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March 19, 2010

Mr. William B. Hurley, P.E.
Senior Water Resources Engineer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Subject: Response to Comments on the Section 404(b)(1) Alternatives Analysis for the Calaveras Dam Replacement Project, Alameda and Santa Clara Counties, California

Dear Mr. Hurley:

Thank you for your letter of February 24, 2010, providing comments on the December 2009 Clean Water Act (CWA) Section 404(b)(1) Alternatives Analysis for the Calaveras Dam Replacement Project. This letter provides specific responses to each of your comments.

Comment 1: Staging Areas

The Proposed Project includes 11 staging areas with a combined total area of approximately 35.4 acres. The staging areas are required for the contractor's and SFPUC's office trailers, an on-site soils testing laboratory, equipment and maintenance yards, construction materials storage, and for stockpiling imported filter, drain, and aggregate materials. During project design, efforts were made to locate the staging areas to avoid or minimize impacts to jurisdictional features. With the exception of Staging Area 1, none of the staging areas would directly impact a jurisdictional wetland or other water.

Staging Area 1 is located at the intersection of the dam access road and Calaveras Road. The dimensions and layout of this staging area are the minimum area that would accommodate imported filter, drain, and aggregate materials. Staging Area 1 is the largest of the 11 staging areas and is a critical component of the Proposed Project; eliminating it is infeasible, as there are no other large, potential staging areas nearby that would not have comparable or greater environmental impacts.

As initially configured, preparation of Staging Area 1 would have resulted in the discharge of fill material to two wetlands and a seasonal stream. However, in keeping with the Section 404(b)(1) requirements, the northern and western limits of this staging area were modified to avoid one of the wetlands, the seasonal stream, and a sensitive terrestrial habitat. Implementing the current design for the area would result in the discharge of 135 cubic yards of fill material to 0.08 acre of seasonal wetland.

The seasonal wetland that would be filled at Staging Area 1 is located approximately 200 feet from Calaveras Road, essentially in the core of the staging area. As indicated in the Alternatives Analysis and in the application before your agency for a Section 401 Water Quality Certification, the fill in the seasonal wetland at Staging Area 1 would be temporary. The SFPUC proposes to place a protective geotextile fabric over the wetland for the duration of the project. At the end of project construction, the fill would be removed and the site would be returned to its natural grade and the wetland restored to (at a minimum) its pre-project condition.

Comment 2: Access Roads and Haul Roads

An access road would be needed to enable vehicles to travel from the dam site to Disposal Site 7, located on the northeastern side of the reservoir. The Alternatives Analysis indicated this road would cross several minor drainages where the installation of culverts would result in the discharge of fill material to jurisdictional features.

Subsequent engineering analysis indicates that the existing road would be able to provide access to Disposal Site 7 without major improvements. The project design includes construction of turn outs to enable two-way traffic on the existing road, but culvert replacements and road widening at drainage crossings are not currently proposed. In recognition of your concerns, the project specifications will be modified to utilize arched culverts with open bottoms, when this is technically feasible, should it become necessary to install any new culverts. We will coordinate our assessment of the need to replace any culverts with your agency.

Comment 3: Alternative 5 – Potential Impacts to Waters of the United States

Disposal Site 3 is located at the northwestern edge of the reservoir on the southwestern slope of Observation Hill below the dam access road. At this site, the Proposed Project would discharge 2,250,000 cubic yards of fill material to 0.06 acre (2,036 linear feet) of stream channel and ephemeral drainages, 1.46 acres of wetlands, and 3.2 acres of reservoir. Alternative 5 would entail discharging 2,020,000 cubic yards of fill at this site, a reduction of about 6 percent compared to the Proposed Project. However, as noted in Table 6 and Table 19 of the Alternatives Analysis, Alternative 5 would impact the same jurisdictional acreage as the Proposed Project.

The perennial stream at this disposal site follows the natural grade at the bottom of the hill, and ephemeral drainage features occur on the hillsides. The wetlands at this site border the stream and occur on the hillside.

Preparation of this site to receive fill material would involve constructing a rock-filled dike across the drainage below the reservoir water level at an elevation of approximately 700 feet. This dike would stabilize the toe of the disposal site and prevent fill material from entering the reservoir. Site preparation also would involve extensive grading of the hillside to provide a stable substrate for the disposal material. Following site preparation, the placement of fill material would begin at the bottom of the site and progress upslope.

Reducing the volume of fill material by 6 percent would lower the ultimate height of the top of the fill below its maximum design elevation of 960 feet. However, it would not reduce the area of impacts to wetlands or to the more vegetated portions of the drainages lower on the hillside. A reduced volume of surplus material would not result in a smaller rock dike within the reservoir because it would still be necessary to support and stabilize a similar volume of material on the slope above the reservoir.

The design of this disposal site received considerable attention by the SFPUC and the regulatory agencies at Interagency Task Force meetings in 2007. The rationale for selection of the current configuration was described in a final memo distributed to the resource agencies in March 2008. As indicated on Figure 11 of Appendix A of the Alternatives Analysis, the area of the disposal site, and the associated impacts to jurisdictional features, has been markedly reduced since October 2005.

Comment 4: Alternative 5 – Potential Impacts to Fisheries and Aquatic Habitat and Water Quality

The Proposed Project and Alternative 5 have the potential to affect fisheries and aquatic habitat. Aside from direct discharges of fill material or unintended spills to waters, the primary mechanism for these impacts would be through soil erosion and sedimentation during the wet season.

The Proposed Project would require 3,319,000 cubic yards of construction source material and would generate 3,780,000 cubic yards of disposal material. Alternative 5 would require 2,946,000 cubic yards of construction source material and would generate 3,550,000 cubic yards of disposal material. Although these differences in volumes are substantial, the Alternatives Analysis concludes that the associated impacts of each of the alternatives on water quality and aquatic resources would be of a *similar* magnitude.

During construction of the proposed project, the main determinant of impacts on water quality, fisheries, and aquatic resources would be the number of wet seasons during which construction would occur. The Proposed Project would require four years for project completion, and nearly all kinds of construction activities would occur during three wet seasons. Alternative 5 would require approximately 4.8 fewer months, but construction of this alternative would also overlap three wet seasons. Accordingly, the two alternatives would have similar durations of work within the staging areas, dam site, borrow areas, haul routes, and disposal sites during periods when precipitation is most likely to occur. Therefore, these alternatives would have similar potential to generate sediment and affect aquatic resources.

The SFPUC has designed the Proposed Project to be completed in the shortest feasible duration, which is four years. Completing the project in this time frame will help minimize the potential for impacts to waters of the State. Of course, the project will implement all actions required by the State to minimize the potential for adverse impacts to waters.

Comment 5: Alternative 5 – Potential Impacts to Water Supply

As indicated in the Alternatives Analysis in Section 2.3.2.1, one of the primary objectives of the Proposed Project is to construct a new dam with a robust design (wide, centrally located clay core, wide filters, and internal drainage) that could accommodate potential enlargement by future generations. The SFPUC does not reasonably foresee the need for a larger dam beyond one that restores the reservoir capacity to pre-DSOD restricted levels, and a larger dam is not included in the Proposed Project.

The Alternatives Analysis includes the following sentence in Section 6.6.4.4:

> "Alternative 5 would have a greater impact on municipal water supply than the Proposed Project because this alternative would reduce the ability of the SFPUC to meet water supply demands in the future without causing additional environmental impacts."

Your letter noted that any statement regarding potential future impacts to water supply should not be included in the Alteratives Analysis unless all potential future impacts associated with raising water levels are evaluated. As it is beyond the scope of the Alternatives Analysis to evaluate potential impacts resulting from a future, unplanned project, the SFPUC agrees that it is appropriate to remove the sentence regarding future water supply demands.

Closing

We appreciate your comments on the Section 404(b)(1) Alternatives Analysis for the Calaveras Dam Replacement Project, and we look forward to working with you and the other resource and regulatory agencies throughout the permitting phase of the project. Please contact Steve Leach at (510) 874-3205 or Kelley Capone at (415) 934-5715 if you have any questions or comments.

Sincerely,

Daniel Wade
Project Manager

cc: CRWQCB, SF Bay Region, Xavier Fernandez
USACE, San Francisco District, Regulatory Branch, Bob Smith, Cameron Johnson, Jane Hicks
USEPA, Region IX, WTR-8, Melissa Scianni
CDFG, Bay-Delta Region, Wesley Stokes
SWRCB, Division of Water Quality

SECTION 404 (B)(1) ALTERNATIVES ANALYSIS IN COMPLIANCE WITH THE CLEAN WATER ACT

CALAVERAS DAM REPLACEMENT PROJECT

SFPUC FILE #CUW 37401
USACE FILE # 29979S

Prepared for

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December 2009

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List of Acronyms

ACDD	Alameda Creek Diversion Dam
af	acre-feet
afy	acre-feet per year
BMP	Best Management Practice
CDFG	California Department of Fish and Game
CDRP	Calaveras Dam Replacement Project
cfs	cubic feet per second
CWA	Clean Water Act
cy	cubic yards
DSOD	California Division of Safety of Dams
ETJV	EDAW-Turnstone Joint Venture
Guidelines	Federal Clean Water Act Section 404(b)(1) Guidelines
IATF	Interagency Task Force
LEDPA	least environmentally damaging practicable alternative
mcy	million cubic yards
mgd	million gallons per day
MOU	Memorandum of Understanding
NMFS	National Marine Fisheries Service
NOA	naturally occurring asbestos
SCM	Standard Construction Measure
SCMA	South Calaveras Mitigation Area
SFPUC	San Francisco Public Utilities Commission
SVWTP	Sunol Valley Water Treatment Plant
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
RWQCB	San Francisco Bay Regional Water Quality Control Board
WSIP	Water System Improvement Program

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EXECUTIVE SUMMARY

The San Francisco Public Utilities Commission (SFPUC) proposes to rebuild Calaveras Dam in Alameda County, California. The existing dam, which impounds Calaveras Reservoir, does not meet current safety standards for large seismic events. The Proposed Project is designed to address this issue, to re-establish water delivery reliability, and to restore the water supply capability and capacity of the reservoir. Project construction will require authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Federal Clean Water Act of 1977 (33 U.S.C. § 1344). The SFPUC has submitted an application for a Section 404 individual permit to the USACE, San Francisco District.

According to regulations established by the U.S. Environmental Protection Agency (USEPA), the USACE may issue a permit for a proposed project only if it determines that the project complies with all parts of the USEPA regulations, commonly referred to as the Section 404(b)(1) Guidelines (Guidelines). The purpose of this document is to demonstrate that the SFPUC's Proposed Project to rebuild Calaveras Dam complies with a major requirement of the Guidelines: the Proposed Project is the least environmentally damaging practicable alternative (LEDPA).

This document describes the Proposed Project and its impacts to waters of the United States, including wetlands. It also assesses six potential project alternatives to determine if their construction is practicable and if they would have fewer impacts to waters of the United States and other adverse environmental consequences. These alternatives are:

- Alternative 1: No Project
- Alternative 2: Off-Site Disposal
- Alternative 3: Off-Site Borrow
- Alternative 4: Consolidated On-site Disposal
- Alternative 5: New Downstream Dam without Provision for Potential Future Enlargement
- Alternative 6: Replacement Dam at Existing Location

Using a step-wise approach (see Figure ES-1), the analysis finds that Alternative 1 would not meet any of the project objectives and eliminates it as a practicable alternative. Alternative 2 and Alternative 3 are found to be impracticable due to their relatively high costs, logistical issues, and long construction periods. Alternative 4 is practicable and would have slightly reduced impacts to waters of the United States compared to the Proposed Project; however, it would result in other adverse environmental consequences that eliminate it from being the LEDPA. Alternative 5 is practicable, but the potential impacts to waters of the United States, and other environmental consequences would be nearly identical to the Proposed Project; therefore, it is not considered less environmentally damaging. Alternative 6 is practicable; however, its high cost, logistical issues, and extensive environmental consequences prevent it from being the LEDPA. A summary of key data used in the analysis is presented in Table ES-1.

This analysis identifies the Proposed Project as the LEDPA. The Proposed Project meets all project objectives, is capable of being constructed within a reasonable time frame and budget, has fewer adverse environmental consequences compared to other alternatives, and incorporates measures to minimize impacts to waters of the United States.

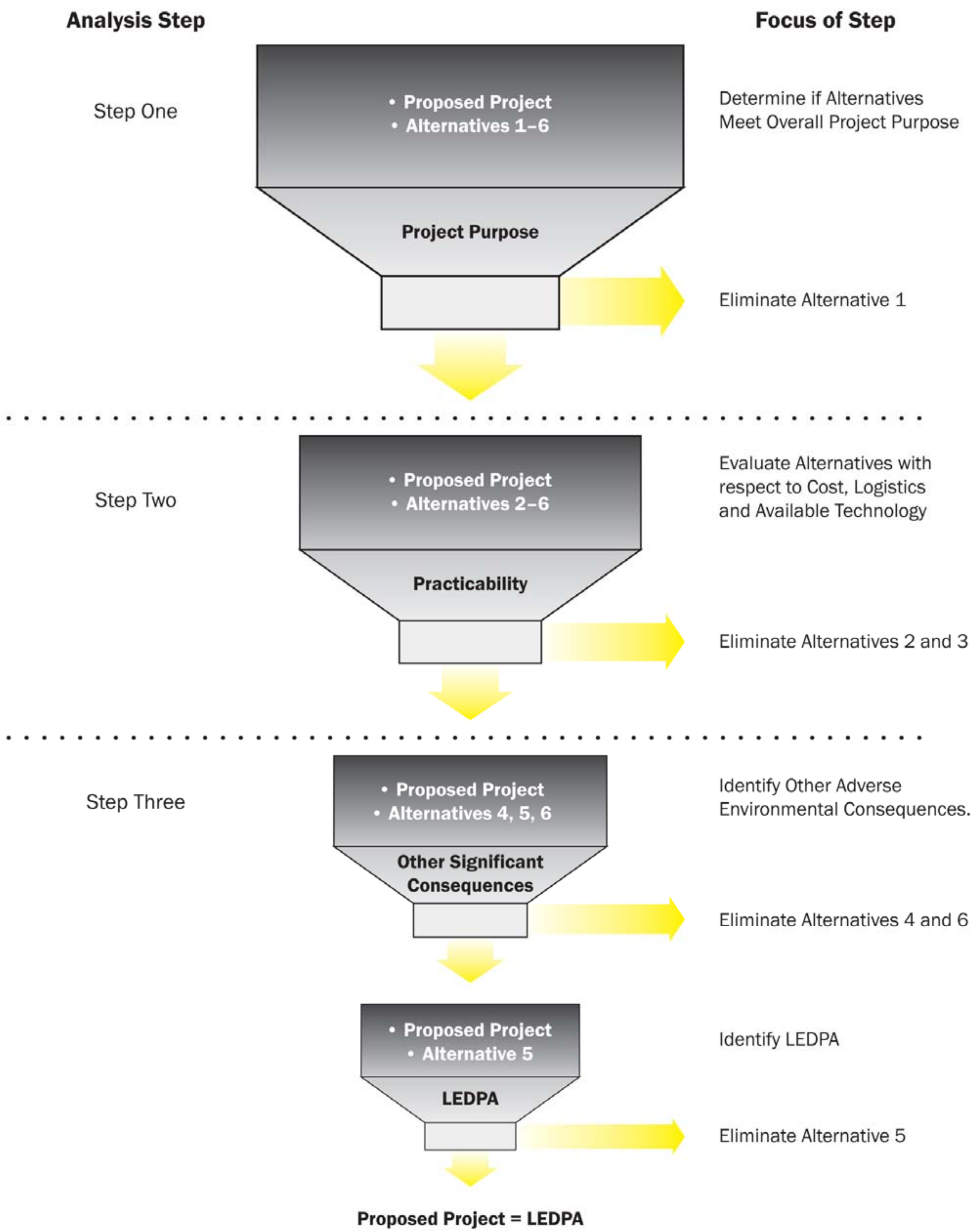

Figure ES-1 Identifying the Least Environmentally Damaging Practicable Alternative

Table ES-1
Key Factors for Identifying the LEDPA

Alternative	Meets No. of Overall Project Purpose Objectives	Practicability Factors				Practicable?	Impacts to Wetlands and Other Waters (acres)		Other Adverse Environmental Consequences[1]
		Cost ($ millions)	Existing Technology Constraints	Logistical Issues			Permanent	Temporary	
				Overall	Years to Build				
Proposed Project	6	264	Low	Low	4	Yes	6.79	18.88	------
Alternative 1 (No Project)	0	40	Low	Low	2	No	1.04	0.00	N.A.[2]
Alternative 2 (Off-Site Disposal)	6	450	Low	High	8	No	1.31	18.88	N.A.[2]
Alternative 3 (Off-Site Borrow)	6	310	Low	Medium	6	No	6.35	0.17	N.A.[2]
Alternative 4 (Consolidated On-Site Disposal)	6	280	Low	Low	4.5	Yes	6.03	18.88	3, 4, 5
Alternative 5 (New Downstream Dam without Provision for Future Enlargement)	5	253	Low	Low	3.6	Yes	6.79	18.88	None
Alternative 6 (Replace Dam at Existing Location)	3+	300	Medium	Medium	5	Yes	6.79	18.88	1, 2, 3, 4

[1] Codes to other adverse environmental consequences:
1 = Vegetation and wildlife, 2 = Fish/aquatic habitat, 3 = Water quality/supply, 4 = Air quality, 5 = Noise and vibration
[2] Not applicable, as this alternative is impracticable.

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1 INTRODUCTION

The San Francisco Public Utilities Commission (SFPUC) proposes to construct the Calaveras Dam Replacement Project (CDRP or Proposed Project). Project construction would involve the discharge of dredged or fill material to waters of the United States. In June 2009, the SFPUC submitted an individual permit application for the Proposed Project to the U.S. Army Corps of Engineers (USACE), San Francisco District.

The purpose of this document is to provide information to the USACE and the U.S. Environmental Protection Agency (USEPA) to enable a determination that the Proposed Project complies with the Federal Clean Water Act Section 404(b)(1) Guidelines (Guidelines). In particular, it demonstrates that the Proposed Project is the least environmentally damaging practicable alternative (LEDPA) as required by the Guidelines at 40 CFR 230.10(a) and described below in Section 2.1. This document also will be used by the San Francisco Bay Regional Water Quality Control Board (RWQCB) in its process to regulate the Proposed Project, as the RWQCB adopted the Guidelines in its Basin Plan for determining the circumstances under which filling of wetlands, streams, and other waters of the State may be permitted (RWQCB 2007).

This document summarizes relevant Guideline requirements, analyzes the potential effects of the Proposed Project and potential project alternatives on waters of the United States, and describes other environmental consequences associated with each of the alternatives. It includes information presented in other CDRP documents (i.e., the USACE permit application, biological assessments, and application for State water quality certification) to enable a clearer understanding of the analysis without having to refer to these other documents.

Much of the information presented herein has been reviewed and discussed by representatives of the State and Federal regulatory agencies including the California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), RWQCB, USACE, USEPA, and U.S. Fish and Wildlife Service (USFWS) at Interagency Task Force (IATF) meetings. SFPUC staff initiated IATF meetings for this project in 2005 and has convened them monthly. These meetings have been designed to elicit timely input from the regulatory agencies and have resulted in modifications to project design that seek to minimize potential impacts on special status species, wetlands and other waters of the United States, sensitive natural communities, water quality, and other environmental factors.

Recognizing that on-site disposal of surplus excavated material would account for the vast majority of permanent project impacts to wetlands and other waters of the United States (for the Proposed Project, these discharges would account for 84 percent of the impacts), the SFPUC evaluated many options for reducing disposal impacts. In 2007, it undertook a detailed evaluation of disposal sites with the IATF members. That process, which involved screening 11 off-site and on-site disposal options, identified the Proposed Project as the option that best met engineering and environmental objectives, including minimizing potential project impacts to waters of the United States and associated environmental resources. A summary of that analysis is included in Appendix A. (Please refer to Section 3.4.4 for additional avoidance measures identified with input from the IATF regulatory agencies.)

This analysis evaluates potential impacts to wetlands and other waters of the United States associated with the Proposed Project and six potential alternatives. It also briefly describes several preliminary alternatives evaluated by SFPUC staff at a more conceptual level, but subsequently eliminated because they did not adequately meet the project's overall project purpose and were not considered practicable. The Proposed Project and project alternatives analyzed herein are also evaluated in the SFPUC's Calaveras Dam Replacement Project Draft Environmental Impact Report (SFPUC 2009a).

The following sections present the requirements of Section 404 of the Clean Water Act, describe the Proposed Project and its impacts to waters of the United States, and analyze potential project alternatives. The analysis of project alternatives presented in Chapter 6 includes three discrete steps:

- Step 1: Alternatives are screened to assess their ability to meet the overall project purpose. Alternatives that meet most or all of the project objectives are retained for further analysis.
- Step 2: The practicability of the retained alternatives is assessed with respect to cost, logistics, and technology. Alternatives found to be practicable are retained for further analysis.
- Step 3: Practicable alternatives are evaluated with respect to other potentially significant adverse environmental consequences. The final part of this step identifies the LEDPA.

Chapter 7 summarizes the analysis and presents the rationale for designating the Proposed Project as the LEDPA.

2 REGULATORY BACKGROUND

2.1 CLEAN WATER ACT REQUIREMENTS

Section 404 of the Federal Clean Water Act (CWA) (33 USC 1244) establishes a framework for regulating the discharge of dredged or fill material to waters of the United States, including adjacent wetlands. The USEPA and USACE each have specific roles in the Section 404 regulatory program. One of USACE's main roles is to administer a program for authorizing individual discharges. One of USEPA's key roles is to develop guidelines the USACE must apply when considering whether to authorize a proposed discharge. The USEPA promulgated these guidelines (commonly known as the Section 404 Guidelines, and referred hereinafter as the Guidelines) in 1980 (40 CFR 230).

At the core of the Guidelines are four major restrictions on discharge. The USACE may authorize a project only if it complies with each of these restrictions, which are excerpted below.

1. Alternatives to the Proposed Discharge [40 CFR 230.10(a)]

A discharge of dredged or fill material may not be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

Practicable alternatives include, but are not limited to: (1) activities which do not involve a discharge of dredged or fill material into waters of the United States, and (2) discharges of dredged or fill material at other locations within waters of the United States. An alternative is considered practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. Practicable alternatives may include placing a project in an area not owned by the permit applicant that could be reasonably obtained by the applicant to fulfill the basic purpose of the proposed project.

If a proposed project involving a discharge to a special aquatic site [1] is not water dependent (i.e., requires access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose), then it is presumed that practicable alternatives that do not involve a discharge to a special aquatic site are available. Furthermore, these practicable alternatives are presumed to have less adverse impact to the aquatic ecosystem, unless demonstrated otherwise.

A practicable alternative that has the least adverse impact on the aquatic ecosystem and no other significant adverse environmental consequences is designated as the least environmentally damaging practicable alternative, or LEDPA. The USACE may only authorize a project alternative that it designates the LEDPA.

2. Water quality standards/toxic effluent standards/Endangered Species Act [40 CFR 230.10(b)]

No discharge of dredged or fill material shall be permitted if it causes or contributes to violations of state water quality standards, violates toxic effluent standards under Section 307 of the CWA, or jeopardizes the continued existence of an endangered or threatened species or results in the likelihood of destruction or adverse modifications to critical habitat under the Federal Endangered Species Act.

[1] Special aquatic sites include sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes.

3. Significant Degradation [40 CFR 230.10(c)]

No discharge of dredged or fill material shall be permitted which would cause or contribute to significant degradation of the waters of the United States. Degradation includes adverse effects on: (1) human health through impacts to municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites; (2) life stages of aquatic life and wildlife dependent on aquatic ecosystems; (3) ecosystem diversity, productivity, and loss of fish and wildlife habitat; and (4) recreational, aesthetic, economic values.

4. Adverse Impact Minimization [40 CFR 230.10(d)]

No discharge of dredged or fill material is permitted unless appropriate and practicable steps have been taken which would minimize potential adverse impacts of the discharge on the aquatic ecosystem.

2.2 SEQUENCING

Subpart A of the Guidelines at 40 CFR 230.5 establishes the general procedures the USACE must follow in applying the Guidelines. These result in a process commonly referred to as “sequencing”. To comply with the sequencing process, a project seeking USACE authorization must demonstrate that it has taken steps to:

- Avoid, to the maximum extent practicable, impacts to waters of the United States,
- Minimize unavoidable impacts, and
- Compensate unavoidable impacts

This analysis demonstrates that the SFPUC has taken a sequential planning approach in designing its project to rebuild Calaveras Dam, particularly with respect to avoidance. Please refer to Sections 3.4.4 and 3.4.5 regarding measures to minimize and compensate unavoidable adverse project impacts.

2.3 PROJECT PURPOSE

A key component of a Section 404 alternatives analysis is the description of “project purpose”. To demonstrate compliance with the Guidelines actually requires two project purpose descriptions. The first is the “Basic Project Purpose”, which is used to determine water dependency for a project proposing a discharge to a special aquatic site. The second is the “Overall Project Purpose”, which is the applicant’s statement of objectives used to evaluate practicable alternatives to a proposed project.

2.3.1 BASIC PROJECT PURPOSE

The basic purpose of the CDRP is to replace the existing Calaveras Dam so that it meets current California Division of Safety of Dams (DSOD) requirements for seismic stability and to reinstate the previous capacity of Calaveras Reservoir to provide necessary local water supply in the event of interruption of service at Hetch Hetchy or in the event of a drought.

2.3.1.1 WATER DEPENDENT PROJECT

The Proposed Project is water dependent because it requires siting within a special aquatic site to fulfill its basic purpose. The rationale for this conclusion is as follows: There are two potential sites at which to replace Calaveras Dam. One site is at the upstream face of the existing dam, within the reservoir; the other is at the base of the existing dam, in the canyon downstream. The construction of a replacement dam at either of these sites would necessitate the discharge of fill material to wetlands at the base of the dam. These wetlands are classified as a special aquatic site; therefore, according to the Guidelines, the Proposed Project is considered to be water dependent. Regulatory staff of the USACE, San Francisco District, has determined that the Proposed Project is water dependent (Smith, pers. com. 2009). Accordingly, there is no need in this alternatives analysis to rebut a presumption that there are practicable alternatives to the Proposed Project that do not involve a discharge of dredged or fill material to a special aquatic site [see 40 CFR 230.10(a)(3)].

2.3.2 OVERALL PROJECT PURPOSE

The overall project purpose of the Calaveras Dam Replacement Project (CDRP) is to replace an existing dam with a new earth and rock-fill dam that meets current seismic safety design requirements and accommodates a public water supply reservoir of the same size as the original reservoir (96,850 acre-feet).

As described by the SFPUC, the overall project purpose has four primary and two secondary objectives.

2.3.2.1 PRIMARY OBJECTIVES INCLUDE:

- Re-establish water delivery reliability

Calaveras Reservoir is a prominent local component of the SFPUC water system. The reservoir provides a significant portion of overall water deliveries during the winter when the Hetch Hetchy reservoirs are filling. It also helps meet customer demand when the supply of water from the Hetch Hetchy System is interrupted due to planned and unplanned outages. The conditions that may trigger outages include scheduled shutdowns for system maintenance, emergency repairs, drought, or the rare event when the Hetch Hetchy System supply temporarily does not meet water quality standards. Replacing Calaveras Dam would allow the reservoir storage to be restored to its historic capacity of 96,850 acre-feet (af) and would provide the previous level of delivery reliability during maintenance, emergency or droughts.

- Restore water supply and the capacity of the reservoir to its pre-2001 restriction level of 96,850 af using water from the Alameda Creek watershed, thereby restoring 7 million gallons per day (mgd) of water supply during the 8.5-year design drought (the SFPUC's drought planning scenario)

The DSOD restriction in storage (noted below and described in Section 3.2) has impaired the Reservoir's ability to retain local runoff for delivery to meet customer demand during emergency or planned outages at Hetch Hetchy or during drought conditions. The replacement dam would reestablish the reservoir to its original nominal capacity, enabling the water system to meet average daily demand and to provide approximately 7.1 mgd during the 8.5-year design drought. Drought protection is a key objective of the Proposed Project.

- Improve seismic reliability through construction of a replacement dam designed to safely retain 96,850 af of water and withstand the maximum credible earthquake (7.25 moment magnitude) on the Calaveras Fault

Calaveras Reservoir inundates part of Calaveras Valley, through which runs the Calaveras fault. The Calaveras fault has generated small and moderate earthquakes during the past 200 years. The major active trace of the Calaveras fault is located 1,600 feet west of the existing dam's spillway, and other traces are nearby. Because of the type of dam construction and the proximity of the existing dam and reservoir to the Calaveras fault, in 2001 SFPUC reduced the level of the reservoir to elevation 700 feet (revised in 2003 to elevation 705) and in 2003 evaluated the dam's seismic performance. This evaluation identified several concerns regarding the dam's expected performance in the event of an earthquake.

The Proposed Project is intended to respond to these concerns by replacing the existing dam with a dam designed to meet current DSOD requirements to withstand the seismic forces that may occur at the site. The DSOD performance objectives include providing outlet releases sufficient to meet DSOD emergency reservoir evacuation requirements and providing a dam that remains functional to store and supply water after an earthquake.

- Construct a new dam with a robust design (wide centrally located clay core, wide filters, and internal drainage) that could accommodate potential enlargement by future generations

The objective of constructing a new dam with a robust design that could accommodate potential enlargement by future generations is included so that the dam would be designed and constructed so as not to preclude potential future enlargement. The design would allow for potential future reuse of dam components without the requirement of extensive dam removal or rebuilding. The SFPUC does not reasonably foresee the need for a larger dam beyond one that restores the reservoir's capacity to pre-DSOD restricted levels, and a larger dam and reservoir is not included in the Proposed Project. Potential future dam enlargement is not proposed at this time.

2.3.2.2 SECONDARY OBJECTIVES INCLUDE:

- Continue reservoir and outlet works operation, to the extent possible, during construction

Because of the important role of Calaveras Reservoir in the operation of the water system, particularly when Hetch Hetchy System operations are suspended, or during a drought, the SFPUC must be able to draw on Calaveras Reservoir as a source of supply during the project construction period of 4 years. The outlet works to the SVWTP will be operational at all periods of construction, except during two consecutive summer construction seasons when the outlet works will be rebuilt and relocated.

- Maintain high water quality, restoring a deeper pool that would keep water temperatures cooler to limit algal growth in the reservoir

The current baseline, with a lowered reservoir elevation, has created conditions that increase the potential for algae growth, leading to taste and odor problems. Although these problems have been minimized at the reservoir by use of the hypolimnetic oxygenation system and treatment at the SVWTP, restoring the reservoir elevation to its historic storage level will provide for cooler water temperatures that limit algal growth problems and improve the quality of the water at the source.

In addition to meeting primary and secondary project objectives, the Proposed Project must comply with the performance objectives mandated by the DSOD. These objectives require:

- Freeboard and spillway capacity designed for an inflow design flood based on the Probable Maximum Precipitation (PMP) event.
- Outlet releases sufficient to meet DSOD emergency reservoir evacuation requirements.
- The dam and related works to remain functional after the design earthquake. This requires that the safety of the dam embankment itself not be impaired by: 1) extensive cracking, 2) crest settlement that will impair freeboard, and 3) excessive deformation in critical zones such as filters and drains. It also requires that the outlet works and spillway remain intact and operational during construction.

3 PROPOSED PROJECT DESCRIPTION

Calaveras Dam and Reservoir are components of the SFPUC's San Francisco water system. Figure 1 shows the project location. This section begins with a brief description of the water system and how Calaveras Reservoir functions as a part of this system, followed by a description of the Proposed Project.

3.1 OVERVIEW OF THE SAN FRANCISCO WATER SYSTEM

The San Francisco water system includes facilities in the Sierra Nevada, the Central Valley, and local watersheds in the San Francisco Bay area (Figure 2). The system extends from Hetch Hetchy Reservoir in the upper Tuolumne River watershed to San Francisco, and it develops water supply in the Tuolumne, Alameda, and Peninsula watersheds. The overriding system operating goal is to ensure that sufficient water is available year-round regardless of hydrologic conditions (i.e., drought, normal, and above-normal precipitation). The system delivers an annual average of about 265 mgd, of which about 85 percent originates in the Tuolumne River watershed and about 15 percent is from the combined Alameda and Peninsula watersheds (the "local" watersheds) (CDM et al. 2005). Water originating in the Tuolumne River watershed is transmitted to the Bay Area through Hetch Hetchy System pipelines and tunnels.

Local reservoirs provide back-up or redundancy in the event of water quality problems or transmission disruptions in the Hetch Hetchy System. When water in excess of customer demands is available from Hetch Hetchy Reservoir, and there is available capacity in the transmission system and local reservoirs, the SFPUC diverts water from the Hetch Hetchy System for storage in San Antonio, San Andreas, and Crystal Springs Reservoirs. Other local reservoirs, including Pilarcitos and Calaveras Reservoirs, only contribute water that originates within their watersheds. All of the local reservoirs are operated to maximize use of local resources for annual water deliveries, drought supply, peak summer demand, and emergencies.

Operation of the local reservoir system varies with the seasons. During the winter season, when rainfall and local watershed runoff occurs, the local reservoirs are managed to maintain sufficient available storage to minimize uncontrolled spills. Towards the end of the winter, as the likelihood of rain decreases, the reservoirs are operated to capture local watershed runoff with a goal of maximizing carryover storage in combination with Hetch Hetchy System storage.

During the summer, water drawn from the local reservoirs is minimized to ensure adequate supply in the event of a disruption of flow from Hetch Hetchy or unplanned outages within the system. As the system demand increases past the capacity of flow from the Hetch Hetchy System, water is drawn from the local reservoirs to additionally serve demands. At the beginning of fall, if demand has not drawn down each reservoir to its wintertime storage objective level, conveyance between the reservoirs, Hetch Hetchy flow rates, and treatment plant flow rates are adjusted to reach storage objective levels. If storage levels are still below objectives, additional water may be conveyed from the Hetch Hetchy System to replenish a reservoir.

3.2 PROPOSED PROJECT

Calaveras Dam, constructed in 1925 and later modified, was designed to store 96,850 af of local watershed runoff in the Alameda Creek watershed in Alameda County and Santa Clara County. Calaveras Reservoir is the largest SFPUC San Francisco Bay Area reservoir, providing about 40 percent of the SFPUC's local water storage and 66 percent of local water yield.

Studies initiated in 1998 indicated that the dam does not meet current safety standards for large seismic events. In response to safety concerns about the seismic stability of the dam and a mandate from the DSOD, the SFPUC was required to lower the water levels in the reservoir beginning in the winter of 2001. The current normal elevation of the lowered water level corresponds to about 38,100 af of storage, which is approximately 60 percent less than the normal maximum water storage capacity before the DSOD restriction. DSOD requested that SFPUC pursue an aggressive schedule to alleviate the seismic safety concerns about Calaveras Dam.

The Proposed Project would replace the existing dam with a new one that meets DSOD requirements. The water levels in Calaveras Reservoir would then be restored, increasing the necessary water supply and increasing water delivery reliability in the event of interruption of service or drought.

The Proposed Project area includes the temporary and permanent construction limits of the new dam and spillway, support buildings, haul roads, road improvements, staging and stockpile areas, borrow areas, and disposal sites shown on Figure 3. The project area also includes the mitigation areas where actions would be implemented as mitigation for the project.

3.2.1 PERMANENT PROJECT COMPONENTS

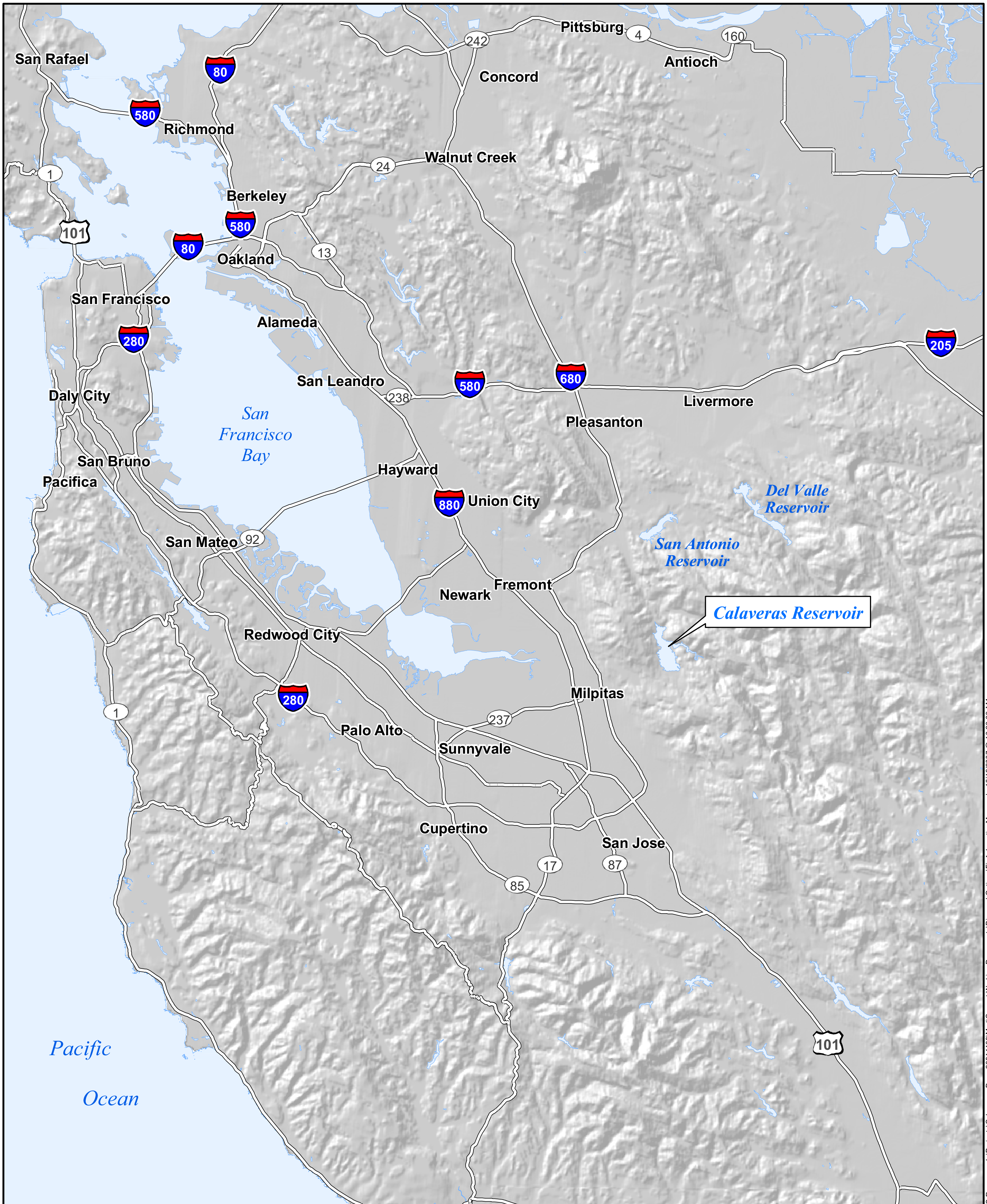
3.2.1.1 REPLACEMENT DAM

The replacement dam would be located immediately downstream at the toe of the existing dam (see Figure 4). It would have a nominal reservoir storage of 96,850 af, which is the same as the storage capacity of the reservoir when the existing dam was completed. Table 1 compares the existing dam to the proposed replacement dam.

The soil and rock fill materials for construction of the replacement dam are proposed to be derived from the same sources as those for the original dam construction, as well as those for the dam reinforcement project conducted in 1974. The replacement dam would be constructed with fill and rock from Temblor Sandstone and Franciscan Complex formations excavated on site. Table 2 shows the sources/locations of construction material, amount/type of material needed, amount proposed to be used, and post-construction disposition.

Construction in Franciscan Mélange at the dam site and nearby borrow areas is anticipated to encounter serpentinite and ultramafic rocks, which are known to contain naturally occurring asbestos (NOA) and enriched concentrations of select metals (arsenic, copper, chromium, and nickel) at the CDRP site. Excavation of the existing dam core likewise may encounter materials containing NOA, as local rock material was used in its original construction.

While some materials would be salvaged from the existing dam, no part of the existing dam structure would be retained as part of the proposed replacement dam. However, as much as possible, the existing dam would be left in place to avoid impacts from dam removal. The only parts of the existing facilities that would be retained for future use would be from the outlet works: intake adits, the drainpipe, and the portion of the outlet pipe that runs beneath the existing dam.



