3. Description of the Sites Reservoir Project Alternatives

This chapter describes the proposed Sites Reservoir Project (Project) Alternatives and associated construction, operation, and maintenance of necessary facilities that are evaluated in this EIR/EIS. The development and screening of alternatives, as well as a description of the Existing Conditions/No Project/ No Action Condition are included in Chapter 2 Alternatives Analysis.

This chapter is organized in the following manner:

- Description of Project features and facilities by alternative (also includes construction, operation, and maintenance descriptions specific to the features and facilities under each alternative) (Section 3.1 Sites Reservoir Project Features and Facilities)
- Proposed construction and operations/maintenance activities required to construct, operate, and maintain all Project facilities (Section 3.2 Construction and Operation/Maintenance Common to All Alternatives)
- Project operations (including diversions, releases, ecosystem enhancement actions, hydropower generation, and other benefits) common to all action alternatives (Section 3.3 Diversion and Reservoir Operations Common to All Alternatives)
- Project alternative-specific operations (including diversions, releases, and hydropower generation) (Section 3.4 Proposed Operations by Alternative)
- Environmental commitments (preventive measures, plans, and best management practices [BMPs]) included as part of all action alternatives (Section 3.5 Environmental Commitments Included as Part of the Project and Alternatives)

The proposed operations vary under Alternatives A, B, C, C_1, and those included in Alternative D. The final operations of the Project are intended to be flexible and vary from year to year in response to conditions and the needs of the California water supply system to provide high-quality water to enhance the environment, the economy, and quality of life for Californians. In all cases the specific operational parameters included in this Draft EIR/EIS were identified to support/evaluate the upper bound of potential impacts. The operations evaluated for Alternative D were based on operations included in the application to the California Water Commission for the Water Storage Investment Program (WSIP). The operations included in that application were specifically selected to respond to the requirements of that program and its evaluation criteria.

3.1 Sites Reservoir Project Features and Facilities

This section identifies and describes the primary facilities associated with each of the alternatives as well as construction, operation, and maintenance specific to each Project facility. Facilities are grouped into “complexes”, based on function and location, to assist the reader in understanding and tracking facilities by and across alternatives. Combinations of Project facilities were used to create Alternatives A, B, C, C_1, and D. Some Project features/facilities and operations (e.g., reservoir size, overhead power line alignments, and provision of water for local uses) differ by alternative, and are evaluated in detail within each of the resource areas chapters. After a thorough evaluation of these various components in the Draft EIR/EIS, the Sites Reservoir Authority (Authority) may choose to select or combine individual features as determined necessary and feasible. The proposed complexes include the following:

- Sites Reservoir Complex
- Holthouse Reservoir Complex
- Terminal Regulating Reservoir (TRR) Complex
- Delevan Pipeline Complex
- Overhead Power Lines and Substations
- Project Buffer

Table 3-1 provides a summary list of Project features by complex for each alternative.

Table 3-1
Comparison of New Project Facilities and Features and Existing Facilities Relied Upon[a]

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Sites Reservoir Complex					
Sites Reservoir Inundation Area	1.3-MAF capacity (12,400 acres)	1.8-MAF capacity (14,200 acres)	(same as B)	(same as B)	(same as B)
Golden Gate Dam, Sites Dam, Saddle Dams	9 dams (Golden Gate Dam; Sites Dam; Saddle Dams 1, 3, 5, 6, 8a, 8b, 10)	11 dams (Golden Gate Dam; Sites Dam; Saddle Dams 1, 2, 3, 4, 5, 6, 7, 8, and 9)	(same as B)	(same as B)	(same as B)
Borrow Areas (onsite)[b]	Approximately 920 acres in inundation area; 200 acres northeast and east of the inundation area	(same as A)	(same as A)	(same as A)	(same as A)
Sites Reservoir Inlet/Outlet Structure and Associated Facilities	Multi-level valved tower, 4,000-foot tunnel; 220-foot-high structure; intake openings at 7 levels; trash racks, fish screens; bridge; 15,200-cfs emergency release outlet capacity	Same as A but taller structure (260 ft.); intake openings at nine levels	(same as B)	(same as B)	(same as B)
Sites Pumping/ Generating Plant and Electrical Switchyard	5,900-cfs pumping capacity 5,100-cfs generating capacity	3,900-cfs pumping capacity 5,100-cfs generating capacity	(same as A)	5,900 cfs pumping capacity (No generation)	(same as A)
South Bridge and Roads	Temporary construction roads, several access roads to new facilities, and new roads to replace those currently in the inundation area. South Bridge to provide access between Maxwell and Ladoga.	Same as A but slight difference related to access to Saddle Dam 10 for A	(same as B)	(same as B)	Same as B but with a road to provide access to the community of Leesville; some southern roads not needed

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Recreation Areas[c]	Saddle Dam Stone Corral Antelope Island Lurline Headwaters Peninsula Hills	(same as A)	(same as A)	(same as A)	Stone Corral Peninsula Hills Boat Ramp Day Use Area
Field Office Maintenance Yard	Administration, maintenance buildings, asphalt batch plant (possible temporary location), and parking (also serves Holthouse and TRR reservoirs)	(same as A)	(same as A)	(same as A)	(same as A)
Holthouse Reservoir Complex					
Holthouse Reservoir	6,250 AF active storage capacity	(same as A)	(same as A)	No Holthouse Reservoir; modifications to existing Funks Reservoir; 3,372 AF capacity	(same as A)
Holthouse Spillway and Stilling Basin	15,200 cfs capacity	(same as A)	(same as A)	Existing Funks Reservoir 15,200 cfs gated spillway	(same as A)
WAPA Transmission Line Relocation	8 transmission line towers moved to the west	(same as A)	(same as A)	None	(same as A)
Sites Pumping/Generating Plant Approach Channel	6,300 feet long	(same as A)	(same as A)	(same as A)	(same as A)
Tehama-Colusa Canal Construction Bypass Pipeline/Operation and Maintenance Siphon to Tehama-Colusa Canal	12-foot-diameter approx. 2,600-foot-long siphon pipeline would divert Tehama-Colusa Canal water around Holthouse Reservoir during construction; during operation, would pass water to the canal downstream of the reservoir without pumping	(same as A)	(same as A)	Same as A; could be used for re-routing the water from Tehama-Colusa Canal during maintenance of Funks Reservoir	(same as A)

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Additional Pumps at the Red Bluff Pumping Plant (in Secondary Study Area)	Install two additional 250-cfs capacity pumps	(same as A)	(same as A)	(same as A)	(same as A)
Terminal Regulating Reservoir (TRR) Complex					
Terminal Regulating Reservoir	2,000 acre-feet capacity 200 acres Approximately 4,000-foot-long 60-inch-diameter underground outlet pipe to Funks Creek	(same as A)	(same as A)	(same as A)	1,200 acre-feet capacity 150 acres Only a minimal drain would be required due to the close proximity of the TRR to Funks Creek
TRR Pumping/ Generating Plant and Electrical Switchyard	1,800-cfs pumping capacity 900-cfs generating capacity 4-acre electrical switchyard	(same as A)	(same as A)	1,800-cfs pumping (No generation)	(same as A)
GCID Main Canal Connection to TRR	GCID Main Canal energy dissipation bay/check structure; TRR inlet channel and inlet control structure	(same as A)	(same as A)	(same as A)	Similar to A, however approach would be smaller
TRR Pipeline and TRR Pipeline Road	1,800-cfs pumped capacity 900-cfs gravity flow capacity 2.5-mile road	(same as A)	(same as A)	Same capacity as A; longer TRR Pipeline for delivering GCID Main Canal flows from TRR to modified Funks and slightly longer TRR Pipeline Road	(same as A)
GCID Main Canal Modifications	New headgate and canal lining	(same as A)	(same as A)	(same as A)	Refurbished existing gates; canal lining immediately upstream and downstream of the TRR

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Delevan Pipeline Complex					
Delevan Pipeline Intake/Discharge Facilities	250-foot-long by 80-foot-wide facilities building with multiple stories; four 500-cfs capacity pumping/generating units; two 750 cfs turbines	No intake (smaller structure required for discharge-only facilities)	(same as A)	(Same as A)	(same as A)
• Flat Plate Fish Screen Structure and Forebay	560-foot-long structure; 13-foot-high by 15-foot-wide flat plate screens (32 total); 2,000 cfs capacity; forebay would be constructed between fish screen and pump turbine station	Fish screen and forebay not necessary for discharge-only facility; would include a spillway with fish barrier racks and energy dissipation valves	(same as A)	(same as A)	(same as A)
• Pumping/ Generating Plant	2,000-cfs pumping capacity/ 1,500-cfs generating capacity	No pumping/generating plant (release only) discharge only; 1,500-cfs gravity release flow; energy dissipation valve and structure to minimize river release energy	(same as A)	2,000-cfs pumping capacity (no generation)	(same as A)
• Electrical Switchyard	4-breaker ring bus with poles 15 to 60 feet tall	No switchyard needed	(same as A)	(same as A)	(same as A)
• Maintenance and Electrical Buildings	Mechanical control building; electrical building; (each approx. 5,000 square feet)	Not needed for B	(same as A)	(same as A)	(same as A)
Delevan Pipeline	West-East alignment from Delevan Intake/Discharge to Holthouse Reservoir 2,000-cfs capacity pumping/ 1,500-cfs capacity release	Same alignment as A; no pumping; 1,500-cfs capacity release	(same as A)	(same as A)	50-150 feet south of alignment for A, B, C, and C_1; same capacity as A

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Overhead Power Lines and Substations					
Substations	Stepdown power from the existing WAPA 230 kV/ PG&E 230 kV lines near Funks/Holthouse Reservoir; up to 6 acres including multiple electrical components and related structures, concrete pad, overhead power line tower/pole[d], fencing	(same as A)	(same as A)	(same as A)	In addition to substation near Funks/Holthouse Reservoir identified in other alternatives, D would include a substation to stepdown power from the existing WAPA 230 kV lines approximately 1 mile southwest of Colusa, north of Highway 20; up to 6 acres; similar facilities as A
Electrical Connection for Sites Pumping/Generating Plant	New 1- to 4-mile-long, 230 kV or 115 kV, overhead power line from the proposed substation west to Sites Pumping/Generating Plant	(same as A)	(same as A)	(same as A)	(same as A)
Electrical Connection for TRR Pumping/Generating Plant	New 230 kV or 115 kV overhead power line from the proposed substation, east to TRR Pumping/Generating Plant	(same as A)	(same as A)	(same as A)	(same as A)
Electrical Connection for Delevan Pumping/Generating Plant	New 230 kV or 115 kV overhead power line from the proposed Sites substation, east to Delevan Pumping/Generating Plant	Local service from existing PG&E lines near State Route 45. (no new west to east lines to the Sacramento River needed for Delevan discharge-only facility)	(same as A)	(same as A)	New 115 kV overhead power line along SR 45 from the proposed substation west of Colusa to the Delevan Pumping/Generating Plant; Line will cross SR 45

Project Features/Facilities	Alternative A	Alternative B	Alternative C	Alternative C_1	Alternative D
Project Buffer					
	Total land acquired for the Project beyond the facility footprints, out to the nearest existing parcel boundaries[e]; applies to Sites Reservoir Complex, Holthouse Reservoir Complex, TRR Complex, Delevan Pipeline Complex (excluding the pipelines)	(same as A)	(same as A)	(same as A)	(same as A)

[a]The table is meant as a comparison illustrating the main differences between the Alternatives; not all facilities or features of the Project are included in this table but are further detailed in Section 3.2 Construction and Operation/Maintenance Common to All Alternatives.

[b]Offsite sources for filter, drain, and transition materials, and concrete aggregate would be required if the onsite sources of these materials are found to be unsuitable or if additional material is required. It is anticipated that approximately 80 percent of materials would come from onsite sources and 20 percent from existing, offsite, commercial sources

[c]Per discussions with Glenn and Colusa counties, not all recreation areas would be constructed; all five are included to provide flexibility and a conservative analysis. Development of recreation areas will be phased, based on public demand.

[d] Although poles are anticipated for all overhead power lines, towers were included in the acreage assessment to provide a conservative estimate. The relocation of the WAPA transmission lines described under the Holthouse Reservoir Complex will include towers.

[e]Where the parcel boundary is less than 100 feet from the facility, the Project buffer will extend beyond the parcel boundary to result in a minimum 100-foot-wide buffer. Acquisition or establishment of temporary or permanent easements of private properties either through voluntary or eminent domain processes would be required prior to initiation of construction activities.

Notes:

cfs = cubic feet per second
I-5 = Interstate 5
kV = kilovolt
AF = acre feet
MAF = million acre-feet
PG&E = Pacific Gas and Electric
WAPA = Western Area Power Authority
SR = State Route

3.1.1 Alternative A

Alternative A (see Figures 1-6A and 3-1) would include the following primary features and facilities (associated Project-related storage, diversion rates, and power generation capabilities are shown in parentheses):

- Sites Reservoir capacity: 1.3 million acre-feet (MAF)
- Sacramento River diversions: Existing Tehama-Colusa Canal (Red Bluff) (2,100 cubic feet per second [cfs]) and GCID Main Canal (Hamilton City) (1,800 cfs) pumping plants, and proposed Delevan Pipeline Intake/Discharge Facilities (2,000 cfs)
- Delevan Pipeline operation: 2,000-cfs intake and 1,500-cfs release
- Hydropower Generation capability: approximately 96 megawatts (MW)

Approximate permanent facility footprint sizes by complex for Alternative A are provided in Table 3-2.

Table 3-2
Permanent Facility Footprint – Alternative A

Complex Name	Size (acres)
Sites Reservoir Complex	15,300
Holthouse Reservoir Complex	600
Terminal Regulating Reservoir Complex	300
Delevan Pipeline Complex	25
Overhead Power Lines and Substations	20
Project Buffer	12,000

Note: Acreages are based on permanent footprint; overlap of facilities (e.g., the Sites Pumping/Generating Plant located within the footprint for the Sites Inlet/Outlet Approach Channel) occurs in some cases. Construction footprint estimates are conservative and are described in resource analysis chapters, where applicable.

3.1.1.1 Sites Reservoir Complex

The Sites Reservoir Complex includes the features and facilities that are geographically or functionally associated with the Sites Reservoir. This complex includes the Sites Reservoir Inundation Area, the dams that would form the reservoir, proposed borrow locations for materials required to construct the dams, the inlet/outlet facilities the pumping/generating plant and associated electrical switchyards, the tunnel that would connect the pumping/generating plant to the inlet/outlet structure, and the bridge, roads, recreation areas, and office/maintenance area. Design, construction, and operation of all applicable facilities under every alternative would account for Division of Safety of Dams requirements as appropriate, as well as the potential for anticipated seismic activity, including fault rupture, ground shaking, ground failure, and liquefaction.

Sites Reservoir Inundation Area

The Sites Reservoir would be located in Antelope Valley, approximately 10 miles west of the town of Maxwell. Alternative A would have the smallest reservoir inundation area of the alternatives considered. The 1.3-MAF Sites Reservoir would have a maximum normal water surface elevation of 480 feet above mean sea level (msl) (the minimum operating water surface would be at elevation 340 feet) and an inundation area of approximately 12,400 acres. The dams would include Golden Gate Dam on Funks Creek, Sites Dam on Stone Corral Creek, and seven saddle dams (all dams are discussed further below).

Many areas within the Sites Reservoir Inundation Area would be used for staging of materials and equipment prior to and during construction of the Sites Reservoir dams.

Construction. The majority of the total construction disturbance for this complex would occur within the inundation area.

Anticipated ground-disturbing activities during construction include the following:

- **Clearing and Grubbing.** Approximately 95 percent of the reservoir inundation area footprint is composed of annual grasslands; as a result, clearing and grubbing would not be needed in this area. The remaining 5 percent consists of blue oak woodland, agricultural crops, and other vegetation, which would be cleared. Cleared vegetation would be disposed of at an appropriate landfill/green waste facility or onsite as appropriate and necessary.
- **Demolition of Existing Structures.** Within the Sites Reservoir Inundation Area, approximately 20 houses 25 barns, and 40 other structures (combination of sheds, silos, and a pump houses) would be demolished once all property owner negotiations were completed. Existing septic tanks and other underground storage tanks would also be removed. In addition, many miles of fencing and asphalt would be removed as necessary. Demolition debris would be transported and disposed of at an approved landfill(s).
- **Cemetery Relocation**. Two private cemeteries would be relocated.
- **Salt Lake.** Saline water has been observed to seep from underground salt springs in the vicinity of the Salt Lake Fault within the proposed inundation area of Sites Reservoir. To avoid potential reservoir water quality issues, pressure grouting of seeps and/or concrete caps would be constructed where saline water seeps from the salt springs within the inundation area (Salt Lake). The existing salt deposits and highly saline soils in and surrounding Salt Lake would be capped with clay materials from construction of the dams and other Project facilities. Subsurface investigations would be conducted to confirm the nature and extent of the springs and appropriate treatment. Observation of saline seeps outside of the reservoir or changed conditions of the springs once the reservoir is filled, would be addressed by regular reservoir and facilities maintenance procedures. Pressure grouting and capping would also be used if new seeps surface in other areas. Grout and concrete caps would be engineered, designed, and constructed to prevent seepage, using standard engineering practices.[1]

Operations. Water from the Sacramento River would be pumped into Sites Reservoir each year during times and years that water is available for diversion according to the criteria identified in Section 3.3, Diversion and Reservoir Operations Common to All Action Alternatives. In wetter years, the facility would be anticipated to reach maximum storage levels, while in drier years, storage would not likely be at full capacity (see Chapter 6 Surface Water Resources and related appendixes). Given the facility would be an “offstream” storage facility, it would receive little natural runoff (approximately 1 percent of the 1.3-MAF reservoir storage capacity) from its own 83-square-mile watershed. Releases would then be made throughout the year to assist in meeting demands, depending on time of year and year type in

[1] As detailed in Section 3.5 Environmental Commitments Included as Part of the Project and Alternatives, and included in Chapter 28 Public Health and Environmental Hazards, and in Chapter 4 Environmental Compliance and Permit Summary, all hazardous materials and wastes, including contaminated soils, will be handled and disposed of in accordance with applicable policies, laws, and regulations.

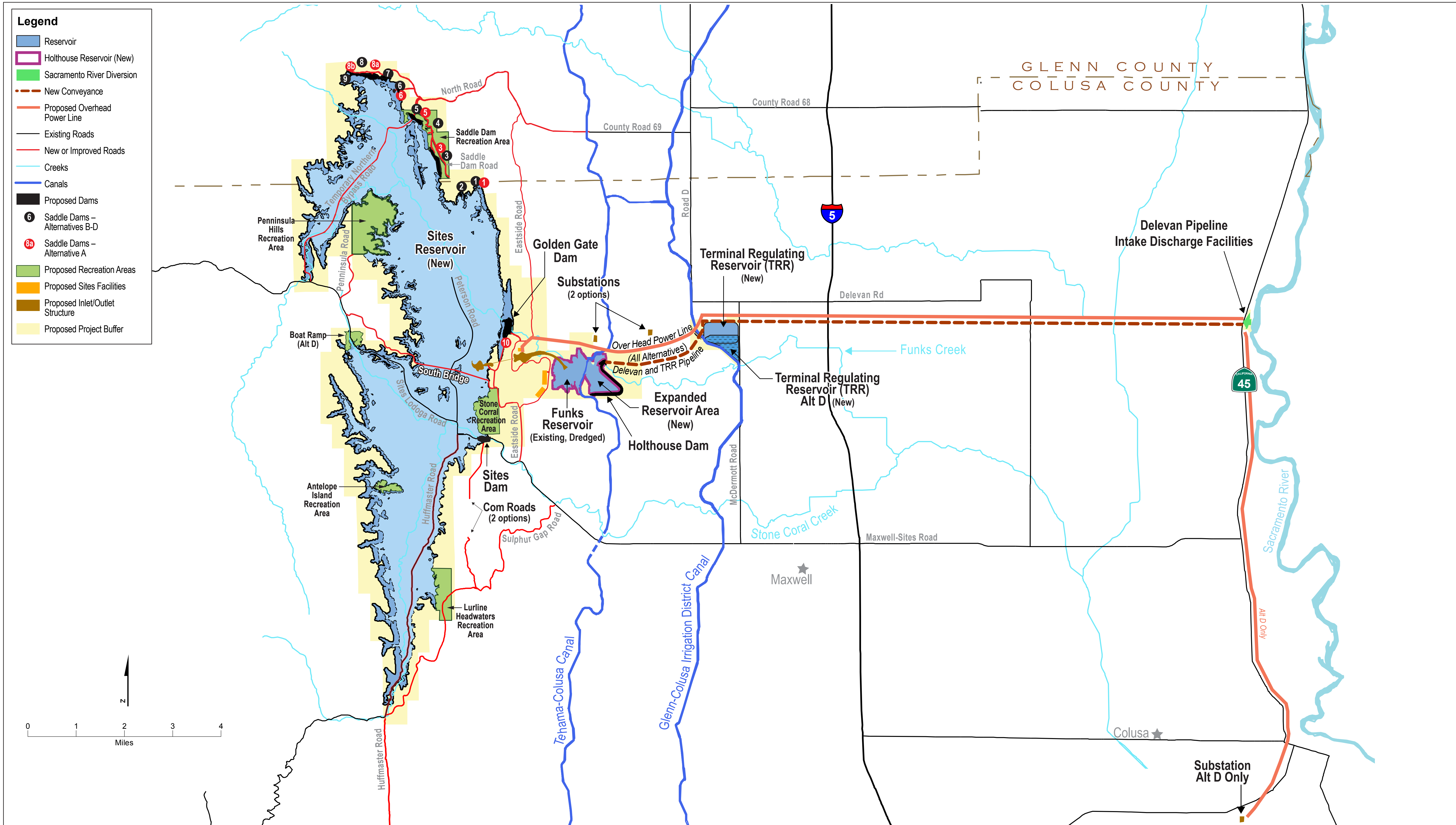

FIGURE 3-1
Proposed Project/Proposed Action Facilities – All Alternatives
Sites Reservoir Project EIR/EIS

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accordance with water user agreements. As such, it is anticipated that the reservoir level would fluctuate greatly throughout the season based on demands and the ability to divert water. Specific reservoir operations are discussed in Section 3.3.1 Operational Scenario.

Maintenance. Maintenance activities for the proposed Sites Reservoir Inundation Area and adjacent lands are anticipated to include law enforcement (including those associated with boating), garbage removal, and maintenance of signs, culverts, and buoys.

Golden Gate Dam, Sites Dam, and Saddle Dams

Nine dams would be needed to create the proposed 1.3-MAF Sites Reservoir (Figure 3-1): Golden Gate Dam, Sites Dam, and seven saddle dams. One saddle dam (number 10) would be located just south of Golden Gate Dam and the remainder along the northern perimeter of the reservoir between the Funks Creek and Hunters Creek watersheds, near the Glenn-Colusa County line. The proposed Golden Gate Dam would be constructed on Funks Creek, approximately 1 mile west of the existing Funks Reservoir. The proposed Sites Dam would be constructed on Stone Corral Creek, approximately 0.25 mile east of the town of Sites and 10 miles west of the town of Maxwell.

The Golden Gate Dam location was selected to optimize material quantities and construction costs with respect to the site topography. For the 1.3-MAF Sites Reservoir, the Golden Gate Dam would be located on the western edge of the ridges that form the east reservoir rim. This dam site is only suitable for reservoir elevations less than approximately 480 feet due to steep and narrow abutment ridges. Construction of an additional small saddle dam, saddle dam number 10 mentioned above, would be required.

The seven proposed saddle dams are anticipated to be earthfill embankment dams and would be constructed primarily of materials from borrow areas within the reservoir inundation area (Table 3-4 and Figure 3-6). Site topography, geology, seismicity, and foundation features were considered when selecting the dam alignments, design, and dam cross sections. Table 3-3 lists the proposed height and length of the main and saddle dams, as well as the total volume of materials needed to construct the dam embankments.

Table 3-3
Characteristics of Proposed 1.3-MAF Sites Reservoir Dams for Alternative A

Dam	Maximum Height Above Base* (feet)	Crest Length (feet)	Total Embankment Volume (cubic yards)
Golden Gate Dam	270	2,250	5,987,000
Sites Dam	250	850	2,853,000
Saddle Dam 1	10	490	1,400
Saddle Dam 3	90	3,810	1,365,000
Saddle Dam 5	60	2,290	398,000
Saddle Dam 6	10	530	9,000
Saddle Dam 8a	65	2,990	390,000
Saddle Dam 8b	5	340	15,000
Saddle Dam 10	Included in Golden Gate Dam	Included in Golden Gate Dam	Included in Golden Gate Dam
Total			**11,018,400 cubic yards**

*Base is defined as ground surface elevation.

