, California

Prepared for:
U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region *and*
San Luis & Delta-Mendota Water Authority

Submitted to:
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Project No. 3639-01

B.F. Sisk Dam Raise Alternative Area of Potential Effects: 5,028 Acres
USGS 7.5-Minute Topographic Maps: Los Banos Valley (2015), Mariposa Peak (2015), Pacheco Pass (1971), and San Luis Dam (1969), Merced County, California

June 2020

Confidentiality Statement

Archaeological remains and historic period built environment resources can be damaged or destroyed through uncontrolled public disclosure of information regarding their location. This document contains sensitive information regarding the nature and location of cultural resources, which should not be disclosed to unauthorized persons.

Information regarding the location, character or ownership of certain historic properties may be exempt from public disclosure pursuant to the National Historic Preservation Act (54 USC 300101 et seq.) and the Archaeological Resources Protection Act (Public Law 96-95 and amendments). In addition, access to such information is restricted by law, pursuant to Section 6254.10 of the California State Government Code.

Management Summary

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and San Luis & Delta-Mendota Water Authority (Authority) initiated the B.F. Sisk Dam Raise Project (Project) to examine potential strategies or alternatives aimed at increasing the quantity and operational flexibility of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. On behalf of Reclamation and the Authority, and under contract to CDM Smith, Pacific Legacy, Inc. conducted a cultural resources investigation in support of the Project that encompasses two main alternatives: the Non-Structural Alternative and the B.F. Sisk Dam Raise Alternative. The Non-Structural Alternative would entail operational changes only and would result in no significant changes to reservoir water elevations. The B.F. Sisk Dam Raise Alternative would increase the height of the dam and greatly expand the storage capacity of the San Luis Reservoir. The implementation of the Non-Structural Alternative is expected to result in no impacts to cultural resources, therefore this investigation focuses on the B.F. Sisk Dam Raise Alternative, which has the potential to result in significant impacts to cultural resources if implemented.

This cultural resources investigation was carried out in compliance with federal and state historic preservation laws, including the National Environmental Policy Act (42 USC 4321-4347), Section 106 (54 USC 306108) of the National Historic Preservation Act (54 USC 300101 et seq.), and the California Environmental Quality Act (PRC 21000 et seq.). Archival and record searches were completed by Pacific Legacy for the B.F. Sisk Dam Raise Alternative Project Area, defined as a 0.5-mile radius surrounding the Area of Potential Effects (APE). Contact with the Native American Heritage Commission (NAHC) was initiated, and consultation with Native American tribal representatives was undertaken by Reclamation in 2017 and in 2019 for resources within the B.F. Sisk Dam Raise Alternative APE. Pacific Legacy completed cultural resource inventory surveys within the APE, and JRP Historical Consulting, LLC. (JRP) conducted an architectural field visit to evaluate the B.F. Sisk Dam and its key features. All of these efforts were aimed at identifying archaeological and historic period built environment resources in areas that may be impacted by implementation of the B.F. Sisk Dam Raise Alternative, particularly historic properties that are listed in or may be eligible for listing in the National Register of Historic Places (NRHP) and/or historical resources that are listed in or may be eligible for listing in the California Register of Historical Resources (CRHR).

The archival and record searches, contact with the NAHC, and cultural resource inventory surveys noted above were originally performed in support of the San Luis Low Point Improvement Project (SLLPIP) between 2012 and 2019, while the architectural field visit by JRP was conducted in support of the B.F. Sisk Safety of Dams (SOD) Modification Project in 2018. As proposed by Reclamation and the Santa Clara Valley Water District (Valley Water), the SLLPIP includes four action alternatives aimed at increasing the quantity and reliability of water supplies to contractors and consumers dependent on the San Luis Reservoir. Archival and record searches conducted for the SLLPIP alternatives fully encompassed the B.F. Sisk Dam Raise Alternative and were updated in 2020 for the current Project. Inventory surveys conducted by Pacific Legacy for SLLPIP action alternatives also directly overlapped the APE for the B.F. Sisk Dam Raise Alternative. All relevant cultural resources data collected and processed as a part of the SLLPIP have been integrated in this document. Cultural resources associated with the SLLPIP were previously discussed in a 2018 cultural resources report (Pacific Legacy 2018) and assessed in a Draft Environmental Impact Statement (EIS)/ Environmental Impact Report (EIR) (Reclamation and Valley Water 2019). In-depth archival research completed by JRP (2018) on the B.F. Sisk Dam and its key features for the B.F. Sisk SOD Modification Project also has been included in this report. As proposed by Reclamation and State of California Department of Water Resources (DWR), the B.F. Sisk SOD Modification Project included two main action alternatives aimed at ensuring the safety of the downstream public following a significant seismic event. Cultural resources associated with the B.F. Sisk SOD Modification Project were documented in a 2019 cultural resources report (Pacific Legacy 2019) and analyzed in a Final EIS/EIR (Reclamation and DWR 2019).

The B.F. Sisk Dam Raise Alternative APE spans 5,028 acres in western Merced County. It encompasses all areas included in the B.F. Sisk SOD Modification Project as well as the San Luis Reservoir and Cottonwood Bay shorelines and the Cottonwood Bay embankment along State Route (SR) 152. Approximately 4,454 acres within the APE were subject to intensive pedestrian inventory surveys between 2012 and 2020, while 574 acres could not be examined due to inundation or safety concerns. Erosion has impacted portions of the Cottonwood Bay shoreline, while much of the San Luis Reservoir shoreline has been affected by wave action and recreational activity. Areas closer to the B.F. Sisk dam have been altered by construction and maintenance of existing dam infrastructure.

Archival and record searches revealed that 52 prior cultural resource studies have been carried out within the B.F. Sisk Dam Raise Alternative Project Area and that 33 of those studies overlapped the APE. Fifty-one cultural resources were previously recorded within the Project Area, including 19 within the APE. Fifteen of those 19 resources are prehistoric archaeological sites (CA-MER-14, CA-MER-15, CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-28, CA-MER-29, CA-MER-41, CA-MER-82, CA-MER-130, CA-MER-136, CA-MER-137, and CA-MER-437), one is a prehistoric archaeological district (P-24-000489/San Luis Gonzaga Archaeological District), and three are historic period resources (CA-MER-451H, CA-MER-521H, and the B.F. Sisk Dam).

Eleven previously recorded cultural resources were relocated within the APE, including seven prehistoric sites (CA-MER-15, CA-MER-28, CA-MER-82, CA-MER-83, and CA-MER-130, CA-MER-136, and CA-MER-137), most with midden, lithics, and groundstone; one historic period water tank and trough (CA-MER-521H); one historic period ranch complex (CA-MER-451H); one historic period road (CA-MER-477H); and key features of the B.F. Sisk Dam/San Luis Reservoir Historic District. Two of these known resources (CA-MER-83 and CA-MER-477H) were originally plotted outside of the APE but were noted within it during inventory surveys. Ten resources previously recorded in the B.F. Sisk Dam Raise Alternative APE were not relocated during inventory surveys. These included seven prehistoric archaeological sites originally noted along the San Luis Reservoir shoreline (CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-29, and CA-MER-41); one prehistoric site (CA-MER-14) that was presumably destroyed by dam construction; one that was found to be a natural feature (CA-MER-437); and one arbitrarily defined prehistoric district (P-24-000489/San Luis Gonzaga Archaeological District) with no physical markers in the APE.

Thirty-two resources were discovered within the B.F. Sisk Dam Raise Alternative APE during inventory surveys conducted between 2012 and 2020. These included a series of historic period transmission poles with a debris scatter (CA-MER-484H); two industrial sites (CA-MER-492H and CA-MER-509H) associated with construction of the B.F. Sisk Dam; eight historic period road segments (CA-MER-489H, CA-MER-491H, CA-MER-493H, CA-MER-494H, CA-MER-495H, CA-MER-513H, CA-MER-519H, and PL-Sisk-01); a concrete equipment pad (CA-MER-510H); a corral and water tank (CA-MER-511H); a helicopter pad (CA-MER-512H); a ditch segment (CA-MER-514H); three earthen dams with impound ponds (CA-MER-515H, CA-MER-516H, and CA-MER-518H); two prehistoric middens, one with lithics and groundstone (CA-MER-517) and the other with fire-affected rock (PL-Sisk-05); and a series of survey markers and monitoring wells (CA-MER-520H) associated with construction and maintenance of the B.F. Sisk Dam. A historic period well head (P-24-002166), metal can (P-24-002167), concrete foundation (P-24-002172), two watering troughs (P-24-002169 and P-24-002170); and bottle (P-24-002171) were recorded as isolated finds in addition to an isolated prehistoric core (P-24-001990), a biface fragment (P-24-001991), a cobble and flake (P-24-002168), and a displaced cupule boulder (PL-Sisk-02).

Two of the previously recorded prehistoric sites (CA-MER-130 and CA-MER-136) and the prehistoric district (P-24-000489/San Luis Gonzaga Archaeological District) are listed in the NRHP and CRHR. JRP (2018) recommended the B.F. Sisk Dam and its key facilities eligible for listing in the NRHP and CRHR as contributing elements to the B.F. Sisk Dam/San Luis Reservoir Historic District, though not eligible as individual facilities. Drawing on information from inventory surveys and site-specific documentary research, Pacific Legacy has produced survey level evaluations for most of the cultural resources within the B.F. Sisk Dam Raise Alternative APE. Two industrial resources associated with construction of the B.F. Sisk Dam system (CA-MER-492H and CA-MER-509H) are recommended not eligible for listing in the NRHP or CRHR and are considered non-contributing elements of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018). Seven historic period resources (CA-MER-510H, CA-MER-511H, CA-MER-512H, CA-MER-513H, CA-MER-514H, and CA-MER-520H, CA-MER-521H) have been determined not eligible for inclusion in the NRHP with concurrence from the State Historic Preservation Officer and recommended not eligible for listing in the CRHR (Polanco 2018). Twelve historic period resources (CA-MER-477H, CA-MER-484H, CA-MER-489H, CA-MER-491H, CA-MER-493H, CA-MER-494H, CA-MER-495H, CA-MER-515H, CA-MER-516H, CA-MER-518H, CA-MER-519H, and PL-Sisk-01) are recommended not eligible for listing in the NRHP and the CRHR. Seven prehistoric archaeological sites (CA-MER-15, CA-MER-28, CA-MER-82, and CA-MER-83, CA-MER-137, CA-MER-517, and PL-Sisk-05) remain pending evaluation for listing in the NRHP and CRHR.

Sixteen of the resources listed above may be subject to construction impacts under the B.F. Sisk SOD Modification Project. One resource would be subject to additional construction impacts under the B.F. Sisk Dam Raise Alternative, one would be altered as a result of modifications to SR 152, and 17 resources along the San Luis Reservoir and Cottonwood Bay shorelines would experience operational impacts from increased and fluctuating water levels. These resources, and the potential effects that would result from implementation of the B.F. Sisk Dam Raise Alternative, are the focus of this document.

This report begins with an introduction to the current Project, specifically its geographic and regulatory setting (Chapter 1.0), followed by an overview of the natural environment (Chapter 2.0) and cultural history (Chapter 3.0) of the Project vicinity. Archival and records search results are presented (Chapter 4.0) along with a discussion of the methods that were used during the inventory surveys (Chapter 5.0). The results of those surveys are detailed (Chapter 6.0), and conclusions and recommendations are offered regarding the known or potential significance of cultural resources within the B.F. Sisk Dam Raise Alternative APE (Chapter 7.0). Archival and records search result maps are included (Appendix A), as are maps of cultural resources relocated or discovered within the B.F. Sisk Dam Raise Alternative APE during inventory surveys (Appendix B). Confidential cultural resource records for resources within the B.F. Sisk Dam Raise Alternative APE are provided (Appendix C), along with NAHC correspondence (Appendix D) and photographic documentation (Appendix E). Depending on which alternative is selected under the current Project, many of the cultural resources discussed in this document may not be impacted by ground disturbing activities. The information and recommendations provided in this report, however, should assist Reclamation and the Authority in managing cultural resources associated with this and future projects associated with the B.F. Sisk Dam and San Luis Reservoir.

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

amsl	above mean sea level
ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effects
Authority	San Luis and Delta-Mendota Water Authority
BP	before present
BLM	U.S. Bureau of Land Management
CCIC	Central California Information Center
CCS	Cryptocrystalline silicate
CFR	Code of Federal Regulations
CHL	California Historical Landmark
CHRIS	California Historical Resources Information System
CRHR/CR	California Register of Historical Resources/California Register
CVP	Central Valley Project
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
GPS	Global Positioning System
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRHP/NR	National Register of Historic Places/National Register
NWIC	Northwest Information Center
PRC	Public Resources Code
Reclamation	U.S. Bureau of Reclamation
SHPO	State Historic Preservation Officer
SLLPIP	San Luis Low Point Improvement Project
SR	State Route
SWP	State Water Project
USGS	United States Geological Survey
Valley Water	Santa Clara Valley Water District

Chapter 1 Project Background

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and San Luis & Delta-Mendota Water Authority (Authority) initiated the B.F. Sisk Dam Raise Project (Project) to examine potential strategies or alternatives aimed at increasing the quantity and operational flexibility of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. On behalf of Reclamation and the Authority, and under contract to CDM Smith, Pacific Legacy, Inc. conducted a cultural resources investigation in support of the Project, which encompasses two main action alternatives: the Non-Structural Alternative and the B.F. Sisk Dam Raise Alternative. The Non-Structural Alternative would entail operational changes only and would result in no significant changes to reservoir water elevations. The B.F. Sisk Dam Raise Alternative would increase the height of the dam and greatly expand the storage capacity of the San Luis Reservoir. The Non-Structural Alternative is not expected to result in impacts to cultural resources. This investigation therefore focuses on the B.F. Sisk Dam Raise Alternative, which has the potential to result in both construction and operational impacts to cultural resources if implemented.

This cultural resources investigation was carried out in compliance with federal and state historic preservation laws, including the National Environmental Policy Act (42 USC 4321-4347), Section 106 (54 USC 306108) of the National Historic Preservation Act (54 USC 300101 et seq.), and the California Environmental Quality Act (PRC 21000 et seq.). Archival and record searches were completed by Pacific Legacy for the B.F. Sisk Dam Raise Alternative Project Area, defined as a 0.5-mile radius surrounding the Area of Potential Effects (APE). Contact with the Native American Heritage Commission (NAHC) was initiated, and consultation with Native American tribal representatives was undertaken by Reclamation in 2017 and in 2019 for resources within the B.F. Sisk Dam Raise Alternative APE. Pacific Legacy completed cultural resource inventory surveys within the APE, and JRP Historical Consulting, LLC. (JRP) conducted an architectural field visit to evaluate the B.F. Sisk Dam and its key features. All of these efforts were aimed at identifying archaeological and historic period built environment resources in areas that may be impacted by implementation of the B.F. Sisk Dam Raise Alternative, particularly historic properties that are listed in or may be eligible for listing in the National Register of Historic Places (NRHP) and/or historical resources that are listed in or may be eligible for listing in the California Register of Historical Resources (CRHR).

The archival and record searches, contact with the NAHC, and cultural resource inventory surveys noted above were originally performed in support of the San Luis Low Point Improvement Project (SLLPIP) between 2012 and 2019, while the architectural field visit by JRP was conducted in support of the B.F. Sisk Safety of Dams (SOD) Modification Project in 2018. As proposed by Reclamation and the Santa Clara Valley Water District (Valley Water), the SLLPIP includes four action alternatives aimed at increasing the quantity and reliability of water supplies to contractors and consumers dependent on the San Luis Reservoir. Archival and record searches conducted for the SLLPIP alternatives fully encompassed the B.F. Sisk Dam Raise Alternative and were updated in 2020 for the current Project. Inventory surveys conducted by Pacific Legacy for SLLPIP action alternatives also directly overlapped the APE for the B.F. Sisk Dam Raise Alternative. All relevant cultural resources data collected and processed as a part of the SLLPIP have been integrated in this document. Cultural resources associated with the SLLPIP were previously discussed in a 2018 cultural resources report (Pacific Legacy 2018) and assessed in a Draft EIS/EIR (Reclamation and Valley Water 2019). In-depth archival research completed by JRP (2018) for the B.F. Sisk SOD Modification Project on the B.F. Sisk Dam and its key features also has been included in this report. As proposed by Reclamation and State of California Department of Water Resources (DWR), the B.F. Sisk SOD Modification Project included two main action alternatives aimed at ensuring the safety of the downstream public following a significant seismic event. Cultural resources associated with the B.F. Sisk SOD Modification Project were documented in a 2019 cultural resources report (Pacific Legacy 2019) and analyzed in a Final EIS/EIR (Reclamation and DWR 2019). These documents provide much of the information contained in this report, which is intended to serve as a standalone work.

1.1 Project Location and Setting

The B.F. Sisk Dam Raise Alternative is centered on the San Luis Reservoir in western Merced County south of the Sacramento-San Joaquin Delta. The San Luis Reservoir is located approximately 40 miles southeast of the City of San Jose and 10 miles west of the City of Los Banos (*see* Figure 1-1). It is one of California's largest off-stream reservoirs with a current storage capacity of over two million acre-feet. Water from the Sacramento-San Joaquin Delta is delivered to the San Luis Reservoir via the California Aqueduct, a component of California's State Water Project (SWP), and the Delta-Mendota Canal, a component of Reclamation's Central Valley Project (CVP). The reservoir has a surface area of more than 12,700 acres at its current full capacity. It measures approximately 9 miles in length, 5 miles in width, and features over 65 miles of shoreline. With the exception of water, transportation, and power infrastructure, the San Luis Reservoir area has remained largely undeveloped.

1.2 Project Description and Purpose

As noted above, the main goal of the proposed Project is to increase the quantity of available water supplies and flexibility of water deliveries, particularly to contractors south of the Sacramento-San Joaquin Delta. Reclamation and the Authority have analyzed a range of management measures and alternatives in support of the current Project. The main criteria used to evaluate these measures include the extent to which the measure addresses the needs and purpose of the Project, its cost-effectiveness, and the acceptability of its potential environmental impacts. Measures that remained after initial screening were combined into two action alternatives: the Non-Structural Alternative and B.F. Sisk Dam Raise Alternative. A No Action/No Project Alternative also is examined in the Project Draft EIR/Supplemental EIS (SEIS) prepared by Reclamation and the Authority (2020). Each alternative is described below.

1.2.1 No Action/No Project Alternative

The No Action/No Project Alternative assumes that the proposed Action or Project will not be implemented, though it includes the implementation of other reasonably foreseeable actions that are expected to occur if the proposed Project is not approved. Under the No Action/No Project Alternative, the Crest Raise Action under the B.F. Sisk SOD Modification Project will be implemented, and the height of the dam will be increased to reduce safety concerns for the downstream public following a significant seismic event. Specifically, the Crest Raise Action will

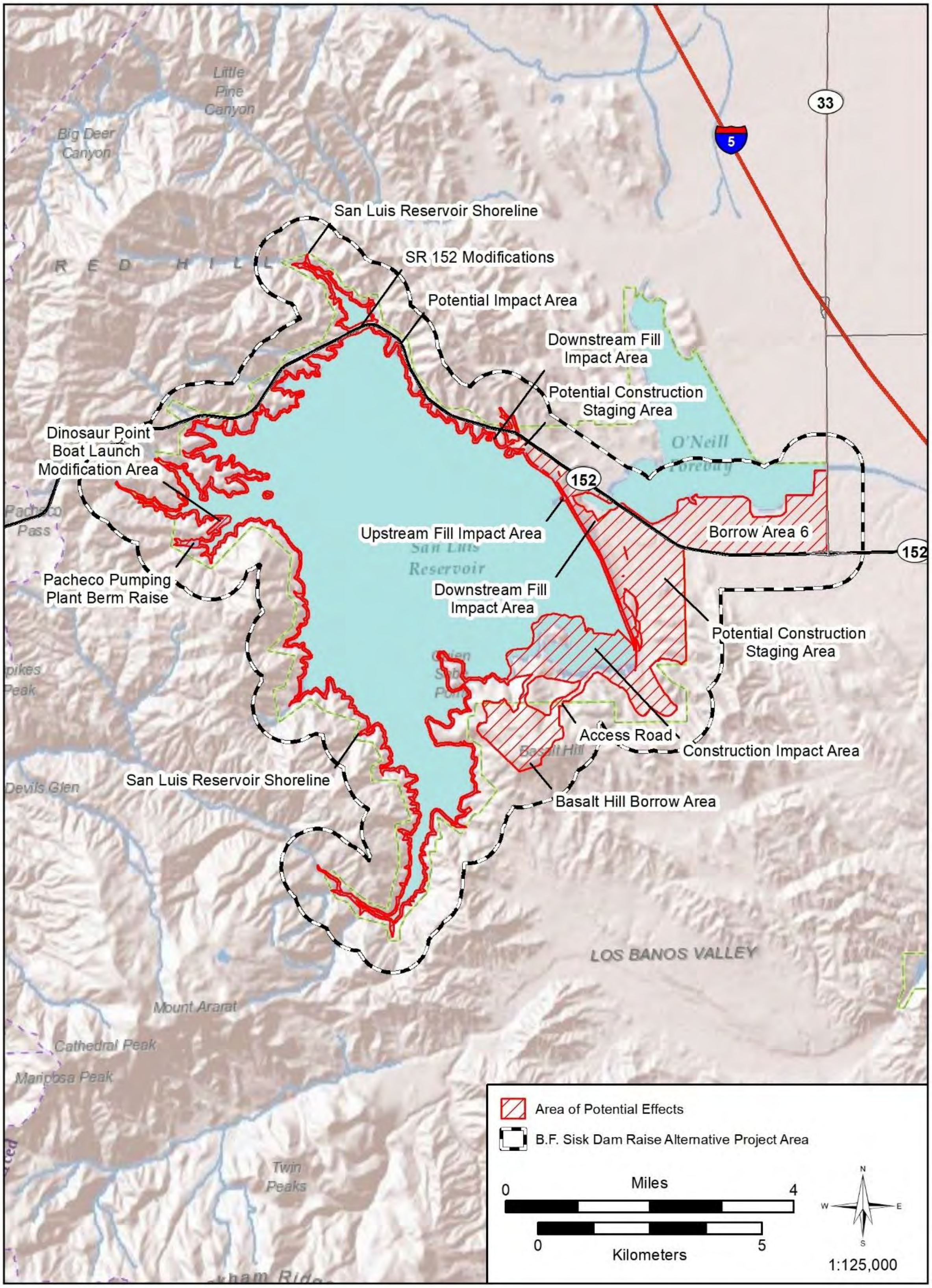

Figure 1-1. The B.F. Sisk Dam Raise Alternative Project Area of Potential Effects.

raise the height of the B.F. Sisk Dam by 12 feet to an elevation of 566 feet above mean sea level (amsl). This will reduce the likelihood of overtopping if slumping or deformation of the dam were to occur as a result of seismic activity and will allow the San Luis Reservoir to continue operating at its current maximum storage elevation. The Crest Raise Action will be implemented by adding embankment material, stability berms, and downstream crack filters to the existing structure. Downstream stability berms will be anchored to bedrock alongside the placement of additional embankment materials on the downstream slope of the dam to increase the crest elevation by 12 feet and to increase the distance between the water surface and the dam crest. This would prevent reservoir overtopping and failure in the event of dam deformation (Reclamation 2019).

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 spur internal erosion within the dam embankment. This seismic crack-induced erosion risk would be addressed by installing downstream filters across the full width of the raised dam crest on the downstream face of the new embankment material. Evaluation of the seismic shaking potential at B.F. Sisk Dam also has identified the potential need for additional modifications to the foundation soils beneath the berm. The development of a foundation shear key is being evaluated as an optional modification. A foundation shear key is developed by over-excavating the weak overburden foundation soils found beneath the berm footprint and replacing them with material with a higher shear strength.

As proposed, the downstream stability berms and shear key would be constructed by first excavating existing soils to bedrock. These excavations would reach depths of 50 to 80 feet for the stability berms with a maximum depth of 160 feet if the shear key option is implemented. Slope protection would be removed to the top elevation of the embankment and stockpiled downstream of the toe. An existing toe drain would then be excavated and removed. These operations would expose an existing blanket drain and surrounding filter materials along the downstream face of the dam. After excavations are complete, existing filters/drains located at the downstream toe would be re-established and a new toe drain seepage collection system would be installed. Stronger materials would then be placed as backfill and compacted. Shell material and a rock blanket would be placed on the downstream side of the embankment until it reaches an elevation of 480 feet. At 480 feet, construction for the two-stage downstream crack filter would begin and the filter material along with shell material would continue up to the new dam crest elevation. Above an elevation of 550 feet, the raised crest would be developed by placing riprap and bedding, core, a two-stage chimney filter, and the downstream shell. Materials used would be stockpiled downstream of the toe and in a borrow area. After fill placement is completed, road base and paving of the dam crest would complete the overlay raise.

The Crest Raise Action will require several borrow, construction, and staging areas near the B.F. Sisk Dam, as well as roads connecting them. These areas include the Basalt Hill Borrow Area, Borrow Area 6, three construction staging areas, upstream and downstream stability berms or fill impact areas, and expanded embankment areas. Construction of the Crest Raise Action also will require the removal of one of nine existing transmission towers near the Gianelli Pumping-Generating Plant. The remaining eight towers will be reconfigured and remain operational during construction. Following completion of the B.F. Sisk SOD Modification Project, the removed transmission tower will be replaced. Cumulatively, the Crest Raise Action spans 3,914 acres. Cultural resources that may be impacted by the B.F. Sisk SOD Modification Project were detailed in a 2019 cultural resources report (Pacific Legacy 2019) and assessed in a Final EIS/EIR (Reclamation and DWR 2019).

Mitigation measures or environmental commitments that would be implemented to reduce impacts to cultural resources from the Crest Raise Action are discussed in a 2019 Record of Decision (ROD).

1.2.2 Non-Structural Alternative

Under the Non-Structural Alternative, Reclamation and the Authority would rely on operational measures to meet Project objectives, specifically changes in the current approach for annual CVP water supply allocations. The maximum storage capacity of the San Luis Reservoir is roughly 2,027,840 acre-feet with a federal share of 966,000 acre-feet and state share of 1,062,000 acre-feet. The annual allocation of CVP supplies is managed by the Reclamation Central Valley Operations Office, which develops the annual allocation to fully utilize stored CVP supply in the reservoir to meet CVP contractors' requirements. Under the Non-Structural Alternative, the annual allocation would be altered so that up to 310,000 acre-feet of stored CVP supply is reserved in the San Luis Reservoir at the end of wetter years for allocation to south-of-Delta CVP contractors in subsequent drier years. In drier years, the 310,000 acre-feet of reserved supply would be allocated to agricultural (98%) and military or industrial south-of-Delta CVP water users (2%). Under this new operational configuration, allocated water supply not used by CVP contractors could not be rescheduled for use in a subsequent year.

This change in San Luis Reservoir operations to increase available water supply in dry and critical years would impact average water supply deliveries to CVP and SWP contractors. This alternative would not completely meet the Project's objectives, though it would partially meet the water supply reliability objective. The Non-Structural Alternative would not require any ground disturbing activities or physical maintenance actions and, according to current models, would result in reservoir elevations consistent with historical norms. Changes in operational measures under the Non-Structural Alternative are not expected to newly inundate or expose cultural resources or result in increased erosion to cultural resources along the margins of the San Luis Reservoir or Cottonwood Bay.

1.2.3 B.F. Sisk Dam Raise Alternative

The B.F. Sisk Dam Raise Alternative would be completed by placing additional fill material on the dam embankment to raise the dam crest an additional 10 feet above the 12-foot embankment raise under development as a part of the B.F. Sisk SOD Modification Project Crest Raise Action. The additional 10 feet of embankment would support an increase in San Luis Reservoir storage capacity totaling 130 thousand acre-feet. It would result in a final crest elevation of 576 feet and a maximum water surface elevation of 554 feet amsl. There are three sub-alternatives under the B.F. Sisk Dam Raise Alternative that relate to different operational configurations, or the varying assignment and use of the increased storage capacity. Impacts to cultural resources under these sub-alternatives are expected to be the same or very similar, however, and are not discussed in detail. Elements common to each of the sub-alternatives include the (1) *Construction of Dam Raise*, (2) *SR 152 Modifications*, and (3) *Operation of Dam Raise*. Briefly, these elements are as follows:

1) *Construction of Dam Raise:* All of the B.F. Sisk Dam Raise sub-alternatives include the elevation of the B.F. Sisk Dam by 10 feet across the entire dam crest. In addition to raising the height of the dam to accommodate the increased capacity of the San Luis Reservoir, all sub-alternatives will include the installation of downstream stability berms and crack filters and raising the existing outlet works intake towers, access bridge, and spillway intake by 10 feet.

The existing saddle dike, or the East Dike, located approximately 1,300 feet north of the main embankment, will be modified by adding a downstream filter. With increased reservoir surface elevations, modifications will be made to the Dinosaur Point and Goosehead Point boat launches to increase the operating elevation of the ramps by 10 feet, and the existing berm near the Pacheco Pumping Plant also would be similarly elevated. Construction of the additional 10-foot dam embankment and associated modifications would begin during construction of the B.F. Sisk SOD Modification Project and would rely on the use of the same access roads, borrow areas, and construction staging areas. The B.F. Sisk SOD Modification Project Crest Raise Action is scheduled to start in September 2020 and continue through December 2028.

2) *SR 152 Modifications:* Under all sub-alternatives, the increased capacity of the San Luis Reservoir will require modifications to a section of SR 152 between Post Mile (PM) R5.239 and R5.806 where it crosses over Cottonwood Creek and spans an embankment separating Cottonwood Bay from the San Luis Reservoir. The current maximum water elevation of the reservoir is 544 feet. Under the B.F. Sisk Dam Raise sub-alternatives, the maximum water level would increase by 10 feet. The current elevation of SR 152 near the Cottonwood Creek crossing ranges in elevation from 555 to 558 feet or higher. With the lowest point of SR 152 approximately 1 foot above the proposed maximum water elevation level, it is assumed that modifications will be needed to protect the roadway. A second location along SR 152 at PM R6.296 will be similarly protected by adding downslope fill material to the embankment to protect the roadway when the enlarged reservoir is filled to capacity.

3) *Operation of Dam Raise:* In coordination with the Authority and its member agencies, Reclamation and DWR identified several operational configurations for the B.F. Sisk Dam Raise Alternative. These sub-alternatives were intended to capture a range of requested stakeholder configurations and cover a range of potential environmental effects. These effects include potential growth inducing impacts from increases in water supply reliability and potential environmental impacts to aquatic resources in the Delta from changes in Delta water exports.

1.3 Area of Potential Effects

The B.F. Sisk Dam Raise Alternative APE spans 5,028 acres and includes all areas that may be directly or indirectly impacted by the Project. It incorporates all areas within the B.F. Sisk SOD Modification Project Crest Raise Action, specifically the Basalt Hill Borrow Area, Borrow Area 6, three construction staging areas, upstream and downstream stability berms or fill impact areas, expanded embankment areas, and several existing access roads that require improvement (*see* Figure 1-1). Ground disturbing activities within these areas may directly alter significant cultural resources as a result of construction, excavation, staging, maintenance, hauling, and other actions. As a part of the Crest Raise Action, Reclamation has developed a Programmatic Agreement that outlines the steps required to complete the Section 106 process for historic properties within these areas (Reclamation 2019).

Additional areas that may be subject to construction impacts under the B.F. Sisk Dam Raise Alternative include the Dinosaur Point and Goosehead Point boat launches, an existing berm at the

Pacheco Pumping Plant, and a portion of SR 152 between San Luis Reservoir and Cottonwood Bay, all of which will be elevated to avoid inundation. Implementation of the B.F. Sisk Dam Raise Alternative also will result in operational impacts to cultural resources as maximum water levels are increased in the San Luis Reservoir and Cottonwood Bay. Significant cultural resources along the San Luis Reservoir and Cottonwood Bay shorelines may be subject to mechanical and biochemical impacts as resources become fully or partially inundated and exposed to increased wave action.

1.4 Regulatory Context

Reclamation is the lead Federal Agency for the Project under NEPA and the Authority is the lead State Agency under CEQA. As a federal undertaking, the Project is subject to Section 106 of the NHPA[1] (54 USC 300108), which states

> The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, shall take into account the effect of the undertaking on any historic property. The head of the Federal agency shall afford the [Advisory] Council [on Historic Preservation] a reasonable opportunity to comment with regard to the undertaking.

The implementing regulations of Section 106 of the NHPA are found in 36 CFR Part 800, which identifies the steps and consultation requirements that must be taken to comply with Section 106 of the NHPA. Pursuant to 36 CFR 800.16(l)(1), a historic property is defined as

> any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

The criteria for determining NRHP eligibility are found in 36 CFR Part 60.

In the event that historic properties within the APE for an undertaking will be subject to adverse effects, the lead federal agency is required to consider ways to avoid, minimize, or mitigate (“resolve”) such effects, in consultation with the Advisory Council on Historic Preservation (ACHP), the SHPO, and other Section 106 consulting parties. This often requires the development

1 Following ACHP guidelines, “Section 106” is referred to as that section of the original public law that enacted the NHPA as opposed to its current legal citation (54 USC 306108). It is a reference that has been in constant use for almost 50 years. The provisions of the newly codified NHPA may be found under 54 USC 300101 et seq.

and execution of a Memorandum of Agreement or Programmatic Agreement among the consulting parties (36 CFR 800.6).

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. At this time, Reclamation does not have an undertaking with the potential to affect historic properties as the feasibility and environmental studies are planning activities. Should Congress authorize an identified Project alternative or other Project that addresses the stated aims of the Project and the lead Federal Agency has an undertaking as defined in 36 CFR 800.14(y) and 800.3(a)(1), that federal action will then be subject to NHPA Section 106 compliance and other federal cultural resources laws as applicable.

Because the Project construction alternative includes lands owned and administered by Reclamation, additional cultural resource policies and procedures also are relevant. Among these is the Native American Graves Protection and Repatriation Act (NAGPRA) (Public Law 101-601; 25 USC 3001-3013), which describes the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian organizations with respect to the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, referred to collectively in the statute as "cultural items," with which they can show a relationship of lineal descent or cultural affiliation. NAGPRA also establishes procedures for the inadvertent discovery or planned excavation of Native American cultural items on federal or tribal lands.

Additional mandates applicable to Reclamation administered lands are outlined in the manuals "Policy for Cultural Resources Management" (LND P01; Reclamation 2012a), "Directives and Standards for Cultural Resource Management" (LND 02-01; Reclamation 2012b), and "Administration of the Archaeological Resources Protection Act (ARPA) on Bureau of Reclamation Land" (LND 02-04; Reclamation 2014). Reclamation is also guided by the "Policy for Museum Property Management" (LND P05; Reclamation 2012c) and "Directives and Standards for Museum Property Management" (LND 02-02; Reclamation 2012d).

1.4.1 National Register of Historic Places

The NRHP is "an authoritative guide to be used by federal, state, and local governments, private groups, and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment" (36 CFR 60.2). Eligibility for inclusion in the NRHP is determined by applying the following criteria, which were developed by the National Park Service in accordance with the NHPA and outlined in 36 CFR 60.4:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or

C. That embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded, or may be likely to yield, information important in prehistory or history.

Any prehistoric or historic period district, site, building, structure, or object that meets one or more of the criteria above and possesses sufficient integrity may be eligible for inclusion in the NRHP as a historic property.

Typically, cemeteries, birthplaces, or graves of historic period figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, commemorative properties, and properties that have achieved significance within the past 50 years are not considered eligible for listing in the NRHP. Such properties may qualify, however, if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

- A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- A building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life.
- A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
- A property achieving significance within the past 50 years if it is of exceptional importance (36 CFR 60.4).

1.4.2 California Environmental Quality Act

State historic preservation regulations affecting the Project include the statutes and guidelines contained in CEQA. CEQA requires lead state agencies to consider carefully the potential impacts of a project on historical resources. A “historical resource” includes, but is not limited to, any object, building, structure, site, area, place, record, or manuscript that is considered historically or archaeologically significant (PRC 5020.1). Section 15064.5 of state CEQA *Guidelines* specifies criteria for evaluating the significance or importance of cultural resources as follows:

- The resource is associated with events that have made a contribution to the broad patterns of California history;
- The resource is associated with the lives of persons important in our past;
- The resource embodies the distinctive characteristics of a type, period, region or method of construction, or represents the work of an important individual or possesses high artistic values; or
- The resource has yielded, or may be likely to yield, important information in prehistory or history.

The technical advice series produced by the California Governor's Office of Planning and Research offers guidance on procedures to identify historical resources, evaluate their importance and potential for listing in the CRHR, and estimate potential impacts on historical resources. The advice series strongly recommends that Native American concerns and the concerns of other interested persons and corporate entities including, but not limited to, museums, historical commissions, associates, and societies be solicited as part of the process of cultural resources inventory. In addition, California law protects Native American burials, skeletal remains, and associated grave goods regardless of their antiquity and provides for the sensitive treatment and disposition of those remains.

1.4.3 California Register of Historical Resources

The CRHR, which is similar to the NRHP, is an authoritative guide that was created to identify the state's historical resources and to indicate what properties are subject to protection, to the extent prudent and feasible, from substantial adverse change. The criteria for CRHR eligibility are based upon NRHP criteria. Certain resources are determined by the statute to be automatically included in the CRHR, including California properties formally determined eligible for or listed in the NRHP, California Historical Landmarks (CHL) numbers 770 and above, and California Points of Historical Interest.

Per the CRHR, historical resources may consist of buildings, structures, objects, or archeological sites. Each of these entities is assessed for its historical, architectural, archaeological, cultural, or scientific importance. Per CEQA *Guidelines*, (Section 15064.5[b]), project activities may have a significant impact on the environment if they would cause a substantial adverse change in the significance of a historical resource. Activities that could result in a substantial adverse change include demolition, replacement, substantial alteration, and/or relocation of the resource. Steps that must be implemented in order to comply with state CEQA *Guidelines* include the following:

- Identify cultural resources;
- Evaluate the significance of the cultural resources based on established thresholds of historical, architectural, archaeological, cultural, or scientific importance;
- Evaluate the effects of a project on all cultural resources; and

- Develop and implement measures to mitigate the effects of the project on significant cultural resources.

The State Office of Historic Preservation has broad authority under federal and state law for the implementation of historic preservation programs in California. The SHPO comments on effect determinations and eligibility for listing in the NRHP and the CRHR.

1.5 Report Organization and Project Participants

This report begins with an introduction to the Project, specifically its geographic and regulatory setting (Section 1.0), followed by an overview of the natural environment (Section 2.0) and cultural history (Section 3.0) of the San Luis Reservoir vicinity. Archival and records search results for the Project Area are presented (Section 4.0) along with a discussion of the methods that were used during the inventory surveys (Section 5.0). The results of those surveys are detailed (Section 6.0), and conclusions and recommendations are offered regarding the known or potential significance of cultural resources encountered within the B.F. Sisk Dam Raise Alternative APE (Section 7.0). Maps of previously recorded cultural resources and prior cultural resource studies associated with each alternative are included (Appendix A), as are maps of cultural resources relocated or discovered within the APE for each alternative during inventory surveys (Appendix B). Confidential records for cultural resources within the B.F. Sisk Dam Raise Alternative APE are provided (Appendix C), along with NAHC correspondence (Appendix D) and photographic documentation (Appendix E).

The following Pacific Legacy personnel assisted in the cultural resources investigation for the Project and/or assisted in the production of this report:

- John Holson (MA), 40 years of experience, Principal Investigator;
- Lisa Holm (PhD), 28 years of experience, Senior Archaeologist/GIS Analyst;
- Elena Reese (MA), 32 years of experience, Historian;
- Mary O'Neill (BA), 22 years of experience, Field Supervisor;
- David Daly (MA), 12 years of experience, Field Supervisor;
- Christopher Peske (BA), 7 years of experience, Field Supervisor; and
- Shanna Streich (MA), 14 years of experience, Supervisor

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Chapter 2 Natural Environment

The following presents an environmental overview of the B.F. Sisk Dam Raise Alternative vicinity with a focus on the physiography and geology of the area as well as its climate, hydrography, vegetation, and fauna. A brief account of recent geoenvironmental history, late Quaternary geology, and soils is offered so that landscape change and geomorphic processes within the B.F. Sisk Dam Raise Alternative APE may be better understood. Relying heavily on existing geoarchaeological studies, particularly that completed by Rosenthal and Meyer (2004b) for District 10 of the California Department of Transportation (Caltrans), the potential to encounter buried cultural resources within the APE also is explored.

2.1 Physiography and Geology

The San Luis Reservoir lies within the eastern Diablo Range foothills, which are a part of the larger Coast Ranges physiographic province. These foothills generally range in elevation from 200-2,500 feet amsl and are characterized by weakly to moderately dissected rolling topography at the eastern extent of the range where they grade into and are buried by the deep alluvium of the Great Valley Physiographic Province. The western foothills are more deeply dissected with steep slopes. The foothills are northwest trending, sub-parallel to the San Andreas Fault, and underlain by Great Valley Sequence bedrock units in the east and rocks of the Franciscan complex in the west, though several isolated outcrops of Miocene basalt also are present (Lettis 1982; Wagner et al. 1991). Broad, terraced valleys generally separate the foothills, which represent sites of localized subsidence and uplift, respectively. The northwest trending valleys are and typically underlain by thick sequences of Quaternary alluvium. The San Luis Reservoir is situated in one of these valleys, the San Luis Flat, which is created by a pull-apart basin in the Ortigalita Fault Zone, a major Holocene dextral strike slip fault zone that constitutes the eastern part of the larger San Andreas Fault system (Bryant and Cluett 2000).

2.2 Late Quaternary Geology, Geomorphology, and Soils

Previous geological studies of the Diablo Range foothills indicate that the area has undergone dramatic landscape changes since people first inhabited the region roughly 15,000 years ago. During the late Pleistocene, the combined runoff from the Sacramento and San Joaquin rivers flowed through what is now the San Francisco Bay as a single inland drainage before reaching the Pacific Ocean near the Farallon Islands (Atwater et al. 1977). Toward the end of the Pleistocene, the melting of continental glacial ice caused a rapid rise in worldwide sea levels, known as eustatic sea level change. In response, the Pacific shoreline migrated eastward, reaching the opening near the Golden Gate about 10,000 years ago. The San Francisco Bay eventually formed as continued sea level rise drowned low-lying inland valley areas. By about 7,000 years ago, the rate of worldwide sea-level rise began to slow dramatically, and relatively slow submersion of more inland portions of the bay and the Sacramento-San Joaquin Delta began (Atwater 1980, 1982; Shelmon and Begg 1975; Stanley and Warne 1994; Wells and Goman 1995). The decrease allowed sedimentation to keep pace with submergence rates, causing extensive tidal flats and marshes to form around the margins of the bay (Atwater et al. 1979).

At the bay margin, the combination of rising water levels and increasing sedimentation rates created higher baselines for streams that entered the bay. As the lower channels of drainages became choked, sediments were pushed onto the surface of surrounding floodplains, burying exposed surfaces and slowly constructing channel margin levees (Helley et al. 1979). Concurrently, older landforms adjacent to upstream reaches in these drainages were eroded by lateral channel migration, as stream sinuosity increased to maintain equilibrium gradients in response to rising baselines. This led to the formation of an "alluvial apron around the bay plain and the extensive valleys of the region" that is graded to the present sea level (Helley et al. 1979: 18). As a result, many of the Late Pleistocene and Early Holocene land surfaces were overlain by thick deposits of younger alluvium that are generally less than 5,000 years old. These older land surfaces usually exhibit well-developed buried soil profiles (paleosols) that represent a significant stratigraphic boundary in the region. A paleosol is an "old soil" that formed because of weathering at or near the ground surface during a past interval of relative landform stability, making it available for human use and occupation in the past. Alternating periods of landform stability that produce paleosols and periods of instability and deposition that bury them have been documented throughout Central California during the Holocene (Meyer and Dalldorf 2004; Meyer and Rosenthal 2008; Rosenthal and Meyer 2004b).

Further inland from the bay margin, upland valleys of the Diablo Ranges also witnessed profound landscape changes in the late Quaternary, though likely more as a direct result of climatic changes rather than eustatic sea level change. Geological studies in Contra Costa County and the foothills of the western San Joaquin Valley demonstrate that many valleys in the region were partially filled with alluvium by several cycles of deposition in the Holocene that were separated by periods of landscape stability and soil formation (Lettis 1982; Marchand and Allwardt 1981; Pape 1978; Rogers 1988). Geoarchaeological studies in eastern Contra Costa County in the Los Vaqueros area determined that distinct episodes of deposition occurred in different valleys during the Early, Middle, and Late Holocene (Meyer 1996; Meyer and Rosenthal 1997).

During the Late Holocene, ongoing but much more gradual sea level rise caused the expansion of tidal marshes at the bay margin in newly filled valleys. By the 1850s, before Euro-American settlement and reclamation, tidal marshes had expanded in the region to cover twice as much surface area as all the inland water of the bay and Sacramento-San Joaquin Delta combined (Atwater et al. 1979). Post Euro-American settlement land use changes, including reclamation efforts for conversion to agriculture, channelization of drainages, widespread grazing, and more recent urbanization have led to further landscape changes. This brief review indicates that the timing, magnitude, and extent of landscape changes were sufficient to have potentially buried cultural resources in the Diablo Range foothills, particularly within the structural basin of the San Luis Flat.

2.2.1 Late Quaternary Surficial Geology

Late Quaternary surficial geology has been mapped for the western portion of the San Luis Reservoir area by Knudsen et al. (2000). That area is marked by Early to Late Pleistocene undifferentiated alluvium (Qoa) that is more than 30,000 years old. Qoa deposits are described as moderately to deeply dissected alluvial fan, stream terrace, basin, and channel deposits. For other portions of the San Luis Reservoir area, detailed surficial geologic mapping does not appear to be available, though a study by Lettis (1982) described deposits for the western San Joaquin Valley and eastern Diablo Range, and the State Geologic Mapping Compilation offers generalized data compiled on a regional basis for the conterminous U.S. (Horton et al. 2017). Much of the San Luis Reservoir area in Merced County appears to be situated on steeply sloping erosional hillslopes underlain by bedrock. Much of the now inundated portion of the San Luis Reservoir area, however, is situated in the alluvial basin of the San Luis Flat (*see* Figure 2-1).

Lettis (1982) described two Holocene units, Patterson and Dos Palos alluvium, that are present in the eastern foothills of the Diablo Range and on the floor of the San Joaquin Valley, respectively. Patterson alluvium underlies present stream channels and low terraces inset into older Late Pleistocene/Early Holocene San Luis Ranch alluvium. Patterson alluvium is purported to form extensive, deep fill-in valleys of the eastern Diablo Range, including Carrisalito Flat, which is located approximately 10 miles south of San Luis Reservoir. A gastropod shell obtained from a depth of 0.5 meters in a low terrace along San Luis Creek just east of O'Neill Forebay provided a Late Holocene date for Patterson alluvium (Lettis 1982: 77). Although the San Luis Reservoir had already inundated the San Luis Flat when Lettis (1982) conducted his research, thus preventing him from mapping that location, it seems likely that Holocene deposits of Patterson alluvium covered portions of the San Luis Flat along Cottonwood Creek, San Luis Creek, and other unnamed drainages that were subsequently flooded.

2.2.2 Soils

The U.S. Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) has mapped soils for the San Luis Reservoir area as a part of the Soil Survey Geographic (SSURGO) database for Merced County (USDA-NRCS 2007). SSURGO mapping does not extend to inundated areas such as the San Luis Reservoir, but otherwise covers both rural and urban areas. Due to inundation, portions of the B.F. Sisk Dam Raise Alternative APE are not mapped as part of the SSURGO database.

With the exception of Hillgate silt loam, all of the soils found around the San Luis Reservoir are formed on erosional landforms (i.e., hillslopes) in residuum (*see* Figure 2-2 and Table 2-1). Hillgate silt loam is formed in alluvium from mixed sources, more specifically on the Qoa unit described in the preceding section on surficial geology. Its well-developed soil profile with numerous Bt horizons is a byproduct of extended subaerial weathering through time (Birkeland 1999; Birkeland et al. 1991), which suggests it has been exposed at the surface since the late Pleistocene. In addition to mapped soils, it is likely that a number of unmapped soils series were present at lower elevations, such as moderately sloped portions of San Luis Flat, including the Lost Hills, Pleasanton, and Ortigalita series (Lettis 1982). These soils are commonly mapped on San Luis Ranch alluvium and are moderately developed with A/Bt/C soil profiles. Soil series on more gently sloped areas of San Luis Flat, especially along Cottonwood Creek and San Luis Creek, would likely have been Panoche, Mocho, Orestimba, Oxalis, Clear Lake, or Levis series soils (Lettis 1982: 126). These soils are commonly mapped on Patterson alluvium, have A/C profiles, and often contain paleosols.

2.2.3 Buried Cultural Resource Sensitivity

The sensitivity for buried cultural resources has been successfully modeled using ages of depositional landforms and soils as a primary variable in Central California (Meyer and Rosenthal 2008; Rosenthal and Meyer 2004a, 2004b). These models generally rely on the probability that more recent Holocene deposits possess a greater potential to bury cultural resources than older Holocene deposits. Because human occupation is generally thought to have occurred in the Latest Pleistocene (after 15,000 years ago), landforms that pre-date this period and remain exposed at the surface have

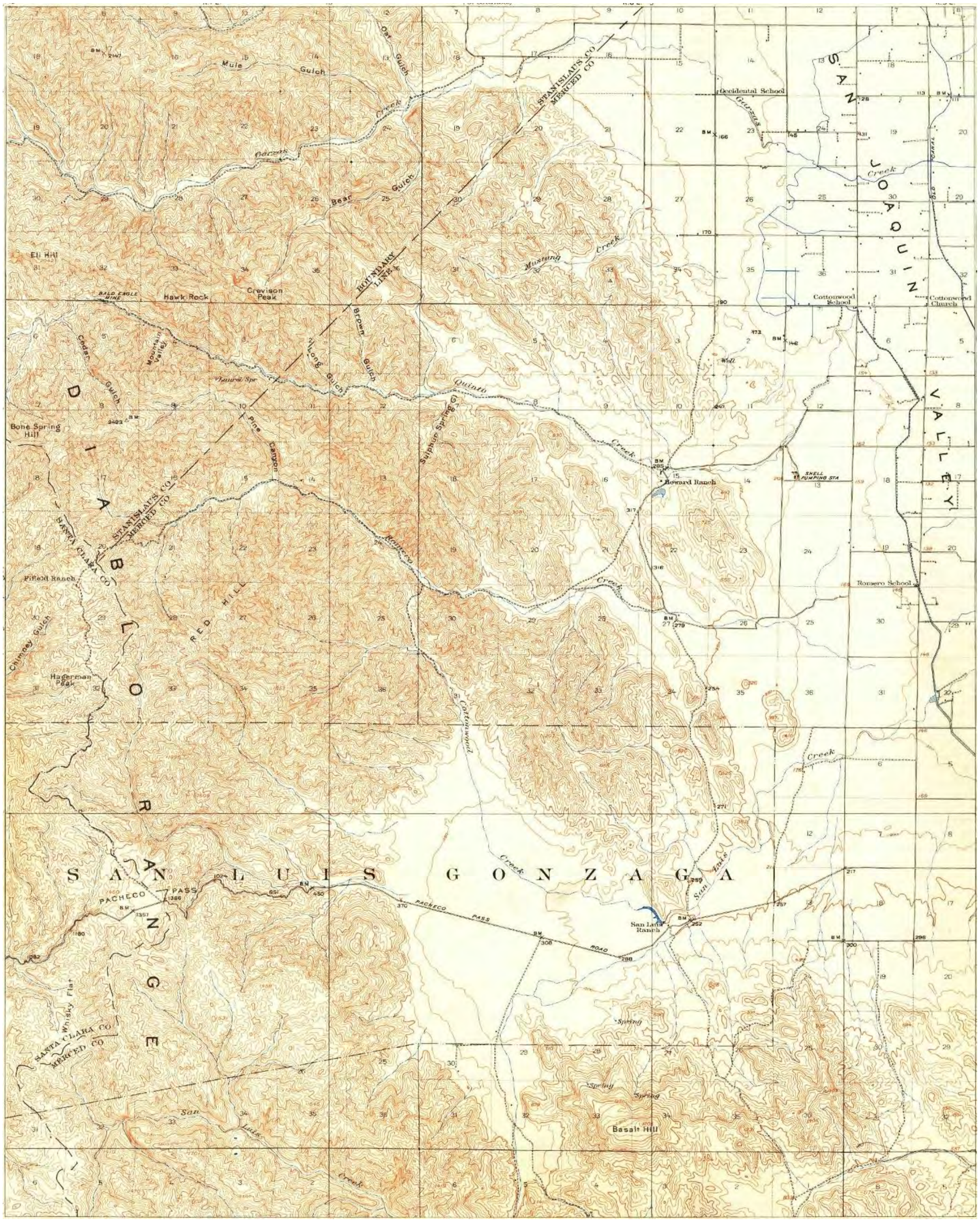

Figure 2-1. A View of the San Luis Flat Area before Dam Construction (1947 USGS 15-Minute Pacheco Pass Topographic Map).

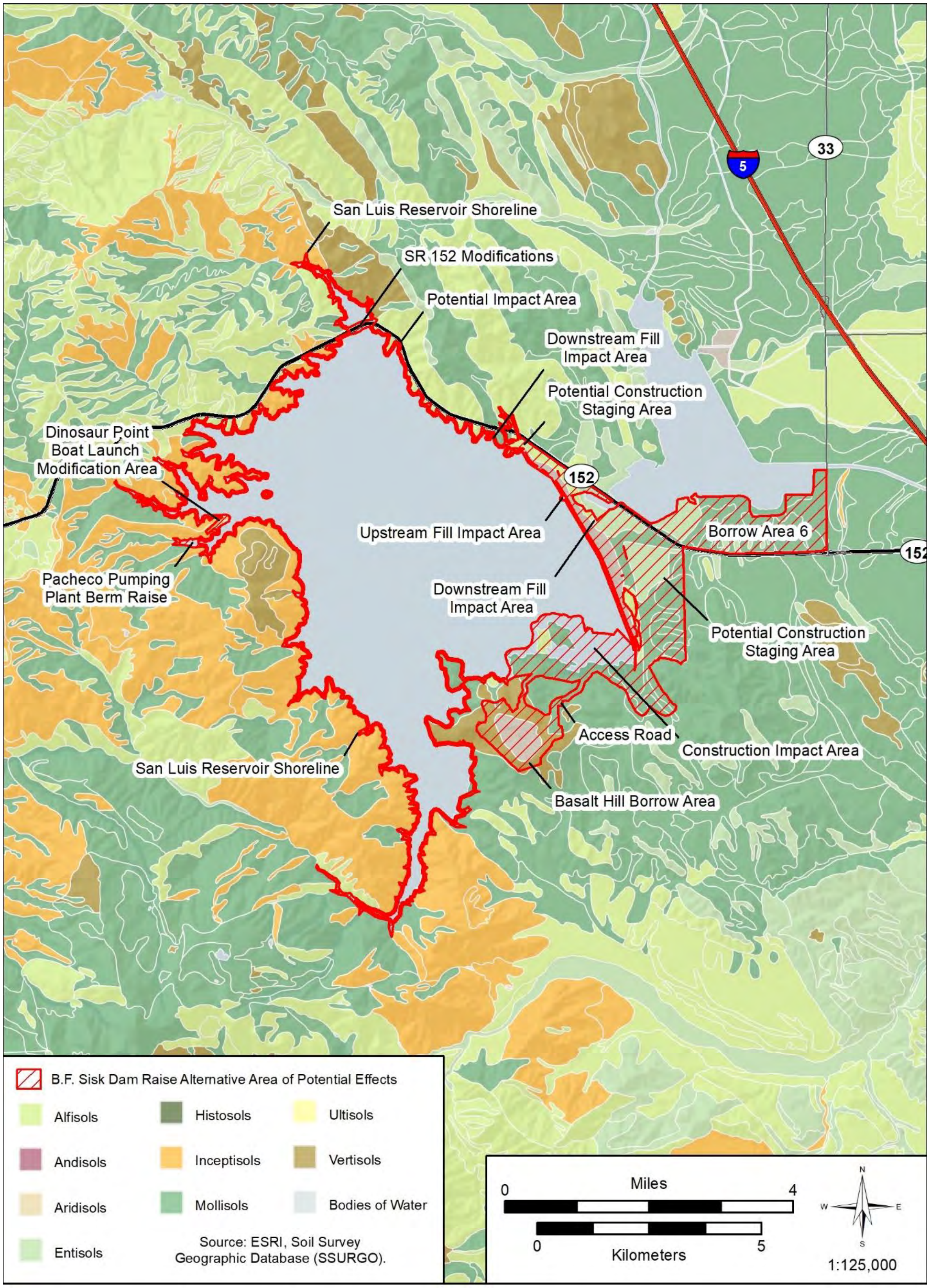

Figure 2-2. SSURGO Soil Map Units within the San Luis Reservoir Area.

Table 2-1. SSURGO Soil Units in the San Luis Reservoir Area.

Map Unit Name1	Soil Order	Soil Profile
Asolt very stony clay, 30-50% slopes	Vertisol	A1/A2/A3/C/R
Conosta clay loam, 8-15% slopes	Alfisol	A1/A2/Bat/Bt/BCt/Cr
Fifield-Gonzaga complex, 30-50% slopes	Mollisol	A/Bt/C1/C2/R (Fifield); A1/A2/ABt/Bt1/Bt2/R1/R2 (Gonzaga)
Fifield-Millsholm complex, 30-50% slopes	Mollisol/ Inceptisol	A1/Bt/C1/C2/R (Fifield); A1/A2/Bt/R (Millsholm)
Hillgate silt loam, 2-9% slopes	Alfisol	A1/A2/A3/2Bt1/2Bt2/2Bt3/2Bt4
Millsholm loam, 8-15% slopes	Inceptisol	A1/A2/Bt/R
Millsholm loam, 30-50% slopes	Inceptisol	A1/A2/Bt/R
Millsholm-Fifield complex, 30-50% slopes	Mollisol/ Inceptisol	A1/A2/Bt/R (Millsholm); A1/Bt/C1/C2/R (Fifield)
Millsholm-Rock Outcrop complex, 15-30% slopes	Inceptisol	A1/A2/Bt/R
Oneil silt loam, 30-50% slopes	Mollisol	A1/A2/A3/AC/Ck/R
Vallecitos rocky loam, 15-30% slopes	Alfisol	A1/A2/Bt1/Bt2/R
Water (Not Mapped)	-	-

1 From USDA-NRCS 2007, 2010a

very low buried cultural resource sensitivity. Many of the areas around the San Luis Reservoir consist of erosional landforms with younger soils or depositional landforms that are Late Pleistocene in age. All of the soils listed in Table 2-1 are estimated to have a very low sensitivity for buried cultural resources, an assessment reinforced by previous regional geoarchaeological studies (Rosenthal and Meyer 2004b). Younger landforms, however, were present within the San Luis Flat prior to the inundation of the reservoir and may be exposed during drought years or periods of significant drawdown. These landforms include Holocene age terraces consisting of Patterson alluvium along drainages. Because Patterson alluvium is considered to be Late Holocene in age, such landforms are considered highly sensitive. Although they have not been mapped in detail due to inundation, these areas should be considered highly sensitive for buried cultural resources. The extent to which the extent to which certain areas were graded or cut for fill material related to construction of the B.F. Sisk Dam or other facilities (e.g., Pacheco Pumping Plant, SR 152 Modifications areas, etc.), however, could lower this sensitivity assessment. The extent of post-inundation erosion would also influence this assessment.

2.3 Climate and Hydrology

The B.F. Sisk Dam Raise Project Area is characterized by a Mediterranean climate consisting of wet, cold winters and hot, dry summers. The Western Regional Climate Center (WRCC 2013) has documented climatological data from six weather stations within the San Luis Reservoir vicinity for roughly a century, depending on the specific weather station. Two weather stations collected data near the San Luis Reservoir. From 1963 to 2007, the B.F. Sisk Dam weather station reported annual temperatures from 38° F in January to 92° F in July while the average was 74° F. Data also was collected at the Pacheco Pass weather station from 1949 to 1977, but it generated insufficient data for temperature generalizations. The growing seasons in the San Luis Reservoir area range from 215 to 260 days per year. This season is defined as the period between the last freezing temperature of the spring and the first freezing temperature of the fall. The last freezing temperature generally occurs in March, while the first occurs in November or December. Precipitation in the San Luis Reservoir vicinity varies considerably from year to year and is based on microclimate. Generally, the average amount of precipitation decreases from the northwest to the southeast. The average precipitation at B.F. Sisk Dam is 10.45 inches and 12.77 inches at Pacheco Pass.

San Luis Reservoir comprises the largest water body in Merced County. As an off-stream storage reservoir, it does not block any major river drainages to obtain water. Instead, water is pumped into the reservoir during wetter months via the California Aqueduct and Delta-Mendota Canal for later use. The reservoir has a catchment area of 84.6 square miles. San Luis Creek is considered the main tributary to San Luis Reservoir, though Cottonwood Creek also empties into the reservoir. The San Luis Reservoir has a current storage capacity of 2,041,000 acre feet (Autobee 2011) and a current high water elevation of 544 feet amsl. The low point of the reservoir pool varies over the year in part due to demand, supply, and water allocation guidelines. The base of the B.F. Sisk Dam rests at 225 feet amsl.

2.4 Vegetation and Fauna

A range of vegetation communities exists within the San Luis Reservoir vicinity, in large part a product of the diverse topography and hydrology of the two main areas. The varied vegetation communities support a wide variety of fish, mollusks, waterfowl, and large and small mammals. At least five distinct natural communities occur within the San Luis Reservoir area. These communities include Valley and Foothill Grassland, Oak Woodland, Northern Mixed Chaparral, Coast Range Mixed Coniferous Forest, and Riparian Forest.

Valley and Foothill Grasslands occur primarily on hill slopes that are barren of trees or brush growth as well areas of the valley floor not subsumed by the San Luis Reservoir. Most of the plant species within this community are non-native grass species such as wild oat (*Avena barbata*) and rip-gut brome (*Bromus diandrus*). This community is generally associated with Oak Woodlands, which tend to occur on areas downslope from ridgelines. Oak Woodlands mark the transition between savannah-like grassy plains in the lowlands and forest-like stands of trees at higher elevations. This community is dominated by coast live oak (*Quercus agrifolia*) and valley oak (*Q. lobata*). Other species may include poison oak (*Toxicodendron diversilobum*) and non-native grass species.

Oak Woodland communities were an important part of the Native American subsistence economy, and acorns comprised a staple food item. It has been suggested that acorn procurement was critical in encouraging more sedentary lifeways among California Native Americans. In addition to acorns, Oak Woodlands also provide habitat for species of fauna that were an important part of the prehistoric diet. These animals included mule deer (*Odocoileus hemionus*), Roosevelt elk (*Cervus canadensis*), ground squirrel (*Citellus* sp.), rabbit (*Sylvilagus* spp.), and Black-tailed Jackrabbit (*Lepus californicus*).

Oak Woodlands often replace areas of chaparral that have been cleared. Clearing and other modern activities have most likely removed much of the chaparral communities from the North Coast Ranges (Fredrickson 1973: 141), yet Northern Mixed Chaparral communities continue to exist within the San Luis Reservoir vicinity. These communities are dominated by plants such as chamise

(*Adenostoma fasciculatum*), scrub oak (*Quercus dumosa*), Manzanita (*Arctostaphylos* sp.), and buckbrush (*Ceanothus cuneatus*). Chaparral communities provide habitat for mule deer (*Odocoileus hemionus*), Roosevelt elk (*Cervus canadensis*), and small mammals such as striped skunk (*Mephitis mephitis*) and badger (*Taxidea taxus*). Many bird species such as California quail (*Lophortyx californicus*) and mourning dove (*Lenaidura macroura*) find refuge in chaparral.

Mountain slopes among the higher elevations continue to be dominated by Coast Range and mixed Coniferous Forest communities. Species in these communities include Douglas fir (*Pseudotsuga menziesii*), California buckeye (*Aesculus californica*), big leaf maple (*Acer macrophyllum*), and madrone (*Arbutus menziesii*). The ground cover in these areas often includes Manzanita (*Arctostaphylos* sp.) and Christmas berry (toyon or *Heteromeles arbutifolia*). This community provided habitat for many large mammals such as grizzly bear (*Ursus californicus*), black bear (*Euarctos americanus*), mountain lion (*Felis concolor*), mule deer (*Odocoileus hemionus*), and Roosevelt elk (*Cervus canadensis*). Many species of birds, such as the golden eagle (*Aquila chrysaetos*) and red-tailed hawk (*Buteo jamaicensis*), and small mammals thrived in these forests.

Along the riparian corridors, Riparian Forests flourish with black walnut (*Juglans californica*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), and red willow (*Salix laevigata*). Although not riparian obligates, California buckeye (*Aesculus californica*), elderberry (*Sambucus mexicana*), and valley oak (*Quercus lobata*) also occur along the banks of drainages. The water elevation of the San Luis Reservoir fluctuates a great deal, preventing the establishment of riparian vegetation typically associated with lake edges such as sedges (*Carex* sp.), bulrush (*Scirpus fluviatilis*), and cattail (*Typha latifolia*).

Chapter 3 Cultural Setting

3.1 Archaeological Background

3.1.1 Central California Archaeology and the Development of Cultural Sequences

Among the earliest archaeological investigations conducted in Northern California was that undertaken by Max Uhle in 1902at the Emeryville Shellmound in the San Francisco Bay Area. Through his excavations, Uhle (1907: Plate 4) recognized ten strata in the mound, though his profile drawings indicate many more strata that he grouped together. From an analysis of burials, artifacts and stratigraphy, Uhle (1907) concluded "there is some support for the suggestion that cultural differences are expressed in the history of the mound." Further investigations by Nels Nelson (1996 [1906]) affirmed much of Uhle's original analysis of the deposit. Nelson (1996 [1906]) identified eleven strata on the opposite side of the mound from where Uhle had originally trenched, though he did not reach a conclusion as to possible cultural differences represented by these strata.

Nelson (1909, 1910) continued his investigations of Bay Area prehistory with a survey of shellmound locations and a more extensive excavation of the Ellis Landing Shellmound near Richmond. At Ellis Landing, Nelson (1910) recognized a distinction between the upper and lower parts of the mound, but he relied heavily on evolutionary principles of cultural development, which obscured the more subtle indications of culture change evident in California shellmounds. Nelson ultimately concluded that no major cultural breaks were present and that the people living at the mound throughout its occupation "were all essentially of the same type of culture" (Nelson 1910: 402).

Alfred Kroeber (1909: 4) drew upon the work of Nelson and Uhle to assert "in California … neither archaeology nor ethnology has yet been able to discover either the presence or the absence of any important cultural features in one period that are not respectively present or absent in the other." With his control of the Department of Anthropology at the University of California and his belief that the archaeology of the Bay Area could lead to few insights concerning the historical development of Native American culture, Kroeber shifted the resources of the Department away from archaeology and more towards salvage ethnography (Gerow with Force 1968: 2). The scattered archaeological work that was conducted in the Bay Area during the pre-war period—such as at the Emeryville Shellmound—further undermined Uhle's early observations of culture change in the archaeological sequence of the region.

While California archaeology in general suffered from assumptions regarding lack of culture change, a breakthrough for the discipline was made with the publication of *Prehistoric Man of the Santa Barbara Coast* (Rogers 1929) and "Chumash Prehistory" (Olson 1930). These publications were the first studies in California prehistory to recognize and name cultural sequences based on archaeological materials. It was not until the publication of *The Archaeology of the Deer Creek-Cosumnes Area* (Lillard and Purves 1936), however, that Central California had a stratigraphically based cultural sequence equivalent to that of Rogers (1929) and Olson (1930). This important publication laid the groundwork for what would become known as the "Central California Taxonomic System," or the CCTS (Gerow with Force 1968: 5).

While these publications sparked a reappraisal of earlier work in the Bay Area, the archaeological investigations that led to the creation of the CCTS were primarily focused on the Central Valley where the sites, due to the presence of rich and abundant grave lots, were considered much more productive for discovering evidence of cultural change. In general terms, the CCTS was a cultural sequence divided into three successive cultural periods: the Early, Middle (also called Transitional), and Late Horizons (Heizer and Fenenga 1939; Lillard and Purves 1936; Lillard et al. 1939). The creation of a cultural sequence for Central California marked a turning point for California archaeology, leading Heizer and Fenenga (1939) to conclude that traditional views of California prehistory as uniform and stable were no longer tenable and that culture change had been ongoing and pronounced.

One of the primary goals of this new paradigm in Central California archaeology was to integrate the culture history of the Central Valley and Bay Area (Beardsley 1948, 1954; Heizer and Fenenga 1939: 396; Lillard et al. 1939: 61). This task was complicated, however, by the advent of radiocarbon dating and an increase in the amount of data available for analysis. Rapid development of the Bay Area meant that more sites and cultural materials were being discovered, which in turn led to an increasing appreciation for the diversity and variation in regional assemblages. The CCTS could not account for these new discoveries without significant revision (Gerow with Force 1968: 5), as the system was based on the belief that "the Bay constituted a local marginal and culturally backward area into which outside influences either failed to spread or spread slowly or halfheartedly" (Heizer 1949: 39).

Being based on the diffusionist notion of "climax" areas or regions (Kroeber 1920, 1939), the CCTS considered the Central Valley as the area in which dominant cultural trends developed and later spread into surrounding areas. In contrast, Gerow with Force (1968) proposed that several different early cultures existed in Central California and that these cultures later converged to create the cultures of the Middle Horizon. Even though this proposition demanded a thorough revision of the CCTS, Gerow with Force (1968) did not offer an alternative to the existing system. Instead, the authors worked within the confines of the CCTS to integrate the new data within the old system, though other archaeologists were also growing dissatisfied with the status quo (Bennyhoff and Fredrickson 1994; Fredrickson 1973, 1994a).

Fredrickson (1994a) undertook to overhaul the CCTS and began by separating the cultural and temporal dimensions of the system. "The three-part Central California cultural sequence proved to be implicitly unilineal, fostered by the deliberate linking, through the concept of the horizon, of the cultural and the temporal dimensions" (Fredrickson 1994a: 5-6). Fredrickson's revision of the sequence for California eventually produced three major chronological periods: Paleo-Indian, Archaic, and Emergent. For the cultural dimensions of the revised taxonomic framework, Fredrickson's most important contribution was the concept of the "pattern" (Bennyhoff and Fredrickson 1994: 20-22; Fredrickson 1994b: 40-43). An archaeological pattern, as typically defined, represents a basic adaptation generally shared by a number of separate cultures over an appreciable period within a given geographic area. The pattern is characterized by similar technological skills and devices (specific cultural items); similar economic modes (production, distribution, consumption), including trade and wealth practices (often inferential); and similar mortuary and ceremonial practices (Bennyhoff and Fredrickson 1994: 21).

The increasing complexity of the revised CCTS reflected the increasing diversity of the archaeological record. Yet with the rise of the "New Archaeology" in the 1960s and 1970s, interest in archaeological taxonomy waned. The new paradigm emphasized the primacy of the environment as the regulating force for culture change at the expense of historical and social factors that may have helped to shape human history (Fredrickson 1992 in Hughes 1994: 92). Classification systems like the CCTS grouped archaeological cultures in such a way to be able to study their historical and social relationships. With the lack of interest in these relationships, the program of classification was largely abandoned. In addition to the shift in paradigm, the sociopolitical tenor of the discipline also began to change. Grave lots, which were the traditional source of data for taxonomic questions, were less accessible to researchers due to avoidance during archaeological projects or out of respect for the wishes of Native American communities. Both the interest in taxonomy and the data necessary for its study became increasingly rare.

3.1.2 The San Luis Reservoir Area

Within Fredrickson's revised CCTS, the Windmiller, Berkeley, and Augustine patterns are particularly relevant to the Central Valley. Best known from archaeological manifestations in the Delta and nearby grasslands, Windmiller Pattern sites (ca. 3000 BC to 1000-500 BC) are also recognized in the Sacramento Valley north of Sacramento, the Sierra Nevada foothills, and the Coast Ranges. The artifact assemblages include a variety of flaked and ground stone, baked clay, and shell items, implying a diverse subsistence base and exchange or trade relationships with distant areas. Most of the non-obsidian rock sources (e.g., quartz crystals, calcite, alabaster, and schist) for Windmiller Pattern artifacts are from Sierra Nevada sources (Moratto 1984), whereas much of the obsidian used for chipped stone artifacts is from the western Great Basin and North Coast Ranges (Jackson 1974). The Windmiller burial pattern is unique in that virtually all of the interments are ventrally extended with the head oriented to the west. Artifacts associated with burials are common and imply social stratification, with males generally having higher status than females. It has been suggested that Windmiller people lived in small, highly mobile groups and that some Windmiller groups occupied the Sierra Nevada foothills during the summer and the Sacramento Valley during the winter. A riverine-marshland orientation is generally recognized for the Windmiller Pattern (Moratto 1984: 206, 552). Windmiller deposits in the Central Valley and Delta are typically situated on low, broad mounds and some are known to underlie complex archaeological deposits (e.g., villages or permanent habitation sites) dating to subsequent periods. Windmiller assemblages have also been identified in cave settings in the Sierra foothills.

The Berkeley Pattern (ca. 1000-500 BC to AD 500) represents a gradual subsistence shift to increased reliance on acorns, fish, and birds. Stone bowl mortars and pestles are found in large quantities. An extensive bone tool kit was also developed along with unique knapping techniques and particular types of shell beads and pendants. Burial practices also differed from Windmiller sites, with flexed burials in variable orientations. Large shell heaps have been the focus of study in the Delta and San Francisco Bay regions, and many of these sites show subsequent occupation during Augustine Pattern times (Moratto 1984).

Augustine Pattern (ca. AD 500-1800) artifact assemblages reflect an intensification of hunting, gathering, and fishing necessitated by an expanding population (Moratto 1984). Acorns, freshwater and anadromous fish, and waterfowl were principal subsistence foods. Mortuary practices showed significant variability and included cremation. Trade networks became more regularized, with serrated obsidian points, black steatite pipes and beads, magnesite cylinders and beads, charmstones, clam shell disk beads, and other durable goods traded into the Central Valley from the North Coast Ranges.

Between 1962 and 1968, several archaeological studies were conducted in the Project vicinity prior to the construction of the San Luis, Los Banos, and Little Panoche reservoirs (Moratto 1984). Olsen and Payen (1969) and Moratto (1984) defined a series of four cultural complexes (Positas Complex, ca. 3300-2600 BC; Pacheco Complex, ca. 2600 BC-AD 300; Gonzaga Complex, ca. AD 300-1000; and Panoche Complex, ca. AD 1500-1850) based on artifact types and burials at 4-MER-S94 (also known as CA-MER-94) and other sites in the western Central Valley. The Positas Complex is represented by artifacts recovered from the base of CA-MER-94 consisting of perforated flat cobbles, small shaped mortars, short cylindrical pestles, a few flake scrapers, milling slabs and mullers, and spire-lopped *Olivella* shell beads.

The Pacheco Complex is represented by artifacts recovered from CA-MER-94 B and C components and is divided into two phases. Phase B (ca. 2600-1600 BC) is marked by large leaf-shaped bifaces, thick rectangular *Olivella* beads, and rare rectangular *Haliotis* ornaments. Phase A (ca. 1600 BC-AD 300) artifacts include various bead types (spire-ground, saucer, and split-drilled *Olivella* beads, *Macoma* clam disc beads, *Haliotis* disc beads, *Haliotis cracherodii* shell ornaments, and stone beads); perforated canine teeth; bird bone awls; scapula grass cutters; polished stone rings, pins, and flat pebble pendants; abundant millingstones, mortars, and pestles; and large to medium projectile points, often stemmed or side-notched. The beads and ornaments relate to the Middle Period in Central California. Coastal influences are reflected in the form and material of some of the projectile points, the presence of *Mytilus* and clamshell in middens, and flexed burials at a time when extended burials were prevalent in the area (Olsen and Payen 1969).

The Gonzaga Complex is represented by CA-MER-3B, CA-MER-14, and CA-MER-94 (Schulz 1970a, 1970b). The majority of diagnostic artifacts from this period have been recovered in association with both extended and flexed burials. Diagnostic artifacts include various bead types (whole spire-ground, thin centrally-perforated rectangular, split-punched, oval, and thin rectangular *Olivella* beads; freshwater mussel shell disc beads and whole limpet shells; and a variety of *Haliotis* ornaments), rare square stem, tapered stem, and serrated projectile points; some bone awls, bone pins, incised mammal bone tubes, bird bone whistles, and scapulae grass cutters; polished stone spool-shaped ear ornaments and small cylindrical plugs; and abundant milling tools such as bowl mortars, shaped pestles, and rarer slab mortars. A single house was discovered with two superimposed floors, a circular basin and a basin with a mud rim and firepit but no postholes. The Gonzaga Complex is similar to Phase I of the "Late Horizon" in the San Joaquin Delta (Moratto 1984).

The Panoche Complex is represented by several sites, including CA-MER-94, CA-MER-27, CA-MER-119, CA-MER-3A, CA-FRE-128, and CA-FRE-129. Diagnostic artifacts include several bead types (clamshell disc beads; steatite disc beads; side-ground, spire-ground, disc, and lipped *Olivella* beads; and *Haliotis* epidermis disc beads and circular and rectangular *Haliotis* ornaments); small side-notched and serrated projectile points; many flaked stone scrapers; bone awls, scapulae grass cutters, bird bone whistles and tubes, and bone beads; polished stone ear spools, conical pipes, and pins; and a variety of mortals and pestles. Flexed burials as well as primary and secondary cremations were noted at Panoche Complex sites. Larger circular assembly houses as well as smaller circular dwellings also were discovered. The Panoche Complex resembles the San Joaquin Delta "Late Horizon" Phase 2 and shows parallels with tribes from the southern coast (Moratto 1984).

3.2 Ethnographic Background

The crest of the Diablo Range is generally regarded as the dividing line between the ethnographic territories of the Northern Valley Yokuts in the Central Valley and the Costanoan, or Ohlone, to the west in the Santa Clara Valley (Kroeber 1925). Territorial boundaries were likely somewhat fluid in the past, however, and there was certainly much trade, exchange, and movement between areas. The following sections therefore discusses both groups and offer a brief account of the Northern Valley Yokuts and Ohlone following European contact.

3.2.1 Northern Valley Yokuts

Territory

The San Luis Reservoir area lies within the traditional territory of the Northern Valley Yokuts, which extended south from the confluence of the Calaveras and San Joaquin Rivers to the point at which the San Joaquin River turns abruptly east. It encompasses the central San Joaquin Valley east from the Diablo Range to the Sierra Nevada. Linguistically, the Northern Valley Yokuts are relative newcomers to the central San Joaquin Valley. They were pushed north by the Numic-speaking Monache beginning about 500 years ago (Kroeber 1959). Approximately 50 linguistically identifiable tribes were known to exist under the umbrella of "Yokuts" (Kroeber 1976). The Kahwatchwah Yokut tribe lived in the San Luis Reservoir area (Latta 1949).

The pre-contact Yokuts population has been estimated as three to four hundred people in each tribe, with 15,000-20,000 people for the entire group (Kroeber 1976). Another estimate, based on available food resources, suggests that the population was as high as 31,000 or more (Baumhoff 1963: 221). The Northern Valley Yokuts territory included riparian woodlands, freshwater marshes, valley grasslands, oak woodlands, open river channels, lakes, and sloughs (Schulz 1981). Little ethnographic information exists for the Northern Valley Yokuts. The rapid spread of disease and the Euro-American invasion of their territory for mining and related activities in the early to mid-19th century led to rapid population declines and displacement of the Northern Valley Yokuts (Wallace 1978).

Subsistence

The Northern Valley Yokuts relied heavily on fishing in rivers, sloughs, and streams throughout their territory in the central San Joaquin Valley. Salmon spawned during the fall in the San Joaquin River and its tributaries, and sturgeon was also an important food resource. Dragnets, stone sinkers, and antler-tipped harpoons were used for fishing. Aquatic birds, such as duck and geese, and plant foods were an integral part of the subsistence base. Fire was commonly used to encourage seed-bearing grasses and plants.

Food processing implements included the mortar and pestle, hand and milling stones, and wood mortars. Baskets were also used in seed winnowing and acorn storage. The bow and arrow were the primary means for hunting mammals such as tule elk, deer, and pronghorn antelope. Projectile points or arrowheads were made of local chert, jasper, and chalcedony. Obsidian was rare, and only available through trade. In terms of volume, acorns were the single most important food in Native Central California. During the winter months, when hunting and fishing could be difficult and fresh plant foods were unavailable, consumption of acorn products may have exceeded that of all other foods combined (Schulz 1981).

Settlement

Most Northern Valley Yokut houses were circular or oval semi-subterranean single-family dwellings of tule mats over pole frames. Large communal residences sheltering ten or more families also were constructed (Moratto 1984). Sweathouses and larger ceremonial chambers have been documented ethnographically (Gayton 1936, 1948). Settlements were reported on mounds above permanent waterways, likely because these elevated ground surfaces were safe from flooding and contained abundant food resources.

Trade

Trade occurred north and south along the San Joaquin River. Tule rafts were used for transportation as well as trade (Gayton 1936). Baskets, blankets, and flaked stone were traded from the Miwok in exchange for dogs (Barrett and Gifford 1933). Trade between the Yokuts of the San Luis Reservoir area and the Ohlone occurred along routes through what would later become "Pacheco Pass." Abalone and mussel shells were imported from the coast. Obsidian was most commonly acquired from sources on the eastern slopes of the Sierra Nevada Range.

3.2.2 Ohlone

Territory

The inhabitants of the territory to the west of the Northern Valley Yokuts were known ethnographically as the Ohlone or Costanoan after the Costanoan language group. Costanoan languages belong to the Utian family of the Penutian language stock (Shipley 1978) and were spoken from the San Francisco Bay Area southward along the coast to Point Sur and inland to the Diablo Ranges and portions of the northern San Joaquin Valley (Milliken 1995). The designation Costanoan derives from the Spanish word *Costaños*, or "coast people." The term is misleading, however, as it amalgamates and homogenizes 10,000 or more people who lived in the region into a single ethnolinguistic unit. In reality, the term "Costanoan" subsumes as many as forty or fifty politically independent groups—some of which spoke mutually unintelligible but genetically related languages—under a single umbrella. Many present-day descendants prefer the term Ohlone, which is said to have derived from the name of a coastal village in San Mateo County (Levy 1978).

Knowledge of Ohlone culture is largely based on information gathered from Spanish expeditions between 1769 and 1776, documents maintained at missions, the works of ethnographers and linguists, and from Native descendants. Primary ethnographic sources include Harrington (1933, 1942) and Kroeber (1925). Overviews are provided in Heizer (1974), Levy (1978a), Margolin (1978), and Milliken (1983, 1991, 1995), among other texts. Galvan (1968) and Williams (1890) offer Native accounts of Ohlone history, and an excellent example of contemporary ethnohistory can be found in Cambra et al. (1996).

Political Organization

As defined by Kroeber (1925) the basic Ohlone political unit was the "tribelet," an autonomous, self-governing, territorially defined unit over which recognized authority was given to one person, in most instances the leader or chief. Each tribelet would be composed of one or more villages and a number of camps within its recognized and protected resource exploitation zone. Studies by C.D. King and others suggest that over time several of these tribelets amalgamated into larger tribal units (Breschini et al. 1983). Due to geographic barriers and distance between Ohlone tribelets, however, the integration of smaller political units into larger ones was the exception rather than the rule.

Recent scholarship has questioned Kroeber's interpretation of the Ohlone political system. According to Milliken, socio-political groups were essentially clusters of unrelated family groups that formed loose cooperative communities in the event of ceremonial festivals, group harvesting efforts, and inter-family conflict resolution (Milliken 1995). These disparate multi-family communities joined for the majority of the year to form a large village centrally located between their lands. In other instances, rather than forming a single village, these family units distributed themselves into as many as five semi-permanent villages.