N

SCALE 1:500,000

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URS

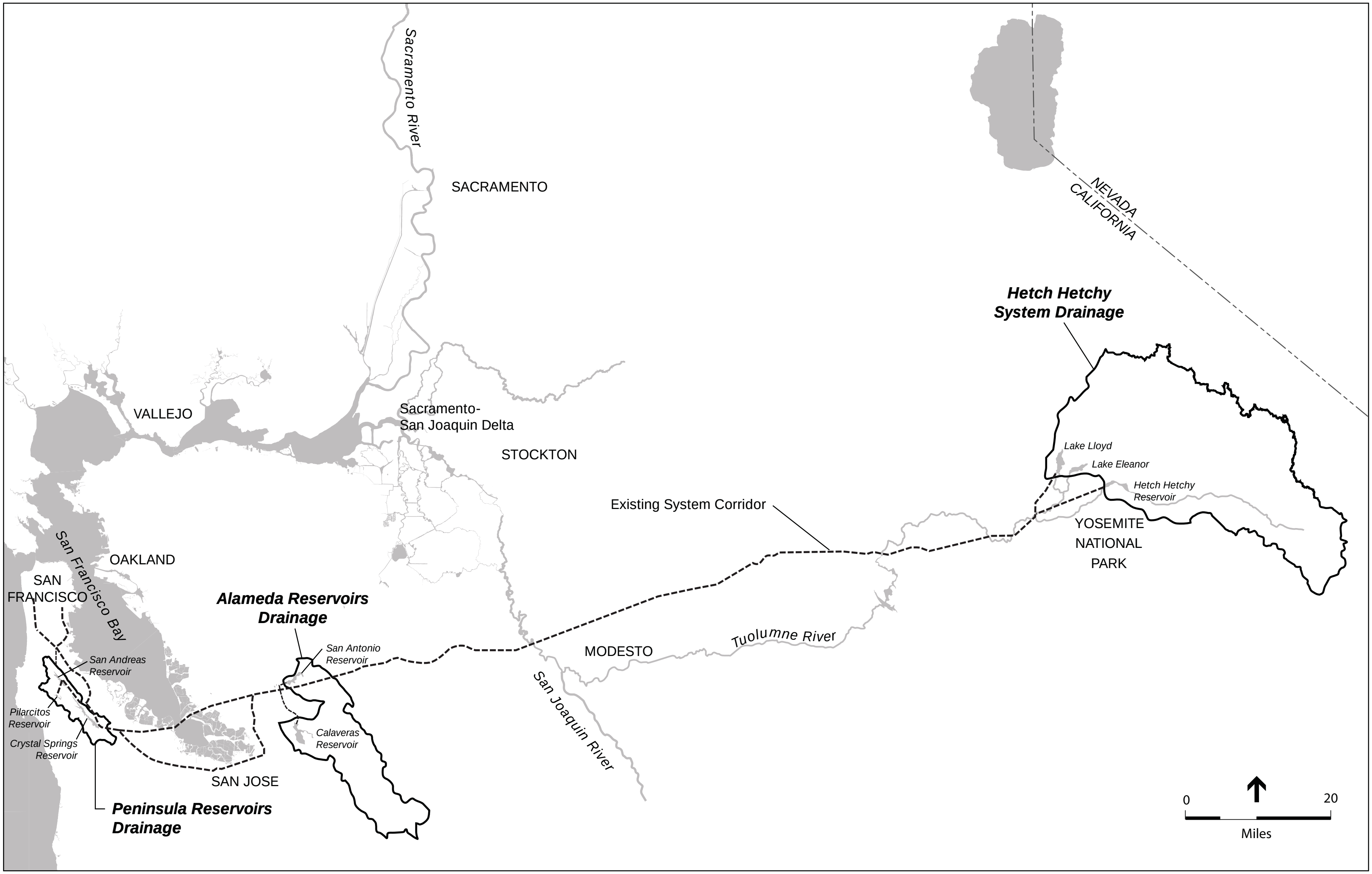
SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

PROJECT NO. 26815610

PROJECT LOCATION

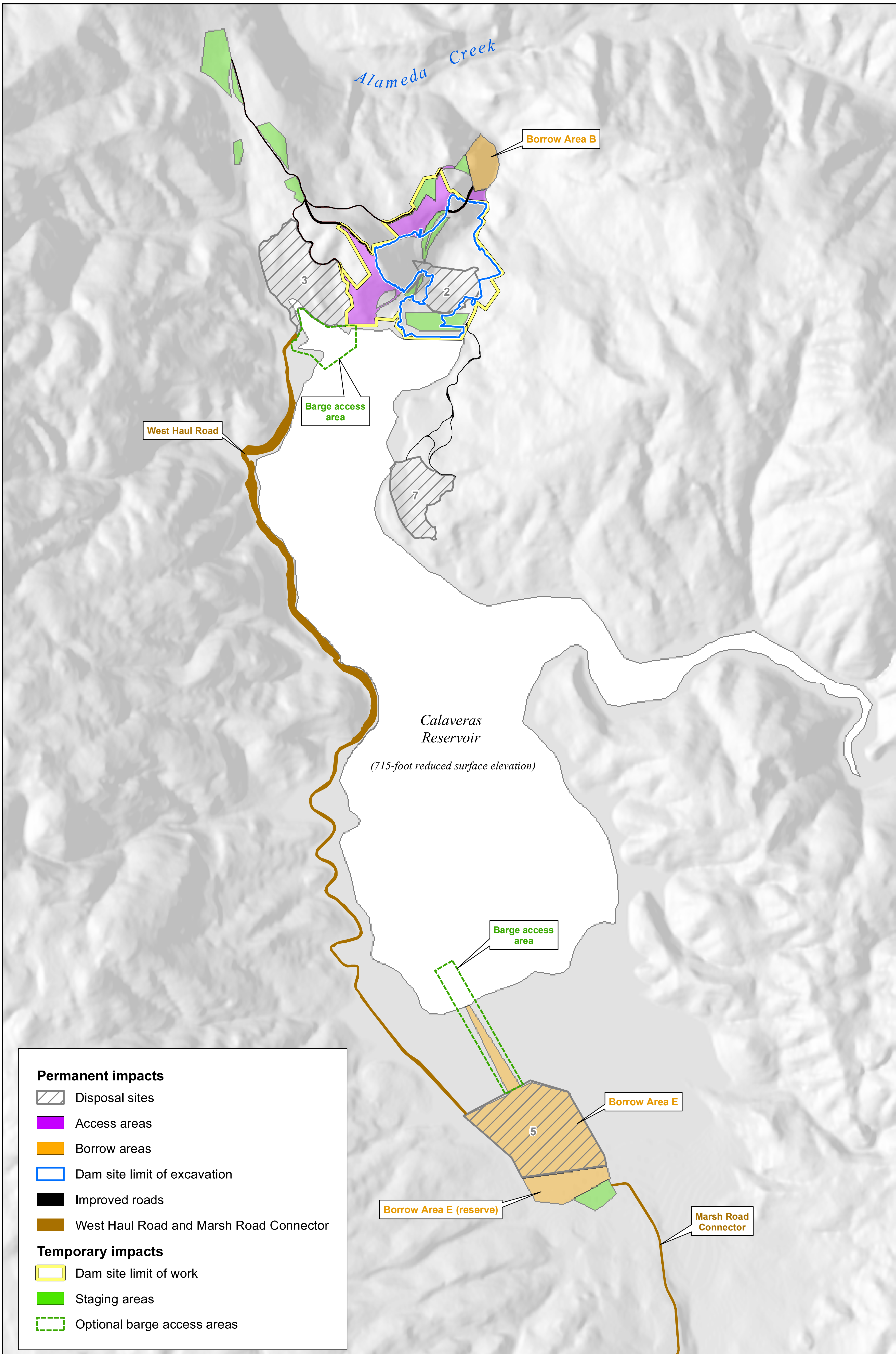
Figure
1

URS Corporation - Oakland CA - C.Raumann L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Disposal Options\Fig1_LocationMap.mxd - 10/19/2007 @ 10:28:39 AM



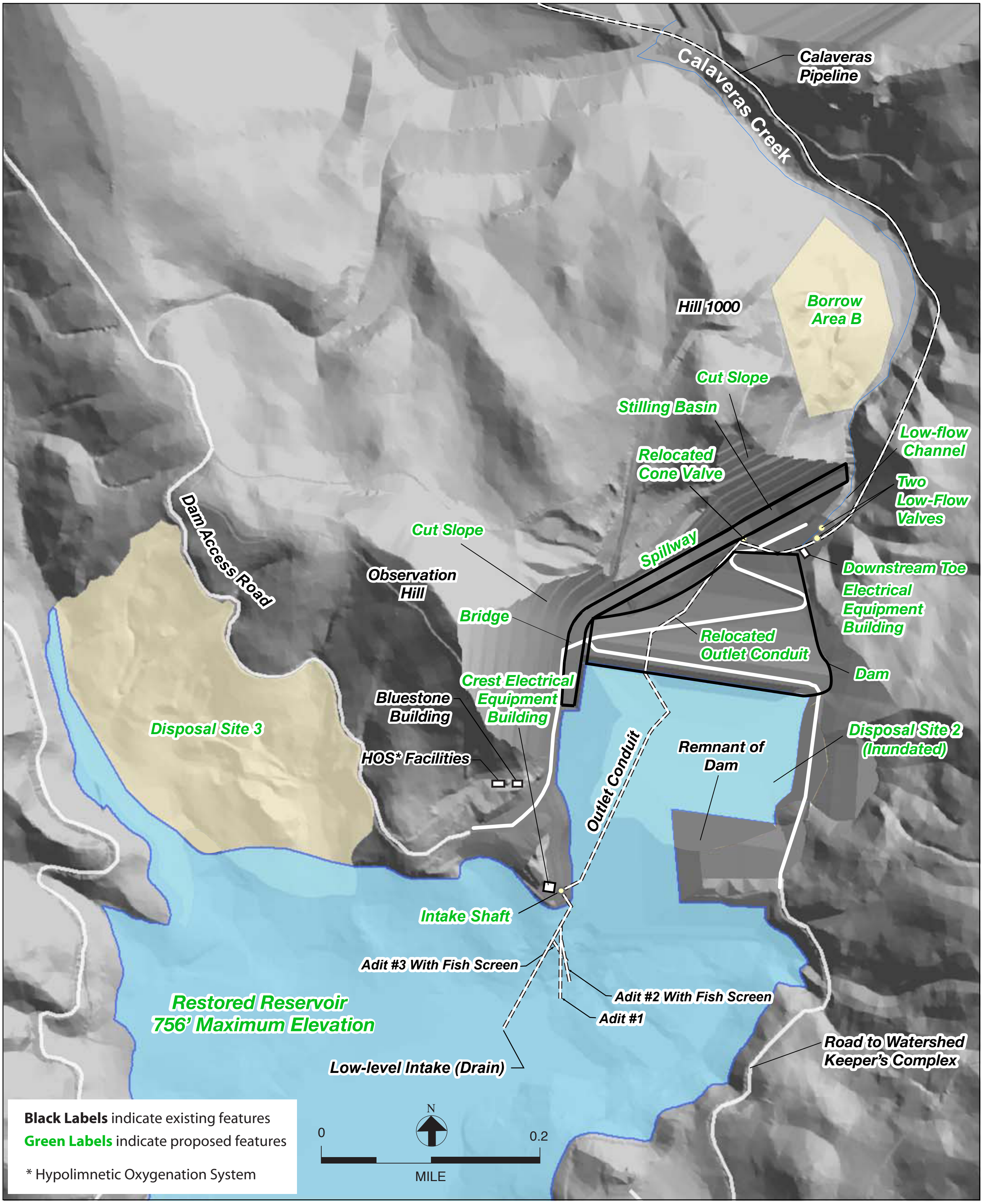
SOURCE: ESA + Orion

Figure 2
Overview of SFPUC Regional Water System
and Water Supply Watersheds



N SCALE 1:18,500 0 500 1,000 2,000 FEET	URS	SFPUC CALAVERAS DAM REPLACEMENT PROJECT PROJECT NO. 26815610	**FINAL PROJECT COMPONENTS**	Figure 3

URS Corp, Oakland CA, C.Raumann L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Project Components\Fig1_Final_Project_Components.mxd - 9/29/2009 @ 1:58:24 PM



SOURCE: EDAW & Turnstone JV

FIGURE 4: PROPOSED PLAN OF DAM AREA

Sand and gravel for filters, drains, and concrete aggregate would be imported from off-site commercial sources. The closest source is about 7 miles north of the dam site, on Calaveras Road at the Sunol quarries. Although this is the closest source, the contractor would determine which source it would use.

Table 1
Comparison of the Existing Dam and the Proposed Replacement Dam

Dam Characteristic	Existing Dam	Replacement Dam
Type of construction	Earthfill, part hydraulic sluiced, clay core	Earth and rock fill with clay core
Volume	3.461 million cubic yards	2.772 million cubic yards
Height: toe to dam crest	210 feet	210 feet
Crest elevation	778.6 feet	772 feet[1]
Crest length	1,200 feet	1,210 feet
Freeboard: spillway crest to top of dam[1]	22.4 feet	15.8 feet
Footprint	18 acres	18 acres
Width at base	1,510 feet	1,180 feet
Width at crest	80 feet	80 feet
Minimum reservoir level	690 elevation in feet	690 elevation in feet

Notes:
[1] Because the new spillway would be larger than the existing spillway, the replacement dam crest would be lower by 6.6 feet than the existing dam.

Table 2
Sources of Construction Materials for the Calaveras Dam Replacement Project

Source of Material	Source Location	Type of Material	Amount and Method of Excavation	Amount and Use in Dam Construction1	Post-Construction Disposition
Spillway Excavation	Western end (left abutment) of proposed dam	Temblor Sandstone	1.87 million cy excavated by blasting or ripping techniques	1.47 million cy used for downstream embankment shell and right abutment landslide stabilization buttress	Spillway for replacement dam
Borrow Area B	North of proposed dam site, north of Hill 1000	Blueschist/ greywacke	685,000 cy overlain by 140,000 cy of Temblor Sandstone (additional 530,000 cy reserve). Temblor Sandstone removed by ripping or blasting; blueschist/greywacke removed by blasting	About 856,000 cy used for rockfill, and riprap	After construction, area will be contoured for drainage and, where possible, revegetated
Borrow Area E	Southern end of reservoir	Alluvium/ Clay	840,000 cy (900,000 cy reserve), obtained by mechanical excavation only; no blasting required	About 755,000 cy used for the core of the dam	After construction, most of the area will be graded to drain and inundated when the reservoir is refilled
Off-site Commercial Sources	To be determined	Sand and gravel	To be determined	298,000 cy used for filters, drains, and concrete aggregate	Not part of the Proposed Project

Notes:
cy = cubic yards
1 The total adds up to 3.29 million cy, which is more than the 2.77 million cy. The difference is due to the amount of material to be used in the right abutment stabilization buttress, which is not counted in the total for the new dam.

3.2.1.2 SPILLWAY AND STILLING BASIN

The new spillway would be constructed at the western end (left abutment) of the dam and would be larger than the existing spillway. The ungated entrance to the spillway would be a 78-foot by 307-foot L-shaped apron at elevation 748. The entrance would lie between two approach walls.

The spillway crest would be a weir at elevation 756 feet. After flowing over the crest, spill flows would be directed first through a 550-foot long chute at a 3 percent slope that would turn to the right, then through a 550-foot long steeper (30 percent slope) straight section. The spillway chute downstream of the crest would be a rectangular, concrete-lined, channel that would narrow from 80 feet wide at the entrance to 60 feet wide at the top of the 30 percent sloping straight section. The lower part of the spillway would include chute blocks that would break the speed and energy of the flow in the spillway as it discharges into the stilling basin.

The concrete-lined stilling basin reduces the velocity of water flowing in the spillway before being discharged into Calaveras Creek. The stilling basin would be 80 feet wide by 155 feet long, 14 feet deep and at elevation 542 feet.

3.2.1.3 DISCHARGE CHANNEL

Below the stilling basin would be a discharge channel, 50 feet wide by 400 feet long, to provide the connection between the stilling basin and Calaveras Creek. This discharge channel, which would be excavated in rock, would discharge into Calaveras Creek, 1,200 feet below the current discharge location, just downstream of the existing U.S. Geological Survey stream gauge. If the quality of the rock is poor, the bottom of the channel would be stabilized with three grade control cut-off walls. Otherwise, the channel will be left in bare rock. The overall length of the spillway, including concrete approach, crest, chute, stilling basin, and discharge channel, is expected to be about 1,950 feet.

3.2.1.4 BORROW AREAS

There are two on-site borrow areas (Borrow Areas B and E) for obtaining construction materials at the site. A third on-site borrow area is the excavation area for the new spillway.

BORROW AREA B AND SPILLWAY EXCAVATION

No features under the jurisdiction of the USACE would be affected by using Borrow Area B or the spillway excavation.

BORROW AREA E

Borrow Area E is at the southern end of the reservoir. This 85-acre site would be excavated to a depth of 10 to 20 feet using conventional excavation methods. Salvaged topsoil would be stockpiled in an area outside of jurisdictional waters. Transportation of clay from this area to the dam site would occur via either haul road or by barge (see Section 3.3.3 for details). The construction contractor may place surplus material from other construction and mitigation areas in Borrow Area E after clay materials are removed. After construction, the excavated portions of Borrow Area E would be graded to facilitate drainage and the development of seasonal wetlands when the reservoir is refilled.

3.2.1.5 DISPOSAL SITES

Disposal sites would be required for unsuitable and excess material generated from the excavation associated with the foundation, spillway, borrow areas, haul roads, staging areas, and partial removal of the existing dam. After extensive analysis to minimize the adverse effects of this activity on waters of the United States (see Appendix A), the SFPUC identified four disposal sites (Disposal Sites 2, 3, 5, and 7) (Figure 3). Soil and rock from the Franciscan Complex may contain concentrations of NOA. With the exception of rockfill from the upstream side of the existing dam and the toes of the disposal sites, excavated materials that potentially contain NOA would be placed in disposal sites at or above elevation 760 feet (4 feet above the proposed normal maximum reservoir surface elevation of 756 feet) to prevent NOA from contacting the reservoir surface water. Topsoil would be stripped and stored before excess rock and spoil are deposited. Spoil material would be deposited and spread in appropriately sized lifts, and then compacted with bulldozers.

At project completion, disposal sites would be contoured to blend into the existing topography and graded to have slopes no steeper than 3:1 (3 horizontal to 1 vertical). The topsoil would be replaced on the final grade and portions of the disposal sites that would not be inundated after the reservoir fills would be hydroseeded with native plant species.

At Disposal Sites 3 and 7, rock-lined swales to either infiltrate or divert surface water runoff would be installed on 10-foot-wide benches placed at 50-foot vertical intervals. Surface runoff upslope of the disposal sites would be collected in swales, routed around the disposal sites, and allowed to infiltrate to reduce surface water volume near the disposal sites. These features would use natural materials to simulate the natural environment as much as possible. Swales would not be necessary at Disposal Site 2 or optional Disposal Site 5 because these sites would be underwater following project completion.

Work at Disposal Sites 3, 5, and 7 would affect jurisdictional features and is described below. Work at Disposal Site 2, which would be between the existing dam and the proposed dam, would result in discharges to jurisdictional features; fill at this site is described under activities associated with the Dam Site. Disposal Site 2 would be entirely inundated when the reservoir is restored to normal capacity and returned to open water.

DISPOSAL SITE 3

Disposal Site 3 would be located to the west of the existing dam, above the northwestern corner of the reservoir, alongside Calaveras Road. A rock-filled dike would be constructed across the drainage at the southwestern corner of the site that would extend below the restricted reservoir water level to about elevation 700 feet. The dike would consist of 55,000 cubic yards (cy) of hard rock blueschist and would have a top elevation of 730 feet. The dike would retard erosion of the fill edge when the water line is at elevation 730 feet or less.

Approximately 2.25 million cy of material would be placed behind the dike in a 39-acre area, 7.3 acres of which would be below the normal maximum water surface elevation of 756 feet when the reservoir is refilled. This disposal site would slope upward to the northeast to a maximum elevation of 960 feet. The final grade of the site would be configured to allow revegetation and would include a re-contoured drainage channel at the western side of the fill; the fill would approximate the contours of the adjacent hilly topography.

The soil and rock material that would be placed in Disposal Site 3 would permanently fill wetlands and other waters of the United States. The affected wetlands include both linear drainage features and a portion of the open water in the reservoir.

DISPOSAL SITE 5

Disposal Site 5 would be located entirely within the excavated portion of Borrow Area E. This disposal site would be used if the amount of surplus rock and soil exceeds the capacity of Disposal Sites 2, 3, and 7, or if local disposal is needed for materials from the barge option. Disposal Site 5 would also be used, if needed, for surplus rock and soil generated by activities proposed at the South Calaveras Mitigation Area. Due to construction sequencing, this site would not be available until the third construction season. Materials that could potentially contain NOA would not be placed in this disposal site. When the reservoir level is restored to elevation 756 feet, most of this site would be under water (URS 2008a).

The soil and rock material that would be placed in Disposal Site 5 would permanently fill waters of the United States.

DISPOSAL SITE 7

Disposal Site 7 would be located on the eastern side of the reservoir south of the existing dam. This site would accommodate approximately 1.06 million cy of material and occupy approximately 17 acres, 0.4 acre of which would be below the normal maximum water surface elevation of elevation 756 feet when the reservoir level is restored.

This disposal site would slope upward to the east to a maximum elevation of 870 feet. Water from the seeps and seasonal wetlands within the footprint of the disposal site would be collected and conveyed under the disposal site to the reservoir through sand and gravel filter drains. The disposal site would be revegetated by hydroseeding with a native grasses erosion control seed mix.

Use of Disposal Site 7 would permanently fill wetlands and other waters of the United States.

3.2.1.6 ALAMEDA CREEK DIVERSION DAM BYPASS TUNNEL FACILITY

The Alameda Creek Diversion Dam (ACDD) is an existing dam on Alameda Creek, 9,700 feet northeast of Calaveras Dam. Constructed in 1931, the 30-foot-high dam is used to divert water into a diversion tunnel that carries 650 cubic feet per second (cfs) flow from Alameda Creek to Calaveras Reservoir. SFPUC proposes to construct, as part of the Proposed Project, a tunnel through the ACDD that would bypass flows down Alameda Creek for resident and anadromous fish species when water is present. This feature would consist of a bypass tunnel through the ACDD abutment and a control gate.

3.2.2 TEMPORARY PROJECT COMPONENTS

The Proposed Project includes temporary components whose construction would involve the discharge of fill material to jurisdictional features. These components are staging areas, access roads, and haul routes.

3.2.2.1 STAGING AREAS

Figure 3 identifies the construction staging areas. The proposed staging areas would be required for the contractor's and SFPUC's office trailers, an on-site soils testing laboratory, equipment and maintenance yards, and construction materials storage, and for stockpiling imported filter, drain, and aggregate materials. The combined total extent of the staging areas would be approximately 35.4 acres. Staging Area 1 would affect jurisdictional features.

3.2.2.2 ACCESS ROADS AND HAUL ROUTES

Construction traffic would use existing public roads and SFPUC private roads in the SFPUC watershed area to import materials and to transport construction equipment. Some of the SFPUC roads would require improvements, and additional temporary roads would be constructed.

The SFPUC has worked closely with the IATF regulatory agencies to locate and design roads in a manner that would avoid or minimize potential impacts (URS 2008b). One access road (Borrow Area E Access Road) would be constructed from Marsh Road to Staging Area 11 on the southern side of Borrow Area E. This road would be 0.69 mile long and would be west of Calaveras Creek. This access road was selected to avoid a crossing of Calaveras Creek that would have required installation of a culvert or other fill in the stream channel (SFPUC 2007b). The roads that would affect waters of the United States are described below.

The existing dam access road (Figure 4) is a 1.2-mile stretch of single-lane roadway connected to Calaveras Road. The dam access road would require improvements for construction traffic. One haul road would be on the northeastern side of the reservoir and would use an existing road alignment, extending between the dam and Disposal Site 7. This route would be about 1 mile long and would cross several minor drainages where culverts would be required; thus, it would fill waters of the United States. This route would end at Disposal Site 7 and would become a permanent road.

Two options[2] are proposed to haul material between Borrow Area E/Disposal Site 5 and the dam site. SFPUC has requested that both options be included in the individual permit for this project to provide flexibility during project implementation to avoid potential impacts to bald eagle. The two options for this haul route are a temporary haul road on the western shore of the reservoir (Option 1), and facilities to allow material to be transported by barge (Option 2):

- Haul Route Option 1 (West Haul Road) (Figure 3). This route would require construction of a new haul road that, after refilling of the reservoir, would eventually lie mostly below the restored normal maximum water surface elevation of 756 feet. This new haul road would be 3.4 miles long and would cross several minor drainages, requiring culverts at these drainage locations. It would disturb approximately 35 acres of land, 32 acres of which would eventually be inundated.
- Haul Route Option 2 (Barge) (Figure 3). This option involves using barges to transport material from Borrow Area E across the reservoir. This option would require temporary docking facilities, likely rockfill jetties, up to 1,000 feet long and 50 feet wide, to be constructed at Borrow Area E and either a floating dock or two jetties up to 500 feet long and 50 feet wide (approximately 6,000 cy each) to be constructed at the northern end of the reservoir, adjacent to Disposal Site 3. The approximate disturbed area for construction of the loading docks would be 2.5 acres.

3.3 CONSTRUCTION AND OPERATION PLAN

3.3.1 CONSTRUCTION SCHEDULE

The estimated duration of construction would be approximately 4 years, which is the shortest feasible duration the SFPUC could establish by incorporating two 10-hour shifts, six days a week. Major work activities that would affect wetlands and other waters of the United States during various construction seasons are summarized in Table 3.

2 SFPUC anticipates that the contractor would construct only one of these options; however, the SFPUC is seeking permit coverage for both options to provide necessary flexibility in the event that one of the routes becomes infeasible. Once the contractor selects a preferred method for hauling materials between the dam site and Borrow Area B/Disposal Site 5, the SFPUC would notify the USACE of the selected option and provide applicable mitigation to address the resulting impacts.

Table 3
Major Construction Activity Resulting in a Discharge of Dredged or Fill Material by Construction Season

Type of Activity	Construction Season 1	Construction Season 2	Construction Season 3	Construction Season 4
Dam Site	X	X	X	
Staging Area 1	X			
Borrow Area E / Disposal Site 5			X[1]	X[1]
Disposal Sites 3 and 7	X	X		
Haul Roads/Alternatives				
Dam Site Road	X			
Disposal Site 7	X			
Western Haul Road Alternative		X		
Barge Alternative		X		
ACDD		X		

Note:
[1] Excavation begins in Borrow Area E. Disposal (Site 5) may occur during these construction seasons.
Source: URS 2009.
ACDD = Alameda Creek Diversion Dam

3.3.2 AVOIDANCE AND MINIMIZATION MEASURES

The Proposed Project has been designed to avoid and minimize impacts to waters of the United States to the greatest extent feasible. The following presents a brief summary of various avoidance and minimization measures.

3.3.2.1 PLANNING/DESIGN AVOIDANCE AND MINIMIZATION MEASURES

Over the last five years, SFPUC has refined the site planning and design of the CDRP to avoid or minimize impacts to waters of the United States, special status species, sensitive natural communities, water quality, and cultural resources, among other environmental factors. An environmental constraints analysis described and evaluated environmental considerations that may constrain dam design and selection of dam replacement/retrofit alternatives then under consideration (URS 2005a). While the conclusion was that each alternative will likely affect special status species, cultural resources and water quality, some alternatives are identified as potentially more desirable from the standpoint of affecting fewer resources. The SFPUC concluded that a replacement dam constructed downstream with the same storage capacity would have fewer substantial impacts to biological and cultural resources (URS 2005a).

From this original conclusion and subsequent conceptual engineering report (URS 2005b), SFPUC fined tuned the design in consultation with the regulatory agencies to further avoid or minimize impacts not only to waters of the United States, but to grassland, woodland, and Diablan sage scrub habitats. For example,

- Seven disposal sites were originally evaluated and that number has been reduced to three primary sites and one reserve site. Furthermore, based on regulatory agency comments, SFPUC reduced the footprint of Disposal Site 3 to minimize impacts to a perennial stream, while the total area of Disposal Site 7 was modified to avoid all of the known occurrences of most beautiful jewel-flower (a special-status species).

- Several routes were evaluated to haul material excavated from Borrow Area E to the dam site. A haul road on the east side of the reservoir was dropped from consideration. This proposed eastern haul road would have used an existing road to an area where it would cross over Arroyo Hondo, requiring the construction of a floating bridge over Arroyo Hondo. Once across Arroyo Hondo, south to Disposal Site 5, the eastern haul road would have required new road construction. The existing portion of the proposed eastern haul road would need to be widened to accommodate trucks. Widening would have filled seasonal and seep wetlands, ephemeral drainages, and seasonal streams. The southern portion of the eastern haul road (the new section of road) would have crossed California tiger salamander critical habitat and possibly callippe silverspot butterfly habitat. Furthermore, it may have filled ephemeral drainages and it would have filled some of the large seasonal wetland area south of the current reservoir. Unlike the proposed west haul road, the portion of the eastern haul road south of the proposed floating bridge would be *above* the restored reservoir elevation. Cultural resources would have been damaged or lost. Because of these considerations, the east side haul road was dropped from consideration by the SFPUC in 2006.

- The conceptual engineering report (URS 2005b) identified five potential borrow areas. However, three borrow areas were subsequently eliminated, in part, to avoid or minimize impacts to sensitive aquatic and upland habitats.

3.3.2.2 SFPUC STANDARD CONSTRUCTION MEASURES

The SFPUC has committed to implementing all relevant SFPUC Standard Construction Measures (SCMs) as part of the Proposed Project. Listed below, the SCMs aim to reduce impacts on existing resources to the extent feasible (SFPUC 2007a). Many, if not all, of these measures, have been implemented or included in project design and planning:

- On-Site Air and Water Quality Measures during Construction: All construction contractors must take measures to minimize fugitive dust and dirt emissions resulting from the construction, and implement measures to minimize any construction effects on local water quality, including a local storm drain system or watercourse. These measures could include preparation of a Stormwater Pollution Prevention Plan (SWPPP), if required by the Bay Area Regional Water Quality Control Board. Erosion and sedimentation controls tailored to the site and project

- Groundwater: If groundwater is encountered during any excavation activities, the construction contractor shall prepare a dewatering plan so that water is discharged to the stormwater system in compliance with the local standards and discharge permit requirements.

- Biological Resources: As an initial matter, SFPUC project managers will screen the project site and area to determine whether biological resources may be affected by construction activities. In the event further investigation is necessary, the SFPUC will comply with all requirements for investigation, analysis and protection of biological resources.

3.3.2.3 FISHERY RELEASES

In 1997, CDFG and SFPUC signed an MOU in which SFPUC agreed to release up to 6,300 af per year of water for enhancement of fisheries and the other natural resources of Alameda Creek once a recapture facility was constructed downstream.[3] The SFPUC is currently proposing to make the MOU flow releases. To meet the MOU total flow requirement of 6,300 acre-feet per year (afy), and seasonal flow and ramping requirements, winter and spring flows would be met to the extent possible by allowing water to flow through the proposed ACDD bypass tunnel rather than diverting it into the diversion tunnel to Calaveras Reservoir. All flows in upper Alameda Creek are natural, that is, there is no storage facility above the ACDD and the ACDD itself provides no storage of note. Thus, when bypass flows available from upper Alameda Creek do not meet the level required by the MOU or the Water System Improvement Program (WSIP) Final Programmatic EIR mitigation measure 5.4.5-3a, “Minimum Flows for Resident Trout on Alameda Creek” (ETJV 2009a), flow would be supplemented as necessary with releases from Calaveras Dam, using the proposed new low-flow valves that would be installed there for this purpose. Fishery releases would not result in the discharge of dredged or fill material.

The SFPUC has also committed to releasing additional flows (up to 42 cfs in wet years) past ACDD and/or out of Calaveras Dam when NMFS has determined that steelhead are present above the BART weir (SFPUC 2009). The flow schedule is currently in review with NMFS and may be revised during Section 7 consultation.

3.4 MITIGATION FOR UNAVOIDABLE IMPACTS TO WATERS OF THE UNITED STATES

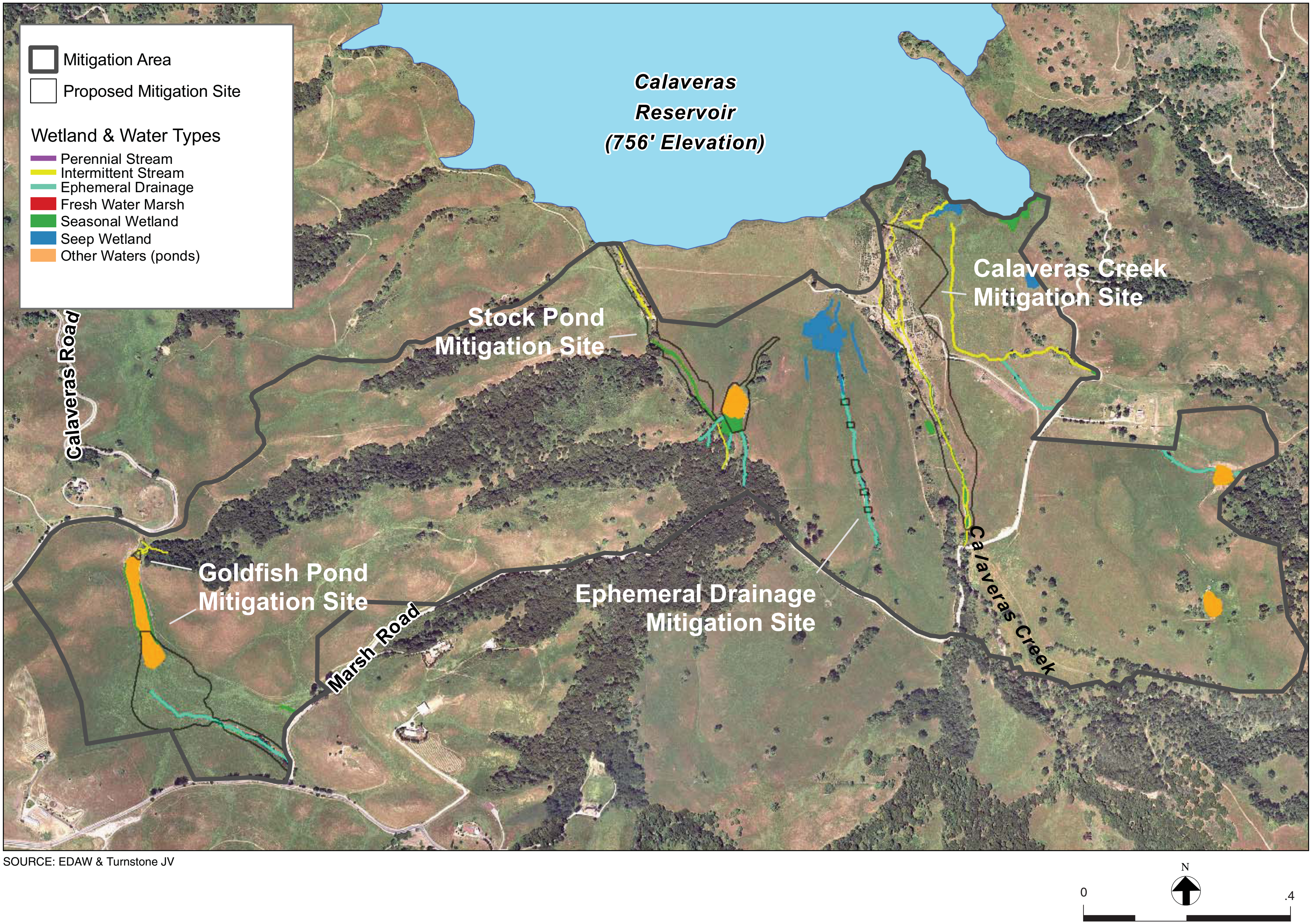
The SFPUC has worked continuously with the regulatory agencies since 2005 to identify compensation locations and activities that would most appropriately mitigate the Proposed Project’s potential impacts to waters of the United States. The SFPUC proposes to provide permittee-responsible compensatory mitigation. The option of using a mitigation bank or in-lieu fee program per the USEPA/USACE final rule on “Compensatory Mitigation for Losses of Aquatic Resources,” (Federal Register Vol. 73, No. 70, April 10, 2008), is not a viable option, as there are no available mitigation banks within the Alameda Creek watershed or within Alameda or Santa Clara counties (USACE and USEPA 2008). Furthermore, there are no in-lieu fee programs for wetlands (Smith, pers. com., 2009).

The SFPUC has utilized a watershed approach to developing the proposed mitigation for the CDRP. All of the proposed mitigation sites are located on SFPUC lands within the Alameda and San Antonio Creek watersheds. The mitigation and monitoring plans prepared for the CDRP (to be submitted separately) outline measurable performance standards, monitoring, and long-term protection, including financial assurances consistent with the final rule. The SFPUC will submit a comprehensive Mitigation and Monitoring Plan to the USACE in 2009 to address potential impacts to wetlands, waters, wildlife, vegetation, and listed species including California tiger salamander, California red-legged frog, callippe silverspot butterfly, and Alameda whipsnake.

[3] The measuring point for compliance with the 1997 MOU’s flow requirements is Alameda Creek immediately below the confluence with Calaveras Creek.

Mitigation for all project impacts to waters of the United States will occur at two locations:

- South Calaveras Mitigation Area: a 641-acre area south of Calaveras Reservoir (Figure 5).
- San Antonio Mitigation Area: a 327-acre area that includes a 5,600-foot reach of San Antonio Creek upstream of San Antonio Reservoir (Figure 6).

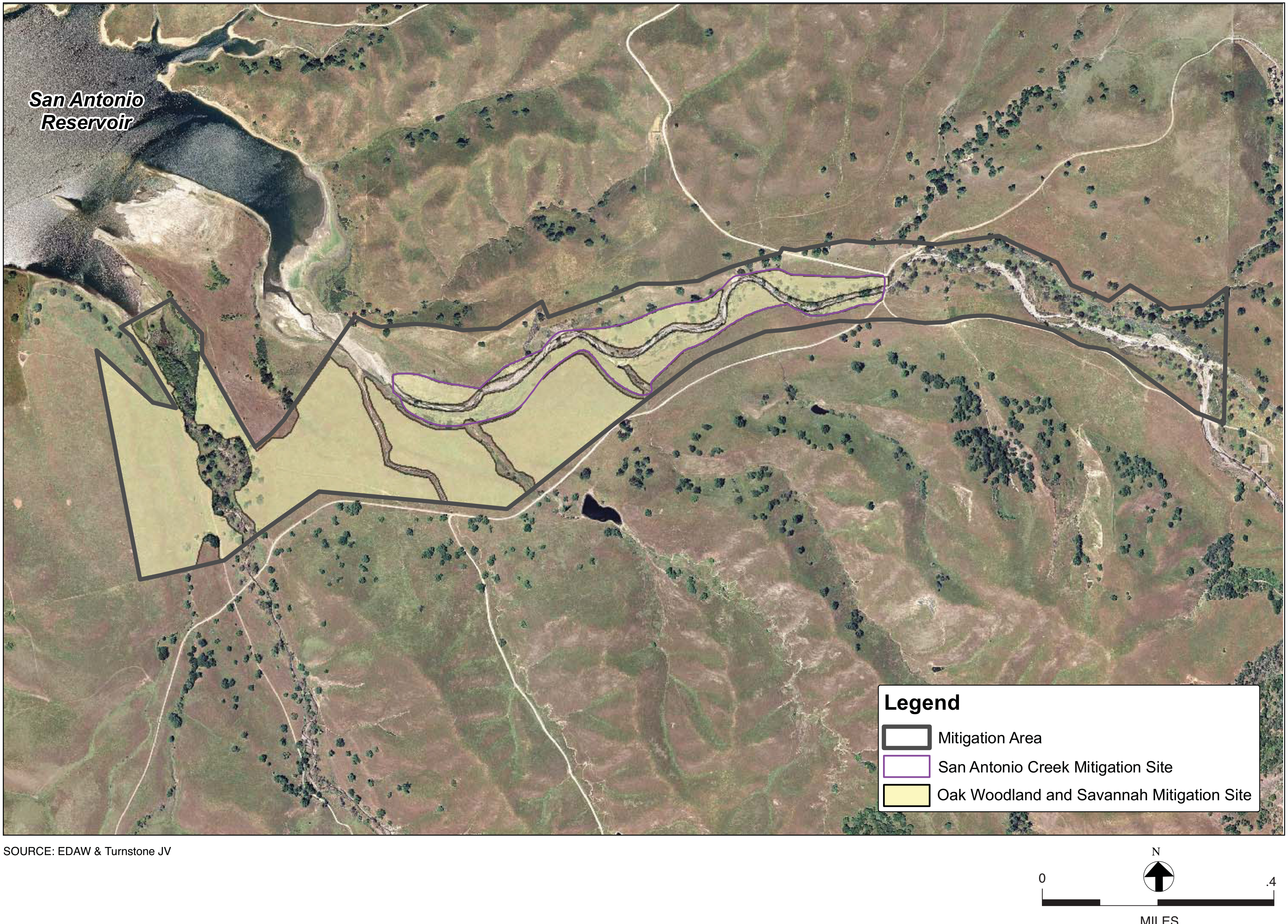


SOURCE: EDAW & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

2005.0161E

FIGURE 5 : WETLANDS AND OTHER WATERS WITHIN SOUTH CALAVERAS MITIGATION AREA AND MITIGATION SITES



SOURCE: EDAW & Turnstone JV

FIGURE 6 : SAN ANTONIO MITIGATION AREA, SAN ANTONIO CREEK MITIGATION SITE, AND OAK WOODLAND AND SAVANNAH MITIGATION SITE

4 WATERS OF THE UNITED STATES AND OTHER BIOLOGICAL RESOURCES IN THE PROJECT AREA

4.1 WATERS OF THE UNITED STATES

Wetlands and other waters were delineated in January, February, and April 2006; July 2007; and January 2008 using USACE approved methods (May & Associates 2006, 2008). The USACE approved the jurisdictional delineation in December 2007 and in January 2009. Within the approximately 2,683-acre verified delineation area, there are approximately 1,050 acres of waters of the U.S. (Table 4), including the 1003-acre reservoir at a restricted surface elevation of approximately 715 feet. Figure 7 shows the locations of wetlands and other waters within the original 2006 and supplemental 2008 delineation areas. When the 2006 wetland delineation was conducted, the 'project' area was much larger, but because of project description refinements to avoid and minimize impacts, the project area around the reservoir has been reduced to the current work limit area.