Table 3-4
Sites Reservoir Project Onsite or Nearby Dam Materials

Material	Facilities	Approximate Size (acres)
Sandstone[a]	Saddle Dams	80
Impervious	Saddle Dams 6 through 9	400
Conglomerate	Multiple	200
Impervious	Saddle Dam 3	80
Impervious	Saddle Dams 1 and 2	40
Sandstone[a]	Golden Gate Dam	70
Sandstone	Golden Gate Dam	60
Impervious	Golden Gate Dam	60
Impervious	Sites Dam	80
Sandstone[a]	Sites Dam	50

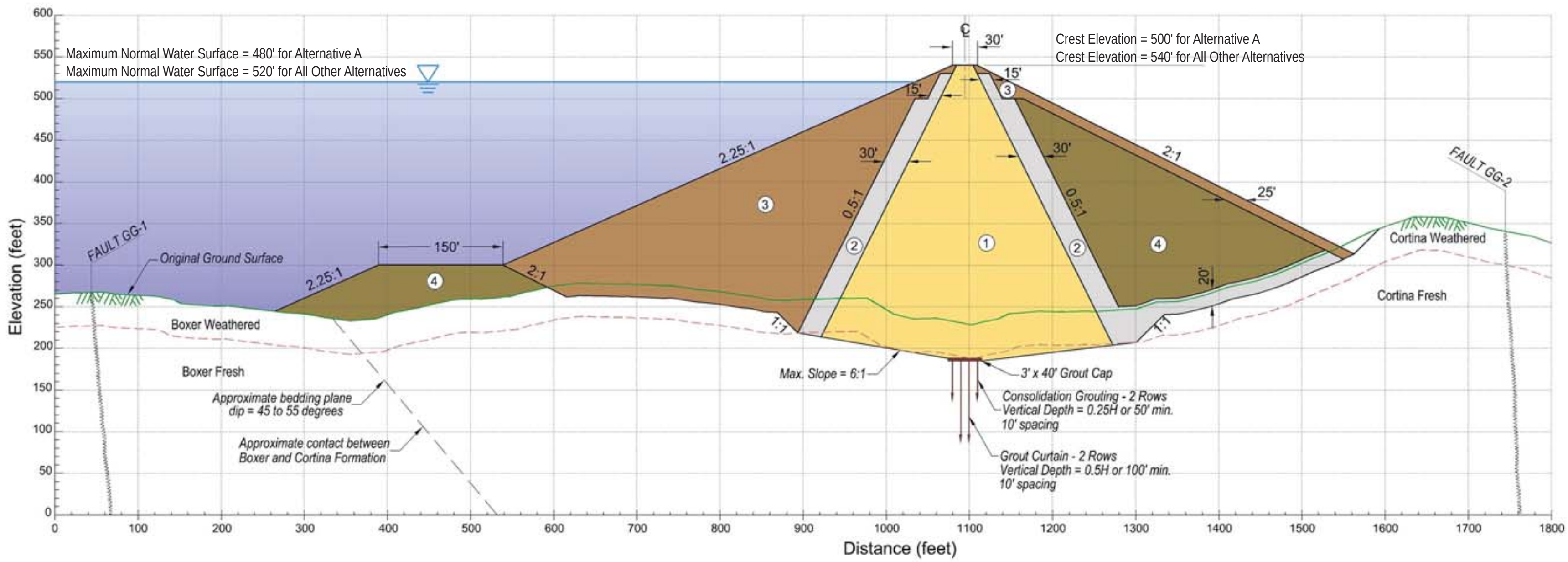
*Located east of the Sites Reservoir Inundation Area

The crest elevation of all nine dams would be 500 feet, providing 20 feet of freeboard above the normal maximum operating level. Sites and Golden Gate dams would have crest widths of 30 feet and embankment slopes of 2.25:1 upstream and 2:1 downstream. The saddle dams would have crest widths of 20 feet and embankment slopes of 3:1 upstream and 2.5:1 downstream.

The nine dams would be constructed as zoned earthen embankments of soil and rock with clay cores. Earthen embankment zones are shown in Figures 3-2 through 3-5. All dams would be constructed under the jurisdiction of the California Department of Water Resources, Division of Safety of Dams (DSOD).

As part of Project design, an updated deterministic and probabilistic seismic hazard analysis would be conducted to account for the anticipated estimated level of ground shaking that could occur due to regional earthquakes. Suitable dam zoning and materials would be included as part of Project design to accommodate anticipated seismic activity, including fault rupture, ground shaking, ground failure, and liquefaction, in coordination with DSOD. In addition, a seismic monitoring array will be designed and implemented as part of the Project to monitor site seismic activity, including identifying any increase in seismicity rate that could be attributed to potential reservoir triggered seismicity (RTS). Although not anticipated to be a substantial concern, the potential for RTS will be monitored through the deployment of strong motion instruments at center crests, abutments, and toes of the two primary dams, the Golden Gate Dam and the Sites Reservoir Dam, before, during, and at a minimum of 2 years after, the reservoir first reaches the maximum normal storage level. As part of the initial impoundment/filling of the reservoir, the rate of impoundment will be monitored in conjunction with seismic monitoring and adjusted as needed in the event of increases in seismicity potentially attributable to RTS. The seismic monitors would remain in service over the life of the Project and would also be part of the dam safety monitoring program.

Material requirements for the Sites Reservoir dams constitute a major component of the overall Project. A construction materials investigation identified and evaluated material sources for construction of the proposed dams. The construction materials investigation program examined materials available in or near the proposed Sites Reservoir, including alluvial deposits (recent and older alluvium), Venado sandstone of the Cortina Formation (fresh and weathered), and mudstone of the Boxer Formation. Table 3-4 and Figure 3-6 present the results of the investigation of materials potentially available within the Sites



NOTES

1. Embankment section presented is preliminary and is based upon feasibility level geologic exploration and materials investigation, testing, and evaluation programs.

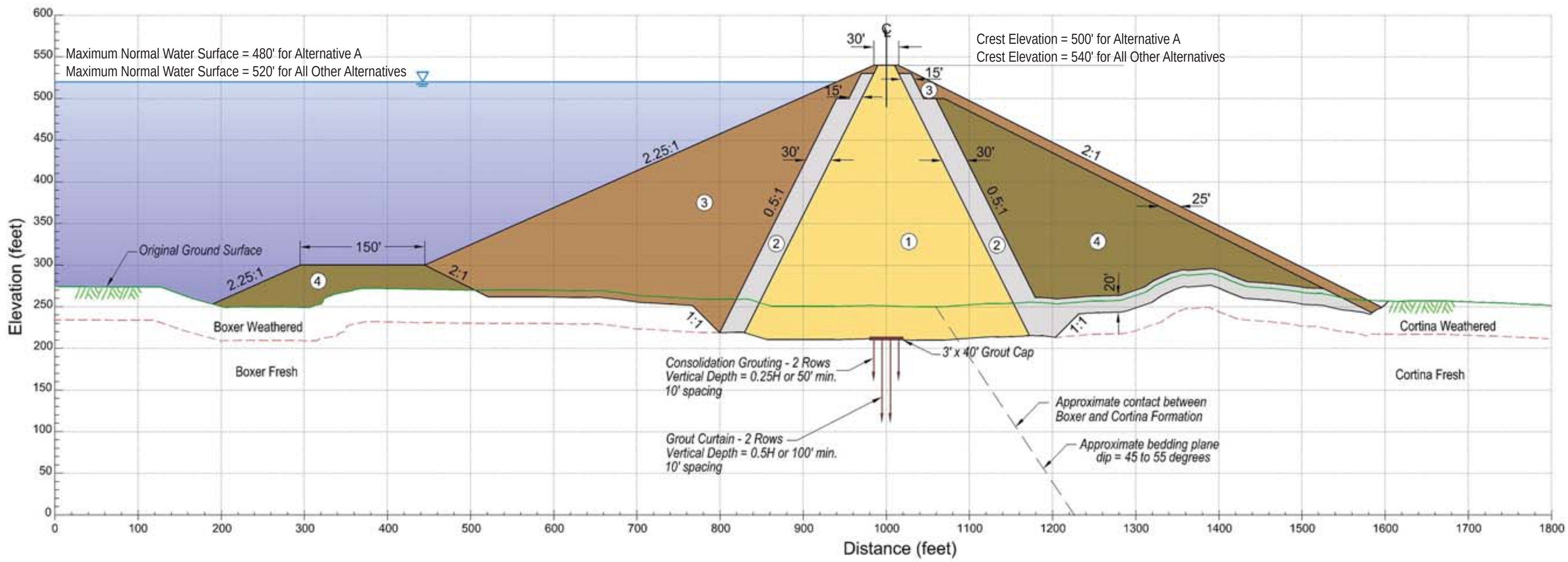
2. Embankment zones are as follows:
   - ZONE ① Core
   - ZONE ② Upstream and Downstream Filter, Drain, and Transition
   - ZONE ③ Rockfill and Riprap - Shell material
   - ZONE ④ Random - Shell material

3. H = Height of Dam

4. ℄: Centerline

5. GG: Informal name of fault

FIGURE 3-2
Golden Gate Dam Cross Section Showing Grouting
Sites Reservoir Project EIR/EIS



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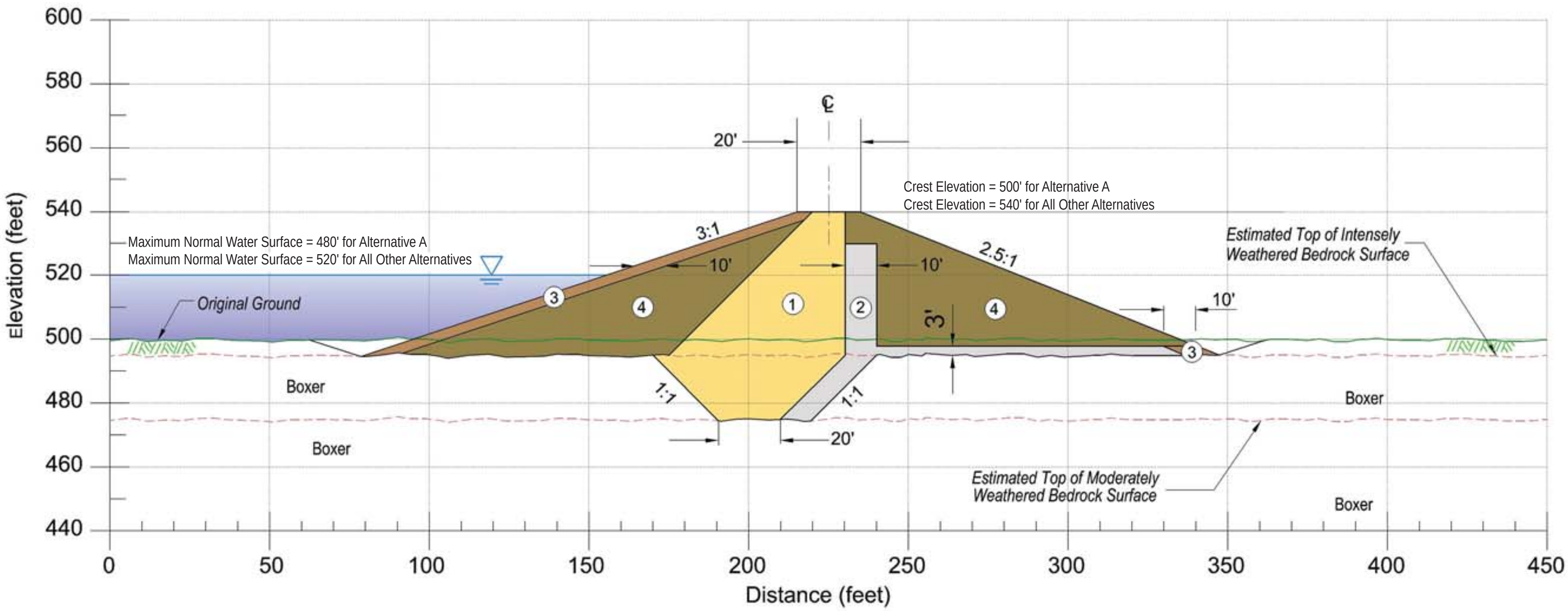
   - ZONE ③ Rockfill and Riprap - Shell material
   - ZONE ④ Random - Shell material

3. H = Height of Dam

4. ℄: Centerline

FIGURE 3-3
Sites Dam Cross Section Showing Grouting
Sites Reservoir Project EIR/EIS



NOTES

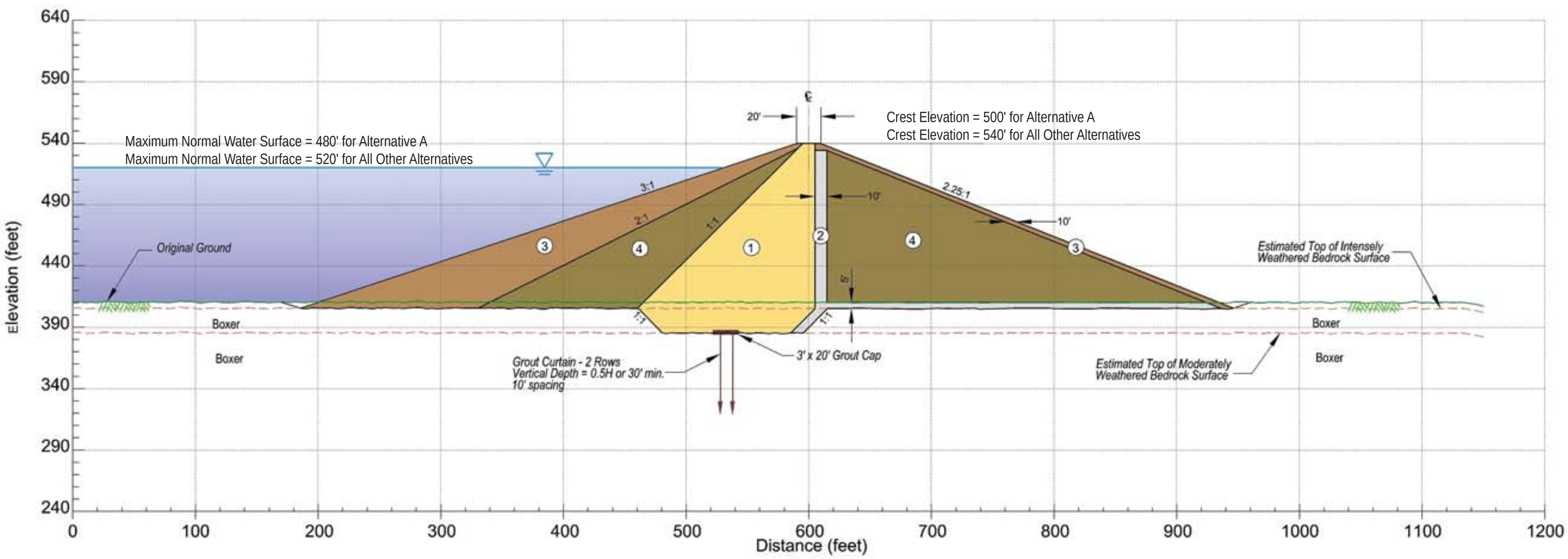
1. Embankment section presented is preliminary and is based upon feasibility level geologic exploration and materials investigation, testing, and evaluation programs.

2. Embankment zones are as follows:
   - ZONE ① Core
   - ZONE ② Upstream and Downstream Filter, Drain, and Transition
   - ZONE ③ Rockfill and Riprap - Shell material
   - ZONE ④ Random - Shell material

3. H = Height of Dam

4. ℄: Centerline

FIGURE 3-4
Saddle Dams 1, 2, 4, and 9 Cross Sections Showing Grouting (Typical)
Sites Reservoir Project EIR/EIS



NOTES

1. Embankment section presented is preliminary and is based upon feasibility level geologic exploration and materials investigation, testing, and evaluation programs.

2. Embankment zones are as follows:
   - ZONE ① Core
   - ZONE ② Upstream and Downstream Filter, Drain, and Transition
   - ZONE ③ Rockfill and Riprap - Shell material
   - ZONE ④ Random - Shell material

3. H = Height of Dam

4. ℄: Centerline

FIGURE 3-5
Saddle Dams 3, 5, 6, 7, and 8 Cross Sections Showing Grouting (Typical)
Sites Reservoir Project EIR/EIS

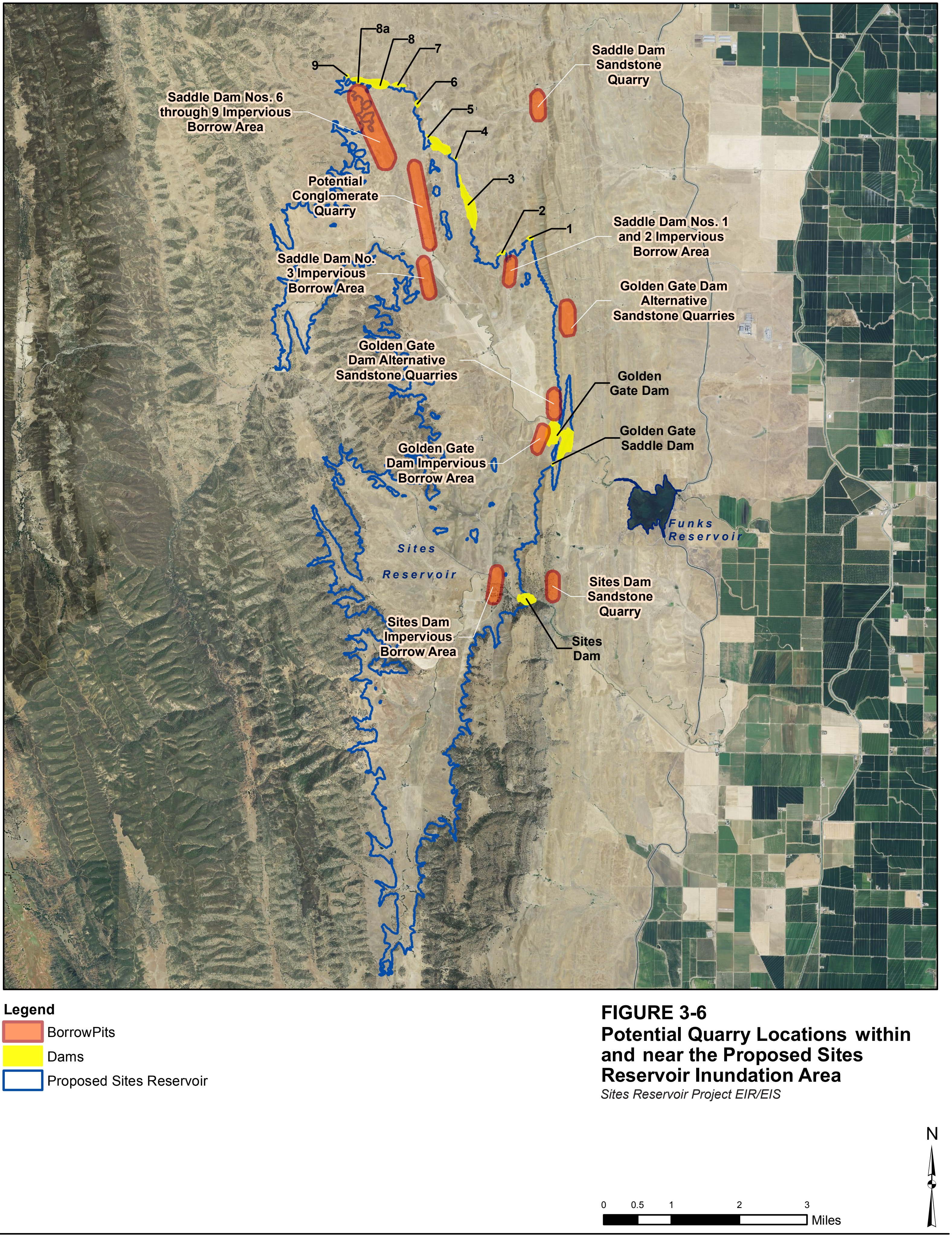


FIGURE 3-6
Potential Quarry Locations within and near the Proposed Sites Reservoir Inundation Area
Sites Reservoir Project EIR/EIS

Reservoir Inundation area or nearby. Offsite sources for filter, drain, and transition materials, and concrete aggregate would be required if the onsite sources of these materials are found to be unsuitable (preliminary testing indicated that it does not meet concrete aggregate durability criteria) or if additional material is required. Several existing commercial locations (over 30), ranging in distance from approximately 35 to 80 miles, are available to meet materials needs for high-quality aggregates.

It is anticipated that all earth and rockfill (approximately 80 percent of materials required) would come from onsite sources and all aggregate (approximately 20 percent of material required) would come from existing, offsite, commercial sources.

The following material requirements and sources were investigated and suitability was evaluated for construction of the dams:

- **Impervious Core –** A large amount of potential impervious material exists within the Project area or nearby. The locations of these potential borrow areas are illustrated on Figure 3-6. Previous studies by Reclamation identified four main areas of alluvial deposits in the reservoir area encompassing roughly 36 million cubic yards of material. Additional impervious materials are located within required excavation and construction areas for the associated structures and the proposed Holthouse Reservoir Complex. Suitable material from these required excavation and construction areas would be used to the maximum extent practicable. The impervious materials are suitable for use in the proposed embankment dams and are generally classified as low to medium plasticity clays, with lesser amounts of high plasticity clays, and clayey sand.
- **Filter, Drain, and Transition Materials –** Filter, drain, and transition materials for the proposed embankment dams would be imported from nearby existing commercial quarries.
- **Rockfill and Riprap –** The best available source of rockfill material for riprap within the Project area is fresh Venado sandstone. Sandstone quarry areas are located within the reservoir inundation area and are presented on Figure 3-6. Sufficient quantities of fresh sandstone for rockfill material could be obtained from these quarries to construct the proposed embankment dams. It is possible that one centrally located quarry would be developed for Golden Gate and Sites dams instead of developing a quarry for each dam. Note that fresh Venado sandstone was used as riprap for the existing Funks Dam and has performed well.

  Figure 3-6 also shows a proposed sandstone quarry location outside of the inundation area for construction of the saddle dams. The haul distance from this proposed quarry is approximately 3 to 4 miles from the saddle dam sites. A potential alternate source of rockfill and riprap material for construction of the saddle dams is a ridge of conglomerate located within the reservoir area near Saddle Dam 3 (Figure 3-6). This potential rockfill source offers a shorter haul distance to the saddle dams (1 to 2 miles). Development of the Venado sandstone quarry would be required for construction of the saddle dams, unless further testing of the conglomerate determines that it is a suitable material.
- **Random Fill** – Random fill is suitable material that can include various types of soil or rock that does not necessarily have the defined physical characteristics of the other categories of materials used for construction. Random fill would be required for construction of all proposed dams. It is anticipated that two general types of random materials would be required for construction. One type of random material would be composed of predominately weathered sandstone from the Cortina Formation, and the other type would be predominately mudstone from the Boxer Formation. Mudstone from the Boxer Formation would tend to be “soil like” after excavation and compaction operations because it

is a low-strength rock. The weathered Cortina Formation tends to have more fine materials and have less well-graded rockfill.

Random fill material needed for the dams will come from two sources; 1) excavations that are required for the dam foundations and excavations for other nearby structures; and 2) from the onsite quarries located in the Sites Reservoir inundation area, including suitable byproducts from processing sandstone for other construction needs. Random material generated during construction of these dams would have haul distances of less than 1 mile.

Although the Boxer Formation material would function more as an upstream and downstream shell zone in the saddle dams, the term *random* is used for this material zone to be consistent with the terminology used for the design of Sites and Golden Gate dams.

- **Concrete Aggregate –** Crushed Venado sandstone and offsite sand and gravel deposits were examined as potential sources of concrete aggregate. Preliminary small-scale testing performed on crushed samples of Venado sandstone indicates that it does not meet concrete aggregate suitability criteria. Verification of the suitability of the Venado sandstone for use as a concrete aggregate would be further investigated in the future when large bulk fresh samples come available for testing. Potential sources of concrete aggregate would be imported from the nearby existing commercial quarries.

For the 1.3-MAF Sites Reservoir for Alternative A, a relatively smaller dam would be constructed at the Saddle Dam 6 site given the ground level of the saddle is approximately at elevation 500 feet, 20 feet above the reservoir maximum operating level. A core trench backfilled with clay would be constructed across the saddle to prevent seepage through the ridge when the water is at or above the maximum normal operating level. The Project would be designed in accordance with California DSOD requirements.[2] A signal spillway would be provided in Saddle Dam No. 6 with invert elevation located just above the probable maximum flood (PMF)[3] storage level. The spillway would be required for use only in the event that water is still being pumped into the reservoir after the PMF had been stored (a very unlikely occurrence). The pipe at this location would include an excavated entry channel, a pipe on the saddle dam foundation, and an energy dissipating structure at the downstream end of the pipeline. The spillway would consist of one 7-foot-diameter concrete pipe sized primarily to accommodate inspection and maintenance activities. If the PMF were to occur when the reservoir is at the normal maximum pool elevation (480 feet), the water surface elevation would rise to 486.25 (with full PMF retention). The dam crest elevation (without camber) would be 500.0 feet, still leaving almost 14 feet of freeboard. The invert of the spillway inlet would be at elevation 487.0 feet, which is just above the estimated pool level with full PMF containment.

To meet DSOD requirements, an emergency release outlet would be constructed to allow water levels in the reservoir to be lowered quickly if the integrity of a dam is at risk. The 30-foot-diameter tunnel with a release capacity of approximately 15,200 cfs is designed to meet DSOD's emergency drawdown release criteria (10 percent drawdown of reservoir depth in 10 days). The emergency release capability is provided by a system of piping and energy dissipating valves located adjacent to the pumping and generating plant. The emergency release bypass outlet would be a 26-foot-diameter pipe that splits off

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2 Detailed seismic and geotechnical evaluations will be conducted as part of final design.