The nature of political authority among Central California tribes has been differentially characterized by early explorers and missionaries as both egalitarian and hierarchical. Records from Mission San Juan Bautista for example attempted to fit local Native Americans into a Spanish system, and described tribal leadership by *capitanes*, or male village leaders. Paradoxically, Father Arroyo de la Cuesta, also of Mission San Juan Bautista, described in his correspondence with Spanish officials a primarily egalitarian, leaderless society in which social control was embedded within the dynamics of deep-seated inter-family feuds. It is evident from Arroyo de la Cuesta's observations that he did not view these divisions in Native leadership as comparable with the hierarchical ranks of bureaucratic Spanish society. He did note, however, that though the "pagan state" lacked distinguished *capitanes*, distinct male leadership roles did arise in battles, banquets, and ceremonies (Arroyo de la Cuesta in Geiger and Meighan 1976).

Spiritual Practices

Early accounts of the Ohlone suggest that they practiced a religion based on sun worship. According to these accounts, the Ohlone often greeted the sun with gestures, demonstrations, and offerings (Kroeber 1925). Sun worship, however, was probably a small part of a much broader pattern of interacting with the natural environment, and early interpretations of sun worship were probably due to the early explorers' cultural misunderstanding of the ceremonies they observed.

Merriam's ethnographic accounts of the late 19th and early 20th centuries describe references to bear shamanism, a practice also observed among other Native American groups. Within shamanistic cultures, shamans serve as spiritual and physical healers, ritual leaders, and as powerful channels of supernatural power. Merriam, having observed shamanistic ritual, described the use of poisons by shamans, including deadly substances like the venom of rattlesnakes, extracts from the lungs of turtles and frogs, and less caustic substances such as human saliva (Merriam 1966).

Subsistence, Trade, and Material Culture

The Ohlone were hunter-gatherers who occupied semi-permanent camps and villages from which they could take advantage of seasonal changes in resource availability. Dwellings at these habitation sites were dome-shaped, with pole frameworks and thatch roofs and walls. Other structures that could be found in an Ohlone village included acorn granaries; sweat houses for the men, often along stream banks; menstrual houses for women; and dance houses and assembly houses, generally in the center of a village (Broadbent 1972). From these villages the Ohlone visited the mountains, valleys, and sloughs to collect resources.

The early explorer Vizcaíno noted a diverse diet among the Ohlone people, which included seeds (dock, tarweed, and chia), nuts (pine nuts, buckeye, hazel, and pepper/bay nuts), berries (Manzanita), grasses, roots, and insects that were gathered locally. The single most important food item among the Ohlone was the acorn, at least four species of which were collected and processed into meal or flour (Breschini et al. 1983). *Pinole* is a ground meal or flour derived from the processed seeds of several plants, including tarweed (Merriam 1966). Tobacco was prepared in a mortar and used as an emetic substance or, more rarely, smoked in the manner of Europeans (Merriam 1966). Tea was commonly prepared from the flowers, leaves, and bark of the Manzanita, elderberry, coffeeberry, toyon, and nettles.

Terrestrial animals formed a large portion of the Ohlone diet, and included birds and small mammals, which were hunted, clubbed, trapped, and snared. Fish were hooked or caught by hand, and explorers reported that sea otters were often clubbed in the water or snared if encountered on land. Shellfish provided an important seasonal food resource, and it is likely that the Ohlone dove for certain prized species, such as *Mytilus edulis,* freshwater mussel (*Gonidea sp.*), marine clams (*Protothaca* sp.), and snails (*Tegula* sp.). Broadbent (1972) reported that frogs, toads, and owls were specifically forbidden from consumption among the Ohlone, a taboo that may have been embedded in socio-cultural beliefs or may simply have reflected cultural preferences.

To promote the growth of seed-bearing annuals and to control the growth of rampant chaparral species, the Ohlone periodically burned vegetation in areas surrounding village sites or in areas of food gathering and hunting. As noted by historical and ethnographic observers, these operations were extremely efficient in controlling vegetation and involved considerable skill and foresight. Gordon states that the burning sequences had the overall effect of bringing to the open “an increased supply of food plants and game” (Gordon 1974: 27), and by the time of initial European settlement in the San Francisco Bay Area, regional vegetation had already been altered considerably by controlled burning.

An abundance of information exists on the material culture of the Ohlone. Mission-era accounts of clothing worn by Rumsen Ohlone neophytes at the Carmel Mission note that women often wore “a short apron of red and white cords twisted and worked as closely as possible, which extends to the knee” (Breschini et al. 1983: 299). According to these accounts, men typically went naked except for the few who covered themselves with a small cloak of rabbit skin above the waist. Other materials employed in the manufacture of clothing were green and dry tule, sea otter furs, and deerskin. Personal ornamentation included black and white face and body paint, which was created from mined cinnabar and typically worn by men. Red ochre was worn as body paint by Ohlone warriors in battle. In daily life, the Ohlone wore ornaments created from abalone shell.

Shell beads were widely used by the Ohlone as a form of currency. *Olivella* shells, mussels, abalone shells, salt, dried abalone, woven baskets, and other items were traded for prized goods with nearby villages and with more distant villages located in other environmental zones. Among the items received by the Ohlone in such transactions were stores of the prized piñon nut and obsidian for tool making. Regional interaction among the Ohlone, and with neighboring cultures such as the Salinan and Yokuts, took place through trade, ceremonies, warfare, and intermarriage. Group exchange and “gifting” occurred at feasts of seasonal resources and at seasonal ceremonial dances and festivals (Milliken 1991: 70). Intermarriage usually occurred between adjacent groups and was rare between those at greater distances (Milliken et al. 1993). Both marital and trade issues were affected by and effected warfare between the tribes (Amoros in Heizer 1974), which has been described as common at the time of Spanish contact (Fages 1937). These well-documented animosities often flared because of territorial disputes and infringements, frequently associated with resource access and control (e.g., Broadbent 1972; Fages 1937; Mason 1912; Langsdorff 1968).

3.3 Historic Period Background

3.3.1 The Spanish Period

Although European contact with Native Americans in California commenced as early as 1542 with the explorations of Juan Rodriguez Cabrillo (Erlandson and Bartoy 1995), the historic period in Central California began in earnest with the expansion of the Spanish frontiers northward from Mexico into Alta California during the 18th century. In 1769, Sergeant José de Ortega, the scout for the expedition of Gaspar de Portolá, discovered the entrance to the San Francisco Bay. The interior of the Bay Area was first explored in 1775 by Juan Mañuel de Ayala and José Cañizares (Hoover et al. 1990: 330). These expeditions were partially focused on the identification of sites for the establishment of missions. Using a tripartite system of military presidios, religious missions, and civilian pueblos, the Spanish government rapidly established a network of settlements from San Diego to San Francisco. One of the first colonizing parties in northern Alta California, under José Joaquín Moraga and Padre Francisco Palou, arrived in San Francisco in 1776 and founded the Presidio of San Francisco and *Misión San Francisco de Asís* (also known as Mission Dolores) (Hoover et al. 1990: 333). The following year, *Misión Santa Clara de Asís* and *El Pueblo de San José* were established in the South Bay (Hoover et al. 1990: 400).

Exploration from the central coast into the San Joaquin Valley began with the Gabriel Moraga expeditions of 1806, 1808, and 1810. The 1806 expedition started in San Juan Bautista, probably entered the valley along San Luis Creek in Merced County, and explored portions of the San Joaquin and Merced Rivers. During the 1810 expedition, Moraga's route brought him back to San Juan Bautista by way of San Luis Creek and Pacheco Pass (Hoover et al. 1990: 198). It has been suggested that the route through Pacheco Pass may have originally been a Yokut or Miwok trade route between the Santa Clara and San Joaquin Valleys (Marschner 2000).

At about the same time as Moraga's explorations, Russia started colonizing coastal lands southward from Alaska into California. The Russians established Fort Ross in 1812 near the modern town of Jenner. The Spanish countered this incursion by establishing *Misión San Rafael Arcangel* and *Misión San Francisco de Solano* in Sonoma to establish a northern frontier.

By the beginning of the 19th century, the Spanish had established an interior road called *El Camino Viejo*. The route ran from the Los Angeles coast north along the western edge of the San Joaquin Valley to the Patterson Pass (near Tracy) and then west to San Antonio (current East Oakland) (Hoover et al. 1990). One of the stopping points for water along the route was at *El Arroyo de San Luis Gonzaga* at *Rancho Centinela* just east of the San Luis Reservoir area (Hoover et al. 1990: 199). Little is known of *Rancho Centinela,* however it is thought to have been a Spanish-era outpost for *vaqueros*, or stockmen, who drove livestock across Pacheco Pass to the Santa Clara Valley. An adobe, which may have dated to as early as 1810, stood at the *vaquero* camp location until it was demolished in 1900 (Latta 1936: 14-15; Snoke 2010).

3.3.2 The Mexican Period

Mexico gained independence from Spain in 1822, and Alta California became a part of the Mexican frontier. The newly established Mexican government attempted to colonize their northern frontier by secularizing mission lands in 1834 and by granting large tracts of land to *Californio* citizens as a reward for loyal service. These ranchos were meant to stake the Mexican claim to the area and halt the possibility of further Russian incursion into Mexican territory (Hoover et al. 1990).

Secularization brought an influx of Mexican settlers to California and allowed for the emergence of a new class of wealthy landowners known as *rancheros*. This led to an emphasis on ranching and agricultural activities in California that became known as the "hide and tallow trade" (Hoover et al. 1990). By the 1840s, there were an estimated 150,000 to 200,000 hides exported annually from Alta California (Burcham 1982: 126-127). During the 1830s and 1840s, there were a series of raids and counter expeditions between the Miwok and Yokut tribes and the Mexican colonists. Although never constructed, Governor Alvarado proposed in 1843 that a fort or stockade be built in Pacheco Pass to secure the route from raiding parties (Beck and Haase 1974: 23).

In 1843, Juan Pérez Pacheco and José María Mejía were granted *Rancho San Luis Gonzaga*, which comprised the eastern Pacheco Pass region, including much of the Project Area as well as the former *Rancho Centinela* property. The land had previously been granted in 1841 to Francisco Rivera but was revoked when Rivera did not establish a residence on the land (Hoover et al. 1990: 200). The grant was bounded by the San Joaquin River to the east; Los Banos Creek to the south; and *Rancho Ausaymas y San Felipe* to the west, which was held by Juan's father Francisco Pérez Pacheco (Beck and Haase 1974). Juan Pérez Pacheco built a one-story adobe house near the route through the pass and raised cattle for the hide and tallow trade. Over the years, the Pacheco family built a second adobe that collapsed during the 1868 earthquake (Hoover et al. 1990: 200; Marschner 2000: 259). The original 1840s adobe survived intact until 1962 when it was unsuccessfully moved in advance of dam construction (Hoover et al. 1990: 200) (*see* Section 3.3.3).

When Juan Pérez Pacheco died in 1855, the property reverted to his father Francisco, who died just five years later in 1860. Francisco's property, including *Rancho San Luis Gonzaga* and half of *Rancho Ausaymas y San Felipe*, passed first to his wife and then to his only surviving child Ysidora after his wife died in 1892. Ysidora married Mariano Malarin in 1850 and had two daughters. One married Dr. Ramon Roca while the other married Dr. Luis Fatjo. The Fatjos and their children inherited the Merced portion of *Rancho San Luis Gonzaga* (Hoover et al. 1999: 200). In 1949, Paula Fatjo, the great-great granddaughter of Francisco Pérez Pacheco, moved to the *rancho* and remodeled the original 1843 adobe (Pierce 1977: 107). *Rancho San Luis Gonzaga* remained an operating cattle ranch during Paula Fatjo's time, though she also bred and boarded Arabian horses there until her death in 1992 (Pierce 1977: 107-111, Bissonnette 2007).

At the west end of Pacheco Pass, was *Rancho San Ysidro* (Old Gilroy), granted in 1810 to Ygnacio Ortega. Ortega died in 1833, and the *rancho* was divided among his heirs, Ysabel Ortega, Quentin Ortega, and María Clara de la Asunción (wife of John Gilroy). The resulting *Rancho Ysidro* and *Rancho La Polka* lay to the west and southwest of the San Luis Reservoir vicinity.

In the 1840s, relations between Mexico and the U.S. became strained as the U.S. expanded westward toward the Pacific Ocean. Political stresses erupted into the Mexican-American War of 1846-1848. At the close of the war, Alta California became part of the U.S. with the signing of the Treaty of Guadalupe Hidalgo.

3.3.3 The American Period

In 1848, at the close of the Mexican-American War, James Marshall discovered gold on the American River and the California Gold Rush began. The discovery brought tens of thousands of immigrants from around the world that pushed further into the California interior than the Spanish or Mexican settlers that had come before. The wealth and expanding population of California curtailed the usual territory phase, and California became a state in 1850 (Hoover et al. 1990).

Due to the rapid influx of settlers into the state, legal determination of ownership of lands awarded by Spanish or Mexican authorities was often disputed. The new American government passed the Land Act of 1851, which placed the burden of proof-of-ownership on the grantees so that the few Native Americans who had received grants lost their titles, as did many Hispanic landowners. By congressional action, grant claims were heard by a board of Land Commissioners and then appealed in federal courts. By 1885, 97% of the claims had been decided. In some instances, however, land ownership was not decided until after a claimant's death. Such was the case with Juan Pérez Pacheco's claim to *Rancho San Luis Gonzaga*. Though he died in 1855, the land was not patented in his name until 1871.

As gold mining in California declined in the 1860s, agriculture and ranching, which had been established to feed the miners, expanded to become important industries for the state economy. Farming in the American Period was characterized by three types of pursuits: cattle and sheep ranching, grain farming, and irrigation agriculture. Cattle and sheep ranching were dominant until the 1880s. During that time, free-ranging, comparatively wild Spanish cattle were replaced by American breeds of livestock and dairy cows. Sheep breeds were also improved in the late 1850s and 1860s by breeding with merino sheep (Burcham 1982).

During the American Period, ranching and dairying activities expanded in the Pacheco Pass region as the *ranchos* were subdivided and portions sold off or leased. General information regarding American Period ranches within and near the San Luis Reservoir vicinity is presented below. Water conveyance and transportation, two other key factors that guided the development of the region, are also discussed below.

Ranches and Agriculture in the San Luis Reservoir Area

Rancho San Luis Gonzaga became known as San Luis Ranch during the American Period. With the onset of the Gold Rush, Juan Pérez Pacheco realized that selling beef to miners was more lucrative than selling hides, and thus he shifted the economic focus of his *rancho*. The Pachecos also partnered with the Butterfield Overland Stage Company and provided a stopover station for the stage route. Due in part to these strategies, and unlike many *Californio* ranchers, the Pachecos were able to retain most of their lands (Marschner 2000: 259; Wood 2005: 46). During the 1930s and 1940s, the 1840s adobe was used as a restaurant, the Old Adobe Inn (Wood 2005: 47). The adobe survived until 1962 when Paula Fatjo attempted to move the adobe to a location west of the proposed San Luis Reservoir in advance of its construction (Hoover et al. 1990: 200; Wood 2005: 46). The remains of the adobe currently lie within Pacheco State Park (Bissonnette 2007).

During the 1850s, Pedro and Bernardo Altube, Spanish Basque immigrants, herded cattle from Southern California and pastured them at the abandoned *Rancho Centinela* adobe prior to their sale (Ziesing et al. 1997: 51). They and their partners, Juan Bautista Arambide, Bernardo Ohaco, and Carlos Garat, acquired the property during the 1860s and 1870s, raised cattle and sheep, and built a second adobe (Snoke 2010; Ziesing et al. 1997: 52). The Bascos, as they were known, came into direct competition with the expanding Miller and Lux cattle empire in the San Joaquin Valley during the 1860s. By 1871, the Altube brothers sold their holdings and moved to Nevada to start their Spanish Ranch in Elko County. The Arambide and Garat families followed them later in the decade (Ziesing et al. 1997: 53).

Henry Miller and Charles Lux came to California during the 1850s as butchers and formed a partnership in 1858 to buy cattle for slaughter (Pierce 1977: 174). From these beginnings, they expanded to become one of the largest cattle ranching corporations on the west coast with land holdings in California, Oregon, and Nevada. When Lux died in 1887, Miller bought out Lux's heirs and continued to expand the empire, which lasted through the 1920s before financial debts curtailed the company's growth (Igler 2001: 180; Pierce 1977: 183). In the San Joaquin Valley, Miller and Lux leased Pacheco lands for grazing and in the 1870s or 1880s built a wood frame-line cabin and corrals near the Pacheco adobe. The line cabin was standing as of 2004 (Wood 2005: 47).

The remains of the Domengine Sheep Ranch are located on the southern shore of current San Luis Reservoir. John Domengine, a French Basque, immigrated to California during the Gold Rush, ranched cattle near Santa Clara until 1865, and then worked for Miller and Lux as a sheep ranch foreman until 1867. Around 1867, he started his own sheep ranch on the San Luis Ranch and ran it until 1873 when he sold his holdings to Simon Camy. In 1872, John's son, Adolph Domengine, joined his father at the sheep ranch and continued to work for the new owner until 1874 when Camy's ranching enterprise moved to Fresno (Vandor 1919: 2181-2182). In 1889, the area near Domengine Spring was issued as a 160-acre homestead entry patent to Joseph Bareilles Couloume, a French immigrant who started sheep ranching south of the reservoir between 1880 and 1889 (BLM 2020a). He and his son, Frank Bareilles, continued ranching and farming there through at least the 1930s (Merced County 1932; U.S. Census Bureau 1920:1A; 1930:6A).

John Dowdy came to California from North Carolina in 1854 (Thompson and West 1876: 109). U.S. Census records suggest John Dowdy and other family members were residing in the Gilroy Township by 1870 and may have been there by 1860 (U.S. Census Bureau 1860: 246, 1870: 99A). An 1882 General Land Office (GLO) plat map shows a "Dowdy Barn and House" northeast of Pacheco Creek near the Stanislaus-Santa Clara County border (BLM 2016). By 1898, the Dowdys had patented 1,144 acres of land in the area (Parkman and McGuire 1984: 108). The current Dowdy Ranch Headquarters complex in Henry W. Coe State Park west of Pacheco Creek was built from ca. 1910 to the 1950s by Franklin, George, and John Dowdy (Parkman and McGuire 1984: 203; U.S. Census Bureau 1910: 9B).

The O'Connor Dairy Ranch was established by 1882 along Pacheco Creek (BLM 2016). No O'Connors are noted in the 1876 directories for Santa Clara County, which suggests that they may not have moved to the area before the late 1870s (Thompson and West 1876). The O'Connor Ranch was shown on the 1921 and 1947 Gilroy Hot Springs 15-minute U.S. Geological Survey (USGS) topographic maps as well as the 1955 Pacheco Peak 15-minute USGS topographic map (USGS 1921, 1947, 1955b). U.S. Census data for 1910 and 1920 show that the Timothy O'Connor family along the Pacheco Pass toll road were raising stock on a cattle ranch and were likely associated with the dairy (U.S. Census Bureau 1910: 9B, 1920: 9B). By 1989, the ranch was owned by the Andresen family of Pacheco Land and Cattle, Inc. (Hylkema 1989: 1).

Water Conveyance

During the late 19th century, the aridity of the western San Joaquin Valley began to pose problems for agricultural production. Wells were initially used for irrigation, but as groundwater was depleted canal projects were undertaken to move water from the San Joaquin River to the west. Henry Miller was involved in early attempts to develop irrigation within the western Central Valley. He organized the San Joaquin & Kings River Canal and Irrigation Company and, in 1871, built a canal from the San Joaquin River to the town of Los Banos (Outcalt 1925:221). In 1874, Miller extended the canal to Los Banos Creek and then to the town of Newman four years later (Outcalt 1925:222). The canals provided much of the irrigation for Miller's properties and for local agriculture. Upon Miller's death in 1916, his daughter and son-in-law inherited the bulk of his vast land holdings along with his water rights (Outcalt 1925:402).

In 1887, the California Legislature passed the Wright Act, which formed irrigation districts across California (Stene 2011:3). The Wright Act was amended in 1897 to ensure that there was sufficient bond funding for irrigation projects (Stene 2011:4). The Merced Irrigation District was established during the 1870s and 1880s for the eastern side of Merced County and developed many miles of canals (Merced Irrigation District 2014). In 1902, the U.S. government passed the Reclamation Act, which established the U.S. Reclamation Service (within the U.S. Geological Survey), which later became the U.S. Bureau of Reclamation. The Reclamation Act encouraged the occupation of previously undeveloped lands through the construction of irrigation systems and the distribution of water through reclamation. The construction of irrigation systems led to an increase in homesteading, which in turn fostered economic development.

By the 1920s, the depletion of groundwater reservoirs was a widely recognized problem within the western San Joaquin Valley. During the 1930s, the federal government began the CVP, a massive irrigation scheme that involved building dams and canals throughout California. In 1939, Henry Miller's heirs agreed to exchange their San Joaquin River riparian water rights, which would be impacted by the construction of Friant Dam and its diversion of the river through the Madera and Friant-Kern Canals, for substitute water diverted from the Sacramento River. They did not abandon their riparian water rights but agreed not to exercise them as long as the government could provide substitute water through "exchange contracts." These contracts are still in effect, and some of Miller and Lux's original canals continue to convey irrigation water today (San Joaquin River Exchange Contractors 2014).

During the early 1940s, America's entry into World War II increased demand for agricultural products and further depleted groundwater in the western Central Valley (U.S. Bureau of Reclamation 2011). By the 1950s, the west side of the Central Valley had become the focus of both the federal CVP and the newly formed SWP (Stene 2011:10). A 1954 federal investigation identified the area along Pacheco Pass in the Diablo Mountains as the ideal site for the San Luis Reservoir (Reclamation 2011). Despite opposition from a variety of regional factions, a state bond measure to fund irrigation in the western Central Valley was narrowly passed in 1960. To avoid the unnecessary expense of parallel aqueducts, the State of California agreed to partner with the federal government in the creation of the San Luis Unit in 1961 (Stene 2011:13-14). The San Luis Reservoir in the Diablo Mountains west of Los Banos would be filled with water supplied by the federal Delta-Mendota Canal and the state's California Aqueduct (Stene 2011:14). A ground-breaking ceremony officiated by John. F. Kennedy marked the start of construction in 1962, and all construction was completed for the project by 1967. Typically, water from the Delta is pumped into the reservoir in winter and early spring and released in summer when water supplies are low (Department of Water Resources 1974:276).

> The 117-mile long Delta-Mendota Canal, completed by Reclamation in 1951, was built to convey water diverted from the Sacramento River to the Mendota Pool, for exchange contract delivery. The canal transports water from the Tracy Pumping Plant (C.W. Bill Jones Pumping Plant) along the western side of the San Joaquin Valley for irrigation and potential storage at San Luis Reservoir, then travels east across the valley for delivery to Mendota Pool, where it is conveyed through various private canals to exchange contract irrigators. At its Mendota Pool

> terminus, the water conveyed through the Delta-Mendota Canal is also used to recharge the San Joaquin River, which is diverted upstream at Friant Dam by the Madera and Friant-Kern canal systems (Stene 1994:13-14).

The California SWP was first envisioned in 1919 by Lt. R.B. Marshall who proposed conveying water from the Sacramento River watershed to the San Joaquin Valley and then over the Tehachapi Mountains to Southern California. A State Water Plan was introduced in 1931, however funding remained unavailable during the Great Depression. After World War II, the SWP was reintroduced and finally passed in 1960. In 1963, construction was begun on the California Aqueduct, a series of canals, tunnels, and pipelines that implement Marshall's early 20th century vision. The main line of the canal was completed in 1971, with subsequent branches or extensions completed as late at 1997 (California Department of Water Resources 2014).

The aqueduct begins at the San Joaquin-Sacramento River Delta at the Banks Pumping Plant, which pumps from the Clifton Court Forebay. Water is pumped by the Banks Pumping Plant to the Bethany Reservoir, which serves as a forebay for the South Bay Aqueduct via the South Bay Pumping Plant. From the Bethany Reservoir, the aqueduct flows by gravity to the O'Neill Forebay at San Luis Reservoir. From the O'Neill Forebay, it flows to the Dos Amigos Pumping Plant and then on for roughly 95 miles before it diverges in Kings County into a main line and a Coastal Branch. In southern Kern County, the main line splits into a West Branch and an East Branch, which together serve Los Angeles, San Bernardino, and Riverside counties. The Department of Water Resources operates and maintains the Gianelli Power Plant, a pumped-storage hydroelectric plant at the base of the B.F. Sisk Dam, which impounds San Luis Reservoir. The San Luis Canal portion of the California Aqueduct comprises the federally built portion of the SWP and delivers both federal and state water to the San Luis Reservoir.

Transportation Development

In 1856 to 1857, a toll road was built through Pacheco Pass by Andrew D. Firebaugh, and two stations (Bell Station and one near Mountain House) were added to collect tolls. The road was used by the Butterfield Overland Stage from 1858 through 1861, and *Rancho San Luis Gonzaga*, also known as the San Luis Station, became a prominent stopping place (Hoover et al. 1990: 199). A telegraph line followed the toll route through the pass (BLM 2016). The ranch complex expanded during the 1850s through the 1880s to include a hotel, a post office, a store, a tavern, and a blacksmith shop. In 1894, the San Luis Ranch also became a station for the short-lived Bicycle Mail Route that existed for two weeks while the American Railway Union went on strike (Wood 2005: 46). By 1878, Merced and Santa Clara counties had purchased the toll road and replaced it with a new road built as a public highway, a portion of which is now a segment of the Whiskey Flat Trail in Pacheco State Park.

In 1915, the Pacheco Pass road became a part of the state highway system, and the state built a third road through the pass (Hoover et al. 1990: 199). Finished in 1923, SR 152 between Bell Station and Pacheco Pass had a number of curves and steep grades. In 1939, beginning roughly one mile east of Bell Station, a 2.6-mile realignment was established that improved the accessibility and safety of the route (CAhighways.org 2010). A 3.3-mile long segment of the road was rebuilt in 1950 as a four-lane expressway, spanning the 1939 alignment and the Merced County border. In 1963 through 1965, a 12-mile long, 4-lane expressway was established from the County border eastward to bypass the San Luis Reservoir, which by then was under development. Whereas the 1940s-era alignment of SR 152 cut through the San Luis Flat, the 1960s-era reroute bypassed it to the north before curving to pass to the south of what would become the San Luis Forebay. This reroute cut and filled the ridges and gulches with 11,400,000 cubic yards of soil and rock to form a level roadbed. The "Cottonwood Fill" (PL-Sisk-04) portion of rerouted SR 152 was designed and built in a coordinated effort by the State Division of Highways, DWR, and Reclamation to simultaneously reroute the road segment over Cottonwood Creek, provide drainage from Cottonwood Creek into Cottonwood Bay, and provide connectivity between Cottonwood Bay and the main portion of San Luis Reservoir (Kroeck 1963; Weaver 1965:5). A portion of SR 152, the "Highway 152 Tree Row" west of Gilroy between Santa Theresa Boulevard and the Uvas Creek Bridge, was listed in the NRHP in 2007, though other portions of the roadway alignment have not been formally evaluated according to available documentation.

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Chapter 4 Background Research Methodology and Findings

4.1 Archival and Records Searches

As noted in Chapter 1, the cultural resources investigation for the current Project relies heavily on prior efforts completed for the SSLPIP and B.F. Sisk SOD Modification Project. In support of the SLLPIP, Pacific Legacy conducted archival and record searches at the Central California Information Center (CCIC) of the California Historical Resources Information System (CHRIS) in November 2009 (CCIC File number 75541), August 2012 (CCIC File number 8330I), and May 2016 (CCIC File number 9765I) for areas that overlap or subsume the B.F. Sisk Dam Raise Alternative Project Area. In February 2020, an updated archival and records search was completed through the CCIC (File number 11316I) for the B.F. Sisk Dam Raise Alternative APE and a surrounding 0.5-mile radius to ensure a complete and current inventory of known cultural resources and prior studies within the Project Area. The locations and unique identifiers[2] for all prior studies and previously recorded cultural resources were obtained from four 7.5-minute USGS topographic reference maps on file with the CCIC. They included the Los Banos Valley (2015), Mariposa Peak (2015), Pacheco Pass (1971), and San Luis Dam (1969) maps. The CCIC also provided listings of properties in the following historic registers maintained by the State of California:

- NRHP Directory of Determinations of Eligibility (California Office of Historic Preservation, Volumes I and II 1990);
- Historic Property Data File for Merced and Santa Clara counties (California Department of Parks and Recreation 2012);
- California Inventory of Historic Resources (California Department of Parks and Recreation 1976); and
- California Historical Landmarks (California Office of Historic Preservation 1996); and
- California Points of Historical Interest (California Department of Parks and Recreation 1992).

The CCIC also provided further ancillary information, including the following:

[2] Unique identifiers for prior studies within Merced County begin with “ME-.” Previously recorded cultural resources may or may not be assigned a state Trinomial number, which begins “CA-,” but will have a Primary number. Primary numbers consist of a “P-” followed by a two-digit numeric county code (“24-” for Merced) followed by a six digit number indicating the order in which it was assigned (e.g., P-24-000116, etc.).

- Caltrans State and Local Bridge Survey (California Department of Parks and Recreation 2011);
- Caltrans Statewide Historic Bridge Inventory (California Department of Transportation 2013), which includes listings of bridges previously evaluated for listing in the NRHP and determined eligible for listing be not re-evaluated, bridges that remain unevaluated, and local agency bridges;
- Historic Highway Bridges of California (California Department of Transportation 1990);
- Historic American Landscapes Survey (HALS) Inventory – Northern California (California Office of Historic Preservation 2009);
- Linear Resource Concordance List for Canals, Ditches, Levees, Railroads, Roads, Trails, and Transmission Lines (California Office of Historic Preservation 2013);
- List of Railroads by County (California Office of Historic Preservation 2013);
- List of Historic Survey Reports (Bibliography) (California Office of Historic Preservation 1994); and
- Survey of Surveys: A Summary of California's Historical and Architectural Resource Surveys (Department of Parks and Recreation 1989).

The archival and records searches included a review of all relevant 7.5-minute and 15-minute USGS topographic maps encompassing the Project Area on file with the CCIC. In general, reports for prior studies conducted within the Project Area were copied in full if they resulted in positive findings (i.e., if they reported on the discovery of cultural resources) or in part if they yielded negative findings (i.e., they reported on no newly discovered cultural resources). Cultural resource records for archaeological sites, built environment resources, and isolated finds were copied in full. Those materials were collated and entered into a geographic information system (GIS) database depicting the spatial extents and basic attributes of each previously recorded cultural resource or prior study. These materials also were scanned and archived as a part of the Project's administrative record. Materials available online such as historic period topographic maps and GLO plat maps were not copied at the CCIC. Instead, they were downloaded and analyzed as necessary to aid in the identification of potential but unrecorded historic period resources.

4.2 Prior Studies and Previously Recorded Cultural Resources

Archival and records searches revealed that 52 prior cultural resource studies have been carried out within the B.F. Sisk Dam Raise Project Area and that 33 of those intersected some portion of the APE (*see* Table 4-1 and Appendix A, Figures A-1 through A-7). Among the most extensive of these was an overview completed by the California Department of Parks and Recreation (2005) for the San Luis Reservoir Recreation Area EIS/EIR. Another was the Luis Reservoir Recreation Area Draft Resource Management Plan/General Plan and Draft EIS/EIR by Reclamation and the California Department of Parks and Recreation (2012). Particularly relevant was a draft "Built-Environment Inventory for the B.F. Sisk Dam Corrective Action Study, Merced County, California" (ICF 2013). It included an inventory of built environment resources within the

Table 4-1. Previous Cultural Resource Studies Conducted within the B.F. Sisk Dam Raise Alternative Project Area.

Study Number	Study Type	Author	Date	Results	Intersects APE
ME-000581	Inventory Survey	Adams	1988	Negative	Yes
ME-000602	Site-Specific	Follett	1983	Positive	Yes
ME-000603	Reconnaissance	Foster	1982	Negative	Yes
ME-000605	Inventory Survey	Foster	1985	Negative	No
ME-000618	Inventory Survey	Littlefield	1984	Negative	Yes
ME-000645	Sensitivity Study	Napton	1990	Positive	Yes
ME-000655	Excavation	Nissley	1975	Positive	Yes
ME-000657	Site-Specific	Olsen	1968c	Positive	No
ME-000666	Inventory Survey	Peak & Associates, Inc.	1979	Negative	Yes
ME-000683	Site-Specific	Riddell	1968	Positive	Yes
ME-000695	Overview	Varner	1975	Negative	No
ME-000699	Inventory Survey	Weber	1978	Negative	No
ME-000709	Reconnaissance	Wren	1987	Positive	No
ME-001462	Site-Specific	Olsen and Payen	1969	Positive	No
ME-001746/ 001747	Excavation	Schulz	1970a; 1970b	Positive	Yes
ME-001954	Reconnaissance	Thornton	1993	Positive	No
ME-001975	Sensitivity Study/EIR	Peak & Associates, Inc.	1991a	Negative	No
ME-001976	Inventory Survey	Peak & Associates, Inc.	1992	Negative	Yes
ME-003228	Excavation	Jensen	1976	Positive	Yes
ME-003345	Site-Specific	Stroppini	1975	Positive	Yes
ME-004287	Reconnaissance	Runnings and Haversat	2001	Negative	No
ME-004424	Inventory Survey	Napton	2001	Negative	No
ME-004578	Inventory Survey	Peak & Associates, Inc.	1991b	Indeterminate	No
ME-004688	Inventory Survey	Jensen	2002	Negative	No
ME-005221	Survey	Hector et al.	2003	Positive	No
ME-005378	Reconnaissance	Wren	2004	Negative	No
ME-005498/ 005499/005500	Inventory Survey	Leach-Palm, Mikkelsen, King, and Hatch	2004a; 2004b; 2004c	Positive	Yes
ME-005590	Inventory Survey	Wulzen	2004	Negative	Yes
ME-005758	Inventory Survey	Jones & Stokes	2003	Negative	No
ME-005777	Inventory Survey	Wulzen	2005	Negative	Yes

Study Number	Study Type	Author	Date	Results	Intersects APE
ME-005908	Reconnaissance	Bonner	2005	Positive	No
ME-005926	Inventory Survey	Maslonka & Associates	2005	Positive	No
ME-006017	Inventory Survey	Whatford	1996a	Positive	No
ME-006099	Master Plan	EDAW	2006	Positive	No
ME-006474	Inventory Survey	Wulzen	2008a	Positive	Yes
ME-006535	Inventory Survey	Wulzen	2007a	Negative	Yes
ME-006834	Geotechnical Testing	Fry	2008	Negative	Yes
ME-006836	Site-Specific	Zaugg	2008	Negative	Yes
ME-006882	Overview (EIS/EIR)	California Department of Parks and Recreation	2005	Positive	Yes
ME-006984	Reconnaissance	Chotkowski	2009a	Negative	Yes
ME-007007	Inventory Survey	Chotkowski	2009b	Negative	Yes
ME-007015	Inventory Survey	Wulzen	2003a	Negative	Yes
ME-007119	Overview	Romoli and Ruby	1963	Positive	Yes
ME-007120	Overview	Olsen	1974	Positive	Yes
ME-007269	Reconnaissance	Chotkowski	2010a	Negative	Yes
ME-007405	Management Plan	Chotkowski	2010b	Negative	Yes
ME-007933	Survey	Siskin et al.	2010	Positive	Yes
ME-008185	Reconnaissance	Wulzen	2009	Positive	Yes
ME-008283	Inventory Survey	Johnston and Brewer	2015	Positive	Yes
---	Built-Environment Inventory	ICF International	2013	Positive	Yes
---	Inventory Survey	Holm, Reese, Ballard, Streich, Kovak, Sanchez and Holson	2014	Positive	Yes
---	Built-Environment Inventory	JRP Historical Consulting, LLC.	2018	Positive	Yes

B.F. Sisk Dam Raise Alternative APE, including the B.F. Sisk Dam and San Luis Reservoir, the O'Neil Dam and Forebay, the William R. Gianelli Pumping-Generating Plant, and the San Luis Operation and Maintenance Center. The study was never finalized, but its author concluded that the dam, the reservoir, the pumping-generating plant, and the forebay were eligible for listing in the NRHP and CRHR under Criterion A/1 for their importance to the development of the CVP and SWP as well as state and federal partnerships regarding water infrastructure (ICF 2013).

More recently, JRP (2018) re-examined the key elements of the B.F. Sisk Dam System during an architectural field inventory in support of the B.F. Sisk Dam SOD Modification Project. They recommended the B.F. Sisk Dam and San Luis Reservoir, the O'Neil Dam and Forebay, the William R. Gianelli Pumping-Generating Plant, and the San Luis Operation and Maintenance Center and their appurtenant features eligible for listing in the NRHP and CRHR under Criterion A/1 as contributing elements to the B.F. Sisk Dam/San Luis Reservoir Historic District. Elements of the district were recommended not eligible for individual listing in the NRHP or the CRHR, but taken together were found to be significant within the context of water resource development in California and an integral part of both the CVP and SWP (JRP 2018). Two ancillary facilities used in construction of the dam, the Basalt Hill Quarry (CA-MER-509H) and a rip-rap separation plant (CA-MER-492H), were recommended as non-contributing elements of the district.

Fifty-one cultural resources have been previously recorded within the B.F. Sisk Raise Dam Alternative Project Area, including 19 that intersect the APE. (*see* Table 4-2). Fifteen (CA-MER-14, CA-MER-15, CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-28, CA-MER-29, CA-MER-41, CA-MER-82, CA-MER-130, CA-MER-136, CA-MER-137, and CA-MER-437) are prehistoric archaeological sites; one is a prehistoric district (P-24-000489/San Luis Gonzaga Archaeological District); and three are historic period resources (CA-MER-451H, CA-MER-521H, and the B.F. Sisk Dam System).

Table 4-2. Previously Recorded Cultural Resources within the B.F. Sisk Dam Raise Alternative Project Area.

Resource Designation	Description	Author	Date	NRHP/CRHR	Intersects APE
B.F. Sisk Dam/San Luis Reservoir Historic District	Historic period B.F. Sisk Dam and its key facilities, including the B.F. Sisk Dam and San Luis Reservoir, the O'Neil Dam and Forebay, the William R. Gianelli Pumping-Generating Plant, and the San Luis Operation and Maintenance Center	ICF International	2013	RE (NRHP/ CRHR)	Yes (Expanded Embankment, Downstream Stability Berms, Construction Staging Areas, and Reservoir Shoreline)
		JRP Historical Consulting	2018		
CA-MER-8[1] P-24-0001091	Prehistoric lithic scatter with one handstone	Treganza	1960	NEV	No
CA-MER-9[1] P-24-0001101	Prehistoric house-pits with lithic scatter and one mortar	Treganza	NA-b	NEV	No
CA-MER-14[2] P-24-000115	Prehistoric lithic scatter with groundstone, burials, and rock cairn; destroyed	Olsen	1962	NEV	Yes (Expanded Embankment)
		Riddell	1962a		
		Glassow	1962, 1963		

Resource Designation	Description	Author	Date	NRHP/CRHR	Intersects APE
CA-MER-15 P-24-000116	Prehistoric village site with bedrock mortars and flaked stone	Riddell	1962b	NEV	Yes (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)
CA-MER-16 P-24-000117	Prehistoric village site with two burials	Riddell	1963	NEV	No
CA-MER-17 P-24-000118	Prehistoric house-pits and midden deposit	Olsen	1963	NEV	No
CA-MER-18 P-24-000119	Prehistoric small, dark, rocky deposit with flakes, a shell, and possibly a human bone	Olsen	1964a	NEV	No
CA-MER-19 P-24-000120	Prehistoric midden deposit with pestle and flaked stone	Olsen	1964b	NEV	No
CA-MER-20 P-24-000121	Prehistoric midden deposit with pestle	Olsen	1964c	NEV	Yes (San Luis Reservoir Shoreline – South Highway 152)
CA-MER-21 P-24-000122	Prehistoric midden deposit with bedrock mortar	Olsen	1964d	NEV	Yes (San Luis Reservoir Shoreline – North of Dinosaur Point Boat Launch)
CA-MER-22 P-24-000123	Prehistoric midden deposit	Olsen	1964e	NEV	Yes (San Luis Reservoir Shoreline – North of Dinosaur Point Boat Launch)
CA-MER-23 P-24-000124	Prehistoric midden deposit with pestle fragment	Olsen	1964f	NEV	Yes (San Luis Reservoir Shoreline – North of Dinosaur Point Boat Launch)
CA-MER-24 P-24-000125	Prehistoric village site with mortars and pestles	Riddell	1964	NEV	No
CA-MER-26 P-24-000127	Prehistoric Midden and small lithic scatter	Olsen	1965a	NEV	No
CA-MER-27 P-24-000128	Prehistoric midden deposit with flaked stone and groundstone	Olsen	1965b	NEV	Yes (San Luis Reservoir Shoreline – Near Dinosaur Point Boat Launch)
CA-MER-28 P-24-000129	Prehistoric occupation deposit with flaked stone	Olsen	1965c	NEV	Yes (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)

Resource Designation	Description	Author	Date	NRHP/CRHR	Intersects APE
CA-MER-29 P-24-000130	Prehistoric Midden with silicate flakes and a scraper and mortar	Olsen	1965d	NEV	Yes (San Luis Reservoir Shoreline – East side of San Luis Creek Inlet)
CA-MER-31 P-24-000132	Prehistoric midden with two silicate scrapers	Olsen	1965e	NEV	No
CA-MER-32 P-24-000133	Prehistoric Midden with flakes and a hammerstone	Olsen	1965f	NEV	No
CA-MER-41 P-24-000142	Prehistoric midden deposit with fire affected rock fragments, flaked stone and groundstone	Olsen	1966a	NEV	Yes (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)
CA-MER-42 P-24-000143	Prehistoric midden deposit with flaked stone	Olsen	1966b	NEV	No
CA-MER-56/H[1] P-24-0001571	Site of historic San Luis Ranch Adobe	Latta	1950	NEV	No
	Prehistoric site with lithic scatter, handstones, mortars, and burials	Treganza	1960		
CA-MER-82 P-24-000182	Prehistoric occupation deposit with flaked stone and fire affected rock	Olsen	1966c	NEV	Yes (San Luis Reservoir Shoreline – West side of San Luis Creek Inlet)
CA-MER-83 P-24-000183	Prehistoric midden deposit	Olsen	1966d	NEV	No
CA-MER-94 P-24-000194	Prehistoric village site with sandstone bowl and flaked stone	Riddell	1962c	NEV	No
CA-MER-96 P-24-000196	Prehistoric midden with groundstone pieces and possible house-pits	Olsen	1964g, 1968a	NEV	No
CA-MER-99 P-24-000199	Prehistoric village site with groundstone and flaked stone tool	Riddell	1962d	NEV	No
CA-MER-130 P-24-000220	Prehistoric midden deposit with "pitted boulder"	Olsen	1968b	E (NRHP, code 1D)	Yes (San Luis Reservoir Shoreline – North of Dinosaur Point Boat Launch)
CA-MER-131 P-24-000221	Prehistoric midden site with one rimmed housepit	Payen and Olsen	1969a	NEV	No

Resource Designation	Description	Author	Date	NRHP/CRHR	Intersects APE
CA-MER-132 P-24-000222	Prehistoric midden site with one small housepit	Payen and Olsen	1969b	NEV	No
CA-MER-134 P-24-000224	Prehistoric midden deposit with bedrock mortars	Payen and Olsen	1969c	E (NRHP, code 1D)	No
CA-MER-135 P-24-000225	Prehistoric midden deposit with pestle fragment	Olsen and Pritchard	1970	E (NRHP, code 1D)	No
CA-MER-136 P-24-000226	Prehistoric midden deposit with pestle fragments	Olsen	1971a	E (NRHP, code 1D)	Yes (Cottonwood Bay Shoreline)
CA-MER-137 P-24-000227	Prehistoric large occupation site on knoll with pestle fragments	Olsen	1971b	NEV	Yes (Cottonwood Bay Shoreline)
CA-MER-138 P-24-000228	Prehistoric midden deposit	Olsen	1973	NEV	No
CA-MER-261H P-24-000351	Two historic rock alignments and one rock pile with ceramic artifacts	Wulzen	2007b	NEV	No
CA-MER-433 P-24-001806	Prehistoric bedrock milling features and petroglyphs	Whatford	2004	NEV	No
CA-MER-437 P-24-001859	Two prehistoric milling stations	Wulzen	2003b, 2007c	NEV	Yes (Construction Impact Area – West of Goosehead Point)
CA-MER-451H P-24-001876	Ranch complex	Wulzen	2008b	NEV	Yes (Construction Staging Area – South of B.F. Sisk Dam)
CA-MER-477H P-24-001822	Historic linear features comprising road cuts and retaining walls associated with State Route 152 and a stage route	Whatford	1996f	NEV	No
	Historic linear feature consisting of a 3,455-foot long segment of the old Pacheco Pass Highway	Barnes	2009		
CA-MER-521H P-24-002173 SLTP-B-11	Elevated water tank and water trough	Fuerstenberg	2014	NE (NRHP), RNE (CRHR)	Yes (Borrow Area 6 - South of O'Neill Forebay)

Resource Designation	Description	Author	Date	NRHP/CRHR	Intersects APE
CA-MER-523 P-24-002193	Historic period ditch segment north of O'Neill Forebay	Hildebrandt	2019	NEV	No
Harris Ranch vicinity	Harris Ranch vicinity per the 1955 USGS Pacheco Pass 7.5-minute topographic map	---	---	NEV	No
P-24-000078	Historic Basalt Hill Fire Lookout Station	Thornton	1991	AE (NRHP, code 4CM)	No
P-24-000489	San Luis Gonzaga Archaeological District comprised of five prehistoric midden sites (CA-MER-107, CA-MER-126 CA-MER-130, CA-MER-134, and CA-MER-135)	Olsen	1970	E (NRHP, code 1S)	Yes (Reservoir Shoreline – Dinosaur Point Area; Cottonwood Bay Levee Modification and Levee Raise Areas)
P-24-000643 CHL-829	California State Historical Landmark # plaque commemorating Lt. G. Moraga's 1805 traversal of Pacheco pass	Arbuckle	1979	NEV (NRHP); E (CRHR)	No
P-24-001729	The site consists of a very light scatter of historic ironstone fragments	Peak and Gerry	1991	NEV	No
P-24-001823	Historic linear feature comprising a 4-mile long fence	Whatford	1996d	NEV	No
P-24-001856	San Luis Gonzaga Rancho-Paula (Pacheco) Fatjo Ranch Historic District	Bissonnette	2007	NEV	No
P-24-001931	California Aqueduct	Ambacher	2011	RE (NRHP and CRHR)	No

[1] Note CA-MER-8, CA-MER-9 and CA-MER-56/H are not plotted on maps provided by the CCIC, however they appear in a 1960 report by A. Treganza (ME-000694) on file with the CCIC that notes their approximate locations and basic constituents.
[2] Note CA-MER-14 appears in a study (ME-07119) by Romoli and Ruby (1963) but is not mapped by the CCIC.
NRHP/CRHR: AE – appears eligible; DNE – determined not eligible; E – eligible; NE – not eligible; NEV – not evaluated; RE – recommended eligible

Five of the 19 cultural resources within the B.F. Sisk Dam Raise Alternative APE have been previously evaluated for listing in the NRHP and/or the CRHR. Two prehistoric sites, one a prehistoric midden deposit with a "pitted boulder" (CA-MER-130, Olsen 1968b) and the other a prehistoric midden deposit with pestle fragments (CA-MER-136), are listed in the NRHP and CRHR. CA-MER-130 is regarded as a contributing element to the San Luis Gonzaga Archaeological

District (P-24-000489), a prehistoric district with five known midden sites that is also listed in the NRHP and CRHR. A fourth resource, a historic period water tank and trough (CA-MER-521H), was determined not eligible for listing in the NRHP and recommended not eligible for listing in the CRHR (Polanco 2018, Holm et al. 2014). Finally, the B.F. Sisk Dam and its key features were recommended eligible for listing in the NRHP and CRHR as a part of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018). Figures A-1 through A-7 in Appendix A depict all previously recorded cultural resources within the B.F. Sisk Dam Raise Alternative Project Area.

4.3 Native American and Organizational Contact

As a part of the current Project, Pacific Legacy contacted the NAHC on February 18, 2020 to request a search of the Sacred Lands File as it encompasses the B.F. Sisk Dam Raise Alternative APE. A response was received on February 25, 2020 from Ms. Nancy Gonzalez-Lopez, Cultural Resource Analyst with the NAHC, indicating that no Native American cultural resources had been identified through a search of the Sacred Lands File within the B.F. Sisk Dam Raise Alternative APE. Ms. Gonzalez-Lopez provided a list of Native American tribal representatives who may have knowledge of or interest in cultural resources in the Project vicinity. These individuals included Valentin Lopez, Chairperson of the Amah Mutsun Tribal Band; Robert Ledger, Chairperson of the Dumna Wo-Wah Tribal Government; Katherine Perez, Chairperson of the Northern Valley Yokuts Tribe; and William Leonard, Chairperson of the Southern Sierra Miwuk Nation. Additional Native American tribal representatives were identified by Reclamation and will be included in Project consultation efforts.

As a part of the environmental review process, Reclamation is consulting with Native American tribal representatives and other potential stakeholders regarding the Project consistent with Section 106 of the NHPA. The Authority is consulting with Native American tribal representatives regarding the Project in accordance with CEQA and Assembly Bill 52. Reclamation has recently conducted outreach to the Native American community on behalf of other proposed projects that overlap the B.F. Sisk Raise Dam APE. These include the SLLPIP as well as and geotechnical studies supporting the B.F. Sisk Dam SOD Modification Project Crest Raise Action. On May 18, 2020, the Authority sent certified letters to Native American tribal representatives identified by the NAHC and Reclamation to inform them about the Project and request consultation. No responses have been received to date, however following Executive Order N-54-20, responses are anticipated within 60 days. All available tribal consultation documentation for the Project is included in Appendix D.

Chapter 5 Survey and Recording Methodology

5.1 Inventory Survey Methods

Pacific Legacy personnel conducted intensive pedestrian inventory surveys within the B.F. Sisk Dam Raise Alternative APE in 2012 and 2016 in support of the SLLPIP. These surveys took place over the course of 12 days between November 13, 2012 and December 6, 2012 and 34 days between June 22, 2016 and August 11, 2016. Approximately 3,904 acres were examined within the APE during these two field seasons. Pacific Legacy personnel completed the intensive pedestrian inventory survey of an additional 355 acres over the course of 7 days between March 30 and April 23, 2020 in support of the current Project. With the exception of areas that were inundated at the time of survey or marked by steep, unsafe terrain, all accessible portions of the B.F. Sisk Dam Raise Alternative APE have been fully examined using the same methodology and level of rigor as of April 2020.

During inventories within the B.F. Sisk Dam Raise Alternative APE, Pacific Legacy personnel were divided into teams of two to six professional archaeologists, each led by a field director or crew chief. Pedestrian surveys were performed using systematic transects in which team members were spaced no more than 12-15 meters apart. No artifacts were collected, and no subsurface testing or excavation was conducted. Within areas of particularly dense vegetation or poor visibility, field personnel performed judgmental surface scrapes to expose the ground surface. The main objective of the inventory surveys was to identify previously recorded cultural resources, document newly discovered resources, and note the potential of surveyed areas to contain buried cultural materials.

All previously recorded and newly identified prehistoric and historic period cultural resources were documented using global positioning system (GPS) receivers with sub-meter accuracy (e.g., Trimble GeoXT or GeoXH). A standardized data dictionary was used with each unit to ensure cross-compatibility between crew members and across field seasons. All location and attribute data collected via GPS receiver were compiled into a geospatial database to aid in record and report production and to facilitate future management.

Prior to initiating the inventory surveys, personnel were supplied with records of previously recorded cultural resources and copies of relevant historic period maps. Field personnel also received information regarding the identification and anticipated age range of prehistoric and historic period cultural resources within the APE as well manuals regarding landforms, soil types, and floral and faunal resources to ensure that standardized recording nomenclature was used.

During the inventory surveys, every effort was made to relocate and document previously recorded sites and isolated finds in accessible areas. Personnel were provided with location information on GPS receivers and on field maps of areas identified for survey. They also were provided with information on potential resources noted but not formally recorded through prior cultural resource studies and through information obtained from historic period map research. If a resource could not be located, field personnel examined nearby locations based on the resource description and using maps from the original records. For those previously recorded cultural resources that were relocated, field personnel noted the condition of the resource, documented any materials not previously observed, created new sketch and location maps as necessary, and updated other pertinent information on Department of Parks and Recreation (DPR) Forms 523 (*see* Appendix C).

When a cultural resource was newly discovered during inventory survey, personnel conducted a careful inspection of the vicinity, assigned the resource a temporary number, plotted its location using a GPS receiver and topographic maps, and documented its nature and extents. All resources were fully recorded at the time of their discovery. Modern structures, objects, or materials were only recorded if they represented a modification, intrusion, or disturbance to a prehistoric or historic period cultural resource. Resources that were indistinguishable as historic period or modern were fully recorded by field personnel and subject to further investigation through archival research. For instance, several road alignments were not immediately distinguishable as historic period travel routes but were documented in the field and examined using historic period topographic maps and aerial photographs.

Generally, recording efforts were limited to the APE though there were several instances in which cultural resources, particularly linear features, extended beyond the APE or encompassed areas not accessible to pedestrian survey (e.g., inundated areas, areas of extreme slope, etc.). In the case of certain road alignments (e.g., CA-MER-519H), accessible segments were recorded in the field but also were documented digitally with the aid of georeferenced true-color orthophotographs. Given its size and scale, similar methods were used to record the Basalt Hill Quarry (CA-MER-509H).

5.2 Vegetation, Terrain and Other Access Limitations

The B.F. Sisk Dam Raise Alternative APE is almost entirely within the San Luis Reservoir State Park and is largely undeveloped except for roads and facilities associated with the construction and maintenance of the B.F. Sisk Dam and San Luis Reservoir. The vast majority of the San Luis Reservoir area is covered with dense, knee-high to waist-high grasses that limit (5%) ground surface visibility away from the shoreline. Relatively few woodland areas are present and are limited mostly to riparian corridors bordering existing drainages. Wave action and currents have eroded a series of step-like benches parallel with the reservoir shoreline. This has limited vegetation growth along the shoreline and contributed to better (30-60%) average ground surface visibility in those areas. Wave action has likely eroded, displaced, or buried many cultural materials that were once present along the San Luis Reservoir and Cottonwood Bay shorelines, particularly those exposed to the prevailing northeast-southeast winds, which can average 25 miles per hour in the during the month of May (Windfinder.com). The terrain in the eastern portion of the San Luis Reservoir area, particularly near the O'Neill Forebay, is generally flat and open with a gentle (1-2°) north-facing or east-facing slope. In contrast, the southern San Luis Reservoir shoreline, Cottonwood Bay shoreline, and Basalt Hill area are marked by rolling foothills and narrow valleys and canyons with slopes that exceed 30° in some areas.

Certain areas within the B.F. Sisk Dam Raise Alternative APE could not be examined due to extreme, unsafe terrain. These areas included the southwestern Cottonwood Bay shoreline and the area surrounding the Basalt Hill Quarry. Other areas were inaccessible due to inundation or the presence of existing infrastructure. For instance, the shoreline within the construction staging area south of the dam was inundated at the time of the inventory surveys, as were areas fronting the dam. Inventory surveys in 2012 and 2016 revealed that Cottonwood Bay could not be safely accessed from SR 152. In 2020, right-of-entry permissions were obtained from the property owner directly north of Cottonwood Bay, and field crews were able to safely access the B.F. Sisk Dam Raise Alternative APE by descending through his property to Reclamation lands.

5.3 Cultural Resource Documentation

All cultural resources encountered during the inventory surveys were documented on DPR Forms 523 and on supplemental records in keeping with procedures identified in the *Instructions for Recording Historical Resources* (California Office of Historic Preservation 1995). At a minimum, resource documentation was completed on DPR Form 523(a) (a Primary form) and DPR Form 523(j) (a 1:24,000-scale map depicting the cultural resource location). Sites were defined as three or more artifacts discovered within 30 meters of each other. Isolated finds were defined as a single artifact, two artifacts located less than 30 meters apart, or as isolated, discrete features within the landscape (e.g., a historic period well head or trough, two prehistoric lithic flakes, etc.).

Isolated finds were recorded via GPS receiver, photographed, and briefly described. Prehistoric sites and historic period resources were recorded via GPS receiver, photographed, described, documented on a sketch map at an appropriate scale, and supplemented with additional forms as necessary. Sketch maps were prepared that depicted the resource boundary, its major elements, and its relationship to other resources or natural features in the vicinity. Some cultural resource sketch maps were rendered against true color orthophotographs to depict the surrounding environment more clearly and to provide a better sense of scale (e.g., the Basalt Hill Quarry/CA-MER-509H). Datum locations, chosen for durability and the potential to remain unaffected by future impacts, were recorded via GPS receiver. These receivers were used to record location and attribute data; they were downloaded and corrected using GPS Pathfinder Office software and converted to GIS shapefiles for use with ESRI ArcGIS software. All sites were photographed to capture their landscape setting, internal features, and diagnostic artifacts, and all photographs were logged using image numbers that included information on photograph orientation, content, and date.

In addition to the standard DPR Forms 523, additional data sheets were included as necessary to document each cultural resource. Diagnostic and unusual, rare, or unique artifacts were assigned artifact numbers and recorded via GPS receivers and on site sketch maps. The potential for buried cultural deposits was noted through the inspection of natural or artificial exposures of soil stratigraphy (e.g., vertical soil exposures, areas of bioturbation, etc.). Daily field notes documenting inventory survey efforts were kept on standardized forms and archived at the Berkeley office of Pacific Legacy. DPR Forms 523 were regularly checked for completeness and consistency during the inventory surveys. Copies of new and updated records for cultural resources recorded in 2012 and 2016 were submitted to the CCIC and received permanent designations through the CHRIS, and these permanent number assignments have been used throughout this document. Records for cultural resources recorded in 2020 will be submitted to the CCIC for permanent number assignment through the CHRIS before the release of a Final EIR/SEIS for the Project.

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Chapter 6 Inventory Survey Results

6.1. Inventory Survey Coverage

Pacific Legacy personnel conducted intensive pedestrian inventory surveys within the B.F. Sisk Dam Raise Alternative APE in 2012 and 2016 in support of the SLLPIP and in 2020 in support of the current Project. All physically accessible areas within the APE were examined using a survey interval of no more than 12-15 meters, and all previously recorded and newly identified cultural resources were documented as they were encountered. The B.F. Sisk Dam Raise Alternative APE includes areas that will be used concurrent with implementation of the B.F. Sisk SOD Modification Project Crest Raise Action. These include the Basalt Hill Borrow Area, Borrow Area 6, three potential construction staging areas, upstream and downstream stability berms or fill impact areas, expanded embankment areas, access roads, toe drains, an existing transmission line scheduled for modification, and a possible tunnel under SR 152 that would accommodate a conveyor system. Many of these activity areas overlap. For instance, the expanded embankment areas overlie the potential construction staging areas to the east of the B.F. Sisk Dam, and the access roads pass through the Basalt Hill Borrow Area, two potential construction staging areas, and Borrow Area 6. Areas that will be used as a part of the Crest Raise Action make up 3,914 acres within the 5,028-acre B.F. Sisk Dam Raise Alternative APE and are centered to the east of the San Luis Reservoir around the B.F. Sisk Dam. Areas within the B.F. Sisk Dam Raise Alternative APE separate from the Crest Raise Action are centered along the Dinosaur Point and Goosehead Point boat launches, the Pacheco Pumping Plant berm, the SR 152 modification alignment, and the San Luis Reservoir and Cottonwood Bay shorelines.

Areas examined within the B.F. Sisk Dam Raise Alternative APE in 2012 included a portion of the reservoir shoreline and a potential construction staging area that overlap the Dinosaur Point Boat Launch and Basalt Point areas. Most other areas within the APE were examined in 2016, including roughly 47.3 miles along the 65.1-mile San Luis Reservoir shoreline between the 560-foot contour downslope for 50 meters. Areas subject to inventory survey in one field season generally were not revisited unless resources were found to span multiple disturbance areas (e.g., historic period roads) and recording efforts necessitated some level of re-examination. Due to safety constraints, areas of extreme terrain within the Basalt Hill borrow area, a roughly 3.4-mile long stretch of the reservoir shoreline fronting the B.F. Sisk Dam, and fill impact and stability berm areas along or immediately adjacent to the dam could not be accessed. Portions of the potential construction staging area west of the dam were inundated during the 2016 inventory survey and also were not examined. The Cottonwood Bay area could not be safely accessed from SR 152, and permissions to access the area through private property could not be obtained in advance of the 2016 field season. A portion of Borrow Area 6 and a potential construction staging area were examined by Pacific Legacy personnel in 2013 as a part of the San Luis Transmission Line Project for the Western Area Power Authority (Holm et al. 2014). These areas were slated for avoidance in 2016 but were essentially re-examined as a part of larger, block survey areas. In total, approximately 3,888 acres were subject to intensive pedestrian inventory surveys within the B.F. Sisk Dam Raise Alternative APE in 2012 or 2016.

In 2018, JRP conducted an architectural field visit of the B.F. Sisk Dam and its key features, specifically the dam, San Luis Reservoir, William R. Gianelli Pumping-Generating Plant, San Luis Operation and Maintenance Center, O'Neill Dam, O'Neill Forebay, and O'Neill Pumping-Generating Plant. The results of that field visit were summarized in an architectural inventory and evaluation report (JRP 2018) submitted to Reclamation. JRP concluded that the dam and its key features, though not individually eligible for listing in the NRHP and/or the CRHR, are contributing elements to the B.F. Sisk Dam/San Luis Reservoir Historic District. They argued that the district is eligible for listing in the NRHP under Criterion A and in the CRHR under Criterion 1 as an integral part of both the CVP and SWP and for its significance within the context of water resource development in California (JRP 2018). JRP also assessed two additional elements relating to the construction of the B.F. Sisk Dam System that were initially recorded in 2012 and 2016. These included the Basalt Hill Quarry (CA-MER-509H) and a rock separation facility (CA-MER-492H); both were recommended as non-contributing elements of the historic district and not eligible for listing in the NRHP or the CRHR.

In 2020, Pacific Legacy completed the inventory survey of areas that were previously inaccessible (i.e., Cottonwood Bay) in 2012 or 2016 or areas that were added to the SLLPIP or B.F. Sisk SOD Modification Project after 2016. Specifically, these included an access route that spans the Basalt Hill Borrow Area and a potential construction staging area west of the dam as well an expanded construction staging area south of the dam. A 2.3 mile segment of the Cottonwood Bay shoreline was examined in 2020, though the southern portion of the western shore remained inaccessible due to steep terrain. As of April 2020, a total of 4,454 acres within the B.F. Sisk Dam Raise Alternative APE have been subject to intensive pedestrian inventory surveys and all physically accessible areas within the APE have been examined. Table 6-1 summarizes the survey coverage achieved for each impact area described in Section 1.2.3.

Table 6-1. Inventory Survey Coverage within the B.F. Sisk Dam Raise Alternative Area of Potential Effects

Alternative Impact Area	Surveyed (Full Coverage)	Unsurveyed (Terrain/ Inundation)	Total Area
Construction of Dam Raise (Basalt Hill Borrow Area, Borrow Area 6, Expanded Embankment, Fill Impact/Stability Berm, Access Roads, Potential Construction Staging Areas, Cottonwood Bay Levee Modification and Levee Raise, Dinosaur Point and Goosehead Point Boat Launches)	3,444	549	3,993
SR 152 Modifications (Between Cottonwood Bay and the San Luis Reservoir	12	11	23
Operation of Dam Raise (Cottonwood Bay and San Luis Reservoir Shorelines)	998	14	1,012
Total	4,454	568	5,028

Note: areas of overlap between the Cottonwood Bay or San Luis Reservoir shorelines and other impact areas are totaled as a part of the Construction of Dam Raise or Operation of Dam Raise impact areas.

6.2 B.F. Sisk Dam Raise Alternative Survey Results

Nineteen cultural resources were previously recorded within the B.F. Sisk Dam Raise Alternative APE. Fifteen of those 19 resources are prehistoric archaeological sites (CA-MER-14, CA-MER-15, CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-28, CA-MER-29, CA-MER-41, CA-MER-82, CA-MER-130, CA-MER-136, CA-MER-137, and CA-MER-437), one is a prehistoric archaeological district (P-24-000489/San Luis Gonzaga Archaeological District), and three are historic period resources (CA-MER-451H, CA-MER-521H, and the B.F. Sisk Dam/San Luis Reservoir Historic District). Ten of the 19 resources previously recorded in the B.F. Sisk Dam Raise Alternative APE were not relocated during inventory surveys. These included seven prehistoric archaeological sites originally noted along the San Luis Reservoir shoreline (CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-29, and CA-MER-41) that may have been mis-plotted when originally recorded, destroyed or obscured by natural processes, or subject to modern disturbance; one prehistoric site (CA-MER-14) that was presumably destroyed by dam construction; one that was found to be a natural feature (CA-MER-437); and one arbitrarily defined prehistoric district (P-24-000489/San Luis Gonzaga Archaeological District) with no physical markers in the APE. Eleven previously recorded cultural resources were relocated within the APE, including seven prehistoric sites (CA-MER-15, CA-MER-28, CA-MER-82, CA-MER-83, and CA-MER-130, CA-MER-136, and CA-MER-137), most with midden, lithics, and groundstone; one historic period water tank and trough (CA-MER-521H); one historic period ranch complex (CA-MER-451H); one historic period road (P-24-001822); and key features of the B.F. Sisk Dam/San Luis Reservoir Historic District. Two of these known resources (CA-MER-83 and CA-MER-477H) were originally plotted outside of the APE but were noted within it during inventory surveys.

Thirty-two resources were first documented in the B.F. Sisk Dam Raise Alternative APE during inventory surveys conducted between 2012 and 2020 (*see* Appendix B, Figures B-1 through B-7). These included a series of historic period transmission poles with a debris scatter (CA-MER-484H); two industrial sites (CA-MER-492H and CA-MER-509H) associated with construction of the B.F. Sisk Dam; eight historic period road segments (CA-MER-489H, CA-MER-491H, CA-MER-493H, CA-MER-494H, CA-MER-495H, CA-MER-513H, CA-MER-519H, and PL-Sisk-01); a concrete equipment pad (CA-MER-510H); a corral and water tank (CA-MER-511H); a helicopter pad (CA-MER-512H); a ditch segment (CA-MER-514H); three earthen dams with impound ponds (CA-MER-515H, CA-MER-516H, and CA-MER-518H); two prehistoric middens, one with lithics and groundstone (CA-MER-517) and the other with fire-affected rock (PL-Sisk-05); and a series of survey markers and monitoring wells (CA-MER-520H) associated with the B.F. Sisk Dam. A historic period well head (P-24-002166), metal can (P-24-002167), concrete foundation (P-24-002172), two watering troughs (P-24-002169 and P-24-002170); and bottle (P-24-002171) were recorded as isolated finds, along with one isolated prehistoric core (P-24-001990), one biface fragment (P-24-001991), one cobble and flake (P-24-002168), and one displaced cupule boulder (PL-Sisk-02). Table 6-2 summarizes the cultural resources that were relocated or discovered within the B.F. Sisk Dam Raise Alternative APE; a fuller discussion of these resources is presented in Section 7.4. Table 6-3 lists those resources that could not be relocated within the APE during the 2012, 2016, and 2020 inventory surveys. Inventory survey findings for the specific impact areas described in Section 1.2.3 are detailed below.

Table 6-2. Previously Recorded and Newly Identified Cultural Resources within the B.F. Sisk Dam Raise Alternative Area of Potential Effects.

Site Number	Description	Author	Date	Impact	APE Location
Previously Recorded Archaeological Sites or Built Environment Resources					
B.F. Sisk Dam System[1]	Historic period B.F. Sisk Dam and associated facilities, with additional Cottonwood embankment feature recorded in 2020	JRP Historical Consulting	2018	Construction of Dam Raise; SR 152 Modifications	Downstream Stability Berms/Fill Impact Areas; Expanded Embankment; Reservoir Shoreline – Fronting the B.F. Sisk Dam
CA-MER-15 P-24-000116	Prehistoric pictographs, bedrock mortars, cupules, cleared areas midden soil, lithic scatter	Greenberg, O’Neill, Sprague, Walton et al.	2016	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat launch
CA-MER-28 P-24-000129	Prehistoric occupation site with lithic scatter	Greenberg, O’Neill, Sprague, Varkel et al.	2016a	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
CA-MER-82 P-24-000182	Prehistoric lithic scatter with groundstone	Greenberg, Sprague, and Wiant	2016a	Operation of Dam Raise	Reservoir Shoreline – West side of San Luis Creek Inlet
CA-MER-83 P-24-000183	Prehistoric midden soil with lithic scatter and groundstone	O’Neill and Walton	2016a	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
CA-MER-130 P-24-000220	Prehistoric midden soil with two bedrock mortar features with five mortars and groundstone	O’Neill and Walton et al.	2016	Operation of Dam Raise	Reservoir Shoreline – North of Dinosaur Point Boat Launch (not previously inundated)[2]
CA-MER-136 P-24-000226	Prehistoric midden deposit with pestle fragments	Peske, O’Neill, and Daly	2020a	Operation of Dam Raise	Reservoir Shoreline – Cottonwood Bay (location not previously inundated) [2]
CA-MER-137 P-24-000227	Prehistoric large occupation site on knoll with pestle fragments	Peske, O’Neill, and Daly	2020b	Operation of Dam Raise	Reservoir Shoreline – Cottonwood Bay

Site Number	Description	Author	Date	Impact	APE Location
CA-MER-451H P-24-001876	Historic period ranch complex	Daly, O'Neill, and Peske	2020a	Construction of Dam Raise	Construction Staging Area – South of B.F. Sisk Dam
CA-MER-477H P-24-001822	Fourteen historic period road segments	Elliott, Ledebuhr, Fittinghoff, Atwater	2012b	Construction of Dam Raise	Dinosaur Point Boat Launch Modification Area; Reservoir Shoreline – Dinosaur Point Area
CA-MER-521H P-24-002173 SLTP-B-11	Historic water tank and trough	Greenberg, O'Neill, Sprague, Trout, and Wiant	2016a	Construction of Dam Raise	Borrow Area 6 - South of O'Neill Forebay
Newly Discovered Archaeological Sites or Built Environment Resources					
CA-MER-484H P-24-001974 PL-SLLP-A-001	Historic period transmission poles and debris scatter	Trout and Atwater et al.	2012a	Operation of Dam Raise	Reservoir Shoreline – Dinosaur Point Area (not previously inundated) [2]
CA-MER-489H P-24-001979 PL-SLLP-A-013	Historic period road segment	Elliott and Trout et al.	2012	Operation of Dam Raise	Reservoir Shoreline – Dinosaur Point Area
CA-MER-491H P-24-001985 PL-SLLP-A-010	Historic period road segment	Trout and Atwater et al.	2012b	Construction of Dam Raise	Potential Construction Staging Area – West of Goosehead Point
CA-MER-492H P-24-001986	Historic period industrial site used in construction of the B.F. Sisk Dam	Elliott, Ledebuhr, Fittingoff, Atwater	2012a	Construction of Dam Raise	Potential Construction Staging Area – West of Goosehead Point
CA-MER-493H P-24-001987 PL-SLLP-A-014	Historic period road segment	Greenberg and Beckett	2016a	Construction of Dam Raise	Potential Construction Staging Area – West of Goosehead Point

Site Number	Description	Author	Date	Impact	APE Location
CA-MER-494H P-24-001988 PL-SLLP-A-015	Historic period road segment	Greenberg and Beckett	2016b	Construction of Dam Raise	Basalt Hill Borrow Area; Potential Construction Staging Area – West of Goosehead Point; Access Road Area
CA-MER-495H P-24-001989 PL-SLLP-A-016	Historic period road segment	Greenberg and Beckett	2016c	Construction of Dam Raise	Potential Construction Staging Area – West of Goosehead Point
CA-MER-509H P-24-002154 PL-SLLPIP-16-01	Historic period Basalt Hill Quarry, part of the industrial complex used in construction of B.F. Sisk Dam system	Daly, O'Neill, and Peske	2020b	Construction of Dam Raise	Basalt Hill Borrow Area; Access Road Area
CA-MER-510H P-24-002155 PL-SLLPIP-16-02	Historic concrete equipment pad near O'Neill Forebay	Greenberg, O'Neill, Sprague, and Trout	2016	Construction of Dam Raise	Borrow Area 6 - South of O'Neill Forebay
CA-MER-511H P-24-002156 PL-SLLPIP-16-03	Historic metal water tank on railroad ties in a corral area near O'Neill Forebay	Greenberg, O'Neill, Sprague, Trout, and Wiant	2016b	Construction of Dam Raise	Borrow Area 6 - South of O'Neill Forebay
CA-MER-512H P-24-002157 PL-SLLPIP-16-05	Historic helicopter pad located east of the BF Sisk Dam	Greenberg, O'Neill, Sprague, Trout, and Wiant	2016c	Construction of Dam Raise	Potential construction staging areas – block east of B.F. Sisk Dam
CA-MER-513H P-24-002158 PL-SLLPIP-16-06	Historic asphalt road segment	Greenberg, Sprague, and Wiant	2016b	Construction of Dam Raise	Potential construction staging areas – block east of B.F. Sisk Dam
CA-MER-514H P-24-002159 PL-SLLPIP-16-07	Historic ditch segment	Greenberg, O'Neill, Sprague, Trout, and Wiant	2016d	Construction of Dam Raise	Potential construction staging areas – block east of B.F. Sisk Dam

Site Number	Description	Author	Date	Impact	APE Location
CA-MER-515H P-24-002160 PL-SLLPIP-16-09	Historic period earthen dam with impound pond	O'Neill and Walton	2016b	Operation of Dam Raise	Reservoir Shoreline – South of SR 152
CA-MER-516H P-24-002161 PL-SLLPIP-16-10	Historic period earthen dam with impound pond	Sprague and Wiant	2016	Operation of Dam Raise	Reservoir Shoreline – South of SR 152
CA-MER-517 P-24-002162 PL-SLLPIP-16-11	Prehistoric lithic scatter with midden and groundstone	Greenberg, O'Neill, Sprague, Varkel et al.	2016b	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
CA-MER-518H P-24-002163 PL-SLLPIP-16-12	Historic period earthen dam with impound pond	Greenberg, Sprague, and Wiant	2016c	Operation of Dam Raise	Reservoir Shoreline – South side of San Luis Creek Inlet
CA-MER-519H P-24-002164 PL-SLLPIP-16-13	Historic period dirt road segments	Greenberg, Sprague, and Wiant	2016d	Operation of Dam Raise	Reservoir Shoreline –San Luis Creek Inlet
CA-MER-520H P-24-002165 PL-SLLPIP-16-14	Historic period survey markers and monitoring wells associated with construction and maintenance of the B.F. Sisk Dam	Greenberg, O'Neill, Sprague, Trout, and Wiant	2016e	Construction of Dam Raise	Downstream Stability Berms/Fill Impact Areas; Potential Construction Staging Areas
PL-SISK-01	Historic period access road associated with the Basalt Hill Quarry	O'Neill and Daly	2020	Construction of Dam Raise	Basalt Hill Borrow Area; Access Road Area
PL-SISK-05	Prehistoric midden site with fire-affected rock	Peske, O'Neill, and Daly	2020a	Operation of Dam Raise	Cottonwood Bay Shoreline
Newly Recorded Isolated Finds					
P-24-001990 PL-SLLP-A-ISO-010 (not updated 2016)	Isolated prehistoric utilized core	Elliott, Ledebuhr, Atwater, Fittingoff	2012c	Construction of Dam Raise	Construction Impact Area – West of Goosehead Point
P-24-001991 PL-SLLP-A-ISO-011 (not updated 2016)	Isolated prehistoric biface fragment	Elliott, Ledebuhr, Atwater, Fittingoff	2012d	Construction of Dam Raise	Construction Impact Area – West of Goosehead Point

Site Number	Description	Author	Date	Impact	APE Location
P-24-002166 PL-SLLPIP-ISO-16-01	Isolated historic well head	Greenberg, O’Neill, Sprague, Trout, and Wiant	2016f	Construction of Dam Raise	Borrow Area 6 - South of O’Neill Forebay
P-24-002167 PL-SLLPIP-ISO-16-02	Isolated historic metal fuel can	Greenberg	2016	Construction of Dam Raise	Potential construction staging areas – block east of B.F. Sisk Dam
P-24-002168 PL-SLLPIP-ISO-16-05	Isolated prehistoric tested chert cobble and flake	Greenberg, Sprague, and Wiant	2016e	Operation of Dam Raise	Reservoir Shoreline – East side of San Luis Creek Inlet
P-24-002169 PL-SLLPIP-ISO-16-06	Isolated historic water trough	O’Neill and Sprague	2016	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
P-24-002170 PL-SLLPIP-ISO-16-07	Isolated historic galvanized water trough	Greenberg, Sprague, and Wiant	2016f	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
P-24-002171 PL-SLLPIP-ISO-16-08	Isolated historic soda bottle	Greenberg, Sprague, and Wiant	2016g	Operation of Dam Raise	Reservoir Shoreline – North of Dinosaur Point Boat Launch
P-24-002172 PL-SLLPIP-ISO-16-09	Historic concrete pad foundations near O'Neill Forebay	O’Neill and Sprague et al.	2016	Construction of Dam Raise	Borrow Area 6 - South of O’Neill Forebay
PL-SISK-ISO-02	Isolated prehistoric cupule boulder	Peske, O’Neill, and Daly	2020b	Construction of Dam Raise	Access Road

Note: Author and Date reflect most recent recording.
[1]Includes the Cottonwood embankment (PL-Sisk-04), a feature of the San Luis Reservoir recorded by Pacific Legacy in 2020
[2]Indicates resources above the current reservoir pool level that could be newly affected by the B.F. Sisk Dam Raise Alternative

Table 6-3. Previously Recorded Cultural Resources Not Relocated during Inventory Survey of the B.F. Sisk Dam Raise Alternative Area of Potential Effects.

Site Number	Description	Author	Date	Impact	APE Location
Archaeological Sites or Built Environment Resources					
CA-MER-14 P-24-000115	Prehistoric lithic scatter with groundstone, burials, and rock cairn; destroyed	Riddell and Olsen	1962	Construction of Dam Raise	Expanded dam embankment
CA-MER-20 P-24-000121	Prehistoric midden deposit with pestle	Olsen	1964c	Operation of Dam Raise	Reservoir Shoreline – South of SR 152
CA-MER-21 P-24-000122	Prehistoric midden deposit with bedrock mortar	Olsen	1964d	Operation of Dam Raise	Reservoir Shoreline – North of Dinosaur Point Boat Launch
CA-MER-22 P-24-000123	Prehistoric midden deposit	Olsen	1964e	Operation of Dam Raise	Reservoir Shoreline – North of Dinosaur Point Boat Launch
CA-MER-23 P-24-000124	Prehistoric midden deposit with pestle fragment	Olsen	1964f	Operation of Dam Raise	Reservoir Shoreline – North of Dinosaur Point Boat Launch
CA-MER-27 P-24-000128	Prehistoric midden deposit with flaked stone and groundstone; reported covered by imported fill in 2012	Olsen	1965b	Operation of Dam Raise	Reservoir Shoreline – Near Dinosaur Point Boat Launch
CA-MER-29 P-24-000130	Prehistoric Midden with silicate flakes and a scraper and mortar	Olsen	1965d	Operation of Dam Raise	Reservoir Shoreline – East side of San Luis Creek Inlet
CA-MER-41 P-24-000142	Prehistoric midden deposit with fire-affected rock fragments, flaked stone and groundstone	Olsen	1966a	Operation of Dam Raise	Reservoir Shoreline – South of Dinosaur Point Boat Launch
CA-MER-437	Two prehistoric milling stations	Wulzen	2003b, 2007c	Construction of Dam Raise	Construction Impact Area – West of Goosehead Point

Site Number	Description	Author	Date	Impact	APE Location
P-24-000489	San Luis Gonzaga Archaeological District comprised of five prehistoric midden sites (CA-MER-107, CA-MER-126 CA-MER-130, CA-MER-134, and CA-MER-135), listed in the NRHP and CRHR	Olsen	1970	Construction of Dam Raise	Cottonwood Bay Levee Modification and Levee Raise Areas; Reservoir Shoreline – Dinosaur Point Area

Note: Author and Date reflect when resource was last located

6.2.1 Construction of Dam Raise

Basalt Hill Borrow Area

The Basalt Hill Borrow Area is on the western shoulder of Basalt Hill, a prominent peak that flanks the southern reservoir shoreline. An existing access road extends northeast from the borrow area to a potential construction staging area and then to Borrow Area 6 while a second road spans the borrow area and a potential construction staging area just west of the dam. The Basalt Hill Borrow Area ranges in elevation from roughly 700 feet amsl along its western margin to 1,707 feet at the summit near the eastern side of the borrow area. Although much of the summit of Basalt Hill was subject to inventory survey, unsafe or extreme areas of terrain surrounding the summit were not accessible.

Three historic period resources were relocated or newly recorded within the Basalt Hill Borrow Area between 2012 and 2020. The most prominent was the Basalt Hill Quarry (CA-MER-509H), which was documented within a 150-acre area made up of a series of terraces that incorporated the improved areas of the mine on the northern shoulder of Basalt Hill. When it was recorded, the quarried area was covered by sparse grasses while the more heavily disturbed areas were marked by invasive weeds. The quarry area as a whole offered fair to good (50-80%) ground surface visibility, though the slopes surrounding the quarry area offered very limited (5-10%) ground surface visibility in areas subsumed by dense, knee-high grasses. Two natural springs were noted on the northern slope of Basalt Hill, but no cultural materials were observed in either location. An improved dirt road (CA-MER-494H) extending northeast from the Basalt Hill Quarry was identified, and an additional segment of the road was recorded in 2016 as it extended west towards the quarry. In 2020, another major historic period access road was recorded to the east (Sisk-01), and additional features associated with CA-MER-509H were noted.

Borrow Area 6

Borrow Area 6 is south of the O'Neill Forebay, east of SR 33, and north of SR 152. It is relatively flat with a slight (1-2°) slope to the north and is crossed by several shallow, unnamed drainages. During the 2016 inventory survey, vegetation throughout the borrow area consisted of thick knee-high to waist-high grasses that offered very limited (0-10%) ground surface visibility. The record for one previously recorded historic period resource was updated and four newly identified historic period resources were recorded in 2016. One resource (CA-MER-521H) was first recorded by Pacific Legacy personnel in 2014, though the site record and accompanying report have not yet been filed with the CCIC pending permission from the Western Area Power Authority (Holm et al. 2014). It was documented as a livestock watering locale with an elevated cylindrical water tank and a circular trough surrounded by fencing. In 2016, the resource appeared as described in the original 2014 cultural resource record. Two newly identified sites included a concrete equipment pad and a large boulder from the Basalt Hill Quarry that were found near the northwest corner of Borrow Area 6 (CA-MER-510H) and a corral complex with a large welded water tank, a loading chute, a livestock access gate, fencing, and two circular metal water troughs (CA-MER-511H). Two isolated finds also were discovered and included a pair of concrete pad foundations (P-24-002172) and an isolated 6-inch diameter iron well head (P-24-002166) along an access road leading to the corral complex.

Potential Construction Staging Areas

Three potential construction staging areas were examined within the B.F. Sisk Dam Raise Alternative APE. Two are located to the east of the B.F. Sisk Dam while the third is along the southern margin of the San Luis Reservoir on the northern flanks of Basalt Hill to the west of the dam. A portion of this third construction staging area was inundated at the time of the 2016 inventory survey and remained inaccessible, but all remaining areas were subject to intensive pedestrian inventory survey.