Table 4
Wetlands and Other Waters within the Jurisdictional Delineation Area

Type	Acres[1]	Linear Feet[1,2]
Wetlands (Waters of the United States)[3]		
Freshwater	1.1	N/A
Seasonal	31.3	N/A
Seep	5.2	N/A
Subtotal	37.6	N/A
Other Waters (Waters of the United States)[3]		
Perennial Stream	1.3	8,934.1
Intermittent Stream	2.1	16,714.3
Ephemeral Drainage	0.9	19,900.8
Open Water (reservoir)	1,003.0	N/A
Open Water (ponds)	4.7	N/A
Subtotal	1,012.0	45,549.2

Note:
[1] Numbers are rounded to the nearest one-tenth.
[2] N/A - linear feet not applicable to non-linear features.
[3] Waters of the United States are inclusive of waters of the State.
Source: May & Associates (2006, 2008).

4.1.1 WETLANDS OCCURRING WITHIN THE JURISDICTIONAL DELINEATION AREA

4.1.1.1 FRESHWATER MARSH

Freshwater marshes are those wetland features that support perennial hydrophytic vegetation such as cattails (*Typha* sp.) and tules (*Scirpus* sp.), willows (*Salix* sp.), and other annual and perennial herbaceous hydrophytic plants common to seep wetlands (such as rushes). Freshwater marshes generally occur near river mouths or adjacent to lakes and springs, and are characterized by a year-round water source. This plant community[4] occurs at one location within the wetland delineation area, at the base of perennial streams where they flow into Calaveras Reservoir.

Freshwater marsh within the wetland delineation area is dominated by hydrophytic herbaceous plants including watercress (*Rorippa nasturtium-aquaticum*), curly dock (*Rumex crispus*), willow herb (*Epilobium ciliatum*), and poison hemlock (*Conium maculatum*), with stands of cattail and Arroyo willow (*Salix lasiolepi*). Other species observed at freshwater marsh wetlands include umbrella sedge or tall flatsedge (*Cyperus eragrostis*), iris-leaved rush (*Juncus xiphioides*), rabbit's-foot grass (*Polypogon monspeliensis*), seep-spring monkeyflower (*Mimulus guttatus*), mule fat (*Baccharis salicifolia*), sedge (*Carex* sp.), spiny cocklebur (*Xanthium spinosum*), stinging nettle (*Urtica dioica*), and horseweed (*Conyza canadensis*).

4.1.1.2 SEASONAL WETLAND

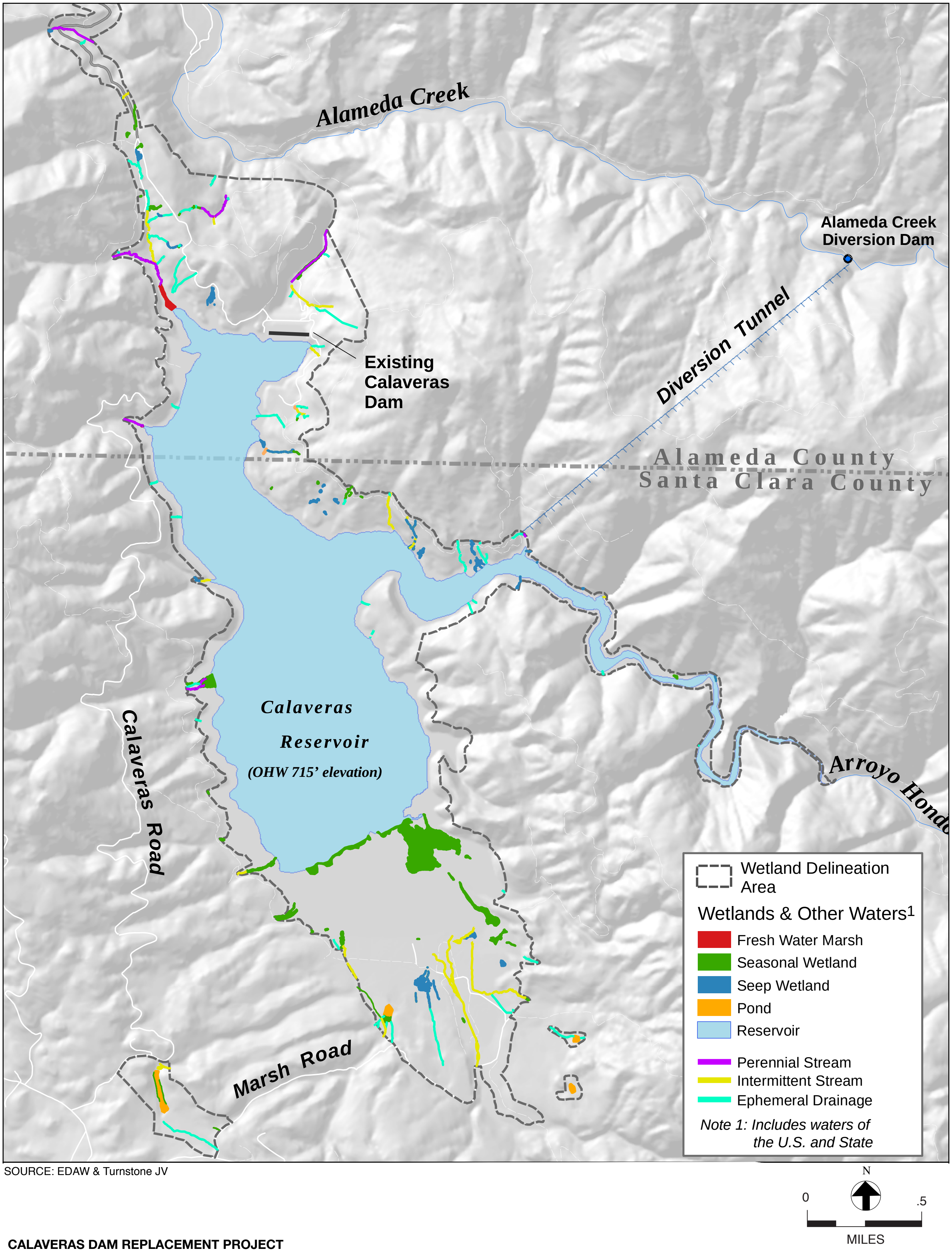
Seasonal wetlands are those wetland features that support annual and perennial hydrophytic vegetation and occur because of saturated soils and/or surface ponding, generally due to a topographic depression or impermeable soils (clay). Many seasonal wetland features occur in topographic depressions in grassland habitat at the base of slopes and/or along roads, or on the edges of ponds and waterways.

The seasonal wetlands within the project area are dominated by annual, marginally hydrophytic plants, the most common including Italian ryegrass (*Lolium multiflorum*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), fiddle dock (*Rumex pulcher*), and sour clover (*Trifolium fucatum*). Other dominant hydrophytic plants include iris-leaved rush (*Juncus xiphioides*), Baltic rush (*Juncus balticus*), Pacific rush (*Juncus effusus* var. *pacificus*), spikerush (*Eleocharis* sp.), curly dock, rabbit's-foot grass, tarweed (*Holocarpha* sp.), manna grass (*Glyceria* sp.), marsh baccharis (*Baccharis douglasii*), swamp timothy (*Crypsis schoenoides*), horseweed (*Conyza canadensis*), spiny cocklebur, cudweed (*Gnaphalium luteo-album*), and Arroyo willow. Plant species composition varies considerably between the seasonal wetlands observed within the wetland delineation area, as evidenced by the number of plant species noted above.

4.1.1.3 SEEP WETLAND

Seep wetlands are those wetland features that support perennial hydrophytic vegetation (such as rushes, spikerushes, and sedges) and occur because of seasonal or perennial groundwater seepage (as opposed to surface ponding from runoff) in grasslands or meadows. Seeps generally occur at grade breaks or intersections of different subsurface strata where groundwater tends to rise to the surface.

[4] The scale of Figure 7 obscures one of the locations of freshwater marsh, which is located south of the freshwater marsh shown on Figure 7 at the base of a perennial stream.



SOURCE: EDAW & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

2005.0161E

FIGURE 7: WETLANDS AND OTHER WATERS IN THE JURISDICTIONAL DELINEATION AREA

This plant community occurs at locations throughout the wetland delineation area, predominantly in the northeastern portion, near the existing dirt access roads where serpentine clay soils are dominant. Many of these features occur in level areas within creeks or drainages, while others occur as isolated features on grassland or exposed rocky slopes.

The seep wetlands within the wetland delineation area are dominated by perennial hydrophytic plants including iris-leaved rush, spikerush, and mexican rush (*Juncus mexicanus*); other dominant hydrophytic plants include herbs (sour clover, fiddle dock, curly dock, and spiny-fruit buttercup [*Ranunculus muricatus*]) and grasses (Mediterranean barley, Italian ryegrass, rabbit's-foot grass, and hairgrass [*Deschampsia* sp.]). Other hydrophytic species at some seep wetlands include hyssop (*Lythrum hyssopifolia*), cattail, creeping wild rye (*Leymus triticoides*), and flowering quillwort (*Lilaea scilloides*). At some seep wetlands, seep-spring monkeyflower, umbrella sedge or tall flatsedge, and watercress are also dominant species.

4.1.2 OTHER WATERS OCCURRING WITHIN THE JURISDICTIONAL DELINEATION AREA

4.1.2.1 STREAMS

The study area contains three major drainages (Calaveras Creek, Arroyo Hondo, and Alameda Creek) that feed Calaveras Reservoir, which contain a mixture of intermittent, ephemeral and perennial drainages. Alameda Creek only feeds Calaveras Reservoir due to the existence of a diversion dam. Its normal course would not feed the reservoir. Arroyo Hondo, on the east side of Calaveras Reservoir, appears to maintain perennial surface flow in most years (JSA 2004). Calaveras Creek above the reservoir and Alameda Creek above the diversion dam maintain only intermittent surface flows, becoming mostly dry by early summer each year (JSA 2004). In addition to these major drainages, there are a number of smaller, unnamed, perennial drainages flowing into the reservoir from the west (JSA 2004).

PERENNIAL STREAM

Perennial streams are defined as linear topographic drainage features that support steady surface water flows throughout the year, including during the dry season in summer and fall (although flows may be limited during this time period).

Most of the perennial streams within the wetland delineation area are 2 to 6 feet wide. A well-defined rocky or gravelly creek bed and distinct banks and steady, fast- and/or large-volume flows observed during the January and February 2006 field surveys generally characterize these features. Perennial streams are differentiated from intermittent streams by comparing flow observations from the delineation survey of January and February 2006 to the observations made during the dry season field assessment of October 2005. The creeks that were flowing or wet during both surveys are classified as perennial streams, while those that were dry during the fall assessment are classified as intermittent streams. Other indicators of flow, similar to those exhibited by ephemeral drainages and intermittent streams but often more pronounced, include bank scouring and/or a "wrack line."

INTERMITTENT STREAM

Intermittent streams are defined as linear topographic drainage features that support steady water flows during the wet season (generally November through April or May), but are dry during the summer and fall.

Intermittent streams ranged from 1 to 20 feet wide. A defined rocky or gravelly creek bed and distinct, unvegetated banks and steady water flows observed during the January and February 2006 field surveys generally characterize these features. Intermittent streams are differentiated from perennial streams (described above) by comparing flow observations from the delineation survey of January and February 2006 to the observations made during the dry season field assessment of October 2005. Other indicators of flow, similar to those exhibited by ephemeral drainages, include bank scouring and/or a "wrack line."

EPHEMERAL DRAINAGE

Ephemeral drainages are defined as linear topographic drainage features that support water flow only during and immediately after storm events, and generally lack a defined creek bed or banks.

Ephemeral drainages ranged from 0.5 – 4 feet wide and were generally dry during the field surveys. These features generally occur because of topography and/or erosion on grassland, scrub, or woodland slopes or along road edges. The ephemeral drainages within the wetland delineation area are generally characterized by a lack of, or a very limited amount of, vegetation growing within the drainage, and a faint water flow pattern exhibited by slight scouring along the edges (resulting in exposed soil or rock), a subtle debris pattern or "wrack line," or all vegetation and/or other in-channel elements laying in the direction of downhill flow.

4.1.2.2 PONDS

The ponds within the study area appear to have been formed artificially by creating a berm within an ephemeral drainage, intermittent or perennial stream, impounding the flowing water. These ponds were created to be used by cattle for drinking water (stock ponds). The ponds within the study area are generally more than 1 to 2 feet deep, and are very sparsely vegetated with hydrophytic vegetation along the water's edge, and with ruderal and annual grassland vegetation along the constructed berms. Ponds typically have emergent or margin vegetation dominated by cattails (*Typha* sp.), tules (*Scirpus californicus*), rushes (*Juncus* sp.), and other sedges (*Scirpus* sp.). Aquatic vegetation such as Eurasian milfoil (*Myriophyllum spicatum*) may also grow in pond habitat. Number ponds exist around the perimeter of Calaveras Reservoir on all sides.

4.1.2.3 CALAVERAS RESERVOIR

The ordinary high water mark of Calaveras Reservoir was found to be at an average elevation of 715 feet, based on a range of Global Positioning System points taken along the reservoir's edge during the January and February 2006 field surveys. The Global Positioning System points were taken where evidence of the reservoir's current ordinary high water mark was observed, which was evidenced by (1) bleaching or staining of rocks and/or vegetation along the shoreline, and/or (2) a "wrack line" of driftwood and other vegetative debris deposited by the reservoir waves during recent periods of high water levels.

4.2 OTHER BIOLOGICAL RESOURCES

4.2.1 NATURAL COMMUNITIES

The study area lies within the central Coast Range. Variation in the physical characteristics of the study area has promoted the development of a range of natural communities. The following four natural communities are the most common in the study area.

Oak Woodlands. Oak woodland is the most common woodland community in the study area. There are large continuous patches of this habitat, particularly on north facing slopes. Several different types of oak woodland occur throughout the Alameda watershed, including those dominated by coast live oak (*Quercus agrifolia*), blue oak (*Quercus douglasii*), and valley oak (*Quercus lobata*).

Riparian Woodlands. Riparian woodlands exist along intermittent and perennial streams within the study area. These woodlands often blend with the adjacent oak woodlands found in upland areas. Several different types of riparian woodland exist in the Alameda watershed, which area characterized by the dominant plant species and hydrological characteristics of the drainage. Typical species include coast live oak, western sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), and willow (*Salix* sp.). Riparian woodlands are particularly well developed along the Arroyo Hondo and Alameda Creek. Other drainages to Calaveras Reservoir have riparian woodlands, but to a lesser extent.

Annual Grassland. Non-native grassland is the most common grassland community type in the study area. It is a herbaceous plant community dominated by non-native annual grasses such as wild oat (*Avena* sp.), brome (*Bromus* sp.), wild barley (*Hordeum* sp.), Italian ryegrass (*Lolium multiflorum*) and annual fescue (*Vulpia* sp.). Serpentine bunchgrass grassland is an uncommon habitat type in the study area, although there are a few small areas near Calaveras Reservoir (JSA 2004).

Scrub/Chaparral. Diablan sage scrub is the only type of scrub or chaparral habitat within the study area (JSA 2004). It is most common on south facing slopes, usually in small patches. Characteristic species include California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), and several sage (*Salvia*) species.

4.2.2 SPECIAL STATUS WILDLIFE SPECIES

Several special status animal species occur within the project area. These species are afforded protections under state and federal endangered species acts. Project planning has emphasized the need to avoid or minimize adverse impacts to these species. As the Proposed Project and its alternatives would affect these species to varying degrees, as noted in Section 5 and Section 6, they are described briefly below.

Alameda Whipsnake (*Masticophis lateralis euryxanthus*). The Alameda whipsnake is a federal and California state threatened species. Historically, this species occurred in the eastern side of the San Francisco Bay region, in Alameda, Contra Costa, and Santa Clara counties. Currently, five remnant populations exist throughout the historical range. The Alameda whipsnake's primary habitat within the study area is Diablan sage scrub. This species may also utilize non-native grasslands and oak woodland as secondary habitat, especially for dispersal. Small mammal burrows or rock outcrops are also important refuge sites for the Alameda whipsnake. Surveys have not been conducted near Calaveras Reservoir, but sightings have occurred within the Alameda Watershed, near San Antonio Reservoir. Primary habitat for this species occurs along throughout northwest side of Calaveras Reservoir and in patches along the remaining borders. All other upland habitat surrounding the reservoir is considered suitable movement habitat.

California Red-Legged Frog (*Rana aurora draytoni*). The California red-legged frog is a federally threatened species and a California state species of special concern. It is the largest native frog in the western U.S. Adult frogs require dense, shrubby or emergent riparian vegetation closely associated with deep (greater than 2 1/3-foot deep) still or slow moving water. The largest densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) in ponds and riparian areas. Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter.

California red-legged frog has been recorded by the USFWS in the study area within Upper Alameda Creek, below the existing Calaveras Dam (JSA 2004). Several drainages on the western and southern sides of Calaveras Reservoir are considered suitable breeding habitat for this species (JSA 2004). Multiple ponds on all sides of the reservoir are considered highly suitable breeding habitat, most of which are more than ¼ mile from the reservoir. Virtually all of the remaining upland habitat around the reservoir is considered suitable migration and aestivation habitat (JSA 2004).

Foothill Yellow-Legged Frog (*Rana boylii*). The foothill yellow-legged frog is a state species of concern. This is a moderate-sized frog with highly variable coloration. The foothill yellow-legged frog requires shallow, flowing water, in small to moderate-sized streams with at least some cobble-sized substrate (Hayes and Jennings 1988, Jennings 1988) for breeding and refuge. This species is infrequent or absent in habitats where introduced aquatic predators (i.e., various fishes and bullfrogs) are present.

In California, *R. boylii* was historically distributed throughout the foothill portions of most drainages from the Oregon border to the San Gabriel River. Within the vicinity of Calaveras Reservoir, “core” foothill yellow-legged frog habitat is considered to be three drainages on the western side of the reservoir, Alameda Creek, and the upper Arroyo Hondo drainage. Most of the other drainages surrounding the reservoir are considered low-use areas. Foothill yellow-legged frog has been recorded in Arroyo Hondo and is considered fairly abundant in that location (Sak 2004).

Western Pond Turtle (*Clemmys marmorata*). The western pond turtle (*Clemmys marmorata*) is a federal and California state species of concern. Western pond turtles range throughout the state of California, from southern coastal California and the Central Valley, east to the Cascade and Sierra Nevada mountains. Western pond turtles occur in a variety of permanent and intermittent aquatic habitats, such as ponds, marshes, rivers, streams, and ephemeral pools. They require suitable basking and haul out sites, such as emergent rocks or floating logs. In addition, western pond turtles require an upland oviposition site such as grassy, open fields. This species may spend the winter in an inactive state, on land or in the water, and has been documented hibernating up to 350 meters (1,100 feet) from a watercourse, immediately adjacent to a watercourse (Jennings and Hayes 1994), and underwater in mud (Zeiner et al. 1988). Upland hibernaculae may include any type of crack, hole or object that a turtle seeking cover might squeeze into or burrow under.

Within the study area, western pond turtles have been documented within the Arroyo Hondo drainage (Sak 2004). Although no additional studies have been conducted, it is likely that Alameda Creek and the majority of drainages into Calaveras Reservoir would provide suitable habitat for western pond turtle.

California Tiger Salamander (*Ambystoma californiense*). The California tiger salamander is listed as threatened under the federal ESA, and is a California state species of special concern. Six populations of this species remain in California. California tiger salamander is a grassland species which breeds in temporary ponds or pools, and slower parts of streams. They also require upland refuge sites during the dry season, typically burrows or cracks in the ground.

There are two known records of the California tiger salamander within one mile of the Calaveras Reservoir, and many other suitable breeding ponds, primarily at the south end of the reservoir. Virtually all upland habitats adjacent to the reservoir are considered suitable migration and aestivation habitat for this species (JSA 2004).

Golden Eagle (*Aquila chrysaetos*). The golden eagle is a California state fully protected species and a species of special concern. It occurs as a permanent resident in areas of California, including the Alameda watershed area near Calaveras watershed. This species prefers rolling hills and mountainous areas. This species nests in large trees and rocky cliff ledges. Golden eagles are documented in the vicinity of the study area near the headwaters of Calera Creek in Ed Levine County Park, 2 miles west of Calaveras Reservoir (CDFG 2004).

White-tailed Kite (*Elanus leucurus*). The white-tailed kite is a California fully protected species. White-tailed kites are year-round residents of coastal California in low-lying areas. This species breeds in lowland grasslands, agriculture, wetlands, oak-woodland and savannah habitats, and riparian areas associated with open areas (PRBO 2004). They are typically found foraging in open grassland or agricultural areas, feeding on small mammals, birds and reptiles. They nest in tall trees near grassland or agricultural foraging areas, and riparian areas are thought to be their historical preference for breeding. White-tailed kites may also breed the project area. This species has the potential to utilize open areas and grasslands in the project area for year-round foraging habitat.

Bay Checkerspot Butterfly (*Euphydryas editha bayensis*). The Bay checkerspot butterfly is a federally threatened species, which historically occurred throughout the San Francisco Bay region. There are two known populations of this species, one in Santa Clara County, and one in San Mateo County. However, the USFWS considers any appropriate habitat within the species former range to be potentially suitable (JSA 2004). Suitable habitat includes serpentine grasslands. However, surveys conducted in 2004 around Calaveras Reservoir for this species did not reveal any butterflies (Arnold 2004).

Callippe Silverspot Butterfly (*Speyeria callipe callipe*). The Callippe silverspot butterfly is a federally endangered species which occurs in grasslands where its single plant source food, Johnny jump-up (*Viola pedunculata*) occurs. Surveys for this species were conducted around Calaveras Reservoir in 2004, but no individuals were observed (Arnold 2004).

Rainbow Trout/Steelhead (*Oncorhynchus mykiss*). The rainbow trout is a cold water species that occurs in Calaveras Reservoir, in its major tributary (Arroyo Honda), and in Alameda Creek. In winter, adults in the reservoir move upstream to spawn in Arroyo Hondo; approximately 1.8 miles of this stream (closest to the reservoir) provide suitable spawning habitat for this species (Sak 2004). Although suitable habitat exists for approximately 6.0 miles above that, the fish are likely blocked by landslide debris on Arroyo Hondo, approximately 1.8 miles above the reservoir (Sak 2004; Entrix 2003).

Steelhead are rainbow trout that are anadromous. Steelhead occur in the lower reach of Alameda Creek, but are currently unable to migrate above the BART weir (located approximately 9 miles upstream of San Francisco Bay). No steelhead were observed in Calaveras Creek during electrofishing surveys in 1999, 2000, or 2001 (SFPUC 2004a); however, it is anticipated that steelhead will re-inhabit the area once passage is provided downstream at the BART weir.

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5 PROPOSED PROJECT IMPACTS TO WATERS OF THE UNITED STATES

The design of the Proposed Project avoids and minimizes potential impacts to wetlands and other waters of the United States to the maximum extent practicable. The effects of construction on these areas are categorized as permanent or temporary. Permanent effects include loss of waters in areas that would be substantially altered or would not be restored after construction, such as the location of the new dam, borrow areas, disposal sites, and haul routes. Temporary effects include activities that would affect waters of the United States during the construction period. These activities include dam site construction, staging areas, disposal sites, and haul routes. Temporary impacts to jurisdictional wetlands and other waters would be restored after construction is complete.

The Proposed Project would result in the discharge of fill material to wetlands and other waters of the United States at several locations. The area of permanent fill would be 6.79 acres; the area of temporary fill would be 18.88 acres.

Table 5 provides a breakdown of the type of material being discharged and the amount in cubic yards (by location). Because of the scale of the project, Table 5 presents the major locations (e.g., dam site or haul road) but not individual locations where a specific fill activity (such as the installation of a culvert) will occur.

Table 5
Discharge Locations, Type of Material Discharged, and Fill Volume

Location	Type of Material	Type of Waters	Estimated Permanent Fill in Waters of the United States (cubic yards)[1]	Estimated Temporary Fill in Waters of the United States (cubic yards)[1]
Dam Site	Rock, soil, and gravel	Ephemeral Drainage	33.44	17.15
		Intermittent Stream	96.31	27.15
		Perennial Stream	796.47	59.20
		Seasonal Wetland	490.95	37.78
Staging Area 1	Imported sand and filter material	Seasonal Wetland	0.0	135.74
Disposal Sites	Rock and soil			
Disposal Site 3		Ephemeral Drainage	63.02	0
		Freshwater Marsh	3,364.44	0
		Perennial Stream	37.74	0
		Reservoir	59,475.61	0
		Seep Wetland	337.80	0
Disposal Site 5 (Borrow Area E)		Intermittent Stream	20.08	0
		Seasonal Wetland	698.14	0

Table 5
Discharge Locations, Type of Material Discharged, and Fill Volume

Location	Type of Material	Type of Waters	Estimated Permanent Fill in Waters of the United States (cubic yards)[1]	Estimated Temporary Fill in Waters of the United States (cubic yards)[1]
Disposal Site 7		Other Waters	906.67	0
		Reservoir	4,803.46	0
		Seasonal Wetland	28.66	0
		Seep Wetland	244.42	0
Haul Roads				
Disposal Site 7	Geotextile filter fabric and rock/soil[2]	Ephemeral Drainage	4.25	0
		Intermittent Stream	0.61	0
		Seasonal Wetland	0.77	0
Dam Site Road	Geotextile filter fabric and rock/soil[2]	Ephemeral Drainage	0.70	0
West Haul Road	Geotextile filter fabric and rock/soil[2]	Ephemeral Drainage	0.00	45.34
		Perennial Stream	0.00	11.91
		Reservoir[3]	0.00	46,054.30
		Seasonal Wetland	0.00	64.19
Barge Haul Alternative	Rock	Reservoir (north)[3]	0.00	390,790.21
		Reservoir (south)[3]	0.00	108,136.44
		Seasonal Wetland (south)	0.00	722.90
	Total		71,403.54	546,102.31

Note :
[1] Estimated volume of fill that would be placed below the ordinary high water elevation or equivalent.
[2] Fill and filter fabric will be removed on project completion to restore the original ground surface.
[3] This fill would be inundated when the reservoir is refilled.
Source: URS (2009), as included in RWQCB Section 401 certification application

Table 6 presents the amount of fill by type of jurisdictional feature and the impact duration (permanent or temporary).

Table 6
Fill in Wetlands and Other Waters of the United States within the Project Work Limits

Type	Permanent: Acres/Linear Feet (lf)[1]	Temporary Acres/Linear Feet (lf)[1]
Wetlands		
Freshwater Marsh	1.04	
Seasonal Wetland	0.75 ac	0.59[2]
Seep Wetland	0.72 ac	
Subtotal	2.51 ac	0.59
Other Waters		
Perennial Stream	0.51/1,285 lf	0.05/158 lf[3]
Intermittent Stream	0.07 ac/1,200 lf	0.02/293 lf
Ephemeral Drainage	0.06 ac/2,197 lf	0.04/897 lf[4]
Subtotal	0.64 ac/4,682 lf	0.11/1,348 lf
Reservoir	3.53[5]	18.18[6]
Pond	0.11	
Subtotal	3.64	18.18
Total (Wetlands and Other Waters)	6.79	18.88

Note:
[1] Linear feet is presented for linear features (e.g., perennial and intermittent streams and ephemeral drainage) only.
[2] Reduce by 0.19 acre if only the west haul route alternative is selected.
[3] Reduce by 0.78 lf if only barge route is selected.
[4] Reduce by 665 lf if only barge route is selected.
[5] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[6] Reduce by 12.47 acres if only the west haul route alternative is selected.
Source: ETJV 2008 and 2009b, modified by URS for inclusion in RWQCB Section 401certification application

Table 7 presents the extent of fill in wetlands and other waters for each of the project components.

Table 7
Permanent and Temporary Fill in Wetlands and Other Waters, by Project Component

Type of Activity	Wetland/Other Waters Type[1]	Permanent Acres/Linear Feet (lf)[2]	Temporary Acres/ Linear Feet (lf)[2]
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	0.30	0.02
	Perennial Stream	0.49/950 lf	0.04/80 lf
	Intermittent Stream	0.06/1,040 lf	0.02/293 lf
	Ephemeral Drainage	0.02/402 lf	0.01/232 lf
	Stream Subtotal	0.57/2,392 lf	0.07/605 lf
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		0.08
Borrow Area E/Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	0.43	
	Intermittent Stream	0.01/144 lf	
	Stream Subtotal	0.01/144 lf	
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	1.46	
	Perennial Stream	0.02/335 lf	
	Ephemeral Drainage	0.04 /1,701 lf	
	Stream Subtotal	0.06/2,036 lf	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	3.20	
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	0.32	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	0.44	

Table 7
Permanent and Temporary Fill in Wetlands and Other Waters, by Project Component

Type of Activity	Wetland/Other Waters Type[1]	Permanent Acres/Linear Feet (lf)[2]	Temporary Acres/ Linear Feet (lf)[2]
Haul Roads/Alternatives			
Dam Access Road	Ephemeral Drainage	0.00/19 lf	
	Stream Subtotal	0.00/19 lf	
Disposal Site 7[4]	Intermittent Stream	0.00/16 lf	
	Ephemeral Drainage	0.00/75 lf	
	Stream Subtotal	0.00/91 lf	
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		0.45
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		12.47
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland *Subtotal*		0.04
	Perennial Stream		0.01/78 lf
	Ephemeral Drainage		0.03/665 lf
	Stream Subtotal		0.04/743 lf
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		5.71

Note:
[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[2] Linear feet is presented for linear features (e.g., perennial and intermittent streams and ephemeral drainage) only. Impacts to wetlands and other waters related only to excavation are not included in the table because the Clean Water Act regulates dredged and fill material but does not consider excavation in wetlands or other waters.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008

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6 Analysis of Project Alternatives

The SFPUC evaluated a wide range of on-site and off-site alternatives to the Proposed Project to identify alternatives that could meet the project objectives (described in Section 2.2). This section briefly refers to the off-site alternatives that the SFPUC evaluated and subsequently eliminated from further consideration and then focuses on the on-site alternatives with greater potential than the off-site alternatives to be viable projects.

As described in Section 1, the analysis of on-site alternatives in this section follows a three-step screening process:

- **Step 1:** Alternatives are screened to assess their ability to meet the overall project purpose. Alternatives that meet most or all of the project objectives are retained for further analysis.

- **Step 2:** The practicability of the alternatives retained from Step 1 is assessed with respect to cost, logistics, and technology. The alternatives found to be practicable are retained for further analysis in Step 3.

- **Step 3:** The practicable alternatives from Step 2 are evaluated with respect to other potentially significant adverse environmental consequences.

This analysis takes a conservative approach toward evaluating alternatives, as it retains for analysis beyond Step 1 some alternatives (i.e., Alternatives 5 and 6) that do not meet all of the project objectives. For each alternative, regardless of whether it meets the overall project purpose or is found to be practicable, the impacted area of waters of the United States is presented. Appendix C presents a tabular summary of the pertinent potential environmental consequences of the Proposed Project and the alternatives.

6.1 Alternatives Eliminated from Further Consideration and Alternatives Retained for Further Consideration

During the course of project planning, the SFPUC evaluated several off-site alternatives to the Proposed Project. These alternatives, which are described in Appendix B, included:

- Locations in the SFPUC's Upper Tuolumne River system;
- SFPUC and non-SFPUC facilities in the Bay Area;
- Facilities in the Sunol Valley Area; and
- A regional water system.

These alternatives were eliminated from further consideration because they did not re-establish water delivery reliability and did not restore water supply and capacity using water in the Alameda Creek watershed for drought protection during the 8.5-year design drought. Also, these alternatives likely would have taken many years longer to plan and construct than rebuilding Calaveras Dam. They also potentially had greater impacts to waters of the United States than the on-site alternatives and faced institutional and possibly legal constraints.

Six on-site alternatives were retained for further evaluation because they potentially meet the overall project purpose. These alternatives are:

- Alternative 1: No Project;
- Alternative 2: Off-Site Disposal;
- Alternative 3: Off-Site Borrow;
- Alternative 4: Consolidated On-Site Disposal;
- Alternative 5: New Downstream Dam without Provision for Future Dam Enlargement; and
- Alternative 6: Replacement Dam at Existing Location.

The remainder of this section focuses on the six alternatives that were retained for further evaluation.

6.2 ALTERNATIVE 1: NO PROJECT

Under Alternative 1, the existing dam would remain in place in its current form. The reservoir water level would be maintained at elevation 705 feet to prevent uncontrolled releases of impounded water in the event of a major earthquake. The spillway crest would be lowered to elevation 705 feet to comply with DSOD safety requirements, and this lowering would necessitate several other modifications, including the excavation of an upstream approach channel and abutment slopes on the sides of the spillway. These modifications would entail the discharge of fill material to wetlands and other waters of the United States.

Lowering the spillway crest would result in a substantially larger cut into Observation Hill than would be needed for the Proposed Project. The cut could require as much as approximately 500,000 cubic yards of excavation (URS 2007). This excavated material would be disposed of at either Disposal Site 3 or Disposal Site 7 (see Table 8).[5]

New, 20- to 35-foot-high concrete sidewalls would be constructed on much of the upper portion of the spillway chute. The stilling basin at the new spillway bridge would be constructed, which in turn would necessitate a new access road to connect to existing access roads. Because no excavation would occur at Borrow Area E under Alternative 1, the west haul route adjacent to the reservoir would not be constructed.

The overall construction period for Alternative 1 would be approximately 2 years. Operation of Calaveras Dam under this alternative would approximate that of the existing condition with the restricted reservoir water level. The Alameda Creek Diversion Dam (ACDD) would be operated on a limited basis, depending on flow conditions. Assuming DSOD concurrence, storage would remain at about 38,100 af.

[5] Excavation spoils could also be disposed of off-site. This option is discussed in Alternative 2 and is not pursued further for Alternative 1.

Table 8
Estimated Disposal Quantities for the Proposed Project and Alternative 1 (No Project)

	Disposal Quantity (cubic yards)	
	Proposed Project	Alternative 1 (No Project)[1]
Disposal Site 2	470,000	Not used
Disposal Site 3	2,250,000	500,000[2]
Disposal Site 5	Reserve disposal area	Not used
Disposal Site 7	1,060,000	500,000[2]
Total	3,780,000	500,000

Note:
[1] Quantities for Alternative 1 are approximate.
[2] Excess material would be placed in either Disposal Site 3 or Disposal Site 7, but not in both.
Source: URS 2007.

6.2.1 POTENTIAL IMPACTS TO WATERS OF THE UNITED STATES

Alternative 1 would result in the discharge of permanent fill material to approximately 1.04 acres of wetlands and other waters of the United States (Table 9). It would not result in any temporary fills to jurisdictional areas.

Table 9
Alternative 1: No Project Alternative (Assuming Disposal at Disposal Site 7)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	0.32	0
Other waters	0.72	0
Total	1.04	0

Source: Appendix D, Table D-2

The impacts of Alternative 1 to waters of the United States would be substantially less than those under the Proposed Project because no work would take place in the borrow areas, the west haul route would not be necessary, and disposal would occur only at Disposal Site 3 or Disposal Site 7. Potential impacts on seasonal wetlands under Alternative 1 would be substantially reduced as a result of eliminating the borrow areas and the west haul route. The effects of Alternative 1 on the freshwater marsh at Disposal Site 3 and the seep wetlands at Disposal Sites 3 and 7 would depend on the site used but would be less than under the Proposed Project.

6.2.2 ANALYSIS STEP 1: ABILITY TO MEET OVERALL PROJECT PURPOSE

Alternative 1 does not meet any of the primary project objectives and meets only one of the secondary objectives.

Because of the permanent limitation on reservoir size, the water quality, water supply reliability, and emergency supply benefits of the Proposed Project would not be realized under Alternative 1. This alternative would permanently reduce the reservoir's elevation, so it would not meet the primary project objective of restoring the reservoir's water supply and capacity to pre-2001 levels to provide 7.1 mgd of drought water supply. As a result of the permanently lowered reservoir level, this alternative would also not re-establish water delivery reliability or allow for potential future enlargement. Although seismic safety would be provided by permanently lowering of the reservoir water level and the spillway, the seismic safety objective of the Proposed Project would not be fully met, because this project objective is to provide a seismically safe dam that can retain 96,850 af of water. Although this alternative would continue reservoir and outlet works operations during construction, it would not improve water quality by re-creating a deeper pool with cooler temperatures. As a result, Alternative 1 would only partially meet the secondary project objectives.

Given the poor performance of Alternative 1 in meeting the project objectives, it is eliminated from further evaluation.

6.2.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

This step is not applicable, because Alternative 1 does not meet any of the primary project objectives.

6.2.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

Because Alternative 1 is not passed from Step 1 to Step 2, this alternative cannot be passed to Step 3. However, if Alternative 1 had been found to be practicable, its implementation would result in several adverse environmental consequences. As noted above, the potential consequences are summarized in Appendix C.

6.3 ALTERNATIVE 2: OFF-SITE DISPOSAL

Alternative 2 was developed to reduce the potentially significant impacts on biological resources, particularly waters of the United States, associated with the on-site disposal of surplus excavated material. As noted in Section 1, the evaluation of this alternative was conducted with substantive input from the regulatory agencies as part of the IATF meetings, and the methods and findings for this alternative are presented in Appendix A.

Under this alternative, 3.3 million cubic yards (mcy) of the estimated 3.8 mcy of surplus material generated during construction would be disposed of at off-site landfills. The remaining portion would be disposed of in the space between the existing dam and replacement dam (Disposal Site 2). Table 10 presents the disposal volumes and locations.

Table 10
Estimated Disposal Quantities for the Proposed Project and Alternative 2

	Disposal Quantity (cubic yards)	
	Proposed Project	**Alternative 2[1]**
Disposal Site 2	470,000	470,000
Disposal Site 3	2,250,000	Not used
Disposal Site 5	Reserve disposal area	Not used
Disposal Site 7	1,060,000	Not used
Off-Site Disposal	Not applicable	3,310,000
Total	3,780,000	3,780,000

Note:
[1] Quantities for Alternative 2 are approximate.
Source: URS 2008c.

Because of the potential for NOA, disposal of the surplus excavated material would involve the use of one or more landfill sites (Figure 8). The nearest available facilities that can accept such waste are the Kettleman Hills facility, which is in Kettleman Hills, California, and the Altamont Landfill, which is in Livermore, California.

Off-site disposal would result in an estimated 180,000 round-trips to move the 3.3 mcy of materials. This would extend the construction schedule (compared to the Proposed Project) by approximately 4 years, for a total duration of 8 years. Calaveras Road would need to be closed for approximately 6 of the 8 years (Roadifer, pers. com. August 2009).

6.3.1 POTENTIAL IMPACTS TO WATERS OF THE UNITED STATES

Alternative 2 would involve the discharge of permanent fill material to 1.31acres of wetlands and other waters of the United States; it would also involve the discharge of temporary fill to 18.88 acres (Table 11).

Table 11
Alternative 2: Off-Site Disposal
(No Impacts at Disposal Sites 3 and 7)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	0.73	0.59
Other waters	0.58	18.29
Total	1.31	18.88

Source: Appendix D, Table D-3

6.3.2 ANALYSIS STEP 1: ABILITY TO MEET OVERALL PROJECT PURPOSE

Alternative 2 meets all of the primary and secondary project objectives and is retained for further analysis in Step 2.