3 The probable maximum flood is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that is reasonably possible in the drainage basin being studied. Estimated based on Hydrometeorological Report (HMR) Nos. 58 and 59 (National Oceanic and Atmospheric Administration, 1998 and 1999).

from the tunnel/main inlet/outlet manifold. The 26-foot-diameter pipe would then split and reduce in size several more times to join four 8.5-foot dispersion valves located in a reinforced concrete and steel lined dissipation chambers adjacent to the Sites Pumping/Generating Plant. Emergency release flows would flow down the channel from the Sites Pumping/Generating Plant into Holthouse Reservoir. The spillway structure provided in the Holthouse Dam is sized to pass the emergency flow. Spills downstream of Holthouse Reservoir associated with a significant event could lead to potential downstream impacts. This would be addressed in an emergency action plan. The plan would include emergency notification flowcharts, notification procedures, inundation maps, and a variety of other important emergency response protocols for notifying downstream entities if an emergency release was anticipated to occur. The emergency action plan would address potential and actual emergency conditions, and any uncontrolled release of water, including release of any water through the signal spillway, would incorporate lessons learned from the recent Oroville Spillway and Oroville Emergency Spillway incident. These plans are typically reviewed annually and periodically tested through tabletop and functional exercises and drills.

Construction. The total construction disturbance area for the nine proposed dams would be approximately 180 acres. The total construction disturbance area would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, borrow areas, and access roads. The construction disturbance area for the dams would be within the construction disturbance area for the Sites Reservoir Inundation Area. Temporary easements may be required for construction.

Anticipated ground-disturbing activities during construction include the following:

- Surveying
- Setting up staging areas within the Sites Reservoir footprint
- Constructing access roads
- Transporting equipment to the Project site and setting up offices and batch plants
- Clearing, including demolition of existing structures, and grubbing
- Diverting streams within the reservoir inundation area
- Excavating and stockpiling activities
- Grouting of dam foundations and the ridge
- Constructing of dam embankments
- Installing monitoring equipment
- Constructing roads and buildings for facility operation and maintenance
- Cleaning up Project area, removing equipment, and restoring the area

Key activities are discussed in greater detail below:

- **Funks Creek and Stone Corral Creek Diversion Construction.** Diversion of Funks and Stone Corral creeks during construction of the proposed Golden Gate Dam, Sites Dam, and for the proposed facilities downstream, is anticipated to be accomplished by passing storm flows through an 18-inch diameter diversion tunnel through the ridge at Sites Dam. A channel would be excavated within the reservoir to join the two creeks. Coffer dams at the upstream toes of Sites Dam and Golden Gate Dam would protect the work areas from flows diverted to the Diversion Tunnel

  The upstream random zone of Golden Gate and Sites dams would function as the coffer dam and upstream toe berm, provides a convenient place to put waste materials from foundation excavation work during the initial stages of construction, and would be used to divert Funks and Stone Corral creeks from the dam footprint.

Sites and Golden Gate dams would have low-level outlet works capable of releasing stream maintenance flows of up to 10 cfs from October through May into Stone Corral and Funks creeks after construction is completed to mimic the ephemeral nature of these streams.

- **Obtaining and Stockpiling Borrow Materials.** Materials would be stockpiled near temporary or permanent rock-processing plants that would be constructed for the Project. It is anticipated that at least one rock-processing plant would be located within the reservoir footprint to service the impervious material borrow areas and the sandstone quarries.

  The rock-processing operation would consist of rock crushers to produce required sizes, shakers and screens to sort material sizes, and conveyor belts to transport sorted material to stockpiles. Stockpiled materials would be loaded by bulldozers, loaders, and possibly conveyors into large dump trucks and transported to the dam construction sites. Material excavation, processing, and stockpiling are anticipated to occur throughout the dam construction period.

- **Foundation Excavation.** Recent and older alluvium and decomposed and intensely weathered bedrock would be excavated from the entire footprint of the dam sites to obtain a moderately weathered bedrock surface. In addition, moderately weathered bedrock would be excavated from the impervious core footprint down to the top of slightly weathered and/or fresh bedrock surface. Additional shaping of the foundations would be done to meet requirements that: 1) no excavation slopes should be steeper than 1:1; and 2) the core foundation should be approximately level in sections transverse to the dam alignment. Excavation depths would average approximately 20 feet. Excavation would be performed by heavy equipment but blasting may be required in the harder sandstone.

- **Foundation Treatment Grouting.** The foundation grouting for the proposed Golden Gate and Sites dams would consist of a two-row grout curtain, with one row of consolidation holes upstream and one row downstream of the curtain holes. The rows would parallel the dam centerline and would be spaced 10 feet apart. In addition, a 40-foot-wide by 3-foot-thick grout cap was included in the design to prevent grout surface leakage during grouting of the upper stage. Foundation grouting for the proposed saddle dams would consist of a two-row vertical grout curtain spaced 10 feet apart parallel to the dam centerline. The saddle dam foundation grouting would also include a 20-foot-wide by 3-foot-thick grout cap to prevent surface leakage of grout during grouting of the upper stage. Each row of consolidation and curtain grout holes for all dams would consist of mandatory primary and secondary holes spaced at 10-foot centers. Figures 3-2, 3-3, 3-4, and 3-5 show typical grouting at the proposed Golden Gate Dam, Sites Dam, and the saddle dams.

  The grout curtains would be constructed by drilling vertical holes into the bedrock and filling the holes with grout pumped in under pressure.

- **Additional Grouting.** Additional grouting will be performed along the east ridge of the reservoir north of Golden Gate Dam. Grouting will be in narrow ridge areas and is intended to minimize any seepage through the ridge when the reservoir is full. Grouting would extend from the ground surface down into fresh rock.

- **Dam Embankment Construction.** All proposed dams composing the Sites Reservoir would be constructed as zoned earth rockfill embankment dams and would be constructed of four types of fill materials. The impervious core materials (finer material known as Zone 1), Zone 3 materials (rockfill and riprap), and Zone 4 materials (random materials) would be hauled in large dump trucks from the borrow sites that would be located within the reservoir footprint, spread by graders or bulldozers, moisture-conditioned with water trucks, and compacted with sheepsfoot rollers or compactors. Zone 2 materials (filter, drain, and transition materials) would potentially be hauled in large dump trucks from offsite commercial sources, spread, watered, and compacted.
- **Monitoring Equipment Installation.** Monitoring equipment, including strong motion seismic detectors, piezometers, settlement points, and seepage weirs would be permanently installed at each proposed dam site.

Operations. Once the proposed dams are constructed and Sites Reservoir is filled, there would be few dam operations required other than release of water from the reservoir during normal or emergency operations. Additional information on operations is included in Section 3.2 Construction and Operation/Maintenance Common to All Alternatives and Section 3.3 Diversion and Reservoir Operations Common to All Action Alternatives.

Maintenance. Typical ongoing dam maintenance would consist of debris and vegetation removal from the embankment slopes, and periodic monitoring and evaluation of all instrumentation. Cleared debris and vegetation materials would be disposed of at an appropriate landfill/green waste facility or on-site as appropriate and necessary. Dam security and/or law enforcement staff would patrol the proposed dams and other proposed facilities. Additional security measures may include fences to prevent automobiles and pedestrians from accessing the dams and other Project features, booms to prevent boats from approaching the dams, security gates, 24-hour security patrols, and security cameras.

Sites Reservoir Inlet/Outlet Structure

The purpose of the proposed Sites Reservoir Inlet/Outlet Structure would be to regulate proposed Sites Reservoir inflows and releases through the proposed tunnel to the proposed Sites Pumping/Generating Plant. The structure would be located on the west end of the tunnel and southwest of the proposed Golden Gate Dam (Figure 3-7). As discussed above, the structure would consist of a low-level inlet/outlet structure for emergency drawdown releases, a multi-level inlet/outlet structure tower, two fixed wheel gates to isolate the tunnel, a tower access bridge, and various valves and operators to regulate flows into and out of the reservoir.

The low-level inlet/outlet structure would be approximately 120 feet high from bottom of foundation to the top of trash racks. The rectangular structure dimensions would be approximately 100 feet by 120 feet. The three 30-foot by 30-foot intake openings would be covered by trash racks. The primary function would be for emergency release only.

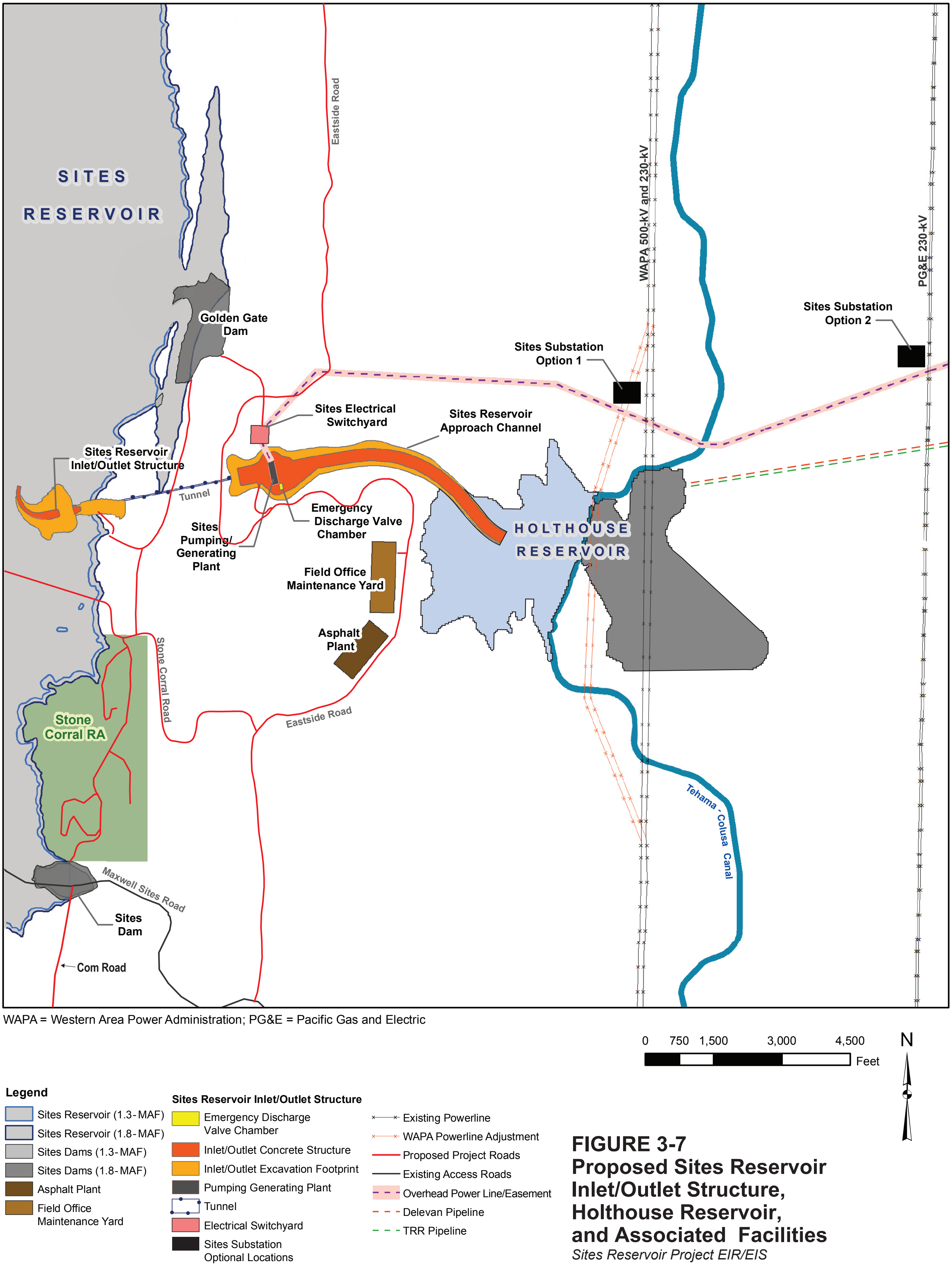


FIGURE 3-7
Proposed Sites Reservoir Inlet/Outlet Structure, Holthouse Reservoir, and Associated Facilities
Sites Reservoir Project EIR/EIS

The multi-level inlet/outlet structure tower would have multiple inlet ports with the capability of drawing water at different levels in the reservoir and trash racks with port valves (butterfly valves) embedded in the inlet tower tiers with four valves around each tier. The tower would also contain movable fish screens around two tiers for varied operational purposes (6,000 cfs for two tiers). Each port valve could be operated independently, or all valves could be operated together in each tier. The tiers would be spaced approximately 20 feet apart down the tower beginning approximately 30 feet below the maximum reservoir water level. The high inlet tower/shaft would also contain two 9-foot by 35-foot fixed wheel gates at the base of the tower to isolate the tower from the main tunnel for inspection and maintenance. The main tower shaft would have an inner diameter of 32 feet and an outer diameter of 39 feet. Cranes would be used to hoist the fish screens, port valves, and gates for necessary inspection and maintenance.

Table 3-5 provides details for the proposed Sites Reservoir Inlet/Outlet Structure tower for Alternative A.

Table 3-5
Sites Reservoir Inlet/Outlet Structure Tower Details

Detail	Unit
Top elevation	540 feet
Bottom elevation (top of bench)	320 feet
Inside diameter	32 feet
Outside diameter	39 feet
Number of ports	28 (4 each at 7 levels)
Functional reservoir release elevations	480 feet to 340 feet

An approximately 440-foot bridge would provide access to the multi-level tower from the nearby access road. The bridge deck elevation would be approximately equal to the dam crest heights (approximately 500 feet for the 1.3-MAF reservoir). The bridge is expected to be a simple welded-plate girder system with a lightweight concrete deck. The girders would be supported by the multi-level inlet/outlet structure tower, cast-in-place reinforced concrete piers, and a reinforced concrete abutment.

Construction. The total construction disturbance area would be approximately 100 acres, mostly within the Sites Reservoir Inundation area. It would include the footprint of the proposed facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads.

Anticipated ground-disturbing activities during construction include surveying and marking, clearing and grading, building access roads, installing temporary power to the site, preparing materials laydown and equipment staging areas, transporting construction materials and equipment to the site, hillside excavation and tower shaft excavation (separate from tunnel), dewatering, building the multi-level tower base and deck, building the access bridge to the multi-level tower, installing cranes on the tower deck, building the low-level intake structure, and finished grading and site clearing.

Operations. The proposed multi-level inlet/outlet structure tower and low-level intake structure would be operated remotely. The multi-level tower port valves could be operated independently or by tier. Port valve operations could be adjusted locally or remotely via a supervisory control and data acquisition (SCADA) system. Port valve operations would be changed by adjusting the hydraulic operators.

Maintenance. Typical maintenance of the proposed inlet/outlet structure is expected to occur annually and would consist of servicing the hydraulic equipment (hoist cranes, control motors) and fish screen lift mechanism. Hydraulic equipment maintenance service would primarily involve lube and filter replacements.

Maintenance of the fixed wheel gate would involve moving both gates through a full stroke (open and closed) position. Annual inspections for corrosion and wear would also be performed. As part of emergency preparedness checks, the gate operation electrical control panel would be tested every 6 months.

The port valve hydraulic operations would require a relatively higher level of maintenance including quarterly inspection and maintenance. Typical port valve maintenance would involve lube and filter replacements and inspections for hydraulic line damage.

The concrete low-level intake structure is considered to require relatively low maintenance because it has no mechanical component and it would be underwater. It is assumed that the stop logs that can be installed in the low-level intake at the upstream end of the tunnel would only be installed in the event of a problem with operation of the downstream wheel gate. The wheel gates would normally be down so that normal inflows to and from the reservoir would occur through the vertical Sites Reservoir Inlet/Outlet Structure tower, not through the low-level inlet. The low-level inlet would provide the emergency release capability and permit removal of water from the reservoir between the lowest normal operating level for the tower and the dead storage level.

During the first few years of operation, it is anticipated that the Sites Reservoir Inlet/Outlet Structure tower and tunnel downstream of the fixed wheel gates would be dewatered for inspection and any required maintenance. After this initial period of inspection demonstrates proper performance, the inspection period would be extended out in time.

Sites Pumping/Generating Plant and Electrical Switchyard

The purpose of the proposed Sites Pumping/Generating Plant would be to pump water from the proposed Holthouse Reservoir into the proposed Sites Reservoir and to generate electricity during the release of water from Sites Reservoir to Holthouse Reservoir. The Sites Pumping/Generating Plant would be located approximately 3,300 feet southeast of the proposed Golden Gate Dam (Figure 3-7).[4]

The Sites Pumping/Generating Plant would have a total pumping capacity of 5,900 cfs and a release capacity of 5,100 cfs. Table 3-6 summarizes the pump and pump/turbine configuration for the 5,900-cfs plant. The pumping/generating plant would lift water from Holthouse Reservoir into Sites Reservoir and would be connected to Holthouse Reservoir by an approximately 6,300-foot-long excavated approach channel, as described in Section 3.1.1.2 Holthouse Reservoir Complex. The existing Funks Reservoir, which would be incorporated into the proposed Holthouse Reservoir, currently operates in coordination with the Tehama-Colusa Canal between elevations of 203 and 205 feet. The Sites Pumping/Generating Plant would operate with tailwater elevations down to elevation 190 feet during pumping to take advantage of the full 6,500 acre-feet of active capacity of the proposed Holthouse Reservoir. A 30-foot-diameter, 4,000-foot-long tunnel would be located on the inlet side of the Sites Pumping/Generating Plant connection to Sites Reservoir (the tunnel is discussed below).

[4] The plant and associated operation would be a part of all alternatives, except there would not be generation for Alternative C_1.

Table 3-6
Sites Pumping-generating Plant Configuration for Alternative A

Unit Type	Number of Units	Net Head (feet)	Pumping Capacity (cfs)	Generating Capacity (cfs)	Total Pumping Capacity (cfs)	Total Generating Capacity (cfs)
Pump - Francis Vane (dual speed)	2 (+1 standby)	290	870	-	5,926	5,100
		162	870	-		
Pump - Francis Vane (dual speed)	2	290	435	-		
		162	435	-		
Pump/Turbine - Reversible Francis (dual speed)	4 (+1 standby)	290/270	663	1,020		
		162/142	663	1,020		
Pump/Turbine - Reversible Francis (dual speed)	2	290/270	332	510		
		162/142	332	510		

Water from Holthouse Reservoir would be drawn into the Sites Pumping/Generating Plant by the pumping and pumping-generating units. The number of units operating would be selected to provide the approximate pumping capacity needed to deliver all water stored in the Holthouse Reservoir on a daily basis during the off-peak pumping period. The Sites Pumping/Generating Plant would be a conventional, indoor-type pumping-generating plant with an inline arrangement of vertical pumping units and a reinforced concrete substructure and a steel superstructure. The size of each unit bay was determined based on the minimum required spacing between each unit. Two service bays have been incorporated on either side of the Sites Pumping/Generating Plant and have been sized to allow for two units to be serviced simultaneously while the remainder of the Sites Pumping/Generating Plant continues operation.

The pumps would be connected to a complex intake/outflow manifold. When water is drawn out of Holthouse Reservoir and pumped up to Sites Reservoir, the pumped water would flow through successive pipe connections until all 12 pipes coming from the pump units combine into a single 26-foot-diameter pipe. This pipe would then join the 26-foot-diameter pipe coming from the emergency bypass outlet, and the two pipes would connect to the 30-foot-diameter tunnel.

A 230-kV electrical switchyard (Sites Electrical Switchyard) would handle pumping and generating power to the Sites Pumping/Generating Plant. Power will be supplied to the switchyard from a proposed substation, to be located near one of two existing 230 kV transmission lines northeast of the proposed Holthouse Reservoir (substations are described further in Section 3.1.1.5 Overhead Power Lines and Substations). The Sites Electrical Switchyard would be approximately 3.5 acres and would be graded flat. Multiple pieces of electrical equipment would be housed in the switchyard on concrete pads. An overhead power line tower/pole (approximately 50 feet tall) would receive the electrical line entering the site. Although poles are anticipated for all overhead power lines, towers were included in the acreage assessment to provide a conservative estimate. The switchyard would be approximately 500 feet by 300 feet, and would have multiple metallic poles with heights varying between 15 and 60 feet. The switchyard would be surrounded by a 6- to 8-foot-high chain-link fence with barb or serpentine wire along the top.

The switchyard and overhead power lines connecting the pumping/generating plant to the substation at the grid would provide all the electricity needed by the pumping/generating plant. The switchyard and overhead power lines would also allow the pumping/generating plant to feed electricity back into the electrical grid during periods of generation.

Construction. The total site footprint of the proposed Sites Pumping/Generating Plant and approach channel would be approximately 75 acres. An additional 20 acres of land adjacent to the plant would likely be disrupted during construction.

Anticipated ground-disturbing activities include the following:

- Transporting materials to the construction site (including contractor's temporary office and utility hookup)
- Clearing and grading the construction workspace
- Placing construction materials at staging areas
- Excavating the approach channel and pumping plant and hauling excavated material
- Dewatering
- Constructing the forebay, pump house, and pump bay
- Performing site restoration after construction is complete

The total construction disturbance area for the Sites Pumping/Generating Plant includes the footprint of the proposed switchyard, the materials and equipment staging area, electrical transformer area, and temporary access roads.

Anticipated major construction activities include clearing and grading the construction workspace, placing necessary construction materials at staging areas, and preparing the switchyard pad.

Operations. A SCADA system would control all of the proposed operational modes. The system would be located onsite and would broadcast status information to a manned location in the Operation and Maintenance Building. Plant operators would require continuous communication with the TRR Pumping/Generating Plant, Delevan Pipeline Intake/Discharge Facilities, and Tehama-Colusa Canal operators to coordinate flows into and out of the proposed Holthouse Reservoir and Sites Reservoir for filling and releasing. The proposed switchyard would be operated remotely or by onsite operations/maintenance staff.

Maintenance. Routine maintenance and monitoring of the proposed Sites Pumping/Generating Plant would likely be required on a daily basis by onsite personnel. Regular maintenance and inspection would be required for each pump and pump turbine unit and the related equipment, such as gates, valves, electrical equipment, and other mechanical systems. The Sites Pumping/Generating Plant would be equipped with cranes to facilitate operation and maintenance. There would be a 100-ton capacity indoor bridge crane for assembly and maintenance of pumping/generating units and associated equipment. A 50-ton capacity outdoor traveling gantry crane would be installed for assembly and maintenance of butterfly valves. In addition, a 10-ton capacity outdoor traveling gantry crane would be installed to aid in the installation and removal of inlet gates and trash racks.

The proposed switchyard would require maintenance once or twice a year. Maintenance activities may include annual washing and cleaning of insulating equipment, preventive maintenance, scans of the switchyard under full load, and routinely scheduled testing to meet Western Electricity Coordinating

Council (WECC) requirements. Regular maintenance activities would include inspections for damage by animals and landscape maintenance.

Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure

The purpose of the proposed tunnel is to transport water between the proposed Sites Pumping/Generating Plant and the proposed Sites Reservoir Inlet/Outlet Structure. The tunnel alignment would be located west of the existing Funks Reservoir and south of the proposed Golden Gate Dam on Funks Creek. The tunnel alignment would fall between the proposed Sites Pumping/Generating Plant location and the proposed Sites Reservoir Inlet/Outlet Structure location and would be approximately 4,000 feet long (Figure 3-7).

The proposed 30-foot-inside-diameter tunnel was designed to meet DSOD emergency drawdown release criteria. The tunnel would have a maximum discharge capacity of 15,200 cfs with a corresponding tunnel velocity of 21.5 fps. Pumping velocities through the tunnel would be approximately 8.20 fps for the 5,900-cfs pumping plant.

The full tunnel length between portals would be concrete-lined to prevent rock fallout and to provide a smooth interior surface, thus reducing head loss and minimizing seepage into the surrounding rock. The tunnel concrete liner would include an additional steel liner in the lower 1,000 feet adjacent to the pumping plant where rock cover over the tunnel is too shallow to confine the internal pressure.

Construction. The total construction disturbance area would be approximately 3 acres. It would include the footprint of the proposed facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads. There would be no permanent aboveground disturbance area for this facility.

Anticipated ground-disturbing and related activities during construction include the following:

- Surveying and marking
- Clearing and grading
- Building access roads
- Installing temporary power to site
- Developing staging and material laydown areas
- Transporting construction materials and equipment to the site, upstream cofferdam, and diversion facilities
- Portal excavations at both ends
- Portal construction
- Tunnel blasting/excavating
- Dewatering and excavated material removal
- Concrete and steel liner installation
- Performing site restoration and cleanup

Operations. The typical operation scenario for the proposed tunnel would be 24 hours per day, 7 days per week. The tunnel would transport flows between the proposed multi-level Sites Reservoir Inlet/Outlet Structure upstream and the Sites Pumping/Generating Plant downstream. During emergency release operations, the tunnel could discharge a maximum flow rate of approximately 15,200 cfs.

Maintenance. Maintenance would likely occur on an annual basis in coordination with maintenance and inspection of the proposed Sites Reservoir Inlet/Outlet Structure and multi-level intake tower upstream and the proposed Sites Pumping/Generating Plant downstream.

The Sites Reservoir Inlet/Outlet Structure tower wheel gates would be closed off to completely isolate the tunnel from the reservoir below the inlet/outlet structure for inspection and maintenance; to allow tunnel inspection and maintenance upstream of the wheel gates, stop logs would be used to shut off flow from the low-level inlet structure to the downstream tunnel section. The stop logs would be lowered from a barge above and dropped into the low-level inlet structure.