The terrain within the construction staging areas varied greatly. The southern third of the construction staging area to the west of the dam was marked by heavily vegetated hills and slopes while the northern portion of the staging area was characterized by largely denuded, gentle slopes where inundation, wave action, and recent recreational activities had altered the landscape. Mechanical impacts along the reservoir shoreline in the northern portion of the staging area were evident in the form of a series of shallow, stepped, cut terraces. Human activities, particularly recreational fishing, also left behind hundreds of rock features, including fishing rod supports that appeared as cairns or rock piles, rock alignments in linear or semi-circular shapes, and other rock accumulations. None of these features was identified as prehistoric, and all were presumed to post-date the filling of the San Luis Reservoir. During the inventory surveys, eight resources were identified within the construction staging area to the west of the B.F. Sisk Dam. These included segments of four historic period roads (CA-MER-491H, CA-MER-493H, CA-MER-494H, and CA-MER-495H) that were first documented in 2012. Two (CA-MER-493H and CA-MER-495H) were updated in 2016 to include additional segments. The northern portion of a historic period industrial resource that was used to support construction of the B.F. Sisk Dam (CA-MER-492H) and two isolated prehistoric finds (P-24-001990 and P-24-001991) also were encountered within the potential construction staging area.

The two potential construction staging areas just east of the B.F. Sisk Dam were examined in 2016. One was a smaller northern block of roughly 113 acres and the other was a much larger block to the south encompassing approximately 1,102 acres. The northern staging area spans a narrow stretch of land at the northern end of the B.F. Sisk Dam just southwest of SR 152 that extends from the north side of the inlet to the O'Neill Forebay to just south of Romero Overlook. The landform includes level to slightly east-facing flats with two prominent hills. Elevations range from 240 feet at the O'Neill Forebay to over 600 feet amsl at the northern end of the area. In 2016, the vegetation was mostly high grass with sparse juniper, which offered very poor (0-10%) ground surface visibility. The larger, southern construction staging area is marked by fairly level terrain and elevations of approximately 300 feet in the northern portion of the block that becomes increasingly steep to the southeast where elevations exceed 600 feet amsl. As with the northern construction staging area, the area to the south was characterized by thick, high grasses that offered very limited (0-10%) ground surface visibility. Sixteen features associated with CA-MER-520H, all historic period survey markers or observation wells, were recorded in the construction staging areas to the east of the dam. Four additional historic period resources were encountered in the southern block in addition to the CA-MER-520H features. These included a helicopter landing pad (CA-MER-512H), an asphalt road segment (CA-MER-513H), an excavated earthen irrigation ditch (CA-MER-514H), and an isolated metal can (P-24-002167).

Dinosaur Point and Goosehead Point Boat Launches and Pacheco Pumping Plant

The Dinosaur Point Boat Launch and Pacheco Pumping Plant areas are located on the western margin of the San Luis Reservoir near Dinosaur Point Road, and the Goosehead Point Boat Launch is along the reservoir shoreline just north of a potential construction staging area north of Basalt Hill. Both boat launches will be elevated 10 feet to accommodate increased water elevations within the reservoir, and the existing berm or levee at the Pacheco Pumping Plant also will be elevated by 10 feet to protect facility operations. Inventory surveys revealed a series of 14 historic period road segments (CA-MER-477H) that pass through the Dinosaur Point Boat Launch area extending west outside of the APE. A previously recorded prehistoric site (CA-MER-27) within the Pacheco Pumping Plant area was presumably destroyed or capped by fill material during its construction and was not relocated during inventory survey. The arbitrarily defined extents of the San Luis Gonzaga Archaeological District (P-24-000489) also overlap the Pacheco Pumping Plant area, however none of the district's contributing resources occur within the APE. No cultural resources were noted within or near the Goosehead Point Boat Launch area, which was heavily impacted and scoured by wave action.

Expanded Embankment, Downstream Fill Impact, and Access Road Areas

The proposed expanded embankment areas and downstream stability berm or fill impact areas largely overlap. They also intersect the two potential construction staging areas east of the B.F. Sisk Dam. Portions of the expanded embankment areas and downstream stability berm or fill impact areas were inaccessible due to terrain or safety considerations, and accessible portions appeared largely disturbed by previous dam and facility construction. Vegetation in these areas consisted mostly of dense knee-high grasses, thistle, and a few areas with sparse tree cover, yielding very poor (0-10%) ground surface visibility. Eleven features associated with CA-MER-520H were detected in areas that could be safely accessed. All of these features consisted of brass Reclamation elevation markers or observation wells used for measuring ground water levels and potential dam seepage.

Existing access roads identified for improvement pass through the potential construction staging areas, Borrow Area 6, and the Basalt Hill Borrow Area. One of these access roads begins at the northwest corner of Borrow Area 6 near the O'Neill Forebay, crosses SR 152 at the inlet to the O'Neill Forebay, and passes south along the eastern side of the B.F. Sisk Dam before turning west towards the Basalt Hill Quarry (CA-MER-509H). A second access road links a potential construction staging area to the west of the dam with the Basalt Hill Borrow Area to the south (PL-Sisk-01). An isolated displaced prehistoric cupule boulder (PL-Sisk-ISO-02) was noted downslope from this second access road. Segments of a third existing access road were recorded in 2012 and 2016 (CA-MER-494H) as they approach and enter the Basalt Hill Quarry Borrow Area. These access roads range in elevation from roughly 240 feet to more than 1,200 feet amsl and pass through rugged, variable terrain (*see* Appendix E).

6.2.2 SR 152 Modifications

The main SR 152 Modifications area comprises an approximate 0.6-mile linear tract between PM R5.239 and PM R5.806 in the northern portion of the San Luis Reservoir where Cottonwood Creek would empty into the reservoir. This SR 152 Modifications area is characterized by imported fill and riprap that form the Cottonwood embankment, which supports the roadway and allows waters from Cottonwood Bay to flow via a culvert into the reservoir. During the 2020 survey, the eastern end of the embankment was visually inspected. The western end was not accessible due to steep terrain, and the water level in the reservoir prevented access to the central section. Grasses are present around the embankment near the water level and are subject to active cattle grazing. Above the Cottonwood Bay high waterline, scattered oak trees are present. Apart from the cottonwood embankment itself, no previously recorded or newly identified cultural resources were noted in the area, which overlaps the reservoir shoreline. The Cottonwood embankment was documented in 2020 as PL-Sisk-04 and is considered a key feature of the San Luis Reservoir, which is a contributing element of the B.F. Sisk Dam/San Luis Reservoir District (P-24-002184). Additional embankment fill material also will be added just southwest of SR 152 at PM R6.295 to protect the roadway from inundation. This area was examined in 2016, but no cultural resources were observed.

6.2.3 Operations

San Luis Reservoir Shoreline

The San Luis Reservoir shoreline spans roughly 65.1 miles around the circumference of the reservoir from the 560-foot elevation contour downslope for roughly 50 meters, with the lower extents varying based on topography. The reservoir shoreline crosses each of the potential construction staging areas, with the greatest overlap occurring within the potential construction staging area west of the dam. A portion of the shoreline within that staging area was inundated at the time of the 2016 inventory survey, and approximately 3 miles that front the western face of the B.F. Sisk Dam were inaccessible, but all remaining portions of the San Luis Reservoir shoreline were subject to inventory survey. Since the shoreline is below the reservoir high waterline, the majority of the area is relatively flat and clear of vegetation, with ground surface visibility ranging from 30-75% along the wave-eroded lake margins.

Eight cultural resources were previously recorded along the reservoir shoreline and noted within the B.F. Sisk Dam Raise Alternative APE. These include a prehistoric site with petroglyphs, milling features, cleared areas, midden, and lithic tools (CA-MER-15); two prehistoric midden sites with lithic and artifact scatters (CA-MER-28 and CA-MER-83); a prehistoric lithic scatter with groundstone (CA-MER-82); a midden deposit with associated bedrock milling features and groundstone (CA-MER-130); and a historic period road (CA-MER-477H) that also crosses the Dinosaur Point Boat Launch area. The arbitrarily defined San Luis Gonzaga Archaeological District (P-24-000489) and elements of the B.F. Sisk Dam/San Luis Reservoir Historic District also intersected the reservoir shoreline. The Cottonwood embankment, which supports SR 152 and bridges Cottonwood Bay and the San Luis Reservoir, was recorded in 2020 as a feature of the reservoir, which is a key contributing element to the B.F. Sisk Dam/San Luis Reservoir Historic District.

Seven archaeological sites or built environment resources and four isolated finds were newly identified along the reservoir shoreline, including a series of historic period transmission poles with a debris scatter (CA-MER-484H); three earthen dams with impound ponds (CA-MER-515H, CA-

MER-516H, and CA-MER-518H); a prehistoric lithic and groundstone artifact scatter (CA-MER-517); and two historic period roads (CA-MER-489H and CA-MER-519H). The four isolated finds included a prehistoric chert cobble and flake (P-24-002168), two isolated water troughs (P-24-002169 and P-24-002170), and one isolated bottle (P-24-002171).

Seven previously recorded prehistoric sites (CA-MER-20, CA-MER-21, CA-MER-22, CA-MER-23, CA-MER-27, CA-MER-29, and CA-MER-41) could not be relocated along the San Luis Reservoir shoreline during inventory survey. It is possible that these sites were mis-plotted during initial recording; mis-plotted later through the CHRIS; or impacted by wave action, geomorphic processes, and/or human activities. One prehistoric site (CA-MER-27) along the shoreline that also overlaps the Pacheco Pumping Plant area is believed to have been destroyed or covered by imported fill.

All of the resources along the reservoir shoreline within the B.F. Sisk Dam Raise Alternative APE may be subject to impacts if the maximum water level of the reservoir is increased. These potential operational impacts have been studied in other lake and reservoir settings (Lenihan et al. 1981:18), and can include *mechanical impacts* from persistent wave action and nearshore currents that shape, abrade, erode, cover, and reveal shoreline topography and cultural resources as well as *biochemical impacts* to site soils and contextual relationships that can lead to the differential preservation of archaeological materials. These mechanical and biochemical impacts would be in addition to any direct effects to cultural resources that might result from construction activities associated with implementing the alternative. In particular, it is anticipated that two archaeological sites (CA-MER-130 and CA-MER-484H) will be newly affected by an increase in the maximum water level of the San Luis Reservoir.

Cottonwood Bay Shoreline

Cottonwood Bay is to the north of the San Luis Reservoir and the Cottonwood embankment, which supports SR 152 and allows Cottonwood Creek to drain south into the reservoir. The perimeter of the bay measures some 3.5 miles around the shoreline from the 560-foot elevation contour downslope for roughly 50 meters. Approximately 2.3 linear miles of the Cottonwood Bay shoreline were surveyed in 2020, corresponding to the entire eastern shore and the northern portion of the western shore. The southern portion of the western shore was inaccessible due to steep terrain. Because the shoreline lies below the high waterline for the reservoir, the area was largely clear of vegetation, and surface visibility ranged between 35-75% between the water level and the high waterline.

Two prehistoric archaeological sites were previously recorded along the shore of Cottonwood Bay. Both were originally recorded as midden sites with lithic scatters (CA-MER-136 and CA-MER-137), though when they were relocated in 2020 only midden soils were evident, and no surface artifacts remained. One prehistoric midden site with groundstone tools (PL-Sisk-05) was newly identified in 2020. The Cottonwood embankment also was documented in association with the B.F. Sisk Dam/San Luis Reservoir Historic District.

Chapter 7 Evaluations, Conclusions, and Recommendations

Archival and record searches and inventory surveys revealed that 43 cultural resources are present within the B.F. Sisk Dam Raise Alternative APE, including 11 resources that were previously recorded and 32 that were newly discovered as a result of Pacific Legacy investigations (*see* Table 6-2). These totals do not include cultural resources that were previously recorded but not relocated (*see* Table 6-3). Between 2012 and 2020, all accessible areas within the APE were subject to intensive pedestrian surveys, and a comprehensive inventory of archaeological and built environment resources was produced. Certain areas were inaccessible due to safety constraints or inundation, and these areas are expected to remain inaccessible if the B.F. Sisk Dam Raise Alternative is implemented. An assessment of the B.F. Sisk Dam and its appurtenant facilities was completed by JRP in 2018, and further evaluation efforts centered on the dam and its key elements are not anticipated.

This investigation fulfills three main objectives that will assist Reclamation and the Authority in managing cultural resources associated with the current Project. First, it presents a complete inventory of cultural resources within all accessible portions of the B.F. Sisk Dam Raise Alternative APE. Second, it incorporates a geospatial database with current, accurate cultural resource boundaries that may be used to locate, manage, and potentially avoid archaeological and historic period built environment resources within the APE if the B.F. Sisk Dam Raise Alternative is selected. Finally, it provides important baseline data in the form of detailed records that can be used to evaluate and manage cultural resources for this and other overlapping projects.

In the sections that follow, data collected during the inventory surveys will be used in conjunction with resource-specific documentary research to offer NRHP/CRHR eligibility recommendations for archaeological sites and built environment resources within the B.F. Sisk Dam Raise Alternative APE. These evaluations are prefaced by a brief discussion of the criteria and methods that were used in assessing eligibility, the research themes and questions that were explored when examining prehistoric and historic period resources, and the resource types and attributes that were used to classify archaeological sites and built environment resources within the Project vicinity. Evaluations were based surface evidence, natural subsurface exposures (e.g., bioturbation, drainage profiles, hillslope erosion exposures, etc.), and archival research as appropriate. No subsurface excavation was undertaken during inventory surveys within the APE.

7.1 Cultural Resource Evaluation Criteria and Methods

Criteria for formally evaluating cultural resources under the NRHP and the CRHR were introduced in Sections 1.4.1 and 1.4.2. Using those criteria, evaluations will be based on an approach that assesses the integrity or condition of cultural resources and their significance in relation to the four criteria outlined under 36 CFR Part 60.4 and under Section 15064.5 of state CEQA *Guidelines*.

Assessments of integrity are based upon the integrity of location, design, setting, materials, workmanship, feeling, and association for each resource examined. Integrity of location refers to whether a resource has been displaced from its original position. It may apply to standing structures or infrastructural elements, or it may apply to archaeological sites or cultural resource deposits that have been moved or displaced from where they originated. Cultural resources that lack integrity of location will generally have lost their depositional or historic context and would be expected to provide little significant information important to the study of prehistory or history. Integrity of setting, feeling, and association are particularly relevant when assessing historic period buildings, structures, objects, and sites for which the physical setting and its degree of preservation are important (e.g., a historic period irrigation ditch that is part of a larger intact site or district, a canal or aqueduct that remains in use and has not been substantially altered, or a historic period farmstead that retains its rural agricultural setting). In contrast, archaeological sites, particularly prehistoric cultural deposits, can be significant if undisturbed even if they are encountered in a developed setting incongruent with the context of their original deposition. Integrity of design, materials, and workmanship may be pertinent to prehistoric sites or historic period resources, though integrity of design and workmanship are most often examined with reference to historic period built environment resources.

In order to evaluate prehistoric or historic period cultural resources for their potential eligibility for listing in the NRHP/CRHR, it is necessary examine them with reference to a historic context. Information regarding the natural environment and cultural history of the Project vicinity was included in Sections 2.0 and 3.0, while Section 4.2 outlined many of the most common types of cultural resources that have been previously documented within the Project Area. Research themes and questions relevant to the specific resource types likely to be encountered in each alternative Project Area are offered below in Sections 7.2 and 7.3. Contextual information specific to individual cultural resources is presented in Section 7.4. This information was developed largely through an examination of archival documents and records and was particularly critical to the evaluation of historic period sites and structures within the B.F. Sisk Dam Raise Alternative APE. A variety of sources, many available online, were consulted. These included previous site records; historic period topographic maps; federal land patents; GLO survey plats and mineral survey plats; federal manuscript and agricultural census records; mining bulletins and journals; historical newspapers and photographs; and local county histories, tax documents, and voter registers. Online materials were accessed through the following locations:

- *USGS* (http://nationalmap.gov/) for topographic maps;
- *BLM* (http://www.glorecords.blm.gov/) for land patent data and cadastral survey maps;
- *USGS, The National Map: Historic Topographic Map Collection* (http://nationalmap.gov/historical/);
- *Historic Map Works* (http://www.historicmapworks.com/Browse/United_States/California/);
- *David Rumsey Map Collection* (http://www.davidrumsey.com/) for historical maps;
- *Library of Congress: American Memory Map Collection* (http://memory.loc.gov/ammem/gmdhtml/gmdgeogindex1.html) for historical maps;

- *UC Berkeley Map collection* (http://sunsite.berkeley.edu/histopo/) for historical topographic maps;

- *University of Alabama Historical Maps of California* (http://alabamamaps.ua.edu/historicalmaps/us_states/california/index_Before1875.html) for maps;

- *The Meriam Library Special Collections at California State University, Chico* (http://cricket.csuchico.edu/spcfotos2/photos6.html) for historical photographs and maps;

- *Historic Aerial photographs by NETR Online* (http://www.historicaerial photographs.com/) for historic aerial photographs;

- *UC Santa Barbara Library, Map and Imagery Laboratory* (http://www.library.ucsb.edu/mil/airs) for aerial photographs;

- *California Digital Newspaper Collection*, UC Riverside (http://cdnc.ucr.edu);

- *Online Archive of California* (http://www.oac.cdlib.org/);

- *USGS Publications Warehouse* (http://pubs.er.usgs.gov/browse/usgs-publications) for water supply papers and well data;

- *Ancestry.com* (http://www.ancesty.com) for federal census data, county voter registers and tax data bases, California newspaper collection, local newspapers, city/town directories, military records, and vital statistics; and,

- Google books for county histories and other government publications.

The aim in constructing resource-specific contexts was to identify potential associations with events that made a significant contribution to the broad patterns of our history (NRHP Criterion A/CRHR Criterion 1) and to identify potential associations with one or more individuals who were significant to our past (NRHP Criterion B/CRHR Criterion 2). The distinctive physical characteristics—the construction, style, or artistic values (NRHP Criterion C/CRHR Criterion 3) of cultural resources—were most evident through their material aspects but were also considered in light of their historic context. Finally, resource-specific contexts were used to evaluate the potential of sites or structures to yield information important to the study of prehistory or history (NRHP Criterion D/CRHR Criterion 4).

7.2 Potential Research Themes and Questions for Evaluating Prehistoric and Historic Period Cultural Resources

A series of research themes and questions that might be addressed during the evaluation of cultural resources within the B.F. Sisk Dam Raise Project Area are presented below. Most of these themes and questions are relevant to both prehistoric and historic period resources, though the manner in which they are addressed will vary greatly based on the type of resource under assessment.

- *Chronology* is a fundamental research theme central to the study of both prehistoric and historic period cultural resources. A focus on chronology allows researchers to examine sites and/or structures as representative of (or anomalous within) a particular time and place, relate sites and/or structures to one another and to broader regional landscapes or patterns in prehistory or history, and better understand change through time as expressed through a given resource. Questions relating to chronology might include the following:
  - Does the resource contain dateable or temporally sensitive materials such as charcoal, other organic remains, obsidian, diagnostic projectile point types, or dateable historic period glass, metal, or ceramic artifacts?
  - Does the historic period structure exhibit details in its fabrication or construction that would render it dateable?
  - What do dateable materials or structures reveal about when the site was used, how it was related to other sites in the vicinity, and how use or occupation of the resource may have changed through time?
- *Economy* comprises another key research theme that is relevant to the study of prehistoric and historic period cultural resources. For historic period resources, the theme of economy has much to do with how products or materials were produced, sold, purchased, and consumed. For prehistoric sites, the theme of economy is closely related to subsistence, though it also may relate to how raw materials or finished goods were obtained or traded. The theme of economy is closely aligned to other research themes such as settlement or community organization, technology, trade and exchange, and cultural identity. Questions relating to economy or economic subsistence might include the following:
  - Does the resource contain evidence of the subsistence economy such as macrofloral or faunal remains? Do those materials represent seasonally or more permanently available foods? If seasonal materials are represented, what might they reveal about when or how a given site was used (e.g., temporary versus long-term habitation)? Is there evidence of food storage present?
  - Are non-local resources represented, perhaps indicating trade or exchange?
  - What do the floral or faunal remains reveal about the use of technology at the site?
  - Within historic period resources, is there evidence that food was grown for household consumption and/or grown as an economic commodity? Is there evidence for the consumption of non-local or mass produced goods?
- *Settlement or Community Organization* refers to how people occupied the landscape—how they moved through space, where they established their settlements or communities, how those settlements or communities were structured and organized, and how those settlements or communities were related to others within the same region or territory. Questions relating to settlement or community organization might include the following:

  - How is space structured within the boundaries of the resource? Is there evidence for different activity areas? What might that reveal about aspects of cultural identity such as gender, race, or ethnicity?

  - How does a particular resource relate to the larger settlement landscape or community? What cultural or environmental factors might have influenced the choice of one locale versus another?

  - Was a given resource area used temporarily or permanently? On a seasonal or year-round basis?

  - What might the resource reveal about social or economic structures at the local or regional level?

- *Technology* refers to the tools or methods that are used during the course of daily activities such as procuring or processing foods, building dwellings or other structures, and manufacturing utilitarian or non-utilitarian items. Questions relating to technology might include the following:

  - What kinds of tools were being used or manufactured by the people accessing or inhabiting the resource area?

  - Do they shed light on how the resource area was used or what activities may have been carried out there?

  - Do the artifacts present represent finished or unfinished items and what might that reveal about trade, exchange, and/or commerce?

  - What does the technology represented at a given resource location reveal about cultural chronology, the economy, and/or trade and exchange?

- *Trade and Economic Exchange* relate to how finished goods and raw materials were obtained through direct or indirect interactions between social groups. At prehistoric sites, it is possible to discover marine shell from the coast at sites within the San Joaquin Valley interior or non-local lithic materials procured from other regions. At historic period sites, it is even more common to find goods or materials of non-local manufacture that were acquired through commercial activity. Questions relating to trade and exchange might include the following:

  - Does the site contain non-local materials or goods? How and from whom were those materials obtained?

  - What do those items reveal about the spatial extent and stability of trade networks? What might those items reveal about technology, community organization, cultural identity, or the priorities and values of a given site's occupants?

  - How do non-local materials at a resource location relate to the broader cultural landscape and environmental region?

- *Cultural History and Identity* pertain to the ways in which groups developed and formed shared identities based on social organization, political affiliation, religious practices, and/or gender, race, and ethnicity. Questions relating to cultural history and identity might include the following:
    - Does the resource area contain materials that can be linked to a particular social group that may shed light on the cultural history or identity of its inhabitants?
    - What do those materials or the ways in which they were structured, used, or organized reveal about gender, race, or ethnic identity?
    - Are particular ethnographic or linguistic groups represented?
    - For late prehistoric or historic period resources, how do the materials or remains within a given site support or refute other lines of evidence such as oral history or documentary records?

The research themes and questions above are not exhaustive but provide a basic framework for examining cultural resources within the San Luis Reservoir vicinity and for evaluating the potential NRHP/CRHR eligibility of those resources within the APE for the B.F. Sisk Dam Raise Alternative.

7.3 Site Types and Attributes

An integral part of conducting cultural resource evaluations includes defining and documenting the site types represented by a given group of cultural resources. This was noted in Section 6.0 when discussing the types of cultural resources that were encountered during the inventory surveys. Defining and documenting general site types is useful because it can guide the construction of contexts for historic period sites and structures or suggest fruitful research themes and questions for prehistoric sites. A brief outline of site types and attributes representative of those typically found within the San Luis Reservoir vicinity is presented below. Several of these site types were encountered during inventory surveys while others were noted during archival and records searches of the B.F. Sisk Dam Raise Project Area.

7.3.1 Prehistoric Site Types and Attributes

Typical prehistoric site types might include permanent or temporary habitation sites or activity-specific sites such as lithic scatters or food processing areas.

- *Permanent habitation sites* comprise residential sites that were occupied on a permanent or nearly permanent basis. Such sites are often distinguished by their size and by evidence for long-term occupation and material deposition. Permanent habitation sites frequently contain stratified midden deposits or mounds. Midden deposits consist of black or very dark, organic-rich soils that accumulate through intensive or long-term and repeated deposition. Permanent habitation sites might also be expected to feature evidence of house-pit depressions or the remains of other habitation structures. House-pit depressions are typically round, measure between 2-20 meters in diameter, and feature a low berm around their periphery. Given the effects of environmental forces and modern development, house-pit depressions are rarely encountered in the archaeological record but can provide valuable information about daily activities and the use of space in prehistory. The presence of bedrock milling features may also be indicative of long-term habitation. Frequently encountered in the foothills and in areas with bedrock outcrops, bedrock milling features contain mortars or slicks—rounded, cup-like depressions or shallower, elongated depressions that were formed by and used for grinding hard seeds such as acorns and other materials. Although many bedrock milling features have been associated with long-term habitation, they also frequently occur in isolation or independent of other archaeological deposits. The evaluation of a site's physical setting or context is critical in examining such features. In addition to midden soils, house-pit depressions, and bedrock milling features, the archaeological assemblage at permanent habitation sites might be expected to include an array of groundstone and lithic tools as well as floral and faunal remains.

- *Temporary or seasonal habitation sites* include those that were occupied for a short duration or those that were occupied repeatedly, though on a seasonal or short-term basis. Typically smaller than permanent habitation sites, temporary or seasonal habitation sites usually lack accumulated midden deposits or formal house-pit depressions. An array of activities may be evident at temporary or seasonal habitation sites, though materials would be expected to be less diverse than encountered at permanent habitation sites. Bedrock milling features, groundstone, lithic tools, and floral and faunal remains may all be present at temporary or seasonal habitation sites, though the assemblage would likely be less varied, and materials would be expected to be fewer in number when contrasted with permanent habitation sites.

- *Activity-specific sites* include those that were used for one purpose or for a very limited range of purposes. Lithic scatters, lithic quarry areas, or food processing locales are all examples of such sites. Typically used once or for a short duration, these sites are often characterized by limited assemblages that represent the narrow range of activities that would have occurred there.

7.3.2 Historic Period Site Types and Attributes

Historic period site types that have been encountered or might be anticipated within the B.F. Sisk Dam Raise Alternative APE would include intact or remnant farmstead or ranch sites, agricultural sites, transportation infrastructure, water conveyance features, prospect pits or mining sites, foundations or structure pads, and debris scatters or deposits. Historic period site types are usually based on functional categories, and such sites are typically easy to distinguish based on their physical attributes. Cultural constituents often encountered at historic period sites include pits, privies, fences, ditches, water features, other structural elements, and domestic or industrial debris.

- *Farmstead or ranch sites* frequently include a residence and one or more outbuildings or structures clearly associated with ranching or agricultural activity (e.g., barn, corral, livestock watering locale, and/or shed). They may feature associated historic period debris deposits or scatters and may contain pits, privies, fences, ditches, and livestock watering locales marked by troughs, windmills, and/or water pumps.

- *Agricultural sites* typically include features that are functionally related to the cultivation, production, and harvesting of crops. Such sites are often distinguished by irrigation ditches and canals, fencelines, modified or landscaped hedgerows or tree lines, and berms or mounded soil areas meant to aid water retention or abatement.

- *Transportation infrastructure* consists of historic period features such as paved or unpaved roads and railroad lines or grades. Railroad lines or grades generally feature a relatively level grade, typically on a constructed berm that may or may not include rails, ties, or spikes. Former railroad lines are often dismantled and repurposed as roads and can be difficult to distinguish in the form of berms that have been converted into unpaved roads. Roads are usually easier to distinguish and are sometimes associated with bridges, culverts, and/or secondary debris deposits or scatters left casually or deliberately by passing vehicles.

- *Water conveyance features* include infrastructural elements such as canals, ditches, dams, and dykes and are generally easy to distinguish in form and function, though they can be hard to discern or differentiate when encountered as a part of a larger water conveyance system. For instance, an agricultural canal and ditch system may contain hundreds of elements that have been added, removed, or transformed through time, and it can be difficult to distinguish the precise date or period when certain elements were altered.

- *Foundations or structure pads* include the material remains of a building's base and are generally constructed of stone, concrete, or wood. Structure pads are areas that have been leveled, typically for the placement of small, less permanent structures, and do not contain foundation elements.

- *Prospect pits or mining sites* typically comprise excavated pits or quarry areas made to test for or extract rocks, gravels, minerals or metals. Spoils piles, or areas of mounded soils or stones removed from prospect pits, are often found in conjunction with them.

- *Debris scatters or deposits* are typically composed of domestic and/or industrial materials that have been scattered or deposited in the area in which they were used (i.e., a primary deposit) or in an area unassociated with their use (i.e., a secondary deposit). A farmstead or ranch site for instance might feature one or more primary debris scatters containing domestic items such as glass, metal, and ceramics and might contain debris associated with ranching or farming activities such as barbed wire, fencepost remnants, and horseshoes. A historic period road might feature a secondary scatter of domestic or industrial items representing one or more roadside discard events.

7.4 Cultural Resource Evaluations

Not all of the cultural resources encountered during inventory surveys within the B.F. Sisk Dam Raise Alternative APE will be eligible for listing in the NRHP and/or the CRHR, and not all will require protection, avoidance, or mitigation per Section 106 of the NHPA or CEQA. Until all appropriate consultation efforts have been completed, however, Reclamation and the Authority will avoid impacts to cultural resources that have not been previously evaluated for listing in the NRHP and/or the CRHR.

Survey-level evaluations are offered below for cultural resources within the B.F. Sisk Dam Raise Alternative APE. Many of these resources were evaluated in support of the SLLPIP and B.F. Sisk SOD Modification Project. Some resources recommended not eligible for listing in the NRHP have received concurrence from the SHPO (Polanco 2018), though their eligibility status for listing in the CRHR remains unresolved. Other resources, specifically those discovered in 2020, are discussed for the first time. In the sections that follow, cultural resources evaluations are grouped according to the types of impacts anticipated under the B.F. Sisk Dam Raise Alternative: Construction of Dam Raise, SR 152 Modifications, and Operation of Dam Raise (*see* Section 1.2.3).

7.4.1 Construction of Dam Raise

Most of the construction activities that will occur under the B.F. Sisk Dam Raise Alternative also will occur under the B.F. Sisk SOD Modification Project Crest Raise Action, and cultural resources that overlap the APE for both are expected to experience the same type and level of impacts within the same timeframe. For instance, three historic period road segments (CA-MER-493H, CA-MER-494H, and PL-Sisk-01) will be improved; the Basalt Hill Quarry (CA-MER-509H) will be re-activated; potential construction staging areas affecting five resources (CA-MER-492H, CA-MER-451H, CA-MER-512H, CA-MER-514H, and CA-MER-520H) will be used; and the Basalt Hill Borrow Area and Borrow Area 6 will be accessed to supply further materials for the enlarged dam embankment, potentially affecting five resources (CA-MER-494H, CA-MER-509H, CA-MER-510H, CA-MER-511H, and CA-MER-521H).

Construction impacts that would differ under the B.F. Sisk Dam Raise Alternative include raising the B.F. Sisk Dam a further 10 feet; increasing the crest elevation of the berm at the Pacheco Pumping Plant; and raising the operating elevation of the Dinosaur Point and Goosehead Point boat launches by 10 feet. No features would be removed, altered, or added to the to the B.F. Sisk Dam, the Pacheco Pumping Plant, or their appurtenant facilities that would be incongruent with their current setting, use, or operation. Further raising the height of the dam is not expected to result in adverse effects to the B.F. Sisk Dam/San Luis Reservoir Historic District or its contributing elements (JRP 2018). The elevation of the Goosehead Point Boat Launch would impact one historic period road (CA-MER-477H) that has been recommended not eligible for listing in the NRHP and CRHR, but no additional construction impacts associated with raising the height of dam a further 10 feet have been identified. Descriptions and survey level evaluations for cultural resources that overlap the B.F. Sisk SOD Modification Project Crest Raise Action and additional construction impact areas associated with the B.F. Sisk Dam Raise Alternative are presented below. An evaluation of the B.F. Sisk Dam/San Luis Reservoir Historic District is presented in a separate report by JRP (2018) and is not replicated here, though the district has been recommended eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-451H
P-24-001876

Recommended Not Eligible for Listing in the NRHP/CRHR

Site Description

CA-MER-451H is a historic period sheep ranch site near Domengine Spring that served as the ranch headquarters and residence. The site was first recorded in 2009 by W. Wulzen. Wulzen recorded eight features spanning a 2.76-acre area, including a possible structure pad (Feature 1); two galvanized water tanks (Features 2 and 3); fencing or a possible corral (Feature 4); an alignment of rocks (Feature 5); an improved spring (Feature 6); and two piles of rocks (Features 7a and 7b). No standing buildings associated with the ranching operation were present during the 2009

Appendix A, Figure A-6
Appendix B, Figure B-6

Construction of Dam Raise (Potential Construction Staging Area – South of B.F. Sisk Dam)

recording. Feature 1 is a 24 foot (NW/SE) by 12 foot (NE/SW) structural flat with daffodil bulbs planted nearby, but no signs of a foundation. Feature 2 is a 12-foot tall cylindrical water tank on an earthen pad with PVC pipe attached. Feature 3 is a second 8-foot tall tank on a wooden platform with a steel pipe and remains of a wooden roof with wire nails. Feature 4 is a 20-foot diameter possible corral with a wooden trough, fragmentary fencing, a gate, and a scatter of fence hardware. Feature 5 is a discontinuous rock alignment 75 feet from Feature 1. Feature 6 is an improved spring approximately 320 feet from Feature 2; it consists of a subterranean tank covered in wooden planks. Features 7a and 7b are basalt rock piles in the northwest corner of the site. Feature 7a is 16 feet (N/S) by 4 feet (E/W) and Feature 7b is 14 feet (N/S) by 5 feet (E/W).

CA-MER-451H is situated in a swale among surrounding hills south of the historic period San Luis Gonzaga Ranch and current San Luis Reservoir area and east of Basalt Hill. Vegetation includes seasonal grasses, non-native Eucalyptus, almond, and pine trees, and reported daffodils. No dates were established for the construction of these features, except that the water tanks and well improvements likely date to the early 20th century. On April 1 and April 8, 2020, archaeologists from Pacific Legacy conducted an intensive pedestrian survey of CA-MER-451H. Features 1-5, 7a, and 7b identified by Wulzen were relocated. Features 5, 7a and 7b (within the survey area) were photographed. Feature 6 was not relocated since it was further outside of the survey area. No associated artifacts were observed. The site condition is largely unchanged from the original recording, except that Feature 5 is now clearly disturbed and site vegetation has become more overgrown.

Archival Research Summary

CA-MER-451H is located in Township 10 South, Range 8 East in the southwest quarter of Section 26. An 1860 GLO plat for the township shows no structures or development in Section 26 indicating that the ranch was not yet present (BLM 2020a). The 1920 Pacheco Pass 15-minute USGS topographic map shows one structure at the ranch site southwest of the north-south road leading north to the San Luis Ranch (USGS 1920). The 1940 Pacheco Pass 15-minute USGS topographic map and 1953 San Luis Creek 7.5-minute USGS topographic map show two structures present, one on either side of the road, indicating the ranch may have continued operation into the 1940s (USGS 1940a, 1953). A 1953 aerial clearly depicts several standing structures and the water tank features near the corral. A 1964 aerial photograph depicts possibly three to four structures present at the ranch site, but they also may be related to construction of the B.F. Sisk Dam (Fairchild Aerial Surveys 1964).

The spring at CA-MER-451H is named Domengine, which refers to John Domengine and his son Adolph, who operated a sheep ranch there between about 1870 and 1873 (Vandor 1919:2181). John Domengine was a French Basque who arrived in California during the Gold Rush. After operating a laundry in San Francisco, he ran a cattle ranch in Santa Clara County in the 1860s but lost it during the drought of 1864. He worked for Miller and Lux until 1867, when he struck off on his own and began his sheep ranching operation at San Luis Ranch (Vandor 1919:2181; Wulzen 2009). In 1873, John returned to France and sold his ranch to Simon Camy. Adolph stayed on to work for Mr. Camy, and a year later Camy and Domengine moved their flock to Fresno County where Adolph later became a prominent sheep rancher (Vandor 1919:2181-2182). The area of Section 26 that encompasses the ranch site is within the southwest quarter that was patented to Joseph Bareilles Couloume in 1889 (Doc #1902; BLM #CACAAA 096285) (BLM 2020b). Couloume, also known as Bareilles, was a barkeeper in San Francisco in 1880, but was voting in Mendezable Precinct in Merced County as a stock raiser by 1890 (Merced County 1890; U.S. Census Bureau 1880:621A). He continued to ranch and farm there through at least 1920 and is son, Frank Bareilles, continued to ranch in Township 3 through at least 1932 (Merced County 1932; U.S. Census Bureau 1920:1A; 1930:6A).

NRHP/CRHR Evaluation

CA-MER-451H is a historic period sheep ranch complex that includes a residence or barn structure pad, possible corral, two water tanks, and a water system derived from Domengine Spring. The site is evaluated under the historic context of *Ranching and Agriculture* in the American Period (*see* Section 3.3.3). Based on historic period maps, aerial photographs, land patent records, county history data, and chronological markers from the site's features, the site may have originally been used for sheep ranching as early as 1870, though the current features more likely date to the early to mid-20th century. There were definitely structures present between 1919 and 1940, remaining in use until the construction of the San Luis Reservoir in the 1960s. The site appears to date to the end of or post-date the height of Central Valley ranching (the late 19th century through the 1920s). The ranch was not prominent in agricultural development history in California. CA-MER-451H does not appear to have been associated with events significant in local or regional history and is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-451H may be associated with Adolph Domengine, a prominent sheep rancher in Fresno County, who spent three years sheep ranching with his father and a later owner in the site vicinity. His prominence is not directly connected with the CA-MER-451H site. The Couloume/Bareilles family ranched at CA-MER-451H from the 1890s through the 1930s. The family is not significant in local, state, or national history. The site is thus recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-451H is made up of components that are commonly used to control and maintain livestock (i.e., metal water tanks, a corral, fencing with a gate, and a wood water trough) and either a barn and/or residence.

There are no standing structures, and the type of structure (barn or residence) that was once present remains unclear. The other site features are fragmentary, except the water tanks and spring. None of these components is structurally unique, nor do they exemplify distinctive characteristics of a type, period, or method of construction. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

The resource is made up mostly of fragmentary livestock ranching features or features that have been modified for recent use (Domengine spring) and do not possess clear chronological association. There are no standing structures at the site and there are no signs of hollow-fill features such as a privy or debris pit. No historic period artifacts were noted at CA-MER-451H in 2020. Although CA-MER-451H has not been archaeologically tested for subsurface features, it is unlikely that such testing would reveal a sufficient quantity or diversity of artifacts with intact stratigraphy that might be used to address important research questions concerning *Ranching and Agriculture* in the American Period (*see* Section 3.3.3). Based on the surface features of the site, CA-MER-451H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-451H is in poor condition. Wulzen (2009) described site impacts as including the removal of standing structures, the construction of the Basalt water tank road through the site, construction of a house trailer pad approximately 50 feet from Feature 1, modern improvements to the Domengine Spring (Feature 6), and possible removal of cultural components by visitors from the nearby campground. The 2020 survey revealed that the Feature 5 rock alignment is now displaced in push piles. The resource's integrity of location is fair, though the extent of the site may not be fully defined due to the fragmentary nature of the features. The uncertainties regarding what features might be missing and their temporal assignment diminishes the site's integrity of design and workmanship. Aspects of setting, association, and feeling have been impacted by the construction of the dam and reservoir during the 1960s, by the removal of the structures noted on historic period maps from the 1940s and 1950s, and by the construction of the Basalt water tank road and nearby recreational campground (USGS 1920, 1940, 1953). The site no longer retains sufficient integrity of association and feeling to convey its history. Overall, the resource possesses poor integrity. CA-MER-451H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-477H
P-24-001822

Description

CA-MER-477H was first recorded by J.C. Whatford in 1996 as three segments (Features A, B, and C) of three separate road alignments. Feature A is located on a contour below the paved access road to Dinosaur Point. Feature B is a road cut situated on a contour above the paved access road to Dinosaur Point that includes the remains of an asphalt surface and occasional dry-laid stone retaining walls. Feature C comprises the road cut

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix A, Figure A-3
Appendix B, Figure B-3

Construction of Dam Raise (Dinosaur Point Boat Launch Modification Area; Reservoir Shoreline – Dinosaur Point Area)

along which the paved Dinosaur Point access road is oriented (Whatford 1996a). The modern four-lane alignment of SR 152 is located roughly 0.3 miles to the northwest of Feature C.

During the 2012 field inventory, the three road segments originally recorded as CA-MER-477H by Whatford were relocated along with 11 additional road segments. All of these segments comprise three separate road alignments that together span 3.5 miles E/W on the western side of San Luis Reservoir. Features A, B, and C, originally noted by Whatford in 1996, were re-designated Segments A, B, and C in 2012, while the remaining segments were designated Segments D through N. All represent travel routes that spanned Pacheco Pass before 1967. They begin in the wide valley at the top of Pacheco Pass near the modern alignment of SR 152 and cross the summit of the pass before following a ridgeline down into the former San Luis Valley. The features consist primarily of roadbeds cut into the hillsides, with some segments exhibiting asphalt paving and built-up roadbeds and causeways. A series of "C" blocks—concrete posts with a "C" stamped into one side—were noted along one of the road alignments and designated as Features 1 through 5. Posts of this type were used to delineate highway right-of-way between 1914 and 1934 (Windmiller 2007).

The three historic period road alignments include the 1920s-era route of SR 152. Construction of the route was completed in 1923, and it is represented by Segments B, D, E, F, G, H, I, J, and K as well as Features 1 through 5. Segments C and L represent two discontinuous portions of the improved 1940s-era route of SR 152. Finally, Segments A, M, and N represent the earliest alignment, which may mark the route of the 1856 Andrew Firebaugh Toll Road, the Pacheco Pass Stage Road, and/or a portion of the Butterfield Overland Mail route.

The main disturbances to CA-MER-477H include the construction and maintenance of Dinosaur Point Road and a pumping plant access road. Inundation of the reservoir has affected road Segments L, K, and M, and erosion has affected most of the resource segments. CA-MER-477H generally follows the course of a northwest-southeast trending ridgeline, first on the north side and then crossing to the south, with the exception of Segments M and N that continue on the north side. The resource passes through three vegetation communities: low to medium density chaparral with Manzanita, California sagebrush, coyote bush, chamise, and blue oaks; oak savanna blue oaks and non-native grasses; and open non-native grassland with cockleburs and other herbaceous plants. The resource descends below the reservoir's high-water mark in several locations, which are marked only by sparse grasses and cockleburs.

Archival Research Summary

CA-MER-477H is located in Township 9 and 10 South, Range 7 East and in Township 10 South, Range 8 East in the unsectioned San Luis Gonzaga

Land Grant. The land grant was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts only the area not covered by the land grant. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho, but it is unclear if the stage route depicted corresponds to one or more of the CA-MER-477H road alignments (BLM 2016). The 1920 Pacheco Pass 15-minute USGS topographic map depicts Segments B, D, E, F, G, H, I, J, and K (USGS 1920). The 1940 Pacheco Pass 15-minute USGS topographic map shows Segments C and L. The 1955 Pacheco Pass 7.5-minute map portrays the San Luis Reservoir while the "Boat Ramp" road appears to represent portions of the 1940s-era alignment of SR 152. Two segments of the 1920s-era alignment of SR 152 are also shown (USGS 1955). A 1946 aerial photograph of the resource area shows numerous braided road alignments to the west of the reservoir near Dinosaur Point (Fairchild Aerial Surveys 1946). The 1920s-era SR 152 alignment is clearly visible, as is the later 1940s-era route. Several road segments that may represent the 19th century stage road are also visible. Two of the 1920s segments of SR 152 (Segments B and N) are most clearly discernible, as is one of the 1940s segments (Segment C).

Based on aerial photograph and historic period map evidence, CA-MER-477H represents the remains of three separate roads that traversed Pacheco Pass prior to 1967. One is the original 1920s-era route of SR 152, which was the first paved road over the pass and the one that included the distinctive "C" blocks. A second is the improved 1940s-era SR 152, a portion of which was repaved as Dinosaur Point Road after the flooding of the San Luis Reservoir in 1967 (Beck and Haase 1974: 52; Hoover 1990: 199; Whatford 1996: 1-2). Finally, the 1856 Andrew Firebaugh Toll Road, which later became the Pacheco Pass Stage Road and part of the Butterfield Overland Mail route, may be represented. Its correlation with early historic period maps is more tenuous, however, and it lacks associated features, such as the later 1920s-era "C" blocks that might support its link with a specific period and function.

NRHP/CRHR Evaluation

CA-MER-477H comprises 14 segments of three separate historic period road alignments that spanned Pacheco Pass. Each of the three alignments is evaluated under the historic context of *Transportation Development* in the American Period (*see* Section 3.3.3). Pacheco Pass is a part of a historically significant transportation corridor that was used by Native Americans as well as Spanish, Mexican, and American explorers, soldiers, and settlers. A commemorative plaque marking Gabriel Moraga's 1805 exploration of Pacheco Pass has been designated as CHL-829 (P-24-000643) and installed at the Romero Overlook on the northeastern edge of San Luis Reservoir.

Segments A, M, and N of CA-MER-477H may represent portions of the 1856 Andrew Firebaugh Toll Road that later became the Pacheco Pass

Stage Road and part of the Butterfield Overland Mail route. Given the imprecision of the 1909 GLO map of the diseño of Rancho San Luis Gonzaga, the braided nature of the roads that cross the area, and the lack of associated materials that might confirm the age of the three recorded alignments, however, it is not possible to definitively link the road segments to the 19th century toll, stage, or mail route. Segments B, D, E, F, G, H, I, J, and K, which represent the 1920s-era alignment of SR 152, can be more securely linked to early historic period topographic maps (USGS 1920, 1955), as can the two segments (Segments C and L) that represent the improved 1940s-era alignment (USGS 1955).

Mere association with historical events or trends is not enough to qualify a resource for listing in the NRHP/CRHR under Criterion A/1. The resources' association with particular historical events or trends must be considered important as well. For instance, a historic period commercial building must be shown to have been significant in commercial history. Similarly, the three road alignments that make up CA-MER-477H may be considered potentially eligible for listing in the NRHP/CRHR under Criterion A/1 if they played a significant role in local or regional transportation development or history. As noted above, Segments A, M, and N of CA-MER-477H cannot be securely linked to their use as a part of the Andrew Firebaugh Toll Road, the Pacheco Pass Stage Road, or the Butterfield Overland Mail Route. Segments B, D, E, F, G, H, I, J, and K, which represent the 1920s-era alignment of SR 152, and Segments C and L, which represent the 1940s-era one, can be more firmly linked to a specific period through historical map and aerial photographic evidence. As remnant road alignments that played a significant role 1920s and 1940s-era transportation in Central California, 11 of the 14 road segments may be regarded as potentially eligible for listing in the NRHP/CRHR under Criterion A/1.

None of the road alignments that make up CA-MER-477H could be definitively linked with one or more historically significant individuals. The resource is recommended not
eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-477H comprises 14 segments of three separate road alignments that could not be clearly linked to any other buildings, structures, or sites within the vicinity. The road segments are not structurally unique and do not exemplify distinctive characteristics of a type, period, or method of construction. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As a series of isolated road segments, there is little potential to encounter subsurface components or vertical stratigraphy along CA-MER-477H. As a physical entity, the resource offers little potential to address important research questions about *Transportation Development* in the American Period (*see* Section 3.3.3). Thus, CA-MER-477H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The overall condition of CA-MER-477H in 2012 was described as fair, with impacts from construction and maintenance of the Dinosaur Point Road and a pumping plant access road, reservoir inundation, and erosion. Generally, the road segments retain integrity location and materials, though vegetation growth has diminished their aspect of workmanship and materials. Integrity of design has been diminished by modern construction and development, while the aspect of setting has been impacted by later road, pumping station, and boat ramp construction and by the San Luis Reservoir. Aspects of association and feeling also have been impacted by access road, reservoir, and boat ramp construction, which resulted in the re-routing of SR 152 in its current alignment. Some of the CA-MER-477H road segments have lost any clear historic period association. For instance, Segment G is described as being potentially “mistaken for a wide shoulder” (Elliot et al. 2012c). The integrity of CA-MER-477H is poor to fair.

The potential 19th century road alignment of CA-MER-477H could not be securely linked to a specific time period or function and may represent portions of a toll road, stage road, and/or overland mail route. The 1920s and 1940s-era alignments of CA-MER-477H can be more securely fixed in time and space. Both served an important role in historic period transportation development, however both lack sufficient integrity to convey their significance in local or regional history. Portions of these alignments have been paved, inundated, and/or severely eroded. The recorded road segments are discontinuous and frequently limited in scale. Overall, the resource retains poor integrity. CA-MER-477H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-491H
P-24-001985
PL-SLLP-A-010

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-6

Description

CA-MER-491H is a dirt road segment that has been cut into the western slope of a north-south trending finger ridge. It measures approximately 600 feet in length and 10 feet in width. The cut into the ridge is approximately 2 feet high at a 32° angle. The northern end of the dirt road segment joins a maintained dirt road segment that intersects Basalt Road. A large boulder (6-x-5-x-2.5 feet) rests in the middle of the road roughly 200 feet south of its northernmost section. The south end of the road ends at a high water mark near the southeastern shore of the San Luis Reservoir.

CA-MER-491H is characterized by steep-sided, grassy finger ridges with slopes ranging from 16-22°. Sparse trees and dry, non-native grasses grow throughout the area, though most of the trees in the vicinity represent modern landscaping planted adjacent to a boat ramp parking lot. CA-MER-491H is fully exposed with fair to limited (20%) ground surface visibility. The road is in fair condition but has been impacted by erosion.

Construction of Dam Raise (Potential Construction Staging Area – West of Goosehead Point)

Archival Research Summary

CA-MER-491H is located in Township 10 South, Range 8 East in the southeast quarter of Section 28. Section 28 represents a half-section, with the unsectioned northern half subsumed by the San Luis Gonzaga Land Grant. Section 28 was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). The northern half of the southeast quarter, which subsumed the resource area, and the eastern half of the southwest quarter were later patented on February 23, 1892 by Antonio Lopez (Doc #2241, BLM# CACAAA 096296) (BLM 2016). In 1895, he also patented the western half of the southwest quarter.

An 1860 GLO plat map shows the Butterfield Overland Mail route and a telegraph line as they crossed the northwest corner of Section 13, however no historic period features were depicted in Section 28. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho—the future alignment of SR 152—but does not show the CA-MER-491H road alignment (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the dirt road segment (USGS 1920, 1940a). The 1953 San Luis Creek 7.5-minute USGS topographic map shows an east-west trending unimproved road spanning Section 28 that corresponds to CA-MER-491H (USGS 1953). The road segment, however, is not depicted on the 1969[3] San Luis Dam 7.5-minute USGS topographic map (USGS 1969a), likely because the area was inundated by that time. A 1946 aerial photograph of the area clearly shows the road segment as a part of a road leading west from a north-south trending road in Section 26 (Fairchild Aerial Surveys 1946).

CA-MER-491H passes approximately 760 feet to the west of a possible former homestead site (CA-MER-261H) that may have been associated with Antonio Lopez. Antonio "Antone" Lopez was born in 1844, came to California in 1851, and died in 1907 in Los Banos (Findgrave.com 2016). His obituary noted that he "worked for 40 years as Head Vaquero for Henry Miller of Miller and Lux. Antone was married to Theresa Harper and they had four children Maria Antonia, Henry Francis, Albert Henry, and Frank Henry." Early 20th century U.S. Census records noted that Antonio Lopez resided in Township 3, was married to Theresa Lopez, had four children, and listed his occupation as "farmer" (U.S. Census Bureau 1900a: 9A, 1910: 9A). Since CA-MER-491H features no associated artifacts and aerial photographs reveal only that it was present by 1946, the road segment cannot be clearly linked to the Lopez land grant or to the possible former homestead.

NRHP/CRHR Evaluation

CA-MER-491H consists of a historic period road segment that was

[3] The 1969 San Luis Dam 7.5-minute USGS topographic map was based on aerial photographs taken in 1967 and field checked in 1969.

constructed prior to 1946 (Fairchild Aerial Surveys 1946). It is evaluated under the historic context of *Transportation Development* in the American Period (*see* Section 3.3.3). The construction date of CA-MER-491H and its period of use remain unclear, though it may have been associated with a possible former homestead (CA-MER-261H) or with homesteaders or ranchers who required an east-west route outside of the San Luis Gonzaga Land Grant. The road segment could not be clearly linked to any buildings, structures, or sites within the vicinity, though the possible former homestead site is located just 760 feet to the west. CA-MER-491H does not appear to have been linked to any significant events or developments in local or regional history. It is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-491H lay within a land grant patented to Antonio Lopez in 1892, however no links could be established between Lopez or any subsequent landowners or leasees and the construction and use of the road segment. Although the builder or builders of the road remain unknown, it is unlikely that they figured prominently in local or regional history. CA-MER-491H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-491H is an isolated road segment that could not be clearly linked to any other buildings, structures, or sites within the vicinity. The road segment is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. Thus, the resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As an isolated road segment, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-491H. It offers limited potential to address important research questions about *Transportation Development* in the American Period (*see* Section 3.3.3). The resource is thus recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-491H does not appear to be maintained or in active use, though the northern end of the road joins another road segment that is maintained and leads to Basalt Road. It is in fair condition despite impacts from erosion and retains integrity of location, design, feeling, materials, and workmanship. It lacks integrity of association, however, because it could not be clearly linked to a particular time, event, individual, or purpose and could not be associated with other buildings, structures, or sites in the vicinity. It also lacks integrity of setting, as the resource has been inundated by the San Luis Reservoir to the south and truncated by a more recent road to the north. CA-MER-491H possesses fair overall integrity and is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-492H
P-24-001986
PL-SLLP-A-011

Recommended Not Eligible for Listing in the NRHP/CRHR, (Non-Contributing Element to the B.F. Sisk Dam/San Luis Reservoir Historic District)

Appendix B, Figure B-6

Construction of Dam Raise (Potential Construction Staging Area – West of Goosehead Point)

Description

CA-MER-492H is a historic period industrial resource measuring 1,600 feet N/S by 1,100 feet E/W. It represents a part of the larger Basalt Hill Quarry (CA-MER-509H) and separation plant complex built in 1963 to process basalt into riprap for construction of the B.F. Sisk Dam (Autobee 2011: 11-12; Berman 2012: pers. comm.; Reclamation 1974: 49). The Basalt Hill Quarry (CA-MER-509H) is located approximately 2,500 feet to the southwest and comprises the main component of the complex, which also includes two historic period access roads (CA-MER-493H and CA-MER-494H). CA-MER-492H features five main loci (Locus 1 through 5). Locus 1 is a concrete tunnel through a small hill covered with piled riprap on top of which are three concrete foundation pads, six vertically embedded I-beams, a road segment, and a large number of cuts, flats, and bulldozer ramps. Locus 2 consists of a deep road cut, a road segment, and a flat. Locus 3 comprises a number of bulldozer scrapes as well as road segments and piled riprap. Locus 4 consists of two large bulldozer scrapes and two road segments. The final main locus, Locus 5, consists of two large bulldozer scrapes.

Considerable amounts of earth were moved during the formation of CA-MER-492H, and the hill that the tunnel is built through appears to be artificial. The site is located in a wide, flat, round valley situated between Basalt Hill to the southwest and San Luis Reservoir to the northeast. The terrain surrounding the resource area is relatively flat to the north and east, with moderate ground surface visibility obscured only by non-native grasses and occasional coyote bushes. The area has a 0-5° slope, is fully exposed, and features a northeastern aspect. The relatively level nature of the site may be due to historic period earthmoving. A 6-foot deep bank runs roughly parallel to the northwest-trending segment of one access road, separating the main portion of the site from the rest of the valley. A small knoll rests between the bank and Basalt Road, with portions of the knoll exhibiting bulldozer activity. The hills to the south and west are steep (>20°), particularly Basalt Hill, which has a maximum elevation of 1,707 feet amsl. Soils within the resource area are tan-brown silty loam and have been graded away in some areas, exposing the sedimentary bedrock beneath. Large portions of the resource area are covered by riprap, either piled or strewn, that would have arrived via a conveyor belt from the Basalt Hill Quarry (CA-MER-509H). The conveyor belt is no longer in place but does appear in historic period photographs.

CA-MER-492H is in fair condition with few visible impacts. The main impacts relate to the decommissioning of resource—standing superstructures in Locus 1 were removed, leaving only embedded I-beams and concrete pads. Grading of an access road has also damaged or covered the historic period access road that led through the tunnel. There are very few artifacts present at CA-MER-492H, likely as a result of cleanup activities following the facility's closure (Poole 2012: pers. comm.).

Archival Research Summary
CA-MER-492H is located in Township 10 South, Range 8 East in the southwest quarter of Section 27. The southern half of Section 27 was patented to the Southern Pacific Railroad Company on April 20, 1875 (Doc #4, BLM# CACAAA 093859) (BLM 2016). No railroad was ever built through the section, however, and it was likely sold to local ranchers or other property owners. An 1860 GLO plat map depicts drainages along the northern edge of Section 27, but no historic period development (BLM 2016). The 1920 Pacheco Pass 15-minute USGS topographic map shows that the resource area was dominated by a northeast-southwest oriented drainage originating from a spring to the southwest in Section 34, but no access routes to or from the resource area are depicted (USGS 1920). The 1940 Pacheco Pass 15-minute USGS topographic map does not show CA-MER-492H but does depict a portion of a road that accesses the resource area (USGS 1940). The 1953 San Luis Creek 7.5-minute USGS topographic map shows that the resource area in Section 27 and the Basalt Hill Quarry (CA-MER-509H) area to the southwest in Section 33 remained unmodified (USGS 1953). To the south of CA-MER-492H in Section 34, the same map shows a fire lookout (P-24-000078) on the top of Basalt Hill and a south-trending access road leading away from it (USGS 1953). An access road through Section 27 to the north of the resource area is also depicted, though only a portion to the northwest currently remains on dry land. The concrete tunnel in Locus 1 of CA-MER-492H first appears on the 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969a), which also depicts the San Luis Reservoir and the Basalt Hill Quarry (CA-MER-509H).

Historic period map evidence supports other accounts that the Basalt Hill Quarry (CA-MER-509H) and separation plant complex were established in 1963 to support construction of the B.F. Sisk Dam and San Luis Reservoir, which were completed in 1967 (Autobee 2011: 11-12; Reclamation 1974: 49). In describing how the complex would have operated, Autobee (2011: 11) noted that Rock for zones 4 and 5 on the upstream face of the dam were extracted from a quarry at the top of nearby Basalt Hill. The quarry-run rock was excavated with a 15 cubic yard electric shovel and transported by 75-ton trucks to a separation plant. This plant separated the rock into plus-and-minus nine-inch sizes. Huge bar screens directed the larger size rock into a hopper that loaded the zone 5 material into 60-ton rear-dump trucks. The trucks had special braking systems for hauling safely down the steep access road. The smaller zone 4 rock dropped onto a 3,200-foot long conveyor belt down the hillside. This ended on a cantilevered tower over a 100-foot high stockpile at the bottom. There was a drive-through tunnel under the pile that allowed 100-ton trucks to be loaded in two minutes.

The Basalt Hill Quarry (CA-MER-509H) and separation plant complex was thus used for quarrying and separating rock fill, bedding, and riprap. CA-MER-492H would have been on the receiving end for "smaller zone 4 rock" that would have been transported from the Basalt Hill Quarry (CA-MER-509H) via the "3,200-foot long conveyor belt" (Autobee 2011: 11). Although the conveyor belt is no longer extant, the hill cut for the belt remains highly visible. The concrete footings and embedded I-beams in Locus 1 of CA-MER-492H likely represent the remains of the end of the conveyor belt and the tower. The poured concrete tunnel in Locus 1 would have been used in loading separated material onto vehicles for conveyance to the reservoir embankment and dam construction area.

After construction of the B.F. Sisk Dam was completed in 1967, the quarry and riprap separation plant were shut down, and the tunnel in Locus 1 of CA-MER-492H was reused for storage. Chain-link fencing was bolted to each tunnel entrance, and openings in the roof for loading rock were closed with metal sheeting. The conveyor belt linking CA-MER-492H with the Basalt Hill Quarry (CA-MER-509H) was removed, and superstructures such as the cantilevered tower noted by Autobee (2011: 11) were dismantled.

NRHP/CRHR Evaluation
CA-MER-492H is a historic period resource that was associated with the Basalt Hill Quarry (CA-MER-509H) and separation plant complex. This complex was established in 1963 to support the construction of the B.F. Sisk Dam and the San Luis Reservoir and comprises a part of the larger dam system. CA-MER-492H is evaluated as a part of that larger system under the historic context of *Water Conveyance* in the American Period (*see* Section 3.3.3).

The B.F. Sisk Dam and its appurtenant features were recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for their contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). As a feature within the B.F. Sisk Dam system, CA-MER-492H may be regarded as a contributing or non-contributing element under Criterion A/1. A connection to significant historic period events or trends is insufficient, in and of itself, to render a resource eligible for listing in the NRHP/CRHR under Criterion A/1. Rather, the role the resource played in those events or trends must be significant. The dam symbolizes the first and only state-federal collaboration in California water development to be conducted on such a large scale (Autobee 2011). The Basalt Hill Quarry and separation plant complex was created and used to support the construction of the B.F. Sisk Dam, however its role in the development of the dam and its key facilities was transitory and not sufficiently significant to render CA-MER-492H a critical part of the larger system. CA-MER-492H is thus recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion A/1.

No connection between the resource and one or more individuals significant in local, state, or national history could be established. Although the dam is named for former U.S. Congressman Bernice Sisk, that association is commemorative and too tenuous to be regarded as significant under NRHP/CRHR Criterion B/2. CA-MER-492H is thus recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion B/2.

The Basalt Hill Quarry (CA-MER-509H) and separation plant complex was used for quarrying and separating rock fill, bedding, and riprap. Structurally, the complex is not unusual or distinctive in engineering, or architecture. Cedar Spring Dam and Silverwood Lake in Southern California also used a gravity separation plant when quarrying rock for construction in the 1960s (California Dept. of Water Resources 1974: 328). The tunnel in Locus 1 of CA-MER-492H is lined with board-molded concrete and is not distinctive from other man-made tunnels. CA-MER-492H is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion C/3.

As an industrial resource, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-492H, and few surface artifacts remain. Much of the research potential for the Basalt Hill Quarry (CA-MER-509H) and separation plant complex may be found through archival documents and historic period photographs rather than through the resource's physical remains. CA-MER-492H is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion D/4.

CA-MER-492H does not appear to be actively maintained or used. It remains in fair condition despite impacts from decommissioning and retains integrity of location and workmanship. Integrity of materials is diminished because portions of the resource have been removed. It retains integrity of setting and association as the reservoir and dam are nearby, though integrity of association has been somewhat lessened by the removal of super-structures (i.e., tower and conveyor belt) that tied the site to the upper quarry area and separator plant. A current access road has damaged the historic period road system, which also diminishes its integrity of setting. The purpose of the tunnel system is no longer evident and no longer visually or physically connected to the larger complex. The aspect of feeling has been diminished, as construction of the dam and reservoir have long been completed. The overall integrity of CA-MER-492H is fair. CA-MER-492H possesses fair overall integrity. It is recommended as a non-contributing element to the NRHP/CRHR eligibility of the B.F. Sisk Dam system, recently defined as the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018).

CA-MER-493H
P-24-001987
PL-SLLP-A-014

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-3 and B-6

Construction of Dam Raise (Potential Construction Staging Area – West of Goosehead Point)

Description

CA-MER-493H is an earthworks road segment that measures approximately 5,400 feet or 1.02 miles in length and 15 feet in width. It is oriented roughly northeast-southwest and connects with another road (CA-MER-494H) at its midpoint that trends southwest towards the Basalt Hill Quarry (CA-MER-509H). A 3,100-foot long segment of the road was recorded during the 2012 inventory survey while a 2,300-foot long segment was later recorded during the 2016 inventory survey. The road is built up to a height of 25 feet in some sections and cut 13 feet into the hillside in others to maintain a consistent grade. The road is mostly covered by gravels, which become sparse and eventually disappear as the road continues southwest. A small southern offshoot of this road was also discovered descending due south towards a drainage. It is covered by gravels and features two metal culverts. The main alignment contains one 3-foot diameter iron culvert in the center of a built-up causeway. Roughly 80% of the main road alignment and the small southern offshoot segment lie beneath the current average waterline of the San Luis Reservoir.

An orange-white CCS core (P-24-001990) and a red CCS biface fragment (P-24-001991) were discovered along the main road alignment near where CA-MER-493H and CA-MER-494H intersect. The core was embedded in the road while the biface fragment was found lying on the surface of the road. Neither was believed to be *in situ*. CA-MER-493H was likely built to facilitate dam construction, as it leads from an industrial resource (CA-MER-492H) that was a part of the Basalt Hill Quarry (CA-MER-509H) and separation plant complex to the B.F. Sisk
Dam area. The road is in fair condition despite impacts from erosion, inundation, and use by four-wheel drive vehicles.

Archival Research Summary

CA-MER-493H is located in Township 10 South, Range 8 East in the southern half of Section 27 and in the unsectioned San Luis Gonzaga Land Grant. The land grant was patented on May 16, 1871 to Juan Pérez Pacheco (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). The southern half of Section 27 was patented to the Southern Pacific Railroad Company on April 20, 1875 (Doc #4, BLM# CACAAA 093859) (BLM 2016). No railroad was ever built through the section, which was likely sold to unknown ranchers or other landholders. On February 23, 1892, Antonio Lopez patented the northern half of the southeast quarter and the eastern half of the southwest quarter in Section 28, which is just west of and adjacent to Section 27. He also patented the western half of the southwest quarter of Section 29 on Mary 30, 1895. Antonio Lopez had a homestead that was adjacent to an east-west road that crossed Sections 27 and 28, which may have included a small portion of the CA-MER-493H road alignment. That east-west road may have served as an early access route to the homestead during Lopez's tenure on the property (ca. 1890s to 1900).

An 1860 GLO plat map shows the Butterfield Overland Mail route and a telegraph line roughly 2 miles northeast of CA-MER-493H as they crossed Section 13, however no cultural features are depicted in Section 27. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho, but does not show roads to the south or southeast and does not depict a road in the CA-MER-493H location (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the road segment (USGS 1920, 1940), though they depict the east-west trending road that may have crossed or just slightly overlapped the location of CA-MER-493H. Similarly, a 1946 aerial photograph of the area and the 1953 San Luis Creek 15-minute USGS topographic map depict the east-west road alignment but not CA-MER-493H (Fairchild Aerial Surveys 1946; USGS 1953). The resource first appears on the 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969a), which depicts the inundated San Luis Reservoir and a small segment of the road as it ascends northeast towards the dam. As it would have been inundated, most of the recorded road segment is not depicted. The tunnel associated with the neighboring industrial resource (CA-MER-492H) also first appears on the 1969 map (USGS 1969a).

Based on historic period map evidence, CA-MER-493H appears to have been established prior to the inundation of the San Luis Reservoir in 1968 but after 1953 (USGS 1953, 1969). This supports the idea that the road was established to facilitate the construction of the dam and reservoir. CA-MER-493H does not appear to have been related to the east-west trending road that passed through Sections 27 and 28, though it may have slightly overlapped that earlier alignment.

NRHP/CRHR Evaluation

CA-MER-493H is a historic period road segment that was likely constructed after 1953 and prior to 1968. As recorded in 2012 and 2016, it serves as a link between an industrial resource (CA-MER-492H) associated with construction of the B.F. Sisk Dam and a point just southwest of the dam itself. It appears to have been established to support dam and reservoir construction activities. It is evaluated under the historic contexts of *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3).

The B.F. Sisk Dam has been recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for its contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). There is no evidence to indicate that CA-MER-493H was the first or only road used the in the construction of the B.F. Sisk Dam. It was likely used to convey building materials to the dam construction area, but it does not contribute to the importance of the B.F. Sisk Dam system or the wider CVP and SWP. CA-MER-493H is thus recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion A/1.

There is no evidence indicating that CA-MER-493H was developed or used during the 19th century, and no evidence linking the resource to early settlers or ranchers such as Juan Pérez Pacheco or Antonio Lopez. No connection between the resource and one or more people significant in local, state, or national history could be established. CA-MER-493H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-493H is an earthworks road segment. It is not structurally unique, nor does it exemplify distinctive characteristics of a type, period, or method of construction. CA-MER-493H is recommended not eligible for inclusion in the NRHP/CRHR under Criterion C/3.

As a road segment, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-493H. The resource offers limited potential to address important research questions about *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3). CA-MER-493H is recommended not eligible for inclusion in the NRHP/CRHR under Criterion D/4.

CA-MER-493H does not appear to be actively maintained or used. It remains in fair condition despite apparent impacts from erosion and inundation and retains integrity of location, design, materials, and workmanship. Physically and functionally, it lacks some integrity of association, feeling, and setting because the industrial resource (CA-MER-492H) it once supported is no longer in operation, dam construction has been completed, and the resource is largely inundated during non-drought years. Overall, CA-MER-493H retains fair integrity. CA-MER-493H is recommended not eligible for inclusion in the NRHP/CRHR.

CA-MER-494H
P-24-001988
PL-SLLP-A-015

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-6

Description

CA-MER-494H is a historic period graded dirt road that measures approximately 8,130 feet or 1.54 miles in total length and 20 feet in width. It is oriented generally northeast-southwest and bridges the Basalt Hill Quarry (CA-MER-509H) to the south and an earthworks road (CA-MER-493H) to the north. Two segments of the road (Segments 1 and 2) were recorded during the 2012 field inventory to either side of Basalt Road. Segment 1, located to the south of Basalt Road, measures approximately 1,950 feet in length and 20 feet in width. It contours though the hills downslope from the quarry and includes a number of hill cuts and causeways to maintain an approximate 5% road grade. Segment 2, located north of Basalt Road, measures 830 feet in length and 20 feet in width. It consists of a built-up causeway road covered in gravels that stands approximately 20 feet high on its west side and 15 feet high on its east side. The east side is covered with riprap and basalt boulders. During the 2016

Construction of Dam Raise (Basalt Hill Borrow Area; Potential Construction Staging Area – West of Goosehead Point; Access Road Area)

inventory survey, a 5,350-foot long segment of the road was recorded descending southwest towards the Basalt Hill Quarry (CA-MER-509H) from Segment 1. It also measures 20 feet in width and is consistent in construction with Segment 1.

Segment 1 and the portion of the road recorded in 2016 are located above the reservoir's high waterline and both pass through a non-native grassland area with no trees or shrubs. The northern end of Segment 1 features a berm that was constructed to deny vehicle access from Basalt Road. Segment 2 is located below the reservoir's high waterline and is bordered by sparser non-native grasses, cockleburs, and the occasional willow tree. The CA-MER-494H road alignment slopes (3-5°) to the northeast and is fully exposed. It exhibits impacts from erosion, inundation, and the use of four-wheel drive vehicles.

Archival Research Summary

CA-MER-494H is located in Township 10 South, Range 8 East in the northeastern quarter of Section 33, the northwest quarter of Section 34, and the southern half of Section 27. The southern half of Section 27 was patented to the Southern Pacific Railroad Company on April 20, 1875 (Doc #4, BLM# CACAAA 093859) (BLM 2016). No railroad was built through the section, which was likely sold to unknown ranchers or other landholders. Those areas of Sections 33 and 34 that encompass the road were patented to the State of California in 1924 (BLM# CACAAA 002567, 096293, and 096298) (BLM 2016). The area includes a natural spring, and the land may have been leased for ranching or grazing.

An 1860 GLO plat map shows the Butterfield Overland Mail route and a telegraph line roughly 2 miles northeast of CA-MER-494H as they crossed Sections 12 and 13, however no cultural features are depicted in Sections 27, 33, or 34. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho, but does not show roads to the south or southeast and does not depict a road near the CA-MER-494H location (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the road (USGS 1920, 1940). The 1953 San Luis Creek 15-minute USGS topographic map depicts an east-west road alignment in Section 27 but it does not correspond to CA-MER-494H (USGS 1953). Perhaps most surprisingly, the 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969a) does not shows the road alignment, though it does portray the inundated San Luis Reservoir and a road leading north from the Basalt Hill Mine as well as a dirt road leading southeast through Section 34. A 1946 aerial photograph of the site vicinity shows the east-west trending road through Section 27 as well as Segments 1 and 2 of CA-MER-494H (Fairchild Aerial Surveys 1946). The road segments appear to lead towards the spring in Section 34 or possibly the Basalt Hill Quarry (CA-MER-509H).

Historic period map evidence and land patent information provided few clues about when CA-MER-494H was built. In construction, it greatly resembles the historic period road (CA-MER-493H) that it intersects to the north. That road was associated with dam construction, and CA-MER-494H, which acts as a bridge between the Basalt Hill Quarry (CA-MER-509H) and the northern road, was almost certainly used during dam construction as well. Given its appearance on a 1946 aerial photograph, however, it may have originated as an earlier alignment leading to the natural spring in Section 34.

NRHP/CRHR Evaluation

CA-MER-494H is a historic period road that was likely constructed, at least in part, prior to 1946. As recorded in 2012 and 2016, it serves as a link between the Basalt Hill Quarry (CA-MER-509H) to the southwest and a historic period access road (CA-MER-493H) to the northeast that leads to the B.F. Sisk Dam area. It appears to have been established, or at least used primarily, to support the construction of the B.F. Sisk Dam and the San Luis Reservoir. It is evaluated under the historic contexts of *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3).

The B.F. Sisk Dam has been recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for its contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). As a feature within the B.F. Sisk Dam system, CA-MER-494H may be regarded as a contributing or non-contributing element under Criterion A/1. A connection to significant historic period events or trends however does not necessarily render a resource eligible for listing in the NRHP/CRHR. Rather, the role the resource played in those events or trends must be significant. There is no evidence to indicate that CA-MER-494H was the first or only road used in the construction of the B.F. Sisk Dam. It was likely used to convey stone from the Basalt Hill Quarry (CA-MER-509H) to the dam construction area, but it does not contribute in a meaningful way to the importance of the B.F. Sisk Dam system as a component within the wider CVP and SWP. CA-MER-494H is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

There is no evidence indicating that CA-MER-494H was developed or used during the 19th century, and no evidence linking the resource to early settlers or ranchers in the vicinity. No connection between the resource and one or more people significant in local, state, or national history could be established. CA-MER-494H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-494H is a graded dirt road. It is not structurally unique, and it does not exemplify distinctive characteristics of a type, period, or method of construction, nor does it represent the work of a master engineer. CA-MER-494H is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As a road segment, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-494H. The resource offers limited potential to address important research questions about *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3). CA-MER-494H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-494H does not appear to be actively maintained or used. A berm blocks access to much of the resource from Basalt Road, and the northern portion of the resource would be inundated in non-drought years. Overall, it remains in fair condition despite impacts from erosion and inundation and retains integrity of location, design, materials, and workmanship. Physically and functionally it lacks integrity of association, feeling, and setting because the quarry location (CA-MER-509H) it once supported is no longer in operation, dam construction has been completed, and the resource is partially inundated during non-drought years. Overall, CA-MER-494H retains fair integrity. CA-MER-494H is recommended not eligible for inclusion in the NRHP/CRHR.

CA-MER-495H
P-24-001989
PL-SLLP-A-016

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-6

Construction of Dam Raise (Potential Construction Staging Area – West of Goosehead Point)

Description

CA-MER-495H consists of a dirt road that is graded into the contour above the western end of Basalt Road and below a gated access road that leads to the Basalt Hill Quarry (CA-MER-509H). It ascends the hillslope from the northeast where it intersects a steep ravine as well as the quarry access road before continuing southwest and west towards the center of Section 28 in Township 10 South, Range 8 East. The eastern portion of the resource was first recorded during the 2012 inventory survey and the western portion of the alignment was mapped during the 2016 inventory survey. The total recorded road segment measures approximately 2,955 feet in length and 15 feet in width. The road is cut approximately 3-4 feet into the south-facing slope of a hillside and is built up about 2-3 feet on the downslope side. The road is wide enough for single vehicles to pass but not wide or stable enough to have supported heavy traffic or the large vehicles that would have been used to construct the B.F. Sisk Dam.

CA-MER-495H appears infrequently used and has been built above the inundation level of the reservoir, though it has been heavily impacted by erosion. The area surrounding the resource is fully exposed and marked by slopes of roughly 20°. The San Luis Reservoir is located just 750 feet to the northwest. Non-native grasses prevail along the road alignment, and no trees or shrubs are located in the vicinity.

Archival Research Summary

CA-MER-495H is located in Township 10 South, Range 8 East in the southeast quarter of Section 28. Section 28 represents a half-section, with the unsectioned northern half subsumed by the San Luis Gonzaga Land Grant. Section 28 was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). The northern half of the southeast quarter, which subsumed most of the resource area, and the eastern half of the southwest quarter were later patented by Antonio Lopez on February 23, 1892 (Doc #2241, BLM# CACAAA 096296) (BLM 2016). In 1895, Lopez also patented the western half of the southwest quarter.

An 1860 GLO plat map shows the Butterfield Overland Mail Stage route and a telegraph line as they crossed Sections 12 and 13 well to the northeast of the resource, however no historic period features were depicted in Section 28. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho—a future alignment of SR 152—but does not show CA-MER-495H (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the road alignment (USGS 1920, 1940). The 1953 San Luis Creek 7.5-minute USGS topographic map shows an east-west trending unimproved road spanning Sections 27, 28, and 29 to the north of the resource, but it does not appear to correspond to CA-MER-495H (USGS 1953). The road segment may represent a later southwestern offshoot from the other alignment, which may indicate a 1940s-1950s date for CA-MER-495H. The 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969a) also fails to depict the resource, though it does depict the gated road to the Basalt Hill Quarry (CA-MER-509H).

Aerial photographs from 1946 and 1956 show the more northern east-west road alignment in the resource vicinity, but do not capture CA-MER-495H (Fairchild Aerial Surveys 1946; USDA 1957). CA-MER-495H passes approximately 750 feet south of a possible former homestead site (CA-MER-261H). Since CA-MER-495H features no associated artifacts and aerial photographs and historic period maps reveal only that it may have been present by the 1940s to 1950s, the road cannot be clearly linked to the Lopez land grant, the possible former homestead, or to any specific historic context or function.

NRHP/CRHR Evaluation

CA-MER-495H is a historic period road segment that may have been constructed in the 1940s-1950s based on its proximity and likely association with an east-west trending road to the north. It is evaluated under the historic context of *Transportation Development* in the American Period (*see* Section 3.3.3). The construction date of CA-MER-495H and its period of use remain unclear, though it may have been associated with homesteaders or ranchers who required an east-west route outside of the San Luis Gonzaga Land Grant. The road segment could not be clearly linked to any buildings, structures, or sites within the vicinity, though a possible former homestead site (CA-MER-261H), is located just 750 feet to the north. CA-MER-495H does not appear to have been linked to any significant events or developments in local or regional history. It is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-495H lies within a land grant patented to Antonio Lopez in 1892, however no links could be established between the construction or use of the road segment and Lopez or any subsequent landowners or leasees. Although the builder or builders of the road remain unknown, it is unlikely that they figured prominently in local or regional history. CA-MER-495H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-495H is an isolated road segment that could not be clearly linked to any other buildings, structures, or sites within the vicinity. The road segment is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. The resource is thus recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As an isolated road segment, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-495H. It offers very limited potential to address important research questions about *Transportation Development* in the American Period (*see* Section 3.3.3). The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-495H does not appear to be maintained or in active use. Although it has been impacted by erosion, it lies above the average waterline level of the San Luis Reservoir and remains in fair condition. It retains integrity of location, design, feeling, materials, and workmanship. It lacks integrity of association, however, because it could not be clearly linked to a particular time, event, individual, or purpose and could not be associated with other buildings, structures, or sites in the vicinity. Its integrity of setting has also likely been diminished by the inundation of the San Luis Reservoir. CA-MER-495H possesses fair overall integrity. The resource is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-509H
P-24-002154
PL-SLLPIP-16-01

Recommended Not Eligible for Listing in the

Description

CA-MER-509H, or the Basalt Hill Quarry, is a historic period industrial resource that spans 4,000 feet NW/SE by 5,000 feet NE/SW. It represents the main element of a quarry and separation plant complex built in 1963 to process basalt into riprap for construction of the B.F. Sisk Dam (Autobee 2011: 11-12; Berman 2012: pers. comm.; Reclamation 1974: 49). A smaller industrial resource (CA-MER-492H) that was connected to the Basalt Hill Quarry via a conveyor belt is located approximately 2,500 feet

NRHP/CRHR, (Non-Contributing Element to the B.F. Sisk Dam/San Luis Reservoir Historic District)

Appendix B, Figure B-6

Construction of Dam Raise (Basalt Hill Borrow Area; Access Road Area)

downslope and to the northeast; it received riprap separated at the main quarry area that was then transported for construction of the dam and its related facilities. The conveyor belt was removed following construction of the dam, but the grade that supported it remains clearly visible. Two historic period earthworks roads (CA-MER-494H and PL-Sisk-01) linked the Basalt Hill Quarry to the dam area, while a second graded dirt road (CA-MER-493H) led from CA-MER-492H to the dam area.

The Basalt Hill Quarry has largely modified the entire western shoulder of Basalt Peak, which is located approximately 1,500 feet to the east and reaches a maximum elevation of 1,707 feet amsl. Descending from near the top of the hillslope, the quarry is divided into five terraces (Terraces 1-5) representing five elevations of the mining operation. Originally, four features were identified including a cairn with a metal post (Feature 1); a series of concrete equipment pads (Feature 2); a large gravity separator built into the hillside (Feature 3); and a triangular equipment pad (Feature 4) that may be associated with the operation of Feature 3. In 2020, Feature 4 was expanded to encompass the conveyor belt system, which includes the beltway alignment and three equipment pads: a triangular pad (4A), and two machinery mounts (4B and 4C). Few cultural materials were noted across the quarry area in 2016, but included a few pieces of milled lumber, heavy 3-inch diameter wire rope, nuts and bolts, heavy equipment parts, and pieces of metal grating. A single soft-top beverage can was found that dates from the late 1950s to the early 1960s (Maxwell 1993). An area near Feature 3 identified as Concentration 1 contains additional materials such as plate glass, indicating that some form of structure, potentially an operations office, once stood there. Two-track roads (CA-MER-494H and PL-Sisk-01) provide access to much of the site, and massive rock ramps, likely for heavy equipment, link the terraces.

The features present at the Basalt Hill Quarry reflect how infrastructure within the site was likely placed and used. Most significant was Feature 3, a large (85 feet N/S by 75 feet E/W) rock and aggregate size-sorter/separator that was built into a steep, north-facing slope at the northern edge of the resource. This 80-foot tall reinforced concrete structure was used to sort larger mined materials from the quarry into various sizes for use in different locations or aspects of the dam's construction. Material from the quarry was used for rock fill, riprap, and bedding. Quarried material was pushed into the top of Feature 3 and separated at the 8-inch size, with some materials crushed to manufacture bedding materials (California Department of Water Resources 1974: 279). The smaller fraction was transported via conveyor belt to CA-MER-492H where the material was picked up by trucks. The recorded Feature 4 conveyor beltway is a 2,800-foot long (NE/SW), 24-foot wide (NW/SE) road cut segment connecting the quarry to the processing site. The road is flat at the southwest upslope quarry end but has an 8° downslope to the northeast. Along the east side of this road cut, the alignment is built up approximately 6 inches above the roadbed grade. Along this raised portion, parallel railroad ties measuring approximately 4-5 feet long by 12-18 inches wide are embedded perpendicular to the alignment and 20 feet apart. These wood ties likely supported the conveyor belt framework. The three associated concrete equipment pads likely supported the electric motor and equipment that ran the conveyor belt system (Autobee 2011:11).