6.3.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

Cost: Alternative 2 is the most expensive alternative; it would cost approximately $450 million, which is 70 percent more expensive than the Proposed Project (Roadifer, pers. comm. September 2009). Much of its relatively high cost results from transporting approximately 3.3 mcy of surplus material to off-site landfills (the Kettleman Hills facility and Altamont Landfill).

Logistics: This alternative would take 4 years longer to construct than the Proposed Project. It would present substantial logistical issues associated with the transportation of disposal materials to remote, off-site locations. The substantial increase in the number of truck trips associated with hauling materials off-site and the associated 4-year increase in the construction schedule would increase the logistical problems associated with transportation control and traffic safety hazards, including the impacts associated with the closure of Calaveras Road.

Existing Technology: No obvious technological constraints would render this alternative impracticable.

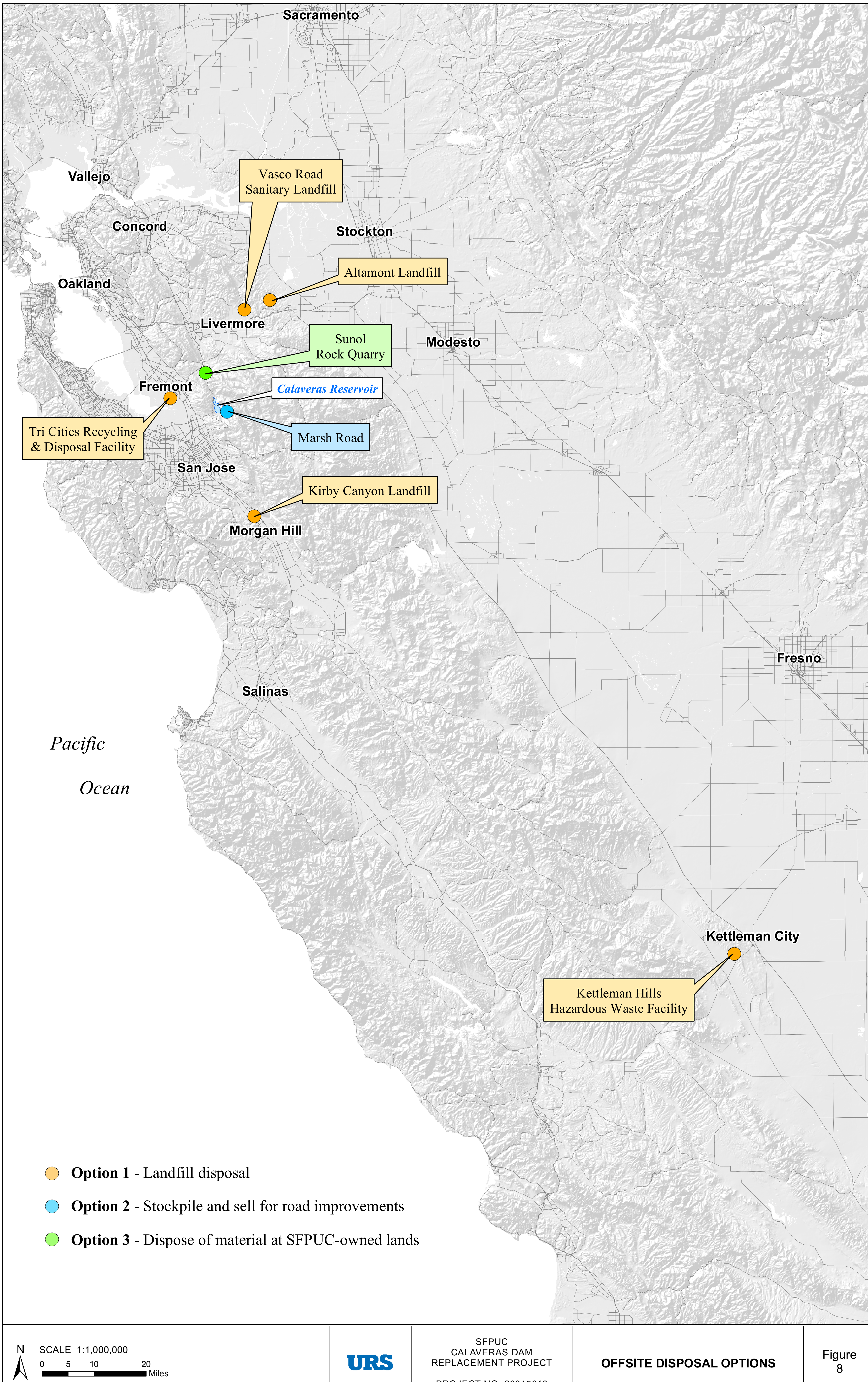
Alternative 2 has an extremely high cost, and logistical problems are associated with the 8-year construction duration of this alternative. Therefore, this alternative is not practicable and does not warrant additional analysis.

6.3.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

Alternative 2 is not evaluated in Step 3 because it is not practicable. However, Alternative 2 would result in several adverse environmental consequences that do not compare favorably with the Proposed Project. These consequences are summarized in Appendix C.

6.4 ALTERNATIVE 3: OFF-SITE BORROW

Alternative 3 was developed to reduce the potentially significant impacts on biological, cultural, and visual resources associated with on-site borrow areas. This alternative would involve the import of approximately 1.5 mcy of clay and rock for the construction of the replacement dam rather than the use of on-site materials. Borrow Areas B and E would not be disturbed (Table 12). Precise off-site locations for the needed material have not been identified, but for the purpose of this analysis, it is assumed that clay materials would be obtained from existing licensed and permitted facilities within a travel distance of approximately 40 miles.



URS

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

PROJECT NO. 26815610

OFFSITE DISPOSAL OPTIONS

Figure 8

URS Corporation - Oakland CA - cxrauma0 L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Disposal Options\Fig4_Optional_Disposal_Sites.mxd - 11/9/2009 @ 3:45:07 PM

Table 12
Comparison of Construction Source Materials for the Proposed Project and Alternative 3

Source of Material	Type of Material	Amount of Source Material (cubic yards)	
		Proposed Project	Alternative 3[1]
Spillway excavation	Temblor Sandstone	1,470,000	1,470,000
Borrow Area B	Blueschist/greywacke	764,000	Not used
Borrow Area E	Clay alluvium	755,000	Not used
Imported Filter and Drain Material	Sand and Gravel	330,000	330,000
Off-Site Borrow (imported fill materials)	Clay for core Durable rock	Not applicable	755,000 764,000
Total		3,319,000	3,319,000

Note:
[1] Quantities for Alternative 3 are approximate.
Source: URS 2005a; Forrest, pers. com. 2009

Alternative 3 would not require construction and use of the west haul route or barge facilities. Gravel and sand for use as filters and drains in the replacement dam would be obtained off-site, as under the Proposed Project. The dam construction materials to be obtained off site would need to be trucked from their sources to the construction area for the new dam. Thus, this alternative would involve substantial increases in the number of truck trips on nearby roads and freeways.

Table 13 identifies the differences in estimated disposal quantities between the Proposed Project and Alternative 3. The disposal quantities for this alternative are less than for the Proposed Project because no disposal of overburden from on-site borrow areas is required.

Table 13
Estimated Disposal Quantities for the Proposed Project and Alternative 3

	Disposal Quantity (cubic yards)	
	Proposed Project	Alternative 3[1]
Disposal Site 2	470,000	470,000
Disposal Site 3	2,250,000	2,080,000
Disposal Site 5	Reserve disposal area	Reserve disposal area
Disposal Site 7	1,060,000	1,060,000
Total	3,780,000	3,610,000

Note:
[1] Quantities for Alternative 3 are approximate and are less than for the Proposed Project because there is no disposal of overburden from on-site borrow areas.
Source: Forrest, pers. com. 2009.

Other aspects of the replacement dam and appurtenances would be the same as for the Proposed Project; however, the rate of embankment construction would be controlled by the long duration of hauling (approximately 2 years), and the available staging areas at the site would be used for stockpiles of the imported materials. As a result, the duration of construction would be extended by an additional 2 years, for a total of 6 years. This alternative would require closure of Calaveras Road during the 2 years of hauling.

6.4.1 POTENTIAL IMPACTS TO WATERS OF THE UNITED STATES

Alternative 3 would result in the discharge of permanent fill to 6.35 acres of wetlands and other waters of the United States; this alternative would also result in the discharge of temporary fill to 0.17 acre (Table 14).

Potential impacts on seasonal wetlands under this alternative would be substantially reduced compared to the Proposed Project as a result of eliminating the borrow areas and the west haul route. Eliminating the use of Disposal Site 5 would further reduce impacts on seasonal wetlands south of the reservoir.

Table 14
Alternative 3: Off-Site Borrow
(No Impacts at Borrow Areas B and E)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	2.08	0.10
Other waters	4.27	0.07
Total	6.35	0.17

Source: Appendix D, Table D-4

6.4.2 ANALYSIS STEP 1: ABILITY TO MEET THE OVERALL PROJECT PURPOSE

Alternative 3 meets all of the primary and secondary project objectives and is retained for further analysis in Step 2.

6.4.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

Cost: Alternative 3 is the second-most expensive alternative; the estimated cost is about $310 million. Much of the relatively high cost of this alternative would result from the purchase and hauling of rock and clay from commercial sources.

Logistics: Alternative 3 would take 2 years longer to construct than the Proposed Project. The transportation of borrow material from commercial sources to the project site would present substantial logistical issues. The substantial increase in the number of truck trips associated with hauling materials to the site and the associated 2-year increase in the construction schedule would increase the logistical problems associated with transportation control and traffic safety hazards, including the substantial impacts associated with the closure of Calaveras Road.

Existing Technology: No obvious technological constraints would render this alternative impracticable.

Alternative 3 has an extremely high cost, and logistical problems that are associated with the 6-year construction duration of this alternative. Therefore, this alternative is not practicable and retained for additional analysis in Step 3.

6.4.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

Alternative 3 is not evaluated in Step 3 because it is not practicable. However, Alternative 3 would result also result in several adverse environmental consequences. These consequences are summarized in Appendix C.

6.5 ALTERNATIVE 4: CONSOLIDATED ON-SITE DISPOSAL

Alternative 4 would eliminate the use of Disposal Site 7. Under this alternative, construction activities would be the same as under the Proposed Project, except for the following changes: (1) Materials that would have been placed in Disposal Site 7 would instead be placed in the reserve Disposal Site 5; (2) The reserve capacity of Disposal Site 5 would be eliminated; and (3) Additional area for temporary stockpiling of disposal materials would be required while Borrow Area E is excavated to create Disposal Site 5. These project changes would reduce potential impacts on biological resources at Disposal Site 7, which contains a small pond (0.11 acre), seep wetlands (0.17 acre), and habitats potentially used by the federally listed California tiger salamander and California red-legged frog. Disposal Site 7 is also adjacent to stands of the protected most beautiful jewel flower and habitat that includes the host plant of the federally listed Callippe silverspot butterfly.

Disposal Site 5 would be within the excavation created by Borrow Area E at the south end of the reservoir and would be inundated by the reservoir when the project is completed. The first 840,000 cubic yards disposed of there would effectively restore the borrow area to existing grade. Materials disposed in Disposal Site 5 in excess of this amount would be mounded above the existing grade but would still be inundated by the reservoir when the project is completed. Table 15 identifies the differences in allocation of estimated disposal quantities between the Proposed Project and Alternative 4.

Table 15
Estimated Disposal Quantities for the Proposed Project and Alternative 4

	Disposal Quantity (cubic yards)	
	Proposed Project	**Alternative 4[1]**
Disposal Site 2	470,000	470,000
Disposal Site 3	2,250,000	2,250,000
Disposal Site 5	Reserve disposal area	1,060,000
Disposal Site 7	1,060,000	Not used
Total	3,780,000	3,780,000

Note:
[1] Quantities for Alternative 4 are approximate.
Source: URS 2008c.

Because Disposal Site 5 is within the excavation created by Borrow Area E, use of the site would not be possible until after the borrow materials (clays) are removed and the dam embankment is constructed. Therefore, approximately 1,060,000 cubic yards of material would need to be temporarily stockpiled. Materials could be stockpiled adjacent to Borrow Area E and placed into the disposal site after removal of clay materials in the second construction season (URS 2008c). The excavated earth and rockfill materials that would be placed in Disposal Site 5 would likely include NOA.

The construction period under Alternative 4 would increase by approximately 6 months. Under this alternative, no reserve capacity for disposal materials would be provided. Should disposal volumes during construction be found to be larger than estimated, additional sites would need to be identified at that time, potentially extending the duration of construction or affecting other resources.

6.5.1 POTENTIAL IMPACTS TO WATERS OF THE UNITED STATES

Alternative 4 would result in the discharge of permanent fill material to 6.03 acres of wetlands and other waters of the United States; this alternative would also result in the discharge of temporary fill to 18.88 acres (Table 16).

Table 16
Alternative 4: Consolidated On-Site Disposal Alternative
(No Impacts at Disposal Site 7)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	2.19	0.59
Other waters	3.84	18.29
Total	6.03	18.88

Source: Appendix D, Table D-5

6.5.2 ANALYSIS STEP 1: ABILITY TO MEET THE OVERALL PROJECT PURPOSE

Alternative 4 meets all of the primary and secondary project objectives and is retained for further analysis in Step 2.

6.5.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

Cost: Alternative 4 is significantly more expensive than the Proposed Project; it would cost about $280 million. Much of the additional expense for this alternative results from increased project duration, transportation of surplus material to Disposal Site 5, and associated stockpiling.

Logistics: This alternative would take 6 months longer to construct than the Proposed Project. Many of the logistical aspects of this alternative (e.g., traffic control, safety, closure of Calaveras Road) would be similar to those of the Proposed Project but of longer duration.

Existing Technology: No obvious technological constraints would render this alternative impracticable.

Consideration of the results of the three evaluation criteria and the overall project purposes indicates that this alternative is available, capable of being constructed, and is therefore considered to be practicable.

6.5.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

Alternative 4 would result in several adverse environmental consequences, as described below.

6.5.4.1 AGRICULTURAL RESOURCES AND RECREATION

This alternative would not significantly affect agricultural uses, but it would have adverse impacts to recreational activities that occur in the project vicinity (e.g., bicycling, hiking, picnicking, bird watching). Also, these effects would be of greater duration than those associated with the Proposed Project, because project construction under this alternative would take 6 months longer than under the Proposed Project.

6.5.4.2 VEGETATION AND WILDLIFE

Disposal Site 5 is entirely within the area of excavation for Borrow Area E and therefore would be disturbed under either the Proposed Project or Alternative 4. As described above, use of Disposal Site 5 under Alternative 4 would not be possible until after the borrow materials (clays) are removed and the dam embankment is constructed. Therefore, approximately 1,060,000 cubic yards of material would need to be temporarily stockpiled adjacent to the site. This stockpiling would create additional or new impacts to vegetation and wildlife in the area, including potential impacts on (1) upland dispersal habitat for the California tiger salamander, (2) U.S. Fish and Wildlife Service–proposed critical habitat for the California red-legged frog, and (3) seep wetlands and Calaveras Creek that adjoin Borrow Area E.

6.5.4.3 FISHERIES AND AQUATIC HABITAT

Overall, the impacts of Alternative 4 on fisheries and aquatic habitat would be similar to those associated with the Proposed Project. Under Alternative 4, ground disturbance would be reduced at Disposal Site 7 but increased at Disposal Site 5. Inundation effects would be similar to those under the Proposed Project. Disposal Site 5 (Borrow Area E) would be inundated under both the Proposed Project and this alternative.

Alternative 4 would provide for water releases for fisheries downstream of the reservoir. However, given its longer construction compared to the Proposed Project, water releases for fisheries could be postponed for up to a year.

6.5.4.4 WATER QUALITY/WATER SUPPLY

Alternative 4 would increase water quality impacts relative to the Proposed Project. The removal of Disposal Site 7 from the project would remove the need for site stabilization and management of runoff from this disposal site area. However, additional stockpiling and the double-handling of the spoils that would go to Disposal Site 5 would be a source of erosion and sediment discharge into the reservoir and would result in increased impacts.

Under the Proposed Project, fine-grained materials that may contain NOA and metals would be placed in disposal sites at or above elevation 760 feet (4 feet above the proposed normal maximum reservoir surface elevation of 756 feet) to prevent NOA and metals from coming into contact with the reservoir surface water. Under Alternative 4, fine-grained materials potentially containing NOA would be placed at Disposal Site 3 at or above 760 feet to avoid potential water quality impacts similar to those for the Proposed Project.

Similar to the Proposed Project, potential impacts on water quality under Alternative 4 would require mitigation measures, including soils investigations to properly classify materials and design and construction of disposal sites to minimize releases. All other aspects of construction and operation impacts under Alternative 4 would be the same as under the Proposed Project.

Alternative 4 would not differ from the Proposed Project in its ability to provide water for municipal uses.

6.5.4.5 TRANSPORTATION AND CIRCULATION

The project impacts on transportation and circulation under Alternative 4 would be similar to those of the Proposed Project. On-site truck traffic would increase with the use the west haul route, but this increase would not affect traffic safety on Calaveras Road.

6.5.4.6 AIR QUALITY

Alternative 4 would generate more air pollution from vehicle and heavy equipment within the project area than would the Proposed Project, because truck trips and ground disturbance at Disposal Site 7, on the eastern side of the reservoir, would be replaced with longer haul trips to Disposal Site 5, at the south end of the reservoir. Air quality impacts would be further increased under Alternative 4 because of stockpiling and additional handling of the disposal materials. As a result, fuel consumption would be an estimated 180,000 gallons greater than under the Proposed Project (URS 2008c). Alternative 4 would have greater air pollutant emissions than the Proposed Project and would require an even higher level of reduction to be below the Bay Area Air Quality Management District (BAAQMD) thresholds. Even with implementation of mitigation (such as controls for fugitive dust, exhaust, and NOA), emissions for Alternative 4 would likely exceed the BAAQMD draft significance thresholds.

6.5.4.7 NOISE AND VIBRATION

Traffic-generated noise levels from off-site hauling of materials for dam construction would be increased under Alternative 4 relative to the Proposed Project. Construction-generated noise would increase in the vicinity of Disposal Site 5 (Borrow Area E) because of additional truck traffic and decrease in the vicinity of proposed Disposal Site 7. Significant and unavoidable impacts from nighttime construction activities at Disposal Site 5 would remain and increase by 6 months under this alternative because of the back-up beepers on the construction equipment. Although mitigation could partly reduce these effects, the nighttime construction noise impact would be considerable.

6.6 ALTERNATIVE 5: NEW DOWNSTREAM DAM WITHOUT PROVISION FOR FUTURE DAM ENLARGEMENT

Alternative 5 differs from the Proposed Project in that it would consist of a replacement dam with a thinner core and narrower crest width that would not provide for potential future enlargement. This alternative would reduce the need for borrow material by approximately 11 percent and disposal materials by approximately 6 percent as compared to the Proposed Project. Consequently, Alternative 5 would reduce the construction-related impacts associated with the movement of soil materials. Under this alternative, and similar to the Proposed Project, the dam would be constructed downstream of the existing dam with an open channel spillway on the left abutment. The construction period for this alternative would be approximately 4 months shorter than the construction period for the Proposed Project. Similar to the Proposed Project, Alternative 5 would make use of and extend the existing outlet system.

Similar to the Proposed Project, Alternative 5 would require stabilization of the landslide on the right abutment, both before excavation of the dam foundation and after construction of the embankment.

Under this alternative, the dam would not be designed to accommodate potential future enlargement. Because of this characteristic, the core width and chimney filter thickness could be reduced, thus reducing the volume of excavation required to form the core trench. The excavation for this alternative would also be reduced because the upstream toe of the dam would be shifted downstream such that less of the existing dam would need to be removed to expose the dam foundation. These reductions in excavation would reduce the amount of material that would be disposed in Disposal Site 3 by about 230,000 cubic yards, a 6 percent reduction in the volume of disposed material relative to the Proposed Project.

Except for the reduced width of the core and filter and drain zones, the dam footprint and the upstream and downstream slopes would be the same as for the Proposed Project. Under both Alternative 5 and the Proposed Project, approximately 945 linear feet of Calaveras Creek would be permanently affected by the dam footprint.

Table 17 identifies the differences in the volumes and locations of the borrow material between the Proposed Project and Alternative 5. The filter and drain material would be imported from off-site commercial sources for both the Proposed Project and this alternative, but the amount imported for Alternative 5 would be less, as shown in Table 17. The amount of material excavated from Borrow Area E would be reduced under this alternative. Borrow Area E would include the same area of disturbance; however, the excavation would not be as deep in some locations. Overall, this alternative would use about 11 percent less material as compared to the Proposed Project.

Table 17
Comparison of Construction Source Materials for the Proposed Project and Alternative 5

Source of Material	Type of Material	Amount of Source Material (cubic yards)	
		Proposed Project	Alternative 5[1]
Spillway excavation	Temblor sandstone	1,470,000	1,470,000
Borrow Area B	Blueschist/greywacke	764,000	764,000
Borrow Area E	Alluvium	755,000	410,000
Imported filter and drain material	Sand and gravel	330,000	302,000
Total		3,319,000	2,946,000[2]

Note:
[1] Quantities for Alternative 5 are approximate.
[2] This total is about an 11 percent reduction compared to the total for the Proposed Project.
Source: URS 2005a, 2005b.

Table 18 identifies the differences in the estimated quantity of disposal materials between the Proposed Project and Alternative 5. The volume of disposed material would be the same for this alternative as for the Proposed Project except for a reduction in the amount of material disposed of at Disposal Site 3. The footprint of Disposal Site 3 would be the same under the Proposed Project and Alternative 5.

Table 18
Estimated Disposal Quantities for the Proposed Project and Alternative 5

	Disposal Quantity (cubic yards)	
	Proposed Project	**Alternative 5[1]**
Disposal Site 2	470,000	470,000
Disposal Site 3	2,250,000	2,020,000
Disposal Site 5	Surplus disposal area	Surplus disposal area
Disposal Site 7	1,060,000	1,060,000
Total	3,780,000	3,550,000[2]

Note:
[1] Quantities for Alternative 5 are approximate.
[2] This total is about a 6 percent reduction from the total for the Proposed Project.
Source: URS 2005b.

The key differences between Alternative 5 and the Proposed Project are the reduction in the amount of material borrowed from Borrow Area E for the dam core zone, the imported filter and drain materials, and the disposal of materials at Disposal Site 3. The amount of rockfill excavated from Borrow Area B would be similar for the Proposed Project and Alternative 5.

6.6.1 POTENTIAL IMPACTS TO WATERS OF THE UNITED STATES

Alternative 5 would result in the discharge of permanent fill material to 6.79 acres of wetlands and other waters of the United States; this alternative would also result in the discharge of temporary fill to 18.88 acres (Table 19). Although this project alternative would have a smaller overall footprint compared to the Proposed Project, it would have the same impacts to waters of the United States. Accordingly, this alternative is not less environmentally damaging to waters of the United States.[6]

[6] While this alternative does not have fewer impacts to waters of the United States compared to the Proposed Project, it was included in the CEQA Draft EIR, and is therefore included here for consistency.

Table 19
Alternative 5: New Downstream Dam without Provision for Future Dam Enlargement
(Borrow Area E and Disposal at Disposal Site 3 Would Have an 11 percent Fill Reduction)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	2.51	0.59
Other waters	4.28	18.29
Total	6.79	18.88

Source: Appendix D, Table D-6

6.6.2 ANALYSIS STEP 1: ABILITY TO MEET THE OVERALL PROJECT PURPOSE

Alterative 5 meets 5 of the 6 objectives of the overall project purpose. The only objective this alternative does not meet is the primary objective of a robust design that could accommodate potential dam enlargement by future generations. This primary objective is important; however, not meeting it is not adequate justification, in and of itself, for eliminating this alternative from further analysis.

6.6.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

Cost: Alternative 5 is slightly less expensive than the Proposed Project; it would cost about $253 million. This cost is slightly lower than the cost of the Proposed Project because this alternative involves the transport and disposal of less material.

Logistics: This alternative would take 4 months less to construct than the Proposed Project. Many of the logistical aspects of this alternative (e.g., traffic control, safety, closure of Calaveras Road) would be similar to those of the Proposed Project but would be of slightly shorter duration.

Existing Technology: No obvious technological constraints would render this alternative impracticable.

Consideration of the results of the three evaluation criteria and the overall project purposes indicates that this alternative is available, capable of being constructed, and is therefore considered to be practicable.

6.6.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

Alternative 5 would result in several adverse environmental consequences, described below.

6.6.4.1 AGRICULTURAL RESOURCES AND RECREATION

Overall, project impacts on agriculture and recreation under Alternative 5 would be similar to those of the Proposed Project. The slightly shorter construction duration (4 months less) would result in less disruption of grazing activities. The reduction in construction duration and the number of truck trips associated with importing filter and drain material would lessen the construction impact on established recreational uses.

6.6.4.2 VEGETATION AND WILDLIFE

The area of habitat disturbance for construction, including borrow and disposal sites, would be the same for the Proposed Project and Alternative 5. Thus, this alternative and the Proposed Project would have similar impacts on wetlands and other aquatic habitats and special-status plants and animals.

6.6.4.3 FISHERIES AND AQUATIC HABITAT

Impacts on fisheries and aquatic habitat for Alternative 5 would not be substantially different from those under the Proposed Project. Although less material would be excavated from Borrow Area E and less material would be disposed of in Disposal Area 3 under Alternative 5, the potential impact on fisheries and aquatic habitat resources as a result of potential sediment discharge and exposure to contaminants would be essentially the same for Alternative 5 and the Proposed Project, because the overall amount of material that would be handled at the site would be of similar magnitude. The implementation of an SWPPP and measures for preventing water quality impacts from accidental discharges of drilling fluids would reduce this impact.

6.6.4.4 WATER QUALITY/WATER SUPPLY

Impacts related to soil erosion and sediment discharge into waters and the potential for spills of construction-related substances into waters would be essentially the same as those identified for the Proposed Project. The reduction in excavation at Borrow Area E would marginally reduce the potential for soil erosion and sediment discharge in this area, but the overall amount of material that would be handled at the site would be of similar magnitude and would likely result in similar impacts. The implementation of an SWPPP and measures for preventing water quality impacts from accidental discharges of construction-related substances and drilling fluids would reduce this impact.

Alternative 5 would have a greater impact on municipal water supply than the Proposed Project because this alternative would reduce the ability of the SFPUC to meet water supply demands in the future without causing additional environmental impacts.

6.6.4.5 TRANSPORTATION AND CIRCULATION

Under this alternative, the total number of truck trips would be reduced compared to the Proposed Project, and the construction period would be reduced by 4 months compared to the Proposed Project. However, this reduction in on-site truck trips would not substantially affect traffic, and impacts would be similar to those for the Proposed Project. Hauling excavated materials to Disposal Site 3 and hauling core material from Borrow Area B would occur on-site and would not contribute to transportation and circulation impacts. Under this alternative, fewer truck trips would be required to haul filter and drain materials from off-site and from Borrow Area E than would be required for the Proposed Project.

The potential impacts of Alternative 5 related to a reduction in roadway capacity, an increased potential for traffic hazards during construction, and wear and tear on haul routes would be similar to those of the Proposed Project, though slightly shorter in duration. Despite the 4-month reduction in the construction period under this alternative, the potentially significant and unavoidable traffic safety impact identified for the Proposed Project would remain if Alameda County does not permit the temporary closure of Calaveras Road. The increase in traffic delays would be slightly shorter in duration under this alternative than for the Proposed Project.

6.6.4.6 AIR QUALITY

Under this alternative, the reduced number of on-site and off-site truck trips and the 4-month reduction in the construction period would reduce construction-related air quality impacts. However, the generation of temporary, construction-related emissions and the exposure of sensitive receptors to short-term project-generated emissions of diesel particulates would be extensive under this alternative and would require the implementation of fugitive dust control and diesel particulate matter reduction measures.

The Proposed Project would need to reduce emissions of several key air pollutants to be below the draft BAAQMD thresholds. This level of reduction is not likely to be achieved even with mitigation. Alternative 5 would have fewer emissions than the Proposed Project because it would involve less excavation and disposal of materials and a slightly shorter construction period. However, even with implementation of controls for fugitive dust, exhaust, and NOA, the emissions for this alternative would likely exceed the BAAQMD draft significance thresholds.

6.6.4.7 NOISE AND VIBRATION

Overall, the noise and vibration impacts of this alternative would be similar to those of the Proposed Project. The 4-month reduction in the construction period due to the excavation and disposal of less material would only marginally reduce the construction-related noise impacts. The level of activity in Borrow Area E would be reduced due to the reduction in the volume of material that would be excavated. The duration of the activity in Borrow Area E during dam construction would be reduced from about 11 months to 9 months. Blasting would occur for the excavation of the dam foundation and the spillway and in Borrow Area B under this alternative, as with the Proposed Project. This alternative would reduce the duration of the noise impacts on sensitive receptors near the southern boundary of the project area by 2 months. Although the number of trucks trips for hauling core material would be reduced under this alternative relative to the Proposed Project, even with the implementation of noise controls, the noise impacts would still be considerable.

6.7 ALTERNATIVE 6: REPLACEMENT DAM AT EXISTING LOCATION

Alternative 6 differs from the Proposed Project in two ways: (1) under this alternative, the dam would be in the footprint of the existing dam rather than immediately downstream from it, as with the Proposed Project; and (2) this alternative would reuse the existing spillway and thereby avoid a cut slope on Observation Hill and Hill 1000. This alternative was identified to examine options for lessening or avoiding significant impacts from the Proposed Project, including impacts on visual resources and biological resources. Although the Proposed Project would use the existing dam as a cofferdam during construction, Alternative 6 would require construction of a cofferdam immediately upstream of the existing dam, in the reservoir. The cofferdam likely would be of cellular sheetpile constructed to an estimated elevation of 665 feet (NGVD 29 datum). To protect the construction area for the replacement Calaveras Dam, the cofferdam would need to bypass flows, including those of a 100-year flood event. Bypassing of flow would require reopening and rehabilitating a decommissioned 19.5-foot-diameter tunnel that is underneath the existing Calaveras Dam. Previous analysis of such a cofferdam and bypass tunnel identified significant challenges regarding the constructability of such features, and their feasibility remains uncertain at this time (URS 2005b;

SFPUC 2004b). Dredging, underwater construction, and pile driving would be required for this alternative.

Unlike the Proposed Project, this alternative would allow the reuse of the existing open channel spillway alignment on the left abutment of the existing dam. The spillway would likely require some reconstruction to pass the design flood.

Similar to the Proposed Project, Alternative 6 would make use of the existing outlet system, where possible, and would modify the outlet works where necessary. This alternative would also require stabilization of the landslide downstream of the right abutment of the existing dam, as is required for the Proposed Project. Because the topography of the left abutment at the existing dam site is lower than at the Proposed Project site, it would not be feasible to construct a dam at this location with provision for potential future enlargement without extensive removal and demolition.

Table 20 identifies the differences in borrow material volumes and borrow locations between the Proposed Project and Alternative 6. As with the Proposed Project, the filter and drain material would be imported from off-site commercial sources under Alternative 6.

Table 20
Comparison of Construction Source Materials for the Proposed Project and Alternative 6

Source of Material	Type of Material	Amount of Source Material (cubic yards)	
		Proposed Project	Alternative 6[1]
Spillway excavation	Temblor sandstone	1,470,000	Not applicable
Existing dam	Existing earthfill	Not applicable	1,300,000
Borrow Area B	Blueschist/greywacke	764,000	985,000
Borrow Area E	Clay alluvium	755,000	490,000
Imported filter and drain material	Sand and gravel	330,000	350,000
Total		3,319,000	3,125,000[2]

Note:
[1] Quantities for Alternative 6 are approximate.
[2] This total s about a 6 percent reduction compared to the total for the Proposed Project.
Source: URS 2005a, 2005b.

Although Alternative 6 would use about 6 percent less volume of materials than the Proposed Project, it would use more materials than Alternative 5, because the axis for a dam at the existing dam location is longer than would be required at the location immediately downstream of the existing dam. Although Alternative 6 would use less material overall than the Proposed Project, more rock would be required from Borrow Area B under this alternative to replace the rock that would come from excavation of the new stilling basin under the Proposed Project.

Table 21 identifies the differences in estimated disposal quantities between the Proposed Project and Alternative 6. The volume of surplus rock and soil produced under Alternative 6 would increase by 6 percent due to removal of the existing dam material, including the upstream and downstream faces and previously completed buttresses. As indicated in Table 21, Disposal Site 2, which is between the Proposed Project and the existing dam, would not exist under Alternative 6. Disposal Site 5 would be needed due to the larger volume of material that would need to be disposed and the elimination of Disposal Site 2.

Table 21
Estimated Disposal Quantities for the Proposed Project and Alternative 6

	Disposal Quantity (cubic yards)	
	Proposed Project	**Alternative 6**[1]
Disposal Site 2	470,000	Eliminated
Disposal Site 3	2,250,000	2,250,000
Disposal Site 5	Reserve disposal area	690,000
Disposal Site 7	1,060,000	1,060,000
Total	3,780,000	4,000,000[2]

Note:
[1] Quantities for Alternative 6 are approximate.
[2] This total is about a 6 percent increase compared to the total for the Proposed Project.
Source: URS 2005b.

Because this alternative would require the construction of an upstream cofferdam of reduced height (in comparison to the use of the existing dam as a cofferdam under the Proposed Project), the level of the reservoir during the 4-year construction period after completion of construction of the cofferdam would be reduced to a nominal storage of approximately 8,500 acre-feet (in comparison to 34,400 acre-feet under the Proposed Project), and all flows would be bypassed. Flows originating in Alameda Creek would be bypassed at the ACDD (with no diversion to the reservoir), and flows originating in Arroyo Hondo and Calaveras Creek upstream of the reservoir would be released through the cofferdam bypass tunnel. Due to the small capacity of the drawdown reservoir and the potential water quality issues from such a low reservoir level, storage and yield during construction would be effectively eliminated. For this reason, the water storage and supply functions of Calaveras Reservoir would be restricted during construction under this alternative.

The overall construction period for this alternative would be approximately 1 year longer than under the Proposed Project (for a total of 5 years) due to construction of the cofferdam.

6.7.1 IMPACTS TO WATERS OF THE UNITED STATES

Alternative 6 would result in the discharge of permanent fill material to 6.79 acres of wetlands and other waters of the United States; this alternative would result in the discharge of temporary fill to 18.88 acres (Table 22).

Table 22
Alternative 6: Replacement Dam at Existing Location
(No Impacts to Disposal Site 2)

Jurisdictional Feature	Permanent (acres)	Temporary (acres)
Wetland	2.51	0.59
Other waters	4.28	18.29
Total	6.79	18.88

Source: Appendix D, Table D-7

6.7.2 ANALYSIS STEP 1: ABILITY TO MEET THE OVERALL PROJECT PURPOSE

Alternative 6 meets three of the four primary project objectives: restoring water reliability, supply, and seismic reliability; however, this alternative does not meet the primary project objective of allowing potential dam enlargement by future generations or the secondary project objective of continuing operation of the reservoir and outlet works during construction. Also, this alternative only partially meets the secondary objective of maintaining high water quality, because reservoir water quality during construction would be significantly impacted.

Although this alternative does not fare well in meeting the project objectives (it meets only about half of the six objectives), it does meet nearly all of the primary objectives, so it warrants further analysis and is retained for analysis in Step 2.

6.7.3 ANALYSIS STEP 2: PRACTICABILITY WITH RESPECT TO COST, LOGISTICS, AND TECHNOLOGY

Cost: This alternative is significantly more expensive than the Proposed Project; it would cost about $300 million.

Logistics: This alternative would take 1 year longer to construct than the Proposed Project. Many of the logistical aspects (e.g., traffic control, safety, closure of Calaveras Road) of the alternative would be similar to those of the Proposed Project but of a longer duration. Also, construction of the cofferdam and rehabilitation of the bypass tunnel would increase the complexity of the project and potentially pose unique logistical challenges.

Existing Technology: No obvious technological constraints would render this alternative impracticable.

Consideration of the results of the three evaluation criteria and the overall project purposes indicates that this alternative is available, capable of being constructed, and is therefore considered to be practicable.

6.7.4 ANALYSIS STEP 3: OTHER POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL CONSEQUENCES

The discussion below highlights the differences in impacts of Alternative 6 compared to the Proposed Project.

6.7.4.1 AGRICULTURAL RESOURCES AND RECREATION

Alternative 6 would result in less disruption of grazing activities during construction than would the Proposed Project because the alternative has a reduced project footprint. Like the Proposed Project, this alternative would not significantly affect agricultural uses. Although the duration of construction is longer, the first year of construction would not involve much traffic on roadways that would affect recreational access. Overall, impacts to agricultural resources and recreation are similar to those for the Proposed Project.

6.7.4.2 VEGETATION AND WILDLIFE

Construction impacts on vegetation and wildlife would increase compared to those for the Proposed Project because of the construction of the cofferdam and the subsequent reservoir drawdown. Although reusing the existing dam site would reduce the loss of riparian habitat downstream, drawdown of the reservoir during construction could affect the access of terrestrial species to the water, reduce aquatic and wetland habitats, affect water quality, and cause loss of food supply/prey. These temporary construction impacts would be greater for this alternative than for the Proposed Project and would require mitigation. Borrow and disposal impacts on vegetation and wildlife would be similar to those of the Proposed Project. Alternative 6 would require about 6 percent less borrow material but would generate about 6 percent more material requiring disposal.

6.7.4.3 FISHERIES AND AQUATIC HABITAT

Alternative 6 would cause substantially increased construction impacts on fisheries and aquatic habitat in the reservoir compared to the Proposed Project. Under this alternative, the reservoir would be largely emptied during construction; therefore, the resident fishery population (including the resident rainbow trout population) could be effectively eliminated. The habitat quality of the remaining pool would be marginal, particularly during the summer when water temperature would rise and the concentration of dissolved oxygen in water would decline. Even with mitigation actions to lessen impacts, the construction impacts on fish populations and aquatic habitat in the existing reservoir would be extensive.

The installation of the cofferdam would result in noise and vibration that could injure fish. Temporary effects on fish related to increases in sediments and turbidity and the release of and exposure to contaminants would be increased due to the excavation and disposal of additional materials and the construction of the cofferdam within the existing reservoir. The reservoir drawdown would lower the reservoir below the California Department of Fish and Game minimum pool elevation of 690 feet. Also, the existing reservoir elevation creates conditions that limit hydrologic connectivity between the reservoir and Arroyo Hondo. These conditions would create adverse migration conditions for rainbow trout, which move between the reservoir and Arroyo Hondo to spawn. An increased drawdown of the reservoir during construction would exacerbate this already limited condition for fish migration/movement.

Because the reservoir would not be operational during construction, flows would be bypassed. Flows originating in Alameda Creek would be bypassed at the ACDD (with no diversion to the reservoir), which would result in increased water in this segment of Alameda Creek; flows originating in Arroyo Hondo and Calaveras Creek upstream of the reservoir would be released through the cofferdam bypass tunnel, which would result in increased water in Calaveras Creek downstream of the existing dam. These conditions would be a potential short-term benefit to downstream habitat and fisheries. Because of the greater drawdown of the reservoir under this alternative, compared to the Proposed Project it would take longer to refill and establish a cold-water pool and enable 1997 MOU releases to support downstream fisheries. Once the reservoir is refilled, operations would be the same as under the Proposed Project.

6.7.4.4 WATER QUALITY/WATER SUPPLY

Water quality impacts in the reservoir during construction would significantly increase compared to those of the Proposed Project. The construction of the cofferdam would increase sediment discharges during construction. The drawdown of the reservoir to 8,500 acre-feet would result in increased water temperatures and decreased dissolved oxygen, particularly during warmer months. The water quality effects of the Proposed Project would be less than significant with mitigation to reduce erosion and sediment discharge during construction. Under this alternative, water quality impacts in the reservoir would be potentially significant and unavoidable due to the construction of the cofferdam and subsequent drawdown of the water level.

Water quality effects related to disturbance of NOA-containing materials would be the same as those of the Proposed Project because a similar volume of NOA and metals-containing materials would be moved under this alternative. Changes in water quality in Calaveras Reservoir during future operation and restoration of pre-DSOD-restricted reservoir conditions would remain the same as under the Proposed Project and would be beneficial. Changes in water quality in Calaveras and Alameda creeks during future operation would be minor.

Alternative 6 would not differ from the Proposed Project in its ability to provide water for municipal uses.

6.7.4.5 TRANSPORTATION AND CIRCULATION

Under Alternative 6, the total number of truck trips would increase compared to the Proposed Project, and the construction period would increase by 1 year. Similar to the Proposed Project, the hauling of excavated materials to the disposal sites and the hauling of core material from Borrow Area E and rockfill from Borrow Area B would occur on-site and would not contribute to transportation and circulation impacts. The hauling of filter and drain materials from off-site would increase truck trips under this alternative compared to the Proposed Project.