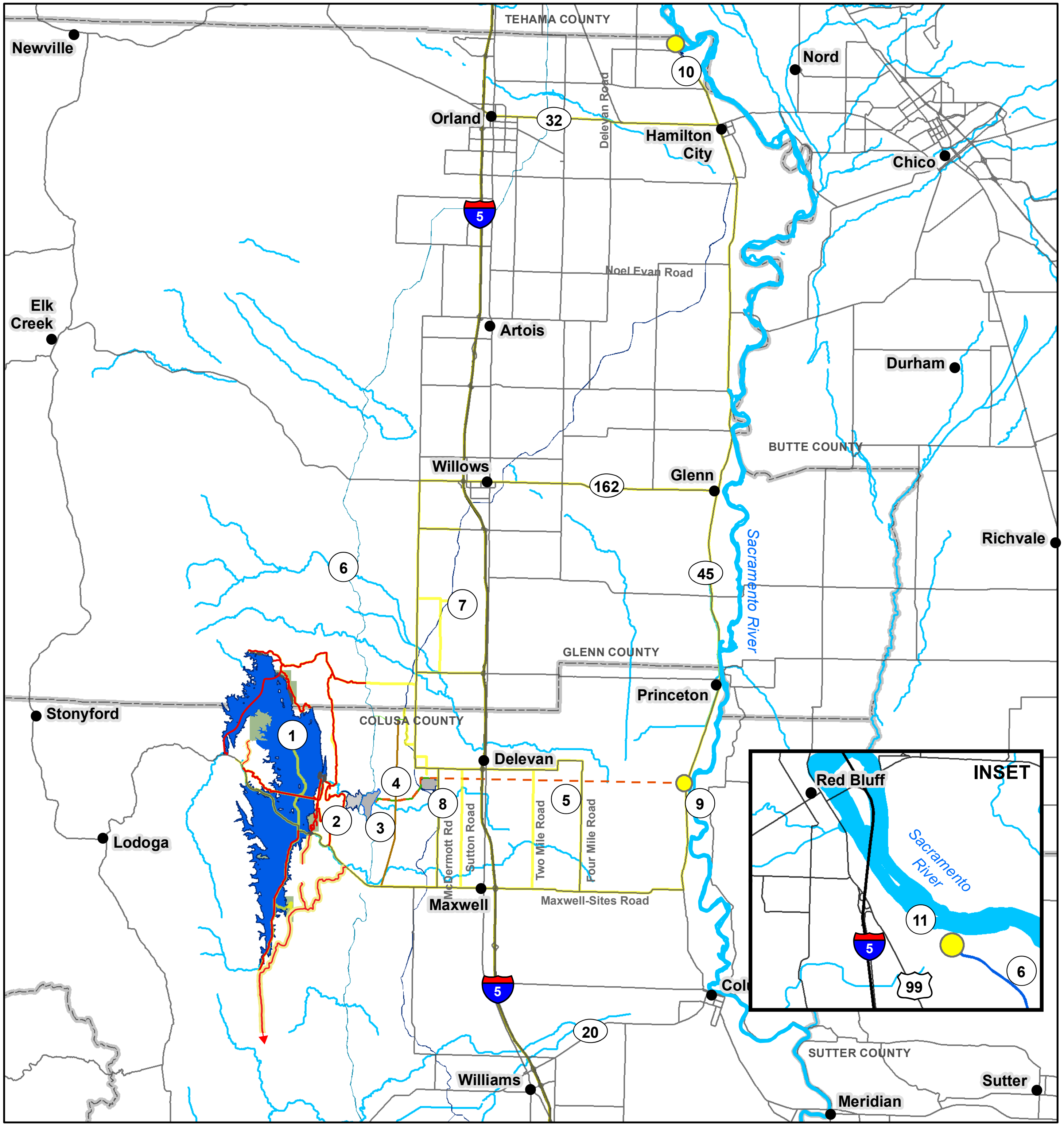
Typical tunnel inspection and maintenance may consist of checking for concrete cracks and leaks at joints between lining sections and around connections with the Sites Pumping/Generating Plant, Sites Reservoir Inlet/Outlet Structure tower gates, and low-level intake structure.

South Bridge and Roads

The proposed Sites Reservoir would inundate several existing roads within Colusa County's jurisdiction. Travel between the towns of Maxwell and Lodoga along the existing Maxwell Sites Road and Sites Lodoga Road would be blocked by the new reservoir. Approximately 6 miles of the existing Huffmaster Road, a gravel county road, would also be inundated. Huffmaster Road provides access to private properties primarily within the proposed Sites Reservoir footprint and the community of Leesville, southwest of the proposed reservoir. Peterson Road, also a gravel county road that provides access to private property, is located entirely within the proposed reservoir footprint. Existing roads would be rerouted, as necessary, to provide alternate access routes.

Approximately 46 miles of new paved and unpaved roads would provide construction and maintenance access to the proposed facilities, as well as provide public access to the proposed recreation areas. The locations of proposed roads, the proposed South Bridge, and existing roads near the proposed Sites Reservoir that would be affected by Project construction and/or operation are shown on Figures 3-8A, 3-8B, and 26-1.

Six road alternatives were evaluated to determine the best method of connecting the towns of Maxwell and Lodoga. To determine the best road alternative available, weighted criteria were independently assessed for shortest travel time, least total cost, least annual operations and maintenance cost, shortest emergency response time, least impact on wildlife habitat, least impact on wetlands and riparian areas, and least impact on public safety. Of the road alternatives, the South Bridge Alternative was selected as the Project alternative. The portions of Maxwell Sites and Sites Lodoga roads that would be inundated by the proposed reservoir would be replaced by the proposed South Bridge. The proposed road (including new bridge) would start approximately 1 mile east of the proposed Sites Dam on Maxwell Sites Road. The new route would consist of the proposed Eastside Road, Stone Corral Road, the South Bridge, and an approach road west to Sites Lodoga Road. This route would also provide access to the proposed Stone Corral and Peninsula Hills Recreation Areas.



Legend

- Cities and Towns
- Pumping Plant
- Dams
- New or Improved Roads
- Existing Roads
- Access Routes
- Recreation Areas
- Interstates
- Rivers/Creeks
- Counties
- 1 Sites Reservoir (New)
- 2 Funks Reservoir (Existing; Dredged)
- 3 Holthouse Reservoir (New)
- 4 TRR Pipeline (New)
- 5 Delevan Pipeline (New)
- 6 Tehama-Colusa Canal (Existing)
- 7 Glenn-Colusa Irrigation District (GCID) Canal (Existing)
- 8 Terminal Regulating Reservoir (New)
- 9 Delevan Pipeline Intake/Discharge Facilities (New)
- 10 GCID Pumping Plant (Existing)
- 11 Red Bluff Pumping Plant (Existing; Add Pump)

FIGURE 3-8A
Proposed Access Routes to Project Facilities
Sites Reservoir Project EIR/EIS

0 2 4 8 12 Miles

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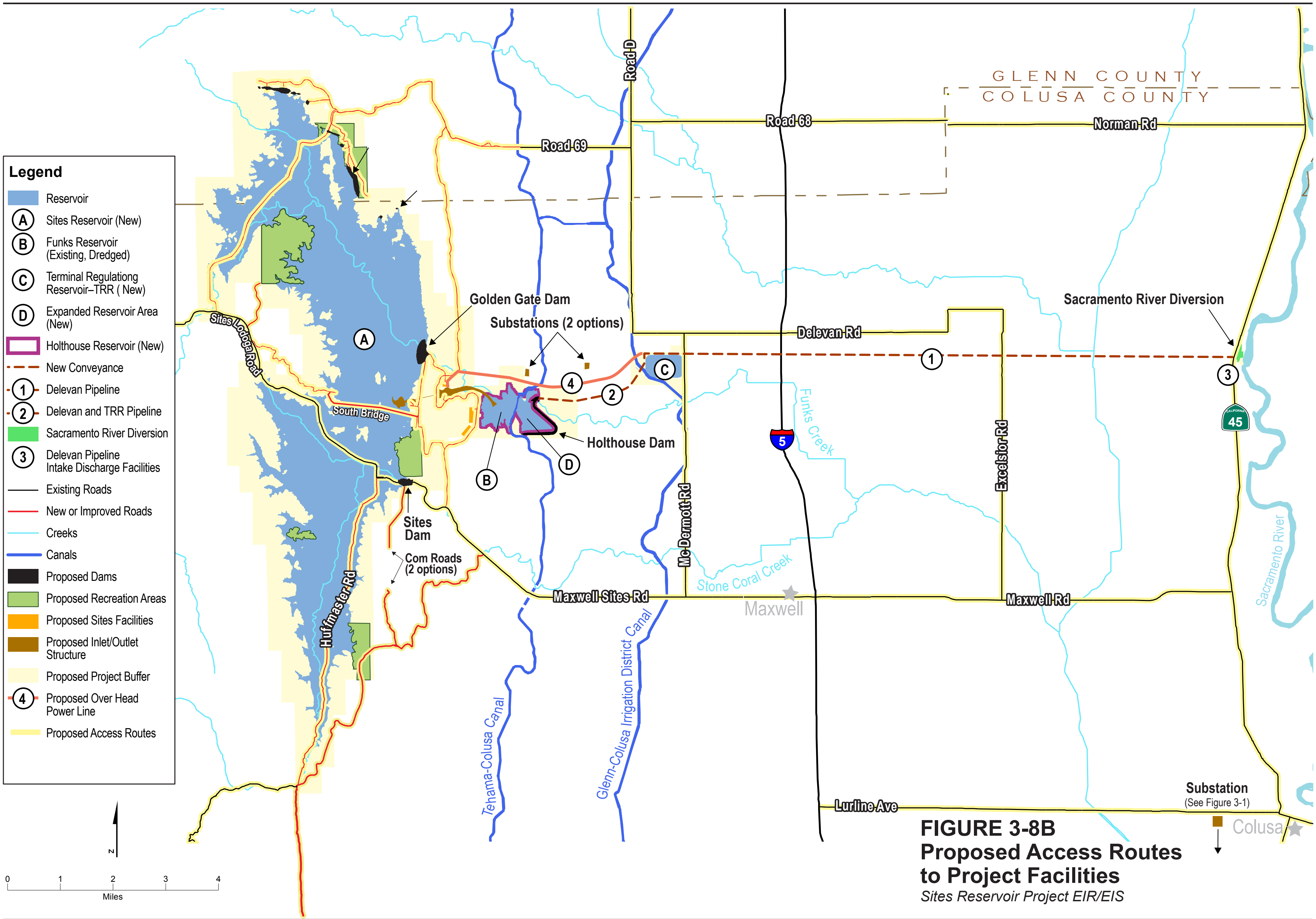

FIGURE 3-8B
Proposed Access Routes to Project Facilities
Sites Reservoir Project EIR/EIS

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The proposed South Bridge would be a two-lane concrete bridge, 35.5 feet wide and approximately 1.5 miles long. The top deck elevation would be 45 feet above the Sites Reservoir's maximum normal water surface elevation. For the roads leading up to and away from the bridge, the proposed road right-of-way would be 60 feet wide with a 4 percent maximum grade. Culverts and minor bridges would be constructed to provide passage for streams and drainage of surrounding areas, including the construction of a culvert where the proposed Eastside Road would cross Funks Creek. Guardrails, signs, striping, and lighting would be installed after the roads are completed pursuant to applicable county, Caltrans, and American Association of State Highway and Transportation Officials (AASHTO) design specifications. Permanent fencing would be installed along both edges of the right-of-way (60-foot width).

The proposed North Road and Saddle Dam Road (both new gravel roads) would provide access to northern portions of the Sites Reservoir and saddle dams. The new Eastside Road would be gravel from the existing County Road 69 to near the proposed Sites Pumping/Generating Plant and paved south of the plant. Eastside Road would connect the proposed Stone Corral Road to County Road 69, providing access to the northern portions of the Sites Reservoir, Holthouse Reservoir Complex, Golden Gate Dam, and associated structures and to properties northeast of the Sites Reservoir. Along the west side of the Sites Reservoir, the proposed Peninsula Road would provide access from Sites Lodoga Road to the proposed Peninsula Hills Recreation Area. The proposed Sulphur Gap Road would provide access to southern portions of the Sites Reservoir, the Lurline Headwaters Recreation Area, and private property adjacent to the proposed Com Road and would connect to Huffmaster Road. Two options for the Com Road were considered and are shown on Figure 3-1. One option would start at Sites Dam and proceed south to the communications tower; the other option would be aligned from Sulphur Gap Road north to the communications tower.

Permanent facility access roads constructed from gravel and asphalt would facilitate operation and maintenance. These proposed access roads would require new construction or the relocation of existing public county roads and bridges; these activities would follow Caltrans and AASHTO design standards as applicable. During construction, gravel roads would be constructed on the following detour and construction roads: the proposed Sulphur Gap and Lurline roads and an existing dirt road west of the proposed Lurline Headwaters Recreation Area to Huffmaster Road.

A new temporary bypass road at the north end of Sites Reservoir would be provided to help expedite the closure of Sites Lodoga Road in the Project area and the start of construction in borrow areas and for the main dams. The new bypass road would begin on the east where existing Road 69 intersects the Tehama-Colusa Canal. Access to Road 69 would be from Highway 5 at the Road 68 interchange, then west along Road 68 to Road D and Road 69. From the Tehama-Colusa Canal crossing, the planned access road would follow existing ranch roads and trails that are planned for use as the saddle dam access road. From the saddle dam access road near Saddle Dams 5, existing ranch roads and trails would also be followed to cross the bottom of the reservoir to the southwest and connect back to Sites Lodoga Road on the west side of the proposed reservoir, just above the planned inundation area. The bypass road would meet applicable county standards and would be paved along its full length for public use.

Characteristics of the proposed roadways, South Bridge, and the minor structures are listed in Tables 3-7, 3-8, and 3-9, respectively.

Table 3-7
Characteristics of Project Roadways and South Bridge Approaches

Road or Segment Name	New or Existing	Permanent (P) or Temporary (T)	Gravel Road (miles)	Paved Road (miles)	Total (miles)
Public Access Roads					
Com Road[a]					
Dam Crown Access Road to Communication Tower	New	P	2.95		2.95
Sulphur Gap Road to Communication Tower	New	P	1.14		1.14
Eastside Road					
Field Office Maintenance Yard Access to Sites Pumping/Generating Plant Access	New	P		0.93	0.93
Golden Gate Dam/Electrical Switchyard Access Roads to Property North of Golden Gate Dam	New	P	1.52		1.52
Maxwell Sites Road to Stone Corral Road	New	P		1.30	1.30
Property North of Golden Gate Dam to North Road	New	P	3.63		3.63
Sites Pumping/Generating Plant Access to Golden Gate Dam/Electrical Switchyard Access Roads	New	P		0.95	0.95
Stone Corral Road to Field Office Maintenance Yard	New	P		1.09	1.09
North Road					
County Road 69 at Tehama-Colusa Canal to Saddle Dam Road	Existing (dirt road to be improved)	P		4.69	4.69
Saddle Dam Road to Saddle Dam 9	New	P	1.84		1.84
Peninsula Road					
Sites Lodoga Road to Peninsula Hills Recreation Area (East Segment)	New	P	0.90		0.90
Sites Ladoga Road to Peninsula Hills Recreation Area (West Segment)	New	P	1.00		1.00
Saddle Dam Road					
North Road to Saddle Dam 1	New	P	3.10		3.10
Temporary North Bypass Road					
Saddle Dam Road to Sites Lodoga Road West[b]	New	T		4.90	4.9
South Bridge					
South Bridge	New	P		1.48	1.48
South Bridge East Approach					
Included with Stone Corral Road (below)	NA	NA	NA	NA	NA

Road or Segment Name	New or Existing	Permanent (P) or Temporary (T)	Gravel Road (miles)	Paved Road (miles)	Total (miles)
South Bridge West Approach					
South Bridge to Sites Lodoga Road	New	P		2.16	2.16
Stone Corral Road					
Eastside Road to Stone Corral Recreation Area	New	P		1.6	1.6
South Bridge East Approach to Stone Corral Recreation Area	New	P	0.21		0.21
Sulphur Gap Road					
Maxwell Sites Road to Huffmaster Road	New	P	7.61		7.61
Private Access Roads					
Golden Gate Access Roads					
Eastside Road to bottom of Golden Gate Dam	New	P		0.26	0.26
Eastside Road to Sites Pumping/Generating Plant Electrical Switchyard	New	P		0.12	0.12
Eastside Road to Field Office Maintenance Yard	New	P		0.04	0.04
Eastside Road to Sites Pumping/Generating Plant	New	P		0.18	0.18
South Bridge East Approach to Inlet/Outlet Structure Tower	New	P		0.50	0.50
South Bridge East Approach to top of Golden Gate Dam	New	P		1.2	1.2
Saddle Dam Access Roads					
North Road to Saddle Dam 6	New	P	0.28		0.28
Saddle Dam Road to Saddle Dam 2	New	P	0.03		0.03
Saddle Dam Road to Saddle Dam 3	New	P	0.16		0.16
Saddle Dam Road to Saddle Dam 5	New	P	0.11		0.11
Saddle Dam Road to Saddle Dam 10 (Alt A only)	New	P	0.30		0.30
Total			**24.78**	**21.4**	**46.18**

[a]Only one of the two options listed would be constructed, but both are included in the total to provide a conservative assessment.

[b]Assumes no upgrades to Roads 68 and 69.

Table 3-8
Proposed South Bridge Characteristics

Item	Dimension
Bridge length	Approximately 8,000 feet (1.5 miles)
Bridge width	35.5 feet
Bridge height[a]	Approximately 45 feet above maximum water surface elevation
Bridge depth[b]	20 feet maximum, 8 feet minimum
Spans	400 feet maximum, 260 feet minimum, 22 spans total
Columns – 1.3 MAF dimensions	22 feet by 14 feet square, hollow, maximum height approximately 260 feet, 21 columns total
Foundations	Large mat foundations under columns with 4-foot-diameter, cast-in-place, drilled shafts, 36 per footing, 168 total

[a]The bridge height is the distance from the top of the bridge deck to the maximum water surface elevation.
[b]The bridge depth is the distance from the top of the bridge deck to the bottom of the bridge structure that sits atop the columns.

Table 3-9
Characteristics of Proposed Minor Structures

Item	Typical Dimensions
Culverts (over unnamed streams), 17 total	6-foot diameter by 100-foot length
Minor bridge (over named streams), 1 total	40-foot width by 80-foot length

Note: Minor structures would be built using steel pipe or precast pieces.

Construction. The construction disturbance area would include the footprint of the proposed South Bridge structure and proposed roads and stream crossings, the materials and equipment staging areas, the area needed to construct the facilities, and access roads. Traffic that is not construction-related would be diverted around construction disturbance areas in accordance with a traffic control plan.

If necessary, an asphalt batch plant would be built onsite and outside of the Sites Reservoir footprint. The batch plant could be temporary or permanent, depending on Project needs. One possible location could be adjacent to the footprint of the proposed Field Office Maintenance Yard. This location would be centrally located to the Project's paving needs, is relatively flat, and has shallow soils and impervious subsoil that should allow for easy spill containment and site cleanup. Alternatively, the construction contractor may obtain asphalt from regional commercial sources. Concrete bridge construction would include excavation for foundations and abutments; installing cast-in-place concrete formwork; placing reinforcing steel; installing bridge deck expansion joints; pouring and curing concrete; removing concrete forms; installing bridge barriers, bridge railings, bridge lighting, approach roadway guardrails, fences, signs, and reflectors; and painting approach and bridge deck striping.

Anticipated ground-disturbing and related activities during construction include the following:

- Surveying and marking
- Clearing and grading the construction workspace
- Preparing the construction materials laydown and equipment staging areas
- Transporting materials and equipment to the Project site
- Building concrete and/or asphalt batch plant
- Creating road cuts and fills; hauling excess cut materials

- Constructing bridge foundation, including drilled pier installation for foundations
- Constructing bridge columns
- Constructing bridge spans
- Installing culverts and minor bridges
- Laying aggregate road base and asphalt
- Installing fences, guardrails, and signs
- Installing roadway striping and reflectors
- Performing erosion and stormwater management
- Implementing BMPs
- Performing site restoration and cleanup

Operations. Standard nighttime bridge safety lighting would be provided in accordance with county requirements. Electricity would likely come from an existing overhead distribution line that currently parallels exiting Sites Lodoga Road. Daily management of the right of way (e.g., speed restrictions and closures) would be conducted by county and state law enforcement agencies.

Maintenance. Procedures will be incorporated to reduce impacts from lighting (e.g., directional lighting and non-reflective materials). Typical road maintenance would consist of chip sealing; patching; grading; crack filling; asphalt overlays; guardrail, fencing, and signage repairs; embankment erosion repair; and vegetation control. Typical culvert and minor bridge maintenance would consist of debris removal, cleaning, and repair of steel pipe corrosion and precast concrete cracks.

Typical bridge maintenance would consist of debris clearing from bridge deck and deck drainage outlets; barrier, railing, and light repairs; concrete deck and expansion joint repairs; occasional resurfacing; approach slab and guardrail repairs; and abutment erosion maintenance and repair. In addition, annual safety and maintenance inspections would be conducted pursuant to county, Caltrans, and AASHTO requirements as applicable to maintain a bridge condition monitoring record.

Recreation Areas

Alternative A includes the development of up to five recreation areas. Per discussions with Glenn and Colusa counties, a total of three recreation areas are anticipated to ultimately be constructed; however, all five are included to be conservative and provide flexibility. Development of the recreation areas would be phased, likely starting with Stone Corral. Development of additional recreation areas would be initiated based on public demand. The development of new recreation areas at the Sites Reservoir could meet public demand for recreation opportunities. The five potential recreation areas at Sites Reservoir were evaluated based on the site topography, environmental considerations, and the effect of potentially large fluctuations in the water surface levels due to normal reservoir operations. The following sites were selected for Alternative A based on the screening process:

- **Saddle Dam Recreation Area** – The Saddle Dam Recreation Area (Figure 3-9A) would be located on the northeast side of the proposed Sites Reservoir, along the edges of the proposed Saddle Dams 3, 4, and 5. Access would be provided from the proposed Saddle Dam Road via the proposed North Road. The maximum proposed size of the Saddle Dam Recreation Area is 330 acres.

- **Stone Corral Recreation Area –** The Stone Corral Recreation Area (Figure 3-9B) would be located on the eastern shore of the proposed Sites Reservoir, north of the existing Maxwell Sites Road and proposed Sites Dam. Access would be provided by either the proposed South Bridge or Eastside Road and Stone Corral Road. The maximum proposed size of the Stone Corral Recreation Area is 230 acres.

- **Lurline Headwaters Recreation Area –** The Lurline Headwaters Recreation Area (Figure 3-9C) would be located near the southeast tip of the proposed Sites Reservoir. Access would occur from the proposed Lurline Road. The maximum proposed size of the Lurline Headwaters Recreation Area is 220 acres.
- **Antelope Island Recreation Area –** The Antelope Island Recreation Area (Figure 3-9D) would be located in the southwestern portion of the proposed Sites Reservoir. Antelope Island would offer boat-in access only; however, during construction, a temporary road would provide access to the island. The maximum proposed size of the Antelope Island Recreation Area is 50 acres.
- **Peninsula Hills Recreation Area** – The Peninsula Hills Recreation Area (Figure 3-9E) would be located on the northwest shore of the proposed Sites Reservoir, to the north of the existing Sites Lodoga Road and across the reservoir from the proposed Saddle Dam Recreation Area. Access would be provided to the proposed Peninsula Road via the existing sites Lodoga Road west of the reservoir. The maximum proposed size of the Peninsula Hills Recreation Area is 370 acres.

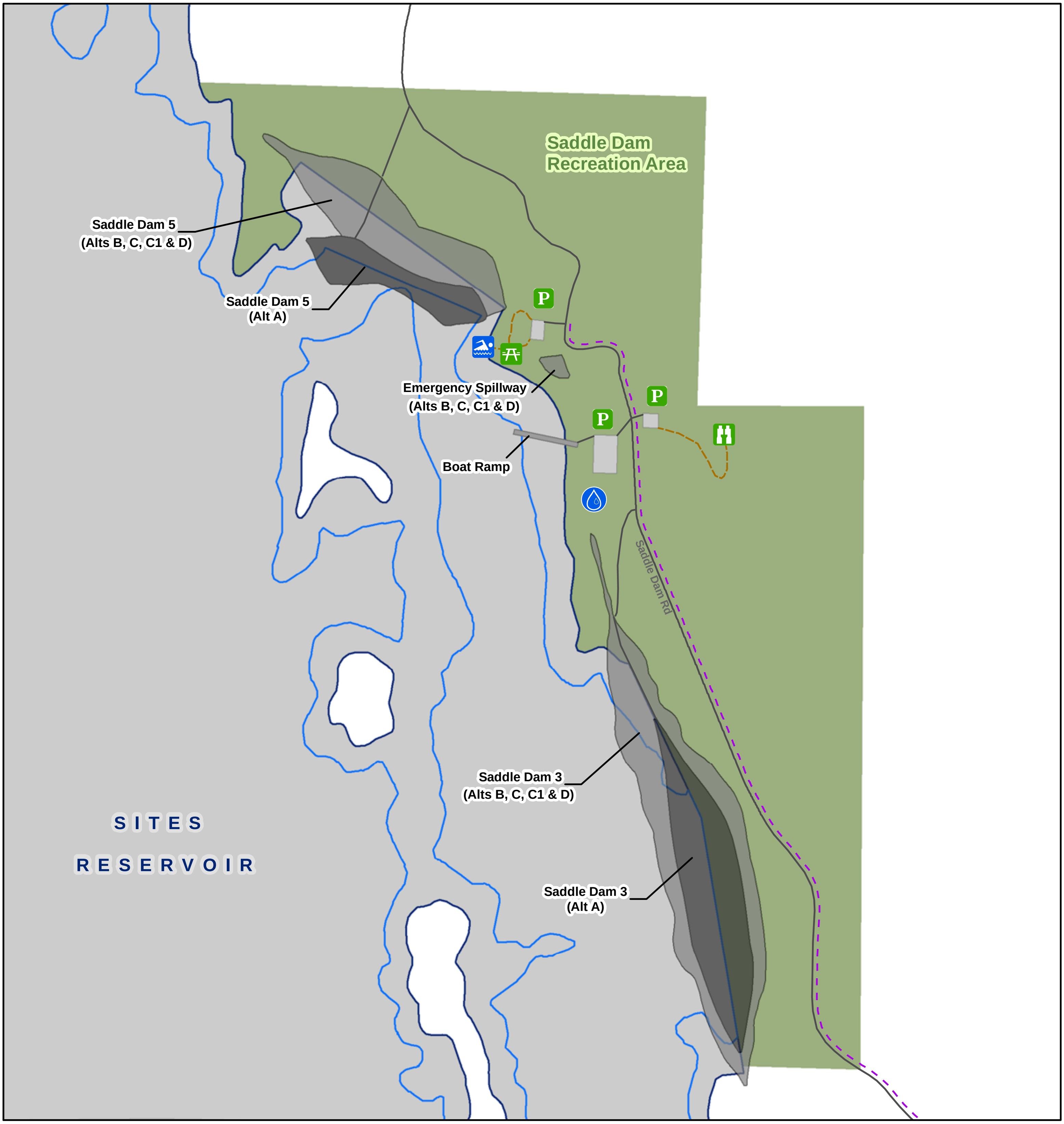
Recreation opportunities at the proposed recreation areas would include boating, camping, picnicking, fishing, swimming, and hiking. Depending on the recreation area, proposed facilities are anticipated to include boat launch sites (Figure 3-9F), trails, designated swimming and fishing access, picnic tables, shaded canopies, campfire rings/barbeques, vault toilets, and dumpsters. In addition, gravel parking areas would be provided for camp sites, day-use areas, and boat launch facilities.