Much of the Basalt Hill Quarry area has essentially been denuded of soils and surface vegetation, offering good (70-80%) ground surface visibility, though portions of the site are dominated by low grasses and occasional shrubs. The 1953 San Luis Creek 7.5-minute USGS topographic map shows that the site area featured a relatively gentle slope (5-6°) to the northwest, with a steep drop along the western margin of the landform. After the quarry was abandoned, the area had been leveled in five main, nearly flat terraces, with piles of rock spotting the landscape and some rock debris pushed off the steep western flank of the hillside. The area surrounding the site is dominated by waist-high and taller grasses, sparse mustard and thistle, and occasional trees in the lower lying areas. The Basalt Hill Quarry remains in fair condition with few visible impacts. The main impacts relate to the decommissioning of the resource—standing superstructures have been removed and there are very few artifacts present, likely as a result of cleanup activities following construction of the dam. The conveyor belt system, likewise, now lacks its machinery and belts as well as being impacted by erosion and vegetation growth.

Archival Research Summary
CA-MER-509H is located in Township 10 South, Range 8 East in Section 33. All of Section 33 was patented to the Southern Pacific Railroad Company on April 20, 1875 (Doc #4, BLM# CACAAA 093859) (BLM 2016), though no railroad was ever built through the area. An 1860 GLO plat map depicts drainages along the northern edge of the section, but no historic period development (BLM 2016).

The 1920 Pacheco Pass and 1922 San Luis Creek 15-minute USGS topographic maps do not show the quarry or any access routes at the site location, though they do show that later quarrying activates flattened much of the Basalt Hill area (USGS 1920, 1922a). Similarly, the 1940 Pacheco Pass 15-minute USGS topographic map does not show any historic period development within the site area (USGS 1940). The 1953 San Luis Creek 7.5-minute USGS topographic map shows that the resource area remained unmodified (USGS 1953), though a fire lookout (P-24-000078) and a south-trending access road had been established on the top of Basalt Hill by that time. The Basalt Hill Quarry complex first appears on 1964 and 1967 aerial photographs and on the 1969 San Luis Dam 7.5-minute USGS topographic map (Fairchild Aerial Surveys 1964; NETROnline 1967; USGS 1969a), which also depict the San Luis Reservoir and one of the features at CA-MER-492H. This supports historic period accounts that the Basalt Hill Quarry and separation plant complex were established in 1963 to support construction of the B.F. Sisk Dam and San Luis Reservoir, which were completed in 1967 (Autobee 2011: 11-12; Reclamation 1974: 49).

In describing how the complex would have operated, Autobee (2011: 11) noted that

> Rock for zones 4 and 5 on the upstream face of the dam were extracted from a quarry at the top of nearby Basalt Hill. The quarry-run rock was excavated with a 15 cubic yard electric shovel and transported by 75-ton trucks to a separation plant. This plant separated the rock into plus-and-minus nine-inch sizes. Huge bar screens directed the larger size rock into a hopper that loaded the zone 5 material into 60-ton rear-dump trucks. The trucks had special braking systems for hauling safely down the steep access road. The smaller zone 4 rock dropped onto a 3,200-foot long conveyor belt down the hillside. This ended on a cantilevered tower over a 100-foot high stockpile at the bottom. There was a drive-through tunnel under the pile that allowed 100-ton trucks to be loaded in two minutes.

The Basalt Hill Quarry and separation plant complex was thus used for quarrying and separating rock fill, bedding, and riprap. CA-MER-492H would have been used to receive "smaller zone 4 rock" transported from the Basalt Hill Quarry via the "3,200-foot long conveyor belt" (Autobee 2011: 11). An electric motor was used to start the conveyor belt moving and then gravity completed moving loads downhill which allowed the motor to become a generator to feed power back into the construction site's transmission circuit (Autobee 2011:11-12; Cotter 1963:1068).

After construction of the B.F. Sisk Dam was completed in 1967, the quarry and riprap separation plant were shut down. The conveyor belt linking the Basalt Hill Quarry to CA-MER-492H was removed, and superstructures were dismantled as a part of site cleanup (Autobee 2011: 11). The quarry has been intermittently used since 1967 to supply repair materials for various SWP facilities (Clinkenbeard 1999:23). The gravity rock separator at CA-MER-509H represents a substantial structure, though it was not unique. Similar separators were built for the 1966-1971 construction of Cedar Springs Dam and Silverwood Lake in Southern California (California State Parks 2009:8).

NRHP/CRHR Evaluation

CA-MER-509H is a historic period resource that comprised the main element of the Basalt Hill Quarry and separation plant complex. This complex was established in 1963 to support the construction of the B.F. Sisk Dam and the San Luis Reservoir and was a part of the larger dam system. CA-MER-509H is evaluated as a part of that larger system under the historic context of *Water Conveyance* in the American Period (*see* Section 3.3.3).

The B.F. Sisk Dam and its appurtenant features were recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for its contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). As a feature within the B.F. Sisk Dam/San Luis Reservoir Historic District, CA-MER-509H may be regarded as a contributing or non-contributing element under Criterion A/1. A connection to significant historic period events or trends is insufficient by itself to render a resource eligible for listing in the NRHP/CRHR under Criterion A/1. Rather, the role the resource played in those events or trends must be significant. The dam symbolizes the first and only state-federal collaboration in California water development to be conducted on such a large scale (Autobee 2011). The Basalt Hill Quarry and separation plant complex were created and used to support the construction of the B.F. Sisk Dam, however its role in the development of the dam and its key facilities was transitory and not sufficiently significant to render CA-MER-509H a critical part of the dam complex. CA-MER-509H is recommended as non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion A/1.

No connection between the resource and one or more individuals significant in local, state, or national history could be established. Although the dam is named for former U.S. Congressman Bernice Sisk, that association is commemorative and too tenuous to be regarded as significant under NRHP/CRHR Criterion B/2. CA-MER-509H is thus recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion B/2.

The Basalt Hill Quarry and separation plant complex were used for quarrying and separating rock fill, bedding, and riprap. Structurally, the complex is not unique or distinctive in engineering or architecture. Cedar Spring Dam and Silverwood Lake in Southern California also used a gravity separation plant when quarrying rock for construction in the 1960s (California Dept. of Water Resources 1974: 328). Similarly, other elements of CA-MER-509H such as the terraces and other features are not structurally unique or distinctive. The conveyor belt system used a combined electric motor and gravity system to run the conveyor belt, which in turn generated power for other elements of the system. This subsystem was noted in the *Minerals Yearbook, 1963* and *Engineering News Record* along with a general description of the overall system processes (Cotter 1963:1068; Engineering News Record 1963:46). The innovation does not appear to have been singled out as significant, and the associated machinery and motor were removed when the quarry closed thus leaving no physical trace. CA-MER-509H is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion C/3.

As an industrial resource, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-509H, and few surface artifacts remain. Much of the research potential for the Basalt Hill Quarry and separation plant complex may be derived from archival documents and historic period photographs rather than through the resource's physical remnants. CA-MER-509H is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion D/4.

CA-MER-509H is not actively maintained and has not been used since the 1980s. It remains in fair condition despite impacts from decommissioning and retains integrity of location and workmanship. Integrity of materials is diminished because portions of the resource have been removed. It retains integrity of setting and association as the reservoir and dam are nearby, though integrity of association has been somewhat lessened by the removal of superstructures (i.e., possible structure near Concentration 1, conveyor belt elements) that were a part of the site and that tied the site to other areas of the complex. The aspect of feeling also has been diminished as construction of the dam and reservoir have long been completed. CA-MER-509H possesses fair overall integrity. It is recommended as a non-contributing element to the NRHP/CRHR eligibility of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018).

CA-MER-510H
P-24-002155
PL-SLLPIP-16-02

Determined Not Eligible for Listing in the NRHP Recommended Not Eligible for Listing in the CRHR

Appendix B, Figure B-4

Construction of Dam Raise (Borrow Area 6 - South of O'Neill Forebay)

Site Description

CA-MER-510H consists of a concrete foundation pad (Feature 1) with four raised concrete blocks with 1-inch diameter threaded studs with nuts. Approximately 100 feet east-southeast of Feature 1 is a large basalt rock with a 5-inch diameter bore hole drilled through it that does not appear to be associated with the resource. The concrete foundation pad may have supported compressors or similar equipment, but its function is unclear. Feature 1 is shaped roughly like the Roman numeral "II" and is made from rounded aggregate; it has a smoothed surface and beveled edges. No artifacts were noted in association with the feature, and its date of construction remains indeterminate. Nearby structures depicted on historic period topographic maps of the area indicate that the foundation may date to the 1940s or 1950s.

CA-MER-510H is located on the west side of the San Joaquin Valley along the southern shore of the O'Neill Forebay in a flat, open area. Surface visibility is poor due to dense knee-high vegetation that includes grasses, foxtails, mustard weed, vinegar weed, and sticky tarweed. The site is located roughly 80 feet south of an inoperative electric fence and 100 feet south of an east-west trending access road.

Archival Research Summary
CA-MER-510H is located in Township 10 South, Range 8 East in the northwest corner of Section 13. An 1860 GLO plat map depicts the Butterfield Overland Stage route and telegraph line in Section 13 but does not depict any structures near the resource location (BLM 2016). The Southern Pacific Railroad Company patented all of Section 13 on April 20, 1875, (BLM 2016) but did not develop the land.

The 1920 Pacheco Pass 15-minute USGS topographic map shows that the original alignment of SR 152 passed through Section 13 near the site location (USGS 1920). By 1940, three houses were depicted on the General Highway Map of Merced County within Section 13, roughly 0.25 miles to the west, south-southwest, and south-southeast of the resource location (DPW-DH 1940). The 1940 Pacheco Pass 15-minute USGS topographic map shows that SR 152 had by then been rerouted to the southern edge of Section 13; it also shows that a series of telegraph lines followed the 1920 road alignment to the western edge of Section 13 before proceeding south along the section line to follow the new road alignment (USGS 1940). The 1940 map portrays a cluster of four buildings and an access road to the northeast of the resource area. The 1953 San Luis Creek 7.5-minute topographic map shows a house and windmill to the northeast of the site area, while the 1969 San Luis Dam 7.5-minute USGS topographic map shows the resource location to the south of O'Neill Forebay and to the north of a utility line (USGS 1953, 1969). Aerial photographs from 1946 depict structures to the northeast of the site area, but no structures could be clearly discerned near CA-MER-510H (Fairchild Aerial Surveys, Inc. 1946). CA-MER-510H may have been associated with the 1940s-era structures or with the 1950s-era house and windmill to the northeast.

NRHP/CRHR Evaluation
CA-MER-510H is a historic period concrete foundation pad with no associated artifacts. The site is evaluated under the historic context of *Ranching and Agriculture* in the American Period (*see* Section 3.3.3). Based on historic period maps, land patent records, and historic period aerial photographs, the site was most likely associated with nearby structures constructed in the 1940s to 1950s-era. The site is also located near the 1940s-era alignment of SR 152 and may be associated with it. If CA-MER-510H was associated with ranching and/or agricultural activities, it likely post-dated the height of ranching in the Central Valley (the late 19th century through the 1920s). CA-MER-510H does not appear to have been associated with events significant in local or regional history and is therefore recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No association between CA-MER-510H and one or more individuals was revealed through archival research, so no link could be established between the feature and persons significant in local or regional history. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-510H consists of a concrete foundation that is missing its superstructure. The feature is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

The site is made up of a single foundation. A boulder with a 5-inch diameter drilled hole lies roughly 100 feet east-southeast of the foundation, but it is temporally non-diagnostic and its association with the resource remains uncertain. The site does not contain materials that might be used to address important research questions regarding ranching and agriculture, transportation, or other potential research themes. Thus, the site is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-510H is in poor condition; it is largely subsumed by vegetation and the concrete that forms the foundation is crumbling. Although the resource retains integrity of location, the equipment and/or superstructure that once made up a part of the site has been removed, thus affecting its integrity of design, materials, and workmanship. Its integrity of setting, feeling, and association has presumably been diminished by the construction of the reservoir and dam and, possibly, by the re-routing of SR 152. Overall, the integrity of CA-MER-510H is fair to poor. CA-MER-510H is recommended not eligible for listing in the NRHP/CRHR.

In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-510H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-511H
P-24-002156
PL-SLLPIP-16-03

Determined Not Eligible for Listing in the NRHP

Recommended Not Eligible for Listing in the CRHR

Site Description

CA-MER-511H is an apparent historic period livestock corral and watering location. It consists of a large, welded water tank set atop railroad tie supports situated within a corral that features a loading chute, a livestock access gate, fencing, and two circular metal water troughs. The corral fencing is portable and constructed of a variety of materials including metal piping, barbed wire, 4-x-4 wooden posts, remnant telephone poles, and other wooden posts. The welded water tank is set atop railroad tie supports for stabilization and constructed in three sections. The tank measures 17 feet in length and stands 6 feet high. The livestock-loading chute is positioned at the far northwestern corner of the corral. The livestock access gate is situated along the northeastern side of the corral and is constructed from metal piping and sheet metal. The “W” ranch brand or logo was cut into areas of the metal gate and on the corral fencing adjacent to the gate but could not be identified as a current

Appendix B, Figure B-4

Construction of Dam Raise (Borrow Area 6 - South of O'Neill Forebay)

California brand (CDFA 2010). One metal water trough lies within the corral; it is circular with a wood-framed float protector. An upside-down circular metal water trough lies outside and to the west of the corral. Most of the components that make up CA-MER-511H are portable and could be reconfigured.

CA-MER-511H is located 0.36 miles to the south of the O'Neill Forebay and 0.26 miles north of the current alignment of SR 152. It lies just south of a northwest-southeast oriented transmission line and north of a road and a second transmission line. A gated access road to the north extends to the east from the main road around O'Neill Forebay. The site area is fully exposed, relatively flat, and densely covered by knee-high grasses, mustard weed, vinegar weed, and sticky tar weed that limit ground surface visibility.

Archival Research Summary

CA-MER-511H is located in Township 10 South, Range 9 East in the southeast quarter of Section 13. An 1879 GLO plat map depicts the Butterfield Overland Mail route and a telegraph line crossing the northwest quarter of Section 13 but depicts nothing in the resource location (BLM 2016). The 1920 Pacheco Pass 15-minute USGS topographic map shows the original alignment of SR 152 through the northwest quarter of Section 13 (USGS 1920). The 1940 Pacheco Pass 15-minute USGS topographic map shows that SR 152 had been rerouted to the southern edge of Section 13 and that one cluster of four buildings and another cluster of two buildings had been built in the northeast quarter of Section 13 (USGS 1940a). The 1953 San Luis Creek 7.5-minute USGS topographic map shows two wells and a windmill in the northeast quarter and a northwest-southeast trending utility line (USGS 1953). The 1969 San Luis Dam 7.5-minute USGS topographic map portrays the O'Neill Forebay to the north as well as an east-west trending utility line that follows SR 152. It also depicts a paired utility line immediately north of the resource that trends northwest-southeast and does not follow the alignment depicted on the 1953 map (USGS 1972). A 1946 aerial photograph shows the structures in the northeast quarter of Section 13, but no features are discernible in the area surrounding CA-MER-511H. A 1940 General Highway Map of Merced County depicts houses in the southwest, southeast, and northwest quarters of Section 13, and it is possible that the livestock complex is associated with the house in the southeast quarter.

The Final EIS/EIR for the San Luis Reservoir State Recreation Area mentions recent use of the resource area:

> March 19, 1996, Concession Contract, Cattle Grazing. Located at San Luis Reservoir State Recreation Area, Medeiros Area in Merced County. This is a legal contract between the State and Chet Vogt, granting Mr. Vogt the right, privilege, and duty to graze cattle on an approximately 1,000-acre tract of the Medeiros Area located south of O'Neill Forebay, for the period of 8

months. Attached to the contract is a CEQA project evaluation (Reclamation 2013: Appendix A: A-19).

The 1940 U.S. Census noted that George Vogt, a farmer, lived north of Merced in Merced County (United States Census Bureau 1940). Although the connection is tenuous and not traceable through land patent records, it is possible that the Vogts have had ties to the area since the historic period, perhaps as lease holders and/or landowners. Ultimately, CA-MER-511H could not be tied to any specific individuals or to a particular time period. The complex may be associated with ranching activities that pre-date the reservoir's construction (ca. 1940s-1950s) or it may be associated with San Luis Reservoir Recreation Area grazing leases (Reclamation 2013: Appendix A-19).

NRHP/CRHR Evaluation

CA-MER-511H is a livestock complex that includes a water tank, a corral with a loading chute, a livestock access gate, fencing, and two circular metal water troughs that potentially date to the historic period. The site is evaluated under the historic context of *Ranching and Agriculture* in the American Period (*see* Section 3.3.3). Based historic period maps, land patent records, county history data, and chronological markers from the site's features, the site may have been constructed between 1919 and 1940, remaining in use into the late 20th century. The site post-dates the height of Central Valley ranching (the late 19th century through the 1920s). CA-MER-511H does not appear to have been associated with events significant in local or regional history and is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-511H may be associated with Chet Vogt and/or with George Vogt, though no clear link could be established between the site and any individual from the historic period. The site is thus recommended not eligible for the NRHP/CRHR under Criterion B/2.

CA-MER-511H is made up of components that are commonly used to control and maintain livestock (i.e., a water tank, a corral, a loading chute, a livestock access gate, fencing, and metal water troughs). None of these components is structurally unique, nor do they exemplify distinctive characteristics of a type, period, or method of construction. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

The resource is made up mostly of moveable livestock control features that could be reconfigured as required. No portable artifacts were noted at CA-MER-511H, and it could not be linked to a particular time period. The site does not contain materials that might be used to address important research questions concerning *Ranching and Agriculture* in the American

Period (*see* Section 3.3.3). CA-MER-511H is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-511H is in fair condition. The resource's integrity of location is uncertain given the potential mobility of many of its components. Its potential mobility also diminishes its integrity of design and workmanship, which are diminished by uncertainties regarding what features might be missing. Aspects of setting, association, and feeling may have been impacted by the construction of the dam and reservoir during the 1960s, or by the removal of the structures noted on historic period maps from the 1940s and 1950s (USGS 1940a, 1953). Overall, the resource possesses fair integrity. CA-MER-511H is recommended not eligible for listing in the NRHP/CRHR.

In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-511H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-512H
P-24-002157
PL-SLLPIP-16-05

Determined Not Eligible for Listing in the NRHP

Recommended Not Eligible for Listing in the CRHR

Appendix B, Figure B-4

Construction of Dam Raise (Potential Construction Staging Areas – Block East of B.F. Sisk Dam)

Description

CA-MER-512H is a control center and helicopter landing pad that spans a 2-acre area atop a cut and leveled hill 0.65 miles east of the B.F. Sisk Dam and the San Luis Reservoir. Two well-developed asphalt roads provide access to the resource area from Basalt Road, which lies 300 feet to the southwest. The top of the hill that makes up the resource area was cut and leveled for the concrete landing pad and the spoils were used to expand its dimensions. Several features were identified at CA-MER-512H including two circular concrete equipment pads (Features 1 and 2), a white-painted boulder (Feature 3), two reflector posts (Features 4 and 5), two white lines painted on a portion of the landing pad (Feature 6), and an underground telecommunications/radio terminal (Feature 7).

Features 1 and 2 measure approximately 8 to 9 feet in diameter and rest at ground level. One pad has four metal pipe-lined holes in a triangular configuration with one hole in the center; the other pad has only three holes. The holes are situated in the center 12 inches of each pad and are threaded with 0.5-inch diameter pipe that likely served as attachments to equipment or former superstructures. Feature 3, the white-painted boulder, rests on the south side of the pad just west of an access road and may not be *in-situ*. It was likely used as a reflector for safety purposes. Features 4 and 5 are metal posts with orange reflectors located in the western portion of the resource area near the perimeter of the pad. The posts are vertical pipes that stand approximately 2 feet high with protruding wires that are inserted in a 1-foot diameter circular concrete post support. Feature 7, the telecommunications/radio terminal, lies within in the far western portion of the site. It consists of an upright post with wires and cables that extend underground. The only other cultural constituents noted at CA-MER-512H include two downed and cut wood distribution line poles that likely post-date the construction and use of the landing pad.

CA-MER-512H lies within an oak woodland vegetation community with sparsely scattered oaks. The site is in poor condition with much of the concrete landing pad eroded or no longer present. The immediate area is fully exposed and dominated by tall grasses and mustard weed that cover much of the landing pad. Features 1 and 2 lack any superstructure and the remaining features appear to be broken, dismantled, heavily eroded, or displaced.

Archival Research Summary

CA-MER-512H is located in Township 10 South, Range 8 East in the unsectioned San Luis Gonzaga Land Grant. The San Luis Gonzaga Land Grant, which included much of Township 10 South, was patented to Juan Pérez Pacheco (Doc # PLC 234, BLM # CACAAA 094227) on May 16, 1871 (BLM 2016). An 1879 GLO plat map depicts the area outside of the land grant but does not show the area encompassing CA-MER-512H.

The 1940 Pacheco Pass 15-minute USGS topographic map and a 1946 aerial photograph do not depict CA-MER-512H but do portray the rise on which the helicopter landing pad would be built (USGS 1940a, Fairchild Aerial Surveys 1946). The 1950[4] San Luis Creek 7.5-minute USGS topographic map and a 1957 aerial view of the site show the headquarters of nearby San Luis Ranch but do not show the helicopter landing pad or the roads leading to it (USGS 1950, USDA-CSS 1957). The site first appears on the 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969a). Land grant and historic period map data offer no evidence of development within the resource area prior to the establishment of the helicopter landing pad.

An account of the groundbreaking ceremony for the B.F. Sisk Dam, which was captured in a 1962 film clip (YouTube 2016), may mention the resource area:

> The still morning of August 18, 1962 grew warm as the sun rose over 15,000 people driving the two-lane Pacheco Pass Highway leading to the site of the San Luis Dam. They gathered to view President John F. Kennedy as he presided over the dam's groundbreaking ceremonies, and at 11:30a.m., the presidential helicopter landed near the 100-foot-long speakers' platform (Autobee 1996).

[4] The 1950 San Luis Creek 7.5-minute USGS topographic map was based on 1950 aerial photographs and was field checked in 1953.

The California Department of Water Resources (1974: 276) noted that the B.F. Sisk Dam, initially called the San Luis Dam, was constructed in 1963-1967. The "General Plan and Sections of San Luis Dam and O'Neill Forebay" show a "helicopter pad" cut into the hilltop at the site location. The plan does not show the helicopter landing pad's date of construction, but it almost certainly dates to the early 1960s period of dam construction and pre-dates the August 1962 groundbreaking ceremony (California Department of Water Resources 1974: 278).

NRHP/CRHR Evaluation
CA-MER-512H is a historic period helicopter landing pad and control center that includes two circular concrete equipment pads (Features 1 and 2), a white-painted boulder (Feature 3), two reflector posts (Features 4 and 5), two white lines painted on a portion of the landing pad (Feature 6), and an underground telecommunications/radio terminal (Feature 7). Historic period maps indicate that the site was built after 1957 and before 1967, though it was likely constructed shortly before the 1962 groundbreaking ceremony or during the 1963-1967 period of dam construction (California Department of Water Resources 1974: 276).

On August 18, 1962, John F. Kennedy arrived by helicopter for the San Luis Dam groundbreaking ceremony. After comparing film footage of the event and current inventory survey photographs, it remains unclear whether CA-MER-512H marks the location of the President's arrival or of any other groundbreaking event (YouTube 2016). The B.F. Sisk Dam has been recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for its contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). No definitive link could be made between CA-MER-512H and the 1962 groundbreaking ceremony, however, which was one of many commemorative events associated with CVP and SWP history. Any role CA-MER-512H may have played in the dam's construction or commemoration remains unclear. CA-MER-512H is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

Although CA-MER-512H lay within the San Luis Gonzaga Land Grant conferred to Juan Pérez Pacheco (Doc # PLC 234, BLM # CACAAA 094227) (BLM 2016), there is no evidence that the resource area was used or developed during the rancho period. CA-MER-512H may have been associated with President John F. Kennedy's 1962 groundbreaking ceremony for the B.F. Sisk Dam. If it was associated, its connection to the president's visit was tenuous and transitory, thus insufficient to render the site eligible for listing in the NRHP/CRHR under Criterion B/2. No other potential connection between CA-MER-512H and one or more people significant in local, state, or national history could be established. CA-

MER-512H is thus recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

The site consists of a control center and helicopter landing pad on a leveled hilltop with seven internal features. CA-MER-512H does not display distinctive characteristics of a type, period, or method of construction or represent the work of a master engineer. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-512H has no associated artifact deposit and consists only of two concrete equipment pads, a white-painted boulder, two reflector posts, two white painted landing pad lines, and an underground telecommunications/radio terminal. Based on its extant features and the lack of any associated artifact deposit, the site does not offer sufficient data potential to contribute to our understanding of dam and reservoir construction, transportation systems, or other potential research themes. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The resource retains integrity of location, setting, feeling, and association. Its integrity of design, materials, and workmanship have been somewhat diminished by the lack of superstructures at two of the site's features and by the condition of the site as a whole (e.g., its features have been mostly broken, dismantled, heavily eroded, or displaced).

Overall, the integrity of the site is fair. CA-MER-512H is recommended not eligible for listing in the NRHP/CRHR. In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-512H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-513H
P-24-002158
PL-SLLPIP-16-06

Determined Not Eligible for Listing in the NRHP

Recommended Not Eligible for Listing in the CRHR

Description

CA-MER-513H is a historic period road segment situated on a low berm. The two-lane segment is located east of the B.F. Sisk Dam, trends east-southeast from the 1940s-era alignment of SR 152, and lies just 210 feet to the south of the modern SR 152 alignment. Most of the road segment is asphalt-paved with a white-painted centerline, though an unpaved portion of the road trends to the northwest. The entire road segment measures approximately 300 feet in length and 30 feet in width. The underlying berm measures 50 feet in width and stands roughly 4.5 feet above the ground surface and slightly higher than the 1940s-era SR 152 alignment. No historic period structures or features were noted in association with the road, which has largely become overgrown with dense grasses and mustard weed. A portion of a metal Ford emblem was noted in association with the resource and likely dates to the 1960s.

Appendix B, Figure B-4

Construction of Dam Raise (Potential Construction Staging Areas – Block East of B.F. Sisk Dam)

CA-MER-513H is located on a broad, relatively level (1-2°) plain immediately south of Gonzaga Road and east of Basalt Road. A large engineered drainage lies immediately south of the resource. CA-MER-513H is fully exposed, though dense vegetation greatly impedes ground surface visibility.

Archival Research Summary
CA-MER-513H is located in Township 10 South, Range 8 East in the unsectioned San Luis Gonzaga Land Grant just west of Section 13. The land grant was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts the Butterfield Overland Mail route and a telegraph line within the northwest quarter of Section 13 but does not depict the CA-MER-513H road segment. The 1920 Pacheco Pass 15-minute USGS topographic map does not depict the resource (USGS 1920), though it does show the original alignment of SR 152 through the northern half of Section 13. The 1940 Pacheco Pass 15-minute USGS topographic map also does not portray the resource (USGS 1940a), though it does show that SR 152 had by then been rerouted along the southern edge of Section 13. The 1953 San Luis Creek and 1969 San Luis Dam 7.5-minute USGS topographic maps show the 1940s-era alignment of SR 152, now Gonzaga Road, which appears to pass immediately north of the resource (USGS 1953, 1969), though CA-MER-513H itself is not depicted.

The 1940 General Highway Map of Merced County shows a house to the west of the southwest quarter of Section 13 and north of the recorded road segment but does not depict a road to the south of the 1940s-era alignment of SR 152 (DPW-DH 1940). A 1946 aerial photograph, however, shows what may be a small structure at the approximate location of the resource (Fairchild Aerial Surveys 1946). CA-MER-513H may thus represent a turnout for some sort of service structure or roadside feature that no longer remains extant.

NRHP/CRHR Evaluation
CA-MER-513H comprises a short road segment that was likely constructed prior to 1946 and may have been associated with the 1940s-era alignment of SR 152. The resource is evaluated under the historic context of *Transportation Development* in the American Period (*see* Section 3.3.3). Historic period map evidence for CA-MER-513H was inconclusive, though a 1946 aerial photograph indicates that the resources may have been associated with a small structure just south of the 1940s-era alignment of SR 152 (Fairchild Aerial Surveys 1946). Ultimately, the resource could not be clearly linked to any extant structure or feature and thus could not be tied to a specific function or period. As a remnant road segment with no clear ties to significant historic period events or trends, CA-MER-513H is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-513H could not be linked to any individual or group of individuals, historically significant or otherwise. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

Although it may have been associated with the 1940s-era alignment of SR 152 and possibly with a former structure located south of the highway, CA-MER-513H could not be clearly linked to any extant buildings, structures, or sites within the vicinity. The road segment is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As an isolated road segment, there is little potential to encounter subsurface components or vertical stratigraphy along CA-MER-513H. Lacking any secure context or association, the resource offers little potential to address important research questions about *Transportation Development* in the American Period (*see* Section 3.3.3). Thus, CA-MER-513H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The overall condition of CA-MER-513H is poor, as the road segment has become almost wholly obscured by vegetation. It retains integrity location and materials, though vegetation growth has diminished its aspects of workmanship and materials. Integrity of design has been diminished by modern construction and development within the reservoir area, which also has affected its integrity of setting. Aspects of association and feeling have presumably been impacted by reservoir construction and the re-routing of the 1940s-era alignment of SR 152. The overall integrity of CA-MER-513H is thus poor to fair. CA-MER-513H is recommended not eligible for listing in the NRHP/CRHR.

In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-513H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-514H
P-24-002159
PL-SLLPIP-16-07

Description

CA-MER-514H is an excavated earthen ditch that measures approximately 0.98 miles in length, 5 to 6 feet in width at the top, 1 to 2 feet in width at the bottom, and varies from 2 to 4 feet in depth. The ditch originates in the southwest near a deeply entrenched drainage that is partially lined with concrete. The drainage and ditch are located adjacent to an access road associated with the B.F. Sisk Dam. The ditch head lies above the depth of the entrenched concrete ditch, which may indicate that this resource predates dam construction or that it serves as overflow for the larger

Determined Not Eligible for Listing in the NRHP Recommended Not Eligible for Listing in the CRHR

Appendix B, Figure B-4

Construction of Raise Dam (Potential Construction Staging Areas – Block East of B.F. Sisk Dam)

concrete channel. The ditch trends to the northeast and terminates roughly 900 feet southwest of the modern alignment of SR 152.

CA-MER-514H loosely parallels Basalt Road to the east. It passes through a broad, gently sloping (1-2°) open flat dominated by dense, low grasses that limit ground surface visibility. The B.F. Sisk Dam is located roughly 800 feet to the southwest of the southern end of the ditch. A historic period road segment (CA-MER-513H) is located 760 feet to the east of the northern end of the ditch.

Archival Research Summary

CA-MER-514H is located in Township 10 South, Range 8 East in the unsectioned San Luis Gonzaga Land Grant. Section 24 is located to the east, and Section 13 is located to the northeast. The resource area was patented on May 16, 1871 to Juan Pérez Pacheco (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts only the area not covered by the land grant. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho as well as two alternate stage routes but does not depict the earthen ditch (BLM 2016). The 1920 Pacheco Pass 15-minute USGS topographic map shows the original alignment of SR 152 through the north of Section 13 while the 1940 Pacheco Pass 15-minute USGS topographic map shows that SR 152 had been rerouted to the southern edge of Section 13 (USGS 1920, 1940a). Neither map depicts the earthen ditch. The 1953 San Luis Creek and the 1969 San Luis Dam 7.5-minute USGS topographic maps show the 1940s-era and modern alignments of SR 152 respectively, but neither depict CA-MER-514H (USGS 1953, 1969). An aerial photograph from 1946 shows what appears to be the ditch to the south of SR 152 and south-southeast of the San Luis Ranch headquarters, so it appears that the resource was present by that time (Fairchild Aerial Surveys, Inc. 1946).

The San Luis Gonzaga Rancho was a Mexican land grant given in 1843 to Juan Pérez Pacheco and José Maria Mejía. The grant was bounded by the San Joaquin River to the east; Los Banos Creek to the south; and *Rancho Ausaymas y San Felipe* to the west, which was held by Juan Pacheco's father Francisco Pérez Pacheco (Beck and Haase 1974). When Juan Pacheco died in 1855, the property reverted to his father Francisco. Francisco died in 1860. His property, including the San Luis Gonzaga Rancho and half of *Rancho Ausaymas y San Felipe*, passed to his only surviving child Ysidora after Francisco's wife died in 1892. Ysidora married Mariano Malarin in 1850 and had two daughters. One married Dr. Ramon Roca while the other married Dr. Luis Fatjo. The Fatjos and their children inherited the Merced portion of San Luis Gonzaga Rancho (Hoover et al. 1999: 200). In 1949, Paula Fatjo, the great-great granddaughter of Francisco Pérez Pacheco, moved to the rancho and remodeled the original 1843 adobe that once stood on the property (Pierce 1977: 107). San Luis Gonzaga was an operating cattle ranch during Paula Fatjo's time, though she also bred and boarded Arabian horses (Pierce 1977: 107-111). If the earthen ditch was present by 1946, it may or may not have been used by Fatjo.

NRHP/CRHR Evaluation

CA-MER-514H is a historic period earthen ditch with no associated artifacts that appears to have been constructed sometime prior to 1946 (Fairchild Aerial Surveys, Inc. 1946). The purpose of the ditch remains unknown, and its possible association with other historic period features or activities remains unclear. It may have been used for agricultural or ranching activities, but it cannot be securely linked to a particular historic context. CA-MER-514H does not appear to have been associated with events significant in local or regional history and is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No association between CA-MER-514H and any individuals was revealed through archival research, so no link could be established between the feature and one or more persons significant in local or regional history. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-514H consists of an earthen ditch with no associated artifacts, features, or structures. The ditch is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. CA-MER-514H is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-514H contains no artifacts or materials that might be used to link the resource to a particular time period. It lacks the data potential to address important research questions regarding early farming or ranching activities, water conveyance, or other potential research themes. The resource is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-514H remains in fair condition. It retains integrity of location, materials, and workmanship. Aspects of design, association, and feeling are diminished because no clear functional or temporal context could be established for the resource. As it appears to predate 1946, reservoir and dam construction have likely impacted the resource's integrity of setting. Overall, the integrity of CA-MER-514H is fair to poor. CA-MER-514H is recommended not eligible for listing in the NRHP/CRHR.

In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-514H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-520H
P-24-002165
PL-SLLPIP-16-14

Determined Not Eligible for Listing in the NRHP

Recommended Not Eligible for Listing in the CRHR

Appendix B, Figures B-4 and B-6

Construction of Dam Raise (Downstream Stability Berms/Fill Impact Areas; Potential Construction Staging Areas)

Description

CA-MER-520H consists of 38 historic period survey markers, elevation markers, control points, or observation wells that are associated with the construction, use, and maintenance of the B.F. Sisk Dam. The markers and control points include 15 stamped brass caps set in concrete pads, two 1.5-foot tall concrete markers, and four 5-foot tall concrete obelisks. Some of the markers are surrounded by piled rocks or are painted silver, presumably to aid identification and/or to offer protection from disturbance. One marker is noteworthy because the surrounding concrete pad features inscribed names, dates (1966), handprints, a child's footprint, and a stylized drawing. The 15 brass markers are stamped with "US Department of the Interior" and below that "Bureau of Reclamation" with an elevation in feet amsl. There are also 17 observation wells that consist of metal or plastic tubes that extend from the ground surface with associated marker signs; they are used to monitor ground water levels and potential dam seepage.

All of the markers and observation wells that make up CA-MER-520H are located on the eastern side of the San Luis Reservoir, and all but two are located to the east of the B.F. Sisk Dam. Thirty-six of the survey markers or observation wells are positioned between a point roughly 0.6 miles north of the Gianelli Pumping Station and below SR 152. They extend south to near the southern edge of the dam. From west to east, they are positioned between the dam and the eastern edge of the San Luis Gonzaga land grant. Two 5-foot tall concrete obelisks lie outside of that area. One is positioned near the 697-foot elevation point on a promontory 0.9 miles southwest of the dam while another is positioned near the top of Basalt Hill. The condition of these survey markers and observation wells varies. Some have fallen into disuse while others appear to be actively maintained.

The setting for these markers and observation wells differs greatly. Some, including those adjacent to the B.F. Sisk Dam, lie within heavily modified environments while others lie within undisturbed areas featuring dense, high grasses and shrubs. The survey markers likely served as benchmarks for the survey and construction of the B.F. Sisk Dam and its appurtenant features. The 5-foot tall concrete obelisks may have acted as major control points while the other markers may have fulfilled more localized survey or construction needs.

Archival Research Summary

The California Department of Water Resources (1974: 276) noted that the B.F. Sisk Dam, formerly the San Luis Dam, was constructed between 1963 and 1967. The isolated survey markers, elevation markers, control points, and observation wells that make up CA-MER-520H were likely established shortly before to shortly after that period. The site features occur in Township 10 South, Range 8 East in the unsectioned San Luis Gonzaga Land Grant and in Section 34. The 5-foot tall concrete obelisks occur near USGS elevation benchmark locations, but do not precisely correspond to them. They and the other concrete markers are not depicted on USGS topographic maps (USGS 1920, 1940a, 1969), nor do they appear on a 1957 aerial view of the vicinity (USDA-CSS 1957).

NRHP/CRHR Evaluation

CA-MER-520H comprises a series of historic period survey markers, elevation markers, control points, and observation wells that were likely set in place prior to or shortly after the 1963 to 1967 construction period for the B.F. Sisk Dam (California Department of Water Resources 1974: 276). The dam and its associated structures have been recommended eligible for listing in the NRHP and the CRHR under Criterion A/1 as a historic district significant in the development of the CVP and SWP and important to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley. CA-MER-520H would have been used for surveying and engineering in support of the dam's construction, while the observation wells have been used to measure seepage as a part of dam monitoring and maintenance. Though important in practical terms, these features played a minor role in the overall development of the B.F. Sisk Dam system. CA-MER-512H is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No connection between CA-MER-520H and one or more people significant in local, state, or national history could be established. CA-MER-520H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-520H consists of a series of isolated features that do not display distinctive characteristics of a type, period, or method of construction, nor do they represent the work of a master engineer. CA-MER-520H is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-520H is made up of survey markers, elevation markers, control points, and observation wells that lack associated artifacts or deposits. They do not offer sufficient data potential, either individually or collectively, to contribute to our understanding of water conveyance systems, dam and reservoir construction, or other potential research themes. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The individual elements of CA-MER-520H retain integrity of location, setting, feeling, association, materials, and workmanship. Their integrity of design, however, may have been somewhat diminished because it is unclear how some markers were used or how they may have been configured when they were first put in place. Overall, CA-MER-520H possesses good integrity. CA-MER-520H is commended not eligible for listing in the NRHP/CRHR.

In support of NHPA Section 106 Consultation for the B.F. Sisk Dam Corrective Action Study Geotechnical Investigations, Merced County, California (Project # 18-SCA0-002.00 I), the SHPO concurred that CA-MER-520H is not eligible for listing in the NRHP (Polanco 2018).

CA-MER-521H
P-24-002173
SLTP-B-11

Determined Not Eligible for Listing in the NRHP

Recommended Not Eligible for Listing in the CRHR

Appendix A, Figure A-4
Appendix B, Figure B-4

Construction of Dam Raise (Borrow Area 6 - South of O'Neill Forebay)

Description

CA-MER-521H is a historic period livestock watering locale that consists of an elevated, cylindrical water tank and a circular trough. Pacific Legacy personnel first recorded the site in 2013 during the Western Area Power Administration's San Luis Transmission Line Project (Holm et al. 2014). The final archaeological survey report for the project remains pending submission to the CCIC by Western. When the site was revisited in 2016, it was found to be unchanged and its features remained intact.

The elevated arc-welded, ferrous metal water tank sits on a railroad tie platform enclosed by an electric fence (Feature 1). It measures 6 feet in diameter and 17 feet in length. The circular trough (Feature 2) is made of corrugated metal with railroad tie and milled lumber supports. It measures 9 feet in diameter, stands 2 feet high, and rests on 52-inch high supports. No artifacts or other materials were observed in association with the site, which encompasses an area measuring 79 feet east-west by 66 feet north-south. CA-MER-521H is located roughly 0.5 miles to the southeast of the San Luis Reservoir on a flat floodplain that is dominated by dry seasonal grasses and mustard weed. It is located at an elevation of 259 feet amsl and is fully exposed.

Archival Research Summary

CA-MER-521H lies within Section 18 of Township 10 South, Range 9 East. An 1855 GLO plat map of Section 18 depicted no structures or cultural features within the site vicinity (BLM 2016). Records indicate that on May 20, 1869, B. Bryant obtained a land patent for Sections 18, 24, 10, and 14 through cash entry (Doc #3279, #CACAAA 097971). A later 1888 GLO plat map depicts a road trending north from Section 19 through the south-central portion of Section 18 before terminating near the center of the section. The north-south road was labeled "the Road from D[???'s] San Luis and Stockton" and passed through an area that is today dominated by the Los Banos Substation (BLM 2016). The northwest corner of Section 18 was labeled as "the old sec. corner at corner of Miller and Lux's fence" (BLM 2016). An agricultural field lay at the center of the southern Section 18 line and was crossed by the road. The closest structure to CA-MER-521H depicted on the 1888 GLO plat map was described as "J. Alamanie's house," which was in the northwest corner of Section 19, roughly 1 mile to the southwest of CA-MER-521H (BLM 2016). Section 18 appears to have been used as an agricultural or ranch property in the 1870s to at least 1890, but it remains unclear if the property was associated with B. Bryant, J.

Alamainie, or with the landholdings of Miller and Lux (*see* Section 3.3.3). Well records dating to 1916 revealed wells in Sections 1 and 24, but none were recorded in Section 18 (Mendenhall et al. 1916: Table 45; Davis et al. 1959).

The 1920 Pacheco Pass and 1922 San Luis Creek USGS 15-minute topographic maps show no buildings, structures, or access roads within the vicinity of CA-MER-521H (USGS 1920, 1922a). The 1940 Pacheco Pass USGS 15-minute topographic map shows no roads leading to the site area but does depict two structure complexes located approximately 0.5 miles to the northwest and southeast of CA-MER-521H. A utility line appeared along the southern border of Section 18 by 1939 (USGS 1940a). The 1953 San Luis Creek USGS 7.5-minute topographic shows no developments in Section 18, though it does depict several wells and windmills in the surrounding sections (USGS 1953).

The 1925 *History of Merced County* did not mention B. Bradley, who was noted in 1869 land patent records in association with Section 18, though it did mention that "Sadie Bradley was born at Mustang, Merced County" to William T. and Frances Bradley (Outcalt 1925: 650). In the 1900 U.S. Census, William T. Bradley was listed as a farmer in Newman Township, Merced County (U.S. Census Bureau 1900b). By 1906, voter records showed that the Bradleys resided in Ingomar where William T. Bradley ran a general store and served as postmaster (Merced County 1906). No clear association between the Bradley family and Section 18 or the CA-MER-521H vicinity could be established for the early to mid-20th century period when the water tank and trough were likely constructed, however, nor could the site be clearly linked to the Miller and Lux operation or to any other specific landowner.

NRHP/CRHR Evaluation

CA-MER-521H appears to be a mid-20th century livestock watering locale. The site is evaluated under the historic context of Ranching and Agriculture in the American Period (see Section 3.3.3). Based on evidence derived from historic period maps, land patent records, a history of Merced County, and the site's material constituents, the site appears to post-date the height (the late 19th century through the 1920s) of Central Valley agricultural and ranching development. The livestock watering locale does not appear to have been associated with significant events in local or state history, thus the site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

Archival research did not identify the owners and operators of the ranch with which CA-MER-521H was associated. The property may have been associated with B. Bryant, J. Alamanie, Miller and Lux, or with another unidentified party. No firm association with any individual or individuals could be established. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-521H comprises features that are common to livestock watering locales (a water tank and a trough). The site's components are not structurally unique, and they do not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

The site is made up structural features and there is little potential to encounter a subsurface component. No artifacts were found in association with the site's features, and those features offer little potential to address important research questions about Technology or Economy within the context of Ranching and Agriculture in the American Period (see Section 3.3.3). Thus, the site is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-521H is in good condition despite the installation of an electric fence around the site. Although the construction of the San Luis Reservoir less than 0.5 miles to the northwest has likely diminished the site's integrity of feeling and association, it retains integrity of location, design, setting, materials, and workmanship and possesses good overall integrity. Despite its condition, CA-MER-521H is recommended not eligible for listing in the NRHP/CRHR. The SHPO concurred that CA-MER-521H is not eligible for listing in the NRHP on January 19, 2018 (Polanco 2018).

PL-SISK-01

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-4

Construction Dam Raise (Basalt Hill Borrow Area; Potential Construction Staging Area – West of Goosehead Point; Access Road Area)

Description

PL-Sisk-01 is a historic period graded, graveled dirt road that measures approximately 10,060 feet or 1.9 miles in total length and 22.5 feet in width. It is oriented generally northeast-southwest and connects the Basalt Hill Quarry (CA-MER-509H) to the south with the industrial riprap production site (CA-MER-492H) to the north. One segment of the road was recorded during the 2020 inventory survey. The segment is located to the south of the current Basalt Road and follows the terrain contours downslope from the quarry northward and maintains an approximate 2-4° sloped road grade. The road segment has a shallow 10-inch drainage ditch and 8-foot wide, 18-inch tall berm on the upslope side and a 3.5-foot wide, 1.5-foot tall berm along downslope sections. A segment of the road was recorded descending southwest towards the Basalt Hill Quarry (CA-MER-509H) from the recorded portion (Segment 1) of historic road CA-MER-494H. CA-MER-494H is a second access road to Basalt Hill Quarry that lies to the east of PL-Sisk-01 and intersects with it at the north end of the quarry near its rock separator feature.

PL-Sisk-01 is located above the reservoir's high waterline and passes through a non-native grassland area with no trees or shrubs. The PL-Sisk-01 road alignment slopes (2-4°) downward to the northeast and is fully exposed. It exhibits impacts from erosion, current road maintenance grading and vehicle use, and alteration of the road alignment at the north end intersection with Basalt Road from a Y-intersection to a T-intersection.

Archival Research Summary

PL-Sisk-01 is located in Township 10 South, Range 8 East in the northeast quarter of Section 33, the southeast quarter of Section 28, and the southwestern quarter of Section 27. The southern half of Section 27 and all of Section 33 were patented to the Southern Pacific Railroad Company on April 20, 1875 (Doc #4, BLM# CACAAA 093859) (BLM 2020a). No railroad was built through the section, which was likely sold to unidentified ranchers or other landholders. The area includes a natural spring in Section 33, and the land may have been used or leased for ranching or grazing.

The area of Section 28 that encompasses the road is within the southern half of the southeast quarter patented to the State of California in 1924 (BLM# CACAAA 003258 01), and the northern half of the southeast quarter, patented to Antonio Lopez in 1892 (Doc #2241; BLM #CACAAA 096296) (BLM 2020b). Based on records for CA-MER-261H, the Lopez Homestead site, there is no physical connection between the historical homestead location and the PL-Sisk-01 road.

An 1860 GLO plat map shows the Butterfield Overland Mail route and a telegraph line roughly 2-3 miles northeast of PL-Sisk-01 as they crossed Sections 12 and 13 into Rancho San Luis Gonzaga lands, however no cultural features are depicted in Sections 27, 28, or 33 (BLM 2020c). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the road (USGS 1920, 1940). The 1953 San Luis Creek 15-minute USGS topographic map depicts an east-west road alignment across Sections 27 and 28 but it does not correspond to PL-Sisk-01 (USGS 1953). The 1969 San Luis Dam 7.5-minute USGS topographic map (USGS 1969) is the first map to depict the road alignment leading north from the Basalt Hill Quarry through Sections 33, 28, and 27. In Section 29 it connects to a road looping through industrial site CA-MER-492H. A 1957 aerial photograph of the quarry vicinity shows no sign of the road, though a 1964 aerial photograph clearly depicts the road segment (Cartwright and Co. 1957; Fairchild Aerial Surveys 1964). The road segment leads north from the Basalt Hill Quarry (CA-MER-509H).

Though the land patent information provided no historical information about the road, the historic period map and aerial photograph evidence indicates the road was built between 1957 and 1964. Those dates bracket 1963, the start of construction for the B.F. Sisk and O'Neill dams. The Basalt Hill Quarry supplied approximately 13.6 million cubic yards of basalt aggregate material for riprap and the construction of the B.F. Sisk and O'Neill dams, from 1963 to 1967 (Clinkenbeard 1999:7; California Department of Water Resources 1974:279). The road location connects the Basalt Hill Quarry (CA-MER-509H) and the riprap processing facility

(CA-MER-492H), which suggests the road was associated with dam construction. Clinkenbeard (1999:23) states that the Basalt Hill Quarry has been intermittently used since 1967 to supply repair materials for various SWP facilities. This suggests that the road has been used at least intermittently since it was first established.

NRHP/CRHR Evaluation
PL-Sisk-01 is a historic period road that was constructed between 1957 and 1964, likely in 1963. It appeared to serve as a link between the Basalt Hill Quarry (CA-MER-509H) to the southwest and the historic period riprap production site (CA-MER-492H) to the northeast via Basalt Road and on to the B.F. Sisk Dam area. It appears to have been established and primarily used to support the construction of the B.F. Sisk Dam and the San Luis Reservoir. It is evaluated under the historic contexts of *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3).

The B.F. Sisk Dam has been recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for its contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). As a feature within the B.F. Sisk Dam system, PL-Sisk-01 may be regarded as a contributing or non-contributing element under Criterion A/1. A connection to significant historic period events or trends however does not necessarily render a resource eligible for listing in the NRHP/CRHR. Rather, the role the resource played in those events or trends must be significant. There is no evidence to indicate that PL-Sisk-01 was the first or only road used in the construction of the B.F. Sisk Dam. In fact, road CA-MER-494H also connects the quarry with the dam construction area. PL-Sisk-01 was likely used to convey stone from the Basalt Hill Quarry (CA-MER-509H) to the riprap production facility (CA-MER-492H) and the dam construction site, but it does not contribute in a meaningful way to the importance of the B.F. Sisk Dam system as a component within the wider CVP and SWP. In the evaluation of the B.F. Sisk Dam/San Luis Reservoir Historic District, JRP (2018:27-28) determined that the transportation grid within the district was a non-contributing element of the district. PL-Sisk-01 is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1 either on an individual level or as a contributing element of the B.F. Sisk Dam/San Luis Reservoir Historic District.

There is no evidence indicating that PL-Sisk-01 was developed or used during the 19th century, and no evidence linking the resource to early settlers or ranchers in the vicinity. No connection between the resource and one or more people significant in local, state, or national history could be established. PL-Sisk-01 is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

PL-Sisk-01 is a graded dirt and gravel road. It is not structurally unique, and it does not exemplify distinctive characteristics of a type, period, or method of construction, nor does it represent the work of a master engineer. PL-Sisk-01 is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As a road segment, there is little potential to encounter a subsurface component or feature with vertical stratigraphy at PL-Sisk-01. The resource offers limited potential to address important research questions about *Transportation* and *Water Conveyance* in the American Period (*see* Section 3.3.3). PL-Sisk-01 is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

PL-Sisk-01 appears to have been actively maintained and has been used since the dam construction era. Overall, it remains in fair condition despite impacts from erosion, recent maintenance grading, and alteration of its intersection with Basalt Road from a Y-intersection to a T-intersection. The road segment retains integrity of location, design, materials, and workmanship. Physically and functionally it lacks integrity of association, feeling, and setting because the quarry location (CA-MER-509H) and riprap facility (CA-MER-492H) it once supported are no longer in operation and dam construction has been completed. Overall, PL-Sisk-01 retains fair integrity. PL-Sisk-01 is recommended not eligible for inclusion in the NRHP/CRHR.

7.4.2 SR 152 Modifications

Under the B.F. Sisk Dam Raise Alternative, fill embankment material would be added just southwest of SR 152 at PM R6.295 to protect the roadway, and the Cottonwood embankment and the portion of SR 152 that separates Cottonwood Bay and the San Luis Reservoir between PM R5.239 and PM R5.806 would be elevated 10 feet to accommodate an increase in the surface elevation of the reservoir. The boundaries of the B.F. Sisk Dam/San Luis Reservoir Historic District encompass the embankment and the full extents of Cottonwood Bay and the San Luis Reservoir. The Cottonwood embankment is not individually eligible for listing in the NRHP or CRHR but is regarded as an appurtenant feature of the San Luis Reservoir, a key contributor to the NRHP/CRHR eligibility of the district. Similar to the elevation of the dam, the elevation of the Cottonwood embankment is not expected to result in adverse effects to the B.F. Sisk Dam/San Luis Reservoir Historic District or any of its contributing elements (JRP 2018). The full extents of SR 152 have not been evaluated for listing in the NRHP/CRHR. The current highway alignment within the Project Area was built between 1963 and 1965 to bypass the San Luis Reservoir. It was converted from a two-lane to a four-lane highway between 1982 and 1992. No archaeological resources have been recorded near or along the Cottonwood embankment, and the potential to encounter such resources is extremely low, as the embankment comprises imported fill materials.

Cottonwood Embankment (PL-Sisk-04)

Description

The Cottonwood embankment, recorded during the 2020 inventory survey under the temporary designation PL-Sisk-04, is a historic period compacted-fill earthwork embankment that separates Cottonwood Bay

Feature of the B.F. Sisk Dam/San Luis Reservoir Historic District

Recommended as a contributing feature of the B.F. Sisk Dam/San Luis Reservoir Historic District

Appendix B, Figure B-1

SR 152 Modifications (Cottonwood Bay and San Luis Reservoir)

from the San Luis Reservoir and supports SR 152 as it crosses the north side of the reservoir. Cottonwood Bay collects water from the upstream Cottonwood Creek drainage and discharges it into the reservoir. The Cottonwood embankment measures approximately 2,000 feet long (WSW-ENE), 650 feet wide at the base, and 125 feet high at its maximum point. At the center of the base is an arched concrete culvert that allows water from Cottonwood Bay to drain into the San Luis Reservoir. The embankment was constructed between 1963 and 1965 as part of the larger project to relocate 12 miles of SR 152 from the San Luis Flat, which was inundated to form the San Luis Reservoir. The road relocation was both a California Division of Highways project and the first necessary phase associated with and preceding the construction of the B.F. Sisk Dam and San Luis Reservoir. The associated B.F. Sisk Dam was constructed between 1963 and 1967, creating the San Luis Reservoir and providing off-stream water storage and hydroelectric power generation for California's Central Valley. The B.F. Sisk Dam and San Luis Reservoir are both key contributing elements of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018). The PL-Sisk-04 embankment, which crosses and constrains the Cottonwood Bay portion of the San Luis Reservoir, is a feature of the San Luis Reservoir and therefore is an element of the historic district. The embankment was not specifically recorded or evaluated as a contributing or non-contributing element of the historic district in 2018, though it must be regarded and assessed as an element within the larger dam system.

PL-Sisk-04 is in good condition with few visible impacts. The access road to the east side of PL-Sisk-04 is well maintained. The only observable impacts to the embankment include vegetation growth between the rock riprap and the highway roadbed, and some erosion along the bay edge near the east end of the embankment. Vegetation includes seasonal grasses and bushes.

Archival Research Summary

PL-Sisk-04 is located in Township 9 South, Range 8 East in the southern half of the southeast quarter of Section 31. The 1920 Pacheco Pass 15-minute USGS topographic map shows that the current access road, Red Mountain Road, was present as "Cottonwood Grade" but does not show the embankment or Pacheco Pass Road in that location (USGS 1920). Historically, Pacheco Pass Road crossed San Luis Flat to the south, connecting San Luis Ranch with Gilroy and Los Banos (USGS 1920, 1940). The PL-Sisk-04 embankment and the rerouted Pacheco Pass highway (SR 152) first appear on the 1966 California State Highway Map and on a 1971 photo-revision of the 1955 Pacheco Pass 7.5-minute USGS topographic map (Division of Highways 1966; USGS 1955 PR1971).

The Cottonwood embankment was built between 1963 and 1965, concurrently with the beginning of construction on the B.F. Sisk Dam. Construction of the embankment was undertaken to allow SR 152 to be relocated from the San Luis Flat, which was to be inundated to form the San Luis Reservoir. As reported in *California Highways and Public Works*, the contemporary journal of the California Division of Highways, the project to construct both the Cottonwood embankment or "Cottonwood Fill," the "Big Fill," and to terrace the hills toward the western end of the rerouted road alignment lasted two years from bid to completion and cost $12 million (Kroeck 1963; Weaver 1965). The highway rerouting project was jointly financed by Reclamation, DWR, and the State Division of Highways as the first phase of building B.F. Sisk Dam and the San Luis Reservoir (Kroeck 1963:45). The overall SR 152 road project blasted, moved, and graded 11,400,000 cubic yards of local soil and rock to provide materials for at least fourteen fill areas, including the Cottonwood Fill and the Big Fill to the west to form a level roadbed across ridges and gulches (Kroeck 1963, Weaver 1965). The Cottonwood Fill used 2,000,000 cubic yards of fill over the top of an arched concrete culvert at the base of the PL-Sisk-04 embankment (Kroeck 1963; Weaver 1965:5). Plans for Cottonwood Fill were designed to account for periodic inundation by the reservoir to within 10 feet below the top of the embankment. The resulting embankment has a clay core with a 10-foot outer facing of rock to provide enough weight to prevent the embankment from sloughing (Kroeck 1963:47). The construction of the rerouted road segment was awarded to McNamara and Mannix, who completed the construction and opened two lanes of the four-lane roadway by January 1, 1965. The completion of the roadway coincided with work on the B.F. Sisk Dam, providing the new route for traffic so that the reservoir could be completed (Weaver 1965:2). The full four lanes of the 12-mile segment were open by 1966 (Division of Highways 1966).

The embankment and the overall reroute design were developed by Louis G. Kroeck, District Design Engineer, and the State Division of Highways in cooperation with DWR and Reclamation (Kroeck 1963:49). The California Division of Highways and Kroeck were awarded a bronze plaque and a scroll by the U.S. Congress for Highway 88, a scenic highway, on March 24, 1966 (California Highways and Public Works 1966:28-32).

The B.F. Sisk Dam was constructed between 1963 and 1967, creating the San Luis Reservoir and providing off-stream water storage and hydroelectric power generation for California's Central Valley. The B.F. Sisk Dam and San Luis Reservoir are contributing elements of the B.F. Sisk Dam/San Luis Reservoir Historic District. The PL-Sisk-04 embankment, which crosses and constrains the Cottonwood Bay portion of the San Luis Reservoir, is a feature of the reservoir and therefore an element of the historic district

NRHP/CRHR Evaluation

PL-Sisk-04 is a historic period embankment associated with the rerouting of SR 152 along the north of San Luis Reservoir that allows connectivity between Cottonwood Bay and the reservoir. The 12-mile highway reroute and the embankment across Cottonwood Bay, also referred to as the Cottonwood Fill, were constructed between 1963 and 1965 to support the construction of the B.F. Sisk Dam and the San Luis Reservoir. PL-Sisk-04, the Cottonwood embankment, is evaluated as a feature of the San Luis Reservoir and part of the larger dam and reservoir system under the historic context of *Water Conveyance* in the American Period (*see* Section 3.3.3) and following JRP's (2018) context for the B.F. Sisk Dam/San Luis Reservoir Historic District.

The B.F. Sisk Dam and its key features were recommended eligible for listing in the NRHP and CRHR under Criterion A/1 as a contributing element to the CVP and SWP and for their contribution to the expansion and sustainability of farmland and municipal and industrial development in the Central Valley (JRP 2018). As a feature within the B.F. Sisk Dam system, PL-Sisk-04 may be regarded as a contributing or non-contributing element under Criterion A/1. A connection to significant historic period events or trends is insufficient, in and of itself, to render a resource eligible for listing in the NRHP/CRHR under Criterion A/1. Rather, the role the resource played in those events or trends must be significant. The dam symbolizes the first and only state-federal collaboration in California water development to be conducted on such a large scale (Autobee 2011). SR 152 originally ran across the footprint of the future reservoir. The SR 152 rerouting was the first necessary step to support the construction of the B.F. Sisk Dam. The Cottonwood embankment was designed and built in a coordinated effort by the State Division of Highways, DWR, and Reclamation to simultaneously reroute the road segment over Cottonwood Creek, provide drainage from Cottonwood Creek into Cottonwood Bay, and provide access between Cottonwood Bay and the main portion of San Luis Reservoir. The PL-Sisk-04 feature was a crucial link between the bay and the reservoir. PL-Sisk-04 is thus regarded as a key feature of the reservoir, which is a contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion A/1.

The SR 152 construction design was developed by Louis G. Kroeck and the Division of Highways in cooperation with Reclamation and DWR. Although Kroeck and the Division of Highways won a Congressional award for a scenic highway (SR 88), their achievement was not connected to the SR 152 roadway segment or the larger B.F. Sisk Dam project. No direct connection between the resource and one or more individuals significant in local, state, or national history could be established. Although the dam is named for former U.S. Congressman Bernice Sisk, that association is commemorative and too tenuous to be regarded as significant under NRHP/CRHR Criterion B/2. PL-Sisk-04 is thus not recommended as a contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion B/2.

The Cottonwood embankment was one of two large fill areas requiring innovative engineering along the SR 152 reroute alignment and the one most closely linked with the San Luis Reservoir. The embankment required special engineering design to accommodate the stresses of both the road and periodic inundation by the reservoir, as well as necessary storm drainage from Cottonwood Creek (Kroeck 1963:46-47). The engineering solution included a clay materials core, a free draining outer core, and a protective 10-foot rock facing slope to prevent sloughing of the interior core of the embankment. The structural problems for embankment stability required a distinctive engineering design solution, but not one that is unique. Based on the structural engineering design of the Cottonwood embankment, and consistent with other engineered elements within the historic district, PL-Sisk-04 is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion C/3.

As a structural resource, there is little potential to encounter a subsurface cultural component or vertical stratigraphy at PL-Sisk-04, and no surface artifacts associated with the structure have been observed. Much of the research potential for the SR 152 reroute and PL-Sisk-04 embankment may be found through archival documents and historic period photographs rather than through the resource's physical elements. PL-Sisk-04 is recommended as a non-contributing element to the B.F. Sisk Dam system under NRHP/CRHR Criterion D/4.

PL-Sisk-04 is actively used and maintained as a support for SR 152 and as an access point between Cottonwood Bay and the San Luis Reservoir. It remains in good condition with few impacts from minor vegetation growth. The embankment retains integrity of location, design, and workmanship, as the highway and reservoir have not been substantially altered since completion. It retains integrity of setting and association, as the embankment is a direct and integral link between the bay and reservoir, and the associated dam is nearby. The overall integrity of PL-Sisk-04 is good. Although the B.F. Sisk Dam/San Luis Reservoir Historic District does not include the transportation grid as a contributing element, the PL-Sisk-04 embankment is both a support to the road alignment and a feature of the San Luis Reservoir itself (JRP 2018:27-28). As a feature of the reservoir with good integrity, PL-Sisk-04 is recommended as a contributing element to the NRHP/CRHR eligibility of the B.F. Sisk Dam system, recently defined as the B.F. Sisk Dam/San Luis Reservoir Historic District, under Criteria A/1 (JRP 2018).

7.4.3 Operation of Dam Raise

In addition to construction impacts and modifications to SR 152, implementation of the B.F. Sisk Dam Raise Alternative would result in operational impacts to cultural resources, specifically as maximum water levels are increased in the San Luis Reservoir and Cottonwood Bay. Seventeen archaeological sites or historic period built environment resources have been recorded along the San Luis Reservoir and Cottonwood Bay shorelines. These include nine prehistoric sites (CA-MER-15, CA-MER-28, CA-MER-82, CA-MER-83, and CA-MER-130, CA-MER-136, CA-MER-137, CA-MER-517, and PL-Sisk-05), most with midden, lithics, and groundstone; a series of historic period transmission poles with a debris scatter (CA-MER-484H); three historic period road segments (CA-MER-489H, CA-MER-519H, and P-24-001822); three earthen dams with impound ponds (CA-MER-515H, CA-MER-516H, and CA-MER-518H); and the Cottonwood embankment noted above. Of the nine prehistoric sites that have been recorded along the perimeters of the San Luis Reservoir and Cottonwood Bay, one (CA-MER-136) is listed in the NRHP and CRHR; one (CA-MER-130) has been listed in the NRHP and CRHR as a part of the San Luis Gonzaga Archaeological District (P-24-000489); and seven had not been evaluated for listing in the NRHP or CRHR (CA-MER-15, CA-MER-28, CA-MER-82, CA-MER-83, CA-MER-137, CA-MER-517, and PL-Sisk-05). These sites would be susceptible to mechanical and biochemical impacts from increased wave action and fluctuating water levels following expansion of the San Luis Reservoir and Cottonwood Bay.

The historic period transmission pole alignment and debris scatter (CA-MER-484H) located along the San Luis reservoir shoreline also would be susceptible to increased wave action and fluctuating water levels. Based on the nature of their construction, three historic period earthen dams with impound ponds (CA-MER-515H, CA-MER-516H, and CA-MER-518H) are unlikely to be impacted, but three historic period road segments (CA-MER-489H, CA-MER-519H, and P-24-001822) would be fully or partially inundated as the capacity of the San Luis Reservoir is increased. Survey-level evaluations of these resources are offered below, though resources that have already been determined eligible are not re-evaluated.

CA-MER-15
P-24-000116

Pending Evaluation for Listing in the NRHP/CRHR under Criteria A/1 and D/4

Appendix A, Figure A-3
Appendix B, Figure B-3

Operation of Dam Raise (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)

Description

CA-MER-15 is a prehistoric site that was first recorded by F.A. Riddell in 1962 as a “small village site among boulders and oaks” with a former quarry on the eastern side of the site area, “several areas cleared among boulders for homes,” several bedrock mortar features, and a lithic scatter (Riddell 1962b). It was later recorded that same year as a bedrock mortar site with numerous pestles, a lithic scatter with chert and obsidian and “a few arrowheads” (Gray-MacDonald 1962). A sketch map included with the later site record indicated that some surface artifacts were collected. In 1965, the site was again recorded by W.H. Olsen as a bedrock mortar, petroglyph and occupation site with “small rock shelters,” one house ring, a pitted boulder, a bowl mortar, “some chippage,” and a “broken fossil bone” (Olsen 1965g). None of the site records for CA-MER-15 from the 1960s include location or sketch maps drawn to scale, though Riddell’s map places the steep break of the hill some distance from the site, which is portrayed as a rocky outcrop among trees. A map of the site (author unknown) depicts some bedrock mortar measurements, a petroglyph, a pictograph, four living areas, and a midden area.

When CA-MER-15 was revisited during the 2016 inventory survey, a complex of 73 rock features (Features 1 through 73) with petroglyphs, bedrock mortars, cupules, and milling surfaces was noted in addition to midden soils, six cleared areas (C1 through C6), 36 flaked stone tools, and a lithic scatter with three loci (Loci A through C). As most recently recorded, the site spans an area measuring 97 meters N/S by 116 meters E/W. The 73 features are spread across 94 modified boulders. Twenty-three boulders have bedrock mortars only; 33 boulders feature cupules but no bedrock mortars, though five also feature petroglyphs; 29 boulders feature both bedrock mortars and cupules, two with petroglyphs also; and three boulders exhibit one or more milling surfaces, two with petroglyphs also. One boulder contains only petroglyphs, though five boulders with cupules, two boulders with cupules and bedrock mortars, and two boulders with one or milling surfaces also feature petroglyphs. In all, 11 of the boulders exhibit petroglyphs. One large prominent boulder features pecked lines, areas with crosshatch lines, rows of cupules, and a few individual cupules. The 73 features were recorded in the western portion of the site furthest from the San Luis Reservoir waterline.

The eastern portion of CA-MER-15 is dominated by the lithic scatter, cleared areas, and midden soils. The lithic scatter contains three loci, and roughly 50% of the debitage in each was counted and analyzed during inventory survey. Locus A, the southernmost of the three, is spatially associated with three of the cleared areas (CL3 through CL5) and features dark, sandy sediment that may represent eroded midden. The locus sits on two relatively flat, narrow, very rocky benches that are dotted by large boulders that liter the surrounding east-facing slope. Sixty-two pieces of debitage were noted in Locus A, including seven pieces of chalcedony as well as 23 pieces of heat-treated chert; the remaining debitage included white or off-white to red, orange, or brown chert, mostly shatter. One chert core fragment was recorded within the locus in addition to an area with ten small pieces of calcined mammal bone.

Locus B is located roughly 13.5 meters east of Locus C. At least 136 pieces of debitage were noted in the locus, which varied from Locus A in that it also contained purplish-red or blue and white cherts as well as a higher percentage of smaller interior percussion, complex, and bifacial thinning flakes. Several artifacts, including a vesicular basalt bowl fragment (Artifact 24), an obsidian biface fragment (Artifact 25), a unidirectional chalcedony core (Artifact 27), and a unifacial chalcedony scraper (Artifact 28) were found within or near the locus. Locus B rests on a moderately steep, east-facing slope studded with boulders and marked by light brown loamy sand with dense gravels and patches of darker brown soils that may represent redeposited midden or lacustrine sediment.

Locus C is located 24 meters north of Locus A. At least 61 pieces of debitage were noted within the locus, including chalcedony and various colors of chert. The locus is dominated by simple and complex interior percussion flakes followed by bifacial thinning flakes and relatively few pieces of shatter or primary and secondary flakes. Artifacts within the locus included a pestle fragment (Artifact 1), a complete portable milling slab (Artifact 15), a complete basalt handstone (Artifact 16), a complete rhyolite mortar (Artifact 32), a rhyolite handstone fragment (Artifact 33), a late-stage rhyolite biface margin (Artifact 34), and a piece of calcined, possibly polished small mammal bone (Artifact 35). Other calcined bone fragments were found throughout Locus C, and 75-100 pieces of debitage were observed outside of the three loci but were not analyzed.

The cleared areas at CA-MER-15 range in size from 10 meters N/S by 38 meters E/W (CL1) to just 5.5 meters N/S by 5 meters (E/W) (CL6). These areas correspond to flat areas within the site noted by Olsen in 1965 and the "living areas" plotted on another sketch map by an unknown author. The 36 tools include nine pestles, nine bowl mortars, five cores and/or hammerstones, four handstones, three portable milling slabs, one groundstone fragment, one portable mortar, two bifaces, one uniface, and one polished bone fragment. The nine pestles include three complete artifacts (Artifacts 19, 21, and 30) and five fragments (Artifacts 1, 2, 4, 7, 11, and 17); the nine bowl mortars are all fragmentary (Artifacts 3, 5, 8, 9, 10, 22, 24, 29, and 31) and include two (Artifacts 3 and 24) that have been repurposed with single mortars; there are five complete cores, core tools/hammerstones (Artifact 12, 18, 23, 26, and 27); four handstones, including two complete artifacts (Artifact 13 and 16) and two fragments (Artifacts 14 and 33); one complete portable milling slab (Artifact 36) as well as two fragmentary ones (Artifacts 15 and 20); one groundstone fragment (Artifact 6); one complete portable mortar on a small boulder (Artifact 32); two bifaces fragments (Artifacts 25 and 34); one uniface fragment (Artifact 28); and one polished bone fragment (Artifact 35). Many of these artifacts were found within and around the three loci. The pictographs that were plotted on one of the early site maps could not be relocated and may have been destroyed through inundation or reservoir level fluctuations.

CA-MER-15 is located on the west side of the San Luis Reservoir on an east-facing slope within an oak grassland vegetation community. Grasses, wild oats, star thistle, and cockleburs also mark the site area. Soils range brown to grayish-brown sandy loam to light-brown or medium-brown loamy sand with dense gravels overlain with sporadic patches of dark brown sediment. The dark brown sediment may represent redeposited midden or organic, lacustrine-based sediment. Large and small boulders and angular scree are scattered throughout the site area. Portions of the site sit on narrow, relatively flat, very rocky benches formed by reservoir wave action. The site features an eastern aspect, a slope of approximately 6-8°, and is fully exposed. Ground surface visibility ranges from approximately 40-75%.

NRHP/CRHR Evaluation

CA-MER-15 is an extensive site containing 73 features with petroglyphs, bedrock mortars, cupules, and milling surfaces as well as midden soils, cleared areas or possible house-pits, flaked and groundstone tools, calcined bone, and a lithic scatter with three loci. Those features and cultural constituents indicate that CA-MER-15 likely represents a permanent habitation site or a temporary habitation site that was occupied repeatedly through time (*see* Section 7.3.1). Permanent habitation sites typically feature accumulated midden deposits, indicating long-term occupation; numerous, diverse cultural constituents; and house-pits or living areas. Temporary or seasonally occupied habitation sites typically lack some or most of these indicators (*see* Section 7.3.1). An examination of the soils at CA-MER-15 suggests that the site likely contains subsurface deposits or buried cultural constituents. Repeated wave action may have removed, redeposited, or buried site sediments—impacts that may become clearer through subsurface testing. The resource is evaluated under the themes of *Economy, Settlement,* and *Cultural History and Identity* (*see* Section 7.2), particularly as they relate to prehistoric settlement, foodways, and group identity.

A search of the Sacred Lands Inventory by the NAHC for the CA-MER-15 vicinity did not reveal any information about the site locale, and the resource is not known to have been associated with any significant events in local or regional Native American history. The presence of numerous petroglyphs at the site and the reported presence of pictographs (not relocated) suggest that CA-MER-15 may have been locally significant to its inhabitants as a locus or expression of communal activity, shared identity, and/or ceremonial practice. Further research at CA-MER-15 would be necessary to make a recommendation as to the site's eligibility for listing in the NRHP/CRHR under Criterion A/1. Establishing the site's chronology, for instance, would allow for a better understanding of its use as an episodic or long-term occupation area.

No definitive association with one or more individuals could be established for CA-MER-15, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

Despite the presence of 11 petroglyph boulders at CA-MER-15, the site does not exhibit structurally or artistically unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

The potential for CA-MER-15 to reveal subsurface components or vertical stratigraphy is high. The data potential of the site (e.g., its depth, integrity, age, and artifact diversity) thus has not been fully explored. Further investigation of CA-MER-15 may reveal information that could be used to address important research questions about chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the data acquired during the 2016 inventory survey, an informed recommendation regarding the eligibility of CA-MER-15 for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If operations associated with the B.F. Sisk Dam Raise Alternative may affect

CA-MER-15, subsurface testing is recommended at the site to determine if it offers the potential to address research questions (*see* Section 7.2).

CA-MER-28
P-24-000129

Pending Evaluation for Listing in the NRHP/CRHR under Criterion D/4

Appendix A, Figure A-3
Appendix B, Figure B-3

Operation of Dam Raise (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)

Description

CA-MER-28 is a prehistoric site that was first recorded in 1965 by W.H. Olsen as an "occupation deposit on top of knoll" with a "few silicate flakes" (Olsen 1965c). As recorded in 2016, the site consists of midden soils with fire-affected rock, one possible heated rock feature, 31 pieces of debitage, one chert core (Artifact 1), and six groundstone artifacts (Artifacts 2-7) that span an area measuring 75 meters SE/NW by 35 meters SW/NE. The heated rock feature measures 0.5 meters N/S x 0.6 meters E/W and contains over 30 cobbles or fire-affected rocks, all of which measure 10 centimeters or less in diameter. The sediment within the feature appears to be a lighter gray and possibly hardened on the surface, which may indicate firing within an excavated pit. A single large white chert secondary flake was located along the margin of the feature.

The six groundstone artifacts include two handstones (Artifacts 5 and 6) and four groundstone fragments (Artifacts 2, 3, 4, and 7). The debitage is variable in color but is locally sourced and white to off-white and mottled with spots and bands of reddish-brown. The debitage reflects the generally poor quality of the raw material, as 17 of the 31 pieces are broken flakes or shatter. Fifteen of the 31 flakes measure 3-6 centimeters in length or more with no small (<1 centimeters) flakes identified. The single chert core is small (7.1-x-4.5-x-1.9 centimeters) and exhibits at least five flake removals. The core may have come from sandstone outcrops to the west of the site, which feature similar material embedded in the visible strata. It may also have come from the sandstone and cobble conglomerate exposed at the western end of the site near the mouth of a nearby creek. The six pieces of groundstone are all basalt. Dark to very dark gray ashy midden soils occur across the entire site area and include a deposit of eroded fire-affected rock.

CA-MER-28 is located on a gently sloping (1-2°), southeast-facing terrace. It lies at the base of a large hill to the west and just north of an unnamed seasonal drainage that opens broadly from a narrow, V-shaped canyon. A taller, oak-studded, east-trending ridge defines the landform south of the drainage. To the east, the landscape opens up and slopes gently eastward towards the San Luis Reservoir on. The site area is fully exposed but covered in dense, knee-high grasses that offer very poor (10%) surface visibility.

CA-MER-28 contains midden soils with fire-affected rock, a possible heated rock feature, debitage, a chert core, and six groundstone artifacts. Another site, CA-MER-517, was newly discovered 35 meters to the east of CA-MER-28 and to the south of the drainage that borders it. No midden soils or fire-affected rock was observed at CA-MER-517, though the two sites may have been associated.

NRHP/CRHR Evaluation

CA-MER-28 consists of midden soils with fire-affected rock, a possible heated rock feature, 31 pieces of debitage, one chert core, two basalt handstones and four basalt groundstone fragments. CA-MER-28 may represent a short-term habitation site (*see* Section 7.3.1). Short-term habitation sites are those that were occupied for a short duration or were occupied repeatedly, though on a seasonal or short-term basis. They typically lack accumulated midden deposits, and the cultural constituents present tend to be less diverse or numerous than at permanent habitation sites (*see* Section 7.3.1). Based on the feature and artifacts observed, CA-MER-28 may have been used for short-term food processing. The presence of a possible heated-rock feature, midden, and fire-affected rock suggest that the site contains a subsurface deposit. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), particularly as they relate to prehistoric subsistence.

Prehistoric temporary habitation sites are relatively common in the foothills of the Diablo Range. Little is known, however, about their relationship to larger, more prominent prehistoric sites located on the western edge of the valley floor or to habitation sites located along major stream courses. A search of the Sacred Lands Inventory by the NAHC did not reveal any information about the CA-MER-28 locale, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for CA-MER-28, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-28 does not contain structurally or artistically unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

Given that CA-MER-28 includes midden soils with fire-affected rock, a possible heated rock feature, groundstone, and lithic debitage, the potential for the site to reveal subsurface components or vertical stratigraphy is high. Thus, the data potential of the site (e.g., its depth, integrity, age, and artifact diversity) has not been fully explored. Further investigation of CA-MER-28 may bring to light information regarding its potential to address important research questions about chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2).

Based on the limited data acquired during inventory survey, an informed recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is recommended to determine if CA-MER-28 offers the potential to address important research questions such as those outlined in Section 7.2.

CA-MER-82
P-24-000182

Pending Evaluation for Listing in the NRHP/CRHR under Criterion D/4

Appendix A, Figure A-5
Appendix B, Figure B-5

Operation of Dam Raise (San Luis Reservoir Shoreline – West Side of San Luis Creek Inlet)

Description

CA-MER-82 is a prehistoric site that was first recorded in 1966 by W.H. Olsen as a small occupation deposit on a bench above a creek featuring dark, rocky midden soils as well as lithic debitage and fire-affected rock. As recorded in 2016, the site comprises one edge-modified flake (Artifact 1), eight pieces of chert debitage, and three pieces of groundstone (Artifacts 2-4) along the northern margin of the previously recorded site boundary within an area that measures 30 meters N/S and 62 meters E/W. Several of the artifacts were found in a sandy area in slightly darker soil that may represent the remnants of an eroded midden deposit.

Artifact 1 consists of an edge-modified flake fashioned from dark gray chert that measures 5.2-x-3.1-x-0.8 centimeters and exhibits use wear along its margins. Artifact 2 is a vesicular basalt groundstone fragment that measures 18-x-12-x-3.6 centimeters found in a sandstone conglomerate in close proximity the main area of the site. Both Artifacts 3 and 4 consist of possible millingstone fragments fashioned from sandstone that measure 3.15-x-14.2-x-7.5 centimeters and 18.2-x-11.4-x-4.0 centimeters.

CA-MER-82 is located on the western side of the San Joaquin Valley along the southwestern edge of the San Luis Reservoir. It is situated within a northeast-facing trough or swale formed by rolling hills to the south, west, and north. Several deeply entrenched seasonal drainages flow into the swale from the south, west, and southwest. The site itself rests on a relatively level, wave-eroded bench that is bordered to the southeast by an unnamed drainage. All artifacts at CA-MER-82 were recorded below the current maximum waterline at an elevation of 400-440 feet amsl and would typically be inundated in non-drought years. On-site vegetation consists of dense knee-high grass, mustard weed, and patches of cockleburs. Several artifacts were found in a sandy area with slightly darker soils and that may represent eroded midden; soils on-site generally consist of tan/orange gravelly sand. The site features a northeastern aspect, minimal slope (1-2°), and is fully exposed.

CA-MER-82 consists of one edge-modified flake, eight pieces of chert debitage, and three pieces of groundstone, including two possible milling slab fragments. Another site, CA-MER-42, was previously recorded approximately 215 meters to the northeast of CA-MER-82 and would have bordered the same seasonal drainage. As originally recorded, it included a rocky midden deposit with lithic debitage (Olsen 1966c); groundstone artifacts were also observed at the site during the 2016 inventory survey. The site may have been associated with CA-MER-82.

NRHP/CRHR Evaluation

CA-MER-82 consists of eight pieces of debitage and three pieces of groundstone as well as a possible remnant midden soils area. The site may have been a short-term habitation or activity-specific site (*see* Section 7.3.1), though given apparent effects to the site from prior inundation its function may be difficult to distinguish. Short-term habitation sites were occupied for a short duration or occupied repeatedly on a seasonal or limited basis while activity-specific sites tended to be used for a fairly narrow range of tasks (e.g., quarrying for lithic material, food processing). Based on the artifacts observed, CA-MER-82 may have been used for food processing. The presence of possible midden at the site suggests that it may retain a subsurface component. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), specifically as they relate to prehistoric subsistence.

Prehistoric temporary habitation and activity-specific sites are relatively common in the foothills of the Diablo Range. A search of the Sacred Lands Inventory by the NAHC for the site vicinity did not reveal any information about the CA-MER-82 locale, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is therefore recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for CA-MER-82, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

Based on surface evidence from an inventory survey, CA-MER-82 does not contain any unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-82 includes surface artifacts in the form of two possible milling slab fragments, one groundstone fragment, one edge-modified flake, and eight pieces of chert debitage. It may also include the remnants of a midden deposit, evident though an area featuring darker soils as well as several artifacts. The potential for the site to reveal a subsurface component or vertical stratigraphy is considered moderate to high, though the data potential of CA-MER-82 (e.g., its depth, integrity, age, and artifact diversity) has not been fully explored. Further investigation of the site could reveal more about its potential to address important research questions relating to chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the materials observed during inventory survey, a recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be made. If the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is recommended to determine if CA-MER-82 offers the potential to address important research questions that might render it eligible for listing in the NRHP/CRHR.

CA-MER-83
P-24-000183

Pending Evaluation for Listing in the NRHP/CRHR under Criterion D/4

Appendix A, Figure A-5
Appendix B, Figure B-5

Operation of Dam Raise (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)

Description

W.H. Olsen first recorded CA-MER-83 in 1966 as a prehistoric "rocky midden deposit on prominence just above stream" (Olsen 1966d). In 2016, the site was recorded as an area of midden soils with fire-affected rock, eight groundstone artifacts (Artifacts 3-8 and 13-14), and six pieces of lithic debitage (Artifacts 1-2 and 9-12) distributed across an area measuring 59 meters N/S by 53 meters E/W. The midden soils are concentrated in the central portion of the site and consist of dark gray or nearly black soils with fire-affected rock. The eight groundstone artifacts include five handstone fragments (Artifacts 3-5 and 13-14), two fragments of indeterminate shape and function (Artifacts 7-8), and one possible milling slab fragment (Artifact 6). The lithic debitage includes three pieces of chert shatter (Artifacts 1, 2, and 9) as well as two chert secondary flakes (Artifacts 10-11) and one chalcedony secondary flake (Artifact 12). The chert debitage is fashioned from white or cream colored material with orange or brown inclusions and the groundstone artifacts are composed of basalt.