Alternative 6 would result in an overall increase in the number of truck trips for hauling as follows:

- The hauling of excavated materials to Disposal Sites 3 and 7 would be unchanged, and an additional 34,800 trips would be required to haul excavated materials to Disposal Site 5.
- The hauling of imported filter and drain materials from off-site for the new dam would require an increase in the number of trips from 23,300 to 24,700.
- The hauling of rockfill materials from Borrow Area B to the dam would require an increase in the number of trips from 34,500 to 44,500.
- The hauling of core materials from Borrow Area E to the dam would reduce the number of truck trips from 38,100 to 24,700.

Compared to the Proposed Project, this alternative would have similar impacts on the reduction in roadway capacity, increased potential for traffic hazards during construction, and increased wear and tear on haul routes. Although the duration of construction is longer under this alternative, the first year of construction would not involve much traffic on roadways that would affect transportation and circulation.

6.7.4.6 AIR QUALITY

The increase in the number of truck trips and the construction duration under Alternative 6 would increase construction-related air quality impacts. Project construction–related activities would generate temporary emissions of criteria air pollutants and ozone precursors from motorized vehicles and heavy equipment. This alternative would increase ground disturbance and material transport in the project area and the associated emissions of fugitive dust. Ground disturbance and material transport could also result in the generation of airborne NOA. As under the Proposed Project, operation and maintenance activities would be unchanged relative to existing conditions. Even with controls for fugitive dust, exhaust, and NOA, emissions for Alternative 6 would likely exceed the BAAQMD draft thresholds.

6.7.4.7 NOISE AND VIBRATION

Under this alternative, temporary construction-related noise and vibration in the area surrounding the dam would remain essentially the same as described for the Proposed Project in Section 4.14. Compared to the Proposed Project, the level of borrow activity in Borrow Area E would be slightly less because a reduced volume of clay material would be excavated. The duration of the activity in Borrow Area E would be reduced from about 11 months to 10 months, but the significant and unavoidable impact from nighttime back-up beepers on construction equipment would remain. This alternative would require the use of Disposal Site 5, which could increase noise impacts on sensitive receptors near the southern end of the reservoir. Blasting would occur in Borrow Area B under this alternative, as with the Proposed Project.

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7 ANALYSIS OF ALTERNATIVES AND IDENTIFICATION OF THE LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE

In the preceding section, the six potential project alternatives were evaluated using a three-step process. Step 1 assessed the extent to which each alternative meets the overall project purposes. Step 2 determined which alternatives are practicable based on cost, logistics, and technology. Step 3 evaluated the practicable alternatives to determine their potential impacts to waters of the United States and identify other potentially significant adverse environmental consequences. This section summarizes the results of the analysis and identifies the LEDPA. Figure 9 shows a schematic rendering of the results of the analysis, and Table 23 highlights the main features of each of the alternatives.

7.1 ANALYSIS OF ALTERNATIVES

The results of the first step of the analysis indicated that Alternative 1 (No Project) does not meet the basic or overall project purpose, and this alternative was therefore eliminated from further consideration as a practicable alternative. This result is in keeping with the Guidance, whose Preamble states, "... to be practicable, an alternative must be capable of achieving the basic purpose of the proposed activity" (Guidance Preamble, page 85339).

The results of the second step found Alternatives 2 and 3 to be impracticable, because they have considerable logistical issues exacerbated by long construction periods (4 years and 2 years longer, respectively, than the Proposed Project). These two alternatives are also the most expensive alternatives, with costs far exceeding the cost of the Proposed Project (Alternative 2 would cost about $185 million more; Alternative 3 would cost about $45.5 million more). Rejecting these alternatives based on their logistical issues and the impacts associated with their lengthy construction periods is warranted; rejecting them based on cost is appropriate, because they are likely not reasonably available or obtainable. Their elimination based on cost is supported by the Guidance, whose Preamble states, "... the intent is to consider those alternatives which are reasonable in terms of the overall scope/cost of the proposed project" (Guidance Preamble, page 85339).

- Alternatives 4, 5, and 6 were found to be practicable in Step 2, and therefore were evaluated in Step 3. Alternative 4 would have slightly fewer impacts to waters of the United States compared to the Proposed Project; however, given the overall project scope, this difference (0.76 acre) is relatively minor. Alternative 4 would result in increased impacts to water quality/supply, air quality, and noise and vibration relative to the Proposed Project and would continue for 6 months longer than the Proposed Project. Also, Alternative 4 would cost significantly more than the Proposed Project. For these reasons, Alternative 4 is not the LEDPA.

- Alternative 5 would have some advantages over the Proposed Project, because this alternative could be constructed somewhat more quickly and at less cost. Also, this alternative would have no major other adverse environmental consequences. The main shortcomings of this alternative are that: (1) it does not lessen the impacts to waters of the United States; and (2) it does not meet all of the primary overall project objectives (i.e., it does not include a robust design that would allow for expansion by future generations). For these reasons, and because this alternative would have equal impacts to waters of the United States as the Proposed Project, Alternative 5 is not the LEDPA.

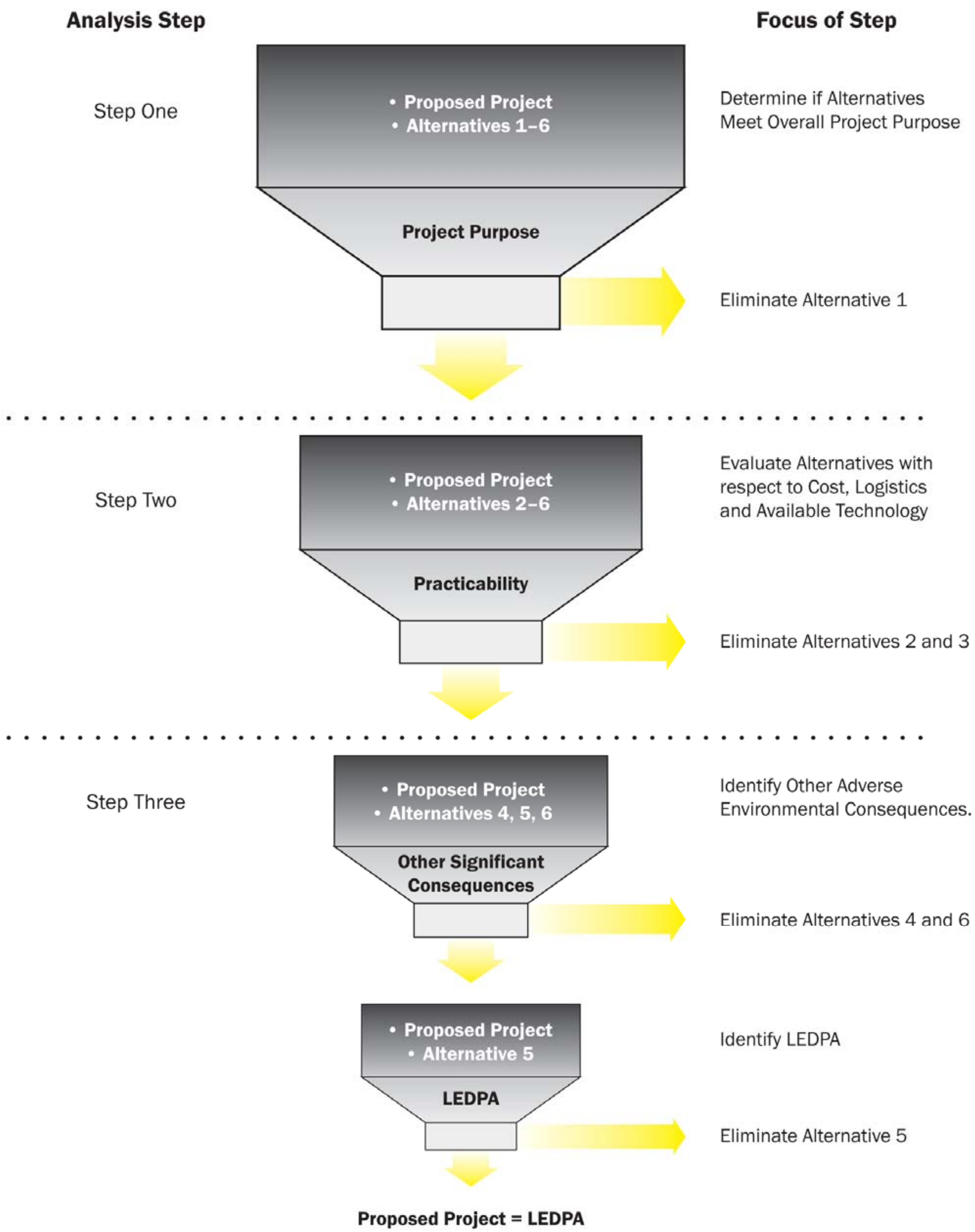

Figure 9. Identifying the Least Environmentally Damaging Practicable Alternative

Table 23
Key Factors for Identifying the LEDPA

Alternative	Meets No. of Overall Project Purpose Objectives	Practicability Factors				Practicable?	Impacts to Wetlands and Other Waters (acres)		Other Adverse Environmental Consequences[1]
		Cost ($ millions)	Existing Technology Constraints	Logistical Issues			Permanent	Temporary	
				Overall	Years to Build				
Proposed Project	6	264	Low	Low	4	Yes	6.79	18.88	------
Alternative 1 (No Project)	0	40	Low	Low	2	No	1.04	0.00	N.A.[2]
Alternative 2 (Off-Site Disposal)	6	450	Low	High	8	No	1.31	18.88	N.A.[2]
Alternative 3 (Off-Site Borrow)	6	310	Low	Medium	6	No	6.35	0.17	N.A.[2]
Alternative 4 (Consolidated On-Site Disposal)	6	280	Low	Low	4.5	Yes	6.03	18.88	3, 4, 5
Alternative 5 (New Downstream Dam without Provision for Future Enlargement)	5	253	Low	Low	3.6	Yes	6.79	18.88	None
Alternative 6 (Replace Dam at Existing Location)	3+	300	Medium	Medium	5	Yes	6.79	18.88	1, 2, 3, 4

[1] Codes to other adverse environmental consequences:

1 = Vegetation and wildlife   2 = Fish/aquatic habitat   3 = Water quality/supply   4 = Air quality   5 = Noise and vibration

[2] Not applicable, as this alternative is impracticable.

- Alternative 6 would have few advantages over the Proposed Project but would have many shortcomings. This alternative would meet only three of the overall project objectives, would be significantly more costly, and would take a full year longer to construct. Because this alternative would involve the construction of a cofferdam, it would face additional logistical and technical issues. Although it would impact the same area of waters of the United States as the Proposed Project, this alternative would result in several additional adverse environmental consequences, including greater impacts to vegetation and wildlife, fish and aquatic resources, water quality/sedimentation, air quality, and noise and vibration. One of the major adverse consequences would result from the dewatering of the reservoir to enable the construction of the cofferdam. For these reasons, Alternative 6 is not the LEDPA.

7.2 IDENTIFICATION OF THE LEDPA

Based on the above analysis, the Proposed Project is designated the LEDPA. It meets the overall project purpose, is available and capable of being constructed (after considering cost, existing technology, and logistics), and minimizes impacts to waters of the United States. The Proposed Project includes appropriate measures to compensate for the unavoidable adverse effects of its discharges on the aquatic ecosystem.

8 REFERENCES

Arnold, R. 2004. *Calaveras Dam and Alameda Watershed HCP Projects Status Report on Butterfly Surveys.* May 23.

CDFG (California Department of Fish and Game). 1997. Memorandum of Understanding Between the City and County of San Francisco Public Utilities Commission and the California Department of Fish and Game Regarding Water Releases and Recapture Facilities for Purposes of Improving Native Fisheries on Alameda Creek. Sent July 25, 1997 from Brian Hunter, Region 3 Regional Manager, to Anson B. Moran, General Manager, San Francisco Public Utilities Commission.

CDFG (California Department of Fish and Game). 2004. California Natural Diversity Data Base (CNDDB). Electronic data provided by the Natural Heritage Division, California Department of Fish and Game, Sacramento, CA.

CDM, EDAW and RMC. 2005. *Bay Area Water Quality and Supply Reliability Program – Final Report*. Prepared for the California Bay-Delta Authority.

Entrix, Inc. 2003. *Aerial Survey of the Upper Alameda Creek Watershed to Assess Potential Rearing Habitat for Steelhead.* Prepared for the SFPUC. April 3.

ETJV (EDAW & Turnstone Joint Venture). 2008. Wetland and Stream Channel Impacts for the CDRP. Unpublished data. February 12, 2008.

ETJV (EDAW & Turnstone Joint Venture). 2009a. Wetland and Stream Channel Impacts for the Mitigation Areas. Unpublished data.

ETJV (EDAW & Turnstone Joint Venture). 2009b. *Draft Biological Assessment / Essential Fish Habitat Assessment National Marine Fisheries Service.* May 2009.

Federal Clean Water Act of 1977. Title 40 Code of Federal Regulations, Part 230. Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material. December 24, 1980.

Hayes, M.P. and M.R. Jennings. 1988. Habitat Correlates of Distribution of the California Red-Legged Frog (*Rana aurora draytonii*) and the Foothill Yellow-Legged Frog (*Rana boylii*): Implications for Management. In: *Management of Amphibians, Reptiles, and Small Mammals in North America,* eds. R.C. Szaro, K.E. Severson, and D.R. Patton. Gen. Tech. Rep. RM166. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. pp. 144158.

Jennings, M.R. 1988. Natural History and Decline of Native Ranids in California. Proceedings of the Conference on California Herpetology. eds. H. F. De Lisle, P. R. Brown, B.

Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Final Report to the California Department of Fish and Game. Inland Fisheries Division, Rancho Cordova. November 1.

JSA (Jones and Stokes). 2004. *Alameda Watershed Habitat Conservation Plan*. Prepared for the San Francisco Public Utilities Commission.

May & Associates. 2006. *Final Delineation of Waters of the United States, Calaveras Dam Replacement Project, Alameda and Santa Clara Counties, California.* Prepared for the San Francisco Public Utilities Commission and EDAW & Turnstone Joint Venture.

May & Associates. 2008. *Supplemental Delineation of Waters of the United States, Potential Mitigation Areas and Access Roads, Calaveras Dam Replacement Project, Alameda and Santa Clara Counties, California.* Prepared for the San Francisco Public Utilities Commission and EDAW & Turnstone Joint Venture.

PRBO (Pt. Reyes Bird Observatory). 2004. CalPIF Grassland Bird Conservation Plan: White-tailed Kite Species Account. Available at: http://www.prbo.org/calpif/htmldocs/species/grassland/wtkiacct.html. Accessed September 13, 2004.

RWQCB. 2007. San Francisco Bay Basin Water Quality Control Plan (Basin Plan). California Regional Water Quality Control Board, San Francisco Bay Region. Incorporating all amendments approved by the Office of Administrative Law as of January 18, 2007.

SFPUC (San Francisco Public Utilities Commission). 2004a. *San Antonio Creek, Indian Creek, and Arroyo Hondo Fish Trapping Data Summary, 2003.* San Francisco Public Utilities Commission Water Quality Bureau. Sunol, CA. 56 pp.

SFPUC (San Francisco Public Utilities Commission). 2004b. *Calaveras Dam Conceptual Engineering Report for the Calaveras Technical Advisory Panel.* Meeting No.2, July 27–29, 2004.

SFPUC (San Francisco Public Utilities Commission). 2007a. Memo from Susan Leal, General Manager, and Tony Irons, Deputy General Manager, to Environmental Project Managers and Project Managers re: Standard Measures to be Included in Construction Contracts and Project Implementation. February 7.

SFPUC (San Francisco Public Utilities Commission). 2007b. Request for Information C85, Temporary Access Road Alignment (Marsh to BA E). May.

SFPUC (San Francisco Public Utilities Commission). 2009a. Public Draft Environmental Impact Report for the Calaveras Dam Replacement Project. San Francisco Planning Department File No. 2005.0161E. October 6. City and County of San Francisco, San Francisco Planning Department.

SFPUC (San Francisco Public Utilities Commission) 2009b. Memo from Michael Carlin, Deputy General Manager, to Harlan Kelly, Assistant General Manager, Infrastructure Division and Julie Labonte, Water System Improvement Program Director re: Proposed Instream Flow Schedules to be included in the Calaveras Dam Replacement Project Biological Assessments. March 13.

URS (URS Corporation). 2005a. *Environmental Constraints Evaluation of the Proposed Dam Alternatives (Task 8)*. Prepared for the San Francisco Public Utilities Commission. April 8.

URS (URS Corporation). 2005b. *Calaveras Dam Replacement Project Final Conceptual Engineering Report Dam and Appurtenant Structures*. Prepared for the San Francisco Public Utilities Commission. October 31.

URS (URS Corporation). 2007. Memorandum to David K. Rogers, San Francisco Public Utilities Commission, San Francisco, CA. March 26.

URS Corporation (URS). 2008a. Memorandum from John Roadifer, Steve Leach, and Lois Autié to Dan Wade, Gilbert Tang, and Craig Freeman (San Francisco Public Utilities Commission) regarding "CUW 37401: Calaveras Dam Replacement Project Alternatives Analysis of Disposal Options for Surplus Soil and Rock. March 5.

URS (URS Corporation). 2008b. *CUW 37401: Calaveras Dam Replacement Project Widening of West Haul Road*. Memorandum from Steve Leach, URS Corporation, to Dan Wade, Craig Freeman, and Janice Hutton, San Francisco Public Utilities Commission. January 30.

URS (URS Corporation). 2008c. *Evaluation of Wetlands Associated with Reservoir Operations Calaveras Dam Replacement Project (CUW 7401).* October 20.

URS Corporation (URS). 2009. Electronic communication via e-mail: Responses to 404 permit application questions transmitted to ETJV by Dan Wade on February 20, 2009, in response to question from Vick Germany via e-mail on February 17, 2009.

USACE (U.S. Army Corps of Engineers) and USEPA (U.S. Environmental Protection Agency). 2008. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. Federal Register 73: 19594-19705. April 10, 2008.

Zeiner, D.C., W.F. Laudenslayer, Jr., and K.E. Mayer. 1988. *California's Wildlife.* Volume I, *Amphibians and Reptiles.* Sacramento, California: California Department of Fish and Game, California Statewide Wildlife Habitat Relationships System.

Personal Communications

Forrest, Michael. Senior Project Manager, URS Corporation, CA. July 20, 2009—email to Samantha Salvia, EDAW | AECOM, San Francisco, CA.

Roadifer, John W., P.E. URS Corporation. August 4, 2009. Email to Samantha Salvia, EDAW | AECOM, San Francisco, CA.

Roadifer, John W., P.E. URS Corporation. September 29, 2009. Email to Jan Novak, URS, Oakland, California.

Sak, Brian. 2004. Biologist, San Francisco Public Utilities Commission Water Quality Bureau. Personal communication with URS Biologist Jennifer Pretare. September 6.

Smith, Robert. 2009. Email exchange of Robert Smith, NEPA Project Manager. U.S. Army Corps of Engineers, Regulatory Branch, San Francisco District, with Vick Germany, AICP, of EDAW regarding inundation. January 21.

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APPENDIX A

Analysis of Disposal Site Options for Surplus Soil and Rock

URS

Memorandum

FINAL

Date: March 5, 2008

To: Dan Wade, Gilbert Tang, and Craig Freeman

From: John Roadifer, Steve Leach, and Lois Autié

Cc: Dave Rogers, Noel Wong, and Mike Forrest

Subject: ***CUW 37401 - Calaveras Dam Replacement Project***
Alternatives Analysis of Disposal Options for Surplus Soil and Rock

1.0 INTRODUCTION

The required excavation work and other construction activities associated with the Calaveras Dam Replacement Project (CDRP) will produce approximately 3.8 million cubic yards[1] (mcy) of surplus soil and rock that cannot be reused in the new dam. This memo presents an analysis of potential disposal options for the surplus material.

Several terms that are frequently used in this memo are defined below:

Onsite – located within or immediately adjacent to the project area.

Offsite – located at least one mile beyond the project area limits.

General disposal options – Combinations of onsite and offsite disposal sites that could accommodate all of the surplus material from the proposed project. This memo evaluates the feasibility of general disposal options to identify the "specific disposal options" as defined below.

Disposal sites – onsite locations that are potentially capable of accepting at least some of the surplus material for disposal. Only one of the onsite disposal sites are capable of accepting all of the surplus material. This memo describes the characteristics of each onsite disposal site[2] in Section 2 and evaluates these sites in Section 4.

Specific disposal options – Feasible disposal options that could accommodate all of the surplus material from the proposed project. This memo evaluates specific disposal options that could be approved by the regulatory agencies and would have the least impacts on cost, schedule, and the environment based on a review of selected criteria.

This memo identifies a range of disposal sites that would accommodate all or a portion of the surplus material and evaluates the costs, logistics, and other unacceptable impacts of the sites. Combinations of disposal sites (specific disposal options) that would accommodate all of the surplus material are evaluated using detailed engineering and environmental criteria. For all the disposal options, the presence of Franciscan Complex, potentially containing naturally occurring asbestos (NOA), in the materials to be disturbed by the Project is considered in the selection and screening of potential disposal options.

The evaluation presented in this memo incorporates updates to the disposal sites based on comments received by the project team at recent site visits and meetings with the San Francisco Bay Regional Water Quality Control Board (RWQCB), the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (EPA), the California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service

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[1] Estimated disposal volume has been updated to reflect the current project design as shown on the attached material balance diagram (Figure 3).

[2] The configuration of onsite Disposal Site 3 has been revised slightly since the November 11, 2007 inter agency meeting, see additional description in Section 2.2.3.

(USFWS), and the Major Environmental Analysis (MEA) Division of the San Francisco Department of City Planning.

This memo is organized into the following five sections.

- Section 1 summarizes the regulatory background of disposal sites, the project purpose and the project description.
- Section 2 identifies the general options for offsite and onsite disposal.
- Section 3 presents the process that was utilized to evaluate the general and specific disposal options that are presented in Section 2.
- Section 4 presents the analysis and results of the general and specific disposal options.
- Section 5 lists the references and personal communications that are cited in this memorandum.
- Tables, Figures, and Photographs are presented at the end of the memo.

1.1 Regulatory Background

Federal and state laws regulate the disposal of surplus material associated with the Calaveras Dam Replacement project. Two laws provide the primary regulatory framework for disposal of materials for this project: the federal Clean Water Act and the California Porter-Cologne Water Quality Control Act. This section describes these laws and the associated regulatory requirements.

Federal Clean Water Act. The proposed project will require an individual permit from USACE under Section 404 of the federal Clean Water Act (CWA). A water quality certification from the San Francisco Bay Regional Water Quality Control Board under Section 401 of the CWA will be required and Waste Discharge Requirements may be required. Section 404 of the CWA requires consideration of practicable options to avoid or minimize adverse impacts to jurisdictional waters of the U.S. A reasonable range of options must be considered in the evaluation of options. Options can be eliminated, prior to detailed analysis, if they are not "practicable" (under Section 404). The Section 404(b)(1) Guidelines specify that a permit can be issued for a discharge of dredged or fill material to waters of the United States only if the discharge is determined to be the least environmentally damaging practicable alternative (LEDPA) (40 CFR § 230.10(a)).

An analysis of alternatives is required when a proposed project requires an individual permit for filling waters of the United States. For this analysis, the LEDPA generally is the practicable alternative that either avoids waters of the U.S. or impacts the smallest area of waters. For non-water dependent project components that require filling of special aquatic sites (e.g. wetlands), the Guidelines also presume that there are upland alternatives available and that these upland sites are less environmentally damaging unless there are significant impacts to other resources. The project proponent is required to prove that the proposed project is the LEDPA.

An alternative is practicable if it:

- Meets the purpose and need;
- Is available and implementable (i.e., it can be accomplished within the financial resources that could reasonably be made available, and it is feasible from the standpoint of technology and logistics); and
- Will not create other unacceptable impacts such as severe operation or safety problems, or serious socioeconomic or environmental impacts.

Alternatives can be eliminated at any stage if they are not practicable. However, the reasons for eliminating an alternative from detailed analysis need to be documented.

California Porter-Cologne Water Quality Control Act. Under the Porter-Cologne Water Quality Control Act (Porter-Cologne), the State Water Resources Control Board (State Board) has the ultimate authority over State water rights and water quality policy. However, the nine Regional Water Quality Control Boards (Regional Boards) have authority over water quality issues on a day-to-day basis at the regional level.

The Regional Boards engage in a number of water quality functions in their respective regions. One of the most important is preparing and periodically updating Basin Plans (water quality control plans). Each Basin Plan establishes:

- Beneficial uses of water designated for each water body to be protected;
- Water quality standards, known as water quality objectives, for both surface water and groundwater; and
- Actions necessary to maintain these standards in order to control non-point and point sources of pollution to the State's waters.

Permits issued to control pollution (i.e. waste-discharge requirements and NPDES permits) must implement Basin Plan requirements (i.e. water quality standards), taking into consideration beneficial uses to be protected. The designated beneficial uses for Calaveras Reservoir are municipal and domestic supply, cold freshwater habitat, fish spawning, warm freshwater habitat, wildlife habitat, limited water contact recreation, and noncontact water recreation (SF Planning Department 2007). Beneficial uses of surface waters, ground waters, marshes and mudflats serve as a basis for establishing water quality objectives and discharge prohibitions to obtain this goal.

1.2 Project Purpose

Calaveras Dam and Reservoir are important components of the San Francisco Public Utilities Commission (SFPUC) Regional Water System. Constructed in 1925 and later modified, Calaveras Dam allows for normal storage of approximately 96,850 acre-feet (AF) (31 billion gallons) of local watershed runoff in the SFPUC's Alameda Creek watershed, in Alameda County and Santa Clara County. Calaveras Reservoir is the largest SFPUC San Francisco Bay Area (local) reservoir, providing about 40 percent of the SFPUC's local water storage and 66 percent of local water yield.

Studies were initiated in 1998 to evaluate the structural stability and performance of the dam during projected large earthquakes. The studies indicated that the dam does not meet current safety standards for large seismic events. In 2001, in response to safety concerns about the seismic stability of the dam and a mandate from the California Department of Water Resources, Division of Safety of Dams (DSOD), the SFPUC lowered water levels in the reservoir beginning in the winter of 2001. The elevation of the lowered water level (705 feet above mean sea level [msl]) corresponds to about 38,100 AF of storage, which is approximately 60 percent less than the previous normal maximum water storage capacity. DSOD has indicated that it is allowing this interim operating level to accommodate a small portion of the water supply needs with the understanding that the

SFPUC is pursuing an aggressive project schedule to alleviate the seismic safety concerns about Calaveras Dam.

The overall purpose of the proposed project is to replace the existing dam with a new dam that will accommodate a public water supply reservoir of the same size as the original 1920's plans (96,850 AF) and will meet current seismic safety design requirements. When the proposed replacement dam is completed, DSOD restrictions will be lifted and the original reservoir pool can be restored. This is represented by the normal maximum water surface (NMWS), at 756 feet msl.

Completion of the proposed project would assist the SFPUC in achieving its stated Water System Improvement Program (WSIP) Level of Service (LOS) objectives for the Regional Water System (SFPUC 2006), including providing high-quality water, maintaining a reliable system during seismic events, maintaining delivery reliability, and, in the case of CDRP, restoring yield to meet customer demand in non-drought and drought conditions through the year 2030.

1.3 Project Description

Calaveras Dam is located on Calaveras Creek in the Diablo Range in Alameda County, California, approximately 12 miles south of the City of Pleasanton and 7.5 miles east of the City of Fremont (Figure 1). Calaveras Dam forms Calaveras Reservoir, which is situated on the border between Alameda and Santa Clara Counties. Calaveras Reservoir captures flows from Calaveras Creek and Arroyo Hondo as well as diversions from Alameda Creek. Calaveras Dam is located on Calaveras Creek at the northern end of the reservoir, approximately 1 mile upstream from the confluence of Calaveras and Alameda Creeks.

The main earth moving elements of the proposed project as shown in Figure 2 are:

- Construct a new earthen dam with a wide, centrally-located clay core, wide filter, and internal drainage and regrade the existing dam to accommodate construction of the replacement dam;
- Remove the existing spillway and construct an ungated, L-shaped spillway with a side channel weir and a new stilling basin;
- Remove the existing intake tower and shaft and construct a new intake tower and shaft connecting to an existing drain and three water inlet adits; and
- Stabilize the right abutment landslide.

1.3.1 Dam

The replacement dam would be located immediately downstream at the foot of the existing dam. The new dam would have a nominal reservoir storage of 96,850 AF. This storage is the same as the storage capacity of the reservoir when it was completed in 1925. No part of the existing dam structure would be retained as part of the proposed replacement dam. The new dam would be designed so as not to preclude potential enlargement up to a 386,000 AF of reservoir storage through a design that would allow potential future reuse of dam components without requiring extensive dam removal and rebuilding.[3]

The dam would be approximately 220 feet high (measured from the bottom of the foundation) and 210 feet above the downstream streambed. The dam crest elevation would be 772 feet. The dam footprint would have an area of about 18 acres and the dam would be 1,210 feet long at the crest, 1,180 feet thick at the base, and 80

[3] SFPUC does not reasonably foresee the need for a larger dam beyond one that restores the reservoir's historic capacity. Any enlargement in the future would require a new CEQA process and approvals of the new project, including, but not limited to, modification or replacement of the existing operating permit by DSOD and possible additional water rights from the State Water Resources Control Board.

feet thick at the crest. The total volume of the dam would be approximately 2.8 mcy (URS 2007). The section of the dam and the required excavation and fill volumes for the dam are shown on Figure 3.

The dam would consist of six zones (see Figure 3) as follows:

- The central core of the dam (Zone 1) would be constructed of approximately 755,000 cubic yards of clay that would be obtained from Borrow Area E, an alluvial source located at the south end of the reservoir (URS 2007).
- Filter and drain zones (Zones 2, 2A, and 3) obtained from commercial sources would comprise about 352,000 cubic yards of material (URS 2007).
- The upstream shell of the dam would be constructed of approximately 750,000 cubic yards of rockfill (Zone 5) that would be obtained from Borrow Area B, a hard rock source located about ½-mile downstream of the dam site.
- The downstream shell of the dam would be constructed using approximately 875,000 cubic yards of Temblor Sandstone (Zone 4) that would be obtained from the required spillway excavation.
- The upstream face of the dam that is in contact with the reservoir would be protected from erosion by a 4-foot-thick layer of riprap (Zone 6) that would be obtained from Borrow Area B.
- The downstream face of the dam would be covered with topsoil and hydroseeded.
- The dam would include a berm located at the downstream toe to serve as the location of the outlet pipe, an electrical building, and seepage collection vault. The berm would be constructed using Temblor Sandstone compacted to the same requirements as the downstream shell (Zone 4) of the embankment.

The bedrock foundation of the currently proposed replacement dam would be Temblor Sandstone at the left abutment and Franciscan Complex in the valley bottom and at the right abutment. Approximately 1,840,000 cubic yards of the existing dam, alluvium, colluvium, Franciscan Complex and Temblor Sandstone will be excavated for the dam foundation (Figure 3). Of the excavated materials from the foundation area, only rockfill from the upstream buttress of the existing dam, and excavated Temblor Sandstone could be reused. The other excavated materials are not strong enough for use in the replacement dam.

1.3.2 Spillway

The new spillway would be located at the western end (left abutment) of the dam. The overall length of the spillway, including concrete approach, L-shaped weir crest, chute, stilling basin, and discharge channel, would be about 1,950 feet. Construction of the spillway foundation would require excavation of approximately 450,000 cubic yards of Franciscan Complex and 1,905,000 cubic yards of Temblor Sandstone. A portion of the excavated Franciscan Complex (65,000 cy) would be suitable for rockfill and would be reused in the replacement dam. The Temblor Sandstone would be reused in the replacement dam and right abutment landslide stabilization berm.

1.3.3 Intake Shaft

A new intake shaft would be constructed just south of the existing compressor building. The structure would consist of a 163-foot deep circular shaft in rock connected to a 30-foot-high reinforced concrete tower. The new intake shaft would have a minimum 20-foot inside diameter. Four 10-foot diameter tunnels would be excavated between the new and existing shaft to connect to existing adits 1, 2, and 3 and the drain pipe and another 10-foot diameter tunnel would be excavated to connect the new shaft to the existing 72-inch outlet pipe beneath the dam. Approximately 4,200 cubic yards of Franciscan Complex would be excavated for the shaft and tunnels.

1.3.4 Right Abutment Landslide Stabilization

The right abutment landslide is located approximately 400 feet downstream of the existing dam. This landslide is 300 to 400 feet wide and approximately 1,200 feet long, with a vertical height of approximately 400 feet. Geologic studies indicate that the landslide is between 20 and 65 feet deep to bedrock. Excavation of the dam foundation will remove the base of the landslide. Therefore, the landslide requires stabilization (Phase 1) prior to foundation excavation and final stabilization (Phase 2). Phase 1 stabilization will consist of a soldier pile tie-back wall. Phase 2 stabilization will be a compacted buttress fill built in front (downhill) of the tie-back wall between the replacement dam and the existing dam. Approximately 595,000 cubic yards of Temblor Sandstone material from the spillway excavation would be used to construct the berm.

1.3.5 Surplus Excavated Materials

The required excavations for the dam, spillway, and intake shaft will generate approximately 3.8 mcy of materials in excess of that which can be reused in the replacement dam. Permanent storage will be required for the unsuitable and surplus material. Approximately 2.4 mcy of this surplus rock and soil is Franciscan and potentially contains NOA. The estimated volume of waste materials that would be produced during each season of construction is shown in Table 1 (at end of memorandum).

1.4 Project Development and Surplus Material Reduction Efforts

This section summarizes the efforts by the project team to minimize the amount of surplus material that would be generated by the proposed project. The quantity of material that would require disposal has evolved as the design of the project was refined. This evolutionary process began with the Conceptual engineering and has continued up through the final design stage of the project that is currently in progress. The intent of this section is to contrast changes to the quantities of surplus material between the initial design and the final design stages that demonstrate how surplus material minimization is a design goal of the project.

1.4.1 Conceptual Engineering

Conceptual engineering of the proposed project began in 2003. As a part of the conceptual studies (ten percent design level), and in accordance with SFPUC Procedure Number PD 3.3, an Alternatives Analysis Report (AAR) (URS, 2005a) was prepared that evaluated different alternatives for remediating or replacing the existing dam. Dam alternatives that were identified included the following:

- Remediate existing dam;
- Replace dam at existing location;
- Downstream earthfill replacement;
- Downstream concrete face rockfill dam; and
- Downstream asphalt concrete core rockfill dam.

Roller compacted concrete dams were also considered during initial screening and determined to be unsuitable for this site due to the weak and variable foundation conditions.

Spillway alternatives that were considered included straight and curved open chutes and an extended approach channel with straight chute. Open chute spillway alignments at the right abutment were determined during initial screening to not be feasible due to the weak Franciscan rock.

The spillway alternatives were analyzed and evaluated based on several factors that included:

- Environmental impacts;

- Operational flexibility;
- Reliability and maintenance requirements;
- Constructability (logistics of implementation);
- Cost; and
- Dam safety approval.

The results of the Alternatives Analysis indicated that the preferred alternative was to replace the existing dam with a new earthen fill dam located downstream of the existing dam with an open-chute spillway.

The volume of surplus soil and rock that was estimated to require disposal during conceptual engineering was 4.45 mcy (URS, 2005b).

1.4.2 Final Design

The proposed project was modified during final design based on the results of geotechnical investigation and analyses, site layout optimization, and spillway model testing. These modifications resulted in a reduction of the volume of material to be disposed from 4.45 mcy to 3.8 mcy. Design modifications that increased or decreased the volume of material to be placed in the disposal sites are shown in Table 2.

Early in the final design, alternatives were developed and evaluated for controlling seepage through the upper 100 feet of the Temblor Sandstone at the left abutment that was determined to be highly fractured and highly pervious. Control of seepage through highly pervious rock is critical to the performance of the dam (URS, 2006a). The alternatives that were evaluated included:

- Multi-row grout curtain;
- Secant pile cutoff wall;
- Open trench backfilled with embankment materials; and
- Open trench backfilled with concrete.

The alternatives were evaluated using the criteria of long-term performance, construction risk, constructability, schedule, and direct cost. The results of the alternative analysis indicated that the open trench backfilled with embankment materials had the highest level of confidence for good long-term performance, manageable constructability issues and risk, and had a slightly higher cost than the secant pile cutoff wall. The open trench backfilled with embankment materials was recommended for the left abutment seepage cutoff and has been used in the final design.

Additional spillway alternatives were also developed and evaluated. The spillway alternatives evaluated included:

- Open chute on the left abutment with side channel crest;
- Open chute on the left abutment with labyrinth crest;
- Curved tunnel spillway on left abutment; and
- A morning glory spillway.

The result of the alternatives analysis was that the open side channel crest offered the least construction risk and capital and long term maintenance cost. Although the morning glory spillway had a similar direct cost, it offered only a slight reduction in the volume of excavation and there are more unknowns and risks associated with the tunnel, especially with regard to underground excavation and long term maintenance.

A significant change during final design is the use of rockfill in the upstream shell of the dam instead of earthfill as was shown in the Conceptual Engineering Report (CER) (URS, 2005b). Rockfill was determined to be required to provide a free draining material that would not generate pore water pressures in the saturated upstream shell and thus be stable during large seismic events. The only available source of hard rock at the site is in Borrow Area B which is an existing quarry located approximately ½ mile downstream of the existing dam that was used to provide rockfill for buttressing of the existing dam in 1974 (URS, 2006b).

2.0 DESCRIPTION OF POTENTIAL GENERAL DISPOSAL LOCATIONS

This section describes locations that have been considered for general onsite and offsite disposal options. These locations are divided into sites that are outside of the project area (offsite) and sites that are within the limits of the project area (onsite). These sites are evaluated in Section 4 using a three tier process described in Section 3.

2.1 Offsite Disposal Options

Three potential general offsite disposal options were identified:

- Landfill
- Stockpile and Reuse for Road Improvements
- Reuse on SFPUC-owned Lands

Offsite locations are shown on Figure 4.

2.1.1 Landfill Disposal

One of the offsite options would be disposal of the surplus material at a landfill. Landfills accept soil and rock that is classified according to its physical and chemical constituents. The type of material acceptable for landfills is generally as Class I, II, or III waste. The surplus rock and soil is likely to be classified based on geology. If disposed off-site, the Franciscan material, which is expected to contain some portion of NOA, would be disposed of as Class I or II waste. The nearest available facilities that can accept such waste are Kettleman Hills Facility located in Kettleman Hills, California for Class I and II waste, and Altamont Landfill located in Livermore, CA for Class II waste.

2.1.2 Stockpile and Reuse for Road Improvements

This offsite disposal option would entail stockpiling surplus rock and soil at either a permanent offsite location or onsite temporarily, and then, use of the Temblor Sandstone portion for local road improvements. This option assumes that the Franciscan material would not be reused on roads because it could potentially contain NOA. Therefore, this is a partial offsite disposal option.

2.1.3 Disposal or Reuse on SFPUC-owned Lands

Other potential general offsite disposal options include disposal or reuse on SFPUC-owned lands in the Sunol Valley, north of the project area. SFPUC owns most of the land within the Sunol Valley and currently leases this land for a variety of ongoing activities including: gravel extraction (by permit from Alameda County and lease from SFPUC), agricultural activities, plant nurseries, and recreation (e.g. a portion of the East Bay Regional Park District [EBRPD] Sunol Regional Wilderness) (SF Planning Department, 2000). Specific SFPUC-owned lands that were evaluated in this technical memo include the gravel pits, currently under operation by Hanson Aggregates, and a piece of land that is currently leased by a nursery.

2.2 Onsite Disposal

Eight potential onsite disposal sites have been identified, as shown on Figure 5. Five of the disposal sites were identified during conceptual engineering (URS, 2005b) and three new disposal sites were identified during final design based on feedback from the resource agencies, MEA and SFPUC. The disposal sites were configured to optimize capacity while also maximizing avoidance of sensitive resources. Except for Disposal Site 8, the capacity of each of the individual disposal sites is less than the total volume of surplus material that requires disposal. Therefore, these sites would need to be combined to accommodate the entire volume of material. Each disposal site is described below and the general characteristics of these sites are summarized in Table 3.

2.2.1 Disposal Site 1

Disposal Site 1 is located in a small drainage north of Observation Hill (see Figures 6 and 7). Disposal Site 1 has a disposal capacity of 0.82 mcy. This disposal site would be used for surplus materials generated from the spillway excavation and thus the haul route would be an access road around the north side of Observation Hill.

2.2.2 Disposal Site 2

Disposal Site 2 would utilize the space between the cofferdam and the replacement dam (see Figure 8). During conceptual engineering this site was anticipated to have a capacity of about 1.10 mcy based on filling the entire space between the two dams up to about elevation 710 feet. The configuration of the disposal site has evolved during final design. Based on the modification of the upstream shell from earthfill to rockfill, the final configuration requires that the maximum elevation of fill against the upstream slope of the replacement dam would be 650 feet such that pore water pressure would not build up in the upstream shell during an earthquake. Rockfill from the upstream buttress of the existing dam would be used to cap the top of the surplus material in Disposal Site 2 to reduce turbidity and protect water quality in the reservoir. This configuration has a capacity of 0.90 mcy.