The approximate number of proposed facilities at each proposed recreation area is listed in Table 3-10.

Construction. It is anticipated that all construction activities associated with the recreation areas would occur within the proposed footprints of the recreation areas and the temporary and permanent access road areas. The total construction disturbance area of the five recreation areas would be within the acreage of the recreation areas themselves, approximately 1,200 acres. Construction disturbance may be much less if recreational facilities are designed and constructed to minimize vegetative disturbance, including tree removal.

Anticipated ground-disturbing and related activities during construction include the following:

- Surveying
- Clearing and grubbing
- Excavating
- Backfilling
- Constructing road and parking lot
- Installing potable water and power connections where they are planned to be provided
- Installing amenities
- Constructing boat ramp
- Performing site revegetation



Legend

- Picnic Area
- Swim Beach
- Vista Point
- Water Tank
- Parking
- Recreation Area Trails
- Overhead Power Line
- South Bridge New Roads (gravel)
- Access Roads
- Dam - Alt A
- Dam - Alts B, C, C1 & D
- Recreation Area Parking
- Boat Ramps
- Recreation Area
- 1.3 MAF Sites Reservoir
- 1.8 MAF Sites Reservoir

MAF = Million acre-feet
Alt = Alternative

FIGURE 3-9A
Proposed Saddle Dam Recreation Area and Facilities

Sites Reservoir Project EIR/EIS

0 250 500 1,000 1,500 2,000 Feet

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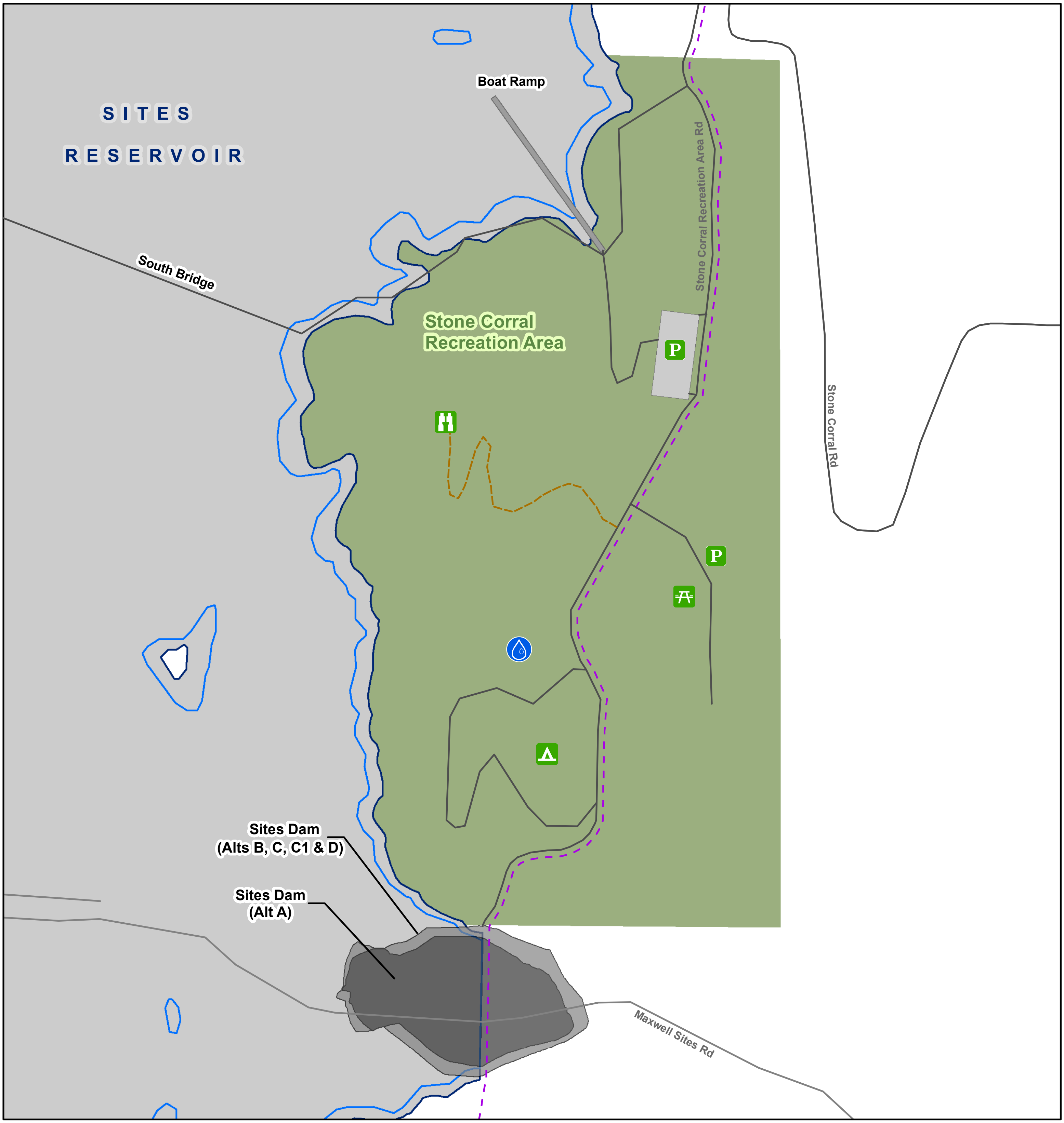

Legend

- Camping/ Group Campsite
- Picnic Area
- Vista Point
- Water Tank
- Parking
- Recreation Area Trails
- South Bridge New Roads (gravel)
- Access Roads
- Overhead Power Line
- Dam - Alt A
- Dam - Alts B, C, C1 & D
- Recreation Area Parking
- Boat Ramps
- Dams
- 1.3 MAF Sites Reservoir
- 1.8 MAF Sites Reservoir
- Recreation Area

MAF = Million acre-feet
Alt = Alternative

0 250 500 1,000 1,500 2,000 Feet

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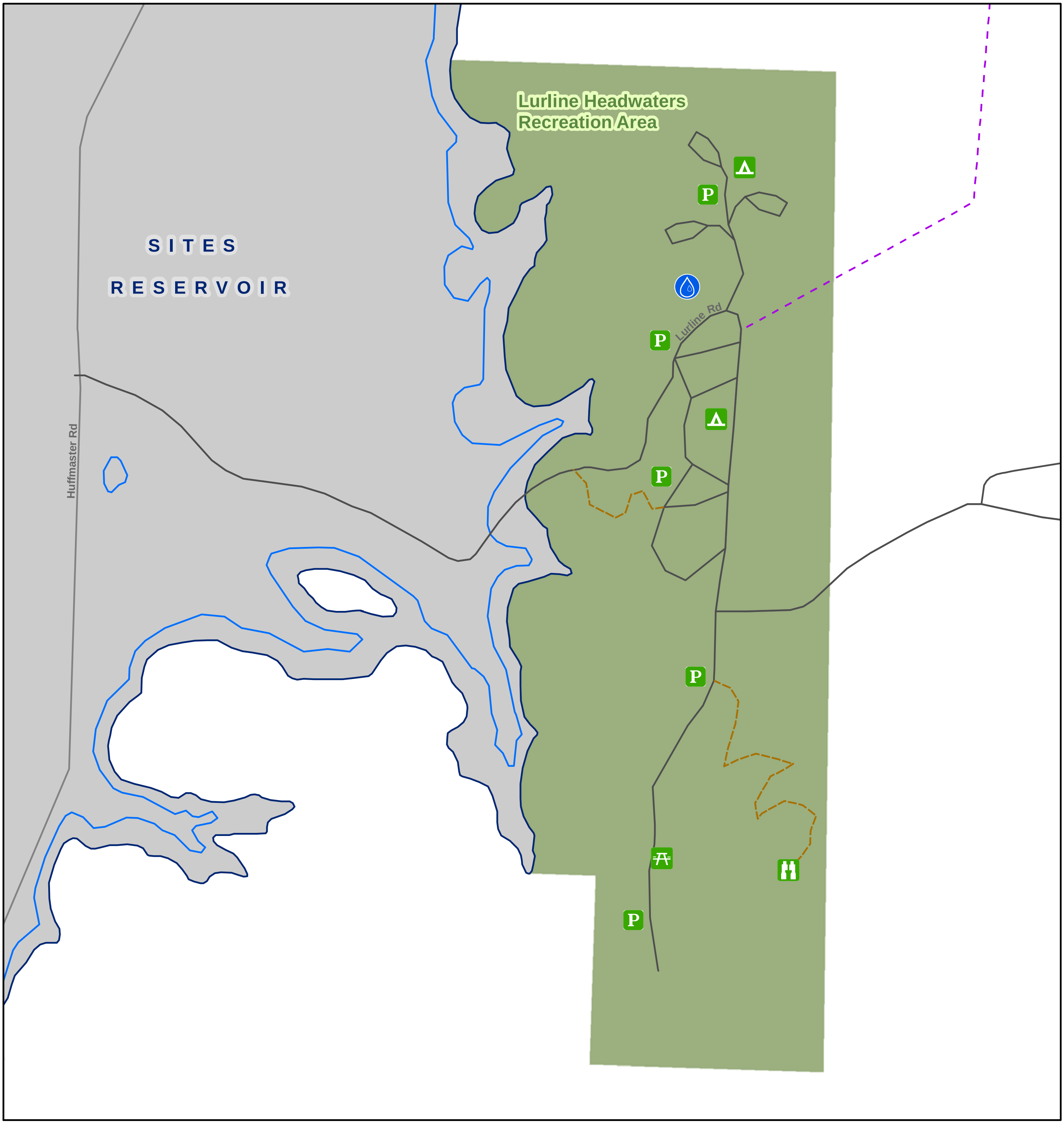
FIGURE 3-9B
Proposed Stone Corral Recreation Area and Facilities
Sites Reservoir Project EIR/EIS



Legend

- Camping/ Group Campsite
- Picnic Area
- Vista Point
- Water Tank
- Parking
- Recreation Area Trails
- Overhead Power Line
- South Bridge New Roads (gravel)
- Access Roads
- Recreation Area Parking
- 1.3 MAF Sites Reservoir
- 1.8 MAF Sites Reservoir
- Recreation Area

MAF = Million acre-feet

FIGURE 3-9C
Proposed Lurline Headwaters Recreation Area and Facilities
Sites Reservoir Project EIR/EIS

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Legend

- Picnic Area
- Undeveloped Mooring
- Recreation Area Trails
- Recreation Area
- 1.3 MAF Sites Reservoir
- 1.8 MAF Sites Reservoir

MAF = Million acre-feet

FIGURE 3-9D
Proposed Antelope Island Recreation Area and Facilities
Sites Reservoir Project EIR/EIS

N

0 125 250 500 750 1,000 Feet

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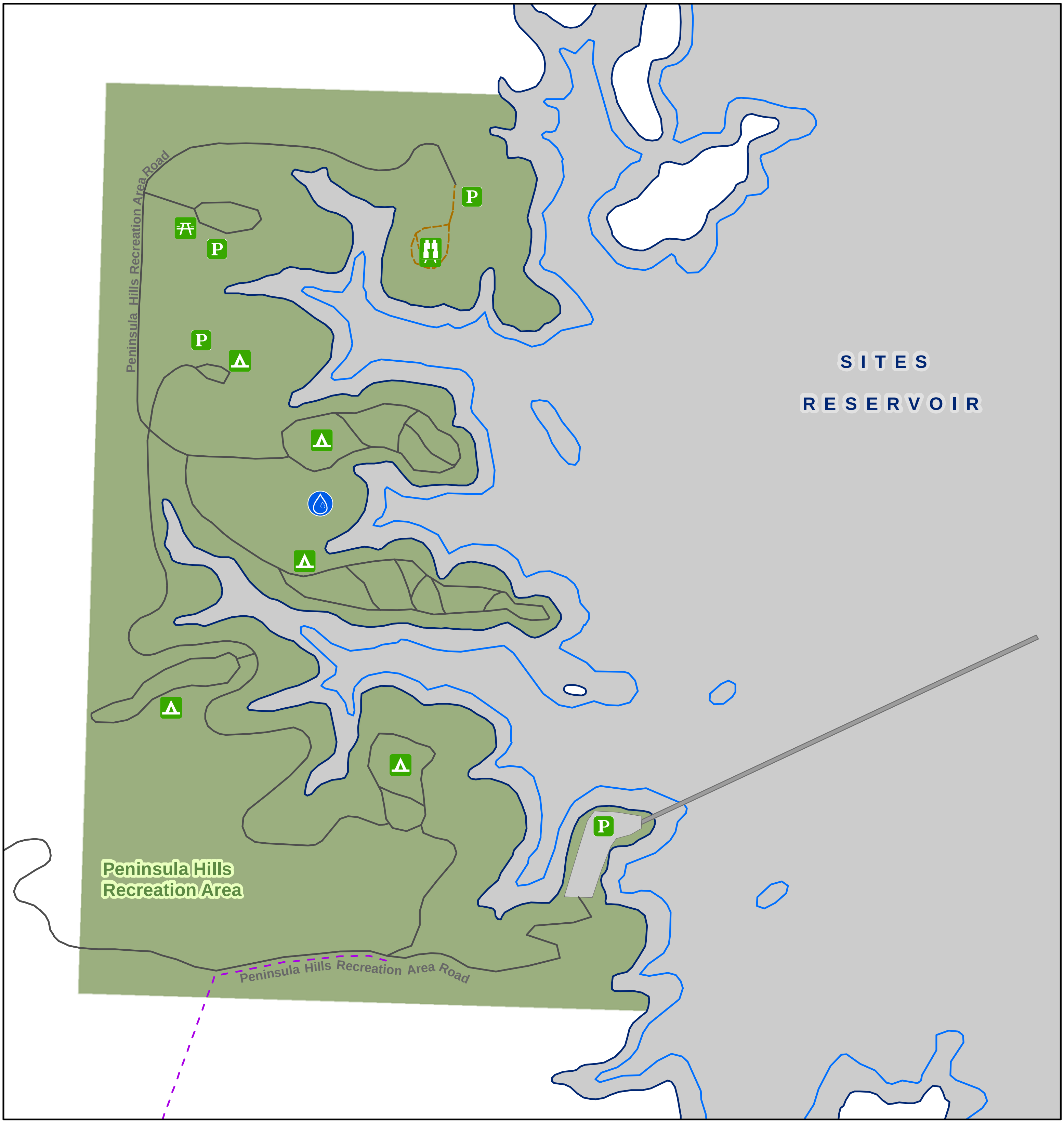

Legend

- Camping/ Group Campsite
- Picnic Area
- Vista Point
- Water Tank
- Parking
- Recreation Area Trails
- South Bridge New Roads (gravel)
- Access Roads
- Delevan Transmission Line
- Recreation Area Parking
- Boat Ramps
- 1.27 MAF Sites Reservoir
- 1.81 MAF Sites Reservoir
- Recreation Area

MAF = Million acre-feet

FIGURE 3-9E
Proposed Peninsula Hills Recreation Area and Facilities

Sites Reservoir Project EIR/EIS

0 250 500 1,000 1,500 2,000 Feet

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Legend

- Recreation Areas
- 1.3 MAF Sites Reservior
- 1.8 MAF Sites Reservior
- Boat Ramp

MAF = Million acre-feet

0 125 250 500 750 1,000 Feet

N

FIGURE 3-9F
Proposed Boat Ramp Recreation Area and Facilities
Sites Reservoir Project EIR/EIS

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Table 3-10
Approximate Number of Facilities at the Recreation Areas

Recreation Areas	Features
Stone Corral Recreation Area	50 campsites (car and recreational vehicle) 10 picnic sites (with parking at each site) 6-lane[a] boat launch site Hiking trails Electricity Potable water[b] 1 kiosk 10 vault toilets
Saddle Dam Recreation Area	10 picnic sites (with parking at each site) Swim area (50 parking stalls) Fishing access parking (20 stalls) Hiking trails 1 kiosk 5 vault toilets
Peninsula Hills Recreation Area	200 campsites (car and recreational vehicle) 1 group camp areas[c] 10 picnic sites (with parking at each site) Hiking trails Electricity Potable water[b] 1 kiosk 19 vault toilets
Antelope Island Recreation Area	12 campsites (boat-in) Hiking trails 1 vault toilet
Lurline Headwaters Recreation Area	50 campsites (car and recreational vehicle) 3 group camp areas 10 picnic sites (with parking at each site) Fishing access parking (10 stalls) Hiking trails Electricity 1 kiosk 8 vault toilets

[a]Reducing the number of boat lanes with increasing water depth.
[b]Treated water from the reservoir would be the source of potable water
[c]Each group camp area has been sized to accommodate 24 people.

Note: See Chapter 21, Recreation Resources regarding American Disabilities Act-compliant facilities.

Operations. It is anticipated that the proposed recreation areas would not have onsite staff. A fee collection box and camping information would likely be available at the kiosk near each recreation area's entrance. It is expected that the majority of use at the facilities would occur between Memorial Day (end of May) and Labor Day (beginning of September) of each year, but that activities such as hiking and fishing would occur year-round.

Maintenance. Maintenance activities would include collection of overnight and day-use fees at the fee collection boxes, road grading, water system maintenance, trash removal at picnic sites and overnight campsites, vegetation maintenance, restroom/vault toilet cleaning and restocking of paper goods, boat ramp debris removal, lake debris control, lake hazard marking, lake boom and barrier maintenance, signage, fence maintenance, fuels management, and law enforcement. During peak recreation use periods, these activities would likely occur on a daily basis, except for road grading, which is expected to occur once per year before the recreation season. During the non-peak seasons, activities other than road grading would likely occur on a weekly basis.

Field Office Maintenance Yard

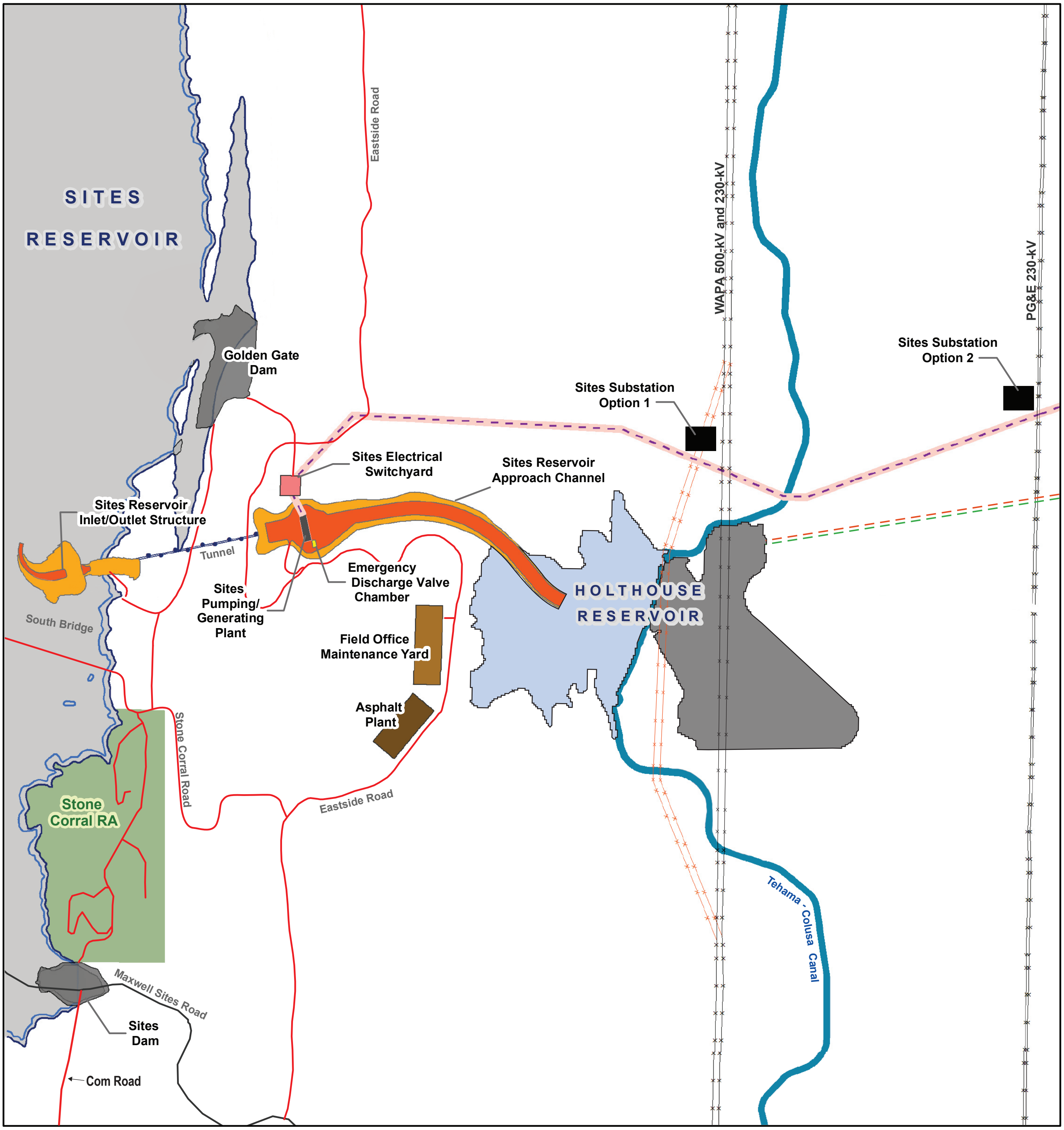
Due to the size of the Project area and the number of facilities, a staffed operation and maintenance complex (Field Office Maintenance Yard) would be built onsite (Figure 3-10) to service all Project facilities if needed. Construction of the Project would be phased, and specifics of the field office maintenance yard would be based on Project need. The following assumptions are conservative to provide flexibility. An administration building and parking area would be constructed to meet Project needs.

Construction. The total construction disturbance area would be approximately 20 acres, with approximately 12 acres of permanent space for the proposed footprints of the administrative and maintenance buildings. Buildings may include an administration/operation building, plant maintenance warehouse, service and supply warehouse, utility craft office, vehicle shop, heavy equipment shop, Project surveillance building, general maintenance headquarters, septic system, aboveground fuel and waste oil storage tanks. Oil/water separators will be provided in maintenance areas, as necessary. A temporary asphalt batch plant may be located in this area but could be located within the construction footprint for other facilities.

Construction of the proposed Field Office Maintenance Yard would include the following:

- Transporting materials to the Project site
- Clearing and grading the site for construction, including demolition of existing structures
- Placing construction materials at staging areas
- Constructing administrative and maintenance buildings
- Constructing ancillary facilities (e.g., leach-field, water treatment, lighting, concrete pad for refueling island, aboveground fuel tanks, perimeter fencing)
- Performing site restoration after construction is complete

Operations. The typical operations scenario for the proposed Field Office Maintenance Yard would be 24 hours per day, 7 days per week. The facility would be fully staffed during normal business hours, when scheduled maintenance of Project facilities would occur. Minimum personnel staffing would occur during off-peak hours to respond to emergency situations. Spare parts for mechanical and electrical equipment would be stored in the warehouse along with lubricants, oils, and greases to maintain equipment. Daily operations could include personnel traveling from the Field Office Maintenance Yard to Project facilities and performing scheduled repairs, inspection, and maintenance of Project equipment, observing Project facilities and operations, and as-needed emergency repairs. Minor equipment repair and overhaul (e.g., pumps, turbines) may take place at the facility, but major repairs and overhauls would be performed offsite. The SCADA system would be operated and monitored remotely from the operations area of the administration building.