CA-MER-83 consists of an area of midden soils with fire-affected rock, eight groundstone artifacts, and six pieces of debitage. Another site, CA-MER-138, was previously recorded approximately 130 meters to the southwest of CA-MER-83 and would have bordered the same seasonal drainage. It was recorded as a large midden site on a knoll (Olsen 1973), and it may have been associated with CA-MER-83. CA-MER-138 was not relocated in 2016 but lay well outside of the B.F. Sisk Dam Raise Alternative APE.

CA-MER-83 is located in an open oak woodland vegetation zone with sparsely scattered oaks. The site area is densely covered with Indian rice grass, wild oats, foxtails, star thistle, and seasonal forbs and grasses that offer very poor (0-10%) surface visibility. The site lies on a flat bench on the south side of an unnamed drainage. CA-MER-83 features a northwestern aspect, a gentle (0-5°) slope, and is fully exposed. Non-midden soils are a rocky, semi-compact, light brown to brown silty clay loam.

NRHP/CRHR Evaluation

The site consists of midden soils with fire-affected rock, eight groundstone fragments, and six pieces of debitage. CA-MER-83 may have functioned as a short-term habitation or activity-specific site (*see* Section 7.3.1). Short-term habitation sites were occupied for a limited duration or occupied repeatedly on a seasonal or short-term basis while activity-specific sites would have been used for a limited range of tasks (e.g., quarrying for lithic material, food processing). The presence of midden and groundstone suggest that CA-MER-83 may have been used for food processing. The presence of possible midden at the site also suggests that it may retain a subsurface component. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), with emphasis on prehistoric subsistence.

A search of the Sacred Lands Inventory by the NAHC for the site vicinity did not reveal any information about the CA-MER-83 locale, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is therefore recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for CA-MER-83, and a literature review did not identify any prominent individuals who may have been associated with the site vicinity during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

Based on surface evidence from an inventory survey, CA-MER-83 does not contain any unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-83 includes surface artifacts in the form of one possible milling slab fragment, five handstone fragments, two indeterminate groundstone fragments, six pieces of debitage, and midden soils with fire-affected rock. The site offers moderately high potential to reveal a subsurface component or vertical stratigraphy, though its data potential (e.g., its depth, integrity, age, and artifact diversity) has not been fully explored. Further investigation of the site could reveal more about its potential to address important research questions relating to chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the limited data acquired during inventory survey, a recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If any of the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is recommended to determine if CA-MER-83 offers the potential to address important research questions that might render it eligible for listing in the NRHP/CRHR.

CA-MER-137
P-24-000227

Pending Evaluation for Listing in the NRHP/CRHR under Criterion D/4

Appendix A, Figure A-1; Appendix B, Figure B-1

Operation of Dam Raise (Cottonwood Bay Shoreline)

Description

CA-MER-137 is a prehistoric site that was first recorded by W.H. Olsen in 1971 as a "large occupation site on knoll" with an "extremely high rock content," including pestle fragments (Olsen 1971b). Olsen also noted a possible housepit depression, which might have been disturbed by cattle. The sketch map for CA-MER-137 is included in Olsen's contemporaneous site record for prehistoric site CA-MER-136, located approximately 30 meters to the west (Olsen 1971a). The map portrayed the site locations relative to Cottonwood Creek, dirt roads, and SR 152. No scale was included in Olsen's sketch map, and no details about the interior features of either site were depicted.

When CA-MER-137 was revisited during the 2020 inventory survey of the B.F. Sisk Dam Raise Alternative APE, the site was found to contain midden soils and copious fire-affected rock. The pestle fragments and possible housepit depression noted by Olsen were not observed. The site covered an area measuring 45 meters E/W by 39 meters N/S. Gray midden soils and fire-affected rock were distributed across the entire site area, and no discernible loci or concentrations were observed.

CA-MER-137 is located on a gently sloping, south-facing terrace. It lies at the base of a large hill to the north. To the west, an unnamed drainage flows south into Cottonwood Creek, which flows to the east south of the site. The terrace adjacent to Cottonwood Creek follows the creek to the southeast towards Cottonwood Bay. Above the reservoir high waterline, oak trees dot the perennial grassland; below the high waterline, trees are sparser, and none exist within the boundaries of the site. The site area is fully exposed, and grasses are kept low by periodic inundation and frequent cattle grazing affording excellent (80%) surface visibility.

Two other prehistoric sites have been documented in the vicinity of CA-MER-137. Olsen recorded CA-MER-136 across the unnamed drainage 30 meters to the west in 1971. Pacific Legacy personnel also discovered a new site (PL-Sisk-05) approximately 265 meters to the west.

NRHP/CRHR Evaluation

CA-MER-137 consists of midden soils with fire-affected rock and thus may represent a short-term habitation site (*see* Section 7.3.1). Short-term habitation sites were typically occupied for a short duration or were occupied repeatedly, though on a seasonal or short-term basis. They frequently lack accumulated midden deposits, and the cultural constituents present tend to be less diverse or numerous than at permanent, more substantial habitation sites (*see* Section 7.3.1). Given the presence of midden and fire-affected, short-term food processing may have occurred at CA-MER-137, suggesting that the site may contain a subsurface deposit. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), particularly as they relate to prehistoric subsistence.

Prehistoric temporary habitation sites are relatively common in the foothills of the Diablo Range. Little is known, however, about their relationship to larger, more prominent prehistoric sites located on the western edge of the valley floor or to habitation sites located along major stream courses. A search of the Sacred Lands Inventory by the NAHC did not reveal any information about the CA-MER-137 locale, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for CA-MER-137, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-137 does not contain structurally or artistically unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

Given that CA-MER-137 includes midden soils with fire-affected rock, the potential for the site to reveal subsurface components or vertical stratigraphy is high. Thus, the data potential of the site (e.g., its depth, integrity, age, and artifact diversity) has not been fully explored. Further investigation of CA-MER-137 may bring to light information regarding its potential to address important research questions about chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the limited data acquired during inventory survey, a recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is recommended to determine if CA-MER-137 offers the potential to address important research questions such as those outlined in Section 7.2.

CA-MER-484H
P-24-001974
PL-SLLP-A-001

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-3

Description

CA-MER-484H is a historic period utility pole alignment or telegraph line set into a series of drainages, ridge tops, and slopes. The resource consists of 15 pole bases, three fallen poles, several wood crossbeams, and a large number of glass insulators. The alignment is depicted on the 1940 Pacheco Pass 15-minute USGS topographic map (USGS 1940), but absent from earlier or later maps. It is aligned almost due east-west at a bearing of 178° for approximately 1,680 feet and terminates as it reaches a modern road. The posts are placed between 120-130 feet apart with the exception of the westernmost three posts that are placed 65 feet apart. All poles have been cut close to the ground surface. Pole Location 1 consists of a single cut pole on the flat surface of a finger ridge. It measures 7¼ inches in diameter

Operation of Dam Raise (Reservoir Shoreline – Dinosaur Point)

and is made of treated wood; it is cut at 4½ inches above the ground surface. A northeast-southwest trenching dirt road that eventually connects with Dinosaur Point Road lies approximately 60 feet to the west of the poles. A modern power pole is located 111 feet to the south, which marks the point from which a modern power line continues southward. Modern trash lies scattered across the ridge top close to the dirt road. Historic period glass insulators and fragments were noted at four pole locations, but no other historic period artifacts were noted.

CA-MER-484H is located on the northwestern side of San Luis Reservoir to the west of a boat ramp and to the north of the 1920s-era alignment of SR 152. Steep-sided, flat-topped finger ridges surround CA-MER-484H. Vegetation along the utility pole alignment includes dry grasses, blue oaks, and seasonal shrubs. Ground surface visibility ranges from 20-35%, and the alignment is roughly 30% exposed.

Archival Research Summary

CA-MER-484H is located in Township 10 South, Range 7 East in the unsectioned San Luis Gonzaga Land Grant. The site area was patented on May 16, 1871 to Juan Pérez Pacheco (Doc #PLC 234, BLM # CACAAA 094227). An 1879 GLO plat map shows only the area not covered by the land grant. A later 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga depicts a stage route through the rancho but no utilities or similar features. The 1920 Pacheco Pass 15-minute USGS topographic map does not portray the utility pole alignment but does depict a road to the north of its location. The utility pole alignment appears on the 1940 Pacheco Pass 15-minute USGS topographic map but is missing from the later 1955 Pacheco Pass 7.5-minute USGS topographic map (USGS 1940, 1955). Thus, based on historic period map evidence, CA-MER-484H was constructed and removed within a span of less than 37 years. Based on marks noted on the glass insulators, the site was likely constructed between 1921 and 1939 (Meier 2016; Whitten 2016a, 2016b).

NRHP/CRHR Evaluation

CA-MER-484H, which comprises 15 cut pole bases, three fallen poles, and several glass insulators, represents the fragment of a larger utility pole alignment that was likely constructed between 1921 and 1939. The first telegraph line across Pacheco Pass was built in 1859 (Mountain-charlie1850.org 2016), and there is no evidence that CA-MER-484H was connected with that early alignment. CA-MER-484H was not the first utility alignment to bridge Pacheco Pass, nor did it appear to be a historically significant one tied to events of local or regional importance. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

This utility pole alignment could not be linked to one or more individuals, historically significant or otherwise. CA-MER-484H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

The site features 15 cut telegraph poles and 3 fallen poles. These features and the alignment they were once a part of are not unusual or distinctive in terms of engineering, architecture, or artistry. CA-MER-484H is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-484H includes approximately 25 scattered glass insulator fragments representing five insulators that were associated with several of the utility poles. Two manufacturing marks were noted on these insulator fragments that indicated the alignment was likely constructed between 1921 and 1939 (Meier 2016; Whitten 2016a, 2016b). No other artifacts or features were recorded in conjunction with the utility pole alignment. The resource does not offer sufficient research potential to contribute to our knowledge of communications, the economy, technology, or other potential research themes and questions. CA-MER-484H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The utility pole alignment retains integrity of location and materials. Its integrity of design, materials, and workmanship has been diminished by the removal of the poles, wires, and insulators that would have been integral to its function and appearance. Aspects of setting and feeling have been diminished by the construction of the boat ramp, Dinosaur Point Road, and the San Luis Reservoir, which truncates the utility pole alignment. Association and feeling are also diminished by the lack of any clear association with a specific utility company, which may have provided further context for the resource prior to the rerouting of SR 152. The remnant alignment no longer carries any clear historic period association and, overall, it has poor integrity. CA-MER-484H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-489H
P-24-001979
PL-SLLP-A-013

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-3

Description

CA-MER-489H consists of a historic period graded dirt road segment with a hard-packed surface that crosses a steep-sided valley below Dinosaur Point Road. It then ascends a hillside to the south and continues north beyond the APE into the San Luis Reservoir. There are small berms on either side of the road segment as it crosses the valley in addition to 3-foot deep cuts into the hillslopes that follow the road. The northwest side of the road (downslope) is also built up-slightly in some areas. CA-MER-489H measures approximately 2,450 feet in length and varies between 10-15 feet in width depending on the extent to which it has been eroded. It passes to the south of a historic period earthen dam and impound pond that are bordered by prehistoric deposits (CA-MER-26/H), a substantial prehistoric habitation site with surface and subsurface deposits (CA-MER-94), and another historic period road segment (CA-MER-477H).

Operation of Dam Raise (San Luis Reservoir Shoreline – Dinosaur Point)

CA-MER-489H is located along the western shore of the San Luis Reservoir below the average waterline. Soils within the resource area have been heavily impacted by erosion and wave action, and only sparse non-native grasses and cockleburs grow in the area. Portions of the eastern end of the road segment have been destroyed by the slumping of the hillside over the road, while the western end of the resource has been washed out by an ephemeral drainage. The resource area is fully exposed, offers good (60%) ground surface visibility, and features a variable slope and aspect.

Archival Research Summary

CA-MER-489H is located in the unsectioned San Luis Gonzaga Land Grant in Township 10 South, Range 7 East. The land grant was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts only the area not covered by the land grant. A 1909 GLO sketch map of Rancho San Luis Gonzaga shows a stage route through the rancho, but it is unclear if the stage route may have corresponded to the CA-MER-489H road segment (BLM 2016).

The 1920 Pacheco Pass 15-minute USGS topographic map does not depict the road segment (USGS 1920), though the 1940 Pacheco Pass 15-minute USGS topographic map does portrays a telegraph or utility line that crossed the road location (USGS 1940). The 1955 Pacheco Pass 7.5-minute USGS topographic map depicts the road segment, which is also clearly shown on a 1946 aerial photograph of the area (USGS 1955; Fairchild Aerial Surveys 1946). The aerial photograph depicts CA-MER-489H to the south of the 1920s-era SR 152 alignment, and it may have served as an alternate, roughly parallel route. No other buildings, structures, or sites were noted proximate to the CA-MER-489H road segment on any historic period maps, and it did not appear to be associated with the historic period earthen dam and stock pond at CA-MER-26/H.

NRHP/CRHR Evaluation

CA-MER-489H is a historic period graded dirt road segment that was established by 1946. It is evaluated under the historic context of *Transportation Development* in the American Period (*see* Section 3.3.3). The construction date of CA-MER-489H and its period of use remain indeterminate, however it may have served as an alternate route associated with the 1920s-era alignment of SR 152 (Fairchild Aerial Surveys 1946; USGS 1920). The road segment did not appear to be linked to any other buildings, structures, or sites within the vicinity, and it was not noted in association with an account of Merced County history (Tinkham 1923). CA-MER-489H does not appear to have been linked to any significant local or regional events or developments. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No links could be established between CA-MER-489H and any individuals significant in local, regional, or state history. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-489H is a graded road segment that could not be definitively linked to other known resources within the vicinity. The road segment is not structurally unique and does not exemplify distinctive characteristics of a type, period, or method of construction. CA-MER-489H is not eligible for listing in the NRHP/CRHR under Criterion C/3.

As an isolated road segment, there is little potential to encounter a subsurface component or vertical stratigraphy at CA-MER-489H. The resource offers limited potential to address important research questions about *Transportation Development* in the American Period (*see* Section 3.3.3). Thus, CA-MER-489H is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

CA-MER-489H does not appear to be maintained or in active use. It remains in fair condition despite apparent impacts from erosion and inundation and retains integrity of location, design, feeling, materials, and workmanship. It lacks integrity of association, however because it could not be linked to a particular time, event, individual, or use and could not be clearly associated with any known resources. It lacks integrity of setting, as the original alignment of SR 152 has been rerouted and the construction of the San Luis Reservoir has greatly altered the surrounding area. CA-MER-489H possesses fair overall integrity. It is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-515H
P-24-002160
PL-SLLPIP-16-09

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-3

Operation of Dam Raise (San Luis Reservoir Shoreline – South of SR 152)

Description

CA-MER-515H is an earthen dam that spans a small inlet of the San Luis Reservoir. The dam is oriented northeast-southwest and impounds water on the western side, forming a pond. The southern end of the dam is truncated by a drainage that flows out of the impound pond; it may be an intentional breach that was formed when the dam was built. The dam measures 275 feet NE/SW by 140 feet NW/SE at the base. The top of the dam is approximately 15-18 feet wide. The eastern side of the dam stands roughly 35-40 feet high from the base to the top. Including the impound pond, the total dimensions of the resource measure approximately 510 feet NW/SE by 320 feet NE/SW. The dam is flat on top and pedestrian accessible, though dead and dying trees along the western base of the dam make it less accessible. No additional artifacts or features were noted at CA-MER-515H.

CA-MER-515H is located on the northwestern side of the reservoir to the north of a boat ramp and the original alignment of SR 152. The site area is characterized by oak woodland and riparian vegetation. Oak trees are sparsely scattered near the drainage with wild oats, cheatgrass, thistle, bursage, datura, mustard, and seasonal grasses. Willow trees, grasses, wild oats, cheatgrass, and several unidentified perennials border or are proximate to the pond. Soils, where visible, consist of light tan, rocky clay loam.

Archival Research Summary
CA-MER-515H is located in the unsectioned San Luis Gonzaga Land Grant in Township 10 South, Range 7 East. The resource area was patented on May 16, 1871 to Juan Pérez Pacheco (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts only the area not covered by the land grant. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho as well as two alternate stage routes but does not depict the earthen dam or impound pond (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not show the dam or impound pond but do depict the 1920s-era SR 152 alignment to the south (USGS 1920, 1940a). The 1940 map also depicts a 104kV PG&E line to the north of the resource location. The 1955 Pacheco Pass 7.5-minute USGS topographic map shows the San Luis Reservoir and the realigned route of SR 152. The "Boat Ramp" road depicted on the 1955 map appears to be an existing segment of the original SR 152 alignment; the dam and impound pond are shown as present but abandoned features, thus they would have been constructed by 1955 but had evidently fallen into disuse by 1971 (USGS 1955). A 1946 aerial photograph of the resource location does not show the dam or pond, thus CA-MER-515H likely post-dates 1946 and pre-dates 1955 (Fairchild Aerial Surveys 1946).

Francisco Pérez Pacheco, who inherited the San Luis Gonzaga Rancho upon the death of his son Juan, had one daughter, Lola. She married Mariano Malarin, and they in turn had two daughters: one married Dr. Ramon Roca, while the other married Dr. Luis Fatjo. The Fatjos and their children inherited the Merced portion of the rancho. In 1949, Paula Fatjo, the great-great granddaughter of Francisco Pérez Pacheco, moved to the rancho and remodeled the original 1843 adobe that once stood on the property (Pierce 1977: 107). San Luis Gonzaga, or San Luis Ranch, was an operating cattle ranch during Paula Fatjo's time, though she also bred and boarded Arabian horses (Pierce 1977: 107-111). If construction of the dam and impound pond do post-date 1946 and pre-date 1955, they may have been associated with Fatjo's tenure on the property. The resource was almost certainly associated with agricultural or ranching activities and could have functioned as a stock watering locale.

NRHP/CRHR Evaluation
CA-MER-515H is a historic period earthen dam and impound pond with no other associated features, structures, or surface artifacts. Based on historic period map and aerial photographic evidence, the resource appears to have been constructed prior to 1955 but after 1946 (Fairchild Aerial Surveys 1946; USGS 1955). While the resource was likely associated with ranching or farming activities, it could not be linked to particular historic

period events, significant or otherwise. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

Although CA-MER-515H may be associated with Paula Fatjo's tenure at the San Luis Ranch, no clear link could be established between her or any other individual and the construction or use of the resource. CA-MER-515H could not be linked to one or more individuals significant in local, regional, state, or national history. It is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

As a historic period earthen dam and impound pond, CA-MER-515H consists of a single engineered feature. That feature is not unique and does not exemplify distinctive characteristics of a type, period, or method of construction, nor does it embody innovative construction techniques. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-515H contains no artifacts or materials that might be used to link the resource to a particular time period. It lacks the data potential to address important research questions regarding early farming or ranching activities, water conveyance, or other important research themes. The resource is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-515H remains in good condition and has not been greatly impacted by erosion. It retains integrity of location, design, materials, workmanship, feeling, and association. The resource's integrity of setting has presumably been impacted by the development and inundation of the San Luis Reservoir. Overall, the resource possesses good integrity. CA-MER-515H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-516H
P-24-002161
PL-SLLPIP-16-10

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-3

Description

CA-MER-516H is an earthen dam constructed across an east-flowing seasonal drainage that emanates from between two prominent hills to the west. The dam is oriented north-south, and the base measures approximately 65 feet in length and 20 feet in width. The top of the dam measures 10 feet in width and is marked by a barbed wire fence with T-posts that is in poor condition. The impound area behind the dam measures roughly 100 feet in diameter and does not retain any water due to a breach 8 feet from the northern end. As a whole, the resource measures 150 feet NW/SE by 100 feet NE/SW.

CA-MER-516H lies within an oak woodland vegetation community with sparsely scattered oaks and seasonal grasses as well as wild oats, cheatgrass, thistle, bursage, datura, and mustard. Visible soils within the resource area consist of light tan, very rocky clay loam. The resource is fully exposed and features a variable slope (0-15°). The canyon upstream from CA-MER-

Operation of Dam Raise (San Luis Reservoir Shoreline – South of SR 152)

516H quickly narrows and contains a dense stand of oaks. The canyon opens into a narrow mouth that forms an inlet of the San Luis Reservoir.

Archival Research Summary

CA-MER-516H is located in Township 10 South, Range 7 East in the unsectioned San Luis Gonzaga Land Grant. The resource area was patented to Juan Pérez Pacheco on May 16, 1871 (Doc #PLC 234, BLM # CACAAA 094227) (BLM 2016). An 1879 GLO plat map depicts only the area not covered by the land grant. A 1909 GLO sketch map of the diseño of Rancho San Luis Gonzaga shows a stage route through the rancho but does not depict the earthen dam or impound pond (BLM 2016). The 1920 and 1940 Pacheco Pass 15-minute USGS topographic maps do not depict the dam or impound pond, though the 1940 map does show the original 1920s-era SR 152 alignment to the north (USGS 1920, 1940a). The 1955 Pacheco Pass 7.5-minute USGS topographic map shows the San Luis Reservoir and a "Boat Ramp" road to the northwest but does not portray the dam or impound pond (USGS 1955). A 1946 aerial photograph of the resource location does not show the CA-MER-516H features, thus they likely post-date 1946 and pre-date 1963 when construction began for the dam and reservoir (Fairchild Aerial Surveys 1946).

Francisco Pérez Pacheco, who inherited the San Luis Gonzaga Rancho upon the death of his son Juan, had one daughter, Lola. She married Mariano Malarin, and they in turn had two daughters: one married Dr. Ramon Roca, while the other married Dr. Luis Fatjo. The Fatjos and their children inherited the Merced portion of the rancho. In 1949, Paula Fatjo, the great-great granddaughter of Francisco Pérez Pacheco, moved to the rancho and remodeled the original 1843 adobe that once stood on the property (Pierce 1977: 107). San Luis Gonzaga, or San Luis Ranch, was an operating cattle ranch during Paula Fatjo's time, though she also bred and boarded Arabian horses (Pierce 1977: 107-111). It is likely that the earthen dam and impound pond supported ranching and/or farming, but it could not be definitively associated with a specific landowner such as Paula Fatjo or with a specific function such as stock watering.

NRHP/CRHR Evaluation

CA-MER-516H is a historic period earthen dam and impound pond with no other associated features, structures, or surface artifacts. Based on historic period map and aerial photographic evidence, the resource appears to have been constructed prior to the dam and reservoir (1963-1967) but after 1946 (Fairchild Aerial Surveys 1946) and perhaps after 1955 (USGS 1955). While the resource was likely associated with ranching or farming activities, it could not be linked to particular historic period events, significant or otherwise. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-516H could not be linked to one or more individuals significant in local, regional, state, or national history. The resource may have been associated with Paula Fatjo and her time at the San Luis Ranch, or it may have been associated with an unknown individual or lease holder. CA-MER-516H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

As a historic period earthen dam and impound pond, CA-MER-516H consists of a single engineered feature. That feature is not unique and does not exemplify distinctive characteristics of a type, period, or method of construction, nor does it embody innovative construction techniques. CA-MER-516H is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-516H contains no artifacts or materials that might be used to link the resource to a particular time period. It lacks the data potential to address important research questions regarding early farming or ranching activities, water conveyance, or other potential research themes. The resource is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-516H remains in fair condition and has not been measurably impacted by erosion. The dam features a major breach, however, and the barbed wire fence that spans the top of the dam is in poor condition. CA-MER-516H retains integrity of location, design, materials, workmanship, and feeling. The resource's integrity of setting has presumably been impacted by the development of the San Luis Reservoir, while the aspect of association is impacted because the resource could not be linked to a particular landowner/ranch complex, function, or time period. The resource possesses fair overall integrity. CA-MER-516H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-517
P-24-002162
PL-SLLPIP-16-11

Pending Evaluation for Listing in the NRHP/CRHR under Criterion D/4

Appendix B, Figure B-3

Description

CA-MER-517 is a prehistoric site with groundstone and flaked stone artifacts that measures 35 meters N/S by 65 meters E/W. The site features four complete basalt milling slabs (Artifacts 1, 5, 9, and 10), one complete sandstone milling slab (Artifact 6), and one fragmentary basalt milling slab (Artifact 13). Seven chert cores (Artifacts 2, 3, 4, 7, 8, 11, and 12) and ten pieces of chert debitage also were noted. Six pieces of debitage consist of larger specimens (>3 centimeters diameter), including two primary and three secondary flakes, though one is a smaller (1-2 centimeter) bifacial thinning flake. Most of the debitage is white to off-white and mottled and banded with red and orange; two pieces are a light pinkish-brown and appear to represent higher quality material. CA-MER-28, a previously recorded prehistoric site with midden soils, fire-affected rock, a possible heated rock feature, groundstone artifacts, and debitage, is located just 40 meters to the northwest on the other side of a steep drainage. Its association with CA-MER-517 is unclear.

Operation of Dam Raise (San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch)

CA-MER-517 is situated on a broad, slightly sloping (3-4°) north and north-northeast facing terrace that overlooks a deep east-flowing creek immediately to the north of the site. Across the drainage to the north, the slope rises up towards a fenceline located mid-slope. To the east, the landform opens up out of the hills towards the San Luis Reservoir. To the south, a series of dissected hills rises steeply. To the west, the hills constrict into a narrow V-shaped canyon. A large rock outcrop is located immediately south of the site, though no evidence of grinding surfaces or other cultural materials were noted. The site is covered with relatively sparse, low grasses that offer fair to good visibility (50-60%). Tall, knee-high grasses dominate the area around the site and may obscure additional cultural materials. Two large cottonwood trees are present in the creek bottom, and oaks form dense stands upslope to the south. Soils in the site area are a very rocky, light brown sandy loam. No midden soils were observed. The majority of the surface rock in the area comprises sandstone slab fragments and rounded cobbles, likely from sandstone conglomerate outcrops located upslope.

NRHP/CRHR Evaluation

CA-MER-517 contains six whole or fragmentary milling slabs, seven chert cores, and ten pieces of chert debitage. CA-MER-517 may represent a short-term habitation site (*see* Section 7.3.1). Short-term habitation sites are those that were occupied for a short duration or were occupied repeatedly, though on a seasonal or short-term basis. They typically lack accumulated midden deposits, and the cultural constituents present tend to be less diverse or numerous than at permanent habitation sites (*see* Section 7.3.1). Based on the cultural constituents observed, CA-MER-517 may have been used for short-term food processing. Although no midden soils or fire-affected rocks were observed, the presence of groundstone milling slabs suggests that the site may contain a subsurface deposit. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), particularly as they relate to prehistoric subsistence.

Prehistoric temporary habitation sites are relatively common in the Diablo Range foothills. Little is known, however, about their relationship to larger, more prominent prehistoric sites located on the western edge of the valley floor or to habitation sites located along major stream courses. A search of the Sacred Lands Inventory by the NAHC for the site vicinity did not reveal any specific information about the CA-MER-517 area, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for CA-MER-517, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

CA-MER-517 does not contain structurally or artistically unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

Although no midden soils were observed at CA-MER-517, the site includes six groundstone artifacts and may have the potential to reveal intact subsurface components and vertical stratigraphy. The data potential of the site (e.g., its depth, integrity, age, and artifact diversity) thus has not been fully explored. Further investigation of the site may yield information that can be used to address important research questions about chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the limited data acquired during inventory survey, an informed recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is recommended to determine if CA-MER-517 offers the potential to address important research questions such as those outlined in Section 7.2. CA-MER-517 is recommended not eligible for listing in the NRHP/CRHR under Criteria A/1, B/2, and C/3 but remains pending evaluation under Criterion D/4.

CA-MER-518H
P-24-002163
PL-SLLPIP-16-12

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figure B-7

Operation of Dam Raise (San Luis Reservoir Shoreline – South side of San Luis Creek Inlet)

Description

CA-MER-518H is an earthen dam constructed across a north-flowing seasonal drainage that flows into San Luis Creek. The earthen dam is oriented east-west and measures approximately 160 feet in length at the top and 30-35 feet in width at the base, forming an impound pond to the southern side of the dam. The northern side of the dam stands 25 feet high while the southern side stands 12-15 feet above the pond. The water impound area is roughly triangular, measuring 225 feet N/S by 100 feet E/W. A historic period dirt road (CA-MER-519H) segment is located approximately 735 feet to the north of CA-MER-518H and across the current San Luis Reservoir spillway.

CA-MER-518H lies to the north of the mouth of San Luis Creek at the far southern end of the San Luis Reservoir. It is situated within an oak woodland vegetation community with sparsely scattered oaks and seasonal grasses. The resource area features a variable slope (0-15°) and is fully exposed. Soils, where visible, are a light tan, very rocky and compact silty clay loam.

Archival Research Summary

CA-MER-518H is located in Township 11 South, Range 8 East in the northeast quarter of Section 18, though current USGS topographic maps depict the land as unsectioned (USGS 1956, 1969). No land patent information is available for the resource area, which is approximately 1.2 miles to the south of the San Luis Gonzaga Rancho. Adjacent areas were patented to Daniel T. Haley on June 2, 1919, including the southeast quarter of the northeast quarter and the northwest quarter of the southeast quarter of Section 18 (Doc # 011232, BLM # CASF 0011232) (BLM 2016). On December 18, 1922, George Haley, Daniel's brother, patented the southeast quarter of the northwest quarter of Section 8 (Doc # 08821, BLM # CASF 0008821) (BLM 2016), which is roughly 0.75 miles to the northeast.

The *History of Merced County, California* (Outcalt 1925) notes that Daniel T. Haley was the son of Esther Byrne and William Haley, an Irish immigrant who settled in San Francisco in 1850 and started the Dairy Delivery Company. Esther and William had eight children together. Daniel was born in 1854, and he followed his father into the dairy delivery business. Daniel settled in Gustine and managed a local plant that distributed 85-100 ten-gallon cans of cream to San Francisco each day for processing. Roughly 10,000 gallons of milk were then distributed to customers throughout the San Francisco and Burlingame areas (Outcalt 1925: 762). William Haley appears to have managed distribution for the family's company while Daniel managed supply. Daniel Haley married Grace Truit and was elected mayor of Gustine when it was incorporated in 1915. The Town of Gustine is located approximately 7 miles northeast of the site area, so it is not clear how much time Daniel may have spent in the San Luis flat area.

The 1922[5] and 1940[6] Quien Sabe 15-minute USGS topographic maps show the resource vicinity as sectioned land. Both depict a dirt road (CA-MER-519H) to the north of the resource but do not show the earthen dam or impound pond (USGS 1922b, 1940b). The 1956[7] Quien Sabe 15-minute USGS topographic map also shows the site vicinity as sectioned, and "Haley Ranch" is depicted roughly 0.75 miles to the northeast in Section 8 in the same quarter that was patented by George Haley in 1922 (USGS 1956, BLM 2016). The dirt road first depicted on the 1922 map remains unchanged (USGS 1956). The 1969[8] Mariposa Peak 7.5-minute USGS topographic map no longer depicts the road to the north of the resource but does depict a road to the south; the earthen dam and impound pond are still not shown and the site vicinity is shown as unsectioned land (USGS 1969b). Although map evidence failed to indicate a likely date range for CA-MER-518H, its construction probably predated construction

[5] The 1922 Quien Sabe 15-minute USGS topographic map was surveyed in 1917-1918.

[6] The 1940 Quien Sabe 15-minute USGS topographic map was revised using aerial photographs in 1939-1940.

[7] The 1956 Quien Sabe 15-minute USGS topographic map revised from aerial photographs taken 1949-1950; field checked 1956.

[8] The 1969 Mariposa Peak 7.5-minute USGS topographic map is based on aerial photographs taken in 1967; field checked in 1969.

of the B.F. Sisk Dam and San Luis Reservoir. No clear tie could be made between CA-MER-518H and Daniel or George Haley, though it seems likely that the resource was used as a stock watering locale, perhaps as a part of the Haley dairy operation.

NRHP/CRHR Evaluation

CA-MER-518H is an earthen dam and impound pond with no other associated features, structures, or surface artifacts. Historic period map evidence failed to indicate a date range for the resource, but it likely pre-dates the construction of the B.F. Sisk Dam and San Luis Reservoir. While the resource was likely associated with ranching or farming activities, perhaps with the Haley family dairy operation, it could not be linked to significant historic period events or trends. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

Although CA-MER-518H may be associated with Daniel and George Haley who patented nearby parcels in 1919 and 1922, no clear link could be established between the Haleys and the resource location. Because the resource could not be linked to one or more individuals significant in local, regional, state, or national history, CA-MER-518H is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

As a historic period earthen dam and impound pond, CA-MER-518H consists of a single engineered feature. That feature is not unique and does not exemplify distinctive characteristics of a type, period, or method of construction. The resource does not embody innovative construction techniques, nor does it represent the work of a master. CA-MER-518H is thus recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

CA-MER-518H contains no artifacts or materials that might be used to link the resource to a particular time period. It lacks the data potential to address important research questions regarding early farming or ranching activities, water conveyance, or other potential research themes. The resource is recommended not eligible for listing on NRHP/CRHR under Criterion D/4.

CA-MER-518H remains in good condition and has not been heavily impacted by erosion. It retains integrity of location, design, materials, workmanship, feeling, and association. The resource's integrity of setting has presumably been affected by the development and inundation of the San Luis Reservoir. Overall, the resource possesses good integrity. CA-MER-518H is recommended not eligible for listing in the NRHP/CRHR.

CA-MER-519H
P-24-002164
PL-SLLPIP-16-13

Description

CA-MER-519H is a historic period dirt road that includes four discontinuous segments (Segments A-D) that were observed during the 2016 inventory survey as well as one digitized segment that was noted on

Recommended Not Eligible for Listing in the NRHP/CRHR

Appendix B, Figures B-5 and B-7

Operation of Dam Raise (San Luis Reservoir Shoreline –San Luis Creek Inlet)

historic period USGS topographic maps and is now largely inundated. The digitized segment extends south from the 1920s-era alignment of SR 152 through a broad flat and the center of what is currently a spillway for the San Luis Reservoir. The northernmost end of the digitized road segment begins roughly 1 mile west of Basalt Hill and descends south for 2.4 miles before curving northwest to follow the contour of San Luis Creek for another 0.6 miles. Most of the alignment is under water or no longer evident on the ground. A historic period earthen dam and impound pond (CA-MER-518H) are located roughly 750 feet south of the southernmost point along the digitized alignment of CA-MER-519H. The four discontinuous road segments that were observed during the 2016 inventory survey begin near the southwestern end of the main alignment and continue northwest for 0.43 miles up the San Luis Creek Canyon. Each measure 375-500 feet in length and approximately 10 feet in width. These segments are bordered by steep 10-15 foot high road cuts and steep drop-offs towards the adjacent drainage, allowing passage along a narrow, single-track corridor.

CA-MER-519H is situated largely within an oak woodland vegetation community with sparsely scattered oaks and dense seasonal grasses. The road alignments themselves feature a moderate grade of 0-5°, though the areas that border them feature a variable slope of up to 45°. Soils, where visible, comprise light tan, very rocky, and compact silty clay loam. The recorded road segments border the southern side of San Luis Creek and terminate near its confluence with Portuguese Creek.

Archival Research Summary

According to current USGS topographic maps, CA-MER-519H is located in Section 32 in Township 10 South, Range 8 East and in Section 5 and unsectioned lands in Township 11 South, Range 8 East. Historic period maps, however, indicate that currently unsectioned lands encompassing the southernmost portion of the resource were previously designated as Sections 7 and 8 of Township 11 South, Range 8 East. The southernmost portion of the digitized alignment lay in both, while the four segments identified during inventory survey were noted in Section 7 (USGS 1940b). A GLO plat from 1875 for the site vicinity depicts a road from the north that descends towards northern Los Banos Valley, which may reflect portions of the CA-MER-519H alignment (BLM 2016). The 1922 Quien Sabe 15-minute USGS topographic map shows the main alignment of CA-MER-519H terminating near the confluence of San Luis and Portuguese Creeks (USGS 1922b). The 1940 Quien Sabe 15-minute USGS topographic map (USGS 1940b) shows an ephemeral road or trail segment continuing further south-southwest along Portuguese Creek to end at a structure. At least portions of the road, therefore, appear to have been in place by 1922. The 1956 Quien Sabe 15-minute USGS topographic map mirrors the 1940 map but also appears to show the four discontinuous road segments continuing from near the southern end of the main alignment as a jeep trail (USGS 1956). The 1969 Mariposa Creek 7.5-

minute USGS topographic map depicts the inundated San Luis Reservoir and no longer depicts the CA-MER-519H road segments but does depict a road from the east that skirts the southern edge of the spillway before turning southwest to border Portuguese Creek and continue west (USGS 1969b).

Land patent information for Township 11 South, Range 8 East indicates that George Haley patented the southeast quarter of the northwest quarter of Section 8 on December 18, 1922 (Doc # 08821, BLM # CASF 0008821) (BLM 2016). Neighboring areas were patented to Daniel T. Haley on June 2, 1919, including the southeast quarter of the northeast quarter and the northwest quarter of the southeast quarter of Section 18 (Doc # 011232, BLM # CASF 0011232) (BLM 2016). No information was available for lands surrounding the structure near the end of the main road alignment as it appears on the 1956 Quien Sabe 15-minute USGS topographic map (USGS 1956). It is possible that the main road alignment of CA-MER-519H was established to bridge the 1920s-era alignment of SR 152 with the Haley's lands or with the lands of other unknown ranchers or farmers. The History of Merced County, California (Outcalt 1925:762) notes that Daniel T. Haley was the son of William Haley, the owner of the San Francisco Dairy Delivery Company. Daniel followed his father into the dairy business, concentrating his efforts on production and supply while his father focused on delivery within the San Francisco and Burlingame areas. Daniel settled in and became the mayor of Gustine, so it is unclear how much time he may have actually spent on lands near San Luis Creek.

NRHP/CRHR Evaluation

CA-MER-519H is a historic period dirt road that consists of one main alignment detectable mostly through historic period topographic maps and four discontinuous road segments that appear to have come into use prior to 1956. All appear to have been abandoned by the time the San Luis Reservoir was inundated. The resource was likely associated with local ranching or farming activities, perhaps with the Haley family dairy operation, though it could not be linked to particular historic period events or uses. The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

CA-MER-519H may be associated with the Haley family dairy operation, though no clear link could be established between Daniel or George Haley and the construction or use of the main road alignment or its offshoots. The resource could not be clearly linked to one or more individuals significant in local, regional, state, or national history and CA-MER-519 H is therefore recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

The CA-MER-519H road segments could not be clearly linked to any other buildings, structures, or sites within the vicinity. They are not structurally unique and do not exemplify distinctive characteristics of a type, period, or method of construction. Thus, the resource is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

As isolated road segments, there is little potential to encounter a subsurface component or vertical stratigraphy along CA-MER-519H. It offers limited potential to address important research questions about Transportation Development in the American Period (see Section 3.3.3). The resource is recommended not eligible for listing in the NRHP/CRHR under Criterion D/4.

The four visible, discontinuous portions of CA-MER-519H do not appear to be maintained or in active use, and the main alignment of the road is now inundated by the San Luis Reservoir. Despite impacts from erosion, the visible road segments are in fair condition and retain integrity of location, design, materials, and workmanship. They lack integrity of feeling and association, however because they cannot be clearly linked to a particular time or purpose, and because the main road alignment of which they were presumably a part retains only integrity of location. As a whole, CA-MER-519H possesses poor integrity. CA-MER-519H is recommended not eligible for listing in the NRHP/CRHR.

PL-SISK-05

Pending Evaluation for Listing in the NRHP/CRHR

Appendix B, Figure B-1

Operation of Raise Dam (Cottonwood Bay Shoreline)

Description

PL-Sisk-05 is a prehistoric midden site or mound with fire-affected rock that measures 29 meters (N/S) by 28 meters (E/W). It is located inside a bend on the south bank of Cottonwood Creek. The site is located over 200 meters upstream from two similar prehistoric sites, CA-MER-136 and CA-MER-137, that were first recorded by W.H. Olsen in 1971. All three sites were characterized by gray midden soils, abundant fire-affected rock, and few other artifacts. Two groundstone artifacts were encountered at PL-Sisk-05: Artifact 1, a groundstone pestle, and Artifact 2, a battered stone. Both were discovered in rodent burrows, suggesting that the site may feature a subsurface component. The area surrounding PL-Sisk-05 is relatively level with an eastern aspect. It is below the high waterline of Cottonwood Bay in a non-native grassland community mixed with thistles. A metagraywacke wall responsible for the bend in Cottonwood Creek also shelters the site from wind. Live oak trees dot the landscape above the high waterline but are scarce below. The site exhibits impacts from erosion, cattle grazing, rodent bioturbation, road grading, and vehicle use.

NRHP/CRHR Evaluation

PL-Sisk-05 consists of midden soils with fire-affected rock and two groundstone tools that may represent a short-term habitation site (*see* Section 7.3.1). Short-term habitation sites were occupied for a short duration or were occupied repeatedly on a seasonal or short-term basis. These sites typically lack accumulated midden deposits, and the cultural constituents tend to be less numerous or diverse than at permanent habitation sites (*see* Section 7.3.1). Given the presence of midden and fire-affected rock, short-term food processing may have occurred at PL-Sisk-05, suggesting that the site contains a subsurface deposit. The presence of two groundstone artifacts discovered in rodent burrows further suggests a subsurface component. The resource is evaluated under the themes of *Economy* and *Settlement* (*see* Section 7.2), particularly as they relate to prehistoric subsistence.

Prehistoric temporary habitation sites are relatively common in the foothills of the Diablo Range. Little is known, however, about their relationship to larger, more prominent prehistoric sites located on the western edge of the valley floor or to habitation sites located along major stream courses. A search of the Sacred Lands Inventory by the NAHC did not reveal any information about the PL-Sisk-05 locale, and the resource does not appear to have been associated with any significant events in local or regional Native American history. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion A/1.

No definitive association with one or more individuals could be established for PL-Sisk-05, and a literature review did not identify any prominent individuals who may have been associated with the site during the ethnographic period. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion B/2.

PL-Sisk-05 does not contain structurally or artistically unique features and does not exemplify distinctive characteristics of a type, period, or method of construction. The site is recommended not eligible for listing in the NRHP/CRHR under Criterion C/3.

Given that PL-Sisk-05 includes midden soils with fire-affected rock, the potential for the site to reveal subsurface components or vertical stratigraphy is high. Thus, the data potential of the site (e.g., its depth, integrity, age, and artifact diversity) has not been fully examined. Further investigation of PL-Sisk-05 may reveal information regarding its potential to address important research questions about chronology, settlement, economy, and technology in northern San Joaquin Valley prehistory (*see* Section 7.2). Based on the limited data acquired during inventory survey, an informed recommendation regarding the eligibility of the site for listing in the NRHP/CRHR under Criterion D/4 cannot be offered. If the B.F. Sisk Dam Raise Alternative is implemented, subsurface testing is advocated to determine if PL-Sisk-05 offers the potential to address important research questions such as those outlined in Section 7.2.

7.5 Summary and Recommendations

Pacific Legacy personnel completed intensive pedestrian inventory surveys of approximately 4,454 acres within the 5,028-acre B.F. Sisk Dam Raise Alternative APE between 2012 and 2020 (*see* Appendix B, Figures B-1 through B-7 and Appendix C). Forty-three cultural resources were documented within the APE, including 11 previously recorded resources, 22 newly identified archaeological sites or historic period built environment resources, and ten isolated finds (*see* Table 6-2). Ten resources noted through archival and record searches could not be relocated within the APE or were found to be non-cultural.

The 11 previously recorded resources relocated within the APE include seven prehistoric sites (CA-MER-15, CA-MER-28, CA-MER-82, CA-MER-83, and CA-MER-130, CA-MER-136, and CA-MER-137), most with midden, lithics, and groundstone; one historic period water tank and trough (CA-MER-521H); one historic period ranch complex (CA-MER-451H); one historic period road (CA-MER-477H); and key features of the B.F. Sisk Dam/San Luis Reservoir Historic District. Two of these known resources (CA-MER-83 and CA-MER-477H) were originally plotted outside of the APE but were noted within it during inventory surveys. The 22 newly identified archaeological sites or historic period built environment resources include a series of historic period transmission poles with a debris scatter (CA-MER-484H); two industrial sites (CA-MER-492H and CA-MER-509H) associated with B.F. Sisk Dam construction; eight historic period road segments (CA-MER-489H, CA-MER-491H, CA-MER-493H, CA-MER-494H, CA-MER-495H, CA-MER-513H, CA-MER-519H, and PL-Sisk-01); a concrete equipment pad (CA-MER-510H); a corral and water tank (CA-MER-511H); a helicopter pad (CA-MER-512H); a ditch segment (CA-MER-514H); three earthen dams with impound ponds (CA-MER-515H, CA-MER-516H, and CA-MER-518H); two prehistoric middens, one with lithics and groundstone (CA-MER-517) and the other with fire-affected rock (PL-Sisk-05); a series of survey markers and monitoring wells (CA-MER-520H) associated with the B.F. Sisk Dam; and the Cottonwood embankment (PL-Sisk-04), which is a feature of the San Luis Reservoir and wider B.F. Sisk Dam/San Luis Reservoir Historic District. The ten isolated finds include a historic period well head (P-24-002166), metal can (P-24-002167), concrete foundation (P-24-002172), two watering troughs (P-24-002169 and P-24-002170); a bottle (P-24-002171); one isolated prehistoric core (P-24-001990); one biface fragment (P-24-001991); one cobble and flake (P-24-002168); and one displaced cupule boulder (PL-Sisk-ISO-02).

Two of the previously recorded prehistoric sites (CA-MER-130 and CA-MER-136) are listed in the NRHP and CRHR, as is a prehistoric district (P-24-000489/San Luis Gonzaga Archaeological District) that intersects the APE but is characterized by no physical markers. JRP (2018) recommended the B.F. Sisk Dam and its key facilities eligible for listing in the NRHP and CRHR as contributing elements to the B.F. Sisk Dam/San Luis Reservoir Historic District, though not eligible as individual facilities. Pacific Legacy produced survey-level evaluations for most of the cultural resources within the B.F. Sisk Dam Raise Alternative APE by drawing on information from inventory surveys and site-specific documentary research (*see* Section 7.4). Two industrial resources associated with construction of the B.F. Sisk Dam system (CA-MER-492H and CA-MER-509H) are recommended not eligible for listing in the NRHP or CRHR and are considered non-contributing elements of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018). The Cottonwood embankment (PL-Sisk-04), newly recorded as a feature of the San Luis Reservoir in 2020, is considered a key feature of the reservoir and thus a component part of a contributor to the historic district (JRP 2018). Seven historic period resources (CA-MER-510H, CA-MER-511H, CA-MER-

512H, CA-MER-513H, CA-MER-514H, and CA-MER-520H, CA-MER-521H) have been determined not eligible for inclusion in the NRHP with concurrence from the SHPO and recommended not eligible for listing in the CRHR (Polanco 2018). Twelve historic period resources (CA-MER-477H, CA-MER-484H, CA-MER-489H, CA-MER-491H, CA-MER-493H, CA-MER-494H, CA-MER-495H, CA-MER-515H, CA-MER-516H, CA-MER-518H, CA-MER-519H, and PL-Sisk-01) are recommended not eligible for listing in the NRHP and the CRHR. Seven prehistoric archaeological sites (CA-MER-15, CA-MER-28, CA-MER-82, and CA-MER-83, CA-MER-137, CA-MER-517, and PL-Sisk-05) remain pending evaluation for listing in the NRHP and CRHR.

Based on the NRHP/CRHR evaluations and assessments presented above, 17 archaeological sites or built environment resources within the B.F. Sisk Dam Raise Alternative APE associated with Construction of Dam Raise impacts should require no additional evaluation efforts (*see* Table 7-1). The B.F. Sisk Dam/San Luis Reservoir Historic District, specifically the Cottonwood embankment recorded as PL-Sisk-04 during the 2020 inventory survey, also lies within the SR 152 Modifications area and will be critical to the elevation of the roadway as a part of the B.F. Sisk Dam Raise Alternative. Similar to alterations to the height of the dam, however, the elevation of the embankment and roadway is not expected to have an adverse effect on the significance of the feature or the district as a whole (JRP 2018). Eight archaeological sites or historic period built environment resources within the B.F. Sisk Dam Raise Alternative APE associated with Operation of Dam Raise impacts should require no additional evaluation efforts, either because they have been previously evaluated and listed in the NRHP/CRHR or because they have been subject to survey-level evaluation and recommended not eligible for listing in either register. Seven prehistoric archaeological sites that may be subject to Operation of Dam Raise impacts may require further evaluation efforts if the B.F. Sisk Dam Raise Alternative is implemented (*see* Table 7-1). These sites would be susceptible to mechanical and biochemical impacts from increased wave action and fluctuating water levels following expansion of the San Luis Reservoir and Cottonwood Bay and may be found to meet criteria as potential historic properties, historical resources, or tribal cultural resources.

Table 7-1. Evaluations Summary for Cultural Resources within the Area of Potential Effects for the B.F. Sisk Dam Raise Alternative.

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
Construction of Dam Raise				
CA-MER-451H P-24-001876	Historic period ranch complex	Potential Construction Staging Area – South of B.F. Sisk Dam	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-477H P-24-001822	Fourteen historic period road segments	Dinosaur Point Boat Launch Modification Area; Reservoir Shoreline – Dinosaur Point Area	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
CA-MER-491H P-24-001985 PL-SLLP-A-010	Historic period road segment	Potential Construction Staging Area – West of Goosehead Point	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-492H P-24-001986	Historic period industrial site used in construction of the B.F. Sisk Dam	Potential Construction Staging Area – West of Goosehead Point	Recommended not eligible for listing in the NRHP/CRHR and a non-contributing element of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018)	No additional evaluation efforts recommended
CA-MER-493H P-24-001987 PL-SLLP-A-014	Historic period road segment	Potential Construction Staging Area – West of Goosehead Point	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-494H P-24-001988 PL-SLLP-A-015	Historic period road segment	Basalt Hill Borrow Area; Potential Construction Staging Area – West of Goosehead Point; Access Road Area	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-495H P-24-001989 PL-SLLP-A-016	Historic period road segment	Potential Construction Staging Area – West of Goosehead Point	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-509H P-24-002154 PL-SLLPIP-16-01	Historic period Basalt Hill Quarry, part of the industrial complex used in construction of B.F. Sisk Dam system	Basalt Hill Borrow Area; Access Road Area	Recommended not eligible for listing in the NRHP/CRHR and a non-contributing element of the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018)	No additional evaluation efforts recommended

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
CA-MER-510H P-24-002155 PL-SLLPIP-16-02	Historic concrete equipment pad near O'Neill Forebay	Borrow Area 6 - South of O'Neill Forebay	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
CA-MER-511H P-24-002156 PL-SLLPIP-16-03	Historic metal water tank on railroad ties in a corral area near O'Neill Forebay	Borrow Area 6 - South of O'Neill Forebay	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
CA-MER-512H P-24-002157 PL-SLLPIP-16-05	Historic helicopter pad located east of the BF Sisk Dam	Potential construction staging areas – block east of B.F. Sisk Dam	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
CA-MER-513H P-24-002158 PL-SLLPIP-16-06	Historic asphalt road segment	Potential construction staging areas – block east of B.F. Sisk Dam	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
CA-MER-514H P-24-002159 PL-SLLPIP-16-07	Historic ditch segment	Potential construction staging areas – block east of B.F. Sisk Dam	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
CA-MER-520H P-24-002165 PL-SLLPIP-16-14	Historic period survey markers and monitoring wells associated with construction and maintenance of the B.F. Sisk Dam	Downstream Stability Berms/Fill Impact Areas; Potential Construction Staging Areas	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
CA-MER-521H P-24-002173 SLTP-B-11	Historic water tank and trough	Borrow Area 6 - South of O'Neill Forebay	Not eligible for listing in the NRHP with SHPO concurrence (Polanco 2018), recommended not eligible for listing in the CRHR	No additional evaluation efforts recommended
PL-SISK-01	Historic period dirt road segment	Basalt Hill Borrow Area; Potential Construction Staging Area – West of Goosehead Point; Access Road Area	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
SR 152 Modification Area / Construction of Dam Raise				
B.F. Sisk Dam/San Luis Reservoir Historic District	Historic period B.F. Sisk Dam and facilities, includes the Cottonwood embankment (PL-Sisk-04), recorded as a feature of the San Luis Reservoir	Downstream Stability Berms/Fill Impact Areas; Expanded Embankment; Reservoir Shoreline	Recommended eligible for listing in the NRHP/CRHR as the B.F. Sisk Dam/San Luis Reservoir Historic District (JRP 2018); key elements of the district not individually eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
Operation of Dam Raise				
CA-MER-15 P-24-000116	Prehistoric pictographs, bedrock mortars, cupules, cleared areas midden soil, lithic scatter	San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site
CA-MER-28 P-24-000129	Prehistoric occupation site with lithic scatter	San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site
CA-MER-82 P-24-000182	Prehistoric lithic scatter with groundstone	San Luis Reservoir Shoreline – West side of San Luis Creek Inlet	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site
CA-MER-83 P-24-000183	Prehistoric midden soil with lithic scatter and groundstone	San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site
CA-MER-130 P-24-000220	Prehistoric midden soil with two bedrock mortar features with five mortars and groundstone	San Luis Reservoir Shoreline – North of Dinosaur Point Boat Launch	Listed in the NRHP/CRHR as a contributing element to the San Luis Gonzaga Archaeological District	No additional evaluation efforts recommended
CA-MER-136 P-24-000226	Prehistoric midden deposit with pestle fragments	Cottonwood Bay Shoreline	Listed in the NRHP/CRHR (code 1D)	No additional evaluation efforts recommended
CA-MER-137 P-24-000227	Prehistoric large occupation site on knoll with pestle fragments	Cottonwood Bay Shoreline	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site

Site Number	Description	APE Location	NRHP/CRHR Status	Recommended Evaluation Measures
CA-MER-484H P-24-001974 PL-SLLP-A-001	Historic period transmission poles and debris scatter	San Luis Reservoir Shoreline – Dinosaur Point Area	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-489H P-24-001979 PL-SLLP-A-013	Historic period road segment	San Luis Reservoir Shoreline – Dinosaur Point Area	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-515H P-24-002160 PL-SLLPIP-16-09	Historic period earthen dam with impound pond	San Luis Reservoir Shoreline – South of SR 152	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-516H P-24-002161 PL-SLLPIP-16-10	Historic period earthen dam with impound pond	San Luis Reservoir Shoreline – South of SR 152	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-517 P-24-002162 PL-SLLPIP-16-11	Prehistoric lithic scatter with midden and groundstone	San Luis Reservoir Shoreline – South of Dinosaur Point Boat Launch	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site
CA-MER-518H P-24-002163 PL-SLLPIP-16-12	Historic period earthen dam with impound pond	San Luis Reservoir Shoreline – South side of San Luis Creek Inlet	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
CA-MER-519H P-24-002164 PL-SLLPIP-16-13	Historic period dirt road segments	San Luis Reservoir Shoreline –San Luis Creek Inlet	Recommended not eligible for listing in the NRHP/CRHR	No additional evaluation efforts recommended
PL-SISK-05	Prehistoric midden site with fire-affected rock	Cottonwood Bay Shoreline	Pending evaluation for listing in the NRHP/CRHR under Criterion D/4	If resource cannot be avoided, subsurface testing is recommended to further evaluate the site

As was noted in Section 2.2.3, Late Holocene landforms in and around the San Luis Reservoir are highly sensitive for buried cultural resources that may become exposed during drought years or periods of significant drawdown. Mechanical and biochemical impacts associated with a fluctuating reservoir shoreline also can have a pronounced effect on cultural resources and can act to cover, expose, erode, or alter both archaeological sites and built environment resources (*see* Section 6.2.3). If the maximum water level of the San Luis Reservoir is increased under the B.F. Sisk Dam Raise Alternative, three known resources (CA-MER-130, CA-MER-484H, and CA-MER-136) may be newly affected. Other resources located along the existing shoreline that have been subject to prior mechanical and biochemical impacts also may be affected in new ways. For instance, additional resource areas may become inundated, subject to wave action, or buried by redeposited sediment. Based on field observations and controlled experiments, Ware (1989) formulated a model for the management of cultural resources in reservoir environments based on three major impact zones. If the current Project is authorized and the B.F. Sisk Dam Raise Alternative is selected, that model might provide an effective tool in managing historic properties or historical resources affected by an increase in reservoir storage capacity.

A Draft EIR/SEIS has been prepared by Reclamation and the Authority that addresses potential impacts of the B.F. Sisk Dam Raise Alternative to cultural resources under CEQA. Given the information available, adverse effects to significant cultural resources (i.e., historic properties) may result from implementation of the B.F. Sisk Dam Raise Alternative. Mitigation measures to resolve adverse effects on historic properties, pursuant to Section 106 of the NHPA, cannot be determined until all cultural resources in the APE for the undertaking have been fully evaluated for NRHP eligibility and consultations are conducted under Section 106 of the NHPA. This will not occur until after the submission of a Project Feasibility Report and SEIS/EIR to the Office of Management and Budget and the authorization of a Project by Congress. When a Project is authorized, efforts to evaluate potential historic properties would continue, a Section 106 finding of effect for the undertaking would be made, and any adverse effects to historic properties would be resolved through completion of the Section 106 process.

The resolution of adverse effects to historic properties occurs through the implementation of measures agreed on through consultation with the SHPO, ACHP, and other Section 106 consulting parties as stipulated in a formal agreement document (i.e., Memorandum of Agreement or Programmatic Agreement). Generally, significant impacts to cultural resources under NEPA would also be mitigated through the measures agreed to through the Section 106 process. Cultural resources that are formally determined not eligible for inclusion in the NRHP or the CRHR would require no further management prior to Project implementation. It should be noted that some cultural resources may not meet NRHP eligibility criteria, but still may be CRHR-eligible. Such resources would be managed per CEQA requirements.

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Appendix A
Archival and Records Search Maps

CONFIDENTIAL - REDACTED

Appendix B
Inventory Survey Maps

CONFIDENTIAL - REDACTED

Appendix C
Confidential Cultural Resource Records Associated with the B.F. Sisk Dam Raise Alternative

CONFIDENTIAL - REDACTED

Previously Recorded Archaeological Sites or Built Environment Resources

Newly Discovered Archaeological Sites or Built Environment Resources

Newly Recorded Isolated Finds

Previously Recorded Archaeological Sites or Built Environment Resources, Not Relocated

Appendix D
Organizational Contact Documentation

Sacred Lands File & Native American Contacts List Request

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd, Suite 100
West Sacramento, CA 95501
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: San Luis & Delta Mendota Water Authority Reservoir Expansion Project (3639-01)

County: Merced

USGS Quadrangle

Name: Los Banos Valley (1969), Mariposa Peak (1969), Pacheco Pass (1955), San Luis Dam (1969)

Township: - Range: - Section(s): please see attached

Company/Firm/Agency:
Pacific Legacy, Inc.

Contact Person: Lisa Holm

Street Address: 900 Modoc Street

City: Berkeley, California Zip: 94707

Phone: (510) 524-3991 Extension: 102

Fax:

Email: holm@pacificlegacy.com

Project Description:

On behalf of the San Luis & Delta Mendota Water Authority and US Bureau of Reclamation, we are conducting a cultural resources investigation for the San Luis Reservoir Expansion and BF Sisk Dam Raise project (3639-01), which will be centered on the San Luis Reservoir in western Merced County. The project would involve expanding the capacity of the reservoir and raising the height of the dam. Potential impact locations include the existing reservoir shoreline, which may become inundated if the storage capacity of the San Luis Reservoir is increased, borrow areas, levee modification and raise areas, downstream fill impact areas, haul roads, and potential construction staging areas. The project area will span approximately 5,022 acres. We would like to request a search of the Sacred Lands File for the project area (please see Figure 1, attached) as well as a list of Native American Tribal representatives for Merced County who may have an interest in or knowledge of the project area. The Authority and/or Reclamation will be contacting these parties for further consultation. If you could also please send us a CEQA Tribal Consultation List (AB 52) for the project area (if separate from the above) it would be much appreciated. Thank you for your assistance.

☑ Project Location Map is attached

USGS 7.5-Minute Quadrangle	Township/Range	Sections
Los Banos Valley	Township 11 South, Range 8 East	4, 5, unsectioned
Mariposa Peak	Township 11 South, Range 8 East	6, unsectioned
	Township 11 South, Range 7 East	6
Pacheco Pass	San Luis Gonzaga Land Grants, Civil Colonies	
	Township 9 South, Range 7 East	36
	Township 9 South, Range 7 East	25
	Township 9 South, Range 8 East	31
	Township 9 South, Range 8 East	36
	Township 10 South, Range 7 East	25, 36, unsectioned
	Township 10, South, Range 8 East	25, 29, 30, 31, 32, unsectioned
	Township 11 South, Range 7 East	6
	Township 11 South, Range 8 East	5, 6, 31, 32
San Luis Dam	San Luis Gonzaga Land Grants, Civil Colonies	
	Township 9 South, Range 8 East	31
	Township 10 South, Range 8 East	13, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35
	Township 10 South, Range 9 East	7, 13, 18
	Township 11 South, Range 8 East	4, 5, 32, 33

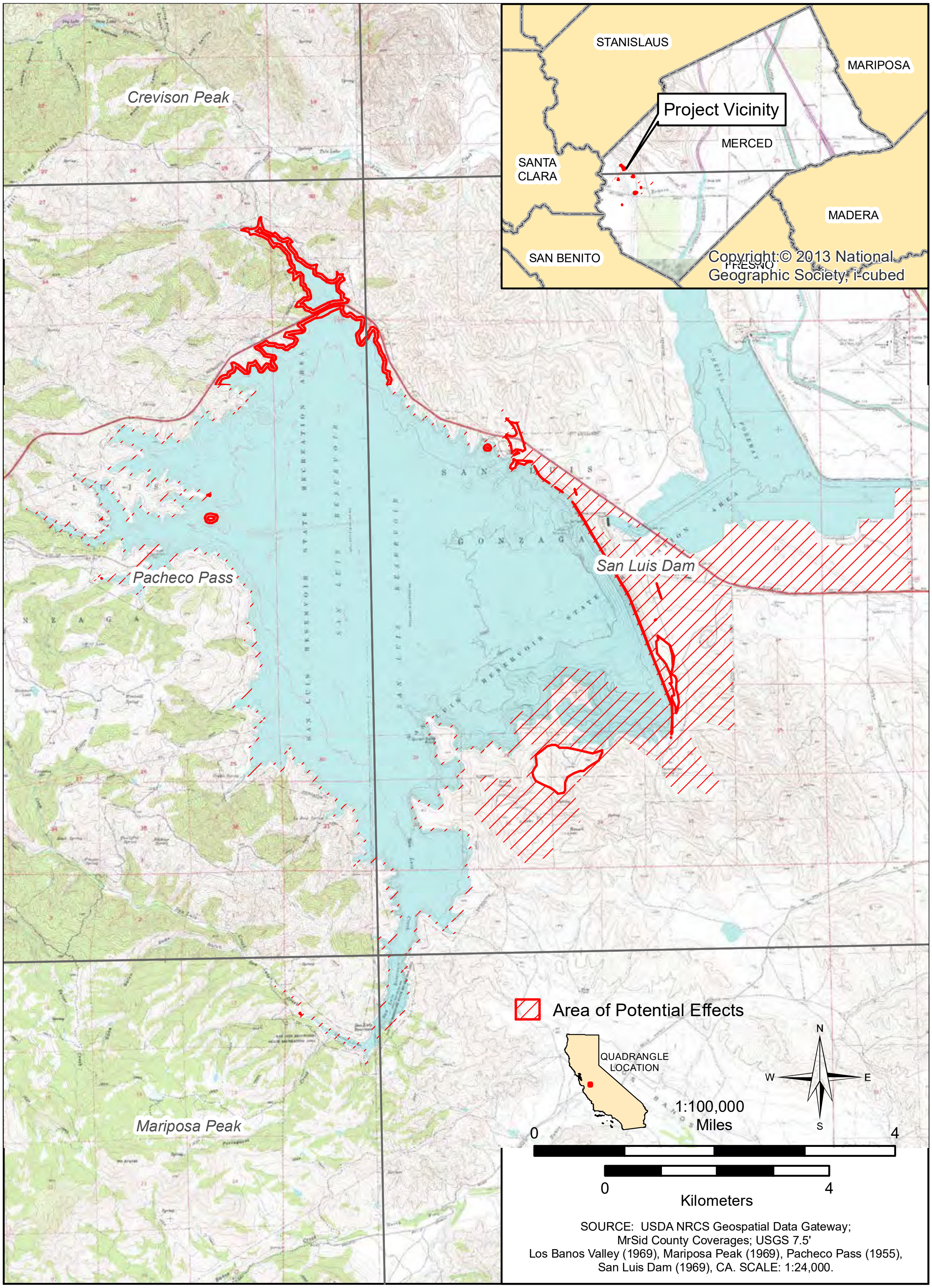

Figure 1. San Luis & Delta Mendota Water Authority Reservoir Expansion Project (3639-01) Location and Vicinity Map.

NATIVE AMERICAN HERITAGE COMMISSION

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

February 25, 2020

Lisa Holm

Pacific Legacy, Inc.

Via Email to: holm@pacificlegacy.com

Re: San Luis & Delta Mendota Water Authority Reservoir Expansion Project (3639-01), Merced County

Dear Ms. Holm:

A record search of the Native American Heritage Commission (NAHC) Sacred Lands File (SLF) was completed for the information you have submitted for the above referenced project. The results were negative. However, the absence of specific site information in the SLF does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Attached is a list of Native American tribes who may also have knowledge of cultural resources in the project area. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated; if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call or email to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance, we can assure that our lists contain current information.

If you have any questions or need additional information, please contact me at my email address: Nancy.Gonzalez-Lopez@nahc.ca.gov.

Sincerely,

Nancy Gonzalez-Lopez

Nancy Gonzalez-Lopez
Cultural Resources Analyst

Attachment

Native American Heritage Commission
Native American Contact List
Merced County
2/25/2020

Amah MutsunTribal Band

Valentin Lopez, Chairperson	
P.O. Box 5272	Costanoan
Galt, CA, 95632	Northern Valley
Phone: (916) 743 - 5833	Yokut
vlopez@amahmutsun.org	

Dumna Wo-Wah Tribal Government

Robert Ledger, Chairperson	
2191 West Pico Ave.	Foothill Yokut
Fresno, CA, 93705	Mono
Phone: (559) 540 - 6346	
ledgerrobert@ymail.com	

North Valley Yokuts Tribe

Katherine Perez, Chairperson	
P.O. Box 717	Costanoan
Linden, CA, 95236	Northern Valley
Phone: (209) 887 - 3415	Yokut
canutes@verizon.net	

Southern Sierra Miwuk Nation

William Leonard, Chairperson	
P.O. Box 186	Miwok
Mariposa, CA, 95338	Northern Valley
Phone: (209) 628 - 8603	Yokut
	Paiute

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed San Luis & Delta Mendota Water Authority Reservoir Expansion Project (3639-01), Merced County.

Native American Tribal Representative and Additional Consulting Party Contact Information	Federally Recognized	California Native American Heritage Commission	Bureau of Indian Affairs	U.S. Department of Housing and Urban Development	National Association of THPOS	Letter Sent	Certified Mail Tracking No.	Delivered	Emailed/ Called	Comments
Jennifer Ruiz, Chairperson Picayune Rancheria of Chukchansi Indians 8080 Palm Ave, Suite 207 Fresno, California 93711 Phone: (559) 412-5590	x		x			5/18/20	7017 0190 0000 8399 0251	In Transit		Note, tribal website lists Claudia Gonzales as Chairperson, Joshua Herr as Vice Chairman. TDAT lists Reggie Lewis as Chairperson and Mary Motola as THPO. TDAT phone: (559) 370-4141 BIA website lists Jennifer Ruiz as Chairperson, physical address as 49260 Chapel Hill Drive, Oakhurst, CA 93644 And local PO Box as P.O. Box 2146, Oakhurst, CA 93644
Tara Estes-Harter, Cultural Director/Tribal Historic Preservation Officer Picayune Rancheria of Chukchansi Indians 49260 Chapel Hill Drive Oakhurst, CA 93644 Tharter@chukchansi-nsn.gov	x				x	5/18/20	7017 0190 0000 8399 0152	5/21/20		
Leo Sisco, Chairperson Santa Rosa Rancheria Tachi Yokut Tribe P.O. Box 8 Lemoore, California 93245 Phone: (559) 924-1278 http://www.tachi-yokut-nsn.gov/	x		x			5/18/20	7017 0190 0000 8399 0268	5/21/20		See also Santa Rosa Indian Community of the Santa Rosa Rancheria, California *or* Santa Rosa Rancheria and/or Tachi Yokut Tribe
Shana Powers, Cultural Director Santa Rosa Rancheria Tachi Yokut Tribe P.O. Box 8 Lemoore, California 93245 SPowers@tachi-yokut-nsn.gov http://www.tachi-yokut-nsn.gov/	x					5/18/20	7017 0190 0000 8399 0244	5/21/20		See also Santa Rosa Indian Community of the Santa Rosa Rancheria, California *or* Santa Rosa Rancheria and/or Tachi Yokut Tribe
Brenda D. Lavell, Chairperson Table Mountain Rancheria P.O. Box 410 Friant, CA 93626-0410 Phone: (559) 822-2587	x		x			5/18/20	7017 0190 0000 8399 0176	5/20/20		
Bob Pennell, Cultural Resources Director Table Mountain Rancheria P.O. Box 410 Friant, CA 93626-0410 Phone: 559-325-0351 Cell: 559-217-9718	x					5/18/20	7017 0190 0000 8399 0213	5/20/20		

Native American Tribal Representative and Additional Consulting Party Contact Information	Federally Recognized	California Native American Heritage Commission	Bureau of Indian Affairs	U.S. Department of Housing and Urban Development	National Association of THPOS	Letter Sent	Certified Mail Tracking No.	Delivered	Emailed/ Called	Comments
Octavio Escobedo III, Chairperson Tejon Indian Tribe P.O. Box 640 Arvin, CA 93203-0640 oescobedo@tejonindiantribe-nsn.gov	x		x			5/18/20	7017 0190 0000 8399 0145	5/20/20		BIA give address as 1731 Hasti Acres Drive Suite 108, Bakersfield, CA 93309
Neil Peyron, Chairperson Tule River Indian Tribe P.O. Box 589 Porterville, CA 93258 Phone: (559) 781-4271 Neil.Peyron@Tulerivertribe-nsn.gov http://tulerivertribe-nsn.gov/enviromental/	x		x			5/18/20	7017 0190 0000 8399 0237	In Transit		Note zip code on Reclamation mailing list showed zip code as 93528 (93258 correct). Tracking indicates must schedule redelivery, option not available online; likely will return to San Luis & Delta-Mendota Water Authority. USPS confirms address is correct with 93258 zip code.
Kerri Vera, Department of Environmental Protection Director Tule River Indian Tribe P.O. Box 589 Porterville, CA 93258 tuleriverenv@yahoo.com or kerri.vera@tulerivertribe-nsn.gov http://tulerivertribe-nsn.gov/enviromental/	x					5/18/20	7017 0190 0000 8399 0282	In Transit		Note zip code on Reclamation mailing list showed zip code as 93528 (93258 correct). Tracking indicates must schedule redelivery, option not available online; likely will return to San Luis & Delta-Mendota Water Authority. USPS confirms address is correct with 93258 zip code.
Valentin Lopez, Chairperson Amah Mutsun Tribal Band P.O. Box 5272 Galt, CA, 95632 Phone: (916) 743 - 5833 vlopez@amahmutsun.org http://amahmutsun.org/		x				5/18/20	7017 0190 0000 8399 0206	5/20/20		
Edward Ketchum, Tribal Historian and Natural Resource Coordinator Amah Mutsun Tribal Band 35867 Yosemite Avenue Davis, CA 95616 http://amahmutsun.org/						5/18/20	7017 0190 0000 8399 0169	5/20/20		
Keith Turner Dumna Wo-Wah Tribal Government P.O. Box 306 Auberry, CA 93602 keithturner@dumnaindians.org						5/18/20	7017 0190 0000 8399 0275	Available for pickup 5/27/20		

Native American Tribal Representative and Additional Consulting Party Contact Information	Federally Recognized	California Native American Heritage Commission	Bureau of Indian Affairs	U.S. Department of Housing and Urban Development	National Association of THPOS	Letter Sent	Certified Mail Tracking No.	Delivered	Emailed/ Called	Comments
Robert Ledger, Chairperson Dumna Wo-Wah Tribal Government 2191 West Pico Avenue Fresno, CA 93705 Phone: (559) 540 - 6346 ledgerrrobert@ymail.com		x				5/18/20	7017 0190 0000 8399 0183	5/20/20		
Katherine Erolinda Perez, Chairperson North Valley Yokuts Tribe P.O. Box 717 Linden, CA 95236-0717 Phone: (209) 887 - 3415 canutes@verizon.net		x				5/18/20	7017 0190 0000 8399 0220	5/20/20		
William Leonard, Chairperson Southern Sierra Miwuk Nation P.O. Box 186 Mariposa, CA 95338-0186 Phone: (209) 628 – 8603 https://www.southernsierramiwuknation.org/		x				5/18/20	7017 0190 0000 8399 0190	5/21/20		

San Luis & Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. Octavio Escobedo III, Chairperson
Tejon Indian Tribe
P.O. Box 640
Arvin, CA 93203-0640

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Escobedo:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

<u>Project Purpose</u>

The Authority and Reclamation are preparing a Draft Environmental Impact Report (EIR) and a Draft Supplemental Environmental Impact Statement (SEIS) for the Project and have analyzed a range of management measures and alternatives aimed at meeting its main objectives. Criteria used to evaluate these measures include the extent to which the measure addresses the needs and purpose of the Project, its cost-effectiveness, and the acceptability of its potential environmental impacts. Measures that remained after initial screening resulted in two main action alternatives: the Non-Structural Alternative and the B.F. Sisk Dam Raise Alternative. A No Action/No Project Alternative also is examined in the EIR/SEIS.

Project Information

The No Action/No Project Alternative will include implementation of the Crest Raise Action under the B.F. Sisk Dam Safety of Dams Modification Project, which was examined by Reclamation and the State of California Department of Water Resources (DWR) in a 2019 Final EIS/EIR. Under the Crest Raise Action, which has been funded by the U.S. Congress and is scheduled to begin in 2021, the height of the B.F. Sisk Dam will be raised by 12 feet to reduce the likelihood of overtopping if slumping or deformation of the dam occurs as a result of seismic activity. This will allow the San Luis Reservoir to continue operating at its current maximum storage capacity while protecting the downstream public.

The Non-Structural Alternative would entail operational changes only and would result in no significant changes to reservoir water elevations. It is expected to have no impacts to cultural resources if implemented and was previously analyzed by the Authority and Reclamation in a 2019 Revised EIR/Supplemental EIS for the Long-Term Water Transfers Program.

The B.F. Sisk Dam Raise Alternative, which is centered on the San Luis Reservoir in western Merced County, has the potential to result in significant impacts to cultural resources if implemented and is the main focus of cultural resource studies conducted for the Project. The B.F. Sisk Dam Raise Alternative would increase the height of the dam by a further 10 feet and expand the storage capacity of the San Luis Reservoir by 130 thousand acre-feet. It would build upon the No Action/No Project Alternative and rely on the use of the same access roads and borrow, construction, and staging areas to implement construction. Collectively, these areas total 3,914 acres. The B.F. Sisk Dam Raise Alternative also would require additional construction activities to accommodate the proposed increase in reservoir storage capacity. These include elevating the Dinosaur Point and Goosehead Point boat launches by 10 feet; elevating the berm or levee at the Pacheco Pumping Plant by 10 feet; and elevating portions of State Route 152 between Cottonwood Bay and the San Luis Reservoir to prevent the roadway from becoming inundated. Figure 1 depicts the proposed Area of Potential Effects (APE) for the B.F. Sisk Dam Raise Alternative.

In addition to construction impacts to cultural resources, implementation of the B.F. Sisk Dam Raise Alternative is expected to result in operational impacts as the maximum water elevation of the San Luis Reservoir is increased. For cultural resources along the expanded reservoir shoreline, these operational impacts would include inundation and/or wave activity and erosion. The APE for the B.F. Sisk Dam Raise Alternative therefore includes not only the 3,914 acres that would be used to support construction of the No Action/No Project Alternative, but also construction areas specific to the alternative as well the Luis Reservoir and Cottonwood Bay shorelines. Cumulatively, the total APE for the alternative spans 5,022 acres.

Known Cultural and/or Historic Records

On behalf of the Authority and Reclamation and under contract to CDM Smith, Pacific Legacy, Inc. performed a cultural resources investigation for the B.F. Sisk Dam Raise Alternative that included archival and record searches for the APE and a surrounding 0.5-mile radius, contact with the Native American Heritage Commission, and cultural resource inventory surveys. As of April 30, 2020, all safely accessible areas within the B.F. Sisk Dam Raise Alternative APE (4,454 acres) have been subject to intensive pedestrian inventory surveys. Forty-three cultural resources were documented within the APE, including 11 previously recorded resources, 22 newly identified archaeological sites or historic period built environment resources, and ten isolated finds. Ten resources noted through archival and record searches could not be relocated within the APE or were found to be non-cultural.

The 11 previously recorded resources relocated within the B.F. Sisk Dam Raise Alternative APE include seven prehistoric sites, most with midden, lithics, and groundstone; one historic period water tank and trough; one historic period ranch complex; one historic period road; and key features of the B.F. Sisk Dam/San Luis Reservoir Historic District. The 22 newly identified archaeological sites or historic period built environment resources include two prehistoric midden sites, one with lithics and groundstone and the other with fire-affected rock; a series of historic period transmission poles with a debris scatter; two industrial sites associated with B.F. Sisk Dam construction; eight historic period road segments; a concrete equipment pad; a corral and water tank; a helicopter pad; a ditch segment; three earthen dams with impound ponds; a series of survey markers and monitoring wells associated with the B.F. Sisk Dam; and the Cottonwood embankment, which is a feature of the San Luis Reservoir and wider B.F. Sisk Dam/San Luis Reservoir Historic District. The ten isolated finds include one isolated prehistoric core, one biface fragment, one cobble and flake, one displaced cupule boulder, one historic period well head, one metal can, a single concrete foundation, two watering troughs, and one bottle.

Construction activities beyond those included under the No Action/No Project Alternative are expected to impact one historic period road near the Goosehead Point Boat Launch as well as the Cottonwood embankment supporting State Route 152 between Cottonwood Bay and the San Luis Reservoir. The historic period road has been recommended not eligible for listing in the National Register of Historic Placed (NRHP) and California Register of Historical Resources (CRHR), and the embankment is considered an element of the B.F. Sisk Dam/San Luis Reservoir Historic District, which has been recommended eligible for listing in the NRHP and CRHR. Nine prehistoric sites and eight historic period built environment resources recorded along the San Luis Reservoir and Cottonwood Bay shorelines are expected to be subject to operational impacts if the alternative is implemented. Two of these prehistoric sites are listed in the NRHP and CRHR and seven have not yet been evaluated.

No known tribal cultural resources as defined under PRC §21074(a) have been reported within the B.F. Sisk Dam Raise Alternative APE, and a search of the NAHC Sacred Lands File for the APE yielded negative results. If you have any interest in or knowledge of cultural resources in the Project vicinity, other concerns about the Project, or an interest in consulting with the Authority about the proposed Project, please do not hesitate to contact the Authority's Chief Operating Officer, Pablo Arroyave, using the contact information below:

15990 Kelso Road
Byron, California 94514
Pablo.arroyave@sldmwa.org
(209) 832-6200

Due Date for Comments

Pursuant to PRC §21080.3.1 (d) and Executive Order N-54-20, you have sixty (60) days from the receipt of this letter to request consultation, in writing, with the Authority. Please send your request to Mr. Arroyave using the contact information above. If you have any questions prior to submitting a written request, please contact Mr. Arroyave at (209) 832-6200 or pablo.arroyave@sldmwa.org. If the Authority does not receive such a request within the specified time period, it will conclude the consultation period and provide written confirmation to you that it has done so.

Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Ms. Tara Estes-Harter, Cultural Director/Tribal Historic Preservation Officer
Picayune Rancheria of Chukchansi Indians
49260 Chapel Hill Drive
Oakhurst, CA 93644

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Estes-Harter:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

Project Purpose

The Authority and Reclamation are preparing a Draft Environmental Impact Report (EIR) and a Draft Supplemental Environmental Impact Statement (SEIS) for the Project and have analyzed a range of management measures and alternatives aimed at meeting its main objectives. Criteria used to evaluate these measures include the extent to which the measure addresses the needs and purpose of the Project, its cost-effectiveness, and the acceptability of its potential environmental impacts. Measures that remained after initial screening resulted in two main action alternatives: the Non-Structural Alternative and the B.F. Sisk Dam Raise Alternative. A No Action/No Project Alternative also is examined in the EIR/SEIS.

Project Information

The No Action/No Project Alternative will include implementation of the Crest Raise Action under the B.F. Sisk Dam Safety of Dams Modification Project, which was examined by Reclamation and the State of California Department of Water Resources (DWR) in a 2019 Final EIS/EIR. Under the Crest Raise Action, which has been funded by the U.S. Congress and is scheduled to begin in 2021, the height of the B.F. Sisk Dam will be raised by 12 feet to reduce the likelihood of overtopping if slumping or deformation of the dam occurs as a result of seismic activity. This will allow the San Luis Reservoir to continue operating at its current maximum storage capacity while protecting the downstream public.

The Non-Structural Alternative would entail operational changes only and would result in no significant changes to reservoir water elevations. It is expected to have no impacts to cultural resources if implemented and was previously analyzed by the Authority and Reclamation in a 2019 Revised EIR/Supplemental EIS for the Long-Term Water Transfers Program.

The B.F. Sisk Dam Raise Alternative, which is centered on the San Luis Reservoir in western Merced County, has the potential to result in significant impacts to cultural resources if implemented and is the main focus of cultural resource studies conducted for the Project. The B.F. Sisk Dam Raise Alternative would increase the height of the dam by a further 10 feet and expand the storage capacity of the San Luis Reservoir by 130 thousand acre-feet. It would build upon the No Action/No Project Alternative and rely on the use of the same access roads and borrow, construction, and staging areas to implement construction. Collectively, these areas total 3,914 acres. The B.F. Sisk Dam Raise Alternative also would require additional construction activities to accommodate the proposed increase in reservoir storage capacity. These include elevating the Dinosaur Point and Goosehead Point boat launches by 10 feet; elevating the berm or levee at the Pacheco Pumping Plant by 10 feet; and elevating portions of State Route 152 between Cottonwood Bay and the San Luis Reservoir to prevent the roadway from becoming inundated. Figure 1 depicts the proposed Area of Potential Effects (APE) for the B.F. Sisk Dam Raise Alternative.

In addition to construction impacts to cultural resources, implementation of the B.F. Sisk Dam Raise Alternative is expected to result in operational impacts as the maximum water elevation of the San Luis Reservoir is increased. For cultural resources along the expanded reservoir shoreline, these operational impacts would include inundation and/or wave activity and erosion. The APE for the B.F. Sisk Dam Raise Alternative therefore includes not only the 3,914 acres that would be used to support construction of the No Action/No Project Alternative, but also construction areas specific to the alternative as well the Luis Reservoir and Cottonwood Bay shorelines. Cumulatively, the total APE for the alternative spans 5,022 acres.

Known Cultural and/or Historic Records

On behalf of the Authority and Reclamation and under contract to CDM Smith, Pacific Legacy, Inc. performed a cultural resources investigation for the B.F. Sisk Dam Raise Alternative that included archival and record searches for the APE and a surrounding 0.5-mile radius, contact with the Native American Heritage Commission, and cultural resource inventory surveys. As of April 30, 2020, all safely accessible areas within the B.F. Sisk Dam Raise Alternative APE (4,454 acres) have been subject to intensive pedestrian inventory surveys. Forty-three cultural resources were documented within the APE, including 11 previously recorded resources, 22 newly identified archaeological sites or historic period built environment resources, and ten isolated finds. Ten resources noted through archival and record searches could not be relocated within the APE or were found to be non-cultural.