Disposal Site 2 would not be available during excavation of the dam foundation. A portion of the surplus material generated from the spillway excavation and material generated from excavating the approach channel through the existing dam during the second construction season could be placed at this location. Rockfill from the upstream buttress of the existing dam would be placed on the fill surface between the two dams to reduce the potential for turbidity in the reservoir at the times when the depth of water above the fill is shallow.

2.2.3 Disposal Site 3

Disposal Site 3 is located on the southwest slope of Observation Hill below the dam access road (see Figure 9 and Figure 10[4]). Figure 11 presents an overview of the changes to the configuration of this site between the preliminary design and final proposed design based on continuing efforts to avoid and minimize potential impacts, including input from resource agencies on this site and Disposal Site 7. Two configurations are evaluated in this memo. One configuration has a capacity of 2.48 mcy and the other has a capacity of 1.47 mcy (analyzed in Disposal Options A and C, respectively, in Table 6). Both of the configurations would confine the fill material to the hill slope and a small portion of the reservoir below elevation (756 feet) to avoid impacts to a perennial stream and mature riparian vegetation. The final grade would extend up the southwest-facing slope above the reservoir to approximately elevation 960 feet. Seepage from a spring located within the limits of the disposal site would be conveyed to the toe of the fill through a drainage layer.

2.2.4 Disposal Site 4

Disposal Site 4 is located on a terrace on the east side of the reservoir (see Figures 12 and 13). The capacity of the configuration evaluated in this memo is 0.60 mcy. This disposal site is considered in this memo because it

[4] The configuration has been revised slightly since the November 11, 2007 inter agency meeting. The revised configuration relocates the rockfill dike to above elevation 695 feet so that it will not require construction in the water. This will simplify construction and reduce the potential for impacts to water quality. The disposal volume lost by shifting the dike is recovered by extending the disposal area up to the margin of the existing dam access road. Overall, the area of this revised configuration is essentially the same as the previous configuration. The revised configuration is carried through the analysis in this memo.

would be accessible from the eastern side of the dam. However, this site is located on an old landslide, as discussed in Section 4.2 in this memo.

2.2.5 Disposal Site 5

Disposal Site 5 is located at the south end of the reservoir (see Figures 14 through 16). The disposal capacity of this site is 0.84 mcy and would replace the volume of material excavated from Borrow Area E and would effectively restore the borrow area to the existing grade. Due to construction sequencing, this site would not be available during the first construction season. However, materials could be stockpiled adjacent to Borrow Area E and placed into the disposal site after removal of clay materials in the second season. This disposal site might also be used during the second season construction for disposal of a portion of the surplus materials generated from spillway excavation that may occur concurrently with core production. Hauling units transporting core materials to the dam could return to Borrow Site E filled with surplus excavated materials for disposal.

Disposal Site 5 would be entirely within the disturbance area for Borrow Area E (clay) and below the normal water surface elevation (756 feet) of the reservoir once the dam has been replaced.

2.2.6 Disposal Site 6

Disposal Site 6 would be located at the junction of Calaveras Road and the dam access road (see Figures 17 and 18). This memo evaluates a configuration of Disposal Site 6 that would have a capacity of 1.10 mcy. The use of this site would require demolition and reconstruction of a portion of Calaveras Road and may also require additional staging of materials and equipment at the dam site to replace a proposed staging area at the dam access gate.

2.2.7 Disposal Site 7

Disposal Site 7 would be located on the east side of the reservoir south of Disposal Site 4 at Corral Point (see Figures 19 and 20). The configuration for Disposal Site 7 evaluated in this memo would have a capacity of 1.06 mcy. This disposal site would be constructed in a shallow valley between a small hill on the west side and a taller hill on the east side. Seepage from a spring located adjacent to the east side of the disposal site would be conveyed to the toe of the fill through a drainage layer.

2.2.8 Disposal Site 8

Disposal Site 8 would be located south of the reservoir near Marsh Road. Material would be placed in two areas: one on the west side of Calaveras Creek (8a) and a second site east of Calaveras Creek and Marsh Road (8b)(see Figures 21 through 23). Disposal Site 8 would have a storage capacity of 4.12 mcy, which is 0.3 mcy greater than the entire quantity of surplus material. Materials for disposal would be hauled to the site along the west haul road. The west haul road would be constructed early in the first construction season and maintained through two construction seasons.

3.0 ANALYSIS OF DISPOSAL OPTIONS

Disposal options that meet the basic purpose of accommodating 3.8 million cubic yards of surplus soil and rock are evaluated in this memo using a three-tier process. This section describes the three-tier analysis process that is illustrated in the flow diagram below.

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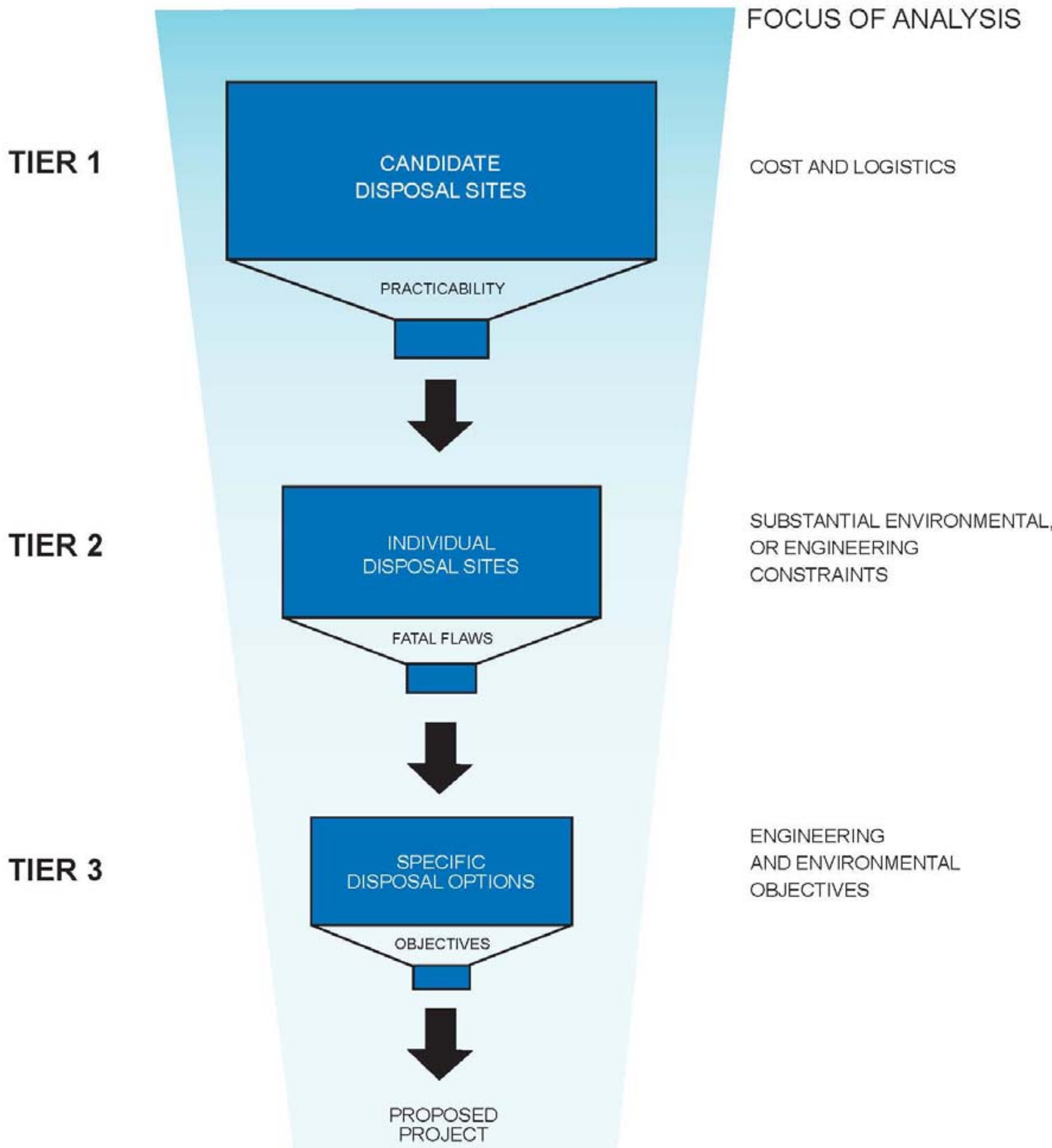
Spoils Disposal Alternatives Analysis Flow Chart



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3.1 Tier 1

The first tier of the analysis is a general screening to eliminate options that are not practicable based on cost or logistics. In this tier of analysis, the cost was considered infeasible if it would increase the total cost of the project by more than 20 percent. From the standpoint of logistics, a site or option was considered infeasible if it would result in severe impacts to offsite traffic, public safety, and project duration. Tier 1 screening included consideration of regulatory acceptance of proposed options for addressing the large volume of potential NOA materials. Sites or options eliminated at this tier are not carried forward to the second tier of evaluation.

3.2 Tier 2

The second tier of the analysis is a focused engineering and environmental analysis of individual disposal sites that are considered feasible based on Tier 1 analysis. The Tier 2 evaluation further screens the options and site for other unacceptable impacts, such as serious geological risks or severe environmental impacts. Examples include sites that are located on known landslides, require substantial relocation of public roads, or that would remove designated critical habitat for a listed species.

Because sites that remained after Tier 1 analysis are all located on or near the Calaveras fault, seismic stability was considered but rejected as a screening criteria under the category of feasibility. Similarly, steep terrain and additional engineering requirements were considered and rejected. These issues are not considered fatal flaws due to infeasibility, as engineering design controls are available, in these cases, to mitigate the risks associated with the proximity of a disposal site to a fault or within steep terrain.

3.3 Tier 3

At Tier 3, sites and options are combined to provide specific disposal options that each have the capacity to accommodate the total volume of surplus rock and soil that would require disposal. In addition, these specific disposal options are combinations of sites that each meet a reasonable range of the environmental, engineering and financial objectives, as discussed below.

Each of the specific disposal options are evaluated to assess the degree to which the sites meet the following financial, engineering and environmental objectives:

- Minimize cost of disposal (financial objective)
- Minimize schedule delays (engineering objective)
  Schedule is primarily a function of two variables:
  - Haul distance
  - Access to disposal sites from both sides of the dam
- Minimize wetland impacts above elevation 756 feet (environmental objective)
- Minimize air quality impacts (environmental objective)
- Minimize impacts to sensitive habitats (environmental objective)
- Minimize potential for water quality impacts (environmental objective)

The thresholds that are used to score the specific disposal options for these objectives are summarized in Section 4.

4.0 ANALYSIS OF DISPOSAL SITE OPTIONS

This section provides the analysis of potential offsite and onsite disposal options for the practicability (e.g. logistics and cost) and environmental considerations. The objective is to establish the basis for selecting the least environmentally damaging, practicable alternative, using the three-tier screening process described in Section 3.0.

4.1 Tier 1 Evaluation

The Tier 1 evaluation considers the practicability of the full range of offsite and onsite disposal options. An option is considered to be practicable if it:

- Meets the purpose and need;
- Is available and implementable (i.e., it can be accomplished within the **financial resources** that could reasonably be made available, and it is feasible from the standpoint of technology and **logistics**) and
- Will not create **other unacceptable impacts** such as severe operation or safety problems, or serious socioeconomic or environmental impacts.

Cost and logistics are the focus of the Tier 1 evaluation because these elements can be compared uniformly across the full range of general onsite and offsite disposal options. Other unacceptable impacts are considered in the Tier 2 evaluation described below. In the Tier 1 evaluation, the cost is considered infeasible if it would increase the total cost of the project by more than 20 percent (approximately $40 million). Logistics were considered infeasible if the disposal option would result in severe impacts to offsite traffic, public safety, and project duration. Sites or options eliminated at this tier are not evaluated in the second tier of evaluation.

The potential cost increase (relative to the proposed project cost of $16 Million for disposal) of the onsite and offsite disposal options is summarized below:

Onsite disposal	$0 - $22 Million
Offsite disposal at landfill	$166 - $608 Million
Offsite stockpile and reuse for road improvement	$129 Million
Offsite reuse and disposal at SFPUC-owned lands	$11 Million

All of the offsite disposal options except for the Sunol quarries would increase the total cost of the project by more than 20 percent. Disposal at the Sunol Quarries site would increase the total project cost by approximately 6 percent ($11 million) but the logistics associated with this general option are considered infeasible for the following reasons:

- The associated increase in vehicle would increase the project duration by more than 12 months;
- The duration of closure of Calaveras Road would increase by more than 12 months over the that currently anticipated by the proposed project (approximately 17 months); and
- Substantial increase in public safety and air quality impacts.

The offsite disposal options are rejected based on the infeasibility of the increased project costs and logistics. No offsite options remain after the Tier 1 screening evaluation. The Tier 2 screening is discussed in Section 4.2. The following section describes the costs and logistics of the general offsite disposal options in greater detail.

4.1.1 Offsite Disposal Options

From the standpoint of cost and logistics, none of the general offsite options are acceptable. Specifically, there are three issues: 1) lack of regulatory desire to landfill this large volume of surplus soil and rock material at permitted facilities, 2) haul distances and associated lack of resources to implement a large and long-distance trucking operation, sufficient capacity and locations for potential beneficial reuse for such large quantities, and air impacts for the number of truck miles, and 3) associated cost and construction / schedule delays that would impact the ability to construct the replacement dam. The following discussion provides detailed analysis of these feasibility and cost issues for the general offsite disposal options. The general offsite options are also summarized in Table 4.

Offsite Disposal Option 1 – Landfill Disposal

Offsite Disposal Option 1 involves the transportation and disposal of 3.4 mcy of surplus rock and soil[5] at a permitted offsite landfill. From the standpoint of regulatory acceptability and cost, this option becomes infeasible due to the amount of material that would be transported and capacity that would be consumed at already limited landfills. In addition, based on the quantities generated in the first year (Table 1), it is anticipated that some of the material would be stockpiled onsite prior to transporting the material offsite. Therefore, temporary impacts to habitat at onsite disposal sites would be likely for this general option.

Cost ranges for this general offsite option were evaluated, and depend on haul distance and waste classification. There are three basic material classifications for the surplus rock and soil generated by the project: 1) cover, 2) Class II waste, and 3) Class I waste. For the purposes of this alternatives analysis, it is assumed that Temblor Sandstone would be suitable cover material, and that material derived from the Franciscan Formation would be classified as Class II waste with between 10 and 50 percent potentially being classified as Class I waste.

Two landfills were considered for this option: Kettleman Hills Class I Waste Disposal Facility located in Kettleman Hills, California, and Altamont Landfill located in Livermore, California. Kettleman Hills Facility is the closest Class I waste facility to Calaveras Reservoir, located approximately 200 miles from Calaveras Reservoir. Altamont Landfill is located approximately 40 miles from Calaveras Reservoir, but does not take Class I waste.

To calculate the cost ranges for disposal, three scenarios are considered:

Scenario 1) This scenario assumes the nearest Class I facility takes all the material and that half of the Franciscan Formation-derived materials are classified as Class I waste. The nearest Class I facility is Kettleman Hills.

Scenario 2) This scenario assumes that a portion of the Franciscan Formation (10 percent) would be deemed Class I material and would be disposed at Kettleman Hills Facility. The remaining Franciscan and Temblor sandstone material would go to the Altamont Landfill, the nearest Class II facility, as Class II waste and cover material, respectively.

Scenario 3) This scenario assumes that all the material would be disposed of at the nearest Class II facility, Altamont Hills, where the Franciscan material would be disposed of as Class II waste, and the Temblor Sandstone as cover material.

It is assumed that the material will be hauled offsite using highway-legal dump trucks, hauling a level struck load of 18 cubic yards. This would result in a total of 211,000 round trips to move the 3.4 mcy of materials. The number of trucks, estimated operational hours, horsepower hours, and fuel usage shown in Table 4 (at end of memorandum) are based on an 8,000 cubic yard per shift production rate and the estimated haul cycle times from the dam to each of the offsite disposal facilities. The estimated cost for each disposal option includes loading, hauling and landfill tipping fees.

Based on an analysis of these three transportation and disposal (T&D) scenarios, fees for T&D could range from a high of $624 million to a low of $182 million (Table 4). Based on cost alone, offsite landfill disposal becomes impracticable. However, it is important to note other logistical flaws in the offsite disposal of this large quantity of surplus rock and soil.

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[5] Excludes the volume of Franciscan Formation material that would be placed in Disposal Site 2 (0.4 mcy) because this site would not require additional disturbance beyond the limits of the area required for replacement of the existing dam.

Calaveras Road, between Geary Road and the dam, is a single-lane road that physically limits the volume of truck traffic. As shown in Table 4, the landfill disposal option would require between 70 and 440 trucks working each shift to meet the project schedule. This would amount to a truck passing any point on the road in a single direction every 1 ½ minutes. This volume of traffic would not be feasible on the narrow portion of Calaveras Road. Additionally, depending on their availability, trucks may need to be secured for this project well in advance and potentially from out of the area or even out of state. Using fewer trucks per shift would result in substantially increasing the project duration. Assuming a traffic volume of a truck every five minutes would result in increasing the schedule duration by 2 years or more. During hauling, Calaveras Road between Geary Road and Felter Road would need to be closed to the public for safety. The duration of closure of Calaveras Road would increase from the approximately 1 ½ years in the current project to 3 years or more.

Environmental considerations associated with this option would include traffic congestion, air quality, and the fossil fuel consumption that would be required to transport the material to suitable landfill locations.

Offsite Disposal Option 2 – Stockpile and Reuse for Road Improvements

Offsite Disposal Option 2 would entail stockpiling surplus rock and soil at either a permanent offsite location or onsite temporarily, and then, use of the Temblor Sandstone portion for local road improvements.

Due to the nature of the Franciscan Formation, none of the 2 mcy would be acceptable from a regulatory standpoint for reuse in road improvement projects. Therefore, for the purposes of this evaluation, none of the material derived from the Franciscan would be considered suitable for this offsite disposal option (Option 2), and would have to be disposed of at an offsite landfill as a Class II waste (General Offsite Option 1) or permanently at an onsite disposal site (Section 4.2).

The remaining approximate 1.4 mcy of surplus soil and rock derived from the Temblor Sandstone would cover approximately 120 road miles with an average depth of three feet of surplus rock and soil. Two unimproved roads in the project vicinity, Marsh Creek Road and Oak Ridge Road (13.5 miles long), would accommodate only approximately 171,000 cubic yards of soil disposal. More than 106 miles of additional road-improvement projects would be required to utilize the remaining surplus materials. In addition, Temblor Sandstone is not a suitable material for road base since it is not as structurally sound as a rock base. The Temblor would likely only be suitable for building up the sides of the road. The time waiting for enough road improvement projects to utilize the entire 1.4 mcy of Temblor Sandstone would be significant. Offsite permanent storage areas would need to accommodate approximately 1.4 mcy of Temblor Sandstone and include upland areas that are near major public transit routes.

Based on the quantities generated in the first year, it is anticipated that some of the material would be stockpiled onsite prior to shipping to the permanent offsite storage locations. Therefore, temporary impacts to habitat at onsite locations would be likely for this option.

Stockpiling the material would require trucking the materials to a temporary stockpile location to prepare the material for reuse. Two stockpile options included onsite and offsite locations. To reach offsite temporary stockpile locations, material would have to be trucked on Calaveras Road during construction, which would significantly increase traffic impacts caused by the project. Potential onsite disposal locations are discussed below in Section 4.2. Utilization of these onsite disposal sites might be necessary in order to stagger truck traffic during construction if offsite Disposal Option No. 2 were implemented, which would require double handling.

The cost of double-handling the material and finding a suitable permanent storage location for 1.4 mcy makes offsite Disposal Option No. 2 infeasible. Therefore, this option is not considered further in this evaluation.

Offsite Disposal Option 3 – Disposal and Reuse of Material at SFPUC-owned Lands

Disposal Option 3 would dispose and reuse surplus rock and soil at existing quarries or other sites on SFPUC-owned lands in the Sunol Valley, north of the project area, as fill material for restoration of quarry pits or operational areas. As stated in Section 2.1, specific SFPUC-owned lands that are evaluated in this technical memo include the gravel pits, currently under operation by Hanson Aggregates, and a piece of land that is currently leased by a nursery. Review of available documents indicates that the Sunol Valley rock quarries will still be under operation during the Project duration. Therefore, these quarries are not available at the time needed by the Project and become infeasible.

SFPUC has considered using lands in the Sunol Valley that are currently leased to plant nurseries for disposal of spoils from other projects. However, the highest capacity of the available sites would be less than 700,000 cubic yards. Therefore, these sites would only accommodate a small proportion of the surplus material from the Calaveras Dam Replacement Project.

For either the gravel pits or the nursery, as with Offsite Options 1 and 3, traffic on Calaveras Road would be greatly impacted during the project duration if materials were disposed of in SFPUC-owned lands. Two potential properties were considered, including: Sunol Valley Quarry and a local nursery that will be closed. In addition Hanson Aggregates, who operates the Sunol Valley Quarry, was approached to evaluate the potential to resell the surplus rock and soil as part of their operations.

Based on initial conversations (Jackson, 2007), Hanson Aggregates may have capacity to process and resell suitable material that would be limited to non-NOA-containing rock and soil. However, the remaining rock and soil is derived from the Temblor Sandstone that does not have sufficient geotechnical properties for use or resale as aggregate.

Environmental considerations for this option would be similar to the landfill option. Traffic and air quality degradation would be associated with transport of the material to a stockpile location for reuse and would depend on the identification of a suitable stockpile location in the Sunol Valley that would not indirectly or directly affect sensitive resources. The Franciscan Complex material would be transported to a landfill or permanently disposed of at an onsite disposal site. The potential presence of NOA in the material would make it unsuitable for reuse. Therefore the cost, traffic and air emissions associated with this option are similar to a landfill disposal option. Assuming that all of the Franciscan Complex is sent to Altamont Landfill and the Temblor Sandstone is trucked to the Sunol Valley (either the quarry or the nursery land), the total cost for T&D would be approximately $145 million. This option is not considered feasible because it would not accommodate all of the surplus material and would have substantially greater costs and environmental considerations. Therefore, this option is not considered further in this evaluation. To fully address the range of offsite disposal options, an alternate scenario (Option 3B) was considered that assumes all of the surplus material could be stockpiled in the Sunol Valley. This option would cost approximately $27 million. However, this option would have the same traffic and logistics issues as the other offsite options that are described above. Therefore it is not considered to be feasible based on logistics and other unacceptable traffic impacts.

4.1.2 Onsite Disposal Options

Onsite disposal options would range in cost from $16 million to $38 million (representing an increase of 0 to $22 million relative to the cost of disposal in the proposed project). All of the onsite disposal sites would be accessible without using public roads. Therefore, the onsite disposal sites would not result in additional road closures, traffic impacts (from use of public roads), or public safety concerns.

4.1.3 Results of Tier 1 Evaluation

Based on an analysis of cost and logistics, all offsite disposal options are fatally flawed and are eliminated from further analysis. The onsite disposal options are considered to be practicable at the Tier 1 level based on cost and logistics and are retained for evaluation in the Tier 2 process.

4.2 Tier 2 Evaluation

The Tier 2 evaluation considers **other unacceptable impacts** that would affect the practicability of the remaining disposal options. Examples could include severe operation or safety problems, or serious socioeconomic or environmental impacts. Unacceptable environmental or engineering constraints considered in this tier of the evaluation include:

- Removal of a substantial area of designated critical habitat
- Located on known landslides
- Require substantial relocation of public roads

Table 5 summarizes the potential biological resource impacts of each onsite disposal site. A “very high” impact rating on Table 5 is considered an unacceptable biological resource impact for the Tier 2 evaluation. The following onsite disposal sites are eliminated in the Tier 2 evaluation because they have substantial engineering constraints and unacceptable environmental impacts:

- Disposal Site 1
- Disposal Site 4
- Disposal Site 6

The rationale for eliminating these sites is discussed below.

4.2.1 Disposal Site 1

Site 1 is removed from further consideration because it would result in unacceptable biological resource impacts. Table 5 summarizes the basis for the “very high” impact rating for Site 1. Factors that contribute to this rating include substantial impacts to designated critical habitat for the Alameda whipsnake and mature oak woodlands. Nearly all of Site 1 would be located within designated critical habitat for the Alameda whipsnake. This site would also impact more than 400 feet of perennial stream and small amounts of intermittent and ephemeral channels and seasonal wetlands. In addition to these impacts, Site 1 would also remove a small amount of serpentine grasslands.

4.2.2 Disposal Site 4

Site 4 is removed from further consideration because it has unacceptable engineering constraints. Based on published literature (Kintzer, 1980 and Nilson et al., 1972) and a recent geologic reconnaissance (URS, 2006c), the terrace where Site 4 would be located is an old landslide. Disposal of a large quantity of soil and rock on this terrace could reinitiate movement of the landslide into the reservoir. Engineering or geotechnical control measures required to solve this problem are not considered feasible due to cost and logistics. The terrace is also the location of a number of buildings including two residences. The residences would have to be relocated if this disposal site were used.

4.2.3 Disposal Site 6

Site 6 is removed from further consideration because it would result in unacceptable biological resource impacts and would require substantial relocation of an existing public road. Table 5 summarizes the basis for the “very high” impact rating for Site 6. Factors that contribute to this rating include substantial impacts to designated critical habitat for the Alameda whipsnake and riparian woodlands, including the only sycamore alluvial woodland in a disposal area, and large area of serpentine grasslands. In addition, this use of this site would affect a very small amount of upland woodlands, including serpentine foothill pine (Table 5). This site would also impact a large amount of intermittent and ephemeral channels and seasonal and seep wetlands. Relocation of Calaveras Road would be required to accommodate the disposal of material at Site 6, and for which a number of additional environmental impacts would occur, increasing the potential biological resource impacts and presenting additional logistical constraints on the project.

4.2.4 Results of Tier 2 Evaluation

Three of the onsite disposal options are rejected as infeasible based on unacceptable environmental and engineering constraints: Site 1, Site 4, and Site 6. The five remaining onsite disposal options are considered to be practicable at the Tier 2 level and are retained for evaluation in the Tier 3 process: Site 2, Site 3, Site 5, Site 7, and Site 8.

4.3 Development of Specific Disposal Options

Except for Disposal Site 8, the remaining onsite disposal sites would not individually accommodate the entire volume of surplus rock and soil. Therefore, these five individual sites are combined to form five specific disposal options that would accommodate 3.8 mcy of surplus material. The combinations were selected to meet a reasonable range of the environmental, engineering and financial objectives.

Each of the specific disposal options meets the overall capacity objective, and achieves the environmental, engineering and financial objectives in a unique manner, as explained in Table 6. The primary objectives for each of the five specific disposal options include:

Option A – the proposed project configuration of disposal sites, which minimizes haul distance from the dam work site.

Option B – this option was selected to avoid wetland and other aquatic habitat impacts associated with Disposal Site 7 by using Disposal Site 8b at the south end of the reservoir.

Option C – this option reduces the amount of material placed in Disposal Site 3 by using Disposal Site 5 at Borrow Area E at the south end of the reservoir.

Option D – this option minimizes impacts to wetlands and aquatic habitats by utilizing Disposal Site 8b and Disposal Site 5 to eliminate the need for Disposal Site 3.

Option E – this option eliminates the need for Disposal Site 3 and Disposal Site 7 by sending 3.37 mcy of material to Disposal Site 8 (8a and 8b).

Combinations of disposal sites were formed such that each specific disposal option includes Disposal Site 2 because it would have very few environmental impacts and would reuse material from the existing dam.

4.4 Tier 3 Evaluation

Table 7 summarizes the engineering and environmental characteristics of each of the five specific disposal options evaluated in the Tier 3 process.

The Tier 3 process evaluates the specific options to assess the degree to which the sites meet the following financial, engineering and environmental objectives:

- Minimize cost of disposal (financial objective)
- Minimize schedule delays (engineering objective)

  Schedule is primarily a function of two variables:

  - Haul distance
  - Access to disposal sites from both sides of the dam
- Minimize wetland and stream impacts (environmental objective)
- Minimize air quality impacts (environmental objective)

- Minimize impacts to sensitive habitats (environmental objective)
- Minimize potential for water quality impacts (environmental objective)

The thresholds that are used to score the specific disposal options for these objectives are summarized below. Each option is scored using a discrete rating of –1, 0, or +1 depending on how well the option would meet the objective using the thresholds described below (i.e., a numerical version of high, medium, and low).

4.4.1 Ratings for Environmental and Engineering Objectives

Minimize cost of disposal. The cost of the potential disposal options is expressed in dollars. The rating is based on a three-way division of the difference between the lowest cost option and the highest cost option. The options that are in the lowest cost group would be given the highest score (+1); the options that are in the middle cost group would receive a neutral ranking (0) and the options in the highest cost group would receive a ranking of –1.

Minimize schedule delays. The potential for schedule delay is rated based upon the number of months that the project would be delayed compared to the option with the least effect on the current project schedule. The rating is based on a three-way division of the difference between the least delay and the greatest delay. The options with the least delay would be assigned the highest score (+1), the options that are in the middle group would receive a neutral ranking (0) and the options with the largest delay potential would receive the lowest ranking (-1).

Minimize wetland and stream impacts. Potential wetland and stream impacts above and below the future inundation elevation of 756 feet are measured in acres and linear feet (Table 7). Wetlands and streams below 756 feet would be impacted by inundation in the absence of any placement of soil or rock materials. Wetlands and streams within the potential disposal sites that are above 756 feet would only be impacted if the site were selected as part of one of the specific disposal options. The differences between the smallest and the largest wetland and stream impacts are divided into three equal ranges of impact for each category: 1) above 756 feet and 2) total area/length above and below 756 feet. The extent to which a particular option would meet this objective is rated based upon these ranges. The options with the smallest area of disturbance (0-33 percent of the difference between the lowest area of wetland impact and the largest area) would be rated with the highest score (+1); the options that are in the middle group (34-66 percent) would receive a neutral score (0) and the options in the group with the largest area of disturbance (66 to 100 percent of the total spread) would be scored low (–1).

Minimize air quality impacts. The total gallons of fuel that would be required to haul the surplus material to the potential disposal sites is used as an indicator of potential air quality impacts. The amount of fuel consumed by a specific disposal option is proportional to the total haul distance, the elevation gain, and the types of trucks that would be used. It is included because minimizing air quality impacts is an environmental objective that is separate from the engineering objective of a short haul distance. The extent to which a particular option would meet this objective is rated using a three-way division of the difference between the smallest quantity of fuel usage and the largest quantity of fuel usage among the specific disposal options. The options with the smallest quantity of fuel usage (0-33 percent of the difference between the lowest quantity and the largest quantity) would be rated with the highest score (+1); the options that are in the middle group (34-66 percent) would receive a neutral rating (0) and the options in the group with the largest quantity of fuel usage (66 to 100 percent of the total spread) would be given the lowest score (–1).

Minimize impacts to sensitive habitats. Potential impacts to sensitive resources are evaluated using a two-step process. First a composite score is created based on the sensitivity rating presented in Table 5 that was compiled for the disposal analysis by ETJV. Second, the composite score is ranked by dividing the difference between the highest and lowest composite scores into equal thirds.

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The following numerical values are assigned to each of the sensitivity ratings provided on Table 5 to create a composite score:

High = 30

Medium = 20

Low = 10

Note: the disposal sites that are rated “very high” were eliminated in Tier 2 and are not included in the Tier 3 specific options.

The values for each site are then added and the composite score for the option is calculated by dividing the total value by the number of sites included in that option (average value).

The composite scores are rated in Table 8 by dividing the difference between the highest and lowest scores into equal thirds. Options in the lowest third of the composite scores are rated high (+1); options that are in the middle third of the composite scores are rated neutral (0); and options that are in the highest third of the composite scores are rated low (-1).

Minimize potential for water quality impacts. This evaluation assumes that contact between surface water in the Reservoir and the surplus materials placed in the disposal sites could temporarily degrade water quality. This impact is rated based on the location of the disposal site relative to the future inundation elevation of Calaveras Reservoir (756 feet above sea level). Options that would place any fill material below elevation 756 feet are rated medium (0) because any effect on water quality would be temporary and could be fully addressed, if needed, by additional treatment at the Sunol Valley Water Treatment Plant (SVWTP). Options that would place all material above elevation 756 feet are rated high (+1) because the potential for degradation of reservoir water quality would be minimized.

4.4.2 Results of Tier 3 Evaluation.

Table 8 summarizes the scoring and ranking of the specific disposal options considered in the Tier 3 evaluation. Option A scored the highest based on the Tier 3 ranking of four environmental objectives, one engineering objective and cost. Option C and Option D scored in the middle range with a neutral overall rating. Option C would have a similar sensitivity of affected habitats and water quality impacts relative to Option A. However, longer haul distances associated with utilization of Disposal Site 5 and Disposal Site 8b at the south end of the reservoir result in less favorable ratings for air quality (Option D) and cost increase (Option C and Option D), as compared to Option A. The additional schedule delay associated with Option D is at least 15 months compared to the proposed project (Option A). This delay would extend the time that the proposed project would potentially disturb nesting birds and other wildlife and would postpone the restoration and revegetation of temporary disturbance areas. Option C and Option D would require additional costs of $8 to 19 million and would only reduce wetland impacts by 0 to 0.27 acre and stream impacts by 0 to 647 linear feet. Options A and C would impact similar types of habitats with relatively similar sensitivities.

Based upon this review Option A is recommended as the least environmentally damaging practicable alternative (LEDPA). The project proposes to use Sites 2, 3, and 7 (Option A). Disposal Site 5 would be kept as a reserve disposal site, thereby providing buffer capacity should actual field conditions present a volume of unusable rock and soil greater than anticipated to date.

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5.0 REFERENCES

Jackson, T. 2007. Personal communication between Maureen Dunn, URS Corp. and Tom Jackson, Plant Manager, Hanson Aggregates Sunol. October 2, 2007.

Kintzer, F. C. 1980. Geology and Landslides at Calaveras Reservoir, Alameda and Santa Clara Counties, California, M.S. Thesis, California State University, Hayward.

Nilsen, T.H., Bartow, J.A., Frizzell, V.A., Jr. and Sims, J.D. 1975. Preliminary photointerpretation maps of landslides and other surficial deposits of 56 7.5-minute quadrangles in southeastern San Francisco Bay region, Alameda, Contra Costa, and Santa Clara Counties, California, U.S. Geological Survey, Open-File Report 75-277.

SF Planning Department. 2007. Draft Program Environmental Impact Report for the Water System Improvement Program. City and County of San Francisco. June 29.

SF Planning Department. 2000. Land and Natural Resources Division. *Alameda Watershed Management Plan: Final Environmental Impact Report*, August 3.

SFPUC. 2007. Technical Memorandum titled "Sunol Valley Scenic View Buffer Study for the SVWTP Expansion, New Irvington Tunnel, and Alameda Siphon No. 4 projects," July 13.

SFPUC. 2006. *AB1823: Notice of Changes to Water System Improvement Program*, March 2006.

URS. 2005a. Calaveras Dam Conceptual Engineering, Evaluation of Dam Remediation and Replacement Alternatives (Task 9.3), Final, March 19.

URS. 2005b. Calaveras Dam Conceptual Engineering, Conceptual Engineering Report, Dam and Appurtenant Structures (Task 14), Final, October 31.

URS. 2006a. Calaveras Dam Replacement Project, Left Abutment Seepage Control Alternatives Evaluation (Tasks C3.1), Draft, April 7.

URS. 2006b. Calaveras Dam Replacement Project, Geotechnical Data Report, Volume 1 of 4, October 6.

URS. 2007. Calaveras Dam Replacement Project, Construction Cost Estimate 65 Percent Submittal, June 20.

Tables and Figures

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Table 1
Volume of Waste Material by Season

Construction Season	Temblor Sandstone (cy)	Franciscan Complex (cy)	Total (cy)
First season	1,330,000	2,035,000	3,365,000
Second and third seasons	85,000	385,000 [1]	470,000
Total	1,415,000	2,420,000	3,835,000

Notes:

[1] Regrading of a portion of the existing dam into Disposal Site 2 to form approach channel.

Table 2
Project Modifications Resulting in Surplus Soil and Rock Increase or Reduction from Conceptual Engineering Report to Final Design

Design Change	Surplus Soil and Rock Increase	Surplus Soil and Rock Reduction
Left abutment seepage control was changed from a concrete cutoff wall to a deep trench to slightly weathered Temblor Sandstone based on alternatives analysis (URS, 2006a).	The deep trench increased the amount of Temblor Sandstone excavated from Observation Hill.	--
Addition of gravity wall at the left abutment of the dam that acts as the foundation for the dam and the right wall of the spillway. (URS, 2006b).	--	Shifts the excavation for the spillway to the right reducing the volume of Temblor Sandstone to be excavated from Observation Hill.
Rotation of dam axis	--	Shifts the left side of the dam downstream reducing excavation and disposal of materials from the existing dam.
Upstream shell material modified from earthfill to rockfill	Reduces volume of Temblor Sandstone from the spillway excavation that can be reused in the replacement dam. Requires greater development of Borrow Area B resulting in removal and wasting of Temblor Sandstone that overlies the hard rock source for the rockfill.	Steeper upstream slope of the dam shifted the upstream toe farther downstream, reducing excavation and disposal of materials from the existing dam.
Excavation of an approach channel through existing dam instead of leveling off the existing dam	--	Leaving the right side of the existing dam results in less material to excavate and place in a disposal site.
Realignment of spillway channel due to the results of final geotechnical investigation	Increased excavation due to higher Hill 1000 slope cut.	--
Raised the spillway channel elevation at the dam crest based on model study	--	Decreased the amount of excavation required in Observation Hill
Selection of a soldier pile wall with tiebacks for initial stabilization and a berm for final stabilization	--	Decreased the volume of landslide excavation

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Table 3
Summary of Onsite Disposal Sites

Disposal Site	Location	Estimated Maximum Disposal Volume (CY)	Estimated Maximum Disturbance Area (acres)	Estimated Maximum/Average Thickness of Disposed Material (ft)	Estimated Maximum Elevation (ft)	Estimated Average One-way Haul Distance (miles) [1]	Estimated Average Elevation Gain (feet) [1]
1	North of Observation Hill	820,000	18	70 / 30	930	0.5	150
2	Between cofferdam and replacement dam	900,000 [7]	11 [3]	200 / 50	750	0.4 [4]	-170 [4]
3	Drainage in reservoir west of existing dam	2,480,000	39	120 / 40	960	0.9	250 [2]
4	Watershed Keeper's residence	600,000	10	90 / 40	1000	0.7	350 [2]
5	Borrow Site E [5]	840,000	85 [3, 6]	20 / 10	756	3.4	200 [2]
6	Junction of Calaveras Road and dam access road	1,100,000	23	90 / 30	1030	1.4	450 [2]
7	Corral Point	1,060,000	17	100 / 40	870	1	300 [2]
8	South of reservoir	4,120,000	92	85/30	940	4.5	330 [2]

Notes:
1 The estimated average haul distance and elevation gain are measured from the center of the dam foundation to the center of the disposal site.
2 Elevation gain includes a 200-foot climb from center of dam foundation to access road on existing dam.
3 Site already included in disturbance site for construction of replacement dam.
4 Estimated average haul distance and elevation loss from lower third of spillway excavation to center of disposal site.
5 Assumes that disposal site would be within the limits of Borrow Site E where core materials have been removed.
6 Includes 25 acres that will be temporarily disturbed during stockpiling of materials adjacent to Borrow Area E during the first construction season.
7 Although Disposal Site 2 has a capacity of 900,000 cubic yards, the actual volume of material proposed for disposal at Site 2 is 470,000 cubic yards

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Table 4
Summary of Offsite Disposal Options

Offsite Disposal Option	Description	Location	Quantity (CY)	Estimated Average Haul Distance (miles)	Estimated Number of Trucks Required per Working Shift[1]	Estimated Horsepower Hours [2]	Estimated Transportation and Disposal Costs ($)
1A	**Landfill Disposal**	Kettleman Hills – Class I	850,000	200	440	234,000,000	624 million
		Kettleman Hills Class II	2,515,000	200			
1B		Kettleman Hills – Class I	240,000	200	96	57,900,000	230 million
		Altamont – Class II	3,125,000	40			
1C		Altamont – Class II	240,000	40	70	44,400,000	182 million
		Altamont – cover material	3,125,000	40			
2	**Stockpile and Sell for Road Improvements**	Stockpile location to be determined	1,415,000	Variable	Variable	Variable	Similar to Option 3 below if a stockpile site is chosen within 10 miles of Calaveras Reservoir
3A	**Dispose of or Reuse Material at SFPUC-owned Lands**	Altamont – Class II	240,000	40	59	37,500,000	145 million
		Altamont – cover material	1,710,000	40			
		Sunol Valley Rock Quarry (Hanson Aggregates) or property in Sunol Valley	1,415,000	10			
3B		Sunol Valley Rock Quarry (Hanson Aggregates) or property in Sunol Valley	3,365,000	10	44	28,000,000	27 million

Notes:
[1] Number of trucks required to meet project schedule based on excavation production of 8,000 cy/shift for a total of 425 shifts, two 10-hour shifts per day (URS, 2007).
[2] Based on 50 percent of the maximum horsepower rating.