WAPA = Western Area Power Administration; PG&E = Pacific Gas and Electric

0 750 1,500 3,000 4,500 Feet

N

Legend

- Sites Reservoir (1.3-MAF)
- Sites Reservoir (1.8-MAF)
- Sites Dams (1.3-MAF)
- Sites Dams (1.8-MAF)
- Asphalt Plant
- Field Office Maintenance Yard

Sites Reservoir Inlet/Outlet Structure

- Emergency Discharge Valve Chamber
- Inlet/Outlet Concrete Structure
- Inlet/Outlet Excavation Footprint
- Pumping Generating Plant
- Tunnel
- Electrical Switchyard
- Sites Substation Optional Locations

- Existing Powerline
- WAPA Powerline Adjustment
- Proposed Project Roads
- Existing Access Roads
- Overhead Power Line
- Delevan Pipeline
- TRR Pipeline

FIGURE 3-10
Proposed Sites Reservoir Inlet/Outlet Structure, Holthouse Reservoir, and Associated Facilities, Alternatives A, B, C, and D
Sites Reservoir Project EIR/EIS

Daily operations are anticipated to include fueling and washing vehicles and equipment, gathering technical data on water quality and Project facilities conditions, and maintaining and repairing mechanical equipment.

Maintenance. Periodic maintenance would likely be performed on an as-needed basis including road, building, vegetation, and fence maintenance and debris removal. Procedures will be incorporated to reduce impacts from lighting (e.g., directional lighting and non-reflective materials).

3.1.1.2 Holthouse Reservoir Complex

The Holthouse Reservoir Complex includes the features and facilities that are geographically or functionally associated with the Holthouse Reservoir. This complex would be composed of the Holthouse Reservoir inundation area including spillway and stilling basin and spillway bridge, the dam that would form the reservoir, the WAPA transmission line relocation, the approach channel for the Sites pumping/generating plant, existing Tehama-Colusa Canal connections, Tehama-Colusa Canal construction bypass pipeline, and installation of two additional pumps at the Red Bluff Pumping Plant.

Holthouse Dam and Reservoir

The existing 3,372-acre-foot Funks Reservoir is located 1 mile downstream of the proposed Golden Gate Dam site. This reservoir was constructed by Reclamation and is part of the Tehama-Colusa Canal system. Funks Reservoir serves as a re-regulating reservoir to stabilize flows in the canal downstream of Funks Reservoir as diverters come online and offline. The existing Funks Reservoir would be expanded to form the proposed Holthouse Reservoir (Figure 3-2) by constructing a new dam (Holthouse Dam) and reservoir to the east of Funks Reservoir, and breaching the existing Funks Dam so that the new and existing reservoirs would act as one unit with an enlarged active storage capacity of approximately 6,500 acre-feet and a surface area of approximately 450 acres. The proposed Holthouse Reservoir is required to facilitate balancing and regulating the Sites Reservoir inflows and outflows through the proposed Sites Pumping/Generating Plant, and to provide sufficient supplemental storage to allow simultaneous pump back power generation during on-peak periods.

The 6,500-acre-foot Holthouse Reservoir would allow the Sites Pumping/Generating Plant to perform a pumped-storage function for up to 6 hours per day while simultaneously collecting and storing inflows from the Sacramento River through the Tehama-Colusa and GCID Main canals and proposed Delevan Pipeline. All water would be pumped into Sites Reservoir from Holthouse Reservoir during off-peak power periods on a daily basis.

The proposed Holthouse Dam would be constructed as a zoned earthen embankment for most of its required length. However, a concrete gravity section would be provided in a rock cut on the left abutment to accommodate the inlet/outlet structure for the TRR and Delevan Pipelines and a flood control spillway. Except for the left abutment, Holthouse Dam would be a zoned embankment dam similar to the existing Funks Dam. The total length of the dam would be approximately 8,500 feet with a height of approximately 48 feet. The crest elevation of the dam would be at elevation 214 feet to match the crest of the existing Funks Dam. Because a deep soil layer could potentially exist along the dam alignment, the central core zone would extend down to suitable foundation in dense soils. A slurry cutoff wall would be constructed to control seepage. A grout curtain, a barrier that would protect the foundation of the dam from seepage as well as minimize seepage to local agricultural lands, would be installed under the dam. A similar such curtain is in place at the existing Funks Reservoir which has not experienced seepage issues to date. A downstream seepage collection drain system would also be installed to limit the potential for seepage in addition to a series of piezometers to monitor performance, several of which would be downstream of the dam section and foundation to monitor seepage.

A concrete gravity dam section on the left abutment would incorporate the inlet/outlet facilities for the four 12-foot diameter Delevan and TRR pipelines (two pipes each) as well as the emergency spillway for Holthouse Reservoir. The spillway would be a multi-gate structure similar to the existing spillway at Funks Dam. The spillway capacity would be sized to pass the emergency drawdown flow for Sites Reservoir. A chute section and stilling basin would be provided for the spillway to dissipate energy before release flows enter Funks Creek. A gated, low-level outlet pipe through the gravity dam section would also be provided to make environmental releases to Funks Creek and to help drain Holthouse Reservoir for inspection and maintenance.

Operating levels within Holthouse Reservoir would vary between elevation 206.0 and 190.0 feet, which would provide the required active storage capacity of approximately 6,500 acre-feet. Elevation 206.0 feet corresponds to the 2011 normal operating level in existing Funks Reservoir. There would be approximately 1,000 acre-feet of dead storage in Holthouse Reservoir due to topographic elevations near the new Holthouse Dam. This space could be allocated to sediment accumulation, disposal of excess excavated material from the Project, or disposal of existing sediment in Funks Reservoir.

Pump-back operations would involve the daily procurement of relatively inexpensive power sources (i.e., renewable energy) to pump water from the proposed Holthouse Reservoir up to the Sites Reservoir during off-peak hours of power usage and release that pumped water from Sites Reservoir to Holthouse Reservoir during peak hours of power usage. Pump-back power production provides flexible generation and would be used to compensate for rapid changes in electric power demand, such as from increased air conditioning use on hot days, as well as to compensate for changes in power production from variable renewable power sources, such as wind and solar power projects. Although water delivery and power production are given equal weight in the planning goals for the Project, pump-back power operations would be secondary to water delivery operations because of the restrictions on water operations from contracts and from environmental restrictions, but would be optimized within those restrictions to produce the greatest value to users. Pump-back operations would be most beneficial at the Sites Pumping/Generating Plant. Pump-back operations at the other Project pumping/generating facilities is not justifiable because of the limited storage potential for water and limited power generation capability compared to the Sites Pumping/Generating Plant.

WAPA Transmission Line Relocation

Eight WAPA transmission line towers are located within the footprint of the proposed Holthouse Reservoir. Based upon preliminary contacts with WAPA, the Project alternative would move a segment of the line to the west so that it would cross at a narrow spot in the existing Funks Reservoir dam.

Sites Pumping/Generating Plant Approach Channel

The Sites Pumping/Generating Plant would be connected to Holthouse Reservoir by an earthen approach channel approximately 6,300 feet long. The channel is expected to have relatively flat slope toward the Sites Pumping/Generating Plant and would be constructed at an elevation below the operating range of the reservoir. The channel would have a trapezoidal geometry with a bottom width of approximately 200 feet and a top width of 400 to 700 feet. When Holthouse Reservoir is full, the channel would be nearly entirely submerged. This channel would allow water from Holthouse Reservoir to flow by gravity to or from the pumping/generating plant and would allow upstream Funks Creek flows to enter Holthouse Reservoir via an approach channel spillway.

Existing Tehama-Colusa Canal Connections

The Tehama-Colusa Canal would continue to discharge into the reservoir at its current location on the north side.

Tehama-Colusa Canal Construction Bypass Pipeline

Installation of a bypass would be required during construction to divert Tehama-Colusa Canal flow before starting modifications to the existing Funks Reservoir. The bypass would be maintained as a permanent feature following modification of Funks Reservoir and construction of Holthouse Reservoir, as requested by Reclamation and the Tehama-Colusa Canal Authority (TCCA). The permanent bypass would provide operational flexibility to pass water to the canal segment below the reservoir without pumping when gravity flow is not possible. The proposed bypass would consist of a 12-foot-diameter pipeline starting approximately 2,600 feet upstream of the Tehama-Colusa Canal inlet into Funks Reservoir. The bypass would route the required flows around Funks Reservoir during reservoir modification construction. The bypass construction would require installation of two cofferdams on the upstream portions of the Tehama-Colusa Canal to isolate the area of embankment cut and pipe installation. The Funks Reservoir would be dewatered, and the existing check structure would be dismantled and reconstructed approximately 3,000 feet upstream. The check structure would consist of two 18-foot by 15.5-foot gates, electrical control, hoists, and concrete supports and reinforcement. The facility would be relocated slightly downstream of the bypass. The bypass would be gated or valve-controlled to regulate releases downstream, as required by Reclamation and the TCCA.

Construction. The total construction disturbance area would include the proposed footprints of Holthouse Reservoir, Holthouse Dam, Holthouse Spillway and Stilling Basin, Tehama-Colusa Canal Construction Bypass Pipeline, and Project buffer adequate for construction staging.

Construction materials for the earth dam would come from required excavations for the Sites Pumping/Generating Plant and the channel connecting the enlarged reservoir with the Sites Pumping/Generating Plant. The material in the existing Funks Dam could also be reused to construct the new dam. Approximately 883,500 cubic yards of core material and 2,000,000 cubic yards of earth and rockfill would be required to construct the earthen dam section. Approximately 41,000 cubic yards of concrete would be required for the concrete gravity dam section on the left abutment.

Construction materials for the proposed Holthouse Dam would include imported sands and gravel. Processed rock from Project excavations could also be used if the material is suitable for such use.

Because the existing Funks Reservoir is an onstream reservoir, a significant portion of the reservoir active storage has been displaced due to sediment accumulation from Funks Creek. Although topographic data are available for the reservoir from the original construction drawings, there are no current bathymetric data to support an estimate of the amount of sedimentation that has actually accumulated. However, it is believed that the current active capacity could be as low as 1,500 acre-feet. This would mean that approximately 750 acre-feet, or 1.2 million loose cubic yards, of sediment have accumulated. A bathymetric survey of the existing reservoir would be performed as part of future design phases of the Project to establish the volume and physical characteristics of the sediment so the material can be properly managed during design and construction.

A portion of the accumulated sediment would be removed and relocated to construct the new Holthouse Reservoir, in particular the low-level flow channel connecting the reservoir with the Sites Pumping/Generating Plant. However, it may not be necessary to remove all of the sediment that is located below the minimum normal operating level that does not affect the active storage of the reservoir. Once a diversion system is installed to route Funks Creek flows around the Holthouse Reservoir worksite, the sediment to be removed would be dewatered over a period of time by ditching and sumping. Once dry enough to be excavated and moved, the material would be disposed of in the lower elevations of the new Holthouse Reservoir in a dead storage area or in backwater areas around the perimeter of the existing reservoir. The construction schedule for the Project would allow adequate time to dewater and remove the material without affecting the new dam construction (which is outside the limits of sediment accumulation).

As described above a grout curtain would be installed under the dam, which would minimize seepage to local agricultural lands. A downstream seepage collection drain system would also be installed to limit the potential for impacts on adjacent lands in addition to a series of piezometers to monitor potential seepage during the operation of the facility. Seismic instrumentation, piezometers, and settlement points would also be installed for long-term monitoring of dam performance.

Typical summer releases from Funks Reservoir to the Tehama-Colusa Canal downstream range from 500 to 800 cfs. Total flows of 50 to 200 cfs for off-peak limited agricultural releases would be needed between November and February, possibly stretching to March, depending on the weather. The proposed bypass consists of a 12-foot-diameter pipeline that would route the required flows around Funks Reservoir during reservoir modification construction.

Operations. Funks Reservoir is operated by TCCA pursuant to a contract with Reclamation. Holthouse Reservoir would be operated cooperatively with TCCA; it would be operated by the designated operator of the proposed Sites Reservoir. During fall and winter, inflows from the conveyance system and water for power generation would be stored during on-peak power periods. The stored water plus ongoing off-peak inflows from the conveyance systems would then be pumped to Sites Reservoir during the partial-peak/off-peak power period on a daily basis. During spring and summer, when releases are made from Sites Reservoir, released water would go through the Sites Pumping/Generating Plant to generate power. Holthouse Dam would maintain releases to Funks Creek of up to 10 cfs year-round based on a recommendation from CDFW staff. This flow is intended to replace the existing seepage flow on Funks Creek below Funks Dam.

Maintenance. Current periodic maintenance required for Funks Reservoir includes road, vegetation, and fence maintenance and debris removal on an as-needed basis. The current Funks Reservoir is also drained annually. Although annual reservoir draining would not be necessary for the larger Holthouse Reservoir, period drawdown may be conducted as needed. Periodic maintenance and inspection of Holthouse Reservoir would be coordinated with Tehama-Colusa Canal operators or could be conducted at a centralized maintenance and operation office for the Sites Reservoir.

Additional Pumps at the Red Bluff Pumping Plant

The TCCA Red Bluff Pumping Plant, located in the Secondary Study Area, was constructed adjacent to Reclamation's Red Bluff Diversion Dam and completed in 2012. The plant, which was constructed as part of the Fish Passage Improvement Project (Figure 3-11), included a fish screen, a pumping plant at the Mill Site (known as the Red Bluff Pumping Plant), canal, siphon, a forebay, switchyard, and a bridge across Red Bank Creek. The fish screen structure was designed to meet NMFS and CDFW criteria for

FIGURE 3-11
Location of the Proposed Pump Installation at Red Bluff Pumping Plant
Sites Reservoir Project EIR/EIS

diversion flows of 80 to 2,500 cfs. The 2,500-cfs Red Bluff Pumping Plant includes 11 vertical axial-flow pumps. Of the 11 vertical axial-flow pumps, 9 (seven 250-cfs and two 125-cfs) were installed in the pumping plant, having a combined total rated capacity of 2,000 cfs. The pumping plant includes two additional pump bays designed for the future installation of two 250-cfs vertical axial-flow pumps.

The Project would require pumping capacity that exceeds the existing total installed capacity of the Red Bluff Pumping Plant. As such, the installation of two additional 250-cfs vertical axial-flow pumps into existing concrete pump bays at the pumping plant would be required (Figure 3-11). The Project also includes the operation and maintenance of the proposed additional pumps. The proposed additional pumps at the pumping plant would provide redundancy if one of the new pumps goes off line and would allow for a total diversion up to 2,160 cfs for each Project alternative in winter and spring, including up to 2,100 cfs for diversion to the proposed Sites Reservoir, and an additional 50 to 60 cfs for maintaining existing winter and spring flow operations of the Tehama-Colusa Canal.

Construction. Because the Red Bluff Pumping Plant was designed for the future installation of additional pumps, construction activities would be minor and would include the following:[5]

- Removing the existing blind flange on the afterbay side of the pumping plant and replacing it with an 84-inch butterfly valve. A new 84-inch-diameter flanged steel pipe spool (approximately 3 feet long) would be connected to the new butterfly valve. Permanent supports would be required beneath the butterfly valve and flap gate.
- Installing the pump during the non-irrigation season to minimize interruptions to the irrigation delivery system. A mobile crane would be required to install the piping and appurtenances.
- Installing pumping plant unit bay stop logs, using a mobile crane if afterbay dewatering is necessary.
- Inspecting the pump bay and removing all sediment. Access to the bottom floor of the pumping plant would be provided at each bay via 4.5-foot by 7-foot access hatches and ladders.
- Removing roof hatches over the pump unit bay using a mobile crane.
- Installing the pump in accordance with the pump manufacturer’s written installation instructions, including constructing the pump pedestal and connecting the pump discharge nozzle to the discharge pipe via a new flexible coupling.
- Installing motor control centers, electrical equipment, electrical conductors and SCADA system to integrate the pumps into plant operation.

Operations. The Red Bluff Pumping Plant includes a control system to provide remote manual and remote auto control of pumps and associated appurtenances. The pumping plant and associated gravity conveyance system are designed to deliver water to the existing 17-acre settling basin located to the west of the Red Bluff Diversion Dam. Once in the settling basin, water would flow to Check No. 1 on the Tehama-Colusa Canal and the Corning Pumping Plant.

[5] A formal work plan that describes all construction activities would be required prior to the start of construction.

Maintenance. It is anticipated that the following basic preventive measures would be undertaken on a regular basis to maintain the vertical axial-flow pumps and related facilities that would be installed as part of the Project. The following activities would occur as part of the regular maintenance activities for the Red Bluff Pumping Plant:

- Washing down or pressure washing, as necessary
- Checking for rust/corrosion, annually; maintaining all coatings
- Visually inspecting for damage or wear, monthly
- Assessing fluids and lubrication; address as necessary
- Inspecting pumping plant trash racks daily and removing debris as necessary
- Visually inspecting butterfly valves and flap gates, monthly

The proposed additional Project pumps would not increase the frequency of maintenance activities required at the pumping plant or require additional personnel to perform pump maintenance. However, the volume and timing of non-TCCA water diversions, through any of the pumps, could affect the sediment load distributed to the TCCA system (i.e., the pumping plant forebay and settling basin). Increased sedimentation associated with non-TCCA water diversions may require more frequent dredging within the pumping plant forebay and settling basin than prior to the Project pump's installation and operation.

3.1.1.3 Terminal Regulating Reservoir Complex

The Terminal Regulating Reservoir Complex includes the Project features and facilities that are geographically or functionally associated with the Terminal Regulating Reservoir (TRR). This complex would be composed of the Terminal Regulating Reservoir inundation area, the dam that would form the reservoir, the TRR Pumping/Generating Plant and electrical switchyard, the GCID Main Canal Connection to Terminal Regulating Reservoir, Terminal Regulating Reservoir Pipeline and Terminal Regulating Reservoir Pipeline Road, and the GCID Main Canal Facilities Modifications.

Terminal Regulating Reservoir

Water conveyed down the GCID Main Canal would be directed into the proposed TRR (Figure 3-12). A new pump station (the proposed TRR Pumping/Generating Plant) would then convey the water from the TRR via the proposed TRR Pipeline to the proposed Holthouse Reservoir. The TRR would be required to provide operational storage for the TRR Pumping/Generating Plant to balance normal and emergency flow variations between the upstream GCID Main Canal Pump Station, the 40 miles of connecting canal, and the TRR Pumping/Generating Plant.

The TRR would be located approximately 3 miles northeast of Holthouse Reservoir. It would be constructed adjacent to the GCID Main Canal by a combination of excavation and embankment. The TRR would be composed of an earth embankment dam, concrete emergency overflow weir, an outfall standpipe, and an approximately 4,000-foot-long 60-inch-diameter underground outlet pipe to Funks Creek (the TRR to Funks Creek Pipeline). The outlet pipe would be used, as necessary, to drain the reservoir for operation and maintenance and emergency purposes. A 15-foot-wide gravel road (the proposed TRR Pipeline Road) would be constructed on top of the embankment to provide access to the facility for operation and maintenance.

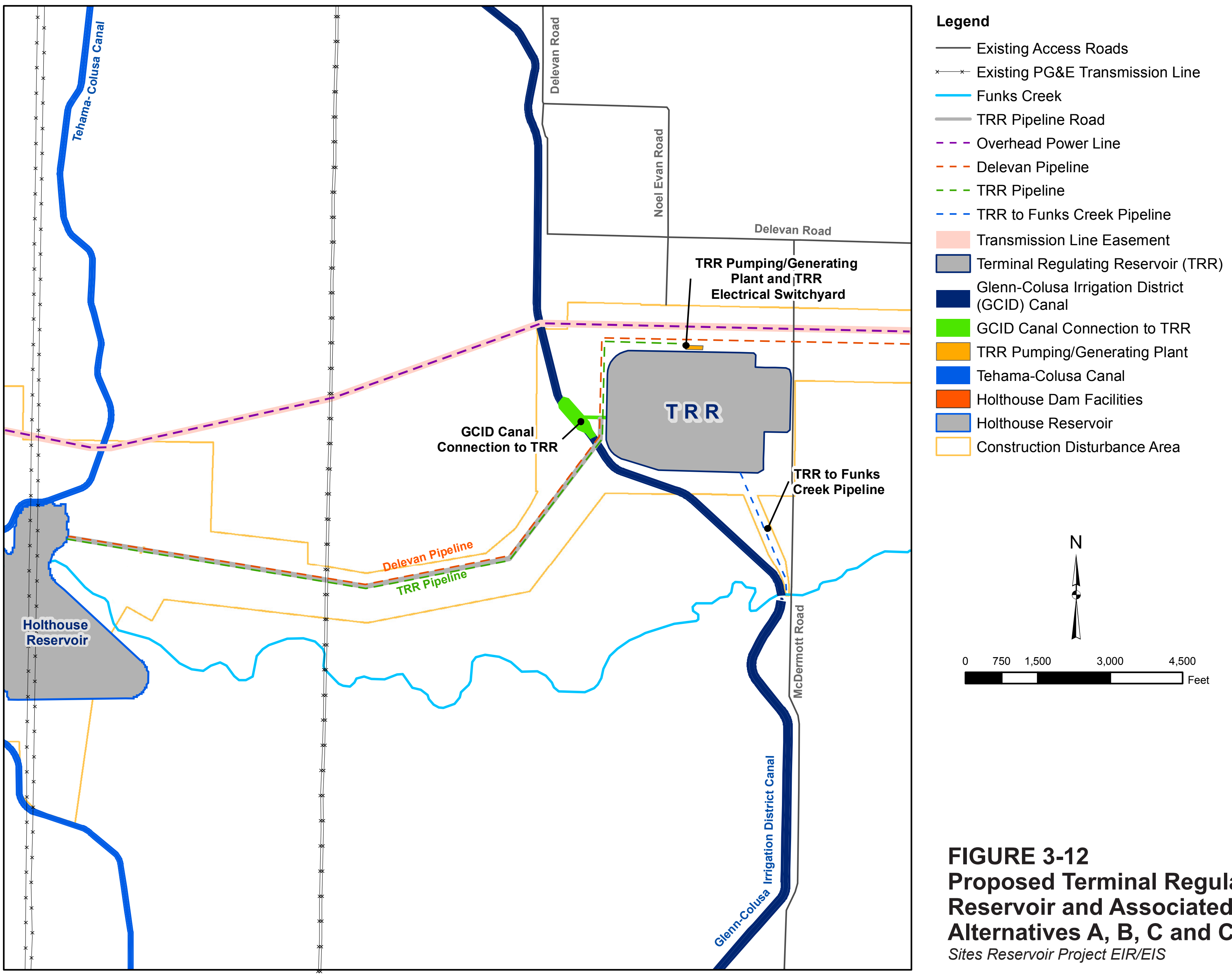


FIGURE 3-12
Proposed Terminal Regulating Reservoir and Associated Facilities
Alternatives A, B, C and C1
Sites Reservoir Project EIR/EIS

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The embankment materials would be impervious earthen material compacted to DSOD requirements. The facility would be lined with plastic to limit the potential for seepage to adjacent agricultural lands. The 200-acre TRR would be approximately 15 feet deep with a maximum water depth of 12 feet, leaving 3 feet of freeboard. The maximum excavation depth of the TRR would be approximately 9 feet, and the maximum embankment height would be approximately 6 feet above existing grade. The total storage volume in the TRR would be divided into three operational components: (1) 2 feet of dead storage beneath the lower operating limit of the pump station; (2) 5 feet of normal operational storage; and (3) 5 feet of emergency storage. The maximum water surface elevation in the TRR could not exceed the water surface elevation in the GCID Main Canal because it is a gravity flow system. The bottom dimensions of the TRR would be approximately 2,900 by 2,900 feet, and the reservoir would have a maximum storage capacity of 2,000 acre-feet. The TRR capacity is designed to provide normal operating and emergency storage as well as a forebay for the proposed TRR Pumping/Generating Plant.

Major associated features would include a GCID Main Canal transition bay, a connecting channel from the GCID Main Canal to the TRR, and a flow control inlet structure.

Construction. The total construction disturbance area would be approximately 300 acres. The proposed TRR site is currently in agricultural production (including rice crops, annual row crops, and orchards). The total construction disturbance area would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads. This staging area could be the same as, or nearby, the GCID Main Canal Connection staging area because the construction sites are located adjacent to each other. In addition, the portion of the proposed Delevan Pipeline construction disturbance area adjacent to the TRR would also be used for the TRR staging area. As described above, the TRR would be lined to limit the potential for seepage to adjacent agricultural lands.

Anticipated major construction activities include transportation of materials to the proposed worksite, clearing and grading the construction work space, staging of construction materials, dewatering, constructing fencing around the perimeter, constructing lighting, and excavation and embankment construction.

Operations. In coordination with GCID Main Canal operation, water would be diverted to the proposed TRR by gravity. Flow into the TRR would be controlled by the TRR inlet control gates. An integrated SCADA and communication system would coordinate operation between the Main Pump Station, GCID Main Canal, and the proposed TRR, TRR Pumping/Generating Plant, and Holthouse Reservoir. Flow to Holthouse Reservoir and the water surface in the TRR would be regulated by the TRR Pumping/Generating Plant. TRR pump operators would require continuous communication with GCID Main Canal and Pump Station operators to coordinate water allocation for both irrigation demands and Sites Reservoir delivery. TRR operation would likely be controlled remotely and would not require daily onsite personnel. The reservoir would be designed to allow emergency releases during operation first to the GCID Main Canal via the GCID Main Canal Connection to the TRR (when hydrologically feasible), and then to Funks Creek via the proposed TRR to Funks Creek Pipeline. Release flows would be controlled by an energy dissipater and small concrete structure at the terminal end of the pipeline.