The 11 previously recorded resources relocated within the B.F. Sisk Dam Raise Alternative APE include seven prehistoric sites, most with midden, lithics, and groundstone; one historic period water tank and trough; one historic period ranch complex; one historic period road; and key features of the B.F. Sisk Dam/San Luis Reservoir Historic District. The 22 newly identified archaeological sites or historic period built environment resources include two prehistoric midden sites, one with lithics and groundstone and the other with fire-affected rock; a series of historic period transmission poles with a debris scatter; two industrial sites associated with B.F. Sisk Dam construction; eight historic period road segments; a concrete equipment pad; a corral and water tank; a helicopter pad; a ditch segment; three earthen dams with impound ponds; a series of survey markers and monitoring wells associated with the B.F. Sisk Dam; and the Cottonwood embankment, which is a feature of the San Luis Reservoir and wider B.F. Sisk Dam/San Luis Reservoir Historic District. The ten isolated finds include one isolated prehistoric core, one biface fragment, one cobble and flake, one displaced cupule boulder, one historic period well head, one metal can, a single concrete foundation, two watering troughs, and one bottle.

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No known tribal cultural resources as defined under PRC §21074(a) have been reported within the B.F. Sisk Dam Raise Alternative APE, and a search of the NAHC Sacred Lands File for the APE yielded negative results. If you have any interest in or knowledge of cultural resources in the Project vicinity, other concerns about the Project, or an interest in consulting with the Authority about the proposed Project, please do not hesitate to contact the Authority's Chief Operating Officer, Pablo Arroyave, using the contact information below:

15990 Kelso Road
Byron, California 94514
Pablo.arroyave@sldmwa.org
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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Jennifer Ruiz, Chairperson

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May 18, 2020

VIA U.S. MAIL

Mr. Edward Ketchum, Tribal Historian and Natural Resource Coordinator
Amah Mutsun Tribal Band
35867 Yosemite Avenue
Davis, CA 95616

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Ketchum:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Valentin Lopez, Chairperson

San Luis & Delta-Mendota Water Authority

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May 18, 2020

VIA U.S. MAIL

Ms. Brenda D. Lavell, Chairperson
Table Mountain Rancheria
P.O. Box 410
Friant, CA 93626-0410

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Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Bob Pennell, Cultural Resources Director

San Luis & Delta-Mendota Water Authority

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May 18, 2020

VIA U.S. MAIL

Mr. Robert Ledger, Chairperson
Dumna Wo-Wah Tribal Government
2191 West Pico Avenue
Fresno, CA, 93705

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Ledger:

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No known tribal cultural resources as defined under PRC §21074(a) have been reported within the B.F. Sisk Dam Raise Alternative APE, and a search of the NAHC Sacred Lands File for the APE yielded negative results. If you have any interest in or knowledge of cultural resources in the Project vicinity, other concerns about the Project, or an interest in consulting with the Authority about the proposed Project, please do not hesitate to contact the Authority's Chief Operating Officer, Pablo Arroyave, using the contact information below:

15990 Kelso Road
Byron, California 94514
Pablo.arroyave@sldmwa.org
(209) 832-6200

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Keith Turner

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. William Leonard, Chairperson
Southern Sierra Miwuk Nation
P.O. Box 186
Mariposa, CA 95338

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Leonard:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

Project Purpose

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<u>Project Information</u>

The No Action/No Project Alternative will include implementation of the Crest Raise Action under the B.F. Sisk Dam Safety of Dams Modification Project, which was examined by Reclamation and the State of California Department of Water Resources (DWR) in a 2019 Final EIS/EIR. Under the Crest Raise Action, which has been funded by the U.S. Congress and is scheduled to begin in 2021, the height of the B.F. Sisk Dam will be raised by 12 feet to reduce the likelihood of overtopping if slumping or deformation of the dam occurs as a result of seismic activity. This will allow the San Luis Reservoir to continue operating at its current maximum storage capacity while protecting the downstream public.

The Non-Structural Alternative would entail operational changes only and would result in no significant changes to reservoir water elevations. It is expected to have no impacts to cultural resources if implemented and was previously analyzed by the Authority and Reclamation in a 2019 Revised EIR/Supplemental EIS for the Long-Term Water Transfers Program.

The B.F. Sisk Dam Raise Alternative, which is centered on the San Luis Reservoir in western Merced County, has the potential to result in significant impacts to cultural resources if implemented and is the main focus of cultural resource studies conducted for the Project. The B.F. Sisk Dam Raise Alternative would increase the height of the dam by a further 10 feet and expand the storage capacity of the San Luis Reservoir by 130 thousand acre-feet. It would build upon the No Action/No Project Alternative and rely on the use of the same access roads and borrow, construction, and staging areas to implement construction. Collectively, these areas total 3,914 acres. The B.F. Sisk Dam Raise Alternative also would require additional construction activities to accommodate the proposed increase in reservoir storage capacity. These include elevating the Dinosaur Point and Goosehead Point boat launches by 10 feet; elevating the berm or levee at the Pacheco Pumping Plant by 10 feet; and elevating portions of State Route 152 between Cottonwood Bay and the San Luis Reservoir to prevent the roadway from becoming inundated. Figure 1 depicts the proposed Area of Potential Effects (APE) for the B.F. Sisk Dam Raise Alternative.

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Known Cultural and/or Historic Records

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> Byron, California 94514
> Pablo.arroyave@sldmwa.org
> (209) 832-6200

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. Valentin Lopez, Chairperson
Amah Mutsun Tribal Band
P.O. Box 5272
Galt, CA 95632

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Lopez:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

Project Purpose

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Project Information

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Edward Ketchum, Tribal Historian and Natural Resource Coordinator

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. Bob Pennell, Cultural Resources Director
Table Mountain Rancheria
P.O. Box 410
Friant, CA 93626-0410

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Pennell:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Brenda D. Lavell, Chairperson

San Luis & Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Ms. Katherine Perez, Chairperson
North Valley Yokuts Tribe
P.O. Box 717
Linden, CA 95236

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Perez:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. Neil Peyron, Chairperson
Tule River Indian Tribe
P.O. Box 589
Porterville, CA 93528

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Peyron:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

Project Purpose

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Project Information

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Kerri Verra, Department of Environmental Protection Director

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Ms. Shana Powers, Cultural Director
Santa Rosa Rancheria Tachi Yokut Tribe
P.O. Box 8
Lemoore, CA 93245

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Powers:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

<u>Project Purpose</u>

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Leo Sisco, Chairperson

San Luis & Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Ms. Jennifer Ruiz, Chairperson
Picayune Rancheria of Chukchansi Indians
8080 Palm Ave, Suite 207
Fresno, CA 93711

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Ruiz:

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Tara Estes-Harter, Cultural Director/Tribal Historic Preservation Officer

San Luis & Delta-Mendota Water Authority

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Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Sisco:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

Project Purpose

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The B.F. Sisk Dam Raise Alternative, which is centered on the San Luis Reservoir in western Merced County, has the potential to result in significant impacts to cultural resources if implemented and is the main focus of cultural resource studies conducted for the Project. The B.F. Sisk Dam Raise Alternative would increase the height of the dam by a further 10 feet and expand the storage capacity of the San Luis Reservoir by 130 thousand acre-feet. It would build upon the No Action/No Project Alternative and rely on the use of the same access roads and borrow, construction, and staging areas to implement construction. Collectively, these areas total 3,914 acres. The B.F. Sisk Dam Raise Alternative also would require additional construction activities to accommodate the proposed increase in reservoir storage capacity. These include elevating the Dinosaur Point and Goosehead Point boat launches by 10 feet; elevating the berm or levee at the Pacheco Pumping Plant by 10 feet; and elevating portions of State Route 152 between Cottonwood Bay and the San Luis Reservoir to prevent the roadway from becoming inundated. Figure 1 depicts the proposed Area of Potential Effects (APE) for the B.F. Sisk Dam Raise Alternative.

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<u>Known Cultural and/or Historic Records</u>

On behalf of the Authority and Reclamation and under contract to CDM Smith, Pacific Legacy, Inc. performed a cultural resources investigation for the B.F. Sisk Dam Raise Alternative that included archival and record searches for the APE and a surrounding 0.5-mile radius, contact with the Native American Heritage Commission, and cultural resource inventory surveys. As of April 30, 2020, all safely accessible areas within the B.F. Sisk Dam Raise Alternative APE (4,454 acres) have been subject to intensive pedestrian inventory surveys. Forty-three cultural resources were documented within the APE, including 11 previously recorded resources, 22 newly identified archaeological sites or historic period built environment resources, and ten isolated finds. Ten resources noted through archival and record searches could not be relocated within the APE or were found to be non-cultural.

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No known tribal cultural resources as defined under PRC §21074(a) have been reported within the B.F. Sisk Dam Raise Alternative APE, and a search of the NAHC Sacred Lands File for the APE yielded negative results. If you have any interest in or knowledge of cultural resources in the Project vicinity, other concerns about the Project, or an interest in consulting with the Authority about the proposed Project, please do not hesitate to contact the Authority's Chief Operating Officer, Pablo Arroyave, using the contact information below:

15990 Kelso Road
Byron, California 94514
Pablo.arroyave@sldmwa.org
(209) 832-6200

Due Date for Comments

Pursuant to PRC §21080.3.1 (d) and Executive Order N-54-20, you have sixty (60) days from the receipt of this letter to request consultation, in writing, with the Authority. Please send your request to Mr. Arroyave using the contact information above. If you have any questions prior to submitting a written request, please contact Mr. Arroyave at (209) 832-6200 or pablo.arroyave@sldmwa.org. If the Authority does not receive such a request within the specified time period, it will conclude the consultation period and provide written confirmation to you that it has done so.

Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Shana Powers, Cultural Director

San Luis & Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Mr. Keith Turner
Dumna Wo-Wah Tribal Government
P.O. Box 306
Auberry, CA 93602

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Mr. Turner:

As a part of the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), the San Luis & Delta-Mendota Water Authority (Authority) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) are examining potential strategies or alternatives aimed at increasing the flexibility and reliability of water deliveries to contractors and consumers south of the Sacramento-San Joaquin Delta. Below, please find a description of the proposed Project, a figure depicting the location of the proposed Project construction alternative, and the name of the Project point of contact for the Authority pursuant to Public Resources Code (PRC) §21080.3.1. This letter serves as formal notification of consultation under Assembly Bill 52.

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Project Information

The No Action/No Project Alternative will include implementation of the Crest Raise Action under the B.F. Sisk Dam Safety of Dams Modification Project, which was examined by Reclamation and the State of California Department of Water Resources (DWR) in a 2019 Final EIS/EIR. Under the Crest Raise Action, which has been funded by the U.S. Congress and is scheduled to begin in 2021, the height of the B.F. Sisk Dam will be raised by 12 feet to reduce the likelihood of overtopping if slumping or deformation of the dam occurs as a result of seismic activity. This will allow the San Luis Reservoir to continue operating at its current maximum storage capacity while protecting the downstream public.

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Robert Ledger, Chairperson

San Luis & Delta-Mendota Water Authority

P.O. Box 2157
Los Banos, CA 93635
Phone: (209) 826-9696
Fax: (209) 826-9698

May 18, 2020

VIA U.S. MAIL

Ms. Kerri Verra, Department of Environmental Protection
Director Tule River Indian Tribe
P.O. Box 589
Porterville, CA 93528

Re: Tribal Outreach under the California Environmental Quality Act, Assembly Bill 52, for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Verra:

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Regards,

Rebecca Akroyd, General Counsel
San Luis & Delta-Mendota Water Authority

cc: Pablo Arroyave
Neil Peyron, Chairperson

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Ms. Jennifer Ruiz, Chairperson
Picayune Rancheria of Chukchansi Indians
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Fresno, CA 93711

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Ms. Kerri Verra, Department of Environmental Protection Director
Tule River Indian Tribe
P.O. Box 589
Porterville, CA ~~93528~~ 93258

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Ms. Shana Powers, Cultural Director
Santa Rosa Rancheria Tachi Yokut Tribe
P.O. Box 8
Lemoore, CA 93245

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Dumna Wo-Wah Tribal Government
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Auberry, CA 93602

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Porterville, CA ~~93528~~
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Appendix E
Photographic Documentation of 2020 Survey Areas

Appendix E: Photographic Documentation

Client: CDM Smith Prepared by: Pacific Legacy, Inc.

Photograph No. 1
Direction: Southwest
Date: 3/30/20
Location:
PL-Sisk-01
Photographer:
M. O'Neill

Description:
(DSCF1368) View of road PL-Sisk-01.

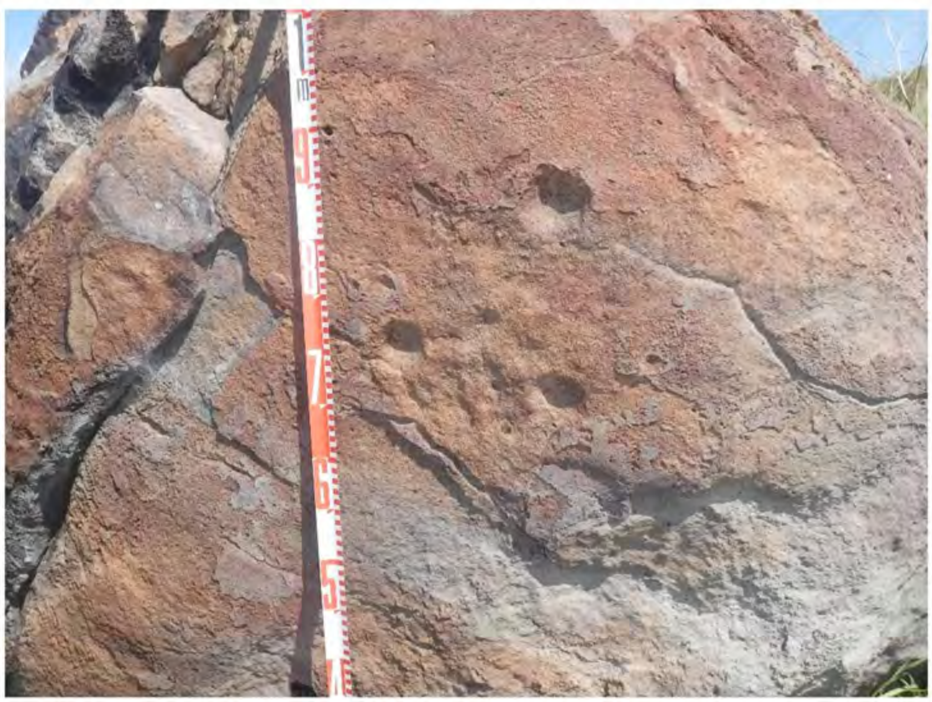
Photograph No. 2
Direction: Northeast
Date: 3/30/20
Location:
PL-Sisk-01
Photographer:
M. O'Neill

Description:
(DSCF1369) View of road PL-Sisk-01 with B.F. Sisk Dam in background.

Photograph No. 3
Direction: North
Date: 3/30/20
Location:
PL-Sisk-02
Photographer:
M. O'Neill

Description:
(DSCF1370) Overview of cupule boulder on slope.

Photograph No. 4
Direction: North
Date: 3/30/20
Location:
PL-Sisk-02
Photographer:
M. O'Neill



Description:
(DSCF1372) Detail of cupule arrangement on cupule boulder PL-Sisk-02.

Appendix E: Photographic Documentation

Client: CDM Smith

Prepared by: Pacific Legacy, Inc.

Photograph No. 5
Direction: Northwest
Date: 3/30/20
Location:
San Luis Reservoir survey area
Photographer:
M. O'Neill

Description:
(DSCF1388) Drainage area west of PL-Sisk-01, unsurveyed because of steep terrain.

Photograph No. 6
Direction: Southwest
Date: 3/31/20
Location:
CA-MER-494H
Photographer:
M. O'Neill

Description:
(DSCF1392) Survey crew on survey corridor along road CA-MER-494H.

Appendix E: Photographic Documentation

Client: CDM Smith

Prepared by: Pacific Legacy, Inc.

Photograph No. 7
Direction: East
Date: 3/31/20
Location: CA-MER-494H
Photographer:
M. O'Neill

Description:
(DSCF1396) Overview of road CA-MER-494H and surrounding terrain.

Photograph No. 8
Direction: Northeast
Date: 3/31/20
Location: CA-MER-509H
Photographer:
M. O'Neill

Description:
(DSCF1399) Overview of conveyor beltway alignment (Feature 4) with San Luis Reservoir in background. A buried timber tie is flagged in foreground, and a crew member stands at the concrete slab.

Appendix E: Photographic Documentation

Client: CDM Smith Prepared by: Pacific Legacy, Inc.

Photograph No. 9
Direction: Detail
Date: 3/31/20
Location: CA-MER-509H
Photographer:
M. O'Neill

Description:
(DSCF1401) Close-up of concrete slab within conveyor beltway alignment (Feature 4). A bolt and a piece of wire are flagged.

Photograph No. 10
Direction: East
Date: 3/31/20
Location: CA-MER-509H
Photographer:
M. O'Neill

Description:
(DSCF1420) Intersection of roads PL-Sisk-01 (left) and CA-MER-494H (background). The concrete gravity sorter (Feature 3) of CA-MER-509H is visible above right.

Appendix E: Photographic Documentation

Client: CDM Smith | Prepared by: Pacific Legacy, Inc.

Photograph No. 11
Direction: West
Date: 3/31/20
Location: PL-Sisk-01
Photographer:
M. O'Neill

Description:
(DSCF1424) View of road PL-Sisk-01 heading west and curving around south toward CA-MER-509H.

Photograph No. 12
Direction: South-southwest
Date: 4/1/20
Location: CA-MER-509H
Photographer:
M. O'Neill

Description:
(DSCF1446) View of concrete footings of Feature 4 of CA-MER-509H, concrete gravity sorter (Feature 3) in background right.

Photograph No. 13
Direction: Southeast
Date: 4/1/20
Location: CA-MER-509H
Photographer: M. O'Neill

Description: (DSCF1434) Smaller rectangular concrete footing of Feature 4 of CA-MER-509H.

Photograph No. 14
Direction: North-northwest
Date: 4/1/20
Location: CA-MER-509H
Photographer: M. O'Neill

Description: (DSCF1438) Larger triangular concrete footing of Feature 4 of CA-MER-509H.

Photograph No. 15
Direction: Northeast
Date: 4/1/20
Location: CA-MER-509H
Photographer: M. O'Neill

Description: (DSCF1448) View from concrete footings of Feature 4 along conveyor beltway. Crew stands on road shoulder. Alignment passes right of lone tree in distance.

Photograph No. 15
Direction: Detail
Date: 4/1/20
Location: CA-MER-509H
Photographer: M. O'Neill

Description: (DSCF1449) Close-up of chain fragment, likely associated with the conveyor beltway (Feature 4).

Appendix E: Photographic Documentation

Client: CDM Smith   Prepared by: Pacific Legacy, Inc.

Photograph No. 17
Direction: West
Date: 4/1/20
Location: San Luis Reservoir survey area
Photographer: M. O'Neill

Description: (DSCF1460) Southernmost end of survey area.

Photograph No. 18
Direction: South-southeast
Date: 4/1/20
Location: CA-MER-451H
Photographer: M. O'Neill

Description: (DSCF1467) View from feature 7a to Feature 7b with crew standing on slope at latter feature.

Photograph No. 19
Direction: Southeast
Date: 4/2/20
Location: P-24-002184
Photographer: M. O'Neill

Description: (DSCF1471) View of SR 152 crossing Cottonwood Fill (Map Reference No. 4).

Photograph No. 20
Direction: North
Date: 4/3/20
Location: CA-MER-137
Photographer: M. O'Neill

Description: (DSCF1492) View of CA-MER-137, with crew member standing at northern bound of site.

Photograph No. 21
Direction: East
Date: 4/3/20
Location: CA-MER-137
Photographer: M. O'Neill

Description: (DSCF1494) View of CA-MER-137, with crew member standing on eastern bound of site.

Photograph No. 22
Direction: East
Date: 4/3/20
Location: CA-MER-136
Photographer: M. O'Neill

Description: (DSCF1505) View of CA-MER-136, from west end, looking toward Cottonwood Creek.

Appendix E: Photographic Documentation

Client: CDM Smith

Prepared by: Pacific Legacy, Inc.

Photograph No. 23
Direction: East
Date: 4/3/20
Location: CA-MER-137
Photographer:
M. O'Neill

Description:
(DSCF1508) View from CA-MER-136 across small, unnamed drainage, to crew member at CA-MER-137.

Photograph No. 24
Direction: Detail
Date: 4/3/20
Location: PL-Sisk-05
Photographer:
M. O'Neill

Description:
(DSCF1526) Close-up of Artifact 1 (complete pestle) in animal burrow at PL-Sisk-05.

Appendix E: Photographic Documentation

Client: CDM Smith | Prepared by: Pacific Legacy, Inc.

Photograph No. 25
Direction: South
Date: 4/3/20
Location: PL-Sisk-05
Photographer:
M. O'Neill

Description:
(DSCF1541) View of PL-Sisk-05 from creek, with crew member standing at road through site.

Photograph No. 26
Direction: South-southwest
Date: 4/3/20
Location: CA-MER-136
Photographer:
M. O'Neill

Description:
(DSCF1548) Artifact 2 (battered stone) in animal burrow adjacent to road at PL-Sisk-05.

Photograph No. 27
Direction: North
Date: 4/23/20
Location: O'Neill Forebay survey area
Photographer: M. O'Neill

Description: (DSCF1633) View of O'Neill Forebay shoreline survey area.

Photograph No. 28
Direction: North
Date: 4/3/20
Location: O'Neill Forebay survey area
Photographer: M. O'Neill

Description: (DSCF1643) View from southeast corner of survey area, SR 33 to the right.

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix N: Geology, Seismicity, and Soils Supporting Information

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Appendix N Geology, Seismicity, and Soils Supporting Information

This appendix presents the project's potential effects related to geology, soils, and geologic hazards, including earthquakes and landslides. Discussions on paleontological and mineral resources are also included in this appendix. Related discussions about water-related and air-related soil erosion are presented in Section 4.1, Water Quality, and Section 4.3, Air Quality.

N.1 Area of Analysis

The area of analysis is based on the location of potential impacts, which for geology, seismicity, and soil impacts is within Merced County. Figure 1 depicts the area of analysis.

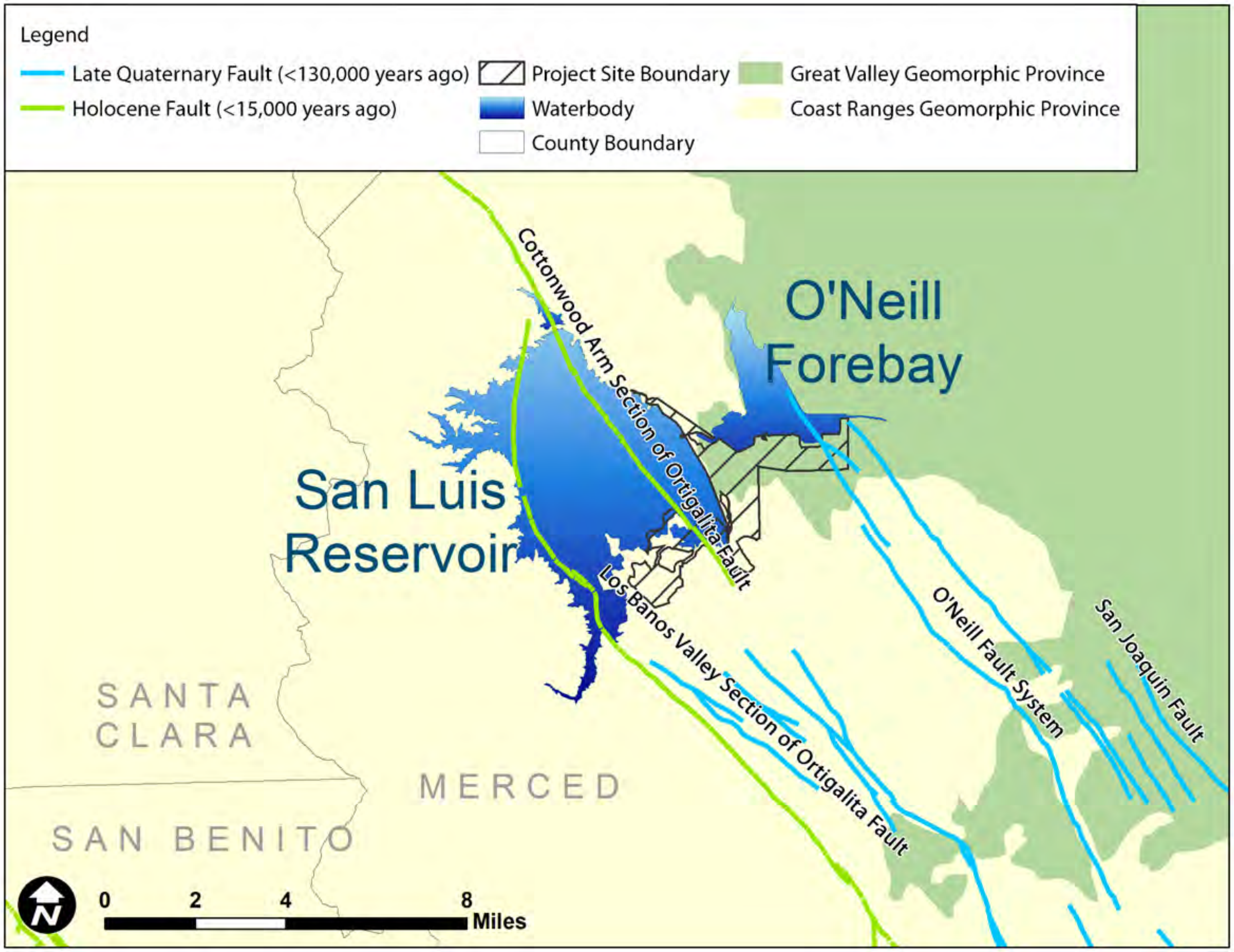
N.2 Affected Environment/ Environmental Setting

The following sections describe some general soil properties as well as the existing geology, seismicity, and soils conditions within the area of analysis.

N.2.1 Soils

Soil types in the area of analysis include expansive soils, dispersive soils, and soils susceptible to hydro compaction. Dispersive soils and soils susceptible to hydro compaction are present east of B.F. Sisk Dam. Dispersive clays have been problematic along United States Department of Interior, Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR)'s canals and other features in the vicinity of B.F. Sisk Dam.

Expansive soils are soils with the potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content. Shrink-swell classes are based on the change in the length of an unconfined clump as its moisture content is decreased or increased. This change is often expressed as a percent and the value is called a linear extensibility percent. In soil surveys, the percent represents the overall change for the whole soil (United States Department of Agriculture [USDA], Natural Resources Conservation Service [NRCS] Nd.).



Source: California Geological Survey 2002a; United States Geological Survey 2017

Figure 1. Geology, Faults, and Soils Area of Analysis

Soils composed primarily of sand and gravel are not considered expansive (i.e., the soil volume does not change with a change in moisture content). Soils containing silts and clays may possess expansive characteristics. The magnitude of shrink-swell capacity in expansive soils is influenced by:

- Amount of expansive silt or clay in the soil;
- Thickness of the expansive soil zone;
- Thickness of the active zone (depth at which the soils are not affected by dry or wet conditions);
- Climate (variations in soil moisture content as attributed to climatic or man-induced changes); and
- Confining pressure.

Soils are classified as having low, moderate, high, and very high potential for volume changes. The linear extensibility is expressed by percentages; the range of valid values is from 0 to 30 %(USDA, NRCS Nd.). Table 1 summarizes shrink-swell classes and the associated linear extensibility percentage. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures (USDA, NRCS Nd.).

Table 1. Shrink-Swell Class and Linear Extensibility

Shrink-Swell Class	Linear Extensibility
Low	< 3%
Moderate	3-6%
High	6-9%
Very High	≥ 9%

Source: USDA, NRCS Nd.

N.2.2 Regional

N.2.2.1 Geology and Topography

San Luis Reservoir and O'Neill Forebay are near the boundary of the Great Valley (San Joaquin Valley portion) and the Coast Ranges geomorphic provinces (California Geological Survey [CGS] 2002a). The Coast Ranges Province is a northwest-trending region that ranges in elevation between 2,000 to 4,000 feet above sea level with some areas reaching 6,000 feet above sea level (CGS 2002a). It extends approximately 50 miles in an east-west direction from the Pacific Ocean to the Great Valley. The Coast Ranges run sub parallel to the San Andreas Fault, which is more than 700 miles long. The San Andreas Fault re-emerges in the Coast Ranges at Shelter Cove and extends northward on land for approximately 7 miles. This segment is referred to as the "Shelter Cove Section" (CGS 2002a).

The Great Valley Province is an alluvial plain about 50 miles wide and 400 miles long in the central part of California (CGS 2002a). The Great Valley is geologically monotonous and forms a trough in which sediments have been deposited almost continuously since the Jurassic period (about 160 million years ago). The valley represents the alluvial, flood, and delta plains of its two major rivers, the Sacramento and San Joaquin, and their tributaries (Fuller et al. 2015). The only two topographic breaks in the province are remnants of an isolated Pliocene volcano located in the Sacramento

Valley (CGS 2002a), and the Kettleman Hills on the western and southern sides of the San Joaquin Valley (Fuller et al. 2015). The southern and southwest portions of the San Joaquin Valley contain oil fields.

The boundary between these two provinces is roughly marked by the Ortigalita Fault and the O'Neill Fault System, which pass underneath and to the south of the San Luis Reservoir and O'Neill Forebay, see Figure 1 (Jennings and Bryant 2010; United States Geological Survey [USGS] 2011). The Ortigalita fault separates bedrock units of the upper Cretaceous marine and Plio-Pleistocene non-marine and the Recent overlying fan and basin deposits of the Great Valley (located to the east of the fault) from the upper Jurassic/lower Cretaceous Franciscan Complex bedrock units that make up the Diablo Range portion of the Coast Ranges Province (located to the west of the fault) (Dibblee 1975, Rogers 1966). These and other geologic units in the San Luis Reservoir region are described in more detail below. Faults and other potential geologic hazards in the region are described in more detail below in Section N.2.3.3, Geologic Hazards.

N.2.2.2 Paleontological Resources

Paleontological resources include fossilized remains and the geologic context in which they occur, providing information about the history of life on earth (City of San Jose 2011). Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined using a qualitative measurement of fossil data, including rock type, history of the geologic unit in producing significant fossils, and fossil localities that are recorded from that geologic unit. In areas of high sensitivity, full-time monitoring by a professionally trained paleontologist is recommended during any type of ground disturbance (City and County of San Francisco 2005).

The western side shoreline of San Luis Reservoir lies within the Franciscan Formation, from the Jurassic or Cretaceous Period 80 million to 200 million years ago (Reclamation and CDPR 2013). This formation consists of a thick assemblage of sedimentary, igneous, and metamorphic rocks and has been ranked at low sensitivity due to the general lack of recorded vertebrate fossils (City and County of San Francisco 2005). The Panoche Formation makes up most of the eastern shore of San Luis Reservoir, from the late Cretaceous Period about 65 million years ago (Reclamation and CDPR 2013). The Panoche Formation consists of shale and thinly bedded sandstone, approximately 25,000 feet thick and has been ranked as moderately sensitive due to the discovery of noteworthy invertebrate marine fossils (California High Speed Rail Authority 2004).

N.2.3 Merced County - San Luis Reservoir Region

N.2.3.1 Geology

The *San Luis Reservoir State Recreation Area (SRA) Resource Management Plan (RMP)/General Plan (GP) Environmental Impact Assessment/Environmental Impact Report (EIS/EIR),* describes the four geologic formations in the area around San Luis Reservoir. These include:

- **The Franciscan formation:** This formation is along the entire western side and southern tip of the reservoir's shoreline. This rock formation is the oldest in western Merced County and is composed of a thick assemblage of sedimentary, igneous, and metamorphic rocks. The sedimentary rocks consist of sandstone, shale, chert, and small amounts of conglomerate.

- **The Panoche formation:** This formation is along most of the eastern shore of the San Luis Reservoir with some intrusion of the Plio-Pleistocene nonmarine and fan deposits of the

Great Central Valley. Portions of B.F. Sisk Dam is founded on the Panoche formation. The formation consists of arenaceous shale and thinly bedded sandstone, approximately 25,000 feet thick. The sedimentary sequence of the formation consists of lenses of coarse-grained conglomerate of boulders, cobbles, and pebbles of porphyritic and granite rock.

- **The Tulare formation:** This formation is found on the shore of O'Neill Forebay and adjacent to the forebay dam. This section of the formation varies in depth from 8 to 42 feet and overlies all of the older formations. In addition, the central portion of B.F. Sisk Dam is founded in the Tulare formation. The formation is approximately 150 feet thick below the maximum section of B.F. Sisk Dam. The Tulare formation consists of nonmarine gravel, sand, silt, and clay and is derived from rocks from the Franciscan formation. Stream terraces are also found in this formation. Briggs (1953 as cited in Herd 1979) also noted a dark gray to light gray colored diatomaceous clay in the O'Neill Forebay area.

N.2.3.2 Soils

There are several soil associations that occur around the San Luis Reservoir. The *RMP/GP* for the San Luis Reservoir SRA describes that Denverton, Kettleman, and Altamont clay associations occupy 2,650 acres of the lands surrounding the reservoir (Reclamation and California Department of Parks and Recreation [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. Other minor soil associations include the Rincon-Pleasanton association composed of Pleasanton gravelly sandy loam, Los Banos clay loams, Rincon clay, and Rincon loam; Altamont-Kettleman loam to the northeast shore of O'Neill Forebay; Sobrante, Vallecitos, and Contra Costa loams; Herdlyn clay loam and Solano silt loam; Herdlyn clay loam on the southern and eastern shores of O'Neill Forebay; and Sorrento, Mocho, and Esparto loams in scattered areas at the reservoir (Reclamation and CDPR 2013). The reservoir area RMP/GP also describes that 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.

The USDA, Soil Conservation Service (SCS; renamed the NRCS) published the most recent soil survey of western Merced County in 1990. The general soil map defines the following soils on the alluvial fans, foothills, and terraces of the San Joaquin Valley, and the foothills, mountains, and valleys of the Coast Range. The following soils all occur in the vicinity of San Luis Reservoir (USDA, SCS 1990).

- **Woo-Stanislaus:** These soils are to the east of O'Neill Forebay. They are very deep, nearly level to gently sloping, well drained soils and are located on alluvial fans. These soils have a loam, clay loam, sandy clay loam, and clay surface texture and mainly used for irrigated agriculture. The main limitations of these soils are the high shrink-swell potential.

- **Damluis-Bapos-Los Banos:** These soil units are along the eastern and southern shores of O'Neill Forebay. They are very deep, nearly level to strongly sloping, well drained soils and are located on terraces. Surface textures in this soil group include clay loam, and sandy clay loam. Smaller areas are comprised of soils with surface textures of extremely gravelly, gravelly clay loam, gravelly sandy loam, sandy loam, and loam. These soils are mainly used for irrigated and non-irrigated crops, rangeland, and recreation. The main limitation of these soils is the high shrink-swell potential.

- **Oneil-Apollo:** The Oneil-Apollo soil unit is along the eastern shore of San Luis Reservoir extending to the north and south. These soils are moderately deep and deep, gently sloping to steep, and well-drained with high organic matter content. The surface texture of these soils is a combination of calcareous silt loam, clay loam, clay, sandy clay loam, and sandy loam. These soils are generally used for rangeland with some areas suitable for agriculture, recreation, and wildlife habitat. These soils are not noted for high shrink-swell potentials.

- **Arburua-Wisflat:** These soils are south of San Luis Reservoir in the vicinity of Los Banos Reservoir. They are shallow and moderately deep, gently sloping to very steep, and well drained soils located along the foothills. The surface texture includes loam, sandy loam, clay loam, and calcareous clay. These soils are mainly used for rangeland and wildlife habitat and the main limitations are erosion hazards and steepness of slope. These soils are not noted for having high shrink-swell potentials.

- **Franciscan-Quinto-Rock outcrop:** These soils are to the north of San Luis Reservoir. They described as being shallow and moderately deep, steep to very steep, and found on rock outcrops and mountains. The surface texture is sandy loam, gravelly sandy loam, clay, and loam. The soils are mainly used for rangeland and wildlife habitat. The main limitation of these soils is steepness and erosion hazard. These soils are not noted for having high shrink-swell potentials.

- **Millsholm-Fifield-Honker:** These soils border the western edge of San Luis Reservoir and are described as shallow and moderately deep, and moderately sloping to very steep. They are generally well drained soils located on mountains. The surface texture is comprised of loam, sandy loam, and very stony clay. The soils are mainly used for rangeland and wildlife habitat and the main limitation is steepness of slope. These soils are not noted for having high shrink-swell potentials.

- **Peckham-Ararat-Laveaga:** There is a small area of these soils bordering the southern end of San Luis Reservoir. They are also found to the west of the reservoir along the border between Merced County and San Benito County and are found on volcanic mountains. This soil group is moderately deep and deep, gently sloping to very steep and well drained. The surface textures of the soils in this group include cobbly loam, extremely stony loam, sandy clay loam, clay loam, very stony clay loam and clay, clay, and clay loam. These soils are mainly used for rangeland and wildlife habitat and the main limitations are steepness of slope and a stony and cobbly surface. These soils are not noted for having high shrink-swell potentials.

Figure 2 depicts the arrangement of the major soil textures in the area of analysis. Figure 3 depicts the shrink-swell potential of soils in the area of analysis.

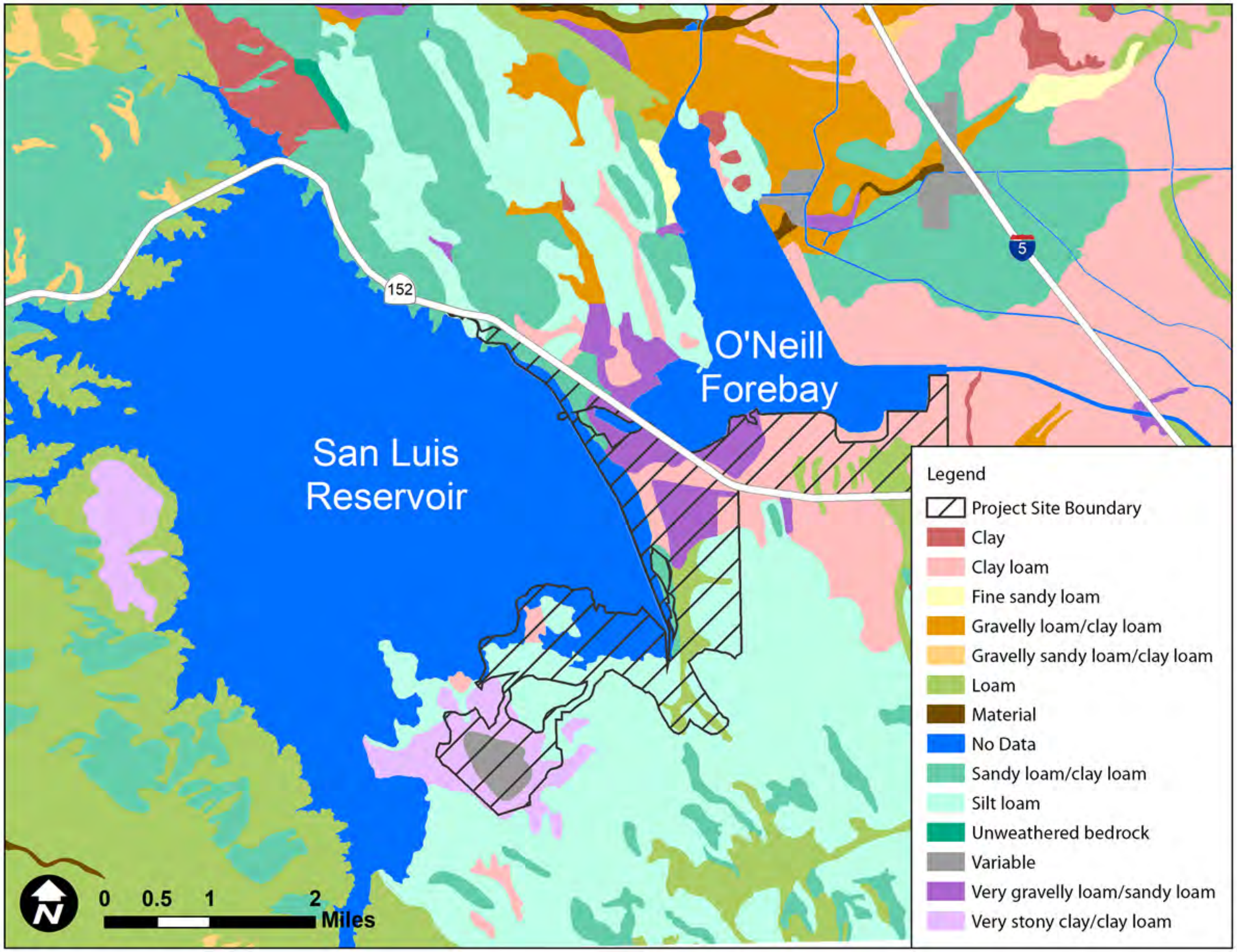


Figure 2. San Luis Reservoir SRA Use Area Map

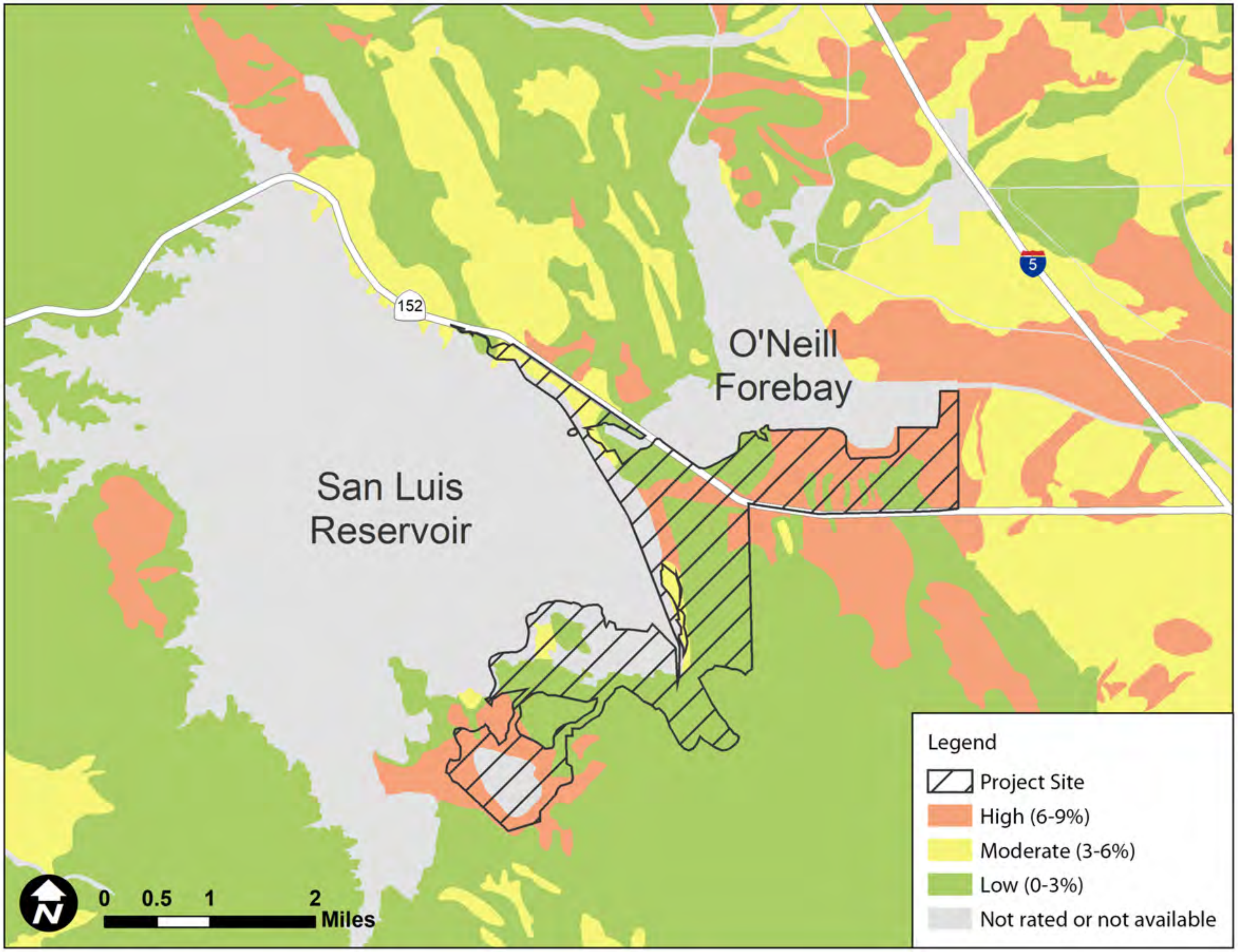


Figure 3. Shrink-Swell Potentials – Merced County

Soil types on the reservoir floor were characterized in geologic borings conducted by Reclamation in 1959. The San Luis and Cottonwood Creeks once flowed beneath the central area of B.F. Sisk Dam. The creeks meandered and deposited fluvial alluvium, creating the Patterson and San Luis Rach formation. These two formations consist of alternating layers of clayey soils and sandy/gravelly soils. Directly underlying these two formations is the Los Banos formation (alluvium) and/ or Tulare formation (alluvium and lacustrine deposits), which also consist of alternating layers of clayey soils and sandy/gravelly soils. The Panoche formation (bedrock), consisting of alternating layers of sandstone, shale, and conglomerate, underlies the Tulare formation. The maximum section of the dam is founded on soils from the four alluvial and lacustrine formations. Coarse grained soils from these formations are susceptible to liquefaction, that could cause the dam embankment to slump/ deform and be overtopped by reservoir water. Fine grained clayey soils from these formations may be sufficiently weak such that they could shear and allow the dam embankment to slide (given a sufficient shaking during a seismic event). Furthermore, portions of the dam embankment are founded on clayey colluvium (slopewash), that presents the same seismic risk as fine-grained clayey soils (Reclamation 2010).

N.2.3.3 Geologic Hazards

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, shown above in Figure 1 (Reclamation and CDPR 2013 and USGS 2020). A detailed geologic study to characterize all the potential seismic sources[1] in the area of B.F. Sisk and O'Neill Forebay dams was conducted by Reclamation in 1999 and 2000. That study identified 9 faults as being potentially significant sources of seismic shaking, including:

- Strike Slip faults of the Ortigalita and San Andreas faults;
- West-dipping bedding-plane reverse faults within the Great Valley Sequence; and
- West-dipping blind thrust faults along the uplift margin of the Diablo Range (Reclamation 2009).

Reclamation also performed an evaluation of Quaternary Stratigraphy and Possible Quaternary Fault Displacement for B.F. Sisk Dam in Technical Memorandum (TM) 86-68330-2009-01 (Reclamation 2010). According to TM 86-68330-2009-01, the numerous faults and shears present in the dam foundation are thought to be older than late Quaternary (130,000 years). There is no evidence of repeated seismic activity in the Quaternary (less than 2.6 million years ago), which was taken into consideration for this probabilistic analysis (Reclamation 2010).

Located in the eastern part of the San Andreas Fault system, the Ortigalita Fault in the vicinity of the reservoir has two sections, the Los Banos Valley section and the Cottonwood Arm section, see Figure 1 (roughly corresponding to the locations described above [USGS 2011 and Bryant and Cluett 2000a]). The Los Banos Valley section is in Merced County. Bryant and Cluett (2000b) do not

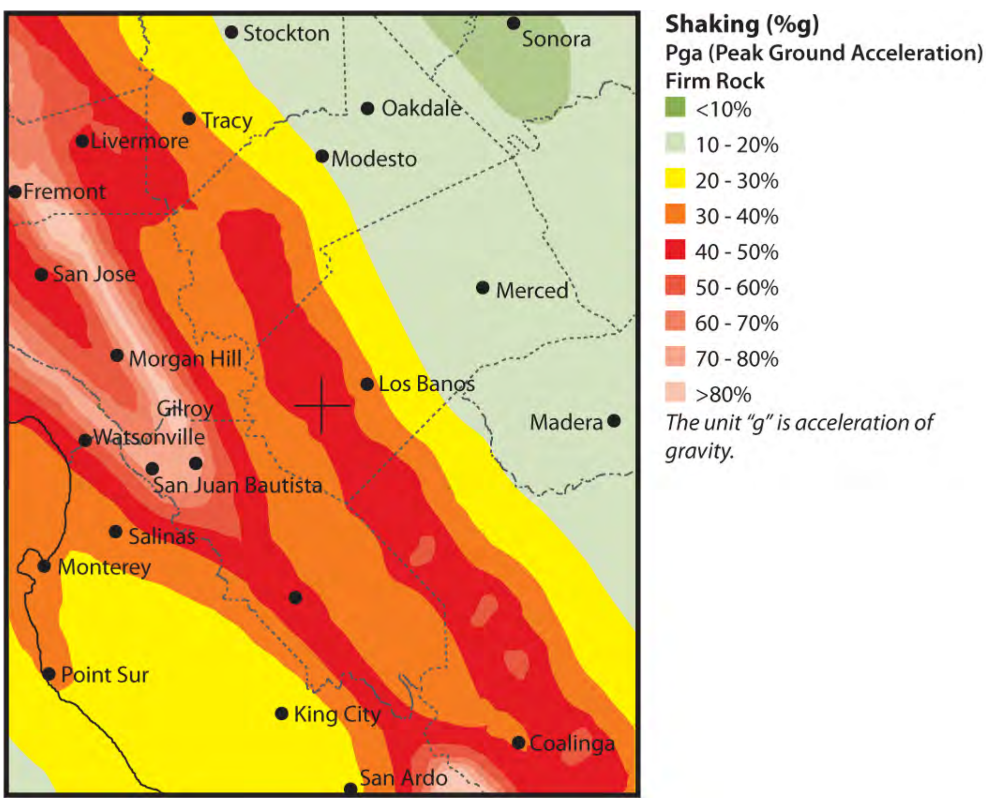
[1] CGS describes seismic sources (faults) as (1) Active, which describe historical and Holocene faults with displacements within the past 11,000 years; (2) Potentially Active, which describes faults with evidence of displacements during the Quaternary (the past 1.6 million years); (3) Inactive, which are pre-Quaternary age. Seismic events and displacements may still take place along an inactive fault; however, the chance of that happening are considered low

report any recent (historic) earthquakes and the most recent prehistoric deformation (defined as the most recent prehistoric surface rupturing or surface deforming earthquake) was the latest Quaternary (around 15,000 years ago). The Cottonwood Arm section is in Merced and Stanislaus Counties. There are no records of recent earthquake activity along this section of the Ortigalita fault zone. The most recent prehistoric deformation was around 15,000 years ago (Bryant and Cluett 2000a).

The O'Neill Fault System runs south and east of O'Neill Forebay and south of San Luis Reservoir, see Figure 1 (USGS 2011). The most recent prehistoric deformation at this fault system was around 130,000 years ago (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.

The California Geologic Survey (CGS) publishes maps of the probabilistic seismic hazards in the state. Figure 4 shows the probabilistic seismic ground shaking in Merced County near San Luis Reservoir. The peak ground acceleration in firm rock in the area of the reservoir is approximately 0.4g ("g" is the acceleration of gravity). As illustrated in the figure, the western part of Merced County would be subject to higher ground shaking than the eastern part of the county in the case of an earthquake. This peak acceleration has a 10 % probability of being exceeded in 50 years.



Source: CGS 2012.

Figure 4. Site Peak Ground Acceleration – Merced County

The 2007 Working Group on California Earthquake Probabilities developed earthquake rupture forecasts to predict the likelihood of a magnitude 5 or greater earthquake occurring in the next 30 years (USGS, California Department of Conservation [California DOC] and CGS 2008). Table 2 summarizes the group's findings relative to Type A faults (defined as faults known to be active) in the area of analysis.

Table 2. 30-Year Probability of Magnitude 6.7 Events on Type A Faults

Fault	Mean Probability
South San Andreas	59%
Calaveras	7%

Source: USGS and CGS 2008

The GP notes that B.F. Sisk Dam is the one dam in the county that has the possibility of being subject to seismic activity; however, the siting of the dam in the vicinity of the Ortigalita fault has been compensated for by structural design (Merced County 2013). The dam was constructed to withstand a magnitude 8.3 occurrence; however, this does not completely eliminate the possibility of dam failure and related flooding (Merced County 2013). A 2009 study by Reclamation investigated the unconsolidated Quartenary geologic units that large portions of B.F. Sisk Dam was built on and the potential for liquefaction of these deposits during a seismic event and concluded that "it seem[ed] prudent to assume that limited 'secondary' fault displacement could occur within the foundation of B.F. Sisk Dam during a major earthquake on either the Ortigalita fault or a nearby buried thrust fault" (Reclamation 2009). The study further concluded that the probability of fault displacement in the foundation "appear[ed] to be low, primarily because of the abundant evidence which indicates that no major Quaternary faults, and probably no faults with late Quaternary displacement, are present within the dam foundation" (Reclamation 2009).

The B.F. Sisk Dam inundation area extends from the dam northeast and southeast covering the towns of Santa Nella, Los Banos, and Gustine. The dam inundation area for O'Neill Forebay is somewhat smaller following a western arch over Santa Nella and then north running along the western side of Gustine (Merced County 2013).

The *2030 Merced County General Plan Background Report* notes that there is potential for liquefaction and related hazards throughout the San Joaquin Valley area where unconsolidated sediments and a high water table coincide. These areas include the county's wetland areas which are generally adjacent to the San Joaquin River and extend west to the Southern Pacific Railroad and east toward State Highways 99 and 59 south (Merced County 2013). There are two wetland areas identified in the *2030 Merced County General Plan Background Report*; however, these are located to the southwest of the reservoir (Merced County 2013). As described above, other wetland areas are closer to State Highways 99 and 59 in the eastern part of the county and not in the area of analysis.

Liquefaction can also occur as a result of earthquakes, if susceptible sediments are saturated during ground shaking. If the soil liquefies, it loses its ability to support structures and they may settle into the ground causing damage that can range from minor displacement to total collapse (Merced County 2013).

In 2006, as a response to studies that determined B.F. Sisk Dam poses a potential risk of seismic failure, Reclamation initiated a B.F. Sisk Dam Safety of Dams (SOD) Modification Project with

DWR to determine a course of action to reduce the risk of dam failure, resulting in the development of this Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS).

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 2013). As mapped by the county, 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 2013).

N.2.3.4 Naturally Occurring Asbestos

There are no reported asbestos occurrences, former asbestos mines, or former asbestos prospects mapped in Merced County.

The United States Geologic Survey (USGS), CGS, and California DOC, Division of Oil, Gas & Geothermal Resources (DOGGR) have mapped historic mines and natural occurrences of asbestos throughout California (California DOC, DOGGR 2000; USGS, DOC and CGS 2011). There are known occurrences of ultramafic rock outcrops in the western part of the county. Ultramafic rocks are formed in high temperatures below the surface of the earth and change to metamorphic rock by the time they are exposed at the surface by uplift or erosion. These rocks can then form chrysotile asbestos or tremolite-actinolite asbestos in bodies of ultramafic rock or along their boundaries (California DOC, DOGGR 2000). Ultramafic rock is known to occur in Merced County near the border of Stanislaus County north of San Luis Reservoir and near the border of Fresno County to the south of the reservoir (California DOC, DOGGR 2000; USGS, DOC and CGS 2011). Neither of these sites would be within the area of construction for the Crest Raise Alternative.

N.2.3.5 Mineral Resources

As part of the Surface Mining and Reclamation Act of 1975 (described in Chapter 28, Consultation, Coordination, and Compliance), the CGS produces mineral land classification maps and reports. Part of the mineral land classification involves the mapping of aggregate availability throughout the state. Aggregate is defined as construction aggregate which is composed of alluvial sand and gravel or crushed stone that meets standard specifications for use in Portland cement concrete or asphalt concrete (Kohler 2006a). The statewide map of aggregate availability shows the location of aggregate mines in Merced County; however, none are located in the vicinity of San Luis Reservoir. The general location of the mine(s) is southwest of Los Banos on the east side of Interstate 5 (Kohler 2006b).

The CGS also maps the location of historic and active gold mines throughout the state (CGS 2002b and 2000). There are no active gold mines in Merced County. Historically active gold mines are located in the far eastern area of the county and are not near San Luis Reservoir (CGS 2000).

The California DOC, DOGGR identified one dry hole well near the eastern edge of the O'Neill Forebay near the connection to the California Aqueduct. This well was abandoned in 1937 (California DOC, DOGGR 2010). Figure 5 shows the location of this abandoned well.

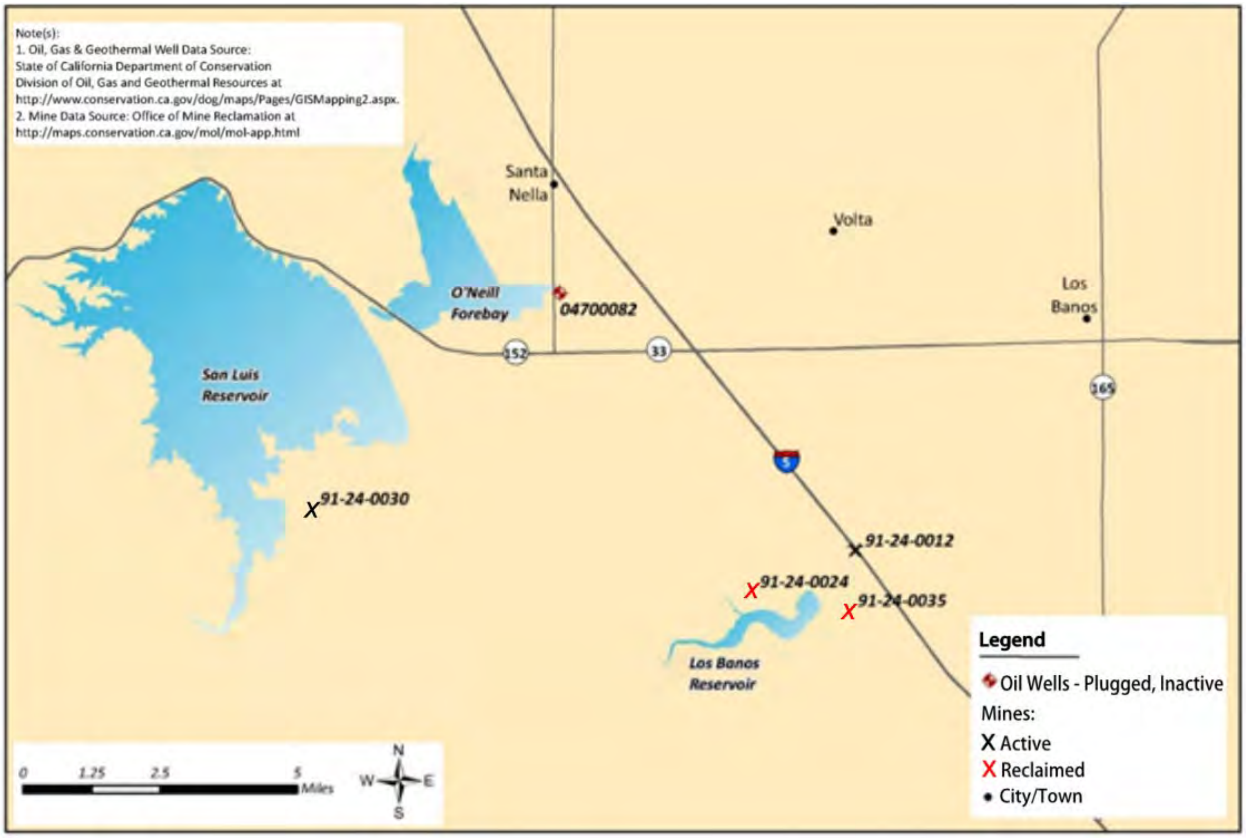


Figure 5. Abandoned Wells and Mines near San Luis Reservoir

The Office of Mine Reclamation maps inactive and active mines throughout the state. There is one mine in the vicinity of San Luis Reservoir and three mines located near Los Banos SRA (California DOC, Office of Mine Reclamation 2016). Table 3 summarizes the information about the mines in Merced County near the area of analysis.

Table 3. Mine Sites Near Area of Analysis – Merced County

Mine ID	Latitude/ Longitude	Location	Description	Status	Commodity
91-24-0030	37° 1' 19.9194"/ -121° 5' 49.92"	Southern shore of San Luis Reservoir	Basalt Quarry – DWR Resources	Active	Rock
91-24-0024	37° 0' 0"/ -120° 57' 38.1594"	North of Los Banos SRA	San Luis Water District	Reclaimed	Sand and Gravel
91-24-0035	36° 59' 30.12"/ -120° 55' 0.12"	East of Los Banos SRA	Pfitzer Pit	Reclaimed	Rock
91-24-0012	37° 0' 21.96"/ -120° 54' 57.96"	East of Los Banos SRA	Canyon Rock Pit	Active	Sand and Gravel

Source: California DOC, Office of Mine Reclamation 2016

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix O: Cumulative Effects Analysis Approach

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Appendix O Cumulative Effects Analysis Approach

This appendix describes, in detail, the cumulative effects analysis completed in this Environmental Impact Report/Supplemental Environmental Impact Study (EIR/SEIS). Included here are descriptions of the regulatory requirements, methodology, and cumulative projects considered. Resource-specific cumulative effects analyses are presented in Chapter 5.

Cumulative effects are those environmental effects that on their own, may not be considered adverse, but when combined with similar effects over time, result in substantial adverse effects. Cumulative effects are an important part of the environmental analysis because they allow decision makers to look not only at the impacts of an individual proposed project, but the overall impacts to a specific resource, ecosystem, or human community over time from many different projects. This section describes the cumulative effects analysis for the action alternatives proposed in this EIR/SEIS including the regulatory requirements, the methodology, the projects considered in the analysis, and the potential cumulative effects for each environmental resource.

O.1 Regulatory Requirements

This section provides an overview of the regulatory setting associated with cumulative effects.

O.1.1 Regulatory Setting

Both the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) require consideration of cumulative effects in an EIR or EIS.

O.1.1.1 California Environmental Quality Act

Cumulative effects are defined in the CEQA Guidelines as:

"Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts."

1. The individual effects may be changes resulting from a single project or a number of separate projects.
2. The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time (CEQA Guidelines Section 15355)."

According to the CEQA Guidelines, a Lead Agency must discuss the cumulative impacts of a project when the cumulative effect is significant and the project's incremental contribution to the cumulative effect would be "cumulatively considerable," that is, when the incremental effects of a project would be significant when viewed in connection with the effects of past, present, and probable future projects (CEQA Guidelines Section 15065[a][3]; Section 15130[a]).

If the combined cumulative impact associated with the project's incremental effect and the effects of other projects would not be significant, an EIR should briefly indicate why the cumulative impact is not significant (CEQA Guidelines Section 15130[a][2]).

Additionally, an EIR can determine that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and therefore not significant. A project's contribution can also be less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. The Lead Agency must identify facts supporting this conclusion (CEQA Guidelines Section 15130[a][3]).

O.1.1.2 National Environmental Policy Act

As defined by NEPA, a "Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 Code of Federal Regulations [CFR] Section 1508.7)."

NEPA regulations require an analysis of direct, indirect, and cumulative effects and define "effects" as:

> "(a) Direct effects, which are caused by the action and occur at the same time and place.
>
> (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
>
> Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR Section 1508.8)."

In addition, the NEPA regulations state that when determining the scope of an EIS:

> "(a) Actions (other than unconnected single actions) which may be:
>
> (1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:
>
> (i) Automatically trigger other actions which may require environmental impact statements.
>
> (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

(2) Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement (40 CFR Section 1508.25[a][1] and [2])."

O.2 Methodology for Assessing Cumulative Effects

This section provides an overview of the methodology used to analyze cumulative effects.

O.2.1 Area of Analysis

Table 1 describes the specific cumulative effects area of analysis for each resource area.

Table 1. Cumulative Effects Area of Analysis

Section	Resource	Area of Analysis
4.1	Water Quality	San Luis Reservoir and the Delta
4.2	Surface Water Supply	Same as Section 4.1 with the addition of South-of-Delta CVP Contractors (SLDMWA)
4.3	Air Quality	Merced County and SJVAB
4.4	Greenhouse Gases	Regional and global
4.5	Visual Resources	San Luis Reservoir, O'Neill Forebay, and SR 152
4.6	Noise and Vibration	San Luis Reservoir and Merced County
4.7	Traffic and Transportation	Roadways in Merced County and local roads in the Cities of Gustine and Los Banos
4.8	Hazards and Hazardous Materials	San Luis Reservoir and SRA
4.9	Aquatic Resources	San Luis Reservoir and SRA, CVP and SWP facilities, and the Delta
4.10	Terrestrial Resources	San Luis Reservoir and Merced County
4.11	Recreation	San Luis Reservoir and SRA, and Pacheco State Park in Merced County; Anderson Reservoir and Anderson Lake County Park (Anderson Park) in Santa Clara County
4.12	Cultural Resources	San Luis Reservoir and Merced County
4.13	Geology, Seismicity, and Soils	Merced County
4.14	Public Utilities, Services, and Power	Merced County

Key: CVP = Central Valley Project; SJVAB = San Juaquin Valley Air Basin; SLDMWA = San Luis and Delta-Mendota Water Authority; SR = State Route; SRA = State Recreation Area; SWP = State Water Project; WTP = water treatment plant

O.2.2 Timeframe for Cumulative Effects Analysis

The timeline for the cumulative effects analysis with the exception of greenhouse gases (GHGs) and traffic and transportation, is 8 to 10 years for all short-term construction-related impacts. These impacts would be temporary and would only occur during construction. The timeframe for all long-term impacts is 20 years, which represents the planning horizon addressed in this EIR/SEIS. The analysis in Section 5.1.3 relies on a 30-year timeframe for long-term impacts consistent with the Bay Area Air Quality Management District (BAAQMD) emission amortization guidelines. The analysis in Section 5.1.7 utilizes a 25-year timeframe for long-term impacts consistent with the Merced County Transportation Authority analysis guidelines.

O.2.3 Identifying Past, Present, and Future Actions and Projects Contributing to Cumulative Effects

CEQA guidelines Section 15130(b)(1) identifies two methods that may be used to analyze cumulative impacts:

1. "A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency," and/or
2. "A summary of projections contained in an adopted local, regional, or statewide plan or related planning document, that describes or evaluates conditions contributing to the cumulative effect. Such plans may include: a general plan (GP), regional transportation plan, or plans for the reduction of greenhouse gas emissions. A summary of projections may also be contained in an adopted or certified prior environmental document for such a plan. Such projections may be supplemented with additional information such as a regional modeling program. Any such document shall be referenced and made available to the public at a location specified by the Lead Agency."

This EIR/SEIS analyzes cumulative impacts using both CEQA methods identified above. These methods are sufficient to satisfy CEQA and NEPA requirements for identifying past, present, and future actions and projects that may contribute to cumulative effects. Most Environmental Impact Statement/Environmental Impact Report (EIS/EIR) resources use one method or the other, but several resource areas use a combination of both methods.

A variety of federal, state, county, and local government sources were reviewed to identify and collect information on past, present, and reasonably foreseeable actions in the project area that could contribute to cumulative effects. These include

- City and county GPs
- Future population, housing, traffic, and other projections found in existing city and county GPs
- Published reports, documents, and plans
- Biological management plans (biological opinions, habitat conservation plans [HCPs], etc.)
- Environmental documents (such as EIS/EIRs)
- Scoping comments
- Consultation with federal, state, and local agencies

Sections O.2.4 and O.2.5 below describe the projects and projections considered for this cumulative effects analysis.

O.2.4 Cumulative Projects Considered for All Resources

This section describes the past, present, and reasonably foreseeable future cumulative actions and projects considered in this cumulative effects analysis. Table 2 describes the projects considered for cumulative analysis under each resource area.

O.2.4.1 Delta Conveyance Project

The Delta Conveyance Project is currently being analyzed by California Department of Water Resources (DWR) and several State Water Contractors.

The Delta Conveyance Project planning process began in 2006, when the Bureau of Reclamation (Reclamation) and DWR, along with several state and federal water contractors including, Kern County Water Agency, Metropolitan Water District of Southern California, San Luis and Delta-Mendota Water Authority (SLDMWA), Santa Clara Valley Water District, Westlands Water District, and the Zone 7 Water Agency (collectively referred to as Potential Authorized Entities) initially proposed the BDCP. The BDCP envisioned updating the State Water Project (SWP) and Central Valley Project (CVP) by adding new points of diversion in the north Delta and by providing for large-scale species conservation through a 50-year HCP/natural communities conservation plan (NCCP). The HCP/NCCP was intended to comply with Section 10 of the federal Endangered Species Act and to achieve compliance with the California Endangered Species Act through the California Natural Community Conservation Planning Act. A Draft EIS/EIR was released in December 2013.

Following release of the Draft EIS/EIR, Reclamation and DWR issued a Supplemental Draft EIS/Partially Recirculated Draft EIR that included for consideration three additional alternatives that would update SWP and CVP without the large-scale conservation efforts in an HCP/NCCP. The Lead Agencies proposed that one of these non-HCP alternatives, known as California WaterFix Alternative 4A, be identified as the preferred alternative in replacement of the BDCP alternative (DWR and Reclamation 2015). The preferred WaterFix alternative (4A) consisted of three new diversion points in the north Delta, tunnel conveyance and ancillary facilities, operational elements, restoration measures, and an adaptive management program (DWR and Reclamation 2015). The Supplemental Draft EIS/Partially Recirculated Draft EIR also included updates to the BDCP alternative and other revisions and updates to the 2013 Draft EIR/EIS analyses. In addition, the state proposed as a separate program, California EcoRestore, to provide restoration efforts for species conservation independent of the SWP and CVP facility upgrades.

The Final EIS/EIR for the BDCP/California WaterFix that identified the California WaterFix for implementation was released in December 2016. Biological opinions for the California WaterFix were released in June 2017.

In May 2019, DWR rescinded all permits, permit applications, bond authorizations, and CEQA documentation for California WaterFix and announced that it was working with public water agencies on a new environmental review process for a single tunnel project. The Delta Conveyance Project remains reasonably foreseeable given that an April 2019 Executive Order regarding how California intended to secure clean and dependable water supplies included direction to plan and modernize conveyance through the Bay-Delta with a new single tunnel project.

O.2.4.2 California High-Speed Rail Project

The California High Speed Rail Authority (CHSRA) and the United States Department of Transportation Federal Railroad Administration completed a programmatic EIS/EIR for the San Francisco to Central Valley portion of an approximately 800- mile-long high-speed rail network connecting San Francisco to San Diego. The track alignments considered in the EIS/EIR included one configuration traversing Pacheco Pass adjacent to State Route (SR) 120 and San Luis Reservoir. The railway is being designed to support train speeds greater than 125 miles per hour and would construct both at-grade and tunnel sections through Pacheco Pass (CHSRA 2012).

The Final Partially Revised Programmatic EIS/EIR was released by CHSRA on April 6, 2012. With a 20-year timeframe, the EIS/EIR identified the Pacheco Pass Network Alternative as the preferred alternative for consideration in future project-level engineering and environmental compliance (CHSRA 2012).

The San Jose to Merced project section is part of the first phase of the California High-Speed Rail System that will provide a critical rail link between the Silicon Valley and the Central Valley. The approximately 84 mile project section would travel between stations in San Jose and Gilroy and (after passing through the Central Valley Wye) north to Merced or south to Fresno (CHSRA 2017).

O.2.4.3 San Luis Reservoir State Recreation Area Resource Management Plan/General Plan

The California Department of Parks and Recreation (CDPR), in partnership with Reclamation, manages the majority of the San Luis Reservoir State Recreation Area (SRA). CDPR's planning process is integrated with Reclamation's Resource Management Planning Process. CDPR, in partnership with Reclamation, has developed and adopted the *San Luis Reservoir State Recreation Area Resource Management Plan (RMP)/GP* (Reclamation and CDPR 2013), to direct the future development, operations, and maintenance of the SRA. The plan was officially adopted in 2013 and has a life expectancy of 25 years. CDPR and Reclamation continue to collaborate on the area's RMP/GP to guide future growth.

The plan area consists of 27,000 acres owned by Reclamation and includes the water surfaces of San Luis Reservoir, O'Neil Forebay, Los Banos Reservoir, and adjacent recreation lands near Los Banos, California. The project area was built as part of the water storage and delivery system of reservoirs, aqueducts, power plants, and pumping stations operated under the SWP and CVP. Lands managed by CDPR for recreation are part of the state park system and comprise the SRA.

The plan's primary objective is to identify general areas in which future development may occur for recreation management. The plan includes an overview of existing conditions, including a summary of opportunities and constraints, a plan for future use and management of the project area, and the associated environmental analysis pursuant to CEQA and NEPA (Reclamation and CDPR 2013).

Table 2. Projects Being Considered for Cumulative Analysis Under Each Resource Area

Resource Area	Delta Conveyance Project	California High-Speed Rail Project	San Luis Reservoir SRA RMP/GP	San Luis Transmission Project	San Luis Solar Project	2018 Bay-Delta Plan Update for the Lower San Joaquin River and Southern Delta	Gonzaga Ridge Wind Repowering Project	State Water Project Supply Allocation Settlement Agreement	Pacheco Reservoir Expansion Project	Los Vaqueros Reservoir Expansion Project	San Luis Low Point Improvement Project	San Joaquin River Restoration Program
	Cumulative Projects											
Water Quality	X	X	X			X			X		X	
Surface Water Supply	X	X				X		X	X		X	
Air Quality	X	X		X	X		X		X	X	X	
Greenhouse Gas Emissions												
Visual Resources		X		X	X		X				X	
Noise and Vibration		X		X	X		X		X		X	
Traffic and Transportation		X		X	X		X		X		X	
Hazards and Hazardous Materials			X	X	X							
Aquatic Resources	X	X		X	X	X		X		X		X
Terrestrial Resources		X	X	X	X						X	
Recreation			X	X	X						X	
Cultural Resources		X	X	X	X				X		X	
Geology, Seismicity, and Soils		X	X	X	X							
Public Utilities and Power		X		X	X							

O.2.4.4 San Luis Transmission Project

The San Luis Transmission Project will develop approximately 95 miles of new transmission lines connecting the Tracy Substation and the Dos Amigos Substation with segments crossing O'Neill Forebay and connecting to the San Luis Substation. Additional components of the San Luis Transmission Project will include two new 500-kilovolt (kV) substations, substation improvements, communication facilities, improvements to existing access roads, and new permanent access roads (Western and SLDMWA 2016). The Final EIS/EIR for the San Luis Transmission Project was released in March 2016, with construction scheduled for 2018 through 2021.

O.2.4.5 San Luis Solar Project

The San Luis Solar Project will allow a 30-year land use authorization to access, install, operate, maintain, and remove a 26-megawatt (MW) alternating current solar facility. The project will be constructed on three sites along O'Neill Forebay and adjacent to the San Luis Reservoir SRA, to the northwest of the SR 152/SR 33 interchange. The three sites will cover a total of 159 acres and consist of solar photovoltaic panels, racks to hold the panels, and electrical infrastructure (Reclamation 2018a). The Final Environmental Assessment and Plan of Development for the San Luis Solar Project was released in May 2018, with construction scheduled for 2018.

O.2.4.6 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary 2018 Update for the Lower San Joaquin River and Southern Delta

The State Water Resources Control Board (SWRCB) is updating the 2006 Bay-Delta Water Quality Control Plan (WQCP) in three phases (SWRCB 2018):

- Phase 1: The first amendment focused on San Joaquin River flows and southern Sacramento-San Joaquin Delta (Delta) salinity. In December 2018, the SWRCB adopted amendments to the water quality objectives for the Lower San Joaquin River and Stanislaus, Tuolumne, and Merced rivers to protect the beneficial use of fish and wildlife and in the southern Delta to protect the beneficial use of agriculture.

- Phase II: Focuses on the Sacramento River and its tributaries, Delta eastside tributaries (including the Calaveras, Cosumnes, and Mokelumne Rivers), Delta outflows, and interior Delta flows. In July 2018, the SWRCB released a framework for the Phase II update that described changes that will likely be proposed through a formal SWRCB staff report and supporting environmental document.

- Phase III: Focuses on implementing the amendments adopted during the first two phases. This Phase has not formally begun; however, several parties have been engaged in discussions on voluntary agreements that would implement the amendments through a package of flow and non-flow measures.

O.2.4.7 Gonzaga Ridge Wind Repowering Project

The Gonzaga Ridge Wind Repowering Project (25-year lease) will allow for the decommissioning and removal of existing wind turbines and overhead energy collection system at Gonzaga Ridge Wind Farm to allow for the installation of modern wind turbines, with a generating capacity of up to 100 MW. In contrast to the originally permitted 166 turbines, the Gonzaga Ridge Wind Repowering Project would consist of up to 40 turbines. The Gonzaga Ridge Wind Repowering Project would continue use of an existing 70 kV transmission line located west and north of San Luis Reservoir and would require construction of an additional 70 kV transmission line on land owned by Reclamation, Merced County, and private owners. Construction has been divided into two phases, with Phase II construction starting between 2021 and 2023/24. The Draft Environmental Impact Report (EIR) was released by CDPR in October 2019 (CDPR 2019).

O.2.4.8 State Water Project Supply Allocation Settlement Agreement

DWR is proposing to approve four separate settlement agreements and amendments related to the agreements to SWP long-term water supply contracts with Solano County Water Agency, the Napa County Flood Control and Water Conservation District, City of Yuba City, and the County of Butte. Implementing this project would result in modifying SWP allocations to improve SWP water delivery reliability and modify the volume of SWP water that may be delivered to each of the above stated agencies. All lease extensions will terminate on December 31, 2035. The Final Initial Study/ Negative Declaration was released by DWR in September 2013 (DWR 2013).

O.2.4.9 San Luis Low Point Improvement Project

Reclamation and Santa Clara Valley Water District (Valley Water) are proposing to address water supply reliability and service interruption issues associated with low water levels in San Luis Reservoir. The Draft EIS/EIR was released in July 2019 and identified the Pacheco Reservoir Expansion Alternative as the CEQA Proposed Project. The Pacheco Reservoir Expansion Alternative includes removal of the existing dam, development of a new reservoir (located 0.5 mile upstream of the existing North Fork Dam along Pacheco Creek), a new earthen dam and spillway, new pipelines and tunnels, a new pump station, and associated channel modifications, a new regulating tank at Pacheco Pumping Plant, and access improvements. The Final EIS/EIR, planned for release in 2020, will identify a NEPA preferred alternative. Construction is planned to start in 2024 (Reclamation and Valley Water 2019).

O.2.4.10 Pacheco Reservoir Expansion Project

Valley Water, the San Benito County Water District and the Pacheco Pass Water District are proposing to increase Pacheco Reservoir's operational capacity from 5,500 acre-feet (AF) to up to 140,000 AF, in order to reduce the frequency and severity of water shortages during droughts (Valley Water 2020). The project would construct new conveyance infrastructure to segments of the CVP san Felipe Division in Merced and Santa Clara counties, and deliver water supply to up to eight South-of-Delta wildlife refuges in Merced County. Construction is planned to begin mid-2027 (California Water Commission 2020). If the Pacheco Reservoir Expansion Alternative is implemented under the San Luis Low Point Improvement Project (described above in Section O.2.4.9), then the Pacheco Reservoir Expansion Project will no longer be analyzed or implemented.

O.2.4.11 Los Vaqueros Reservoir Expansion Project

Los Vaqueros Reservoir is an off-stream reservoir in the Kellogg Creek watershed to the west of the Delta. The Los Vaqueros Reservoir initial construction was completed in 1997 as a 100,000 AF off-stream storage reservoir owned and operated by Contra Costa Water District (CCWD) to improve delivered water quality and emergency storage reliability to their customers. In 2012, the Los Vaqueros Reservoir was expanded to a total storage capacity of 160,000 AF (Phase 1) to provide additional water quality and supply reliability benefits, and to adjust the timing of its Delta water diversions to accommodate the life cycles of Delta aquatic species, thus reducing species impact and providing a net benefit to the Delta environment. As part of the Storage Investigation Program described in the CALFED Bay Delta Program ROD, additional expansion up to 275,000 AF (Phase

2) is being evaluated by CCWD, DWR, and Reclamation. The alternatives considered in the evaluation also consider methods to convey water from Los Vaqueros Reservoir to the South Bay Aqueduct to provide water to Zone 7 Water Agency, Alameda County Water District, and Valley Water. The Final EIS/R was released by Reclamation and CCWD in March 2010. Reclamation approved and released the Record of Decision (ROD) in March 2011. Construction is planned to begin as early as 2021, with a 6- year construction period (Reclamation 2018b).

O.2.4.12 San Joaquin River Restoration Program

The San Joaquin River Restoration Program (SJRRP) is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows. The restoration program is the product of more than 18 years of litigation, which culminated in a Stipulation of Settlement on the lawsuit known as Natural Resource Defense Council (NRDC), et al., v. Kirk Rodgers, et al. The settling parties reached agreement on the terms and conditions of the settlement, which was subsequently approved by Federal Court on October 23, 2006. The settling parties include the Natural Resources Defense Council, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce. The settlement's two primary goals are to:

- Restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish, and;

- Reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the settlement.

The settlement requires specific releases of water from Friant Dam to the confluence of the Merced River, which are designed primarily to meet the various life stage needs for spring- and fall-run Chinook salmon. The release schedule assumes continuation of the current average Friant Dam release of 116,741 AF, with additional flow requirements depending on the year type. Interim flows began in October 2009, and full restoration flows would begin no later than January 2014. Salmon will be reintroduced in the upper reaches no later than December 31, 2012. There are many physical improvements within and near the San Joaquin River that will be undertaken to fully achieve the river restoration goal. The improvements will occur in two separate phases that will focus on a combination of water releases from Friant Dam, as well as structural and channel improvements.

The project was authorized and funded with the passage of San Joaquin River Restoration Settlement Act, part of the Omnibus Public Land Management Act of 2009 (Public Law 111-11) (SJRRP 2019).

O.2.5 Cumulative Projections Considered for All Resources

This section describes the specific projections that have been used for the cumulative effects analysis.

O.2.5.1 Merced County General Plan – Background Report

The Background Report for the *2030 Merced County GP* was released in December 2013. This document presents population and employment projections through 2030. The projections have been developed by the California Department of Finance (DOF).

Table 3 shows both past and projected population estimates from the GP's projections from 2013. The current California DOF (2017) population projection for Merced County in 2030 has been revised downward, to 326,574, but the use of a higher population projection provides a more conservative cumulative impact analysis. Additionally, the table displays average annual growth rates for each period. As indicated in Table 3, the county's population had an average annual growth rate of 3.1% from 2000 to 2005 and 2.7% from 2005 to 2010, and a projected growth rate of 2.6% from 2010 to 2030 (Merced County 2013). Utilizing these population projections, the Background Report identifies an estimated population increase from 2010 to 2030 of approximately 141,000 people that will require housing within the county (Merced County 2013).

Table 3. Past and Projected Population Estimates Merced County and California (2000–2030)

	Merced County	
Year	**Population**	**Average Annual Growth Rate**
2000	210,544	--
2003	225,115	2.3%
2005	243,700	4.1%
2010	276,200	2.7%
2020	340,800	2.3%
2030	417,200	2.2%

Source: Merced County 2013

Employment growth projections presented in the Background Report identified approximately 27,600 jobs that would be added in Merced County between 2005 and 2030. Table 4 shows these employment projections for both unincorporated and incorporated areas within the county from 2005 to 2030.