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Table 5
Disposal Site Ratings for Impacts to Sensitive Biological Resources

DISPOSAL SITE		1	2	3	4	5	6	7	8a	8b
Affected Resource	Alameda Whipsnake	Most of site is in designated critical habitat.	None	Affects relatively large amount of scrub and suitable non-scrub habitat. Located near suitable scrub.	Affects suitable non-scrub and marginal habitat. Very little suitable scrub in the area.	Affects large area of marginal and low-use habitat	Site is in designated critical habitat.	Affects large area of marginal and low-use habitat	Affects small area of marginal and low-use habitat	Affects large area of marginal and low-use habitat
	California Tiger Salamander	Affects small amount of marginal and low-use habitat	None	Mostly affects low-use habitat, and a small amount of suitable upland and marginal habitat.	Affects one small pond with suitable aquatic habitat, and some marginal habitat.	Affects a large amount of suitable upland habitat (entire site).	Affects a large amount of suitable upland habitat.	Affects one pond with suitable aquatic habitat in some years, and a large amount of marginal habitat. Pond has variable hydrology and would not be suitable for breeding all years.	Affects a large amount of marginal habitat, trace of suitable upland habitat.	Affects a large amount of marginal habitat.
	California Red-Legged Frog	None	None	None	Affects one pond with suitable habitat; not known to be occupied.	None	None	Affects one pond with suitable habitat; not known to be occupied. Pond has variable hydrology and may not be suitable for breeding all years.	None	None
	Wetlands/Waters	None	None	1.46 acres of freshwater marsh and seep wetlands. 2,035 feet of streams. Freshwater marsh would be inundated below 756 feet.	Affects 0.02 acre of seep wetlands, and 311 feet of intermittent and ephemeral channels.	Affects 144 feet of intermittent channel and 0.43 acre of seasonal wetlands below 756 feet that would be inundated.	Affects 8 feet of intermittent and ephemeral channels, and 0.42 acre of seasonal and seep wetlands.	Affects 0.27 acre of wetlands that include one pond and a seep wetland. Affects 647 feet of intermittent and ephemeral channels.	Affects 1,645 feet of intermittent channel.	No wetlands or stream channels observed during reconnaissance survey in October 2007.
	Sensitive Vegetation Communities	Impacts large amount of upland woodlands and small amount of serpentine grasslands.	None	Affects riparian woodlands, scrub, serpentine grasslands, and upland woodlands.	Affects large area of serpentine grasslands and riparian woodlands, and some upland woodlands.	None	Affects large area of riparian woodlands, including the only sycamore alluvial woodland in a disposal area, and large area of serpentine grasslands. Also Affects a very small amount of upland woodlands, including serpentine foothill pine.	Affects large area of serpentine grasslands and small amount of riparian woodland.	None	None
	Other Considerations	Center of a Diablo Helianthella (List 1B) population is mapped <50' from site boundary.	None	None	Affects some callippe silverspot habitat.	None	None	None	Located in South Calaveras Mitigation Area; reduces mitigation values of the SCMA.	Affects 2.6 acres of 5.3 acres of callippe silverspot habitat identified for compensatory mitigation in PDEIR II.
Overall Sensitivity		**Very High**	**Low**	**High**	**High**	**Low**	**Very High**	**Medium**	**High**	**Medium**

Sensitivity is based on impact magnitude, resource sensitivity, and complexity of mitigation.	Very High	e.g., jeopardizes continued existence of a listed species or removes designated critical habitat or a significant population of a listed species.
	High	e.g., removes a large amount of habitat suitable for a listed species, wetlands, or sensitive vegetation; impacts are difficult to compensate.
	Medium	e.g., removes a moderate amount of suitable habitat for a listed species, wetlands, or sensitive vegetation.
	Low	e.g., removes a small amount of suitable habitat for a listed species, wetlands, or sensitive vegetation; impacts are relatively easy to compensate.

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Table 6
Objectives and Volume Distribution for Disposal Options
(cubic yards)

	Disposal Option A (Proposed Project)[1]	**Disposal Option B**	**Disposal Option C**	**Disposal Option D**	**Disposal Option E**
Primary Objective for Disposal Option	Minimizes haul distance	Avoids Site 7 wetland impact by using Site 8b	Reduces Site 3 wetland impacts by using Site 5	Avoids Site 3 wetland impact by using Sites 5 and Sites 8a/8b	Avoids Site 3 and Site 7
Disposal Site 2[2]	470,000	470,000	470,000	470,000	470,000
Disposal Site 3	2,480,000	2,480,000	1,465,000	---	---
Disposal Site 5[3]	---	---	840,000	840,000	---
Disposal Site 7	1,060,000	---	1,060,000	1,060,000	---
Disposal Site 8a/8b	---	1,060,000[3]	---	1,465,000[4]	3,365,000
Total Disposal Volume[5]	3,835,000	3,835,000	3,835,000	3,835,000	3,835,000

[1] Option A examines the use of Disposal Sites 2, 3, and 7, while Option C assesses the option of requiring the contractor to also use Disposal Site 5 and proportionally reducing the volume at Disposal Site 3. The project proposes to use Sites 2, 3, and 7 (Option A), in addition to keeping Disposal Site 5 as a reserve disposal site, thereby providing buffer capacity should actual field conditions present a volume of unusable rock and soil greater than anticipated to date. As noted previously, Disposal Site 5 is within the boundary of Borrow Area E.

[2] As the result of required excavation work and other construction activities, the Calaveras Dam Replacement Project (CDRP) will produce approximately 3.8 million cubic yards (mcy) of surplus soil and rock that cannot be reused in the new dam. Approximately 0.4 mcy of the 3.8 mcy consists of material that would be regraded from the existing dam into Disposal Site 2 for Options A through E.

[3] Assumes that surplus rock and soil generated during the first construction season will be stockpiled adjacent to Borrow Area B.

[4] Material would be placed in Disposal Site 8b.

[5] Total anticipated volume of disposal material. The total capacity for some disposal options (sum of the individual sites) is larger depending on the mix of sites included.

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Table 7
Comparison of Disposal Options Attributes [1]

Disposal Option[1]	Additional Cost [2] ($M)	Engineering	Environmental				
		Disposal Hauling Schedule Delay[3] (months)	Wetland and Stream Impacts		Air Quality: Additional Estimated Fuel Usage [4] (gallons)	Sensitivity of Affected Habitats (average value)	Minimizes Water Quality Impacts (H or M)
			Wetland Area Above NMWS (756 feet)/ Total Wetland Area (acres)	Length of Streams Above NMWS (756 feet)/ Total Stream Length (feet)			
A (Sites 2, 3, 7) *Proposed Project* [7]	0	0	1.20/ 1.73	2,442/ 2,682	0	L/H/M (10/30/20) 60/3 = **20.0**	M
B (Sites 2, 3, 8b)	7	11	0.93/ 1.46 [5]	1,795/ 2,035 [5]	330,000	L/H/M (10/30/20) 60/3 = **20.0**	M
C (Sites 2, 3, 5, 7)[7]	8	0	1.20/ 2.16	2,442/ 2,826	180,000	L/H/L/M (10/30/10/20) 70/4 = **17.5**	M
D (Sites 2, 5, 7, 8b)	19	15	0.27/ 0.70 [5]	647/ 791 [5]	630,000	L/L/M/M (10/10/20/20) 60/4 =**15.0**	M
E (Sites 2, 8a, 8b)	22	32	0.00/ 0.00 [5]	1,645/ 1,645 [5]	1,040,000	L/M/M (10/30/20) 60/3 = **20.0**	H

[1] Refer to Table 6 for summary of options. The attributes included in this table do not include Disposal Site 2, which is common to all options.
[2] Additional transportation cost only. Cost basis for unit rates for analysis was 65 Percent Design Construction Cost Estimate (URS, 2007).
[3] Disposal hauling schedule delay analysis is based on a maximum of 12 trucks operating through the constricted area at the left abutment in the vicinity of the existing spillway.
[4] Based on 60 percent of the fuel usage at maximum horsepower and maximum payload.
[5] Sites 8a and 8b are located outside of original delineation study area. Estimate for 8a is based on supplemental delineation by ETJV that has not been verified by the Corps. Site 8b has not been formally delineated. No wetlands were identified at Site 8b during an informal delineation by URS.
[6] Impact to reservoir capacity for all options is less than approximately 500 acre-feet and is therefore considered negligible compared to the nominal capacity of the reservoir (96,850 acre-feet).
[7] Option A examines the use of Disposal Sites 2, 3, and 7, while Option C assesses the option of requiring the contractor to also use Disposal Site 5 and proportionally reducing the volume at Disposal Site 3. The project proposes to use Sites 2, 3, and 7 (Option A), in addition to keeping Disposal Site 5 as a reserve disposal site, thereby providing buffer capacity should actual field conditions present a volume of unusable rock and soil greater than anticipated to date. As noted previously, Disposal Site 5 is within the boundary of Borrow Area E.

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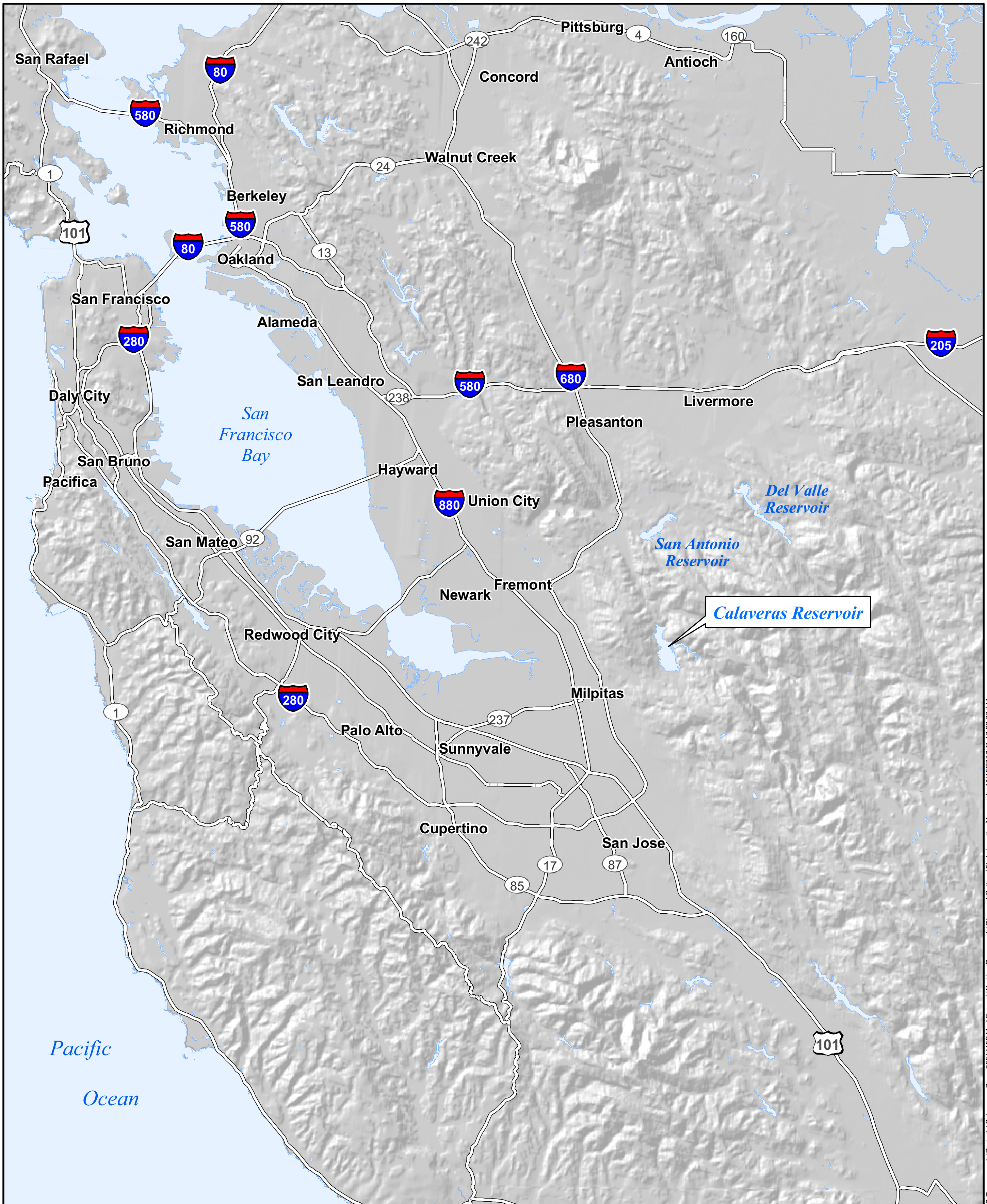
Table 8
Scoring Comparison of Disposal Options Objectives

Disposal Option	Additional Cost	Engineering	Environmental				Total Score
		Disposal Hauling Schedule Delay	Wetland and Stream Impacts	Air Quality: Estimated Fuel Usage	Sensitivity of Affected Habitats	Water Quality Impacts	
A (Sites 2, 3, 7) *Proposed Project*[1]	+1	+1	-1	+1	-1	0	+1
B (Sites 2, 3, 8b)	+1	0	-1	0	-1	0	-1
C (Sites 2, 3, 5, 7)	0	+1	-1	+1	-1	0	0
D (Sites 2, 5, 7, 8b)	-1	0	+1	-1	+1	0	0
E (Sites 2, 8a, 8b)	-1	-1	0	-1	-1	+1	-3

[1] Option A examines the use of Disposal Sites 2, 3, and 7, while Option C assesses the option of requiring the contractor to also use Disposal Site 5 and proportionally reducing the volume at Disposal Site 3. The project proposes to use Sites 2, 3, and 7 (Option A), in addition to keeping Disposal Site 5 as a reserve disposal site, thereby providing buffer capacity should actual field conditions present a volume of unusable rock and soil greater than anticipated to date. As noted previously, Disposal Site 5 is within the boundary of Borrow Area E.



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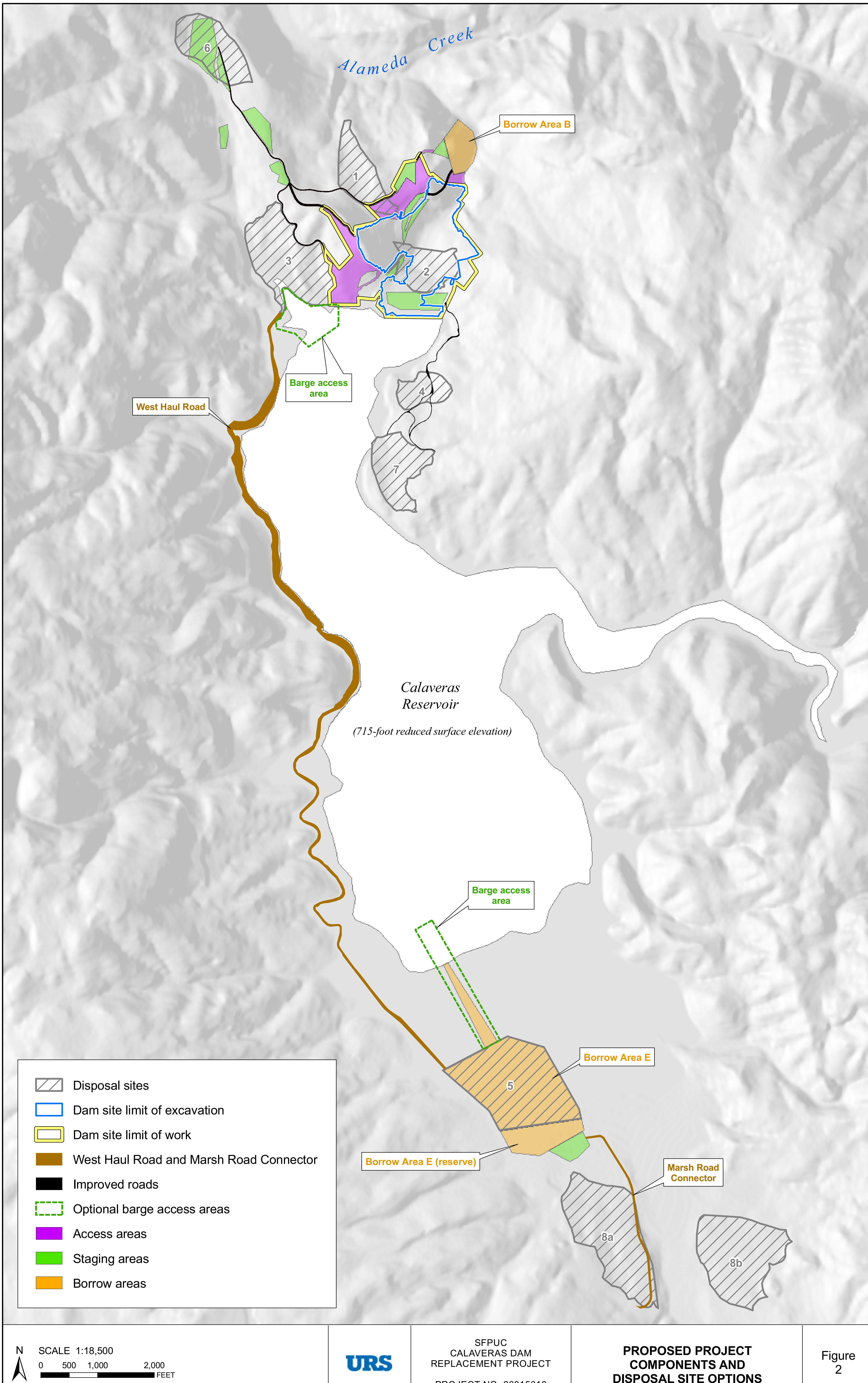
CALAVERAS DAM
REPLACEMENT PROJECT

PROJECT NO. 26815610

PROJECT LOCATION

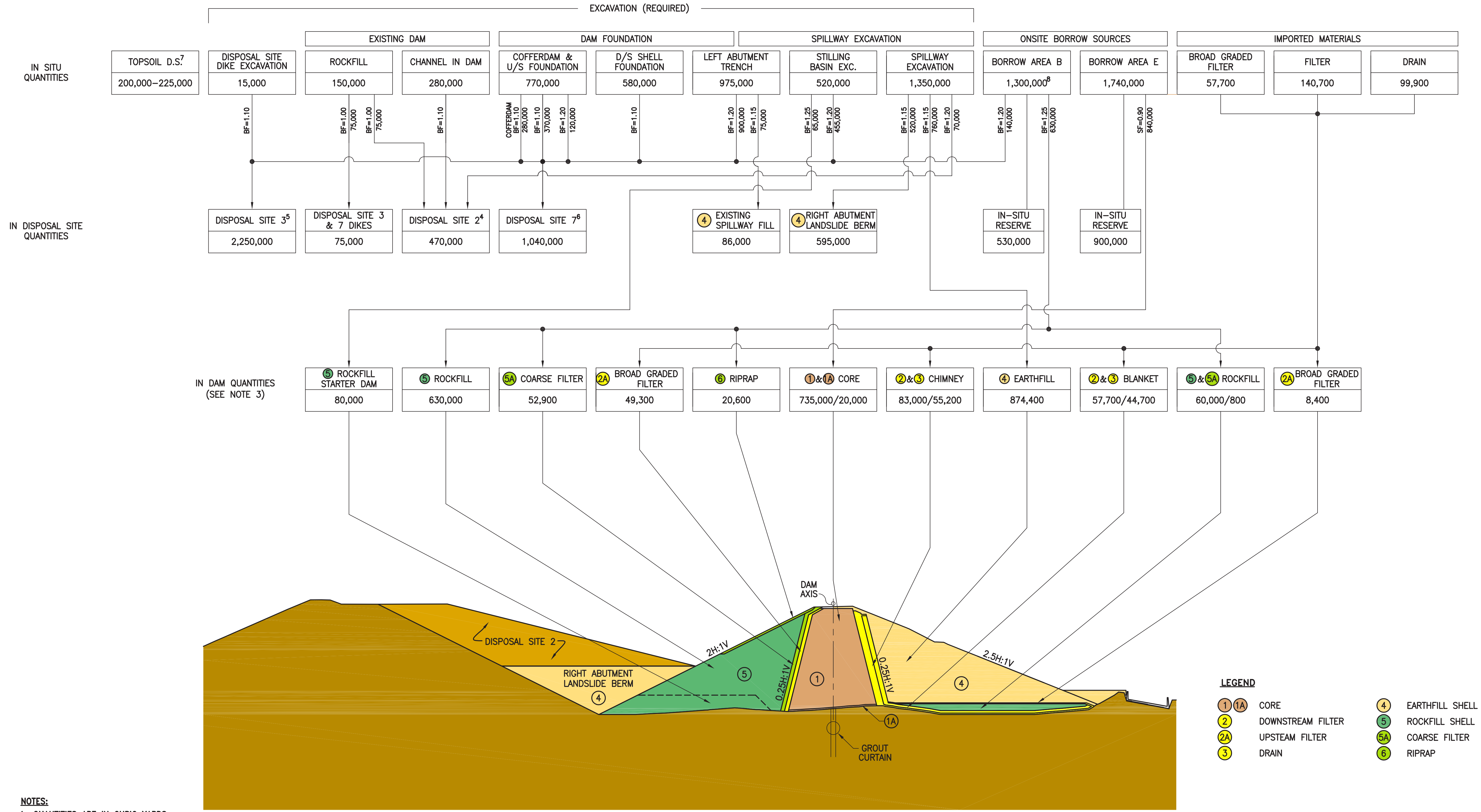
Figure
1

URS Corporation - Oakland CA - C.Raumann L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Disposal Options\Fig1_LocationMap.mxd - 10/19/2007 @ 10:28:39 AM



URS	SFPUC CALAVERAS DAM REPLACEMENT PROJECT PROJECT NO. 26815610	**PROPOSED PROJECT COMPONENTS AND DISPOSAL SITE OPTIONS**	Figure 2

URS Corp, Oakland CA, C.Raumann L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Project Components\Fig2_Proposed_Project_Components.mxd - 3/3/2008 @ 2:35:25 PM



NOTES:

1. QUANTITIES ARE IN CUBIC YARDS.
2. ALL EMBANKMENT QUANTITIES BASED ON DESIGN LINES.
3. OVERBUILD ALLOWANCE NOT INCLUDED.
4. MAXIMUM CAPACITY OF DISPOSAL SITE 2 IS 900,000 CY.
5. MAXIMUM CAPACITY OF DISPOSAL SITE 3 IS 2,480,000 CY.
6. MAXIMUM CAPACITY OF DISPOSAL SITE 7 IS 1,060,000 CY.
7. TOPSOIL ASSUMED TO BE 1 FOOT. TOPSOIL TO BE STRIPPED AND REUSED FOR SITE RESTORATION.
8. INCLUDES TEMBLOR SANDSTONE OVERBURDEN OF 140,000 CY.

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MATERIAL BALANCE DIAGRAM (95 PERCENT DESIGN DRAFT)

FIGURE 3

Dec 13, 2007 – 2:51pm
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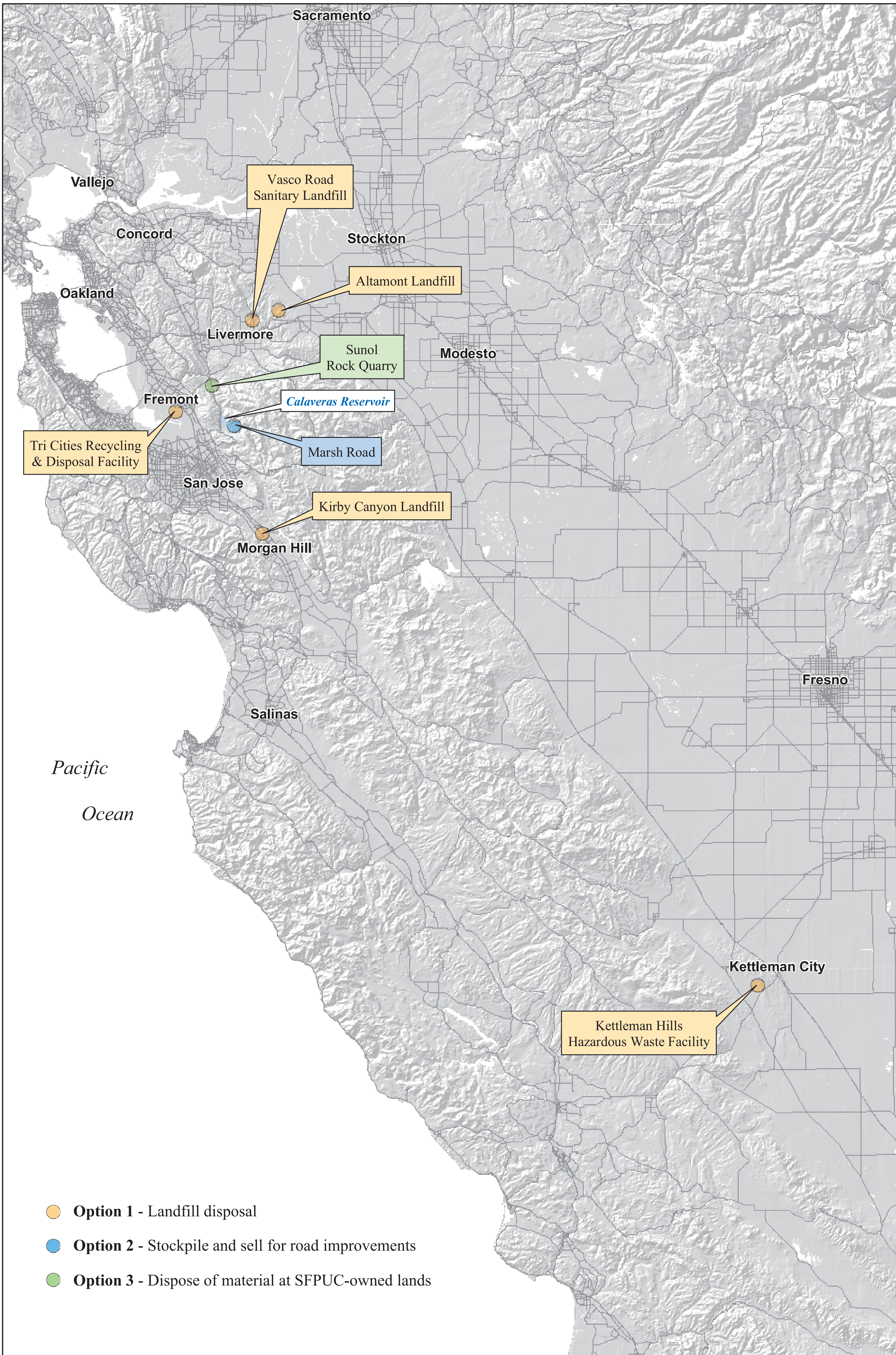

N SCALE 1:1,000,000
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OFFSITE DISPOSAL OPTIONS

Figure
4

N

0 1,000 2,000 4,000 Feet

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REPLACEMENT PROJECT

PROJECT NO. 26815610

ON-SITE DISPOSAL AREAS

Figure 5

URS Corporation, Oakland, CA, dhwrigh0 L:\Projects\Calaveras_Dam_26814408\Mxd\Current Working Documents\Disposal Options\Fig5_Disposal_Sites.mxd - 2/26/2008 @ 4:15:30 PM

Looking Northeast from Observation Hill

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 1	Figure 6

MAX. DISPOSAL VOLUME (CY)	820,000
TOTAL DISTURBANCE AREA (ACRES)	18

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

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ON-SITE
DISPOSAL SITE 1

FIGURE
7

Mar 03, 2008 - 1:01pm
Q:\CADD\Exhibit\033-Disposal Sites with aerial photos.dwg

MAX. DISPOSAL VOLUME (CY)	900,000
TOTAL DISTURBANCE AREA (ACRES)	11

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

URS

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REPLACEMENT PROJECT

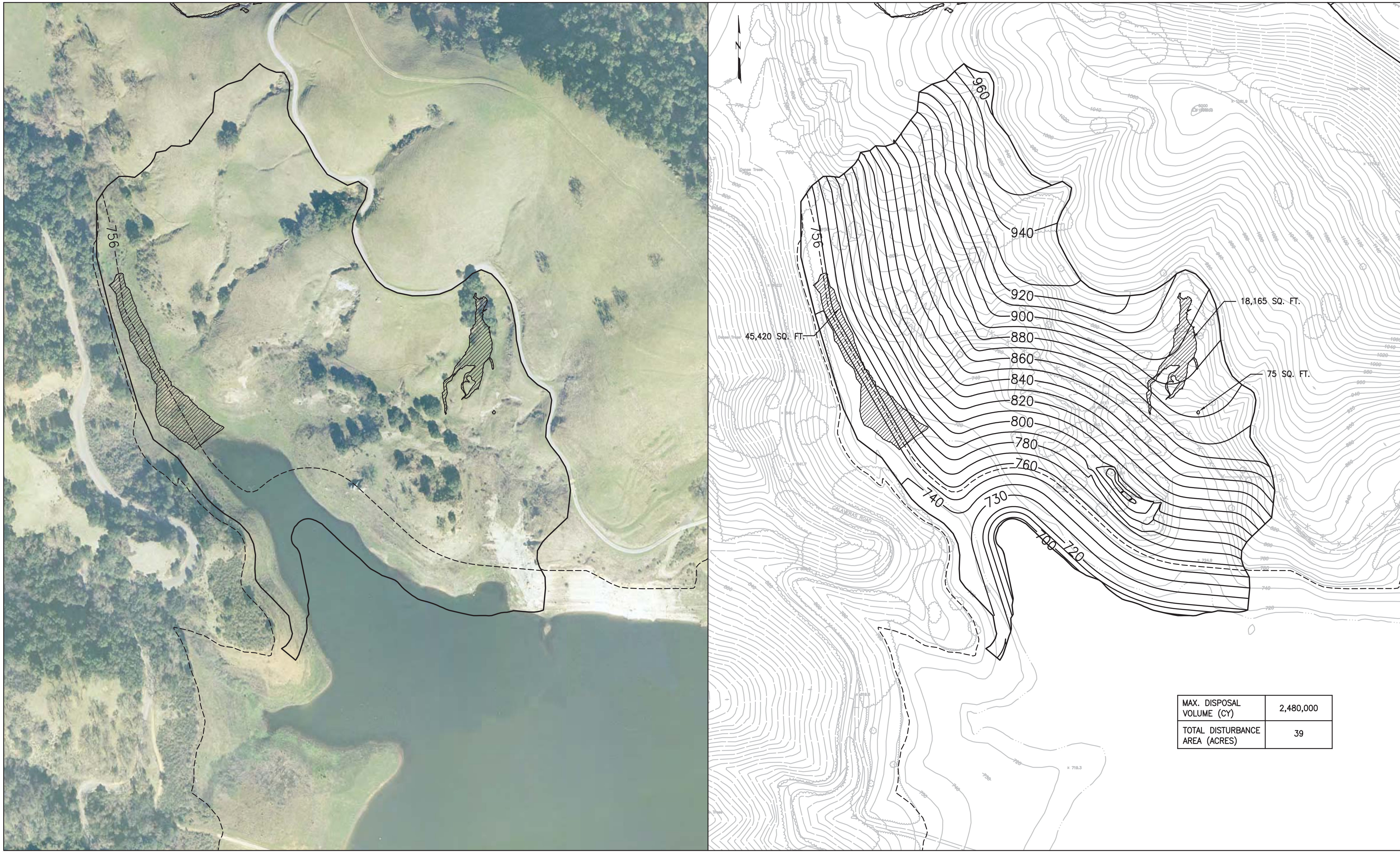
ON-SITE
DISPOSAL SITE 2

FIGURE
8

Mar 03, 2008 – 1:02pm
Q:\CADD\Exhibit\033-Disposal Sites with aerial photos.dwg

Looking South from the Dam Access Road

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 3	Figure 9



MAX. DISPOSAL VOLUME (CY)	2,480,000
TOTAL DISTURBANCE AREA (ACRES)	39

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

URS

Project No. 26815610

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REPLACEMENT PROJECT

ON-SITE
DISPOSAL SITE 3

FIGURE
10

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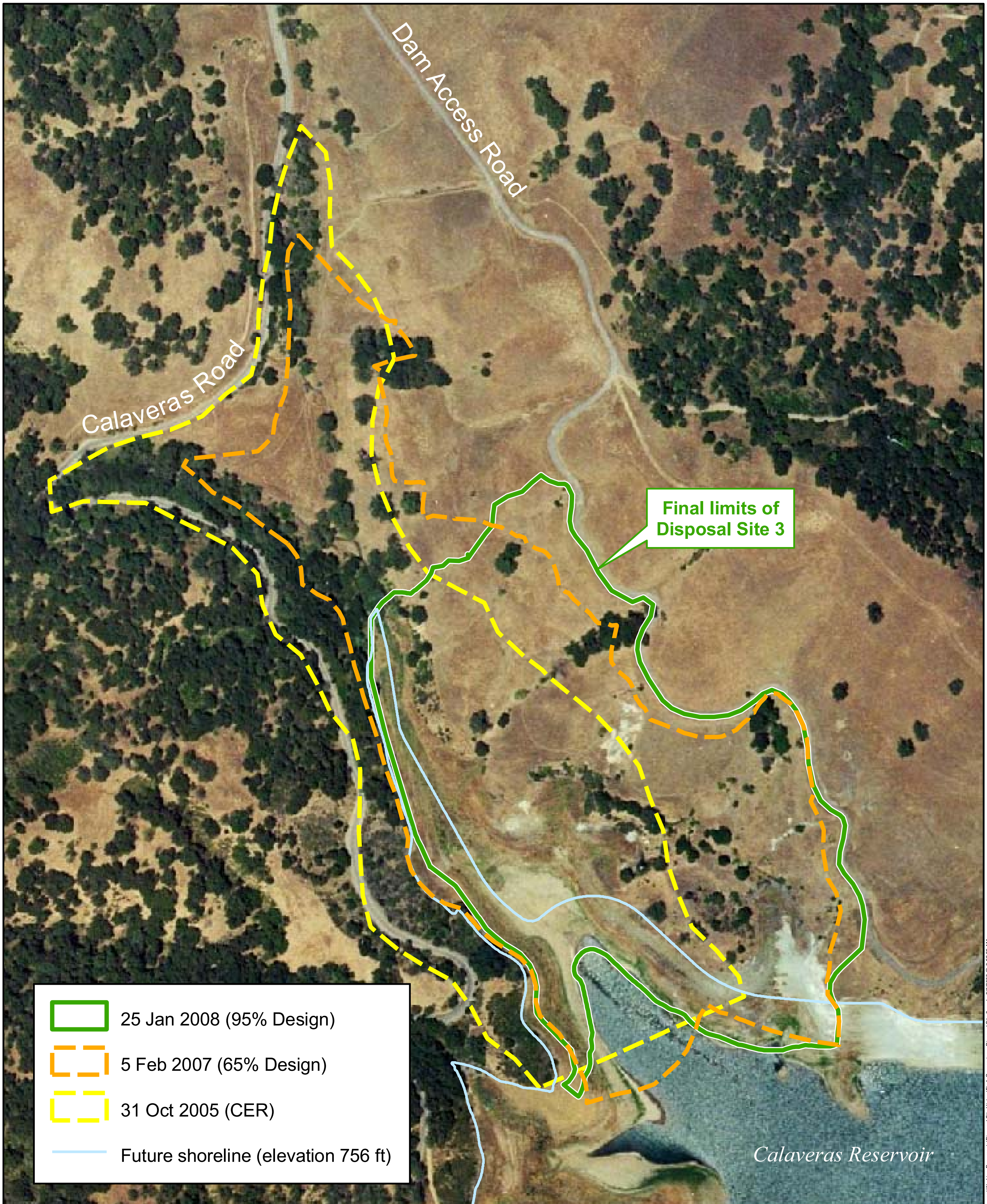

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Aerial Imagery by:
GlobeXplorer, LLC, 2002-10-01

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REPLACEMENT PROJECT

PROJECT NO. 26815610

FINAL LIMITS OF DISPOSAL SITE 3

Figure 11

Looking Northeast

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 4	Figure 12

MAX. DISPOSAL VOLUME (CY)	600,000
TOTAL DISTURBANCE AREA (ACRES)	10

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

URS

Project No. 26815610

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REPLACEMENT PROJECT

ON-SITE
DISPOSAL SITE 4

FIGURE
13

Mar 03, 2008 – 1:05pm
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Looking Southeast from the PG&E Transmission Line Corridor

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 5	Figure 14

Mar 03, 2008 – 1:10pm
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(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'

SCALE 1"=300'

URS

Project No. 26815610

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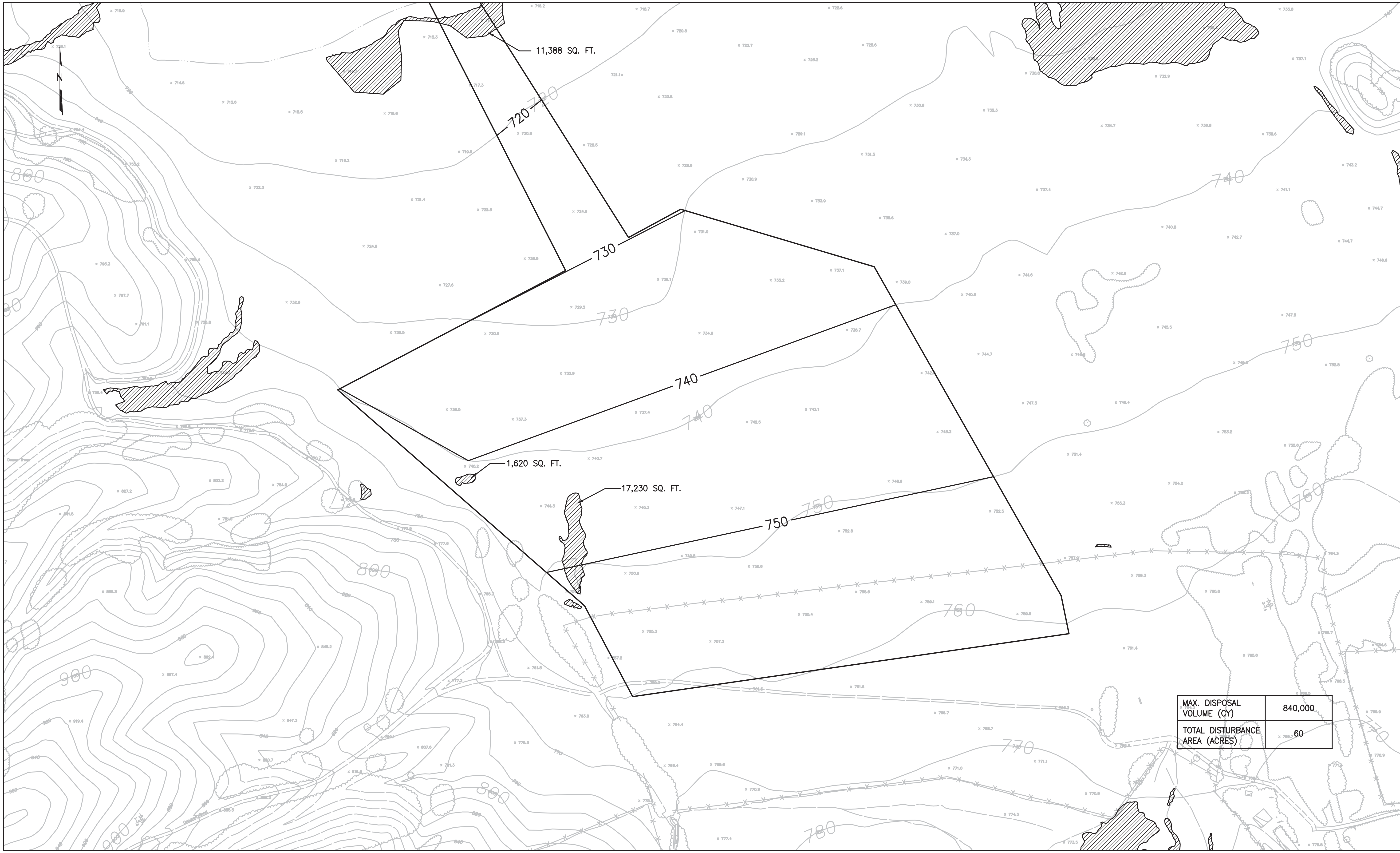
CALAVERAS DAM
REPLACEMENT PROJECT