Maintenance. Typical maintenance of the proposed TRR would include dredging to remove sediment when it is drained, clearing vegetation from the slopes of the embankments, and maintaining the gravel service road atop the embankment. Draining the TRR for maintenance would be accomplished by a standpipe and drain structure at the invert of the reservoir. Drained water would be conveyed to Funks Creek via the proposed TRR to Funks Creek Pipeline. Draining/dredging of the TRR would likely be required every 7 to 10 years, depending on variable sediment transport conditions in the Sacramento River and the surrounding areas. Sediment removed during the dredging activities would be placed on the surrounding levees' embankments.

Procedures will be incorporated to reduce impacts from lighting (e.g., directional lighting and non-reflective materials).

Terminal Regulating Reservoir Pumping/Generating Plant and Electrical Switchyard

The purpose of the proposed TRR Pumping/Generating Plant would be to pump water from the proposed TRR to the proposed TRR Pipeline, which would convey water to the proposed Holthouse Reservoir. Return flows from the proposed Holthouse Reservoir to the proposed TRR would flow through the TRR Pumping/Generating Plant to generate power.

The TRR Pumping/Generating Plant would pump 1,800 cfs of water from the TRR to Holthouse Reservoir. The TRR Pumping/Generating Plant would generate power from flows released through it with a maximum return flow of 900 cfs. The return flow would provide up to 800 cfs for the GCID Main Canal west of Funks Creek (the canal capacity) plus an additional 100 cfs that would be released from TRR directly to other local irrigation ditches or to Funks Creek to meet demand. The minimum water elevation in Holthouse Reservoir for operation of the TRR Pumping/Generating Plant would be 112 feet, and the maximum water elevation for operation would be 121.5 feet.

The TRR Pumping/Generating Plant would be located adjacent to the TRR on the north side (Figure 3-12) and would be approximately 3 miles northeast of Holthouse Reservoir. The TRR pipeline begins on the north side of the TRR, the TRR Pumping/Generating Plant at the pump discharges. The TRR Pumping/Generating Plant would consist of two 620-cfs and two 325-cfs Francis Vane pumps for pumping and one 750-cfs Kaplan turbines for generating during release flows.

Structures associated with the TRR Pumping/Generating Plant would include the following:

- Mechanical features
  - 84-inch online spherical valve on each discharge line
  - Air chambers and butterfly valves with hydraulic power units
  - Compressors
  - Generators
  - Gantry crane – 100 tons
  - Service air and water system
  - Acoustical flowmeter on each discharge line
- Electrical features
  - Switchyard transformers
  - Control system
  - Switchgears
  - Grounding grids
  - Control cabinets
- Refilling of pump units

The discharge lines may periodically need to be dewatered for inspection and maintenance. These lines would need to be filled at a slow rate to allow the release of air through air and vacuum valves. To accomplish this, one or two 100-cfs pump units would be installed or filling bypass pipelines can be provided around isolation valves.

The proposed TRR electrical switchyard would be located within the footprint of the TRR Pumping/Generating Plant (Figure 3-12) and would be approximately 100 feet long by 50 feet wide.

Construction. The total construction disturbance area would be approximately 1 acre and would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads. The construction disturbance area would fall within the construction disturbance area of the proposed TRR Pipeline (discussed below).

Excavation would be conducted using temporary slopes of 1.5:1 for the 25-foot-deep trench along the pipelines and a temporary slope of 2:1 for the 40-foot-deep foundation of the pump stations. Tied-back sheet pile walls can also be used for the pump station excavation. The pump station foundations would be excavated in in situ materials, and no major improvements to the foundations would be required. During construction, the topsoil material would be excavated, stockpiled separately, and replaced to support native grass and plant growth.

The total construction disturbance area for the switchyard would include the footprint of the proposed switchyard, the materials and equipment staging area, electrical transformer area, and temporary access roads. The construction disturbance area for the TRR switchyard would be located within the Delevan Pipeline construction disturbance area.

Anticipated major construction activities include clearing and grading the construction workspace, placing necessary construction materials at staging areas, and preparing the switchyard pad. Anticipated ground-disturbing activities during construction include the following:

- Transporting materials to the Project site
- Clearing and grading the construction workspace
- Placing construction materials at staging areas
- Dewatering
- Excavating the forebay (approach channel) and pumping plant
- Piledriving, if required
- Constructing the forebay, pump house, and pump bay
- Installing the pond liner
- Performing site restoration after construction is complete

Operations. An integrated SCADA and communication system would be used for the proposed TRR Pumping/Generating Plant. Flow to the proposed Holthouse Reservoir and the water surface in the proposed TRR would be regulated by the TRR Pumping/Generating Plant. TRR pump operators would require continuous communication with GCID Main Canal and Pump Station operators to cooperatively provide irrigation water deliveries and supply Sites Reservoir. The proposed switchyard would be operated remotely.

Maintenance. Routine maintenance and monitoring would likely be required on a daily basis. Regular maintenance and inspection would be required for each pump unit and the related equipment, such as gates, valves, and electrical equipment, with possible additional inspections and maintenance needed after earthquakes or storm or flood events.

The proposed switchyard and associated overhead power lines would require maintenance once or twice a year. Maintenance activities may include annual washing and cleaning of insulating equipment, preventive maintenance, scans of the switchyard under full load, and routinely scheduled testing to meet WECC requirements. Regular maintenance activities would include inspections for damage by animals and landscape maintenance.

GCID Main Canal Connection to Terminal Regulating Reservoir

The purpose of the proposed connection from the GCID Main Canal to the TRR would be to reduce the velocity of flows from the GCID Main Canal to approximately 1 fps to form a stable pool. The stable pool would occur just before the turnout to the connecting channel to the proposed TRR.

The connection from the GCID Main Canal to the TRR would be located north of the proposed TRR Pipeline between the GCID Main Canal and the TRR, (Figure 3-12). It would have two features: 1) the GCID Main Canal energy dissipation bay with check structure, and 2) the TRR inlet channel and inlet control structure. The bay would be located along a reach of the GCID Main Canal approximately 500 feet long, with a 220-foot bottom width, 20-foot depth, and embankment slopes of 1.5 to 1. On the east end of the bay, the reservoir inlet channel would divert flow to the TRR. On the south end of the bay, a new radial-gate check structure would serve two purposes: 1) maintain a water surface elevation in the canal transition section to provide available head for conveyance into the TRR, and 2) control flow to the remaining downstream reach of the GCID Main Canal.

The inlet channel would connect the GCID Main Canal to the TRR. The channel would be a lined trapezoidal cross section, having a 70-foot bottom width and a length of 400 feet, with embankment slopes of 1.5 to 1. The inflow control structure would be similar to a standard GCID Main Canal check structure, with three large radial gates to control flow into the TRR. The structure's top deck width would accommodate vehicle traffic to allow access along the canal. A transition apron (a large concrete pad) into the reservoir would be located immediately downstream of the control gates. The apron would be 160 feet wide and 100 feet long. The function of the concrete apron would be to provide an erosion-resistant area for energy dissipation as the water enters the TRR.

The earthen embankment for the inlet channel would be approximately 20 feet high. When the radial gates at the check structure open, the gates would be approximately 15 feet above the embankment.

Construction. The total construction disturbance area would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads. This construction disturbance area would be within the larger construction disturbance area for the proposed TRR.

Anticipated ground-disturbing activities during construction include the following:

- Transporting materials to the Project site
- Clearing and grading the construction workspace
- Placing construction materials at staging areas
- Dewatering and building a temporary bypass channel
- Excavating canal energy dissipation bay
- Performing reservoir inlet excavation and embankment construction
- Constructing check structure

It is anticipated that the proposed reservoir inlet from the GCID Main Canal to the proposed TRR would be constructed by first building a temporary bypass channel to the west of the existing canal alignment. The temporary bypass channel would be approximately 1,000 feet long and would connect into the GCID Main Canal upstream and downstream of the construction zone to supply water to the remaining reach of the canal downstream of the TRR area. The temporary bypass channel would be constructed using a combination of excavation, earth embankment, and sheetpile walls to isolate the construction site from the diversion canal. Following completion of the new check structure, the temporary bypass would be filled in, earth embankments and sheetpile walls would be removed, and the area would be restored to preconstruction conditions.

Operations. Gate operation of the new GCID Main Canal check structure would normally be controlled automatically, with an option for local or remote manual control. Gate operation would be established using either upstream or downstream water-level controls, depending on the overall operating regime for the future canal system.

Flow into the reservoir would be controlled by the proposed TRR inlet control gates. An integrated SCADA and communication system would be required to cooperative operations between the GCID Pump Station, GCID Main Canal, and the proposed TRR, TRR Pumping/Generating Plant, and Holthouse Reservoir. SCADA operation and monitoring would be conducted remotely and would not require daily onsite personnel. Instead, daily operation and monitoring would be managed from a central location.

Maintenance. Maintenance activities would include: 1) removing debris that could collect upstream of check structures, 2) maintaining gate operators to provide adequate control of gates, 3) periodically repairing and repainting the connection, and 4) dredging the dissipation bay and inlet channel for sediment concurrently with the proposed TRR dredging.

Terminal Regulating Reservoir Pipeline and Terminal Regulating Reservoir Pipeline Road

The 3.5-mile-long proposed TRR Pipeline would convey water from the proposed TRR to the proposed Holthouse Reservoir (Figure 3-12). The TRR Pipeline would be bi-directional, allowing water to be pumped from the TRR to Holthouse Reservoir for storage, and allowing water to flow by gravity from Holthouse Reservoir for release to the TRR/GCID Main Canal and other canals. As water released from Holthouse Reservoir flows through the proposed TRR Pumping/Generating Plant at the end of the TRR Pipeline, it would pass through the turbine to generate electricity.

The proposed TRR Pipeline would have a capacity of 1,800 cfs to convey water that is pumped from the TRR to Holthouse Reservoir. The capacity of the TRR Pipeline to convey water by gravity flow from Holthouse Reservoir to the TRR would also be 1,800 cfs, but the demand would only be approximately 900 cfs, based on the GCID Main Canal capacity west of TRR and other local irrigation ditch demands to be met from TRR. The TRR Pipeline would consist of two 12-foot-diameter reinforced concrete pipes to convey the pumping flow. It would be buried a minimum of 10 feet (to top of pipe) below the ground surface. Facilities associated with the TRR Pipeline would include blowoff structures and air valve structures.

The proposed alignment of the TRR Pipeline would cross the existing GCID Main Canal and a primary PG&E natural gas transmission line. At these locations, the bore-and jack-construction method would be used. Bore-and-jack construction would entail excavating a large pit on each side of the existing infrastructure (highway, railroad, or canal) and then tunneling horizontally under the structure. Due to the high water table in the area, this construction method would require dewatering the area. All additional work required for bore-and-jack construction would be conducted within the construction disturbance area and would not require the disturbance of additional land.

The TRR Pipeline would also cross the easement of an existing PG&E 230-kV line. It is expected that the pipeline can be trenched across the utility easement and that boring and jacking will not be required. No permanent aboveground structures associated with the pipeline, other than a 16-foot-wide, 2.1-mile-long gravel maintenance road (the proposed TRR Pipeline Road), from the GCID Main Canal to the proposed Holthouse Reservoir Spillway and Stilling Basin, would be constructed.

Crossing of other existing facilities such as gas lines, water lines, sewer lines, and communications lines would be accomplished using the bore-and-jack or tunneling method or existing facilities would be relocated as determined most appropriate. Disruptions to these utilities would be minimized to the extent possible, and the ground surface would be restored to preconstruction conditions after installation of the TRR Pipeline. Construction activities for the proposed TRR Pipeline would occur within the identified construction disturbance area and would require only slightly more excavation than is required for the pipeline.

Construction. The construction disturbance area for the proposed TRR Pipeline would be approximately 335 feet wide from the TRR to the proposed Holthouse Reservoir (3.5 miles). The Delevan and TRR Pipelines would be in a common trench excavation in the disturbance area. The total construction disturbance area, which would also include a temporary concrete batch plant, would fall within the construction disturbance area for the proposed Delevan Pipeline discussed below.

Anticipated major construction activities include the following:

- Clearing and grading the construction workspace
- Stockpiling topsoil
- Placing necessary construction materials at staging areas
- Transporting materials to the Project site
- Trenching/excavation of pipeline route
- Dewatering
- Performing bedding preparation
- Performing onsite fabrication of pipe
- Installing pipe and valves
- Addressing crossings of roads and utilities
- Backfilling and compacting trench
- Replacing topsoil
- Revegetating and restoring pipeline route
- Constructing a gravel maintenance road

Operations. Operation of the proposed TRR Pipeline would not require daily workers at the site.

Maintenance. Periodic inspection and maintenance of the proposed TRR Pipeline facilities would likely occur once per year, with possible additional inspections and maintenance needed after storm or flood events. Annual inspections would not necessarily include dewatering of the pipelines. Dewatering for inspection may occur in 5-year cycles or when a pipeline problem is expected. Permanent rights-of-way for the land overlying the pipeline would be maintained to provide future access. The proposed gravel maintenance road would be graded, as needed.

GCID Main Canal Facilities Modifications

The GCID Main Canal delivers water from the Sacramento River to water users along its route from its diversion point northwest of Hamilton City to southeast of the City of Williams. The canal is an unlined earthen channel, with capacity varying from 3,000 cfs at the upstream end to 300 cfs at the southern terminus.

Water conveyed by the canal is pumped by the Hamilton City Main Pump Station into the GCID Main Canal. The existing canal facilities include the intake and bypass channels, fish screens, main pump station and forebay, headgates, gradient facility, and the GCID Main Canal. These facilities are located in the Primary Study Area approximately 5 miles northwest of Hamilton City. Project improvements in this area include a new headgate structure and canal lining. A railroad siphon replacement is also proposed near Willows.

For the Project, the existing headgate structure would be left in place to continue to serve as a bridge between County Road 203 and County Road 205. The existing headgate structure would continue to operate during construction of the new headgate structure, and diversion activities would continue throughout construction. The existing headgate would not be adequate for proposed winter operation during high river flows due to the large head-drop (decrease of water elevation) across the structure during high river levels. A new headgate structure would be constructed upstream of the existing structure. The new headgate structure would include three automated gates (two vertical roller gates and one radial gate).

The water level and flow control functions would involve operating conditions that would result in water surface drops across the headgate of between 3 and 15 feet, which would require a set of energy dissipater blocks immediately below the gates to slow down and stabilize the water discharging under each gate.

The canal reach immediately downstream of the new headgate structure would be lined with concrete for approximately 200 feet to prevent erosion due to the turbulent flow conditions.

The Union Pacific Railroad siphon at Mile 26.6 does not meet design and operation criteria for the Project and would need to be replaced. The existing railroad siphon structure was built in the early 1900s and includes two 6-foot-diameter barrels and five 7.25-foot by 6-foot barrels. At maximum existing flows of approximately 2,000 cfs, the head loss across the railroad siphon, due to high flow velocity and poor entrance and exit transitions, reduces upstream canal freeboard to marginal conditions. Based on the structure’s age, hydraulic capacity restrictions, and use as a major transportation link, it should be replaced. The new structure would consist of three prefabricated box culverts. Typical future maximum velocity and head losses would be approximately 4 fps and 0.2 foot, respectively.

The proposed replacement of the railroad siphon would require coordination and planning with railroad operators. Construction restrictions may exist regarding minimizing interference with regular railroad operations. To the extent possible, replacement of the railroad siphon would take place during periods of lowest train traffic, and railroad shutdown time would be minimized.

Construction. The total construction disturbance area would consist of the existing canal prism, existing operation and maintenance roads, and an additional 50 feet on both sides. The total construction disturbance area would include the footprint of the facilities (new headgate structure, canal lining, and replacement of railroad siphon), the materials and equipment staging area, the area needed to construct the facilities, and access roads. All construction activities for the new facilities would occur within the existing GCID right-of-way.

Water delivery to the GCID service area would be maintained during the primary irrigation season (early April through mid-October). The GCID Main Canal is typically out of service each year between early January 7 and late February for maintenance. Construction activities would be scheduled during this maintenance period whenever possible. If construction activities are required outside of the maintenance period, a temporary bypass channel would be built around the construction site to allow diversion water to flow past and maintain regular canal operation. The temporary bypass channel would be constructed within the existing GCID right-of-way using a combination of excavation, earth embankment, and sheetpile walls to isolate the construction site from the canal. After completion of construction, the temporary bypass would be filled in, earth embankments and sheetpile walls would be removed, and the area would be restored to preconstruction conditions.

Operations. The intake and fish screen facility would operate year-round and would be similar to existing operations. Use of the canal for conveyance to the Sites Reservoir would require increased automation between the GCID facilities and other Project conveyance systems. The available capacity for winter operation (October through March) of Project conveyance would range from a minimum of approximately 1,270 cfs during an average November to a maximum of approximately 1,750 cfs during an average March. There is currently little to no available capacity from April through September. To accommodate the Project flow, flows need to be monitored and controlled consistently. SCADA operations and monitoring could be conducted remotely and would not require daily onsite personnel. Instead, daily operation and monitoring would be managed from a central location and would not require additional staff beyond existing personnel.

Maintenance. Required maintenance activities would be similar to current maintenance. Periodic inspection and maintenance of mechanical systems, such as the screen cleaning system, would be required. Water levels would continue to be monitored automatically. Additional sediment and debris removal activities may also be required due to increased diversions during high river water levels.

Debris that enters the intake channel, such as large floating trees, can block flows in the channel, get entangled at the face of the fish screen, block the water control structure, or cause other disruptions to proper operating conditions. Typically, the debris builds up during winter flood flows and is removed at the beginning of the irrigation season in late March to early April. Because of winter diversions, a larger debris load is expected at the intake channel, screen structure, and bypass channel. It is expected that debris removal would be required during the winter to maintain proper operating conditions. It may be necessary to retrofit the mouth of the intake channel with a floating log boom to deflect larger debris and increase protection to the fish screens.

The upper one-third of the intake channel is typically dredged once every 3 years, and the entire channel is dredged once every 10 years. The volume of the dredged materials varies from approximately 30,000 to 130,000 cubic yards. The future volume of sediment in the intake channel is expected to increase with increased Project-related winter operation, and the following assumptions were made regarding future dredging operations:

- A larger dredge with increased capacity and working depth than is currently used would be required. Supporting equipment, such as a high-capacity crane equipped with a grappling hook and clamshell, would be required to assist in debris removal.
- Dredging operation would occur year-round.

Dredged materials would continue to be placed on the 11-acre offsite disposal location southwest of the pump station, at sites on Montgomery Island, and along the canal banks. The new headgate structure would require annual inspection and maintenance including painting and motor control unit inspections, similar to typical check structures along the canal. Expected periodic maintenance activities for the canal that would require onsite personnel include the following:

- Maintaining canal banks to repair sloughing and erosion damage
- Filling in animal burrow holes
- Removing vegetation
- Removing debris from upstream of the check structures
- Maintaining gate operators
- Repairing and repainting gates

3.1.1.4 Delevan Pipeline Complex

The Delevan Pipeline Complex includes the Project features and facilities that are geographically or functionally associated with the Delevan Pipeline. This complex would be composed of the Delevan Pipeline Intake/Discharge Facilities (flat plate fish screen structure, forebay/afterbay pond, pumping/generating plant and switchyard, maintenance and electrical buildings, and other electrical and mechanical features), and the Delevan Pipeline.

Delevan Pipeline Intake/Discharge Facilities

The proposed Delevan Pipeline Intake/Discharge Facilities were designed to divert water from the Sacramento River to the proposed Holthouse Reservoir for storage in the Sites Reservoir (shown on Figures 3-13A through 3-13C). The facilities would be used to release water from Sites Reservoir to the Sacramento River for downstream uses and to generate electricity.

The proposed Delevan Pipeline Intake/Discharge Facilities would be located on the Sacramento River below River Mile 158.5 in Colusa County (Figure 3-13A). The river intake/outlet would be located immediately downstream of the existing Maxwell Irrigation District intake and across the river from Moulton Weir, approximately 10 miles northeast of the town of Maxwell (Figures 3-13B and 3-13C). The total footprint of the site would be approximately 20 acres including the pumping/generating plant buildings, fish screen, and forebay pond.

Water that passes through the fish screen would be pumped up approximately 150 feet vertically through two 12-foot-diameter concrete pipes to Holthouse Reservoir. Water would also be able to flow back from Holthouse Reservoir, by gravity, to the Sacramento River. Reverse flow water would flow through the turbines to generate electricity. The water would then flow through the forebay pond and fish screen at a velocity of 1 fps into the Sacramento River. The 1-fps exit velocity is based on NMFS criteria for adult salmon diffusers to allow the water to exit the screen without extending a false attraction flow to the salmon.

The proposed pumping capacity of the Delevan Pipeline Intake/Discharge Facilities would be 2,000 cfs when diverting water from the Sacramento River and 1,500 cfs when releasing water to the Sacramento River (and generating electricity). Total lift capacity of the facility would be approximately 150 feet.

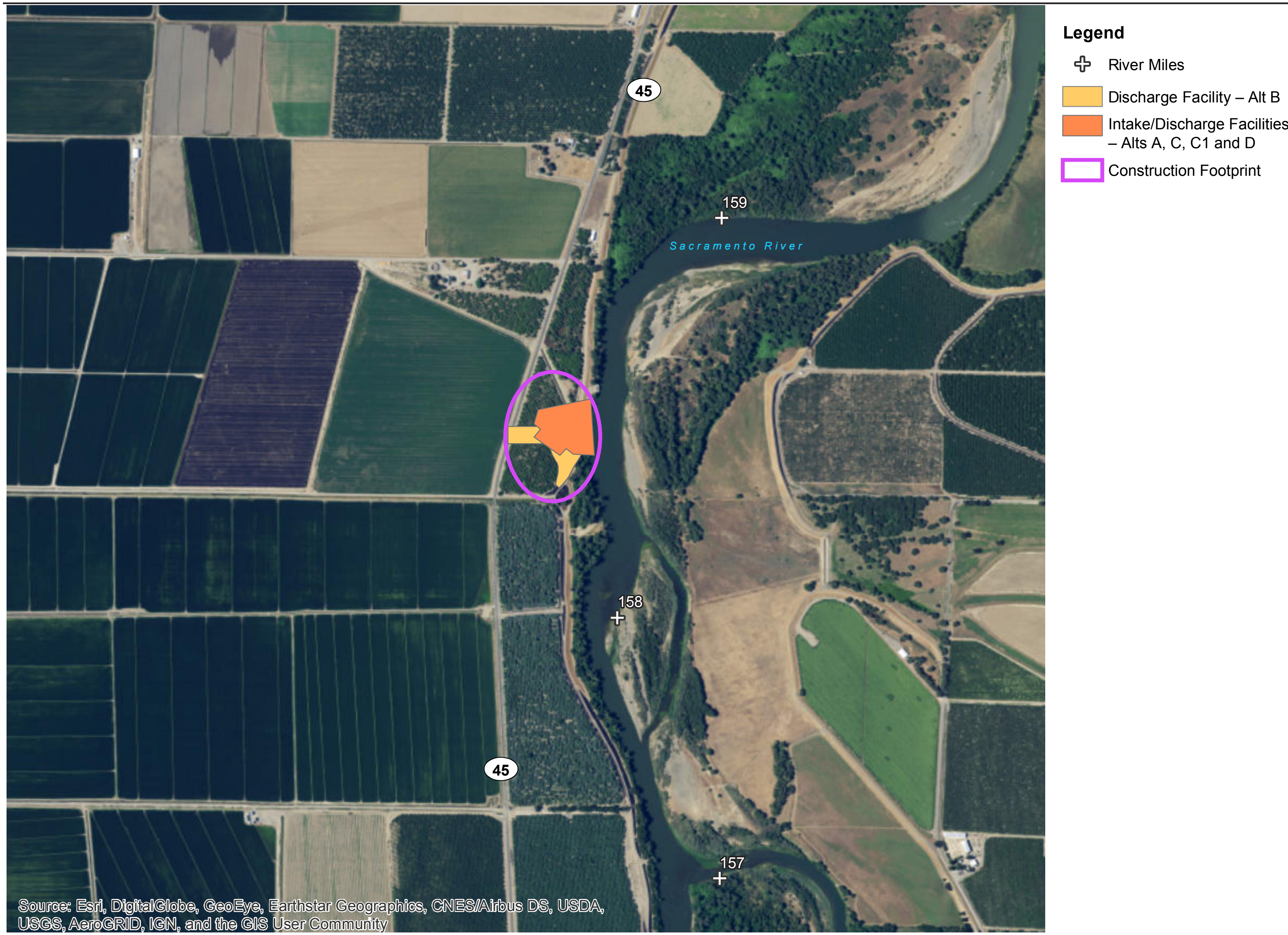


FIGURE 3-13A
Delevan Pipeline Intake/ Discharge Facilities
Sites Reservoir Project EIR/EIS