Table 4. Past and Projected Employment Estimates Merced County (1990–2030)

Year	Observed/ Projected	Total Jobs	Average Annual Growth Rate
1990	Observed	77,300	--
2004	Observed	86,500	0.9%
2005	Projected	87,400	1.0%
2030	Projected	115,000	2.1%

O.2.5.2 Total Estimated and Projected Population for California and Counties

Table 5 presents projections through 2040 for the State of California and the counties that could be affected by the proposed alternatives. Each of these communities has predicted an increase in population by 2040.

Table 5. Population Projections 2010–2040

	2010	2020	2030	2040
California	37,333,583	40,719,999	44,019,846	46,884,801
Alameda	1,515,338	1,708,594	1,878,556	2,032,262
Contra Costa	1,051,525	1,184,094	1,314,573	1,426,050
Fresno	932,628	1,033,068	1,145,646	1,256,572
Imperial	175,107	196,540	220,459	243,975
Kern	841,887	929,787	1,067,631	1,213,558
Kings	152,175	154,403	170,105	187,048
Los Angeles	9,837,011	10,451,759	10,885,337	11,161,569
Madera	150,193	162,814	186,761	212,229
Merced	256,803	286,397	326,574	369,193
Orange	3,014,962	3,260,659	3,434,157	3,558,718
Riverside	2,196,137	2,506,739	2,863,260	3,165,363
San Benito	55,401	60,170	66,796	73,535
San Bernardino	2,044,228	2,235,282	2,483,568	2,735,646
San Diego	3,100,529	3,406,126	3,638,609	3,830,210
San Joaquin	687,827	783,572	895,240	996,379
San Luis Obispo	269,013	286,416	302,323	310,367
Santa Barbara	423,552	461,916	492,495	516,163
Santa Clara	1,790,301	2,018,257	2,230,564	2,443,718
Stanislaus	515,888	572,155	638,995	699,177
Tulare	442,551	488,293	541,140	594,348
Ventura	824,467	871,960	922,001	961,828

Source: California DOF 2017

O.2.5.3 Population and Housing

Table 6 presents population projections through 2030 for each of the communities that could be affected by the proposed alternatives. Each of these communities has predicted an increase in population by 2030.

Table 6. Population Projections 2016–2030

Community	2016[1]	2030	2030 Population Projection Source
Los Banos	36,847	67,100	Merced County 2013
Gilroy	51,649	57,000	LAFCO Santa Clara County 2015
Newman	10,667	16,525	Stanislaus County 2016
Gustine	5,658	9,000	Merced County 2013
Santa Nella	1,965	N/A	N/A

[1] *Source: United States Census Bureau 2016*
Key:
LAFCO = Local Area Formation Committee; N/A = Not Available

According to the most recent data from Merced County Association of Governments (MCAG), the total housing need to accommodate future growth in Merced County from 2014 through 2023 is estimated to be 15,850 units, with 2,473 needed in Los Banos and 320 needed in Gustine (MCAG 2015)[1]. According to the Association of Bay Area Governments (ABAG), Santa Clara County is expected to require a total of 58,836 new housing units to accommodate future growth, including 1,088 in Gilroy, from 2014 through 2022 (ABAG 2013). Stanislaus County is expected to require 21,330 new housing units, with 778 housing units in Newman for 2014 through 2023 (Stanislaus Council of Governments 2014).

All of the cities have recognized the potential for future increases in population and the corresponding need for new housing. In response, they have enacted goals and policies in the housing elements of their general plans to accommodate for this growth.

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B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix P: Supplemental Material

Appendix P Supplemental Material

P.1 List of Preparers

This Environmental Impact Report/ Supplemental Environmental Impact Statement (EIR/SEIS) was prepared by San Luis and Delta-Mendota Water Authority (SLDMWA) and United States Department of Interior, Bureau of Reclamation (Reclamation). A list of persons who prepared various sections of the EIR/SEIS, significant background materials, or participated to a significant degree in preparing this EIR/SEIS is presented below in Tables 1 through 3.

Table 1. CEQA Lead

Preparers	Agency	Role In Preparation
Pablo Arroyave	SLDMWA	Project objective identification, alternative formulation, EIR/SEIS development and review
Frances Mizuno	SLDMWA	Project objective identification, alternative formulation,
Federico Barajas	SLDMWA	Project objective identification, alternative formulation

Key: EIR/SEIS= Environmental Impact Report/ Supplemental Environmental Impact Statement, SLDMWA = San Luis Delta-Mendota Water Agency

Table 2. NEPA Lead

Preparers	Agency	Role In Preparation
Richard Welsh	Reclamation	Alternative formulation, EIR/SEIS development and review
Casey Arthur	Reclamation	Alternative formulation, EIR/SEIS development and review
Kristin White	Reclamation	Alternative formulation, EIR/SEIS development and review
Russ Grimes	Reclamation	EIR/SEIS development and review
Stacey Leigh	Reclamation	Alternative formulation, EIR/SEIS development and review

Key: EIR/SEIS= Environmental Impact Report/ Supplemental Environmental Impact Statement, Reclamation = United States Department of Interior, Bureau of Reclamation

Table 3. Consultants

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
CDM Smith			
Christopher Park, AICP, PMP	MS City and Regional Planning 13 years' experience	Water Resources Planner	Project Manager, Technical Review
Anusha Kashyap	M.S. Environmental Engineering 8 years' experience	Environmental Engineer	Project Management, Introduction, Project Description

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Gina Veronese	M.S. Agricultural and Resource Economics 16 years' experience	Resource Economist	Technical Review
Laura Lawson	B.S. Environmental Studies 3 years' experience	Environmental Planner	Document Review and Revision, Noise, Air Quality, Greenhouse Gases, Consultation and Coordination
Abbie Woodruff, AICP	M.S. Urban and Environmental Planning B.S. Geography B.S. Environmental Studies 4 years' experience	Water Resources Planner	Water Quality, Water Supply, Utilities and Power
Terichael Office	B.S. Environmental Engineering 6 years' experience	Environmental Engineer	Visual Resources, Hazards and Hazardous Materials, Recreation, Geology and Soils
Yonnel Gardes	B.S. Civil Engineering M.S. Transportation Engineering 17 years' experience	Transportation Planner	Traffic and Transportation
Gwen Pelletier	M.S. Environmental Studies 13 years' experience	Environmental Scientist	Air Quality and Greenhouse Gases
John Wondolleck	B.S. Biology M.S. Zoology 47 years' experience	Environmental Management	Technical Review
Terry Crowell, ASQ CQA, CHMM	B.S. Biology 25 years' experience	Quality Assurance	Editorial Review
Pacific Legacy			
Lisa Holm, Ph.D.	Ph.D., 28 years' experience	Supervisor - Prehistoric/Historic Archaeology; Geospatial Analysis	Cultural Resources
John Holson	M.A., 40 years' experience	Principal - Regulatory Compliance; Prehistoric/Historic Archaeology	Cultural Resources
Elena Reese	M.A., 32 years' experience	Supervisor- Historic Archaeology	Cultural Resources
Mary O'Neill	B.A., 22 years' experience	Supervisor- Prehistoric/Historic Archaeology	Cultural Resources

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Dave Daly	M.A., 12 years' experience	Supervisor- Historic Archaeology	Cultural Resources
Christopher Peske	B.A., 7 years' experience	Supervisor- Prehistoric Archaeology	Cultural Resources
Shanna Streich	M.A., 14 years' experience	Supervisor- Prehistoric/Historic	Cultural Resources
Environmental Science Associates			
Gerrit Platenkamp, Ph.D., CERP	Ph.D. Ecology 28 years' experience	Terrestrial Biologist	Terrestrial Resources
Christopher Fitzer	M. Environmental Planning 19 years' experience	Fisheries Biologist	Fisheries Resources
Paul Bergman	M.S. Fisheries B.S. Fisheries and Biology 13 years' experience	Fisheries Biologist	Fisheries Resources
Brian Pittman, CWB	M.S. Environmental Studies 23 years experience	Wildlife Biologist	Terrestrial Biological Resources
Julie McNamara, RCA	M.S. Geographic Information Science 6 years experience	Wildlife Biologist	Terrestrial Biological Resources
Joseph Sanders	B.S. Biology 5 years experience	Botanist/Wetland Scientist	Terrestrial Biological Resources
Chuck Hughes, CA	M.S. Plant Ecology 17 years experience	Botanist/Wetland Scientist	Terrestrial Biological Resources
Christina January	B.S. Environmental Science and Management 4 years experience	Fisheries Biologist	Fisheries Resources
Nicole Dunkley	B.S. Environmental Science and Management 3 years experience	Fisheries Biologist	Fisheries Resources
MBK Engineers			
Walter Bourez	M.S. Civil Engineering, 24 years' experience	Hydrological Modeling	Alternatives development, CalSim modeling
Wesley Walker	M.S. Civil Engineering, 2 years' experience	Hydrological Modeling	Alternatives development, CalSim modeling
Ron Milligan			Alternatives development, CalSim modeling

Key; AICP= Association of Certified Planners, ASQ= American Society of Quality, B.A.= Bachelor of Arts, B.S.= Bachelor of Science, CA= Certified Arborist, CERP= Certified Ecological Restoration Practitioner, CHMM= Certified hazardous Materials Manager, CQA= Certified Quality Auditor, CWB= Certified Wildlife Biologist, M.S.= Masters of Science, Ph.D.=Doctor of Philosophy, RCA= Registered Consulting Arborist

P.2 Acronyms

AADT	Annual Average Daily Traffic
AB	Assembly Bill
APE	area of potential effects
AQMD	Air Quality Management District
B	beneficial
BMP	best management practices
CalRecycle	California Department of Resources Recycling and Recovery
CalSim II	California Simulation Model II
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CH_4	methane
CHRIS	California Historical Resources Information System
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent
CRHR	California Register of Historical Resources
CRLFs	California red-legged frogs
CVP	Central Valley Project
D	Dry
dB	decibels
dBA	A-weighted dB
Delta	Sacramento-San Joaquin River Delta
DMC	Delta-Mendota Canal
DO	Dissolved Oxygen
DOC	Department of Conservation
DOGGR	Division of Oil, Gas & Geothermal Resources
DPM	diesel particulate matter
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources

EC	Electrical Conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
GGERP	Greenhouse Gas Emissions Reduction Plan
GHG	greenhouse gas
HASP	Health and Safety Plan
HCP	habitat conservation plan
Hwy	Highway
I-5	Interstate 5
LOS	Level of Service
LSZ	low salinity zone
LTS	less than significant
LTWT	Long-Term Water Transfers
LUST	leaking underground storage tank
M&I	municipal and industrial
MAF	million acre-feet
$MTCO_2e$	metric tons CO_2e
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NCCP	Natural Community Conservation Plan
NCP	Noise Control Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NI	no impact
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
Pb	lead
PM	particulate matter
PPV	peak particle velocity
PRC	Public Resources Code
Reclamation	United States Department of the Interior, Bureau of Reclamation

ROC on LTO	Reinitiation of Consultation on the Coordinated Long-Term Operations of CVP and SWP
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
S significant	
SBCWD	San Benito County Water District
SCVWD	Santa Clara Valley Water District
SJKF	San Joaquin kit fox
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Air Pollution Control District
SLDMWA	San Luis and Delta-Mendota Water Authority
SLLPIP	San Luis Low Point Improvement Project
SO_2	sulfur dioxide
SOD	Safety of Dams
SOI	Secretary of the Interior
SR	State Route
SRA	State Recreation Area
SU	significant and unavoidable
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
TAC	toxic air contaminant
TAF	thousand acre-feet
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
WTP	Water Treatment Plant

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Chapter 6 – Disclosures, Consultation, and Coordination

No References.

B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report/ Supplemental Environmental Impact Statement

Appendix Q: Public Scoping Report

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Attachments

Abbreviations and Acronyms

AB	Assembly Bill
AF	acre-feet
CEQA	California Environmental Quality Act
CHRIS	California Historical Research Information System
CRAM	California Rapid Assessment Method
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
Delta	Sacramento-San Joaquin River Delta
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ESA	Endangered Species Act
LEDPA	Least Environmentally Damaging Practicable Alternative
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
Reclamation	Bureau of Reclamation
SB	Senate Bill
SBCWD	San Benito County Water District
SCH	State Clearing House
SEIS	Supplemental Environmental Impact Statement
SLDMWA	San Luis & Delta-Mendota Water Authority
SOD	Safety of Dams
SHPO	State Historic Preservation Office
SWP	State Water Project
SWRCB	State Water Resource Control Board
THPO	Tribal Historic Preservation Office
USFWS	United States Fish and Wildlife Service
Valley Water	Santa Clara Valley Water District
WIIN Act	Water Infrastructure Improvements for the Nation Act

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Chapter 1 Introduction

This report documents the scoping activities that occurred for the B.F. Sisk Dam Raise and Reservoir Expansion Project Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS). San Luis & Delta-Mendota Water Authority (SLDMWA) is the designated California Environmental Quality Act (CEQA) Lead Agency and the U.S. Department of Interior, Bureau of Reclamation (Reclamation) is the designated National Environmental Policy Act (NEPA) Lead Agency (collectively known as the Lead Agencies) in preparation for this EIR/SEIS. SLDMWA conducted public scoping activities to receive input, and SLDMWA held a public scoping meeting via a Microsoft Teams Live Event on May 26, 2020.

1.1 Project Background

B.F. Sisk Dam was constructed to create the offstream San Luis Reservoir, which provides supplemental storage capacity for the Central Valley Project (CVP) and the State Water Project (SWP). Currently, San Luis Reservoir provides 2,027,840 acre-feet (AF) of water storage for the CVP and SWP. The water stored in the reservoir is managed for federal (45 %) and state (55 %) uses as part of the CVP and SWP, respectively. Typically, during the winter and early spring, water conveyed from the Sacramento-San Joaquin River Delta (Delta) in the Delta-Mendota Canal (DMC) (a CVP facility) and California Aqueduct (a SWP facility) is lifted from O'Neill Forebay into San Luis Reservoir for storage using the pump-turbines in the Gianelli Pumping-Generating Plant (see Figure 1-1). Later in the year, when CVP and SWP demand increases, water is released from San Luis Reservoir through O'Neill Forebay and conveyed via the DMC or the San Luis Canal/California Aqueduct for use by water users (Reclamation 2019). As water is released back through the Gianelli Pumping-Generating Plant, the plant generates hydropower, which is used to offset the energy demand of project operations. Water also is diverted from the west side of San Luis Reservoir at the Pacheco Pumping Plant to supply water to two CVP water service contractors: Santa Clara Valley Water District (Valley Water) and San Benito County Water District (SBCWD) (Reclamation 2019). In addition to storing and supplying water, San Luis Reservoir provides recreation opportunities.

The B.F. Sisk Dam Safety of Dams (SOD) Modification Project is a federal project that has the potential to influence water supply conditions in San Luis Reservoir. In 2006, Reclamation completed a risk analysis of B.F. Sisk Dam that concluded there is justification to take action to reduce risk to the downstream public from a potential severe earthquake. Consequently, Reclamation, in coordination with California Department of Water Resources (DWR), completed a corrective action study in December 2019.[1] The Crest Raise Alternative, one of the alternatives evaluated in the corrective action study that would reduce the dam safety risk, was selected to be implemented. Raising the crest elevation 12 feet would increase the distance between the water surface and the dam crest (freeboard) to prevent reservoir overtopping and failure in the event of

[1] The B.F. Sisk SOD Modification Project Final EIS/EIR is available for review at the following hyperlink: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=34281

dam deformation from a seismic event. The Crest Raise Alternative does not provide for any additional storage.

The Reclamation Safety of Dams Act of November 2, 1978 (SOD Act) (43 United States Code [U.S.C.] 506 et seq.) was amended by P.L. 114-113 to include authority for Reclamation to develop additional project benefits in conjunction with a SOD modification. Per SOD Act Section 5.B., as amended, Reclamation must determine that additional project benefits are necessary and in the interest of the United States prior to developing any additional project benefits consistent with Reclamation law. Further, it must be determined that the development of additional project benefits will not negatively impact the B.F. Sisk SOD Modification Project.

As a connected action to the B.F. Sisk SOD Modification Project, Reclamation and SLDMWA seek to evaluate an increase in storage capacity of the San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes. This additional 10 feet of dam embankment could add approximately 130,000 AF of water storage to San Luis Reservoir. SLDMWA, in coordination with Reclamation, is conducting a feasibility study to evaluate the proposed action and a potential cost-share per the Reclamation SOD Act and the Water Infrastructure Improvements for the Nation Act (WIIN Act) (P.L. 114-322) 4007.

1.2 Scoping Purpose and Process

Scoping is generally defined as “early public consultation” and is one of the first steps of the CEQA and NEPA environmental review processes. The purpose of scoping is to involve the public, stakeholders, American Indian tribes, and other interested agencies early in the environmental compliance process to help determine the range of alternatives, environmental effects, and mitigation measures to be considered in an environmental document. The results of scoping help to guide an agency’s environmental review of a project.

Scoping is not limited to public meetings; however, public meetings allow interested persons, tribes, organizations, and agencies to listen to information about a proposed project and express their concerns and viewpoints to the implementing agencies. The agencies can provide information regarding how additional information or status reports on the process can be obtained.

Agencies also establish a scoping comment period to accept scoping comments submitted in writing. Scoping comments are considered by the agencies during the formulation of alternatives and are used to determine the scope of the environmental issues to be addressed in the environmental document.

1.3 Applicable Regulations

1.3.1 CEQA Guidelines

CEQA does not require public meetings, but it encourages early consultation (or scoping) with affected parties. This early consultation often solves potential problems before they turn into more serious issues further on in the process. CEQA Section 15083 describes two other benefits for early consultation:

a) *"Scoping has been helpful to agencies in identifying the range of actions, alternatives, mitigation measures, and significant impacts to be analyzed in depth in an EIR and in eliminating from detailed study issues found not to be important.*

b) *Scoping has been found to be an effective way to bring together and resolve the concerns of affected federal, state, and local agencies, the proponent of the action, and other interested persons including those who might not be in accord with the action on environmental grounds."*

Per CEQA Section 21083.9, SLDMWA held a public scoping meeting via an online web-based tool on May 26, 2020. The scoping meeting is discussed in further detail in Chapter 2.

CEQA requires public notification of the initiation of an EIR through a Notice of Preparation (NOP) (CEQA 15082). The NOP was filed with the State Clearinghouse (SCH) (SCH# 2009091004) on May 14, 2020. A copy of the NOP is in Attachment 1 of this Public Scoping Report.

1.3.2 NEPA Regulations

NEPA Section 771.130 describes the process for developing an SEIS and states:

> *"A supplement is to be developed using the same process and format (i.e., draft EIS, final EIS, and ROD) as an original EIS, except that scoping is not required."*

1.4 References

Bureau of Reclamation (Reclamation). 2019. *B.F. Sisk Safety of Dams Modification Project Record of Decision*. November 2019. Available at: https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=41521

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Chapter 2 Scoping Meeting

To meet CEQA requirements (CEQA Section 21083.9), one public scoping meeting was held on May 26, 2020, for the B.F. Sisk Dam Raise and Reservoir Expansion Project EIR/SEIS. Given the coronavirus pandemic and the associated precautions and procedures being followed throughout California, the public scoping meeting was conducted online using a web-based tool that allowed presentation of the project and public participation through the online chat function.

2.1 Publicity

The following meeting notifications were used to announce the intent to start the EIR/SEIS process, in addition to the public scoping meeting.

2.1.1 Notice of Preparation

SLDMWA filed the NOP with the SCH (SCH# 2009091004) on May 14, 2020. The NOP announced the project purpose, the Lead Agencies on the project, and contact information. The NOP listed the meeting date, time, and location for the scoping meeting. The public comment period extended from the date of filing the NOP (May 14, 2020) to June 14, 2020. A copy of the NOP is in Attachment 1 of this Public Scoping Report.

2.1.2 Notice of Intent

Reclamation published a Notice of Intent (NOI) in the *Federal Register* on May 14, 2020. The NOI announced Reclamation's intent to prepare an SEIS for the B.F. Sisk Dam Raise and Reservoir Expansion Project and request public and agency comment to identify significant issues and other alternatives. Submitting written comments on the SEIS scope was extended to June 15, 2020. A copy of the NOI is in Attachment 1 of this Public Scoping Report.

2.1.3 Newspaper Advertisement

A display advertisement was run in the *Merced Sun-Star* newspaper. Attachment 2 includes a copy of this advertisement.

2.2 SLDMWA Representatives

Table 2-1 provides a list of the SLDMWA representatives in attendance during the public scoping meeting.

Table 2-1. SLDMWA Representatives in Attendance

Representative	Agency
Pablo Arroyave	SLDMWA
Frances Mizuno	SLDMWA
Chris Park	CDM Smith (Consultant)
Anusha Kashyap	CDM Smith (Consultant)
Laura Lawson	CDM Smith (Consultant)

2.3 Meeting Agenda and Content

Because of the coronavirus pandemic the scoping meeting was conducted online. The scoping meeting began with a presentation by SLDMWA. The presentation explained the purpose and format of the meeting, provided an overview of the proposed project, and described the public comment process. During the meeting, public participation was allowed through the online question and answer function. The presentation described how to provide comments using the online question and answer tool. Four people attended the meeting and no public comments were received during the online public scoping meeting. Attendees were encouraged to mail or email their comments to P.O. Box 2157 Los Banos, CA 93635 or pabloarroyave@sldmwa.org. A copy of the meeting presentation is in Attachment 3.

Chapter 3 Scoping Comments

Written comments were received during the scoping period of May 14, 2020 through June 14, 2020. A copy of all scoping comments is in Attachment 4. Table 3-1 provides a list of written comments received, including available author, organization, and submission date.

Table 3-1. Comments Received

Comment Author	Organization	Submittal Date
Diane Riddle	State Water Resources Control Board, Division of Water Rights	6/12/2020
Justin Fredrickson	California Farm Bureau Federation, Legal Services Division	6/15/2020
Stephanie Gordon	U.S. Environmental Protection Agency, Environmental Review Branch	6/15/2020
Jason Phillips	Friant Water Authority	6/15/2020
Nancy Gonzalez-Lopez	Native American Heritage Commission	6/12/2020
Amy Nelson Frelinger	Individual	5/16/2020
Krista Frelinger	Individual	5/18/2020
Karen and Ray Briese	Individual	5/15/2020
Karin Campbell	Individual	6/10/2020
John Thompson	Individual	6/8/2020
Diane Falge	Individual	6/8/2020
David Frelinger	Individual	5/21/2020
Dale Ashley	Individual	5/23/2020
Andrew Fisher	Individual	6/8/2020
Linda Foust	Individual	6/8/2020
Loel Wood	Individual	6/8/2020
Lois Wollenman	Individual	6/8/2020
Louie Bishop	Individual	5/14/2020
Monica Wright	Individual	6/8/2020
Paula Bazzell	Individual	5/14/2020
Richard Kreps	Ultra Gro	6/8/2020
Stacey Swinney	Individual	5/15/2020
Sunny Hand	Individual	5/20/2020
Ron Posey	Individual	5/17/2020
William Hembree	Individual	5/16/2020

3.1 Comment Summary

This section presents a summary of the key comments received from the comment letters.

3.1.1 Public Support for the Project

- Numerous letters supporting the Dam Raise Alternative with SOD benefits were received by farmers and other private individuals. Some support letters stated the need for water supply expansion and cited economic reasons to support the Dam Raise Alternative instead of other more costly solutions to increase water supply storage.

3.1.2 Trustee and Responsible Agencies

- A Clean Water Act Section 404 Dredge and Fill permit is required for impacts to Waters of the United States from the U.S. Army Corps of Engineers as a Responsible Agency.
- Water Quality Certification under Clean Water Act Section 401 is required for federal approval under Section 404. The State Water Resource Control Board (SWRCB) would be the Responsible Agency under Section 401.
- A National Pollutant Discharge Elimination System (NPDES) permit under Clean Water Act Section 402 for stormwater discharges from construction activities is required. The Regional Water Quality Control Board would be the Responsible Agency to authorize stormwater discharges under the Construction General permit.

3.1.3 Alternatives

- The EIR/SEIS should evaluate a range of alternatives that avoid or reduce any environmental impacts.
- Environmental impacts should be quantified to the greatest extent possible and include impacts from road and utility relocations, staging and construction areas, and any temporary roads for hauling material to the dam site.
- The draft EIR/SEIS alternatives analysis should fulfill the permit approval requirements under the Clean Water Act and NEPA.
- Explore both structural and nonstructural options to meet the project's purpose when considering a range of alternatives and design screening criteria to allow consideration of nonstructural project components that may provide smaller individual contributions.
- Assess the extent to which the need for water could be reduced through available conservation measures, including more efficient irrigation practices.
- Available conservation measures and demand management measures should be assessed either alone or in combination with other supply management components.

3.1.4 Baseline Condition

- Evaluate project effects using existing conditions as the baseline for comparing impacts across all alternatives, including the No Project/No Action Alternative, using a consistent method to measure impacts.

- When defining baseline conditions, verify that historical data (5 years or older) are representative of current conditions; include hydrological data for wet, average, and dry year analysis at a daily time-step; and include resources directly impacted by the project footprint and within the geographic scope of analysis that may be indirectly impacted by the project.

3.1.5 Water Rights and Supply

- Reclamation should contact the SWRCB Division of Water Rights to determine whether a water right permit or other water right approval for modification of CVP water rights is necessary.
- The EIR/SEIS must document water rights uses and water supply sources anticipated to be stored in the reservoir and whether project alternatives will require changes to existing water rights, permits, and CVP or Exchange contracts.
- The EIR/SEIS should consider the amount of water required for preservation and enhancement of fish and wildlife resources to support future water right applications and change petitions as required.
- The EIR/SEIS should clearly address the multiple project objectives in the purpose and need statement for the project. Identify gaps between water supply and demand to describe water supply needs.
- The project alternatives should not interfere with Reclamation's ability to satisfy San Joaquin River Exchange Contractor demands via the DMC and Mendota Pool or negatively affect allocations or supplies for other CVP water service contractors.
- A complete analysis of potential project impacts to CVP water contractors, operations, water rights and contracts, and appropriate mitigation measures must be described in the SEIS.

3.1.6 Balance Water Supply and Biological Resource Benefits

- The project would benefit Reclamation's ability to better balance and fulfill competing obligations to both protected and recovered sensitive fish species under the federal Endangered Species Act (ESA) and Central Valley Project Improvement Act (CVPIA) and to provide a more reliable water supply to federal water contractors during low water years.
- Reclamation must consider water supply resiliency despite potential negative comments from environmental groups that may be opposed to surface water storage capacity increases and the project's SOD objectives.

3.1.7 Biological Resources

- The environmental documentation for the B.F. Sisk Dam Raise and Reservoir Project should fully evaluate all potential direct, indirect, and cumulative impacts to diversion, rediversion, storage, and use of water.
- Aquatic resources assessments and results presented in the draft EIR/SEIS should be based on scientifically defensible approaches such as the California Rapid Assessment Method (CRAM).
- Aquatic resources in the reservoir footprint should be considered completely impacted.

- The EIR/SEIS should consider impacts to fish and wildlife and identify measures for their protection.
- The EIR/SEIS should identify all petitioned and listed threatened and endangered species and critical habitat in the project area and quantify species and critical habitat affected by each alternative. Special-status resources need to be evaluated and addressed prior to any approvals that would allow ground-disturbing activities or land use changes.
- Reclamation should engage with U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Services (NMFS) as early in the analysis as possible to assure that the environmental analysis addresses their concerns.
- The draft EIR/SEIS should serve as a sufficient basis to determine if the project would satisfy the requirements of the Clean Water Act Section 404 permit or identify appropriate mitigation measures, including compensatory mitigation opportunities, for project impacts from the Least Environmentally Damaging Practicable Alternative (LEDPA).
- Obtain a formal jurisdictional delineation of the Waters of the United States affected by the project, and include a map of the delineated waters, ecosystem functions descriptions, and describe anticipated effects to those waters and functions within the environmental analysis of the draft EIR/SEIS.
- Environmental commitments stated in the draft EIR/SEIS should be implemented in advance of or concurrently with project impacts. Compensatory mitigation will be provided for temporary impacts lasting 1 year or longer.
- Identify and analyze the impacts to the riparian woodland and aquatic habitats around the San Luis Reservoir and the species supported by these habitats.

3.1.8 Bay-Delta Watershed

- Model proposed changes to Delta export and upstream reservoir operations under the proposed alternatives and evaluate the model results in the EIR/SEIS for impacts to biological resources and water quality in the Delta.
- The EIR/SEIS should evaluate potential effects at the life-stage and population level of native Delta fish populations related to changes in flow rates, export volumes, reverse flow, and Delta outflow.
- The EIR/SEIS should identify specific operating criteria to avoid increases in exports and reduction in Delta outflows during time periods that could have adverse effects on water quality, native Delta fish, and aquatic species populations.

3.1.9 Groundwater

- The EIR/SEIS must evaluate each alternative's effect to groundwater systems during construction, operation, and maintenance activities and consider mitigation measures or operational controls to reduce or minimize adverse impacts.

3.1.10 Air Quality

- A robust air quality impact analysis of emissions estimates must be provided in the draft EIR/SEIS to ensure compliance with state and federal air quality regulations and disclosure of potential impacts from temporary or cumulative degradation in nonattainment zones.

- A list of mitigation measures for air quality impacts to be implemented during construction should be identified in the environmental documentation.
- The draft EIR/SEIS should provide a general conformity applicability analysis for each alternative and inclusion of a draft general conformity determination is recommended.

3.1.11 Tribal and Cultural Resources

- The draft EIR/SEIS should describe the process and outcome of consultation efforts between Reclamation and State Historic Preservation Office (SHPO)/Tribal Historic Preservation Office (THPO) and each affected tribal government.
- A discussion of the existence of "Indian sacred sites" in the project area is recommended to be included in the draft EIR/SEIS.
- Explain how the proposed action would address Section 106 of the National Historic Preservation Act (NHPA) and Executive Order 13007 and how the project would avoid adversely affecting the physical integrity, accessibility, or use of historic and sacred sites.
- The draft EIR/SEIS must comply with CEQA noticing, consultation, confidentiality, tribal cultural resources impact analysis, mitigation, and certification requirements under Assembly Bill (AB) 52 and Senate Bill (SB) 18.
- Native American Tribal Contact Lists and Sacred Lands Files and searches should be requested from the Native American Heritage Commission (NAHC).
- Tribal and cultural resources analysis in the EIR/SEIS should be based on archaeological records searches at the appropriate regional California Historical Research Information System (CHRIS) Center and required field survey results.
- The EIR/SEIS should include a mitigation and monitoring reporting program plan with provisions to avoid or minimize impacts to unknown cultural and tribal resources during construction and proper treatment and disposition of recovered Native American cultural items and human remains.

3.1.12 Environmental Justice

- The draft EIR/SEIS should include an evaluation of environmental justice populations, including American Indians, within the geographic scope of the project area.
- The potential for disproportionate adverse impacts to minority and low-income populations and public outreach and coordination efforts to these populations should be described in the draft EIR/SEIS.

3.1.13 Recreation

- The draft EIR/SEIS should include an evaluation of how construction, staging, and road/highway modification activities may temporarily or permanently impact public access and use of wildlife and recreation areas.

3.1.14 Cumulative Effects

- The EIR/SEIS should evaluate the reasonably foreseeable future major diversion and storage projects and their potential changes to river flows, Delta exports, and interior Delta flows and outflows and effects to water quality, native Delta fish and aquatic species populations.

- The EIR/SEIS should evaluate cumulative impacts of the project to fish and wildlife and findings described in the State Water Board's *Scientific Basis Report for Potential Updates to the Bay-Delta Plan for the Sacramento River and Delta* and the *July 2018 Framework for Updates to the Bay-Delta Plan*.
- Quantify cumulative impacts where feasible and data are available.
- Clearly state Reclamation's and other entities' mitigation responsibilities
- The methodology developed by the Federal Highway Administration and California Department of Transportation is recommended for assessing cumulative impacts to air quality.
- The EIR/SEIS should evaluate the potential cumulative impacts of the project and the California High Speed Rail.

B.F. Sisk Dam Raise and Reservoir Expansion Project
Public Scoping Report

Attachment 1: Notice of Preparation and Notice of Intent

Notice of Preparation

To: Agencies and Interested Parties

From: San Luis & Delta-Mendota Water Authority

Date: May 14, 2020

Subject: Notice of Preparation of a Draft Environmental Impact Report and Draft Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project

A joint Draft Environmental Impact Report (EIR) and Draft Supplemental Environmental Impact Statement (SEIS) is being prepared by the San Luis & Delta-Mendota Water Authority (SLDMWA) and the United States Bureau of Reclamation. SLDMWA will be the Lead Agency for the California Environmental Quality Act (CEQA) and Reclamation will be the Lead Agency for the National Environmental Policy Act (NEPA). This environmental document is subsequent/supplemental to the Final EIS/EIR entitled B.F. Sisk Dam Safety of Dams (SOD) Modification Project prepared in September 2019 by Reclamation and the California Department of Water Resources (DWR) (SCH# 2009091004).

Purpose of the Notice of Preparation

The purpose of a Notice of Preparation (NOP) is to notify responsible and trustee agencies, Federal agencies involved in approving or funding a project, and interested parties that an EIR will be prepared. (State CEQA Guidelines, 14 CCR Section 15082[a][1]).

The location, description, and potential environmental impacts of the proposed project are presented below. The EIR will also identify potentially feasible mitigation measures, where appropriate and available, and consideration of a reasonable range of alternatives to avoid or substantially reduce the proposed project's significant adverse environmental impacts.

The purposes of this NOP are to:

1. Notify the appropriate parties that an EIR will be prepared for the proposed project;

2. Briefly describe the proposed project and the anticipated content of the EIR;

3. Announce the public scoping meetings to facilitate public input; and

4. Solicit input by June 14, 2020, from Federal, State, regional, and local agencies, and from interested organizations and individuals, about the content and scope of the EIR, including the alternatives to be addressed and the potentially significant environmental impacts.

Project Background

B.F. Sisk Dam, also known as San Luis Dam, forms San Luis Reservoir, located near Santa Nella, California, along Pacheco Pass. Although the dam was constructed and is owned by Reclamation, DWR operates and maintains the dam and the Gianelli Pumping-Generating Plant that pumps water from O'Neill Forebay into San Luis Reservoir for storage and then later releases it back into O'Neill Forebay for delivery to CVP and SWP water users. The California Department of Parks and Recreation manages the recreational resources associated with San Luis Reservoir. San Luis Reservoir serves as an off-stream reservoir for Reclamation's Central Valley Project (CVP) and DWR's State Water Project (SWP). B.F. Sisk Dam is an earth-filled gravity embankment dam with a crest height of 382 feet and an overall length of about 3.5 miles. Completed in 1967, San Luis Reservoir is the largest off-stream reservoir in the United States, with a capacity of 2,041,000 acre-feet (AF).

B.F. Sisk Dam is in a seismically active area, and the Ortigalita Fault underlies the reservoir. Studies and analyses indicate that a major earthquake could result in substantial consequences, although the possibility of dam failure is remote. Reclamation and DWR completed a Corrective Action Study to identify and develop alternatives to reduce seismic risks. The result of that Corrective Action Study was the identification of an alternative to limit the likelihood of overtopping if embankment slumping were to occur during a seismic event. A 12-foot raise in embankment height across the North and South Valley Sections of the dam would reduce the potential for dam failure due to earthquake-induced cracking. Reclamation and DWR released a Final EIS/EIR for the B.F. Sisk SOD Modification Project in September 2019 with anticipated construction scheduled to start in 2021.

Proposed Project

Project Objectives

Decreased water supply reliability caused by a variety of factors affects the ability of water districts and other public water agencies such as the SLDMWA to meet their needs.

The objectives of the proposed project are to optimize the water supply benefits of San Luis Reservoir while avoiding or reducing impacts to the environment and other water users by:

- Increasing the reliability and quantity of yearly allocations to south-of-Delta contractors dependent on San Luis Reservoir - The CVP and SWP's allocation of water is dependent on the state's highly variable hydrology that ranges from wet years with substantial surplus to dry years with supplies unable to satisfy demands. This variable hydrology leads to the carryover of supplies by water users for use in subsequent dry years to insure against shortage. The presence of this carryover supply can limit total south-of-Delta conveyance in subsequent years given reduced storage capacity in San Luis Reservoir. The B.F. Sisk Dam Raise and Reservoir Expansion Project is being evaluated in part to provide expanded capacity in San Luis Reservoir to store water supply divertible under the existing operation requirements for the CVP and SWP in periods when the existing reservoir would otherwise be full and improve annual allocations.

- Increasing the certainty of access to supplies stored by south-of-Delta contractors in San Luis Reservoir in subsequent water years. San Luis Reservoir is relied on by water users to store over multiple years allocated CVP water supplies diverted in wetter years for later use in drier water years and other acquired water. If the CVP storage capacity in San Luis Reservoir fills in a subsequent year before those water users are able to use their carried over CVP and other supplies, it is reallocated to all south-of-Delta CVP water users and lost to the contractor. The B.F. Sisk Dam Raise and Reservoir Expansion Project is being evaluated in part to provide increased certainty for south-of-Delta contractors on the security of carried over CVP and other water stored in San Luis Reservoir.

Project Description

As a connected action to the B.F. Sisk SOD Modification Project, SLDMWA in collaboration with Reclamation seeks to evaluate increasing storage capacity in San Luis Reservoir for the purpose of providing greater water supply reliability for south-of-Delta contractors dependent on San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes. Increased capacity within San Luis Reservoir would, consistent with the project objectives, be used to store water supply divertible under the existing operation requirements for the CVP and SWP in periods when the existing reservoir would otherwise be full. This stored supply would be used to help meet existing demands under the existing contract supplies and would not serve any new demands or establish any new places of use of CVP or SWP project water. The B.F. Sisk Dam Raise and Reservoir Expansion Project would also implement modifications to State Route 152 in areas where the increased water surface elevation in the reservoir would interact with the roadway.

Project Location

The project location includes San Luis Reservoir and its related water infrastructure, Sacramento-San Joaquin River Delta, and South-of-Delta CVP and SWP contractors reliant on San Luis Reservoir (Figure 1).

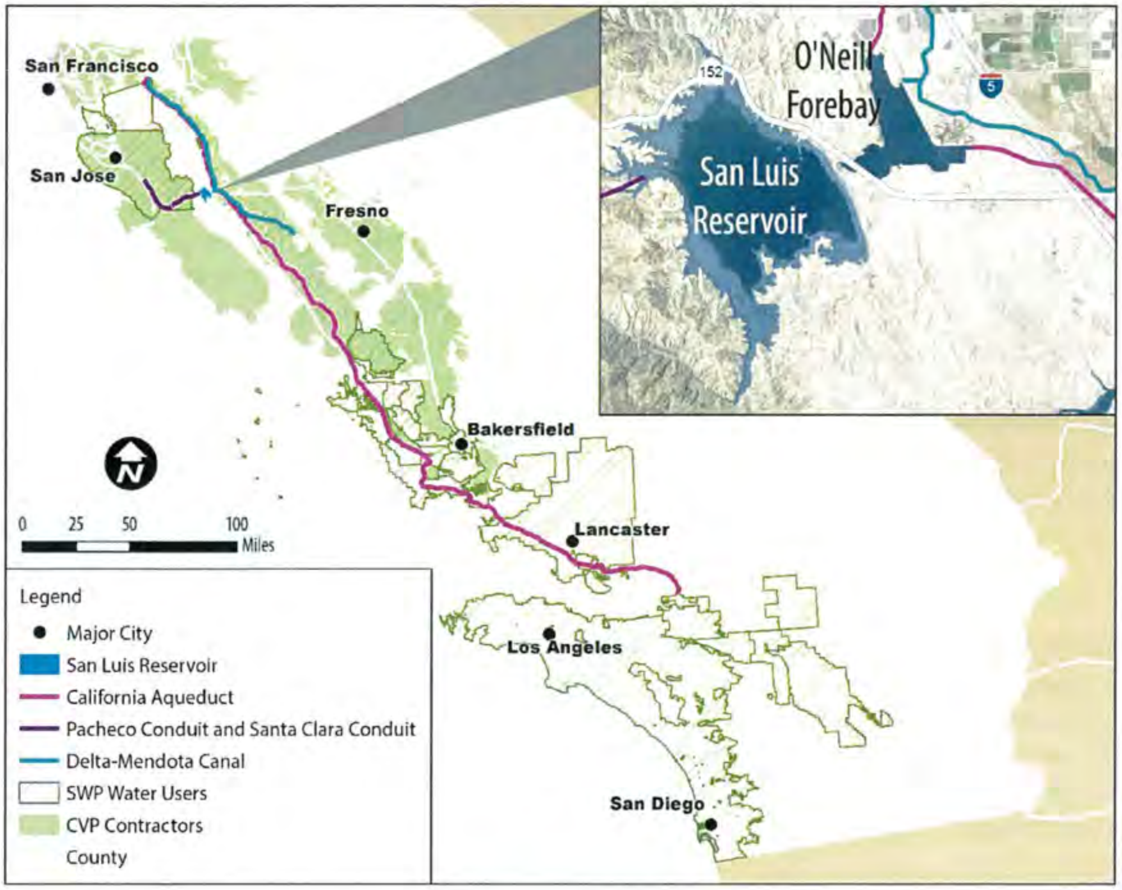

Figure 1. Project Study Area

Environmental Impacts

The EIR will describe the potentially significant direct and reasonably foreseeable indirect environmental impacts of the proposed project. The EIR will also evaluate the cumulative impacts of the project when considered in conjunction with other related past, present, and reasonably foreseeable future projects.

The EIR will include a detailed hydrologic analysis and will focus on potential environmental impacts, including:

- **Water Quality:** The exposure of bare soils, soil and material stockpiles, and the presence of fuels, lubricants, and solid and liquid wastes during construction could cause short-term water quality impacts. Soil disturbance could result in localized surface erosion, minor changes in drainage patterns and changes in erosion rates.

- **Surface Water Supply:** Construction and operation could change the annual supply of water available to the CVP and SWP contractors reliant on San Luis Reservoir.

- **Geology and Soils:** Construction could impact known or previously undiscovered paleontological resources or unique geologic features.
- **Air Quality:** Construction could cause temporary, short-term increases in emissions of criteria pollutants or their precursors.
- **Greenhouse Gas Emissions:** Construction could cause temporary, short-term increases in greenhouse gas emissions, including carbon dioxide, methane, and nitrous oxide. Construction and operation could also conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.
- **Visual Resources:** Construction could create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area and could damage scenic resources within a State scenic highway corridor.
- **Noise:** Noise generated by construction could expose sensitive receptors to noise levels in excess of standards established in the local general plan or noise ordinance. Construction could also cause an increase in ambient noise levels in the project vicinity above levels existing without the project.
- **Traffic and Transportation:** Traffic during construction could increase traffic hazards and result in inadequate emergency access. Modifications to State Route 152 could also require lane closures and rerouting of traffic to isolate areas under construction.
- **Hazards and Hazardous Materials:** Construction could increase the risk of exposure from hazardous materials to the public and construction workers, interfere with an active remediation site, conflict with activities and operations at airports, interfere with an emergency response plan or emergency evacuation plan, and increase the risk of wildfire within the vicinity of the project area.
- **Terrestrial Resources:** Construction could affect special-status species, riparian habitat or other habitats, or sensitive natural communities, and Federally or State protected wetlands.
- **Recreation:** Construction and operation could reduce access to or close recreation areas.
- **Cultural Resources:** Construction could result in adverse effects to historic properties, and/or substantial adverse changes to historical resources, unique archaeological resources, or tribal cultural resources, or result in the disturbance of human remains.

These issue areas will be discussed in the EIR, and potentially feasible mitigation measures will be recommended to avoid or substantially reduce potentially significant impacts.

Opportunities for Public Participation

Scoping Meeting

A public scoping meeting will be held to inform interested parties about the proposed project and to solicit agency and public input on the scope and content of the EIR:

- May 26, 2020, 4:00 p.m. to 5:30 p.m.

Given the coronavirus disease pandemic and the associated precautions and procedures being followed throughout California, the public scoping meeting is being conducted online utilizing Microsoft Teams. This meeting format will allow presentation of the project and public participation through the online chat function.

If special assistance is required to participate in the public scoping meeting, please contact Pablo Arroyave (contact information is provided below) as far in advance as possible, and no less than five days in advance, to enable SLDMWA to secure the needed services. If a request cannot be honored, the requestor will be notified.

Comments

This NOP is being circulated for a 30-day public comment period, beginning on May 14, 2020, and ending on June 14, 2020. Written comments on the proposed content and scope of the EIR can be provided at the public scoping meeting via the online chat function, or submitted via mail or email directly to SLDMWA. Comments must be received no later than 5:00 p.m. on June 14, 2020. When submitting comments, agencies that will need to use the EIR when considering permits or other approvals for the proposed project should:

1. State if they are a responsible or trustee agency for the project, and if so, explain why, and note the specific project elements that are subject to their regulatory authority.

2. Identify any significant environmental issues, reasonable alternatives, and mitigation measures they believe should be explored in the EIR.

3. Provide the name, email address, and phone number of a contact person.

Please send all written and/or e-mail comments to Pablo Arroyave, Chief Operating Officer, San Luis & Delta Mendota Water Authority, 842 6th St, Los Banos, CA 93635; or e-mail at pablo.arroyave@sldmwa.org.

Before including your name, address, telephone number, e-mail address, or other personal identifying information in your comment, please be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can request in your comment that your personal identifying information be withheld from public review, SLDMWA and Reclamation cannot guarantee that this will be possible.

All comments received during the public comment period will be considered and addressed in the EIR as appropriate.

On November 30, 1983, human remains representing, at minimum, two individuals were removed from a house in Mesa, Maricopa County, AZ. These individuals were found by a construction crew, who alerted the Mesa Police Department. The human remains were determined to be associated with a prehistoric site. Subsequently, they were donated to the Arizona Museum of Natural History. No known individuals were identified. The one associated funerary object is a shell bracelet.

Based on current archeological evidence, the region where these human remains were collected was occupied in prehistoric times by people belonging to the Hohokam Material Culture. Based on archeological and ethnographic evidence, these people are ancestral to the Four Southern Tribes of Arizona (*i.e.,* the Tohono O'odham Nation, Gila River Indian Community, Salt River-Pima Maricopa Indian Community, and Ak-Chin Indian Community) and the Hopi Tribe. The Mesa area is primarily Salt River Pima-Maricopa Indian Community ancestral land.

From 1979 to 1991, human remains representing, at minimum, 75 individuals were removed from Park of the Canals in Mesa, Maricopa County, AZ. This portion of the site was excavated by the Southwest Archaeological Team, led by Sam Baar. No known individuals were identified. The eight associated funerary objects are ceramic vessels.

Based on the style of the ceramics and the location of the site, the human remains and objects are related to people belonging to the Hohokam Material Culture. Based on current archeological and ethnographic evidence, these people are ancestral to the Four Southern Tribes of Arizona (*i.e.,* the Tohono O'odham Nation, Gila River Indian Community, Salt River-Pima Maricopa Indian Community, and Ak-Chin Indian Community) and the Hopi Tribe. The Mesa area is primarily Salt River Pima-Maricopa Indian Community ancestral land.

In 2005, 2010, and 2011, human remains representing, at minimum, four individuals were removed from the Riverview site in Mesa, Maricopa County, AZ. No known individuals were identified. The two associated funerary objects are one ceramic bowl and one lot of sherds.

Based on the style of the ceramics and the location of the site, the human remains and objects are related to people belonging to the Hohokam Material Culture. Based on current archeological and ethnographic evidence, these people are ancestral to the Four Southern Tribes of Arizona (*i.e.,* the Tohono O'odham Nation, Gila River Indian Community, Salt River-Pima Maricopa Indian Community, and Ak-Chin Indian Community) and the Hopi Tribe. The Mesa area is primarily Salt River Pima-Maricopa Indian Community ancestral land.

Prior to 2018, human remains representing, at minimum, 11 individuals were removed from AZ. The human remains were found during the cleaning of an archeological lab at the Arizona Museum of Natural History used for studying prehistoric Hohokam Material Culture. No known individuals were identified. The nine associated funerary objects are one lot of corn, one lot of beans, two lots of stones, one lot of possible asbestos, one ceramic bowl, two lots of sherds, and one lot of soil associated with cremation.

Based on the lab's use, the human remains and objects are related to people belonging to the prehistoric Hohokam Material Culture. Based on archeological and ethnographic evidence, these people are ancestral to the Four Southern Tribes of Arizona (*i.e.,* the Tohono O'odham Nation, Gila River Indian Community, Salt River-Pima Maricopa Indian Community, and Ak-Chin Indian Community) and the Hopi Tribe.

Sometime prior to 1982, human remains representing, at minimum, one individual were removed from Mesa Grande in Mesa, Maricopa County, AZ. The human remains were excavated by Midvale and donated to the Arizona Museum of Natural History in 1982. No known individual was identified. The two associated funerary objects are one burn corn and one lot of ceramic sherds.

Based on the style of the ceramics and location of the site, the human remains and objects are related to people belonging to the prehistoric Hohokam Material Culture. Based on current archeological and ethnographic evidence, theses people are ancestral to the Four Southern Tribes of Arizona (*i.e.,* the Tohono O'odham Nation, Gila River Indian Community, Salt River-Pima Maricopa Indian Community, and Ak-Chin Indian Community) and the Hopi Tribe. The Mesa Grande site is primarily Salt River Pima-Maricopa Indian Community ancestral land.

Determinations Made by the Arizona Museum of Natural History

Officials of the Arizona Museum of Natural History have determined that:

- Pursuant to 25 U.S.C. 3001(9), the human remains described in this notice represent the physical remains of 98 individuals of Native American ancestry.
- Pursuant to 25 U.S.C. 3001(3)(A), the 28 objects described in this notice are reasonably believed to have been placed with or near individual human remains at the time of death or later as part of the death rite or ceremony.
- Pursuant to 25 U.S.C. 3001(2), there is a relationship of shared group identity that can be reasonably traced between the Native American human remains and associated funerary objects and the Ak-Chin Indian Community (previously listed as Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation, Arizona); Gila River Indian Community of the Gila River Indian Reservation, Arizona; Hopi Tribe of Arizona; Salt River Pima-Maricopa Indian Community of the Salt River Reservation, Arizona; and the Tohono O'odham Nation of Arizona (hereafter referred to as ''The Tribes'').

Additional Requestors and Disposition

Lineal descendants or representatives of any Indian Tribe or Native Hawaiian organization not identified in this notice that wish to request transfer of control of these human remains and associated funerary objects should submit a written request with information in support of the request to Melanie Deer, Arizona Museum of Natural History, 53 N MacDonald, Mesa, AZ 85201, telephone (480) 644–4381, email *melanie.deer@mesaaz.gov,* by June 15, 2020. After that date, if no additional requestors have come forward, transfer of control of the human remains and associated funerary objects to The Tribes may proceed.

The Arizona Museum of Natural History is responsible for notifying The Tribes that this notice has been published.

Dated: March 25, 2020.

Melanie O'Brien,

Manager, National NAGPRA Program.

[FR Doc. 2020–10344 Filed 5–13–20; 8:45 am]

BILLING CODE 4312–52–P

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

[RR02910000, XXXR0680R1, RR.17529652.2900012]

Notice of Intent To Prepare a Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

AGENCY: Bureau of Reclamation, Interior.

ACTION: Notice of intent; request for comments.

SUMMARY: The Bureau of Reclamation (Reclamation) intends to prepare a Supplemental Environmental Impact Statement (SEIS) for the B.F. Sisk Dam Raise and Reservoir Expansion Project. Reclamation is requesting public and agency comment to identify significant issues or other alternatives to be addressed in the SEIS.

DATES: Submit written comments on the scope of the SEIS on or before June 15, 2020.

ADDRESSES: Provide written scoping comments, requests to be added to the mailing list, or requests for other special assistance needs to Ms. Casey Arthur, Project Manager, Bureau of Reclamation, Willows Construction Office, 1140 W. Wood Street Willows, CA, 95988.

FOR FURTHER INFORMATION CONTACT: Ms. Casey Arthur, Project Manager, Bureau of Reclamation, Willows Construction Office, 1140 W. Wood Street Willows, CA, 95988.; telephone (530) 892–6202; facsimile (530) 934–7679; email *carthur@usbr.gov.* Persons who use a telecommunications device for the deaf may call the Federal Relay Service (FedRelay) at 1–800–877–8339 TTY/ASCII to contact the above individual during normal business hours or to leave a message or question after hours. You will receive a reply during normal business hours.

SUPPLEMENTARY INFORMATION: Reclamation is issuing this notice pursuant to the National Environmental Policy Act of 1969, as amended (NEPA), 42 U.S.C. 4321 *et seq.;* the Council on Environmental Quality's (CEQ) regulations for implementing NEPA, 43 CFR parts 1500 through 1508; and the Department of the Interior's NEPA regulations, 43 CFR part 46.

Background

B.F. Sisk Dam is an earth-filled gravity embankment dam with a crest height of 382 feet and an overall length of about 3.5 miles, impounding San Luis Reservoir with a capacity of 2,041,000 acre-feet (AF). The dam is located near Santa Nella, California, along Pacheco Pass. Although the dam was constructed and is owned by Reclamation, the California Department of Water Resources (DWR) operates the facilities, and the California Department of Parks and Recreation manages the recreational resources associated with San Luis Reservoir. San Luis Reservoir is an off-stream reservoir within Reclamation's Central Valley Project (CVP) and DWR's State Water Project.

Reclamation's Safety of Dams Office completed a risk analysis of B.F. Sisk Dam that evaluated dam stability in the event of seismic activity that proposed a structural solution, which included a crest raise. Reclamation and DWR prepared an environmental impact statement (EIS)/environmental impact report (EIR) analyzing the effects from a No Action Alternative, Operational Alternative, and Crest Raise Alternative, and noticed the availability of the Final EIS/EIR to the public via the **Federal Register** on August 23, 2019 (84 FR 44295). In December 2019, Reclamation signed a Record of Decision providing the rationale for choosing the Crest Raise Alternative (*https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=34281*). Reclamation is currently designing the Crest Raise Alternative under the B.F. Sisk Safety of Dams (SOD) Modification Project.

As a connected action to the B.F. Sisk SOD Modification Project, Reclamation and San Luis and Delta Mendota Water Authority (SLDMWA) seek to evaluate an increase in storage capacity of the San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes (Proposed Action). This additional 10 feet of dam embankment could add approximately 120,000 AF of water storage to San Luis Reservoir. SLDMWA, in coordination with Reclamation, is conducting a feasibility study to evaluate the Proposed Action and a potential cost-share in accordance with the Reclamation SOD Act (43 U.S.C. 506 *et seq.*), as amended by Public Law 114–113, and Section 4007 of the Water Infrastructure Improvements for the Nation (WIIN) Act (Pub. L. 114–322).

The Reclamation SOD Act of November 2, 1978, was amended to include authority for Reclamation to develop additional project benefits in conjunction with a SOD modification. Pursuant to Section 5.B. of the SOD Act, as amended, Reclamation must determine that additional project benefits are necessary and in the interest of the United States prior to developing any additional project benefits, consistent with Reclamation law. Furthermore, it must be determined that the development of additional project benefits will not negatively impact the SOD Modification Project.

As a potential funder for the Proposed Action under the WIIN Act, and in accordance with the amended SOD Act, Reclamation's preliminary purpose and need is to evaluate the feasibility report and determine if SLDMWA's request to increase storage capacity as an additional benefit in conjunction with the current SOD Modification Project is consistent with Reclamation Law, can support a Secretary of the Interior's finding of feasibility, has Federal benefits pursuant to the WIIN Act, and can be accomplished without negatively impacting the SOD Modification Project.

In addition to a feasibility study, Reclamation intends to complete a SEIS pursuant to NEPA to consider potential environmental effects from implementing the Proposed Action. This environmental document is supplemental to the Final EIS/EIR previously developed for the SOD Modification Project entitled B.F. Sisk Dam Safety of Dams Modification Project (84 FR 44295). Reclamation will focus the SEIS on analyzing effects to resources where a potentially significant impact exists. The resources intended to be discussed include: Water quality, surface water supply, geology and soils, air quality, greenhouse gas emissions, visual resources, noise, traffic and transportation, hazards and hazardous materials, terrestrial resources, recreation, and cultural resources including tribal cultural resources. Agencies and the public are encouraged to provide input regarding potentially significant issues to be addressed in the SEIS, or to identify potential alternatives that would meet the purpose of the Proposed Action.

Public Disclosure

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Richard Welsh,

Principal Deputy Regional Director, Bureau of Reclamation, Interior Region 10—California-Great Basin.

[FR Doc. 2020–10296 Filed 5–13–20; 8:45 am]

BILLING CODE 4332–90–P

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

[RR06450000, 19XR0680A4, RX.08254998.0010010]

Off-Road Vehicle Designation for the San Angelo Project, Texas

AGENCY: Bureau of Reclamation, Interior.

B.F. Sisk Dam Raise and Reservoir Expansion Project
Public Scoping Report

Attachment 2: Merced-Sun Star Newspaper Advertisement

LEGAL NOTICES | MERCED SUN-STAR

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Notice Type : **Legal Notices** **Posting Date :** 5/18/2020

Printer Friendly

San Luis and Delta-Mendota Water Authority Announces Public Scoping Meeting for the B.F. Sisk Dam Raise and Reservoir Expansion Project San Luis and Delta-Mendota Water Authority (SLDMWA), in compliance with the California Environmental Quality Act (CEQA), is holding a public scoping meeting and public scoping review period for the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project) to inform interested parties about the proposed project and to solicit agency and public input on the scope and content of the Environmental Impact Report/ Supplemental Environmental Impact Statement, a joint document with the Bureau of Reclamation. Given the coronavirus disease pandemic and the associated precautions and procedures being followed throughout California, the public scoping meeting is being conducted online utilizing Microsoft Teams. This meeting format will allow presentation of the project and public participation through the online chat function. The Notice to Proceed (NOP) is also being circulated for a 30-day comment period and is available here: http://sldmwa.org/sisk-project/. The public scoping review period started on May 14, 2020. The alternatives considered for the Project propose construction at the San Luis Reservoir in Merced County. Operation of the alternatives could affect water system operations in Contra Costa, Fresno Imperial, Kern, Kings, Los Angeles, Merced, Orange, Riverside, San Benito, San Joaquin, San Luis Obispo, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Clara, Stanislaus and Ventura counties. The public scoping meeting to solicit comments has been scheduled for: May 26, 2020, 4 p.m. to 5:30 p.m. via Microsoft Teams, accessible at the following link: https://bit.ly/BFSiskPubScoping Comments may be submitted during the scoping meeting via the online chat function in the Microsoft Teams system. SLDMWA will also consider written comments received or postmarked by the end of the scoping period which ends June 14, 2020. Written comments should be mailed or emailed to: ATTN: Pablo Arroyave San Luis and Delta-Mendota Water Authority P.O. Box 2157 Los Banos, CA 93635 pablo.arroyave@sldmwa.org For additional information, please contact Pablo Arroyave at (209) 832-6200.

Notice Type : **Legal Notices** **Posting Date :** 5/18/2020

Printer Friendly

NOTICE OF PUBLIC HEARING Proposed 2020-21 Budget NOTICE IS HEREBY GIVEN that a public hearing will be held regarding the proposed 2020-21 budget and the COVID-19 Operations Written Report for the Merced River Elementary School District. Date: June 8, 2020 Time: 6:00PM Location: www.MRSD.us (to access the agenda and meeting information) Any member of the public may be heard concerning this budget and the COVID-19 Operations Written Report. Any member of the public who wishes to inspect the proposed budget and the COVID- 19 Written Operations Report prior to the public hearing may do so starting June 3, 2020. The reports will be located online at www.MRSD.us. Steve M. Tietjen, Ed.D. Merced County Superintendent of Schools

Notice Type : **Legal Notices** **Posting Date :** 5/18/2020

Printer Friendly

NOTICE TO BID NOTICE IS HEREBY GIVEN THAT the Livingston Union School District will receive requests for proposal for the furnishing of Dairy Products, Commercial Food & Supplies, Bread and Fresh Produce (RFP #P2021-001) for schools of Livingston Union School District Child Nutrition Department. Bid packets may be requested by emailing rjameson@livingstonusd.org or accessing the website: www.livingstonusd.org and clicking on Departments>Nutrition Services>What''s New. Sealed proposals must be mailed and addressed to: LUSD Child

B.F. Sisk Dam Raise and Reservoir Expansion Project
Public Scoping Report

Attachment 3: Public Scoping Meeting Presentation

B.F. Sisk Dam Raise and Reservoir Expansion Project

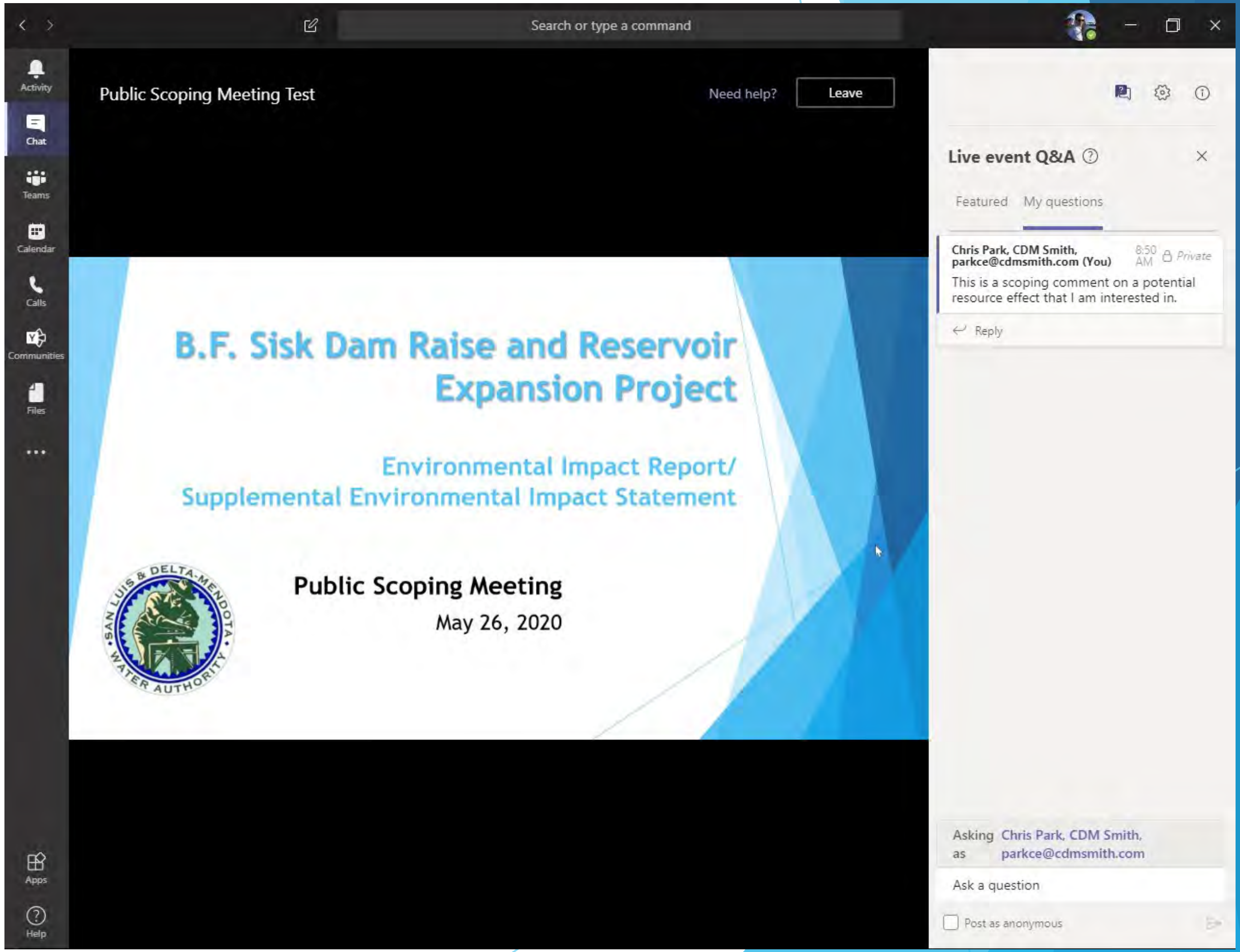
Environmental Impact Report/ Supplemental Environmental Impact Statement

Public Scoping Meeting

May 26, 2020

Meeting Format

- This MS Teams Live Tool does not allow attendees to share audio
- Comments can be submitted in writing via the Q&A Tool
- Comments submitted using the Q&A Tool during this meeting will be addressed in the Public Scoping Report

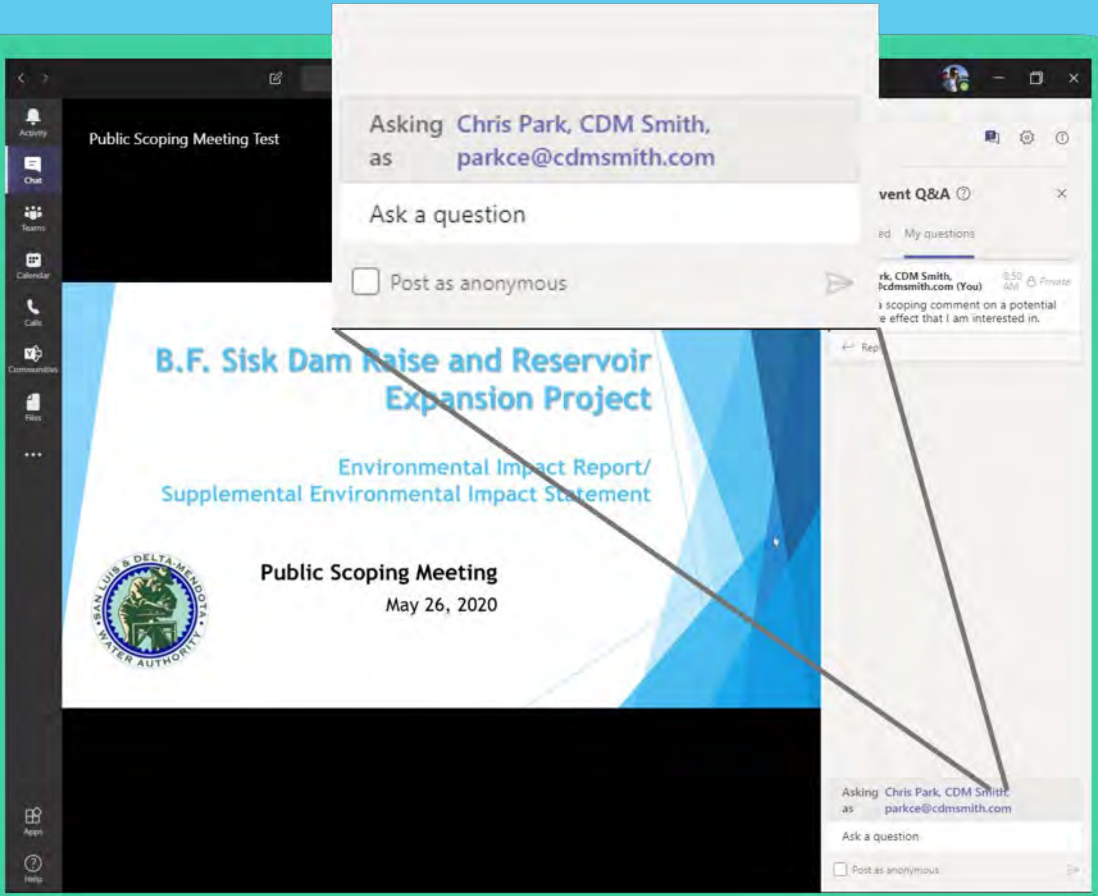


How To Submit Comments During This Meeting

Using Microsoft Teams Q&A Function

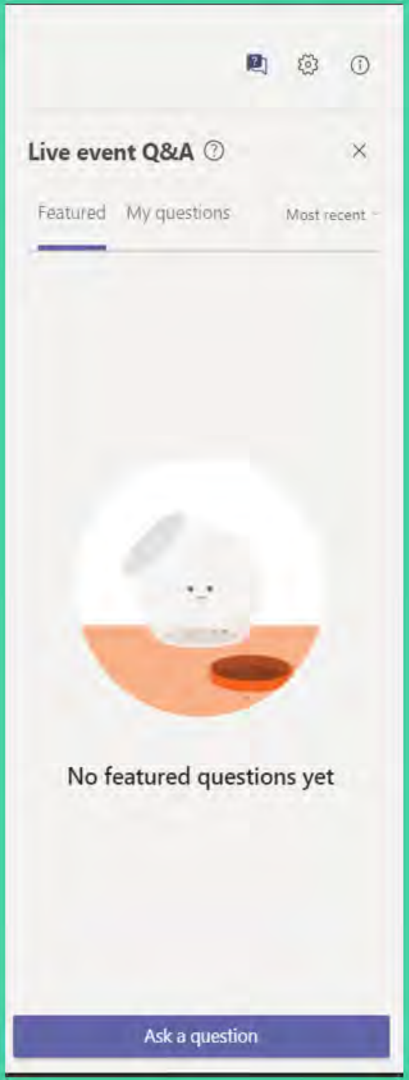
Provide:

- Full name
- Agency/Company name (if applicable)
- Contact information (optional)
- Comment

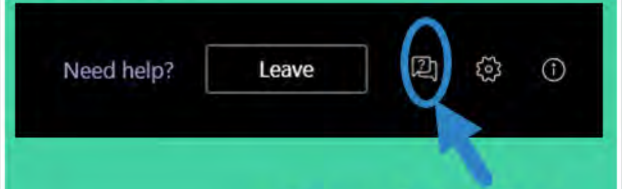


Step-by-Step Approach

Step 1: Use the Q&A Tool on the right side of the screen

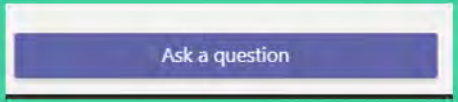


Step 2: If Q&A Tool is not visible, use the Q&A button on the upper right corner of the screen



Show Q&A Tool

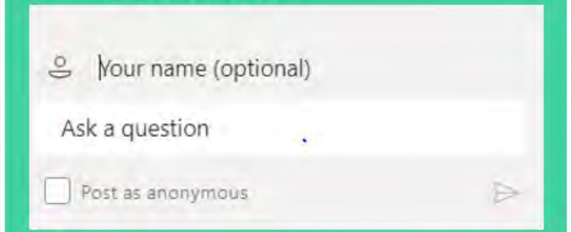
Step 3: Use "Ask a question" button to submit a comment



Step 4: Submit comment

Provide:

- Full name
- Agency/Company name (if applicable)
- Contact information (optional)
- Comment



You can choose to "post anonymous" but you will not be included in our email distribution list for future project correspondence

Meeting Agenda

- Introductions
- Public Scoping Overview
- Meeting Purpose
- Project Overview
- Environmental Impact Report (EIR)/ Supplemental Environmental Impact Statement (SEIS) Development Process
- Project Schedule
- Scoping Comment Period

What is Public Scoping?

This public scoping meeting invites agencies, stakeholders, and the interested public to participate in the environmental review process

Scoping helps to identify and refine potential:

- Options and alternatives
- Environmental impacts
- Mitigation measures

Notice of Preparation published on May 14, 2020

Scoping period closes on June 14, 2020

Meeting Purpose

- Provide information about project and environmental compliance process

- Gather information from the public on alternatives and potential environmental issues

Meeting Outcomes

- Public and government representatives understand the environmental review process that must be completed before the project could be implemented

- Public and government representatives have provided topics and questions that they want investigated for the Environmental Impact Report/ Supplemental Environmental Impact Statement

- Public and government representatives understand how and when they can provide additional input into the environmental review process

Project Objectives

- Increasing the reliability and quantity of yearly water allocations to South-of-Delta contractors dependent on San Luis Reservoir

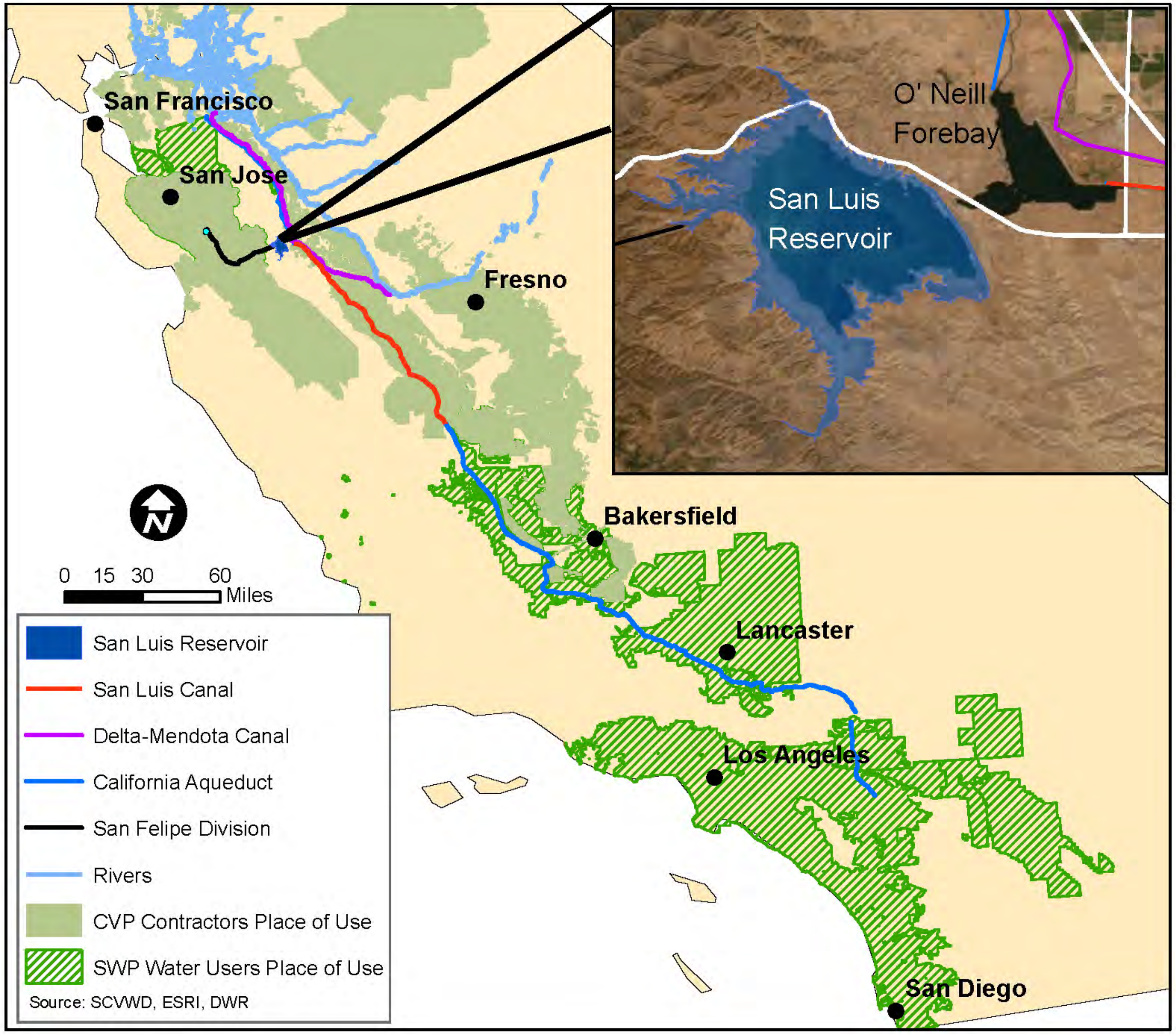
- Increasing the certainty of access to supplies stored by South-of-Delta contractors in San Luis Reservoir in subsequent water years

Proposed Project

- Increasing storage capacity in San Luis Reservoir for the purpose of providing greater water supply reliability for south-of-Delta contractors dependent on San Luis Reservoir
- Additional 10-foot raise above the level proposed for dam safety purposes to a new crest elevation of 576 feet, with an increased storage capacity of approximately 130 thousand acre-feet.
- Modifications to State Route 152 to accommodate higher water levels
- Connected action to the B.F. Sisk Safety of Dams Modification Project

Project Study Area

- San Luis Reservoir and its related water infrastructures
- State Route 152 at Cottonwood Bay
- Sacramento-San Joaquin River Delta
- South-of-Delta CVP and SWP contractors reliant on San Luis Reservoir



Areas of Interest

- Water Quality
- Surface Water Supply
- Geology and Soils
- Air Quality
- Greenhouse Gas Emissions
- Visual Resources
- Noise
- Traffic and Transportation
- Hazards and Hazardous Materials
- Terrestrial Resources
- Recreation
- Cultural Resources

Lead Agencies

- CEQA Lead Agency: **San Luis & Delta-Mendota Water Authority**
- NEPA Lead Agency: **Bureau of Reclamation**
- San Luis & Delta-Mendota Water Authority and Bureau of Reclamation are jointly preparing the EIR/ Supplemental EIS
  - The Supplemental EIS is being prepared as a supplement to the B.F. Sisk Safety of Dams Modification Project EIS/EIR

Environmental Compliance Process

Project Schedule

Project Milestone	Proposed Date
Notice Preparation	May 14, 2020
Scoping Period	May 14 – June 14, 2020
Scoping Meeting	May 26, 2020
Draft EIR/ Supplemental EIS	July 2020
Public Review Period	August 2020
Final EIR/ Supplemental EIS	February 2021
Notice of Determination	February 2021

How To Submit Comments During Review Period

- **A copy of this full presentation will be available at - http://sldmwa.org/sisk-project/**
- **Comments can be submitted during this meeting utilizing the Question & Answer Tool in this Teams Live Meeting**
- **By June 14, 2020**: mail in comments; OR email to:

Pablo Arroyave

San Luis & Delta-Mendota Water Authority

P.O. Box 2157

Los Banos, CA 93635

pablo.arroyave@sldmwa.org

B.F. Sisk Dam Raise and Reservoir Expansion Project
Public Scoping Report

Attachment 4: Comment Letters

CALIFORNIA
Water Boards

Gavin Newsom
Governor

Jared Blumenfeld
Secretary for
Environmental Protection

State Water Resources Control Board

June 12, 2020

Casey Arthur, Project Manager
U.S. Bureau of Reclamation
Willows Construction Office
carthur@usbr.gov

Pablo Arroyave
San Luis & Delta-Mendota Water Authority
pablo.arroyave@sldmwa.org

Dear Ms. Arthur and Mr. Arroyave,

NOTICE OF INTENT TO PREPARE A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE B.F. SISK DAM RAISE AND RESERVOIR EXPANSION PROJECT IN MERCED COUNTY

AND

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT AND DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE B.F. SISK DAM RAISE AND RESERVOIR EXPANSION PROJECT

The State Water Resources Control Board (State Water Board), Division of Water Rights (Division) appreciates the opportunity to submit comments in response to the subject Notice of Intent (NOI) to prepare a Supplemental Environmental Impact Statement (Supplemental EIS) pursuant to the National Environmental Policy Act (NEPA) published by the U.S. Bureau of Reclamation (Reclamation) in the Federal Register on May 14, 2020 and the subject Notice of Preparation (NOP) to prepare a joint Draft Environmental Impact Report (DEIR) pursuant to the California Environmental Quality Act (CEQA) and Supplemental EIS pursuant to NEPA. In August 2019, Reclamation and the California Department of Water Resources (DWR) circulated a Final Environmental Impact Statement/Environmental Impact Report (Final EIS/EIR) for the B.F. Sisk Safety of Dams (SOD) Modification Project. As a connected action to the B.F. Sisk SOD Modification Project, Reclamation and the San Luis and Delta Mendota Water Authority (SLDMWA) are proposing the B.F. Sisk Dam Raise and Reservoir Expansion Project (Proposed Project) to raise the B.F. Sisk Dam embankment by an additional 10 feet, which would increase the storage capacity of the San Luis Reservoir by approximately 120,000 acre-feet (AF).

Water Right Approvals

Based on information provided in the NOI and NOP, it appears that the project may require one or more water right approvals. Reclamation should contact the Division to determine whether a water right permit and/or other water right approvals involving modification of CVP water rights via petition or water right time extensions are necessary to implement the project. Reclamation operates the CVP pursuant to water right permits and a license issued by the State Water Board that authorize the CVP to either (1) divert water to storage, which is released later in the year and re-diverted downstream or (2) directly divert water for beneficial use, or both. Reclamation's time to complete beneficial use of water for 11 CVP permits elapsed on December 1, 1990. On September 19, 1985, Reclamation filed a petition for an extension of time to the year 2030. The petition has been publicly noticed and numerous protests of the proposed time extensions remain active. CEQA compliance is also necessary before the State Water Board can approve the time extensions.

Information regarding the water right permitting and petition processes can be found on the Division's website at: https://www.waterboards.ca.gov/waterrights/.

Water Quality Approvals

In addition to the water right approvals, the Proposed Project would impact Waters of the United States and most likely require a Clean Water Act section 404 Dredge and Fill Permit from the United States Army Corp of Engineers. In addition, Section 401 of the Clean Water Act (33 U.S.C. § 1341) requires every applicant for a federal license or permit which may result in a discharge into navigable waters to provide the licensing or permitting federal agency with certification that the project will be in compliance with specified provisions of the Clean Water Act, including water quality standards and implementation plans promulgated pursuant to section 303 of the Clean Water Act (33 U.S.C. § 1313).

Clean Water Act section 401 directs the agency responsible for water quality certification (certification) to prescribe effluent limitations and other limitations necessary to ensure compliance with the Clean Water Act and with any other appropriate requirements of state law. In this instance, the State Water Board is the state agency responsible for certification. (Wat. Code, § 13160; see Cal. Code Regs. tit. 23, § 3855, subd. (b)(1)(B).) In taking a certification action, the State Water Board must either: 1) issue an appropriately conditioned certification; or 2) deny the certification request. (Cal. Code Regs., tit. 23, § 3859.)

In addition, the Project would need a National Pollutant Discharge Elimination System (NPDES) permit under Clean Water Act section 402 for storm water discharges from construction activities. In California, the NPDES program is administered by the State Water Board and Regional Water Quality Control Boards (Regional Water Boards). (Wat. Code, § 13370 et seq.) To authorize storm water discharges from construction activity, a project proponent must apply for coverage under the Construction General Permit or apply for a separate NPDES permit.

General Comments

The environmental documentation prepared for the Proposed Project should fully evaluate all potential direct, indirect, and cumulative impacts related to the proposed diversion, rediversion, storage, and use of water. In addition to the resources identified in the NOI and NOP that are intended to be discussed in the environmental documents (water quality, surface water supply, geology and soils, air quality, greenhouse gas emissions, visual resources, noise, traffic and transportation, hazards and hazardous materials, terrestrial resources, recreation, and cultural resources including tribal cultural resources), the environmental documents should analyze other resources that could potentially be affected, including but not limited to aquatic resources. The environmental documentation should also include consideration of a range of project alternatives that avoid or reduce any environmental impacts. State laws and regulations relating to the review and approval of water right applications and change petitions require that applicants and petitioners provide information concerning the extent to which fish and wildlife will be affected and identify measures to protect fish and wildlife from unreasonable impacts, and that the State Water Board take into consideration the amounts of water required for the preservation and enhancement of fish and wildlife resources and water quality when determining the amount of water available for appropriation. This information is generally included in environmental documents in support of proposed projects. To the extent it is not, additional information would be required to meet the State Water Board's information needs.

Project Effects in the Bay-Delta Watershed

Environmental documentation prepared for the Proposed Project should evaluate potential impacts from the project on the Delta. Under the Proposed Project, additional water would be conveyed from the Delta to be stored in San Luis Reservoir. If CVP San Luis Reservoir storage is increased, Reclamation may export additional water at times when lack of storage space and real time demand would limit exports in the absence of the project. These changes could affect Delta export operations and should be modeled and evaluated in the environmental documents. The environmental documents should specifically analyze whether there would be changes to the timing or volume of Delta exports, Delta outflows, salinity conditions, reverse flows, and entrainment, and whether there could be impacts on water quality and biological resources in the Delta. The environmental documents should also analyze whether changes to Delta exports would affect upstream reservoir operations resulting in changes to tributary flows, reservoir storage levels in Shasta, Oroville, and Folsom Reservoirs, and whether there could be impacts on water quality and biological resources upstream of the Delta, including impacts related to temperatures. The modeling analyses should be presented on a monthly timescale to reflect the seasonal variations in Delta exports, Delta hydrodynamic processes, and upstream flow and reservoir storage levels and the associated effects on native fish and wildlife species.