ON–SITE
DISPOSAL SITE 5

FIGURE
15



MAX. DISPOSAL VOLUME (CY)	840,000
TOTAL DISTURBANCE AREA (ACRES)	60

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'

SCALE 1"=300'

URS	Project No. 26815610 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	ON-SITE DISPOSAL SITE 5	FIGURE 16

Mar 03, 2008 - 1:11pm
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Looking West from the Calaveras Dam Access Road Junction at Calaveras

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 6	Figure 17

MAX. DISPOSAL VOLUME (CY)	1,100,000
TOTAL DISTURBANCE AREA (ACRES)	23

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'

SCALE 1"=300'

URS

Project No. 26815610

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

ON-SITE
DISPOSAL SITE 6

FIGURE
18

Mar 03, 2008 – 1:12pm
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Looking Southwest Toward Corral Point

URS	Project No. 26815271 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	DISPOSAL SITE 7	Figure 19

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

URS

Project No. 26815610

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

ON–SITE
DISPOSAL SITE 7

FIGURE
20

Mar 03, 2008 – 1:13pm
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Looking North Toward Calaveras Reservoir

Looking Northwest Toward Disposal Site 5

URS

Project No. 26815271

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

DISPOSAL SITES 8A AND 8B

Figure 21

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'

SCALE 1"=300'

URS

Project No. 26815610

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

ON-SITE
DISPOSAL SITE 8

FIGURE
22

Mar 03, 2008 – 1:16pm
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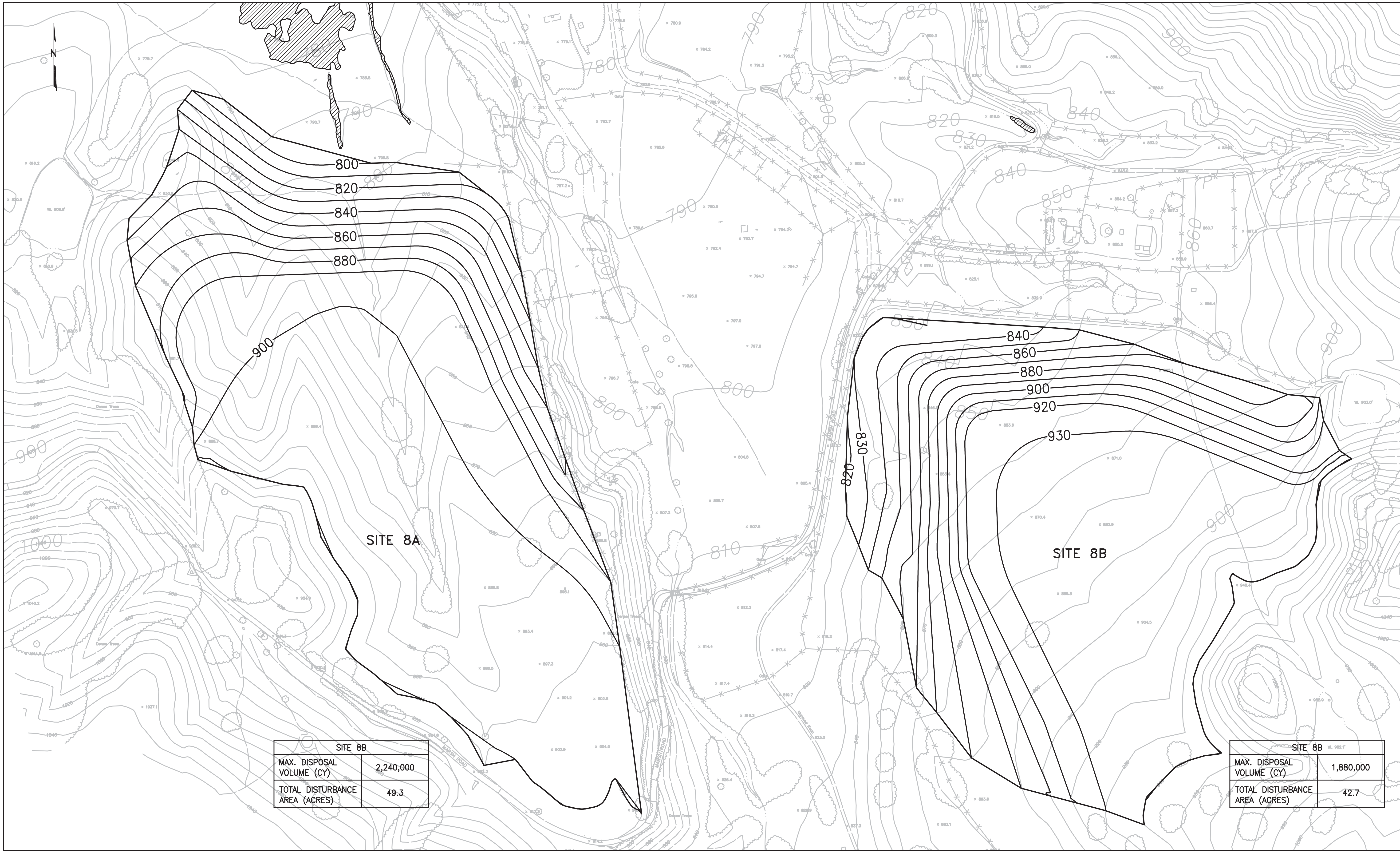

SITE 8B	
MAX. DISPOSAL VOLUME (CY)	2,240,000
TOTAL DISTURBANCE AREA (ACRES)	49.3

SITE 8B	
MAX. DISPOSAL VOLUME (CY)	1,880,000
TOTAL DISTURBANCE AREA (ACRES)	42.7

(1620 sq. ft.) WETLANDS (AREA INDICATED IS WITHIN LIMITS OF DISPOSAL SITE)

LIMITS OF DISPOSAL SITE

RESTORED MNWS (ELEVATION 756)

REPLACEMENT DAM FOOTPRINT

300' 0 300' 600'
SCALE 1"=300'

URS

Project No. 26815610

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

ON-SITE
DISPOSAL SITE 8

FIGURE
23

Mar 03, 2008 – 1:21pm
Q:\CADD\Exhibit\033-Disposal Sites with aerial photos.dwg

APPENDIX B

Alternative Locations for Equivalent Water Storage

The following alternative storage locations to the Proposed Project were considered by the SFPUC, but were eliminated from further consideration for the reasons noted.

Alternative Locations for Equivalent Water Storage in the SFPUC Upper Tuolumne River System or at Non-SFPUC Bay Area Facilities

This alternative considered increasing storage either in the Upper Tuolumne River reservoirs or at SFPUC Bay Area facilities (e.g., Del Valle Reservoir, Los Vaqueros Reservoir, Lexington Reservoir) to accommodate the approximately 96,850 af from the Calaveras Reservoir. The height of the dams at these reservoirs would likely need to be increased to provide additional reservoir storage capacity. In addition, the water supply delivery system would require re-engineering to accommodate the additional flow from these reservoirs.

This approach would require new water supplies or water rights to replace lost supply from the Calaveras and Alameda Creek watersheds, and construction of new facilities to store and distribute the water. If Calaveras Reservoir were to remain at its current reduced level, the spillway would need to be lowered, as described under the No-Action Alternative, with the same impacts as for that alternative.

Enlargement of the existing dams at these alternative locations would entail substantial environmental impacts at new locations compared to the Proposed Project, with potentially greater impacts than those associated with the Proposed Project. Alternative water sources would need to be obtained, resulting in secondary impacts.

Storage in any of these locations would not meet the overall project purposes regarding the use of water from the Alameda and Calaveras Creek watersheds for drought protection and to restore water delivery reliability. For these reasons, this alternative was eliminated from further consideration.

Alternative Locations for Water Storage in SFPUC Facilities in the Bay Area

This alternative would use storage locations within the SFPUC system in the San Francisco Bay Area to replace the storage proposed at the Calaveras Reservoir. New or enlarged piping and pumping systems would be necessary to collect water from Alameda and Calaveras Creeks for storage at the alternative locations. Under this alternative, Calaveras Reservoir could remain at its current level (with modification of the spillway as described for the No-Action Alternative) or the dam could be removed entirely.

Three alternative storage locations were considered: (1) San Antonio Reservoir in the Alameda Creek watershed to the north of Calaveras Reservoir, (2) Crystal Springs/San Andreas Reservoirs, and (3) Pilarcitos Reservoir. These sites are available only in the sense that they are located on City and County of San Francisco land and are owned and operated by the SFPUC. None of these reservoirs has sufficient reserve capacity to accommodate individually increased storage equivalent to the volume that would be made available in the Calaveras Reservoir with the Proposed Project. Thus, an increase in storage capacity would be required; all or most of the dams at these reservoirs would need to be raised to accommodate the additional storage.

In addition to raising the existing dams, it is also possible that the water treatment facilities at the Harry Tracy Water Treatment Plant on the San Francisco Peninsula would need to be enlarged for any of the Peninsula reservoir alternatives. This is because the SVWTP, which treats water from Calaveras and San Antonio Reservoirs, would not be available to treat the additional water stored on the Peninsula under this alternative.

Raising the dams at San Antonio Reservoir and on the Peninsula, and possibly expanding the Harry Tracy Water Treatment Plant, would result in substantial impacts to important biological resources. Therefore, reduced impacts on biological resources around Calaveras Reservoir and Calaveras Creek would be exchanged for increased impacts on biological resources in the alternative storage locations. Construction-related water quality, traffic, and air quality impacts would also result, but in different locations from those identified for the Proposed Project.

Water from Alameda and Calaveras Creeks would need to be pumped directly to the new storage locations, requiring construction of many miles of new pipes and possibly one or more new pump stations. These construction activities would be expected to have temporary, but significant impacts to waters of the United States, and on transportation, air quality, noise, and biological resources, depending on the alignments chosen for the new pipelines and pump stations. Recreational opportunities would temporarily be curtailed during construction at the Peninsula reservoirs.

Significant impacts on visual resources would be different but not eliminated if Calaveras Dam were removed because its removal would leave a large bare, rocky area and expose the sides of the former reservoir. Revegetation would occur in some of the exposed areas over many decades. Visual impacts would be reduced but not eliminated if the existing dam and reservoir were to remain as described in the No-Action Alternative.

This alternative would not avoid or substantially reduce environmental impacts compared with the Proposed Project, and it could result in greater impacts to some resources. In addition, and as with the previous alternative, storage in any of these locations would not meet the overall project purposes regarding the use of water from the Alameda and Calaveras Creek watersheds for drought protection and to restore water delivery reliability. For these reasons, this alternative was eliminated from further consideration.

Alternative Water Storage Facilities in the Sunol Area

This alternative would maintain the same existing water level in Calaveras Reservoir as the No-Action Alternative, and it would use additional facilities in the Sunol area to provide a total water supply from the Alameda Creek watershed equivalent to the Proposed Project. As with the No-Action Alternative, the Calaveras Dam spillway crest would be lowered from the existing elevation of 756 feet to 705 feet. Inflow to Calaveras Reservoir from Calaveras Creek, Arroyo Hondo, and the ACDD would be similar as with the Proposed Project, but water in excess of the existing volumes stored in the reservoir would be passed down Alameda Creek to other storage facilities rather than being stored in Calaveras Reservoir.

Additional storage would be provided in San Antonio Reservoir and in the Sunol quarry pits. To accommodate the additional water, Turner Dam would be raised approximately 32 feet to capture an additional volume of about 34,500 af, and the quarry pits would be lined to prevent seepage losses. A larger pipeline would be needed to convey more water to San Antonio Reservoir than is now transferred from Calaveras Reservoir. New pipelines and pumping facilities would be needed to convey water to the quarry pits and from there to the SVWTP. This alternative would reduce impacts on biological resources identified for the Proposed Project. However, construction of the new pipelines and pumping facilities and raising Turner Darn would result in impacts to biological resources in different locations from those identified for the Proposed Project. Visual impacts would be reduced, but not eliminated, and would be similar to those described for the No-Action Alternative.

Feasibility studies indicate that Turner Dam could he raised (Kennedy/Jenks 1986). However, only about 14,000 af of storage is currently available in the quarry pits. The next increment of storage would not be available for about 30 years.

This alternative meets only one of the four project objectives: improving seismic reliability. This alternative would not satisfy the objective of re-creating a deeper pool in Calaveras Reservoir to limit algal growth and maintain high water quality. It would not achieve the desired storage capacity in the near term, thus failing to satisfy the objective of restoring the water supply and the ability to provide water during the 8.5-year design drought. Therefore, it was eliminated from further analysis.

Regional Water Supply System Alternative

This alternative involves restoring the storage capacity of Calaveras Reservoir through a regional approach that would optimize the use of existing water supplies managed by multiple water agencies in the San Francisco Bay Area.

The assurance of a reliable water supply for the San Francisco Bay Area region (horizon year 2020) was the subject of an investigation undertaken jointly by the CALFED Bay-Delta Program, SFPUC, Bay Area Water Supply Conservation Agency, Alameda County Water District, Contra Costa Water District, East Bay Municipal Utility District, Santa Clara Valley Water District, and Zone 7 of the Alameda County Flood Control and Water Conservation District (CDM et al. 2005). The investigation explored a range of options (example concepts and portfolios that included increased storage, enhanced conservation, recycled water, desalination, and other water source areas) for sharing of resources between water agencies, needed linkages, and other actions for a regionally based approach to water supply reliability (CDM et al. 2005). That investigation included the proposed expansion of Calaveras Reservoir (420,000 afy) and an enlarged Los Vaqueros Reservoir (500,000 afy) (CDM et al. 2005). However, no consideration was given to removing Calaveras Reservoir or other reservoirs from the overall system. In fact, the 2020 planning horizon of the study was based on an assumed increase in demand from 1.07 to 1.24 million afy, and thus did not consider removing storage from the system to meet the increased demand (CDM et al. 2005).

No regional solution to water resource reliability is being undertaken to date or appears imminent. Given the institutional constraints among the San Francisco Bay Area water agencies, and the need not only to keep current storage capacity but also to restore storage to the SFPUC water system, this alternative is not being pursued.

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APPENDIX C

Summary of Project Alternatives: Environmental Consequences

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Agricultural Resources and Recreation						
Agricultural resources impacts would be less than significant. The project is in an undeveloped area without sensitive receptors, and it would not change surrounding land uses. Any reduction in land available for grazing would be minor and temporary. Impacts of construction activities on recreation would be less than significant with mitigation. Restrictions, closures, visual changes, and congestion at recreation facilities would be temporary. Alternate access and bicycle routes and mitigation to coordinate with AMGEN Tour organizers would reduce impacts from temporary road closures to less than significant levels, and any road damage would be repaired.	Decreased Impacts on agricultural resources and recreation would be decreased compared to the Proposed Project. The shorter duration and smaller scale of construction would result in less disruption of recreation and grazing activities during construction	Increased Agricultural impacts would be similar to those of the Proposed Project, with less disruption of grazing activities during construction. Impacts on recreation would be increased due to the substantial increase in truck trips on Calaveras Road and the 4 additional years of construction activities relative to the Proposed Project but would remain less than significant with mitigation.	Increased Agricultural impacts would be similar to those of the Proposed Project, with less disruption of grazing activities during construction. Impacts on recreation would be increased due to the significant increases in truck trips on Calaveras Road and the 2 additional years of construction activities relative to the Proposed Project but would remain less than significant with mitigation.	Similar Agricultural impacts would be similar to those of the Proposed Project. This alternative would result in less disruption of grazing activities during construction. Impacts on recreation would be marginally increased due to the slightly longer construction duration (6 months).	Similar Agricultural impacts would be similar to those of the Proposed Project. The slightly shorter construction duration (4 months less) would result in less disruption of recreation and grazing activities. Like the Proposed Project, the alternative would not significantly affect agricultural land uses.	Similar Agricultural impacts would be similar to those of the Proposed Project. This alternative would result in less disruption of grazing activities during construction; like the Proposed Project, the alternative would not significantly affect agricultural land uses. Although the duration of construction is longer, the first year of construction would not involve much traffic on roadways that would affect recreational access.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Vegetation and Wildlife						
Impacts on wetlands/aquatic habitats would be less than significant with mitigation during construction and reservoir filling. Project design, restoration, and compensation would minimize habitat loss from fill, disturbance, and pollutant discharge. Implementation of flow releases would reduce impacts to less-than-significant levels during operations. Impacts on special-status species/sensitive communities from construction and filling would vary. Impacts would be less than significant for species/communities not expected within the project area and less than significant with mitigation for those present, due to habitat loss/degradation and mortality. Pre-construction surveys, avoidance, relocation, monitoring, and compensation would reduce impacts. During operations, continued mitigation would be required for foothill yellow-legged frog; impacts on all other species would be less than significant. The project would not conflict with local policies or ordinances protecting biological resources.	Decreased Construction impacts on wetland and wildlife habitat would substantially decrease. No new impacts would occur, and the amount of habitat disturbed and restoration needed to mitigate habitat impacts would be reduced. Borrow areas and the west haul route would not be necessary, and disposal would only occur at one disposal site (3 or 7). The overall impact on annual grassland habitat would be less than the impact under the Proposed Project, although excavation into Observation Hill would cause greater local disturbance. Inundation impacts would be eliminated. This alternative would not change reservoir operations from the baseline.	Decreased Impacts on sensitive species associated with the disposal sites would be reduced or eliminated. Dam construction, borrow area excavation, and Alameda Creek Diversion Dam (ACDD) bypass facility construction and operations would have the same impacts as the Proposed Project. The duration of construction impacts would be increased.	Decreased Impacts on sensitive species associated with the borrow areas, west haul route, and Disposal Site 5 would be reduced or eliminated. Dam construction, disposal of surplus materials, and ACDD bypass facility construction and operations would have the same impacts as the Proposed Project. The duration of construction impacts would be increased.	Decreased Impacts on sensitive species associated with Disposal Site 7 would be eliminated. Temporary stockpiling of disposal material adjacent to Disposal Site 5 would result in new or increased impacts on vegetation and wildlife at this site. Dam construction, borrow area excavation, and ACDD bypass facility construction and operations would have the same impacts as the Proposed Project.	Similar The area of habitat disturbance for construction would be the same despite excavation and disposal of less material. This alternative would therefore have impacts similar to those of the project.	Increased Although reusing the existing dam site would reduce the loss of riparian habitat downstream, drawdown of the reservoir during construction could reduce food supply, aquatic/wetland habitat, water quality, and access, increasing impacts on wildlife during construction. Eliminating the new dam footprint and inundation area would reduce less than significant long-term impacts from loss of wetland/aquatic habitat.

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Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Fisheries and Aquatic Habitat						
Impacts on fisheries resources in the reservoir and upstream would be beneficial due to improved water quality and habitat conditions. The project would have no impact on fish barriers or conflicts with local plans. Impacts on fisheries resources downstream and in the extended study area would be less than significant due to fish relocation activities and rainbow trout adaptive management, overall improved habitat, and minimal changes to flows. Impacts from temporary water quality degradation would be less than significant with mitigation. Implementation of Best Management Practices (BMPs) and the Storm Water Pollution Prevention Plan (SWPPP) would minimize localized impacts on fish.	Similar Water quality degradation that could adversely affect fisheries would decrease due to smaller-scale construction, thereby decreasing impacts on fisheries. Like the project, mitigation would reduce impacts to less than significant. Operations would maintain baseline conditions resulting in no change to fisheries resources (this may have long-term adverse effects for fisheries in the reservoir). Beneficial effects of the Proposed Project would not occur.	Decreased Water quality degradation that could adversely affect fisheries would decrease due to reduced ground disturbance and direct contact of the reservoir with disposed material, thereby decreasing construction impacts on fisheries. Operations impacts would be the same as those identified for the Proposed Project.	Decreased Water quality degradation that could adversely affect fisheries would decrease due to reduced ground disturbance, thereby decreasing construction impacts on fisheries. Operations impacts would be the same as those identified for the Proposed Project.	Similar Ground disturbance would be reduced at Disposal Site 7, but increased at Disposal Site 5. Inundation effects would be similar to the Proposed Project. Disposal Site 5 (Borrow Area E) would be inundated under both this alternative and the no project. Operations impacts would be the same as those identified for the Proposed Project.	Similar Water quality degradation during construction that could adversely affect fisheries would be similar, although excavation and disposal of material would be slightly reduced. Operations impacts would be the same as for the Proposed Project.	Increased Drawdown of the reservoir could eliminate resident fisheries and increase temperature, resulting in a significant and unavoidable impact. Noise and vibration, water quality degradation, and limited connectivity to Arroyo Hondo for migratory fish from installing the coffer dam would increase construction impacts. Bypassing flows may benefit downstream fisheries in the short term, but the longer time required to re-fill the reservoir would delay establishment of a cold-water pool. Operations impacts once the reservoir is refilled would be the same as under the Proposed Project.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Hydrology						
Construction and operations impacts would all be less than significant. Any changes to downstream flows during construction would be within the range of past operations. Flooding risks and effects on groundwater supply during construction would be minimal/temporary. Operational effects on flows, channel formation, and sedimentation in Alameda and Calaveras Creeks would be within the range of pre-project conditions. The risk of flooding would decrease, and effects on groundwater would be minimal.	Decreased Construction and operations would have fewer impacts on hydrology as compared to the project because the alternative would maintain baseline conditions, resulting in no changes to hydrology.	Similar Construction-related hydrology impacts would not be appreciably changed due to the change in location of disposal. Operations would be the same as under the Proposed Project, and thus hydrology effects would be the same.	Similar Construction-related hydrology impacts would not be appreciably changed due to the change in the source of borrow material. Operations would be the same as under the Proposed Project, and thus hydrology effects would be the same.	Similar Construction-related hydrology impacts would not be appreciably changed due to the shift in use of disposal sites. Operations would be the same as under the Proposed Project, and thus hydrology effects would be the same.	Similar The reduction in construction and disposal materials would have a negligible effect on construction-related impacts relative to the Proposed Project. Operations would be the same as under the Proposed Project, and thus hydrology effects would be the same.	Similar This alternative would have different impacts during construction and refill than the Proposed Project because it would involve drawdown of the reservoir, full bypassing of flows during construction, and longer time to refill after construction is complete. The increase in flow rates in Calaveras and Alameda Creeks downstream of Calaveras Dam from bypassed flows is expected to be within the historical range of conditions, with less than significant impacts. Operations would be the same as under the Proposed Project, and thus long-term hydrology effects would be the same.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Water Quality (Sedimentation, Water Temperature, Dissolved Oxygen)						
Construction impacts related to erosion, contaminants, solid waste, and groundwater supplies would be less than significant with mitigation. Site-specific BMPs and appropriate management of drilling fluids would avoid/minimize water quality impacts. Operational impacts would be beneficial for the reservoir because the project would improve water quality conditions, particularly temperature conditions. Impacts on Alameda and Calaveras Creeks would be less than significant because water quality would not substantially change over the long term.	Decreased Construction-related water quality impacts associated with the project would be reduced due to the smaller scale and shorter duration of construction. However, construction-related impacts would remain less than significant with mitigation due to excavation of Observation Hill and use of Disposal Site 3 or 7. Operations would maintain baseline conditions, requiring continued use of the hypolimnetic oxygenation system. Maintaining the current reservoir elevation would not increase the cold-water pool volume and consequently would not provide a water quality benefit compared to the Proposed Project.	Decreased Construction impacts from erosion and sediment discharge at on-site disposal sites would be eliminated and decreased overall due to less ground disturbance. However, the duration of construction impacts would be substantially increased. Operational effects on water quality would be the same as those identified for the Proposed Project.	Decreased Construction impacts from erosion and sediment discharge at on-site borrow sites and the west haul route would be eliminated and decreased overall due to less ground disturbance. Potential contact with borrow materials containing naturally occurring asbestos (NOA), metals, or contaminants used in construction would be substantially reduced. The duration of construction impacts would be substantially increased. Operational effects on water quality would be the same as those identified for the Proposed Project.	Increased Temporary stockpiling and additional handling of disposal material could increase impacts from erosion and sediment discharge during construction. Elimination of Disposal Site 7 would reduce the need for site stabilization and run-off management. Operational effects on water quality would be the same as those identified for the Proposed Project.	Similar Construction impacts from erosion and sediment discharge would be marginally reduced due to excavation of less borrow material, but the overall magnitude of material handled would be similar. Operational effects on water quality would be the same as those identified for the Proposed Project.	Increased Construction of the cofferdam and drawdown of the reservoir would substantially increase impacts on water quality in the reservoir and downstream due to increased sediment discharge, exposure to contaminants, and increased water temperatures during construction. This would potentially cause significant and unavoidable impacts. Operational effects on water quality would be the same as those identified for the Proposed Project.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Transportation and Circulation						
Impacts on traffic and emergency access would be less than significant, because the increase in vehicle trips would be minimal and limited to the project area. Impacts on roadway capacity, and wear and tear would be less than significant with mitigation. A Traffic Control Plan would minimize any delays/hazards and require repair of any roadway damage. Impacts on traffic safety would be significant and unavoidable if Alameda County does not permit the temporary closure of the portion of Calaveras Road from Geary Road to the dam site.	Decreased The volume of truck trips would be reduced. Construction activities would require closure of Calaveras Road between Geary Road and the dam, and the potentially significant and unavoidable impact to traffic safety would still occur. Construction would be smaller-scale and 2 years shorter in duration.	Increased Transportation of disposal materials to remote off-site locations would substantially increase truck trips and extend the duration of construction by 4 years. This would increase wear and tear, delays, and traffic safety hazards on Calaveras Road and potentially increase the significant and unavoidable impact to traffic safety.	Increased Transportation of borrow materials from off-site locations would substantially increase truck trips and extend the duration of construction by 2 years. This would increase traffic impacts and wear and tear, delays, and traffic safety hazards on Calaveras Road and potentially increase the significant and unavoidable impact to traffic safety.	Similar Impacts would be similar to those of the Proposed Project. On-site truck traffic on the west haul route would increase, but this would not affect traffic safety on Calaveras Road. Construction activities would require closure of Calaveras Road between Geary Road and the dam, and the potentially significant and unavoidable impact to traffic safety would still occur.	Similar Impacts would be similar to those of the Proposed Project. The excavation, disposal, and importation of less material would decrease on-site and off-site truck trips, but would not substantially change impacts compared to the Proposed Project. Despite the slightly shorter (4 months) construction duration, the potentially significant and unavoidable impact to traffic safety would still occur.	Similar On-site hauling would be increased due to the longer construction duration (1 year), but this would not change transportation impacts. The alternative would require slightly more imported filter and drain material from off-site locations, increasing truck trips, but would not substantially change impacts compared to the Proposed Project. The potentially significant and unavoidable impact to traffic safety would still occur.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Air Quality						
Impacts related to greenhouse gas (GHG) and long-term Clean Air Plan (CAP)/precursor emissions, odors, and air quality plans would be less than significant. Construction activities would be temporary. Short-term increases in CAP/precursor, and diesel particulate matter (PM) emissions would be less than significant with mitigation. BAAQMD dust/exhaust control measures would limit emissions from construction activities. Operations would be similar to existing conditions, resulting in no long term impacts on air quality. Emissions may exceed BAAQMD draft significance thresholds even with mitigation, resulting in a significant and unavoidable impact.	Decreased Fewer truck trips for spoils disposal and the elimination of borrow areas would substantially decrease air emissions. However, emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.	Increased More truck trips for off-site spoils disposal would substantially increase air emissions. Emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.	Increased More truck trips to transport off-site borrow materials would substantially increase air emissions. Emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.	Increased Longer hauling distances to Disposal Site 5, stockpiling, and additional handling of the disposal materials would increase air emissions. Emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.	Decreased Fewer truck trips for excavation and disposal of less material would decrease air emissions. However, emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.	Increased The increase in truck trips and the construction period by 1 year would increase air emissions. Emissions would likely exceed BAAQMD draft significance thresholds, resulting in a significant and unavoidable impact, like the Proposed Project.

Table C-1. Summary of Project Alternatives: Environmental Consequences

Proposed Project	Alternative 1 No Project Alternative	Alternative 2 Off-Site Disposal Alternative	Alternative 3 Off-Site Borrow Alternative	Alternative 4 Consolidated On-Site Disposal Alternative	Alternative 5 No Provision for Future Dam Enlargement Alternative	Alternative 6 Replacement Dam at Existing Location Alternative
Noise and Vibration						
Nighttime construction-related noise would have a significant and unavoidable temporary impact. Noise controls would reduce noise to local ordinance levels, but nearby residences may experience disturbances. Impacts from construction-related vibration and long-term noise would be less than significant. Controlled blasting/pile driving would be below vibration thresholds, and operations would not exceed ambient noise levels. Disturbance from blasting during construction would be less than significant with mitigation. Noise controls and reduction in blasting charges/frequency would minimize noise.	Decreased Borrow Area E and Disposal Site 5 would not be used, eliminating associated noise impacts, including the significant and unavoidable nighttime impact from back-up beepers. Construction noise impacts, including impacts related to blasting, would still occur and be less than significant with mitigation. Disturbances related to long-term operations would remain less than significant.	Similar Noise at disposal sites would be reduced or eliminated. Noise would increase on local roads and regional highways from the increased truck trips to off-site disposal areas but, like the Proposed Project, could be mitigated. The duration of construction would be 4 years longer than under the Proposed Project. The significant and unavoidable nighttime impact due to back-up beepers at Borrow Area E would remain. Disturbances related to long-term operations would remain less than significant.	Decreased The significant and unavoidable noise impact associated with nighttime activities at Borrow Area E would be eliminated. Blasting at Borrow Area E would be eliminated, reducing less than significant impacts near the southern end of the reservoir. Noise would increase on local roads and regional highways from the increased truck trips to off-site borrow areas but could be mitigated. The duration of construction would be 2 years longer than under the Proposed Project. Disturbances related to long-term operations would remain less than significant.	Increased Impacts would be increased compared to the Proposed Project. Noise impacts would be shifted from the vicinity of Disposal Site 7 to Disposal Site 5. The significant and unavoidable nighttime impact due to back-up beepers at Borrow Area E would remain and increase in duration by 6 months. Disturbances related to long-term operations would remain less than significant.	Similar The 4 month shorter construction duration due to excavation and disposal of less material would marginally reduce construction noise impacts, including at Borrow Area E. The significant and unavoidable nighttime impact due to back-up beepers at Borrow Area E would remain. Disturbances related to long-term operations would remain less than significant.	Similar Temporary construction-related noise and vibration in the area surrounding the dam would remain essentially the same as described for the Proposed Project. Noise disturbance at Borrow Area E would be slightly reduced, but the significant and unavoidable nighttime impact due to back-up beepers would remain. Noise disturbance at Disposal Site 5 could be increased. Disturbances related to long-term operations would remain less than significant.

Source: Excerpted from SFPUC 2009. Public Draft Environmental Impact Report for the Calaveras Dam Replacement Project.

APPENDIX D

Detailed Impact Calculations for All Project Alternatives

Appendix D
Detailed Impact Calculations for All Project Alternatives

Table D-1
Impact Acreages for the Proposed Project

Type of Activity	Wetland/Other Waters Type[1]	Permanent Acres/Linear Feet (lf) [2]	Temporary Acres/ Linear Feet (lf)[2]
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E/ Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	*0.43*	
	Intermittent Stream	0.01	
	Stream Subtotal	*0.01*	
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	*1.46*	
	Perennial Stream	0.02	
	Ephemeral Drainage	0.04	
	Stream Subtotal	*0.06*	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	*3.20*	
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	*0.32*	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	*0.44*	
Haul Roads/Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream	0	
	Ephemeral Drainage	0	
	Stream Subtotal	*0*	

Table D-1
Impact Acreages for the Proposed Project

Type of Activity	Wetland/Other Waters Type[1]	Permanent Acres/Linear Feet (lf) [2]	Temporary Acres/ Linear Feet (lf)[2]
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		*0.45*
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		*12.47*
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland Subtotal		*0.04*
	Perennial Stream		0.01
	Ephemeral Drainage		0.03
	Stream Subtotal		*0.04*
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		5.71
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	2.51	0.59
	Other waters	4.28	18.29
	Total	6.79	18.88

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.

[2] Linear feet are presented for linear features (e.g., perennial and intermittent streams and ephemeral drainage) only. Impacts to wetlands and other waters related only to excavation are not included in the table because the Clean Water Act regulates dredged and fill material but does not consider excavation in wetlands or other waters.

[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.

[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.

Source: ETJV 2008 and data from Section 401 water quality certification application, prepared by URS for SFPUC on 10/29/09.

Table D-2
Alternative 1: No Project Alternative (Assuming Disposal at Disposal Site 7)

Type of Activity	Wetland/Other Waters Type[1]	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland		
	Wetland Subtotal		
	Perennial Stream		
	Intermittent Stream		
	Ephemeral Drainage		
	Stream Subtotal		
	Reservoir[3]	0.28	
	Pond/Reservoir Subtotal	*0.28*	
Staging Area 1	Seasonal Wetland		
	Wetland Subtotal		
Borrow Area E/ Disposal Site 5	Seasonal Wetland		
	Wetland Subtotal		
	Intermittent Stream		
	Stream Subtotal		
Disposal Sites			
3	Freshwater Marsh		
	Seep Wetland		
	Wetland Subtotal		
	Perennial Stream		
	Ephemeral Drainage		
	Stream Subtotal		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	*0.32*	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	*0.44*	
Haul Roads/ Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream	0	
	Ephemeral Drainage	0	
	Stream Subtotal	*0*	

Table D-2
Alternative 1: No Project Alternative (Assuming Disposal at Disposal Site 7)

Type of Activity	Wetland/Other Waters Type[1]	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Barge Alternative	Seasonal Wetland		
	Wetland Subtotal		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
West Haul Road Alternative	Seasonal Wetland		
	Wetland Subtotal		
	Perennial Stream		
	Ephemeral Drainage		
	Stream Subtotal		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	0.32	0
	Other Waters	0.72	0
	Total	1.04	0

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS.

Table D-3
Alternative 2: Off-Site Disposal Alternative (No Impacts at Disposal Sites 3 and 7)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E /Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	*0.43*	
	Intermittent Stream	0.01	
	Stream Subtotal	*0.01*	
Disposal Sites			
3	Freshwater Marsh		
	Seep Wetland		
	Wetland Subtotal		
	Perennial Stream		
	Ephemeral Drainage		
	Stream Subtotal		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
7	Seasonal Wetland		
	Seep Wetland		
	Wetland Subtotal		
	Pond		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
Haul Roads/Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream		
	Ephemeral Drainage		
	Stream Subtotal		
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		*0.45*
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		*12.47*

Table D-3
Alternative 2: Off-Site Disposal Alternative (No Impacts at Disposal Sites 3 and 7)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland Subtotal		*0.04*
	Perennial Stream		0.01
	Ephemeral Drainage		0.03
	Stream Subtotal		*0.04*
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		*5.71*
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	0.73	0.59
	Other waters	0.58	18.29
	Total	1.31	18.88

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[2] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS.

Table D-4
Alternative 3: Off-Site Borrow Alternative (No Impacts at Borrow Areas B and E)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E/ Disposal Site 5	Seasonal Wetland		
	Wetland Subtotal		
	Intermittent Stream		
	Stream Subtotal		
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	*1.46*	
	Perennial Stream	0.02	
	Ephemeral Drainage	0.04	
	Stream Subtotal	*0.06*	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	*3.20*	
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	*0.32*	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	*0.44*	
Haul Roads/ Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream	0	
	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Barge Alternative	Seasonal Wetland		0
	Wetland Subtotal		*0*
	Reservoir[3]		0
	Pond/Reservoir Subtotal		*0*

Table D-4
Alternative 3: Off-Site Borrow Alternative (No Impacts at Borrow Areas B and E)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
West Haul Road Alternative	Seasonal Wetland		0
	Wetland Subtotal		*0*
	Perennial Stream		0
	Ephemeral Drainage		0
	Stream Subtotal		*0*
	Reservoir[3]		0
	Pond/Reservoir Subtotal		*0*
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	2.08	0.10
	Other Waters	4.27	0.07
	Total	6.35	0.17

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS.

Table D-5
Alternative 4: Consolidated On-Site Disposal Alternative (No Impacts at Disposal Site 7)

Type of Activity	Wetland/Other Waters Type[1]	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E/ Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	*0.43*	
	Intermittent Stream	0.01	
	Stream Subtotal	*0.01*	
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	*1.46*	
	Perennial Stream	0.02	
	Ephemeral Drainage	0.04	
	Stream Subtotal	*0.06*	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	*3.20*	
7	Seasonal Wetland		
	Seep Wetland		
	Wetland Subtotal		
	Pond		
	Reservoir[3]		
	Pond/Reservoir Subtotal		
Haul Roads/ Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream		
	Ephemeral Drainage		
	Stream Subtotal		
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		*0.45*
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		*12.47*

Table D-5
Alternative 4: Consolidated On-Site Disposal Alternative (No Impacts at Disposal Site 7)

Type of Activity	Wetland/Other Waters Type[1]	Permanent Impacts (Acres)	Temporary Impacts (Acres)
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland Subtotal		*0.04*
	Perennial Stream		0.01
	Ephemeral Drainage		0.03
	Stream Subtotal		*0.04*
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		*5.71*
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	2.19	0.59
	Other waters	3.84	18.29
	Total	6.03	18.88

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS..

Table D-6
Alternative 5: New Smaller Downstream Dam (Borrow Area E and Disposal at Disposal Site 3 Would Have an 11 percent Fill Reduction)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E/ Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	*0.43*	
	Intermittent Stream	0.01	
	Stream Subtotal	*0.01*	
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	*1.46*	
	Perennial Stream	0.02	
	Ephemeral Drainage	0.04	
	Stream Subtotal	*0.06*	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	*3.20*	
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	*0.32*	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	*0.44*	
Haul Roads/ Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream	0	
	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		*0.45*
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		*12.47*

Table D-6
Alternative 5: New Smaller Downstream Dam (Borrow Area E and Disposal at Disposal Site 3 Would Have an 11 percent Fill Reduction)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland Subtotal		*0.04*
	Perennial Stream		0.01
	Ephemeral Drainage		0.03
	Stream Subtotal		*0.04*
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		*5.71*
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	2.51	0.59
	Other Waters	4.28	18.29
	Total	6.79	18.88

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS.

Table D-7
Alternative 6: Replacement Dam at Existing Location (No Impacts to Disposal Site 2)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
Dam Site			
	Seasonal Wetland	0.30	0.02
	Wetland Subtotal	*0.30*	*0.02*
	Perennial Stream	0.49	0.04
	Intermittent Stream	0.06	0.02
	Ephemeral Drainage	0.02	0.01
	Stream Subtotal	*0.57*	*0.07*
Staging Area 1	Seasonal Wetland		0.08
	Wetland Subtotal		*0.08*
Borrow Area E/ Disposal Site 5	Seasonal Wetland	0.43	
	Wetland Subtotal	*0.43*	
	Intermittent Stream	0.01	
	Stream Subtotal	*0.01*	
Disposal Sites			
3	Freshwater Marsh	1.04	
	Seep Wetland	0.42	
	Wetland Subtotal	*1.46*	
	Perennial Stream	0.02	
	Ephemeral Drainage	0.04	
	Stream Subtotal	*0.06*	
	Reservoir[3]	3.20	
	Pond/Reservoir Subtotal	*3.20*	
7	Seasonal Wetland	0.02	
	Seep Wetland	0.30	
	Wetland Subtotal	*0.32*	
	Pond	0.11	
	Reservoir[3]	0.33	
	Pond/Reservoir Subtotal	*0.44*	
Haul Roads/Alternatives			
Dam Access Road	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Disposal Site 7[4]	Intermittent Stream	0	
	Ephemeral Drainage	0	
	Stream Subtotal	*0*	
Barge Alternative	Seasonal Wetland		0.45
	Wetland Subtotal		*0.45*
	Reservoir[3]		12.47
	Pond/Reservoir Subtotal		*12.47*

Table D-7
Alternative 6: Replacement Dam at Existing Location (No Impacts to Disposal Site 2)

Type of Activity	Wetland/Other Waters Type1	Permanent Impacts (Acres)	Temporary Impacts (Acres)
West Haul Road Alternative	Seasonal Wetland		0.04
	Wetland Subtotal		*0.04*
	Perennial Stream		0.01
	Ephemeral Drainage		0.03
	Stream Subtotal		*0.04*
	Reservoir[3]		5.71
	Pond/Reservoir Subtotal		*5.71*
Jurisdictional Features Total (Acres)		**Permanent**	**Temporary**
	Wetland	2.51	0.59
	Other Waters	4.28	18.29
	Total	6.79	18.88

[1] Wetlands are the freshwater marsh, and seasonal and seep wetlands. Other waters consist of perennial and intermittent streams, ephemeral drainage, ponds, and the reservoir.
[3] While the CDRP would place fill in the reservoir, the CDRP would expand the area of the reservoir by approximately 444 acres when it is restored to the original inundation area.
[4] There is a seasonal wetland within the Disposal Site 7 Road, but it is less than 0.01 acres.
Source: ETJV 2008. Data modified by URS.