The environmental documents should evaluate the potential effects of the project on the following aquatic resources at the life-stage and population level. The environmental analysis should evaluate the potential magnitude of impacts to native Delta fish populations by using available relationships between abundance and flow, exports and survival and monthly changes to export volumes, reverse flows, and Delta outflow.

- California Endangered Species Act (CESA) and federal Endangered Species Act (ESA) Endangered Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha)*
- CESA and ESA Threatened Central Valley spring-run Chinook salmon (*O. tshawytscha)*
- ESA Threatened California Central Valley Distinct Population Segment (DPS) steelhead (*O. mykiss)*
- ESA Threatened Green Sturgeon southern DPS *(Acipenser medirostris),* and White Sturgeon (*Acipenser transmontanus*)
- ESA Endangered Killer whale Southern Resident DPS (*Orcinus orca)*
- ESA Threatened and CESA Endangered Delta smelt (*Hypomesus transpacificus*)
- CESA Threatened Longfin smelt (*Spirinchus thaleichthys*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)
- Starry flounder (*Platichthys stellatus*)
- California Bay shrimp (*Crangon franciscorum*)
- Zooplankton (*Neomysis mercedis*, *Eurytemora affinis*, and *Pseudodiaptomus forbesi*)
- Non-native species: American shad (*Alosa sapidissima*), Striped bass (*Morone saxatilis*), Largemouth bass (*Micropterus salmoides*), and other ecological and fishery species of concern
- The lower food web (e.g., phytoplankton and zooplankton biomass and flux)

New and expanded reservoir storage projects south of the Delta have the potential to incrementally reduce local river flows, increase Delta exports, increase reverse interior Delta flows, and reduce Delta outflows which are likely to contribute to further declines in native Delta species. Specific operating criteria should be identified for the Proposed Project in the environmental documentation to avoid or reduce impacts. Proposed Project operations should specifically be designed to avoid increases in exports and reductions in Delta outflows during time periods that are likely to have adverse effects on water quality and native Delta fish and aquatic species populations.

Cumulative Effects

The cumulative impact analysis should evaluate reasonably foreseeable future diversion and storage projects and evaluate and disclose the potential changes to river flows, Delta exports, interior Delta flows, and Delta outflows and the subsequent effects to water quality and native Delta fish and aquatic species populations. Recent major water diversion and storage project proposals that should potentially be evaluated include: Shasta Dam and Reservoir Enlargement Project, Del Puerto Canyon Reservoir Project, Los Vaqueros Reservoir Expansion Project, Pacheco Reservoir Expansion Project, Sites Reservoir, Centennial Reservoir and Water Supply Project, Temperance Flat Reservoir Project, Kern Fan Groundwater Storage Project, Tulare Lake Storage and Floodwater Protection Protect, Willow Springs Water Bank Conjunctive Use Project, and Chino Basin Conjunctive Use Environmental Water Storage/Exchange Program.

As discussed in the State Water Board’s Scientific Basis Report for Potential Updates to the Bay-Delta Water Quality Control Plan (Bay-Delta Plan) for the Sacramento River and Delta[1] and the July 2018 Framework for such updates to the Bay-Delta Plan[2], Delta outflows under existing conditions are highly impaired resulting in prolonged and precipitous declines of native Delta species. Environmental documentation for the Proposed Project should evaluate cumulative impacts of the project in the context of these findings as well as the State Water Board's current effort to update the Bay-Delta Plan to improve protections of fish and wildlife beneficial uses, including potential higher Delta outflow requirements and other CVP and State Water Project related operational constraints. More information about this effort is available on the Division's website at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/.

Division staff appreciates the opportunity to provide scoping comments for the Proposed Project. If you have questions or would like to discuss these comments further, please contact Nicole Williamson at (916) 319-8202 or Nicole.Williamson@waterboards.ca.gov. Written correspondence or inquiries should be addressed as follows: State Water Resources Control Board, Division of Water Rights, P.O. Box 2000, Sacramento, CA 95812-2000.

Sincerely,

Diane Riddle, Assistant Deputy Director
Division of Water Rights

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1 https://www.waterboards.ca.gov/water_issues/programs/peer_review/docs/scientific_basis_phase_ii/201710_bdphaseII_sciencereport.pdf

2 https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/sed/sac_delta_framework_070618%20.pdf

CALIFORNIA FARM BUREAU FEDERATION
LEGAL SERVICES DIVISION
2600 RIVER PLAZA DRIVE, SACRAMENTO, CA 95833 • PHONE (916) 561-5665

June 15th, 2020
Via electronic mail: carthur@usbr.gov

Ms. Casey Arthur, Project Manager
Bureau of Reclamation
Willows Construction Office
1140 W. Wood Street Willows, CA, 95988

Re: Notice of Intent To Prepare a Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Casey Arthur:

The California Farm Bureau Federation ("CFBF") is a non-governmental, nonprofit, voluntary membership California corporation whose purpose is to protect and promote agricultural interests throughout the state of California and to find solutions to the problems of the farm, the farm home, and the rural community. CFBF is California's largest farm organization, comprised of 53 county Farm Bureaus currently representing approximately 34,000 agricultural, associate, and collegiate members in 56 counties. CFBF strives to protect and improve the ability of farmers and ranchers engaged in production agriculture to provide a reliable supply of food and fiber through responsible stewardship of California's resources.

CFBF appreciates the opportunity to provide comments on the Bureau of Reclamation's Notice of Intent to Prepare a a Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California.

As California sinks into a major intensification of the state's legendary 'water wars,' despite new limits and constraints going into place on sides, there is perhaps one thing we, in the Golden State, can still count on: Namely that, however long the dry spell, eventually, another big water year is on its way.

It is in these 'big water years' that, we know, there will again be abundant quantities of the hydraulic resource our state so needs—and, in these times of plenty, the ability to capture a modest portion of Mother Nature's largess *should* be possible. At these times, excess flows can be taken without undue risk to the aquatic species that also rely on our system. In short, the water delivered at these times supplies our farms and cities, does so with minimal impacts to the fish, and everyone is happy.

Currently, however, there is a physical limit that is hit in these wettest of times, when our one major, shared state-federal holding place for water literally fills up. At these times, it's *not* that a modest, yet critically important amount of additional water is *not* there for diversion with no harm to the fish; it's that there is, literally, just no place to put the water. The principal purpose of the proposed Reservoir Expansion Project is precisely this: To provide a modest increment in South-of-Delta storage in these wettest of periods.

While the expense and permitting of new storage is normally quite daunting, in this case the Reservoir Expansion is proposed in connection with a necessary related Safety of Dams ("SOD") Modification Project. As explained in Reclamation's NOI, to qualify as a "connected action" and potential "additional benefit" of the SOD project, and for Reclamation to participate on the project as a potential partner, Reclamation must make various findings. These findings include a conclusion that the project is feasible; that it will not negatively impact the SOD Modification Project; that it is "necessary" and "in the federal interest"; and that it "has Federal benefits pursuant to the WIIN Act."

As to why the project is "necessary" and "in the federal interest," among other possible reasons, one clear important benefit of the proposed project is that it would help Reclamation to better balance and fulfill its competing obligations to both protect and recovered sensitive fish species under the federal Endangered Species Act and Central Valley Project Improvement Act *and*, at the same time, more reliably deliver water to federal water contractors, now regularly shorted.

According to the NOI, the proposed additional 10-foot crest raise to the B.F. Sisk Dam, beyond the proposed SOD Modification Project, could add as much as an additional 130,000 acre-feet in additional storage capacity. The project would have a negible environmental footprint and could be operated within Reclamation's existing water rights, and through its existing facilities. Reclamation's Supplemental EIS and feasibility study will obviously have to study how much of this increased capacity would be actually used, and how often. Clearly though, an ability to store additional wet-year flows aligns well numerous California water objectives, including the 'co-equal goals' of water supply and ecosystem health, the Sustainable Groundwater Management Act, and the drought and climate resilience goals of California's Water Resiliency Portfolio.

If the past is a reliable predictor of the future, we fully expect Reclamation to receive strident objections that the proposed Reservoir Expansion amounts to a cynical attempt to drain the Delta, that it would lead to the certain demise of the delta smelt, the longfin smelt, the chinook salmon, and Central Valley steelhead, etc. The groups that raise these objections, however, will quite likely be the same groups that lauded the Sustainable Groundwater Management Act and that vehemently oppose any new dam, new reservoir, or form of on-stream storage whatsoever. These are the groups that object to dry-year impacts on fish, stemming in part from lack of adequate wet-year carryover. These are the groups that oppose new surface water storage and praise groundwater recharge as an alternative, yet who also again vehemently oppose new diversions to make such recharge possible. These are the groups that are suing on the new biological opinions and, ironically, who, in so doing, have all but ended hopes up proposed Bay-Delta voluntary agreements more beneficial to fish. These same groups decry drought-year impacts on domestic wells and lack of safe, adequate groundwater; yet, these are again the same groups who lose no opportunity to choke off needed surface water supplies to the Valley.

While these mentioned groups have had tremendous success blocking every possible step toward greater water supply reliability over the last many years, we believe there comes a time when the greater good needs to override the unreasonable objections of a small, but vocal few. There also comes a time when reason and cooler heads must prevail over emotion and endless conflict. In the case of a no-regrets project with clear net environmental and water supply benefits like the proposed Dam Raise and Reservoir Expansion Project, it is clear that this thought applies.

Accordingly, CFBF strongly encourages Reclamation to sharpen its best pencil for getting, as soon as possible, to a workable solution on this project. Reclamation should address all legitimate concerns reasonably, so far as possible, and as required by law, but should not slump down in defeat at the first sign of resistence. The existing system is broken and there is just too much at stake. The time to act is now. This is a worthy project. It *should* move forward.

CFBF thanks the Reclamation for this opportunity to comment on its Notice of Intent to Preparation a Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project in Merced County, California. This project has been a long time in coming and we do hope it can now be actually brought to fruition.

Questions on these staff-level comments may be directed to the undersigned at jfredrickson@cfbf.com.

Sincerely,

Justin Fredrickson
Environmental Policy Analyst

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

June 15, 2020

Ms. Casey Arthur
Project Manager
Bureau of Reclamation
Willows Construction Office
1140 W. Wood Street
Willows, California 95988

Subject: Scoping Comments for the Supplemental Draft Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County, California

Dear Ms. Arthur:

The U.S. Environmental Protection Agency has reviewed the Bureau of Reclamation's notice of intent to prepare a Supplemental Draft Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project. Our review and comments are provided pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

In order to address seismic safety concerns at San Luis Reservoir, Reclamation signed a Record of Decision for the B.F. Sisk Safety of Dams Modification Project in December 2019. As a connected action, Reclamation and San Luis and Delta Mendota Water Authority seek to evaluate an increase in storage capacity of the San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes. This Proposed Action was previously evaluated in the Draft EIS for the San Luis Low Point Improvement Project. In reviewing the information already presented on the dam raise and dam safety actions, the EPA offers the following scoping recommendations to Reclamation to consider when preparing the Supplemental Draft EIS including impacts to wetlands, water quality, wildlife, air quality, and cumulative impacts. These issues are discussed further in the attached Detailed Comments.

We appreciate the opportunity to review this scoping notice and provide early input on this project. We are available to discuss our comments. When the Supplemental Draft EIS is prepared for this proposed action and released for public review, please send one hard copy to the address above (mail code: TIP-2). If you have questions, please contact me at (415) 972-3098 or gordon.stephanies@epa.gov.

Sincerely,

Stephanie Gordon
Environmental Review Branch

Enclosure: EPA's Detailed Comments

cc via email: Nicole Johnson, Bureau of Reclamation
Keith Hess, U.S. Army Corps of Engineers
Lauren Sullivan, U.S. Fish and Wildlife Service
Joel Casagrande, National Marine Fisheries Service

U.S. EPA DETAILED COMMENTS ON THE SCOPING NOTICE FOR THE SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE B.F. SISK DAM RAISE AND RESERVOIR EXPANSION PROJECT- MERCED COUNTY, CALIFORNIA- JUNE 15, 2020

Purpose and Need

In the Supplemental Draft EIS, clearly identify the underlying purpose and need to which Reclamation is responding in proposing the alternatives (40 CFR 1502.13). The *purpose* of the proposed action is typically the specific objectives of the activity, while the *need* for the proposed action may be to eliminate a broader underlying problem or take advantage of an opportunity. The purpose and need should be a clear, objective statement of the rationale for the proposed project.

When projecting the water need, we recommend that the Supplemental Draft EIS describe and quantify the gap between supply and demand. Important considerations in the demand analysis include identifying project participants, community growth projections (e.g., per State Demographer information), and existing and projected future use by each entity (municipal, agricultural, industrial) utilizing consistent methodology (e.g., gallons per day or acre-feet per year). It is informative to describe any available water demand estimates associated with the current community master planning build-out scenarios. If available, it is also helpful to provide similar community-type demand estimates or ranges for comparison purposes.

Range of Alternatives

All reasonable alternatives that fulfill the proposed action's purpose and need should be evaluated in detail. A robust range of alternatives will include options for avoiding significant environmental impacts. The document should clearly describe the rationale used to determine whether impacts of an alternative are significant or not. Thresholds of significance should be determined by considering the context and intensity of an action and its effects (40 CFR 1508.27).

The environmental impacts of the proposed action and alternatives should be presented in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14). The potential environmental impacts of each alternative should be quantified to the greatest extent possible (e.g. acres of habitat impacted; change in water quality). Throughout the resource chapters of the Supplemental Draft EIS, we recommend including impacts from the road and utility relocations, staging and construction areas, and any temporary roads for hauling material to the dam site.

We recommend Reclamation structure the Supplemental Draft EIS alternatives analysis so that it is consistent with requirements under both Clean Water Act and NEPA. We recommend that the Supplemental Draft EIS summarize the regulatory criteria and processes utilized to screen potential alternatives and develop the range of reasonable and practicable alternatives, including any environmental, logistical, technological and cost criteria applied. Providing the reasoning used to eliminate alternatives is also helpful in understanding the decision process. The screening rationale should be consistent with the practicability definition and criteria outlined in the preamble language of the Clean Water Act 404(b)(1) Guidelines (40 CFR § 230.10) for applicable projects.

The EPA recommends exploring both structural and non-structural options to meet the underlying project purpose when considering a range of alternatives. Alternatives could include a combination of non-structural and structural components that together may present a practicable alternative that is potentially less damaging than a single larger structural option. For example, for municipal, industrial or irrigation supply, assess the extent to which the need for water could be reduced through available conservation measures. We recommend considering whether remaining need could be partially or fully met through other non-structural measures such as temporary or permanent agreements for use of agricultural water rights, conjunctive use of groundwater and surface water supplies, availability of other water rights that may be less damaging to aquatic resources, blending raw water, or a combination of these or other alternatives. Because non-structural options (e.g., conservation, water rights leasing) may individually contribute less towards meeting the project purpose and need than structural options, we recommend designing screening criteria so that non-structural components are not eliminated solely based on their potentially smaller individual contributions.

Because this project may supply rural water needs, in addition to the considerations mentioned above, we recommend assessing the extent to which the need for supplemental irrigation water could be met through more efficient irrigation practices (e.g., center pivot or linear move irrigation systems, irrigation pipelines, remote-controlled water ditch gates, and irrigation water management). Additional alternatives to consider for agricultural shortages include rotational fallowing, dry year leasing, gravel pit storage, acquiring and utilizing existing storage from reservoir companies, expansion of non-potable supplies, developing wastewater reuse infrastructure, acquisition of additional shares of irrigation company water rights or purchase of additional water rights in ditch companies.

Conservation

For a complete NEPA analysis, the EPA recommends assessing available conservation measures and presenting the results of the assessment in the Supplemental Draft EIS. We recommend that conservation be used as a tool to reduce demand at the project purpose stage. Another option would be to consider demand management (i.e., an identified level of conservation) in the alternatives analysis, either alone or in combination with other supply management components. Whether as a demand reducer or alternative component, we recommend that the Supplemental Draft EIS quantify the potential role of conservation in reducing future demand/supply needs and identify how these conservation measures can be implemented. In instances where a project proponent determines that certain conservation measures are not practicable under CWA Section 404(b)(1) Guidelines, we recommend that the EIS document the rationale. Depending on the type and amount of anticipated population growth, EPA's Smart Growth Principles may be useful in considering available measures to reduce demand.[1]

Baseline Environmental Conditions

When evaluating project effects, we recommend using existing environmental conditions as the baseline for comparing impacts across all alternatives, including the no-action alternative. This provides an important frame of reference for quantifying and/or characterizing magnitudes of effects and understanding each alternative's impacts and potential benefits. This is particularly important when there are environmental protections in place that are based on current conditions, such as total maximum daily loads (TMDLs) for impaired river segments. It can also be useful, although often less certain, to compare alternatives against a no action baseline that includes reasonably foreseeable future conditions. The EPA recommends that the NEPA analysis compare and present impacts to resources against the existing conditions baseline using a consistent method to measure project impacts for all alternatives. By utilizing existing environmental conditions as a baseline, future changes to environmental resources can be more accurately measured for all alternatives, including the No Action alternative. We recommend that Reclamation consider the following when defining baseline conditions:

[1] https://www.epa.gov/smartgrowth/smart-growth-and-water

- Verifying that historical data (e.g., data 5 years or older) are representative of current conditions.
- Providing a detailed hydrologic analysis to adequately assess the project's potential biological and geomorphic impacts. At a minimum, include wet, average, and dry year analyses at a daily time-step. Also consider potential influences of temperature and precipitation trends on future hydrology.
- Including resources directly impacted by the project footprint within the geographic scope of analysis, as well as the resources indirectly (or secondarily) impacted by the project. These indirectly impacted areas may include downstream segments, source streams where water diversions will occur, and any other resource areas which may be affected by changes in water management or operations.

Biological Resources

The document should identify all petitioned and listed threatened and endangered species and critical habitat that might occur within the project area. We recommend that Reclamation quantify which species or critical habitat might be directly, indirectly, or cumulatively affected by each alternative. The EPA recommends engaging the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as early in the analysis as possible to assure that the proposed alternatives account for the following:

- River restoration, flow and channel modifications, wetlands, and habitat fragmentation regarding species' habitat requirements;
- Impacts to special-status pieces found in the project area;
- Migratory Bird Treaty Act compliance; and
- Protection from invasive species.

Wetlands and Other Waters

The protection, improvement and restoration of wetlands and riparian areas are a high priority because they increase landscape and species diversity, support many species of western wildlife, and are critical to the protection of water quality and designated beneficial water uses. In order to illustrate effects to wetlands in the area, we recommend that the Supplemental Draft EIS specifically include the following analyses or descriptions:

- Description of impacts under individual or nationwide permits authorizing the discharge of fill or dredge materials to waters of the U.S.;
- Maps, identifying wetlands and regional water features;
- Tables, quantifying the direct, indirect, and cumulative impacts to wetlands in the geographic scope, including impacts from changes in hydrology even if these wetlands are spatially removed from the construction footprint. Include the indirect impacts to wetlands from inundation or loss of hydrology from water diversion/transfers, as well as the cumulative impacts to wetlands from future development scenarios based on population and growth estimates.
- For wetlands potentially impacted by project alternatives, include wetland delineations and functional analysis.

According to the San Luis Low Point Draft EIS, construction of the expanded reservoir would result in permanent impacts to wetland and riparian vegetation communities associated with clearing, soil borrowing, grading, staging of equipment, and other ground-disturbing activities that are proposed within streams and jurisdictional aquatic features. Therefore, the proposed project will require a permit, under section 404 of the Clean Water Act, from the U.S. Army Corps of Engineers. A section 404 permit can only be issued for the Least Environmentally Damaging Practicable Alternative (LEDPA). The information provided in the Supplemental Draft EIS should serve as a sufficient basis upon which to determine whether the project, as proposed, would satisfy the requirements for such a permit or to identify appropriate measures to mitigate the project's impacts to waters if the proposed reservoir is determined to be the LEDPA. A verified delineation and jurisdictional determination will be needed before the CWA section 404 permitting process can proceed, and a scientifically defensible assessment of wetland conditions is needed to fully evaluate the potential impacts of the project, as well as to identify potential opportunities to mitigate such impacts.

- Disclose steps taken to achieve compliance with the CWA Section 404(b)(1) Guidelines:
  - In the Supplemental Draft EIS, evaluate alternatives which would reduce impacts to Waters of the U.S. relative to the proposed project. These should include alternatives which would not require impacts to special aquatic sites such as wetlands, off-site alternatives, and a reduced reservoir footprint at the proposed location.
- Work with the Corps to obtain a formal jurisdictional delineation of waters of the U.S. in the project area and include, in the Supplemental Draft EIS, a map of the delineated waters and the anticipated impacts to those waters, to streamline future Section 404 compliance efforts. The Supplemental Draft EIS should also include information about waters in any off-site alternative reservoir locations, such as the Ingram Canyon site identified in the Draft EIR.
- Conduct a formal and reproducible assessment of the aquatic resources in the project footprint, using a scientifically defensible method, such as the California Rapid Assessment Method (CRAM), and include the results in the Draft EIS.
- In the Supplemental Draft EIS, disclose the ecosystem functions provided by the specific wetland and other waters areas that could be impacted by the reservoir and ancillary project facilities. Aquatic resources in the reservoir footprint should be considered completely impacted.

A CWA section 404 permit requires compensatory mitigation for unavoidable impacts to aquatic resource functions. The 2008 Mitigation Rule, issued jointly by the Corps and EPA (40 CFR 230.91-98), establishes a preference for compensatory mitigation based on a watershed approach, and EPA recommends that compensatory mitigation be sited appropriately to ensure that potential direct and indirect impacts of the proposed project are offset. Third-party forms of mitigation, such as mitigation bank credits and in-lieu fees, are preferred over permittee-responsible mitigation.

- In the Supplemental Draft EIS, evaluate the feasibility of providing adequate compensation for the considerable impacts to aquatic resource functions that the proposed reservoir represents, and identify specific compensatory mitigation opportunities.
- Include in the Supplemental Draft EIS a commitment to implement mitigation in advance of, or concurrently with, project impacts. Clearly state that compensatory mitigation will be provided for temporary impacts lasting longer than one year.

Groundwater

We would anticipate this project has the potential to both positively and negatively impact groundwater resources. In assessing the potential impacts of each alternative on groundwater systems in the project area, we recommend that the Supplemental Draft EIS examine the potential for changes in the volume, storage, flow and quality of ground water using available characterization of ground water resources and ground water use. Projected construction, operation or maintenance of a project may have significant impact on streams and other sensitive waterbodies. If the EIS identifies any adverse impacts to groundwater resources, we recommend considering alternatives, mitigation measures or operational controls that would avoid, reduce or minimize impacts on groundwater.

Air Quality

The EPA recommends that Reclamation coordinate closely with the San Joaquin Valley Air District to ensure that the project moves forward in a manner that reduces air quality impacts to the greatest extent possible. It is critical that the Supplemental Draft EIS provide a robust air quality impact analysis, including ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards (NAAQS), criteria pollutant nonattainment areas, and potential air quality impacts of the proposed action, including indirect and cumulative impacts. Such an evaluation is necessary to ensure compliance with state and federal air quality regulations, and to disclose the potential impacts from temporary or cumulative degradation of air quality in an area already in nonattainment for ozone and $PM_{2.5}$.

Estimate emissions of criteria pollutants from the proposed project and discuss the timeframe for release of these emissions over the construction period of the project. Specify emission sources by pollutant from mobile sources, stationary sources, and ground disturbance. Use source-specific information to identify appropriate mitigation measures and areas in need of the greatest attention.

Construction Emissions

Include a list of all mitigation measures to be implemented as part of the construction emissions mitigation plan developed for the project. In addition to measures necessary to meet all applicable local, state, and federal requirements, the EPA recommends the following mitigation measures be included in the construction emissions mitigation plan:

Fugitive Dust Source Controls:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate. This applies to both active and inactive sites during workdays, weekends, holidays, and windy conditions.
- Install wind fencing and phase grading operations where appropriate and operate water trucks for stabilization of surfaces under windy conditions.
- When hauling material and operating non-earthmoving equipment, prevent spillage and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph.

Mobile and Stationary Source Controls:

- Reduce unnecessary idling from heavy equipment.
- Prohibit engine tampering to increase horsepower, except when meeting manufacturer's recommendations.
- Lease or buy newer, cleaner equipment using the best available emissions control technologies.
    - Use lower-emitting engines and fuels, including electric, liquified gas, hydrogen fuel cells, and/or alternative diesel formulations, if feasible.
    - *On-Highway Vehicles* - On-highway vehicles should meet, or exceed, the U.S. EPA exhaust emissions standards for model year 2010 and newer heavy-duty on-highway compression-ignition engines (e.g., drayage trucks, long haul trucks, refuse haulers, shuttle buses, etc.).[2]
    - *Nonroad Vehicles & Equipment* - Nonroad vehicles and equipment should meet, or exceed, the U.S. EPA Tier 4 exhaust emissions standards for heavy-duty nonroad compression-

[2] See https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100O9ZZ.pdf

ignition engines (e.g., nonroad trucks, construction equipment, cargo handlers, etc.).[3]

Administrative Controls:

- Coordinate with appropriate air quality agencies to identify a construction schedule that minimizes cumulative impacts from other planned projects in the region, if feasible.
- Locate diesel engines, motors, and equipment staging areas as far as possible from residential areas and other sensitive receptors (e.g., schools, daycare centers, hospitals, senior centers, etc.).
- Avoid routing truck traffic near sensitive land uses to the fullest extent feasible.
- Use cement blended with the maximum feasible amount of fly ash or other materials that reduce GHG emissions from cement production.
- Use lighter-colored pavement where feasible.
- Recycle construction debris to the maximum extent feasible.
- Prepare an inventory of all equipment prior to construction and identify the suitability of add-on emission controls for each piece of equipment before groundbreaking.[4]
- Reduce construction-related trips of workers and equipment, including trucks.
- Develop a construction traffic and parking management plan that minimizes traffic interference and maintains traffic flow.
- Identify all commitments to reduce construction emissions and quantify air quality improvements that would result from adopting specific air quality measures.
- Identify where implementation of mitigation measures is rejected based on economic infeasibility.

General Conformity

EPA's General Conformity Rule, established under Section 176(c)(4) of the Clean Air Act, provides a specific process for ensuring that federal actions do not interfere with a state's plans to attain or maintain NAAQS. For any criteria pollutants in the air basin of the project area where the air quality status is in nonattainment or attainment – maintenance,[5] complete a general conformity applicability analysis (i.e., a comparison of direct and indirect emissions for each alternative with *de minimis* thresholds of 40 CFR 93.153). We recommend including a draft general conformity determination in the Supplemental Draft EIS to fulfill the public participation requirements of 40 CFR 93.156.

Cumulative Impacts

Understanding the cumulative impacts associated with the proposed project can help identify opportunities for minimizing pressures to resources as a whole. In the Supplemental Draft EIS, identify which resources are analyzed for cumulative impacts, which ones are not, and why. Define the geographic boundary for each resource and describe its current health and historic context. Identify other on-going, planned, and reasonably foreseeable projects in the study area that may contribute to cumulative impacts including the San Luis Low Point Improvement Project and High Speed Rail. Use existing studies on the environmental impacts of these other projects to quantify cumulative impacts where feasible. We suggest the methodology developed by Federal Highways Administration and Caltrans, with assistance from EPA, for use in assessing cumulative impacts.[6] While this guidance was prepared for highway projects in California, the principles and the 8-step process outlined therein can be

[3] See https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100OA05.pdf

[4] Suitability of control devices is based on: whether there is reduced normal availability of the construction equipment due to increased downtime and/or power output, whether there may be significant damage caused to the construction equipment engine, or whether there may be a significant risk to nearby workers or the public.

[5] Maintenance areas redesignated to attainment more than twenty years in the past are no longer required to comply with general conformity.

[6] Available at https://dot.ca.gov/ser/cumulative_guidance/approach.htm

applied to other types of projects. Propose mitigation for any adverse cumulative impacts identified. Clearly state Reclamation's mitigation responsibilities, the mitigation responsibilities of other entities (such as the Department of Water Resources), and the mechanism to be used for implementation.

Consultation with Tribal Governments

Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments" (November 6, 2000) was issued to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the United States government-to-government relationships with Indian Tribes. In the Supplemental Draft EIS, describe the process and outcome of government-to-government consultation between Reclamation and each of the tribal governments within the project area, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative. As a general resource, the EPA recommends the document *Tribal Consultation: Best Practices in Historic Preservation*, published by the National Association of Tribal Historic Preservation Officers.[7]

National Historic Preservation Act and Executive Order 13007

Consultation for tribal cultural resources is required under Section 103 of the National Historic Preservation Act (NHPA). Historic properties under the NHPA are properties that are included in the National Register of Historic Places (NRHP) or that meet the criteria for the National Register. Section 106 of the NHPA requires a federal agency, upon determining that activities under its control could affect historic properties, to consult with the appropriate State Historic Preservation Office/Tribal Historic Preservation Office (SHPO/THPO). Under NEPA, any impacts to tribal, cultural, or other treaty resources must be discussed. Section 106 of the NHPA requires that federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800.

Executive Order 13007 "Indian Sacred Sites" (May 24, 1996) requires federal land managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners, and to avoid adversely affecting the physical integrity, accessibility, or use of sacred sites. It is important to note that a sacred site may not meet the National Register criteria for a historic property and that, conversely, a historic property may not meet the criteria for a sacred site. It is also important to note that sacred sites may not be identified solely in consulting with tribes located within geographic proximity of the project. Tribes located outside of the project area may also have religiously significant ties to lands within the project area and should, therefore, be included in the consultation process.

The EPA recommends that the Supplemental Draft EIS address the existence of Indian sacred sites in the project area. Explain how the proposed action would address Executive Order 13007, distinguish it from Section 106 of the NHPA, and discuss how the Service would ensure that the proposed action would avoid adversely affecting the physical integrity, accessibility, or use of sacred sites. Provide a summary of all coordination with Tribes and with the SHPO/THPO, including identification of NRHP eligible sites and development of a Cultural Resource Management Plan.

Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (February 11, 1994) and the "Memorandum of Understanding on Environmental Justice and Executive Order 12898," released on August 4, 2011, direct federal agencies to identify and address disproportionately high and adverse human health or environmental effects on

[7] *See* http://www.nathpo.org/PDF/Tribal_Consultation.pdf

minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process. CEQ guidance clarifies the terms low-income and minority population, which includes Native Americans, and describes the factors to consider when evaluating disproportionately high and adverse human health effects.

The EPA[8] recommends that the Supplemental Draft EIS include an evaluation of environmental justice populations within the geographic scope of the project area. If such populations exist, describe how the proposed action would address the potential for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation and coordination with these populations.

[8] *See* Promising Practices for EJ Methodologies in NEPA Reviews, May 2016 https://www.epa.gov/sites/production/files/2016-08/documents/nepa_promising_practices_document_2016.pdf

854 N. Harvard Ave.
Lindsay, CA 93247

1121 L St., Ste. 610
Sacramento, CA 95814

(559) 562-6305

June 15, 2020

Casey Arthur
Project Manager
Bureau of Reclamation, Willows Construction Office
1140 W. Wood Street
Willows, CA 95988

Subject: **Notice of Intent to Prepare a Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project**

Dear Ms. Arthur:

On behalf of Friant Water Authority (FWA), thank you for the opportunity to provide comments during the public scoping process for the Supplemental Environmental Impact Statement for the B.F. Sisk Dam Raise and Reservoir Expansion Project (Project), consistent with the requirements of the *National Environmental Policy Act* (NEPA).

As stated in the Notice of Intent to Prepare a Supplemental Environmental Impact Statement (SEIS), the Project includes a crest raise to address seismic risks at the dam but also an additional 10-foot raise to increase storage capacity at the reservoir by approximately 120,000 acre-feet. The Project's local sponsor is the San Luis and Delta-Mendota Water Authority (SLDMWA). The reservoir expansion component may include the Bureau of Reclamation as a federal cost-share partner under the *Water Infrastructure Investments for the Nation Act*.

FWA is a public agency representing a majority of the Friant Division of the Central Valley Project (CVP). FWA also operates and maintains the Friant-Kern Canal, which supplies San Joaquin River water stored at Millerton Lake to more than 30 Friant contractors, and to 15,000 family farms on more than one million acres of irrigable farm land on the eastside of the southern San Joaquin Valley. As such, we thoroughly appreciate that surface water storage is critical for the Valley and for all of California. Protecting existing storage infrastructure and adding it where feasible is important, and we support Reclamation and SLDMWA's efforts to achieve both at Sisk Dam.

The Project's SEIS is being developed as a supplement to existing dam safety project environmental documents, FWA understands that a certain amount of scoping under NEPA has already occurred. However, as SLDMWA and Reclamation look to develop and analyze alternatives for the reservoir expansion component, we offer the following comments to help guide this process in the coming months:

1. None of the alternatives considered for the Project should interfere with Reclamation's ability to satisfy San Joaquin River Exchange Contractor demands via the Delta-Mendota Canal and Mendota Pool, or other factors that would negatively affect allocations or supplies for other CVP water users (such as the Friant Division contractors).

2. The SEIS must document the water rights to be used and sources of water supply that are anticipated to be stored in the reservoir and whether the Project alternatives will require changes to existing water rights, permits, and contracts related to the CVP or the Exchange Contract. Depending on the extent of such changes, additional environmental review within the Project SEIS or separately may be required.

3. The SEIS must also include an analysis of any potential impacts to other CVP water users from the changes in operations, water rights, and contracts that the Project may involve or require, along with appropriate mitigation measures. This should include analysis for construction-related and long-term impacts to CVP South-of-Delta water supplies for:
    a. San Joaquin River Exchange Contractors;
    b. Cross Valley Contractors;
    c. Water Service Contractors;
    d. Repayment Contractors; and
    e. San Joaquin River Restoration Settlement Paragraph 16(a) (i.e. Recapture and Recirculation).

Thank you for the opportunity to comment. You may contact me with any questions at 559-562-6305 or jphillips@friantwater.org.

Sincerely,

Jason Phillips
Chief Executive Officer

STATE OF CALIFORNIA Gavin Newsom, *Governor*

NATIVE AMERICAN HERITAGE COMMISSION

6/12/2020
Governor's Office of Planning & Research
MAY 22 2020
STATE CLEARINGHOUSE

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

May 20, 2020

Pablo Arroyave
San Luis and Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635

Re: 2009091004, B.F. Sisk Dam Raise and Reservoir Expansion Project, Merced County

Dear Mr. Arroyave:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

- **a.** A brief description of the project.
- **b.** The lead agency contact information.
- **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
- **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).

- **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

- **a.** Alternatives to the project.
- **b.** Recommended mitigation measures.
- **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:

- **a.** Type of environmental review necessary.
- **b.** Significance of the tribal cultural resources.
- **c.** Significance of the project's impacts on tribal cultural resources.
- **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:

- **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
- **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:

- **a.** The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
- **b.** A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

- **a.** Avoidance and preservation of the resources in place, including, but not limited to:
  - **i.** Planning and construction to avoid the resources and protect the cultural and natural context.
  - **ii.** Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
- **b.** Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
  - **i.** Protecting the cultural character and integrity of the resource.
  - **ii.** Protecting the traditional use of the resource.
  - **iii.** Protecting the confidentiality of the resource.
- **c.** Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
- **d.** Protecting the resource. (Pub. Resource Code §21084.3 (b)).
- **e.** Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
- **f.** Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

- **a.** The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
- **b.** The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
- **c.** The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf.

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
   a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
   b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/.

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
   a. If part or all of the APE has been previously surveyed for cultural resources.
   b. If any known cultural resources have already been recorded on or adjacent to the APE.
   c. If the probability is low, moderate, or high that cultural resources are located in the APE.
   d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
   a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
   b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:

a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.

b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.

c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Nancy.Gonzalez-Lopez@nahc.ca.gov.

Sincerely,

Nancy Gonzalez

Nancy Gonzalez-Lopez
Staff Services Analyst

cc: State Clearinghouse

[EXTERNAL] San Luis Reservoir - raise its level and capacity

Amy Nelson Frelinger <amy.frelinger@gmail.com>

Sat 5/16/2020 10:29 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Mr. Arthur,

PLEASE, raise the dam at San Luis Reservoir by 10 feet and create an additional 120,000 acre-feet of water.

We Californians, ranchers, farmers and citizens all NEED this improvement while they make the other seismic corrections to this reservoir.

You can make this happen.

Appreciatively yours,
Amy Frelinger

[EXTERNAL] B.F. Sisk Dam

Andrew Fisher <andrewjamesfisher@icloud.com>

Mon 6/8/2020 11:11 AM

To: Arthur, Casandra N <carthur@usbr.gov>

While undergoing seismic upgrades we should raise the dam to increase storage. This is essential since the state hasn’t created any new storage in decades while we pass water bonds ad nauseam. Meanwhile Sites and Temperance Flats have all their funds wasted on study after study and of course? “consultants”. Enough! We need water. More for humans and quit dumping it out to flush the cesspool known as San Francisco Bay. Thank you.

Andrew Fisher, Broker
661 478 8753
CA DRE 00895765
andrewjamesfisher@icloud.com

received MAY 22 2020

105 BCW
200 ∅
111 LAST

May 15, 2020

Casey Arthur
Project Manager,
Bureau of Reclamation
Willows Construction Office
1140 W. Wood Street
Willows, CA, 95988.

Re: San Luis Reservoir Seismic Upgrade and Raising the SLR Dam

Dear Mr. Arthur,

We are writing to respectfully request your consideration to take positive action in support of raising the dam at the San Luis Reservoir during the seismic retrofit process. An additional 10 feet would potentially add 120,000 acre feet of storage.

Here's why:

1. California agriculture feeds the Nation and the world. Water is critical to this effort. Raising the dam at San Luis Reservoir (SLR) would potentially add approx 120,000 acre feet of water our ag desperately needs.

2. It is counter-intuitive that some are advocating a desalinization plant AFTER good clean water is sent into the ocean. With increased storage at San Luis, we can keep the fresh water here, where we need it. No need for an expensive and environmentally destructive de-sal plant. Let's add water storage.

3. It's a given, as water is held, there is aquifer recharge. Any opportunity to <u>retain</u> water that would otherwise be wasted once it combined with ocean salt water, should be acted upon. This is an opportunity not to be missed. Communities, particularly disadvantaged communities, drawing on wells in the aquifer(s) have the potential for improved water conditions.

4. Combining projects; raising the dam and seismic upgrades just makes sense. It's a 'two-fer'.

5. Economic security. Reduction in irrigated farmland means reductions in food quality and quantity. This relates directly to the cost of food grown and raised in CA and what consumers pay. Californians and American citizens, many economically disadvantaged, will be further hurt when demand exceeds supply. Adding water storag at SLR, or anywhere in CA is critical.

5.National Security. It is in the best interest of the United States' security that CA continues to provide food to the Nation. Reliance on other countries, especially those who seek to harm us, is illogical and dangerous.

We strongly support action raising the dam at San Luis Reservoir as soon as administratively possible and tying it in with the seismic updates.

Thank you,

Karen Briese and Ray Briese

[EXTERNAL] CA WATER

Dale Ashley <dsashley@gmail.com>

Sat 5/23/2020 11:20 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Raise the dam at San Luis Reservoir by 10 feet and create an additional 120,000 acre-feet of water NOW!!

[EXTERNAL] San Luis Reservoir

David Frelinger <dfrelinger@yahoo.com>

Thu 5/21/2020 3:48 PM

To: Arthur, Casandra N <carthur@usbr.gov>

As a resident of California I am in favor of adding 10 feet to the San Luis Reservoir. California needs to do a better job collecting water and supporting the needs of the farming community in the Central Valley. This additional 10 feet will allow the savings of 120,000 acre feet of water which is needed to supply the needed food in California. Invest in California's natural resources and not in a disappointing bullet train.

David Frelinger
23480 Olive Street
Perris, CA 92570

[EXTERNAL] B. F. Sisk Reservoir Expansion

Diane Falge <valleyharvest@sbcglobal.net>

Mon 6/8/2020 11:13 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Dear Sir,
As our population has grown and the environmental requirements on our water system has expanded, our state has grossly neglected our infrastructure and has put our state in a perilous shortage of water for urban and agricultural use.

We desperately need to increase our water storage across the state and I fully support increasing the capacity of the B. F. Sisk Dam.

I am a farmer on the east side of our valley and I have children that live in Southern California. Thank you for your work to provide water for the people in our state.

Best Regards,
Diane Falge

(559)260-3234

[EXTERNAL] San Luis Reservoir

bjs19 <bjs19@aol.com>
Mon 6/8/2020 2:07 PM
To: Arthur, Casandra N <carthur@usbr.gov>

To whom it may concern,

I'm a farmer in the central valley. Our family farm has been here since 1938. We have changed our practices & engineered crops to be more drought tolerant. Lots of changes over many decades to become better stewards of the land. Its time for the state to update our infrastructure to accommodate the growing population and the need to feed them. Water is needed for both, without it neither one can flourish. Its been 40+yrs since the state add water storage. Its high time you(California) get off your ass and do what's needed for everyone. The more fertile the land the more it can grow, i i mean by that is if water is affordable and abundant our farms have jobs that means our communities can grow with those jobs, more people living here means more tax revenue. Farms help everyone not just by growing food.
Thank you for your time.

PLEASE ADD STORAGE TO SAN LUIS RESERVOIR.
PLEASE BUILD MORE DAMS OR ADD TO EXISTING DAMS IN CALIFORNIA.

John Thompson
Ceres, Ca.

[EXTERNAL] B. F. Fisk Dam raising project

Karin Campbell <kacycamp@sbcglobal.net>

Wed 6/10/2020 10:04 AM

To: Arthur, Casandra N <carthur@usbr.gov>

To: Casey Arthur, carthur@usbr.gov
From: Karin Campbell, kacycamp@sbcglobal.net
Subject: B.F. Fisk Dam raising project
Date: June 10, 2020

The B.F. Sisk will be undergoing a seismic upgrade. Why not raise the dam 10 feet and create new storage at the same time? It is a smart project, and it has my full support.
San Luis Reservoir is a massive spot to park water, and is where pumped water that doesn't empty into the ocean is stored before being dispersed east, west, and south. The increased capacity would benefit south of Delta water users, be managed by the federal government, and not subject to mismanagement by the state (yay!). I am 100% in favor of going ahead with this project.

Respectfully submitted,

Karin Campbell

[EXTERNAL] Should we Raise San Luis Water Levels?

kb <kdb@sti.net>

Fri 5/15/2020 11:17 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Der Mr. Arthur,

We are writing to respectfully request your consideration to take positive action in support of raising the dam at the San Luis Reservoir during the seismic retrofit process. An additional 10 feet would potentially add 120,000 acre feet of storage.

Here's why:

1. California agriculture feeds the Nation and the world. Water is critical to this effort. Raising the dam at San Luis Reservoir (SLR) would potentially add approx 120,000 acre feet of water our ag desperately needs.

2. It is counter-intuitive that some are advocating a desalinization plant AFTER good clean water is sent into the ocean. With increased storage at San Luis, we can keep the fresh water here, where we need it. No need for an expensive and environmentally destructive de-sal plant. Let's add water storage.

3. It's a given, as water is held, there is aquifer recharge. Any opportunity to <u>retain</u> water that would otherwise be wasted once it combined with ocean salt water, should be acted upon. This is an opportunity not to be missed. Communities, particularly disadvantaged communities, drawing on wells in the aquifer(s) have the potential for improved water conditions.

4. Combining projects, raising the dam and seismic upgrades just makes sense. It's a 'two-fer'.

5. Economic security. Reduction in irrigated farmland means reductions in food quality and quantity. This relates directly to the cost of food grown and raised in CA and what consumers pay. Californians and American citizens, many economically disadvantaged, will be further hurt when demand exceeds supply. Adding water storag at SLR, or anywhere in CA is critical.

5.National Security. It is in the best interest of the United States' security that CA continues to provide food to the Nation. Reliance on other countries, especially those who seek to harm us, is illogical and dangerous.

Finally, we are including a video of President John F Kennedy's speech from 1962 at the San Luis Reservoir. He understood the reasons why water storage is critical.

https://www.youtube.com/watch?v=Q3XbtKCyjnQ

We strongly support action raising the dam at San Luis Reservoir as soon as administratively possible and tying it in with the seismic updates.

Thank you,

Karen Briese

Ray Briese

[EXTERNAL] Adding 10 ft to Sisk Damn

Krista Frelinger <kristafrelinger@gmail.com>

Mon 5/18/2020 10:43 PM

To: Arthur, Casandra N <carthur@usbr.gov>

To whom it may concern:

Please consider raising the Sisk Dam by 10ft during safety modifications. The additional water from this addition would benefit our valley in a multitude of ways. It will not only allow us to produce more fruits, vegetables and nuts to feed our nation and the world but it will also allow us to raise higher quality crops. These crops feed the livelihood of millions in this valley who depend on this water to survive. From farm labor to pest control advisors to farm equipment suppliers their families depend on this water to flourish. All of this valley depends on Agriculture to survive in one way or another. It is crucial that we find a way to support the Central Valley water project to keep our valley alive and thriving.

Thank you for your consideration.

Krista Tavares

Pest Control Advisor, Fresno County

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Krista

B.F. Sisk Dam Raise and Reservoir Expansion Project

NOI Scoping Period Comments

Voicemail received from Linda Foust on Monday, 6/8/20, at 1:07 pm.

Calling to let us know that she is in favor of the raising of the dam at San Luis Reservoir. Perfect time because they are working on the infrastructure and need the extra 10 feet for additional water storage.

We need to do this.

[EXTERNAL] San Luis Reservoir seismic upgrade

Loel Wood <wood71188@comcast.net>

Mon 6/8/2020 1:40 PM

To: Arthur, Casandra N <carthur@usbr.gov>

Casey Author,

I'm taking the me t o send you my support on the SLR project and hope that we can also include raising the dam 10 feet. Our water infrastructure is so far behind and the amount of water just being sent out to sea is just breath taking. Our family owns a small almond orchard, so water is a real concern and our state needs more of the save first spend second atude when it c omes to water conservaon. Thank y ou for taking the me t o hear me out.

Loel Wood

[EXTERNAL] B.F.Sisk dam

loiswollenman@comcast.net <loiswollenman@comcast.net>

Mon 6/8/2020 12:17 PM

To: Arthur, Casandra N <carthur@usbr.gov>

I'm writing regarding the proposal to raise the dam at San Luis Reservoir 10 feet and create new storage at the same time. I know you are aware of needed storage so let's be smart. Help us store our water instead of watching it go directly to the Pacific Ocean.
Thank you for your support!!!!
Lois Wollenman
loiswollenman@comcast.net

Sent from my iPhone

[EXTERNAL] San Luis Reservoir Dam Repairs

Louie Bishop <louiebishop64@gmail.com>

Thu 5/14/2020 8:02 PM

To: Arthur, Casandra N <carthur@usbr.gov>

To Whom It May Concern,

I am a California citizen that is very concerned how our government is taking water from people and farmers, causing man-made shortages and higher prices, not to mention infrastructure deterioration.

Please do all in your power to raise the San Luis Reservoir dam as it is being repaired. The more water for people and farmers, the better our world will be!

Thank you,

Louis Bishop

Sent from my iPhone

[EXTERNAL] San Luis Reservoir B.F. Sisk

Monica Wright <monicag_13@icloud.com>

Mon 6/8/2020 5:40 PM

To: Arthur, Casandra N <carthur@usbr.gov>

Hello Mr. Arthur,

It is way past time our water issues are dealt with and cooperation in finding more storage for the almost 40,000,000 people that live in California.
San Luis Reservoir is a massive spot to park water and is where pumped water that doesn't empty into the ocean is stored before being dispersed east, west, and south. The facility is shared by the federal Central Valley Project (our national water) and the State Water Project (our state water). The increased capacity would benefit south of Delta water users, be managed by the federal government, and not subject to mismanagement by the state (yay!). This additional 10 feet would have been filled to the top last year in 2017, and every year SLR has reached its capacity.

Thank you and sincerely,

Monica Wright

[EXTERNAL] Raise Dam!!!!!

Paula Bazzell <pjbazzell5@yahoo.com>

Thu 5/14/2020 10:14 PM

To: Arthur, Casandra N <carthur@usbr.gov>

California needs all the extra water it can hold anywhere!!! Thanks to a lot of Northern water Districts have sold us out to Southern California's and to much of our water goes down South!!!! It hurts our Farmers and even the small local farmers business owners who need the water of Northern California!!! Which should be at a lower cost for us because it is coming from were we live and pay taxes on all the improvement that always being made on the canals that carry the water to Southern California!!! So yes!!! This would be a great time to
Raise the Dam do it right this time!!! Yes We Need more Water Storage in Northern California!!! IT MAKES GOOD SENSE AND SHOULD BE DONE!!! The Sooner The Better!!!
[Sent from Yahoo Mail on Android]

[EXTERNAL] Water storage

Richard Kreps <rkreps@ultragro.net>

Mon 6/8/2020 12:57 PM

To: Arthur, Casandra N <carthur@usbr.gov>

I am absolutely, with no equivocation, for any project that stores more water for all Californians!

Rich Kreps, CCA, SSp # 371469
Ultra Gro (559) 706-6903

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

June 12, 2020

Pablo Arroyave
San Luis and Delta-Mendota Water Authority
842 6th Street
Los Banos, California 93635

Subject: B.F. Sisk Dam Raise and Reservoir Expansion Project (Project) Notice of Preparation (NOP)

Dear Mr. Arroyave:

The California Department of Fish and Wildlife (CDFW) received a NOP from the San Luis and Delta-Mendota Water Authority and Bureau of Reclamation for the above-referenced Project pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1]

Thank you for the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife. Likewise, CDFW appreciates the opportunity to provide comments regarding those aspects of the Project that CDFW, by law, may be required to carry out or approve through the exercise of its own regulatory authority under Fish and Game Code.

CDFW ROLE

CDFW is California's **Trustee Agency** for fish and wildlife resources and holds those resources in trust by statue for all the people of the State (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines § 15386, subd. (a)). CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (*Id.*, § 1802). Similarly, for purposes of CEQA, CDFW is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on

[1] CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

projects and related activities that have the potential to adversely affect fish and wildlife resources.

CDFW is also submitting comments as a **Responsible Agency** under CEQA (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381). CDFW expects that it may need to exercise regulatory authority as provided by the Fish and Game Code. As proposed, for example, the Project may be subject to CDFW's lake and streambed alteration regulatory authority (Fish & G. Code, § 1600 et seq.). Likewise, to the extent implementation of the Project as proposed may result in "take" as defined by State law of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code may be required.

Water Rights: The use of unallocated stream flows is subject to appropriation and approval by the State Water Resources Control Board (SWRCB) pursuant to Water Code § 1225. CDFW, as Trustee Agency, is consulted by the SWRCB during the water rights process to provide terms and conditions designed to protect fish and wildlife prior to appropriation of the State's water resources. Certain fish and wildlife are reliant upon aquatic ecosystems, which in turn are reliant upon adequate flows of water. CDFW therefore has a material interest in assuring that adequate water flows within streams for the protection, maintenance and proper stewardship of those resources. CDFW provides, as available, biological expertise to review and comment on environmental documents and impacts arising from project activities.

PROJECT DESCRIPTION SUMMARY

Proponent: San Luis and Delta-Mendota Water Authority and Bureau of Reclamation

Objective: The Project proposes to increase the storage capacity in San Luis Reservoir for the purpose of providing greater water supply reliability for south-of-Delta contractors dependent on San Luis Reservoir. The increased storage capacity would be achieved by an additional 10-foot raise of the B.F. Sisk Dam embankment across the entire dam crest above the level proposed for dam safety purposes. The Project would also implement modifications to State Route 152 in areas where the increased water surface elevation in the reservoir would interact with the roadway.

Location: The Project location is the San Luis Reservoir, located approximately 12 miles west of Los Banos, in Merced County, California.

Timeframe: N/A.

COMMENTS AND RECOMMENDATIONS

CDFW offers the following comments and recommendations to assist San Luis and Delta-Mendota Water Authority and Bureau of Reclamation in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources. Editorial comments or other suggestions may also be included to improve the CEQA document prepared for this Project.

There are many special-status resources present in and adjacent to the Project area. These resources may need to be evaluated and addressed prior to any approvals that would allow ground-disturbing activities or land use changes. CDFW is concerned regarding potential impacts to special-status species including, but not limited to, the State and federally threatened California tiger salamander (*Ambystoma californiense*), the State threatened and federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*), the State endangered foothill yellow-legged frog (*Rana boylii*), the State endangered and fully protected bald eagle (*Haliaeetus leucocephalus*), the fully protected golden eagle (*Aquila chrysaetos*), the State threatened Swainson's hawk (*Buteo swainsonii*), the federally threatened and State species of special concern California red-legged frog (*Rana draytonii*), the State candidate-listed as threatened mountain lion (*Puma concolor*), and tule elk (*Cervus canadensis nannodes*). In order to adequately assess any potential impacts to biological resources, focused biological surveys conducted by a qualified wildlife biologist are recommended during the appropriate survey period(s) in order to determine whether any special-status species may be present within the Project area. Properly conducted biological surveys, and the information assembled from them, are essential to identify any mitigation, minimization, and avoidance measures and/or the need for additional or protocol-level surveys, especially in the areas not in irrigated agriculture, and to identify any Project-related impacts under CESA and other species of concern.

I. Environmental Setting and Related Impact

Would the Project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW or the United States Fish and Wildlife Service (USFWS)?

COMMENT 1: California Tiger Salamander (CTS)

Issue: CTS have the potential to occur in the Project site. Aerial imagery shows that the Project site consists of upland habitat, which likely serve as refugia for CTS that are dispersing from and into the area, and aquatic features that may provide CTS breeding habitat.

Specific Impacts: Aerial imagery shows that the proposed Project site has upland habitat for refugia which may function as breeding habitat. Potential ground- and vegetation-disturbing activities associated with Project activities include: collapse of small mammal burrows, inadvertent entrapment, loss of upland refugia, water quality impacts to breeding sites, reduced reproductive success, reduction in health and vigor of eggs and/or young, and direct mortality of individuals.

Evidence impact would be significant: Up to 75% of historic CTS habitat has been lost to urban and agricultural development (Searcy et al. 2013). Loss, degradation, and fragmentation of habitat are the primary threats to CTS in both the Central and San Joaquin valleys. Contaminants and vehicle strikes are also sources of mortality for the species (CDFW 2015, USFWS 2017a). The Project site is within the range of CTS and has suitable habitat (i.e., grasslands interspersed with burrows and vernal pools). CTS have been determined to be physiologically capable of dispersing up to approximately 1.5 miles from seasonally flooded wetlands (Searcy and Shaffer 2011) and have been documented to occur near the Project site (CDFW 2020). Given the presence of suitable habitat within the Project site, ground-disturbing activities have the potential to significantly impact local populations of CTS.

Recommended Potentially Feasible Mitigation Measure(s)

To evaluate potential impacts to CTS, CDFW recommends conducting the following evaluation of the Project site, incorporating the following mitigation measures into the Environmental Impact Report (EIR) prepared for this Project, and that these measures be made conditions of approval for the Project.

Recommended Mitigation Measure 1: Focused CTS Protocol-level Surveys

CDFW recommends that a qualified biologist conduct protocol-level surveys in accordance with the USFWS “Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander” (USFWS 2003) at the appropriate time of year to determine the existence and extent of CTS breeding and refugia habitat. The protocol-level surveys for CTS require more than one survey season and are dependent upon sufficient rainfall to complete. As a result, consultation with CDFW and the USFWS is recommended well in advance of beginning the surveys and prior to any planned vegetation- or ground-disturbing activities. CDFW advises that the protocol-level survey include a 100-foot buffer around the Project area in all areas of wetland and upland habitat that could support CTS. Please be advised that protocol-level survey results are viable for two years after the results are reviewed by CDFW.

Recommended Mitigation Measure 2: CTS Avoidance

If CTS protocol-level surveys as described in the above Mitigation Measure 1 are not conducted, CDFW advises that a minimum 50-foot no-disturbance buffer be delineated around all small mammal burrows in suitable upland refugia habitat within and/or adjacent to the Project site. Further, CDFW recommends potential or known breeding habitat within and/or adjacent to the Project site be delineated with a minimum 250-foot no-disturbance buffer. Both upland burrow and wetland breeding no-disturbance buffers are intended to minimize impacts to CTS habitat and avoid take of individuals. Alternatively, the applicant can assume presence of CTS within the Project site and obtain from CDFW a State Incidental Take Permit (ITP) in accordance with Fish and Game Code section 2081 subdivision (b).

Recommended Mitigation Measure 3: CTS Take Authorization

If through surveys it is determined that CTS are occupying or have the potential to occupy the Project site, consultation with CDFW is warranted to determine if the Project can avoid take. If take cannot be avoided, take authorization would be warranted prior to initiating ground-disturbing activities to comply with CESA. Take authorization would occur through issuance of an ITP by CDFW, pursuant to Fish and Game Code section 2081 subdivision (b). As stated above, in the absence of protocol surveys, the applicant can assume presence of CTS within the Project site and obtain an ITP from CDFW.

COMMENT 2: San Joaquin Kit Fox (SJKF)

Issue: The Project has the potential to impact SJKF. The area from around Los Banos Reservoir to the north of San Luis Reservoir has been identified by the Department and the USFWS as a migratory corridor critical to the continued existence and genetic diversity of the northern kit fox population – with the Santa Nella area being identified as a critical SJKF migratory "pinch-point" within this area (HT Harvey and Associates 2004). The creation of the San Luis Reservoir and O'Neil Forebay resulted in a large migratory barrier to the north-south migration of SJKF, and busy highways in the area such as State Routes 152 and 33 and Interstate 5, as well as the existing urban development further compounded this problem. As a result, any grassland, shrub land, or dry farmed habitat features in this area that could serve as movement or rest areas for SJKF has very high conservation values for this species. Any loss of these features within the corridor is potentially significant. In addition, SJKF has the potential to occur on the Project site because of the proximity of the Project site to the Santa Nella area. Any take of SJKF without appropriate take authorization would be a violation of Fish and Game Code.

Specific impact: Without appropriate avoidance and minimization measures for SJKF, potential significant impacts associated with Project activities include den collapse, inadvertent entrapment, reduced reproductive success, reduction in health and vigor of young, and direct mortality of individuals.

Evidence impact is potentially significant: Habitat loss resulting from agricultural, urban, and industrial development is the primary threat to SJKF (Cypher et al. 2013). The Project area consists and is bordered by some of the only remaining undeveloped land in the vicinity. Therefore, subsequent ground-disturbing activities have the potential to significantly impact local SJKF populations.

Recommended Analysis

CDFW recommends the EIR quantify and describe the direct and indirect potential impacts to SJKF, including any impacts to the SJKF movement corridor and other conservation areas. The evaluation should include the cumulative impacts to SJKF from other existing, planned and potential development from south of the Los Banos Reservoir to north of the San Luis Reservoir that may impact existing upland habitat.

Recommended Potentially Feasible Mitigation Measure(s) (Regarding Environmental Setting and Related Impact Shortcoming)

To evaluate potential impacts to SJKF, CDFW recommends conducting the following evaluation of the Project site, incorporating the following mitigation measures into the EIR prepared for this Project, and that these measures be made conditions of approval for the Project.

Recommended Mitigation Measure 4: SJKF Surveys

CDFW recommends presence/absence of SJKF be assessed by conducting surveys and implementing den avoidance buffers following the USFWS "Standardized recommendations for protection of the San Joaquin kit fox prior to or during ground disturbance" (2011). Specifically, CDFW advises conducting these surveys in all areas of potentially suitable habitat no less than 14 days and no more than 30 days prior to beginning of ground-disturbing activities.

Recommended Mitigation Measure 5: SJKF Take Authorization

SJKF detection warrants consultation with CDFW to discuss how to avoid take, or if avoidance is not feasible, to acquire an ITP prior to ground-disturbing activities, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 3: Foothill Yellow-Legged Frog (FYLF) and California Red-Legged Frog (CRLF)

Issue: FYLF are primarily stream dwelling and requires shallow, flowing water in streams and rivers with at least some cobble-sized substrate; CRLF primarily inhabit ponds but can also be found in other waterways including marshes, streams, and lagoons, and the species will also breed in ephemeral waters (Thomson et al. 2016). FYLF and CRLF have been documented to occur in the vicinity of the Project site (CDFW 2020). The Project site contains habitat that may support both species. Avoidance and minimization measures are necessary to reduce impacts to FYLF and CRLF to a level that is less than significant.

Specific impact: Without appropriate avoidance and minimization measures for FYLF and CRLF, potentially significant impacts associated with the Project's activities include burrow collapse, inadvertent entrapment, reduced reproductive success, reduction in health and vigor of eggs, larvae and/or young, and direct mortality of individuals.

Evidence impact would be significant: FYLF and CRLF populations throughout the State have experienced ongoing and drastic declines and many have been extirpated; historically, FYLF occurred in mountain streams from the San Gabriel River in Los Angeles County to southern Oregon west of the Sierra-Cascade crest (Thomson et al. 2016). Habitat loss from growth of cities and suburbs, invasion of nonnative plants, impoundments, water diversions, stream maintenance for flood control, degraded water quality, and introduced predators, such as bullfrogs are the primary threats to FYLF and CRLF (Thomson et al. 2016, USFWS 2017b). Project activities have the potential to significantly impact both species.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to FYLF and CRLF, CDFW recommends conducting the following evaluation of the Project site, incorporating the following mitigation measures into the EIR prepared for this Project, and that these measures be made conditions of approval for the Project.

Recommended Mitigation Measure 6: FYLF and CRLF Surveys

CDFW recommends that a qualified wildlife biologist conduct surveys for FYLF and CRLF in accordance with the USFWS "Revised Guidance on Site Assessment and Field Surveys for the California Red-legged Frog" (USFWS 2005) to determine if FYLF and CRLF are within or adjacent to the Project area; while this survey is designed for CRLF, the survey may be used for FYLF with focus on stream/river habitat.

Recommended Mitigation Measure 7: FYLF and CRLF Avoidance

If any FYLF or/and CRLF are found during pre-construction surveys or at any time during construction, consultation with CDFW is warranted to determine if the Project can avoid take. CDFW recommends that initial ground-disturbing activities be timed to avoid the period when FYLF and CRLF are most likely to be moving through upland areas (November 1 and March 31). When ground-disturbing activities must take place between November 1 and March 31, CDFW recommends a qualified biologist monitor construction activity daily for FYLF and CRLF.

Recommended Mitigation Measure 8: FYLF Take Authorization

If through surveys it is determined that FYLF are occupying or have the potential to occupy the Project site and take cannot be avoided, take authorization would be warranted prior to initiating ground-disturbing activities. Take authorization would occur through issuance of an ITP by CDFW, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 4: Swainson's Hawk (SWHA)

Issue: SWHA have the potential to forage or nest near or on the Project site. The California Natural Diversity Database shows SWHA occurrences throughout the area near the Project site (CDFW 2020). In addition to annual grasslands, SWHA are known to forage in alfalfa, fallow fields, dry-land and irrigated pasture, rice land (during the non-flooded period), cereal grain crops (including corn after harvest), beet, tomato, and other low-growing row or field crops.

Specific impacts: Without appropriate avoidance and minimization measures for SWHA, potential significant impacts that may result from Project activities include nest abandonment, loss of nest trees, loss of foraging habitat that would reduce nesting success (loss or reduced health or vigor of eggs or young), and direct mortality. Any take of SWHA without appropriate incidental take authorization would be a violation of Fish and Game Code.

Evidence impact is potentially significant: SWHA exhibit high nest-site fidelity year after year and lack of suitable nesting habitat in the San Joaquin Valley limits their local distribution and abundance (CDFW 2016). The Project as proposed, particularly construction of new facilities, will involve noise, groundwork, and movement of workers that could affect nests and foraging which has the potential to result in nest abandonment and decreased feeding, significantly impacting local nesting SWHA.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to SWHA, CDFW recommends conducting the following evaluation of the Project site, incorporating the following mitigation measures into the CEQA document prepared for this Project, and that these measures be made conditions of approval for the Project.

Recommended Mitigation Measure 9: SWHA Surveys

CDFW recommends that a qualified wildlife biologist conduct surveys for nesting SWHA following the survey methods developed by the Swainson's Hawk Technical Advisory Committee (SWHA TAC, 2000) prior to project implementation. The survey protocol includes early season surveys to assist the project proponent in implementing necessary avoidance and minimization measures, and in identifying active nest and foraging sites prior to initiating ground-disturbing activities.

Recommended Mitigation Measure 10: SWHA No-disturbance Buffer

If ground-disturbing activities are to take place during the normal bird breeding season (March 1 through September 15), CDFW recommends that additional pre-activity surveys for active nests be conducted by a qualified biologist no more than 10 days prior to the start of Project implementation. CDFW recommends a minimum no disturbance buffer of ½-mile be delineated around active until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.

Recommended Mitigation Measure 11: SWHA Foraging Habitat

CDFW recommends compensation for the loss of SWHA foraging habitat to reduce impacts to SWHA foraging habitat to less than significant based on CDFW's Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (CDFG, 1994), which recommends that mitigation for habitat loss occur within a minimum distance of 10 miles from known nest sites and the amount of habitat compensation is dependent on nest proximity. In addition to fee title acquisition or conservation easement recorded on property with suitable grassland habitat features, mitigation may occur by the purchase of conservation or suitable agricultural easements. Suitable agricultural easements would include areas limited to production of crops such as alfalfa, dry land and irrigated pasture, and cereal grain crops. Vineyards, orchards, cotton fields, and other dense vegetation do not provide adequate foraging habitat.

Recommended Mitigation Measure 12: SWHA Take Authorization

CDFW recommends that in the event an active SWHA nest is detected during surveys and the CDFW recommended ½-mile no-disturbance buffer around the nest cannot feasibly be implemented, consultation with CDFW is warranted to discuss how to implement the project and avoid take. If take cannot be avoided, take authorization through the issuance of an Incidental Take Permit (ITP), pursuant to Fish and Game Code section 2081 subdivision (b) is necessary to comply with CESA.

COMMENT 5: Tule Elk

Issue: Elk are California's largest land mammal and an important wildlife resource whose population growth in recent decades has been of great interest to the public. Prior to non-indigenous settlement, it is estimated the elk population in California was more than 500,000 animals. Non-indigenous settlement decimated California's elk populations. By 1872, only a few tule elk remained in the San Joaquin Valley. Conservation organizations and hunters were able to restore elk to the California landscape. Elk population growth since 1970 has been significant and California now supports approximately 5,700 tule elk (CDFW 2018). CDFW regional biologists have confirmed tule elk within and adjacent to the Project site. The Project has the potential to impact this species.

Specific impact: Tule elk are known to utilize the Project site and adjacent areas, especially below the B.F. Sisk Dam. Potential impacts to tule elk as a result of the Project includes loss of habitat, mortality resulting from vehicle collisions, and entanglement with fences and other structures. Without appropriate mitigation measures for tule elk, potentially significant impacts include loss of habitat.

Evidence impact is potentially significant: Habitat loss resulting from development or conversion to other land uses are the primary threat to tule elk. The Project site is within the range of tule elk and is utilized by tule elk based on CDFW population assessment surveys. As a result, ground-disturbing activities associated with development of the Project site have the potential to significantly impact local populations of this species.

Recommended Potentially Feasible Mitigation Measure(s)

To evaluate potential impacts to tule elk, CDFW recommends conducting the following evaluation of the Project site, incorporating the following mitigation measures into the EIR prepared for this Project, and that these measures be made conditions of approval for the Project.

Recommended Mitigation Measure 13: Tule Elk habitat

The Project as proposed will result in the loss of tule elk habitat. CDFW recommends that tule elk habitat be conserved at a minimum 1:1 ratio to the loss of habitat within the general vicinity of the Project site.

Recommended Mitigation Measure 14: Fencing

Increasing the storage capacity of the San Luis Reservoir may result in realignment to the perimeter fencing. Physical barriers such as fencing, mesh wire, panels, electric fence, and visual barriers (such as landscaping cloth hung between fence poles) have the potential to impact tule elk. CDFW recommends not utilizing physical barriers that may impede tule elk access to water, and foraging areas.

COMMENT 5: Mountain lion

It should be noted that on June 25, 2019 a petition to list the mountain lion (*Puma concolor*), Southern California/Central Coast Evolutionarily Significant Unit (ESU) in Southern and Central California as Threatened or Endangered pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., "CESA") was submitted to the California Fish and Game Commission. Specifically, the petitioners requested listing as a "threatened species" for the ESU comprised of the following recognized mountain lion subpopulations: 1) Santa Ana Mountains 2) Eastern Peninsular Range 3) San Gabriel/San Bernardino Mountains 4) Central Coast South (Santa Monica Mountains) 5) Central Coast North (Santa Cruz Mountains) 6) Central Coast Central. In April 2020, Fish and Game Commission determined that the petitioned action "may be warranted" and established mountain lion within the proposed ESU as a candidate species under CESA. As a candidate species, mountain lion within the proposed ESU now has all of the protections afforded to an endangered species under CESA.

The Project site is adjacent to the Central Coast North ESU. Therefore, CDFW advises analyzing Project impacts to the subpopulation; CDFW advises including and referencing recent linkage studies on mountain lion that includes these six subpopulations of mountain lions in California. Based on this analysis, CDFW recommends the EIR prepared for this Project include robust feasible avoidance, minimization, and mitigation measures to reduce impacts to mountain lion to less than significant.

COMMENT 6: Riparian Impacts

Issue: The increased storage capacity as a result from the dam raise will impact riparian habitat and associated species throughout the San Luis Reservoir. A hydrologic study or other information may be needed to identify and analyze the impacts of the removal of riparian woodland around the San Luis Reservoir, and the species supported by these habitats.

Specific Impact: Watershed and habitat protection are vital to the CDFW's management of California's diverse fish, wildlife, and plant resources. The various riparian zones around the San Luis Reservoir (i.e. San Luis Creek) supports riparian woodland habitat and associated annual grassland, and may potentially support several sensitive species listed as threatened or endangered under CESA and the Federal Endangered Species Act (FESA), as well as several State special-status species including California red-legged and foothill yellow-legged frog. CDFW is concerned that the loss of riparian habitat will result in direct and cumulative adverse impacts to these fish and wildlife and other public trust resources.

Recommended Analysis

CDFW recommends a hydrologic study or other information that identify and analyze the impacts to the riparian woodland and aquatic habitats around the San Luis Reservoir and the species supported by these habitats.

Study Plan

Where a project could affect the hydrologic regime of a watershed, the necessary elements to successfully maintain the biological diversity and avoid impacts to threatened and endangered species needs to be identified to facilitate sound management decisions. CDFW recommends the Lead Agency develop and implement a site-specific study to evaluate potential Project-related impacts to riparian habitat and determine appropriate measures to reduce impacts to a less than significant level.

At a minimum, CDFW recommends the study plan include the following:

1. Analysis of any impacts to flows necessary to maintain the health and perpetuation of aquatic and riparian resources adjacent to the reservoir that result from Project activities.
2. A complete updated (within the last two years) assessment of the flora and fauna within, and adjacent to, the Project footprint with particular emphasis on identifying endangered, threatened, and sensitive species and sensitive habitats. The assessment should be based on the findings of appropriate applicable protocol surveys to determine the presence or absence of special-status species within the Project footprint. These surveys should be conducted on the project site, including adjacent habitats.

3. A quantification of the loss of biological resources that will occur as a result of the inundation of riparian habitat and associated tributaries, and an evaluation of the impacts to resources.

4. A mitigation plan to replace lost plant, fish, and/or wildlife resources including, but not limited to the species or habitats described above. This plan must include a survey which quantifies the loss of resources that will occur as a result of this project. It must also specify measures that will be taken to offset impacts to resources and outline specific mitigation and monitoring programs.

Comment 7: Department Owned and Managed Lands

CDFW Wildlife Areas are acquired for the protection and enhancement of habitat for a wide variety of species and are open to the public for wildlife viewing, hiking, hunting, fishing, and nature tours. The construction and staging activities near CDFW lands could severely limit the wildlife and public use values of these lands as well as alter the way these lands are managed by CDFW. Most Wildlife Areas depend on visitor fees for operation, maintenance and management. CDFW has concerns that Project-related construction and staging activities may negatively impact the number of visitors to Wildlife Areas resulting in reduced revenues; thereby reducing or eliminating the future enhancement of public recreational opportunities and wildlife habitat provided by these areas.

Specific CDFW-owned lands that are in the Project vicinity include Cottonwood Creek Wildlife Area (Upper and Lower), San Luis Reservoir Wildlife Area, O'Neill Forebay Wildlife Area, Volta Wildlife Area, Los Banos Wildlife Area, Grasslands Wildlife Area and Cañada de los Osos Ecological Reserve. It is of note that the Cottonwood Creek, O'Neill Forebay, and San Luis Reservoir Wildlife Areas were set aside/created as USBR mitigation for the creation of San Luis Reservoir, and these lands appear to be those most likely to be directly impacted by the project. CDFW requests that the EIR evaluate how construction, staging, and road/highway modification activities may temporarily or permanently impact public access and use of these Wildlife Areas in addition to potential resource impacts. It is of note that all of these properties are known to support state and federally listed species.

Comment 8: Cumulative Impacts Related to High Speed Rail

The Bay Area to Merced alignment of the High Speed Train is also planned for the project area vicinity. The currently proposed High Speed Train alignment would run along Henry Miller Road to the east of the Project Area and ultimately would tunnel underneath the Cottonwood Creek Wildlife Area, in close proximity to B,F. Sisk Dam and possibly with overlapping staging, traffic, and road use/construction impacts. We recommend that the DEIR evaluate the potential impacts of both the High Speed Train and the Proposed Project being constructed simultaneously or in close proximity temporally. The related cumulative impacts to CDFW lands and biological resources should also be analyzed and addressed.

II. Editorial Comments and/or Suggestions

Fully Protected Raptors: The fully protected bald eagle and golden eagle are known to nest and forage in the vicinity of the Project site. Projects within occupied territories have the potential to significantly impact the species. The Department recommends that focused surveys be conducted by experienced biologists prior to Project implementation. To avoid impact to the species, the Department recommend incorporating survey protocols developed by the Department (CDFG, 2010) and the USFWS (USFWS, 2010). In the event that the species is found within 0.5-mile of the Site, implementation of avoidance measures are warranted. The Department recommends that a qualified wildlife biologist be on-Site during all ground disturbing/construction related activities and that a 0.5 mile no disturbance buffer be put into effect. If the 0.5 mile no disturbance buffer cannot feasibly be implemented, the Department should be contacted to assist with providing and implementing additional avoidance measures. Mitigation measures for fully protected raptor species should be fully addressed in the CEQA document prepared for the Project.

Lake and Streambed Alteration: The Project is subject to CDFW's regulatory authority pursuant Fish and Game Code section 1600 et seq. Fish and Game Code section 1602 requires San Luis and Delta-Mendota Water Authority to notify CDFW prior to commencing any activity that may (a) substantially divert or obstruct the natural flow of any river, stream, or lake; (b) substantially change or use any material from the bed, bank, or channel of any river, stream, or lake; or (c) deposit debris, waste or other materials that could pass into any river, stream, or lake. "Any river, stream, or lake" includes those that are ephemeral or intermittent, such as the unnamed stream within the Project site, as well as those that are perennial in nature.

For additional information on notification requirements, please contact our staff in the Lake and Streambed Alteration Program at (559) 243-4593. It is important to note, CDFW is required to comply with CEQA, as a Responsible Agency, when issuing a Lake or Streambed Alteration Agreement (LSAA). If inadequate, or no environmental review, has occurred, for the Project activities that are subject to notification under Fish and Game Code section 1602, CDFW will not be able to issue the Final LSAA until CEQA analysis for the project is complete. This may lead to considerable Project delays.

Water Rights: CDFW recommends the EIR address whether the Project proponents anticipate applying for the water rights associated with the proposed increase in storage capacity for the reservoir. CDFW recommends the EIR address how the Project will affect existing water rights including those associated with the Central Valley Project (CVP) and State Water Project (SWP) water supply, pre-1914 appropriative rights, riparian rights, prescriptive rights, and appropriative rights approved under licenses and SWRCB WR Orders.

Project-related diversions to storage may impact riparian, wetland, fisheries and terrestrial (upland) wildlife species and their habitats. As stated previously, CDFW, as Trustee Agency, is consulted by the SWRCB during the water rights process to provide terms and conditions designed to protect fish and wildlife prior to appropriation of the State's water resources. Given the potential for impacts to sensitive species and their habitats, it is advised that consultation with CDFW occur well in advance of any SWRCB water right application process.

Federally Listed Species: CDFW recommends consulting with the USFWS on potential impacts to federally listed species including, but not limited to, CTS, SJKF, and

CRLF. Take under FESA is more broadly defined than CESA; take under FESA also includes significant habitat modification or degradation that could result in death or injury to a listed species by interfering with essential behavioral patterns such as breeding, foraging, or nesting. Consultation with the USFWS in order to comply with FESA is advised well in advance of any ground-disturbing activities.

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a database which may be used to make subsequent or supplemental environmental determinations (Pub. Resources Code, § 21003, subd. (e)). Accordingly, please report any special-status species and natural communities detected during Project surveys to the California Natural Diversity Database (CNDDB). The CNDDB field survey form can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Submitting-Data. The completed form can be mailed electronically to CNDDB at the following email address: CNDDB@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Plants-and-Animals.

FILING FEES

If it is determined that the Project has the potential to impact biological resources, an assessment of filing fees will be necessary. Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW. Payment of the fee is required in order for the underlying project approval to be operative, vested, and final (Cal. Code Regs, tit. 14, § 753.5; Fish & G. Code, § 711.4; Pub. Resources Code, § 21089).

CDFW appreciates the opportunity to comment on the Project to assist San Luis and Delta-Mendota Water Authority and Bureau of Reclamation in identifying and mitigating the Project's impacts on biological resources.

More information on survey and monitoring protocols for sensitive species can be found at CDFW's website (https://www.wildlife.ca.gov/Conservation/Survey-Protocols). If you have any questions, please contact Jim Vang, Environmental Scientist, at the address provided on this letterhead, by telephone at (559) 243-4014, extension 254, or by electronic mail at Jim.Vang@wildlife.ca.gov.

Sincerely,

DocuSigned by:

Julie Vance

FA83F09FE08945A...

Julie A. Vance
Regional Manager

cc: United States Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825

State Water Resources Control Board
Division of Water Rights
Post Office Box 2000
Sacramento, California 95812

United States Army Corps of Engineers
San Joaquin Valley Office
1325 “J” Street, Suite #1350
Sacramento, California 95814-2928

ec: Patricia Cole; Patricia_Cole@fws.gov

Annette Tenneboe, Linda Connolly, Bob Stafford, and Cristen Langner; CDFW

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Attachment 1

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE RECOMMENDED MITIGATION MONITORING AND REPORTING PROGRAM (MMRP)

PROJECT: B.F. Sisk Dam Raise and Reservoir Expansion Project

SCH No.: N/A

RECOMMENDED MITIGATION MEASURE	STATUS/DATE/INITIALS
Before Disturbing Soil or Vegetation	
Mitigation Measure 1: Focused CTS Protocol-level Surveys	
Mitigation Measure 3: CTS Take Authorization	
Mitigation Measure 4: SJKF Surveys	
Mitigation Measure 5: SJKF Take Authorization	
Mitigation Measure 6: FYLF and CRLF Surveys	
Mitigation Measure 8: FYLF Take Authorization	
Mitigation Measure 9: SWHA Surveys	
Mitigation Measure 11: SWHA Foraging Habitat	
Mitigation Measure 12: SWHA Take Authorization	
Mitigation Measure 13: Tule Elk habitat	
During Construction	
Mitigation Measure 2: CTS Avoidance	
Mitigation Measure 7: FYLF and CRLF Avoidance	
Mitigation Measure 10: SWHA No-disturbance Buffer	
Mitigation Measure 14: Fencing	

[EXTERNAL] San Luis

Stacey Swinney <staceylaurae@yahoo.com>

Fri 5/15/2020 5:52 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Please raise the San Luis Dam. We need more water storage in California now! This is an easy choice.
Sincerely,
Stacey Swinney
Dos Palos, CA

Sent from my iPad

[EXTERNAL] Raising CA reservoir 20 ft.

Sunny Hand <sunnyhand@att.net>

Wed 5/20/2020 4:58 PM

To: Arthur, Casandra N <carthur@usbr.gov>

PLEASE Help California undo the damage by to many years of pay for play Democrat politicians and Do everything you can to raise and save our water for this state, the agriculture and the people who love it.

I'm ready to leave and not even a farmer. But I know what goes on here has an impact everywhere in our nation. We need your wise involvement to help us help ourselves.

Thank you.

Sunny Hand
4870 Mendota st.
Union city, CA

via iPhone

[EXTERNAL] SLR EXPANSION

wajwriter@aol.com <wajwriter@aol.com>

Sun 5/17/2020 11:01 AM

To: Arthur, Casandra N <carthur@usbr.gov>

Casey Arthur
Project Manager
Bureau of Reclamation
Willows Construction Office
1140 W. Wood Street
Willows, CA, 95988.

DEAR MR ARTHUR,

I WORKED AS A CIVIL ENGINEER ON THE CALIFORNIA WATER PROJECT FROM THE CLIFTON COURT FOREBAY TO CASTAIC DAM / ANGELES TUNNEL...PLUS I WAS ON THE FIELD DESIGN TEAM FOR THE ORIGINAL PERIPHERAL CANAL.
I SUPPORT RAISING SLR TO ALLOW ADDITIONAL WATER STORAGE.

THE PUBLIC HAS NEVER QUITE UNDERSTOOD HOW THE ENTIRE WATER SYSTEM IS DESIGNED TO OPERATE...AND THE POLITICIANS ALONG WITH THE MEDIA HAVE COMPLETELY STEERED PUBLIC OPINION IN THE WRONG DIRECTION. THE FACT THAT WE ARE CURRENTLY DRAWING WATER FOR THE ENTIRE SYSTEM OUT OF THE ITALIAN SLOUGH / OLD RIVER WAS TO BE A TEMPORARY SITUATION UNTIL THE HOOD TO CLIFTON COURT PERIPHERAL CANAL COULD TO BE CONSTRUCTED...A PROJECT THAT WAS DESIGNED TO BE COMPLETED OVER 50 YEARS AGO!!!

RON POSEY
MODESTO CA

[EXTERNAL] San Luis Reservoir in CA

William Hembree <hembree_hri@sbcglobal.net>

Sat 5/16/2020 1:28 PM

To: Arthur, Casandra N <carthur@usbr.gov>

Good Morning Mr. Arthur,

I'm writing to encourage a positive decision on raising CA's San Luis Reservoir by ten feet.

San Luis Reservoir is a large natural location to store water, and is where pumped water that doesn't empty into the ocean is stored before being dispersed east, west, and south. The SLR facility is shared by the federal Central Valley Project (our federal water) and the State Water Project (our CA state water).

Consequently, the increased storage capacity would benefit south of Delta water users, be managed by the federal government, and not subject to mismanagement by the state and their environmental Waco puppet masters. This additional 10 feet would have been filled in 2019 and in 2017, and every year SLR has reached its capacity.

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California's water i�America's salad, fruits and vegetables! The timing for this expansion is excellent because produce is very spotty now and planning for future catastrophes is high in the minds of quarantined Americans.

Storing rainfall and saving water just makes perfect common sense. Please feel free to call me if you would like further input from a life-long CA resident who is fed up with CA's mismanagement of water which is a scarce and irreplaceable resource.

Thank you for your and the Bureau of Reclamation's roles in raising the capacity of this reservoir by ten feet.

Best Wishes

William E. (Bill) Hembree

3538 Torino Way

Concord, CA 94518

(925) 798-8574