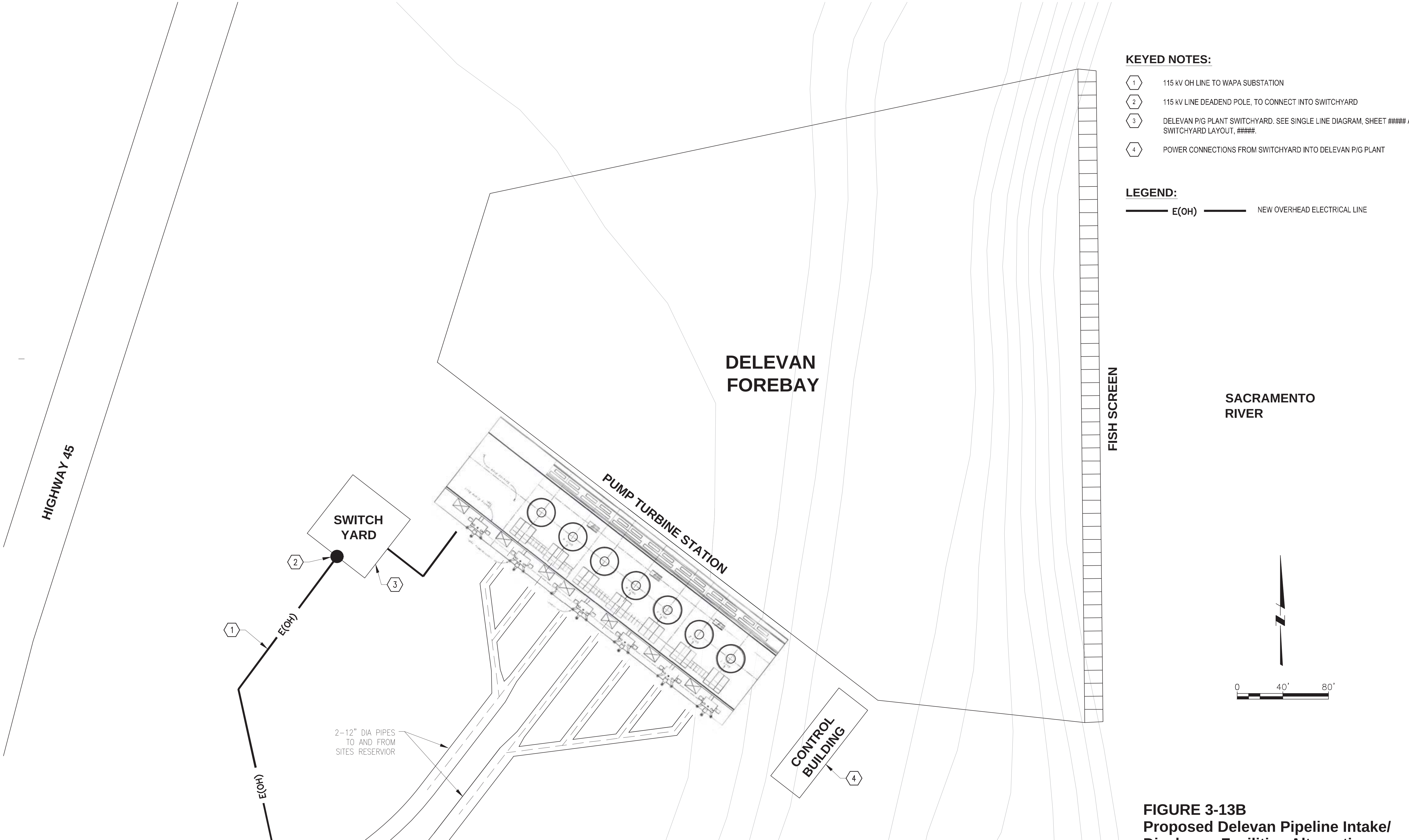
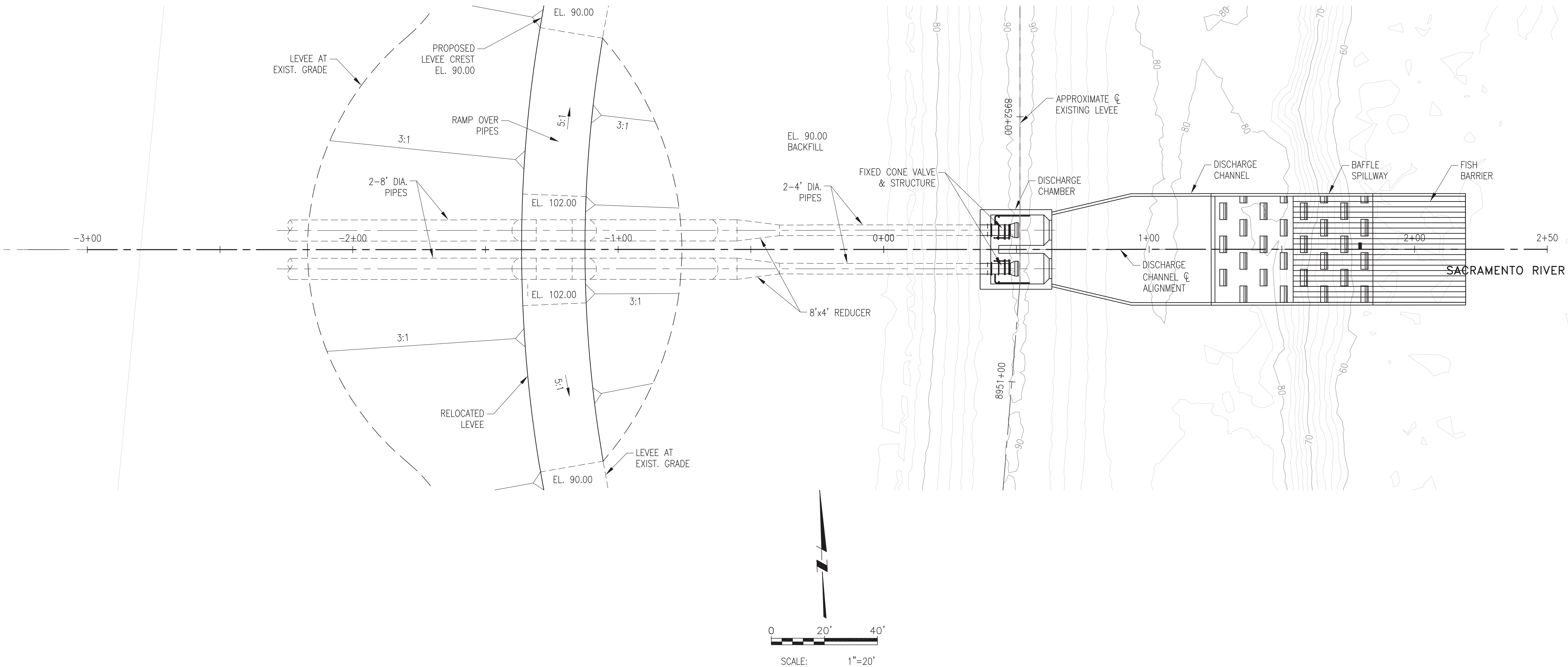


FIGURE 3-13B
Proposed Delevan Pipeline Intake/ Discharge Facilities Alternatives A, C, C1, and D
Sites Reservoir Project EIR/EIS

Source: Sites



LEGEND

DIA = DIAMETER
EL = ELEVATION
℄ = CENTERLINE

Source: URS, 02/18/2011.

FIGURE 3-13C
Proposed Delevan Pipeline Discharge Facility Alternative B
Sites Reservoir Project EIR/EIS

The facilities at this site would include the following:

- **Flat Plate Fish Screen Structure –** The purpose of the fish screen structure would be to exclude fish in the Sacramento River from the water that is being diverted into the pump station. The fish screen would also function as an outlet structure, dissipating the energy of the water being released to the river.

  The fish screen structure would consist of thirty-two 13-foot-tall by 15-foot-wide flat plate screens. The structure would be approximately 560 feet long (the distance created by the 32 screens bays, the additional two blowout bays, and room for the screen cleaning equipment). Panels would be positioned with minimum protrusion into the river channel parallel to river flow. This facility would be designed in compliance with NMFS and CDFW fish screen criteria.

- **Forebay –**After water passes through the fish screen, it would flow into the forebay for the pump station. The forebay would allow fine sediment to settle. The forebay would store water before it is pumped out by the pumping/generating plant. The forebay would be lined with a generally impervious layer of material to limit the potential for seepage to adjacent agricultural lands.

  A spoil area would be provided on the northeastern end of the forebay for removed sediment. To remove sediment, a long-arm excavator would be required in combination with a suction dredge or a clamshell. The suction dredge or clamshell would be used to remove sediment in the area where the excavator could not reach.

- **Pumping/Generating Plant and Electrical Switchyard –** The Delevan Pipeline Intake/Discharge Facilities would pump water from the forebay to Holthouse Reservoir and would release water from Holthouse Reservoir. The Delevan Pipeline Intake/Discharge Facilities building would be approximately 250 feet long by 80 feet wide and would have multiple stories to accommodate mechanical and electrical equipment. The pumping/generating plant would consist of four 500-cfs pumping/generating units (plus one standby unit) to provide a total pumping capacity of 2,000 cfs. Water would be pumped by the pumping/generating plant 150 feet up over 13.5 miles through the Delevan Pipeline. When water is released from Sites Reservoir and through Holthouse Reservoir, the intake facilities would function in reverse, capturing the energy and generating electricity. Release flows of up to 1,500 cfs could be passed through two 750 cfs turbines in the pumping/generating plant.

  An electrical switchyard would be required adjacent to the pumping/generating plant that would step down the electrical voltage from high-voltage lines to a lower voltage that can be used by the pumps and other machinery in the plant. A four-breaker ring bus would be required at the switchyard. The ring bus would have multiple metallic poles with heights varying between 15 and 60 feet. The switchyard would be surrounded by a 6- to 8-foot-high chain-link fence with barb or serpentine wire along the top.

- **Maintenance and Electrical Buildings –** Mechanical control and electrical buildings would be constructed on the site to house mechanical and electrical equipment needed for the operation of the pumping/generating plant. The mechanical and electrical buildings would be approximately 5,000 square feet each. Facilities would be sited and designed such that electrical equipment would be sealed or placed at an elevation above the 100-year flood stage plus 2 feet of freeboard (elevation 82 feet).

- **Other Mechanical and Electrical Features –** Other miscellaneous features that may be included:
  - Spherical valves
  - Air chambers and butterfly valves
  - Compressors, generators, and cranes
  - Service air and water systems
  - Acoustical flowmeters
  - Governors and other control devices
  - Transformers
  - Switchgears
  - Grounding grids
  - Controls cabinets

The proposed Delevan Pipeline Intake/Discharge Facilities site would be protected from flood conditions by installing all mechanical and electrical equipment above the 100-year flood elevation (82 feet above msl). Although the forebay a would be submerged during extreme flood events, it would be designed to withstand these conditions. The site naturally slopes upward away from the river, and a flood protection levee with a height of 90 feet above msl exists along the river approximately 275 feet west of the river. A wide berm or ring levee would be constructed behind the flood protection levee to provide additional protection for the equipment and facilities. The berm would encircle the afterbay, and the Delevan Pipeline Intake/Discharge Facilities would be constructed on top of the berm, as would the mechanical and electrical buildings.

Construction. The total construction disturbance area would be approximately 20 acres. An additional disturbance area around the construction site would be required for staging of materials, equipment, and construction offices. This area is within the construction disturbance area for the proposed Delevan Pipeline. The staging area is estimated to be 1,700 feet by 1,000 feet (a total of 40 acres) located to the north of and adjacent to the facility site.

To isolate the proposed construction area from the Sacramento River, a cellular sheetpile coffer dam would be installed in the river at the location of the fish screen. Approximately 1,200 feet of sheet piles would be required to build the cofferdam. From the river bank at the upstream and downstream ends of the fish screen structure, the cofferdam would extend approximately 40 feet into the water from the river bank. Installation of the coffer dam would involve driving interlocking metal sheet piles into the ground one section after another until the entire length of the intake structure is isolated from the river. The height of the coffer dam would match the height of the surrounding levees. The fish screen structure would be constructed within the coffer dam. This will include driving foundation piles, placing a bottom seal mat, dewatering the cofferdam, and constructing the structure. These features would be removed after the fish screen structure is complete. The area behind the fish screen structure would be dewatered prior to construction of the pumping plant.

Anticipated major construction activities include the following:

- Transporting materials to the construction site
- Clearing and grading the construction workspace
- Placing necessary construction materials at staging areas
- Constructing a coffer dam within the Sacramento River
- Driving foundation piles for fish screen structure within the coffer dam
- Placing a seal mat within the cofferdam

- Constructing the fish screen structure
- Dewatering the work area within the river
- Excavating the forebay and pumping plant site
- Constructing electrical switchyard
- Constructing the berm/ring levee
- Constructing the pump house and pump bays
- Constructing the forebay structure
- Constructing the fish screens
- Removing the coffer dam
- Filling and regrading where needed at site
- Restoring disturbed areas following the completion of construction

As mentioned above, the forebay would be constructed with a generally impermeable material to minimize/eliminate seepage to adjacent properties. Construction of the proposed Delevan Pipeline Intake/Discharge Facilities would require relocation of sections of the Maxwell Irrigation District and Tuttle Ranch pipelines that are located within the construction disturbance area. To minimize impacts on the operations of the Maxwell Irrigation District facilities during construction, either a temporary bypass pipeline would be constructed to provide water to Maxwell Irrigation District users, or arrangements would be made for supplemental water to be conveyed into the Colusa Basin Drain (CBD) for the Maxwell Irrigation District to pick up for delivery to its users. A temporary bypass pipeline would be constructed to provide water to Tuttle Ranch to irrigate its orchards.

Operations. Proposed diversion operations would be such that a minimum of 4,000 cfs would remain in the river channel immediately downstream of the diversion point. The assumed associated minimum water surface elevation at this design condition is 51 feet. The invert of the screen structure would be set at 38 feet, 4 feet above the invert of the river, to reduce sediment deposition in front of the screen panels.

Operation intake and discharge modes are summarized below:

- **Intake Mode**: Intake mode refers to the proposed operation of pumping Sacramento River water to the Sites Reservoir when suitable flows and velocities occur in accordance with pre-established diversion criteria (see Section 3.3.1 Operational Scenario). Flow of water would move through the proposed fish screen into the forebay, through the proposed Delevan Pipeline to the proposed Holthouse Reservoir, and then to Sites Reservoir. During this operation, the screen cleaning mechanism would be working continuously to prevent buildup on the screen panels, the sediment removal system would be operating, the pumps would be operating, and the SCADA system would be monitoring water levels and pressures across the screen.

- **Discharge Mode:** Discharge mode refers to the operation when water from Sites Reservoir would be released through the pumping plant into Holthouse Reservoir to generate electricity, into Delevan Pipeline and discharged into the forebay, and then released through the fish screen into the Sacramento River.

As is customary for any large-scale diversion on a river, if a pressure differential greater than 1.5 feet across the fish screen occurs, an “emergency mode” would be activated. The pumps would stop operating, and the sluice gates would close to allow the forebay to fill up to match the water surface of the Sacramento River. If the pressure differential increases to above 3 feet, the two blowout panels would trigger and release to allow an inflow of river water to allow the water levels to equalize.

A SCADA system would control all operational modes and provide a means to control the diversion without staffing the onsite facility. The system would be located onsite and would broadcast status information to a manned remote location. A sediment removal system would be installed within the fish screen bays, moving sediment back into the river channel or into the forebay. Sediment that has settled out into the forebay would be removed mechanically to maintain optimal operational hydraulics annually.

Maintenance. The proposed Delevan Pipeline Intake/Discharge Facilities would likely be staffed daily to maintain, operate, and monitor the facility. It is anticipated that employees would be onsite during diversion (predominantly in winter) and release (predominantly in summer) activities. Activities would include the following:

- Periodic checking and adjustment of flow distribution through fish screens
- Inspection and periodic maintenance of fish screen cleaning system and debris removal as needed
- Periodic removal of accumulated sediment
- Inspection and periodic maintenance (including lubrication) of operating equipment
- Periodic testing of standby equipment

Delevan Pipeline

The approximately 13.5-mile-long proposed Delevan Pipeline would convey water from the Sacramento River to the proposed Holthouse Reservoir to fill the Sites Reservoir and/or convey water from Holthouse Reservoir to the Sacramento River for releases (Figure 3-1). The Delevan Pipeline would parallel the proposed TRR Pipeline at its western end and would share a common trench and outlet structure into Holthouse Reservoir (Figure 3-2).

The Delevan Pipeline would have a 2,000-cfs capacity to convey water from the proposed Delevan Pipeline Intake/Discharge Facilities (on the Sacramento River) to Holthouse Reservoir. The capacity of the Delevan Pipeline to convey water from Holthouse Reservoir to the Sacramento River would be 1,500 cfs. Because of the available head elevation, releases through the Delevan Pipeline could be made to the river by gravity without the need for pumping. The Delevan Pipeline would consist of two 12-foot-diameter reinforced concrete steel cylinder pipes with gasketed bell and spigot joints. It would begin at the Delevan Pipeline Intake/Discharge Facilities near the Sacramento River and be aligned due west until reaching the GCID Main Canal. At the GCID Main Canal, the Delevan Pipeline would be aligned southwesterly and would parallel the TRR Pipeline in a shared trench until it reaches the Holthouse Reservoir Complex.

Facilities associated with the Delevan Pipeline would include blowoff structures, air valve structures, and an outlet and energy dissipater structure. Blowoff structures would be provided to clean low points in the pipeline and allow dewatering. Blowoff valves would release water from the pipeline. These valves are located at major water conveyances so that water can be drained directly into the river or canal and carried downstream. Air and vacuum valves would be required to evacuate air within the pipeline during filling and supply air during normal dewatering, as well as to release accumulated air. Manholes would be used to access the pipeline for future maintenance or inspections. Aboveground features associated with the Delevan Pipeline are listed in Table 3-11.

Table 3-11
Aboveground Features Associated with the Proposed Delevan Pipeline

Aboveground Feature	Height Above Ground	Color	Appearance	Feature Locations
Manhole and air valve	4 feet maximum, 108-inch-diameter	Gray	Concrete box	At high points and at a minimum of every 2,500 feet along the pipeline
Manhole and blowoff valve	1 foot maximum, 108-inch-diameter	Gray	Concrete box	At low points and at the Sacramento River and the GCID Main Canal crossing

The proposed alignment of the Delevan Pipeline would require five major crossings (SR 45, SR 99, I-5, Union Pacific Railroad, and the GCID Main Canal). The proposed pipeline route would also cross the easements of the existing PG&E 230-kV electrical transmission line and a major PG&E natural gas transmission pipeline. No permanent aboveground structures, other than a gravel maintenance road (TRR Pipeline Road), would be constructed where the electric utility easements and the pipeline easements would intersect. Other existing infrastructure that the pipeline could cross include gas lines, water lines, sewer lines, and communications lines. The pipeline would also cross the Colusa Basin Drain and Hunter's Creek (also called Logan Creek). These major crossings would be accomplished with jack-and-bore construction or facilities would be relocated within the construction corridor.

The Colusa Basin Drain and Hunter's Creek crossing locations would be at the northern end of the drain. The crossing will be made by boring and jacking the pipes under the drain.

Construction. Assuming open-trench construction methods, the construction disturbance area to install the proposed Delevan Pipeline would be large enough to accommodate temporary stockpiling of the trenching spoils. Because of the large volume of spoils and the linear construction process (the entire length would not be constructed at the same time), the area would also be used for construction staging associated with other facilities, such as a temporary concrete batch plant (the same plant as used for the proposed TRR Pipeline).

The Delevan Pipeline would likely be constructed in three independent and concurrent sections. Two of the sections would likely begin from the same point and move in opposite directions. As pipelines are installed and tested, the trench would be backfilled to minimize the amount of open trenching. The construction disturbance area for the Delevan Pipeline would be a linear area, 13.5 miles long and approximately 300 feet wide from the Sacramento River to the proposed TRR (10 miles), and approximately 335 feet wide from the TRR to the proposed Holthouse Reservoir (3.5 miles). The additional width of the construction disturbance area would accommodate the additional TRR Pipeline from the TRR to Holthouse Reservoir. An additional construction disturbance area of 20 acres would be required for a concrete batch plant. Construction disturbance area boundaries would be marked with tape, flagging, or fencing. The construction disturbance area would pass through multiple areas close to residences and would intersect with several roads. The entire Delevan Pipeline construction disturbance area would not be fenced. In high-visibility areas or where the construction site requires more protection for security or safety, a temporary 6-foot-high chain-link fence would be installed around the worksite.

Anticipated major construction activities include the following:

- **Trenching/Excavation Approach –** Approximately 6.3 million cubic yards of material would need to be excavated for the Delevan Pipeline trench. Topsoil would be stockpiled separately from other excavated materials and backfilled so as to maintain pre-Project soil profiles. Trench excavation would be approximately 23 feet deep. For the portion of the Delevan Pipeline that would be installed between the Sacramento River and the TRR, the trench would be approximately 120 feet wide. Two 12-foot-diameter pipelines would be installed from the Sacramento River to the TRR. Trench excavation for the 3.5 miles from the TRR to Holthouse Reservoir would be approximately 165 feet wide to accommodate both the Delevan and TRR pipelines. Four 12-foot-diameter pipes would be installed from the TRR to Holthouse Reservoir. Trench side slopes would be approximately 1:1.5. No shoring would be installed under normal excavation conditions. Special conditions at some locations (unknown at this time) may require additional depth or width, steeper or flatter side slopes, or shoring to accommodate localized soil conditions.

The Delevan Pipeline trench would be excavated using trenchers and tracked and/ or wheeled excavators and backhoes, or pushed up using bulldozers. The type of soils encountered would determine the type of equipment used for trenching. Harder soils, such as caliche, would require larger trenchers. In specific areas, vacuum excavation, “pot-holing” with a backhoe, or hand digging may be necessary to locate buried utilities. Excavation activities similar to the Delevan Pipeline excavation would also be conducted for overhead powerline tower/pole footings that would be installed within the pipeline right-of-way. The following activities would occur simultaneously with the pipeline excavation:

- **Dewatering –** Dewatering of the trench would be necessary in many locations and could be permitted to discharge into local irrigation ditches and drainage canals and/or the CBD after settling of silts. Silts would be disposed of with excavated material. Dewatering would be in accordance with Central Valley Regional Water Quality Control Board requirements and California Storm Water Quality Association BMPs for dewatering.
- **Onsite Fabrication of Pipes –** It is possible that all pipes would be fabricated onsite with a concrete batch plant. A fabrication and curing area for the pipes would be located within the 20-acre batch plant footprint. Pipes would be fabricated onsite using imported steel cylinder and straight lengths of reinforcing steel. It is also possible that pipe would be manufactured offsite and shipped to the site by truck or rail.
- **Bedding Preparation –** Bedding material would be installed in the trench before installation of the pipeline. Bedding material would likely be sand, or cemented controlled density fill. The bedding material would be poured into the trench by dump truck and spread along the bottom of the trench by a small grader or similar type of equipment.
- **Installation of Pipe and Valves –** The finished sections of the pipes would be transported from the fabrication and curing area to the installation location primarily along the pipeline route on flatbed trucks traveling along the construction access roadway (within the construction disturbance area). These trucks would cross public roadways. Pipe sections would be offloaded from flatbed trucks and placed in the excavated pipeline trench by a 50-ton capacity crane. Once in place, the joint would be covered with a cement-based sealing compound. At valve locations, prefabricated valves would be delivered to the site on flatbed trucks and installed into previously constructed structures within the trench using the same crane.
- **Backfill of Trench –** Approximately 5 million cubic yards of material would be needed to backfill the trench after the pipes are installed. Excavated material would be reused to backfill the trench or moved to other Project locations for use, to the extent possible, after placement of pipes. Topsoil would be returned to approximate pre-Project soil profiles. Excess spoils from the excavation (estimated 1.3 million cubic yards) would be spread on adjacent agricultural lands of willing landowners within the 800-yard-wide corridor along the pipeline, used as backfill at the proposed Delevan Pipeline Intake/Discharge Facilities, or placed in the Sites Reservoir footprint.

Excess spoils may also be used to reinforce existing levees in the area as part of a separate program, which would be subject to a separate environmental analysis. Reuse of excavated material may be limited by water content of excavated material and soil compaction requirements. Spreading or stockpiling of excess soil would only occur outside of potential flood inundation areas, in accordance with U.S. Army Corps of Engineers and local flood control district requirements.

Operations. Operation of the proposed Delevan Pipeline would not require daily workers at the site.

Maintenance. Periodic inspection and maintenance of the proposed Delevan Pipeline would likely occur once per year, typically in April and May, with possible additional inspections and maintenance needed after earthquakes or storm or flood events. Permanent 50-foot rights-of-way for the land overlying the pipeline would be maintained to guarantee future access. Disturbed lands would be returned to agricultural production after pipeline construction.

3.1.1.5 Overhead Power Lines and Substations

A proposed substation, associated with an overhead line tie-in to the existing WAPA transmission line (500 kilovolt [kV] or 230 kV) or PG&E transmission line (230 kV) (two possible options), would be constructed in the general vicinity of the existing Funks Reservoir. The substation would be approximately 6 acres and would serve the Sites Reservoir Pumping/Generating Plant, the Terminal Regulating Reservoir Pumping/Generating Plant, and the Delevan Pipeline Intake/Discharge and Pumping/Generating Plant. The proposed electrical substations, switchyards, and overhead power lines that would connect the pumping/generating plants to the grid would provide the electricity needed by the pumping plants, as well as back to the grid from the generating processes. Switchyards are detailed in the sections above.

Under Alternative A, the Sites/Delevan Overhead Power Line would parallel the proposed Delevan Pipeline route from the proposed Delevan Pipeline Intake/Discharge Facilities to the proposed TRR within a 150-foot-wide permanent overhead power line easement, 150 feet north of the permanent easement for the proposed Delevan and TRR pipelines[6] (Figure 3-1). From the TRR at about the GCID Main Canal crossing, the proposed Sites/Delevan Overhead Power Line would travel southwesterly for approximately 9,600 feet, then northwesterly for approximately 3,600 feet, and, finally, west for approximately 5,300 feet, at which point the overhead power line would cross the proposed Eastside Road. From Eastside Road, the Sites/Delevan Overhead Power Line would travel southwesterly for approximately 1,700 feet to connect to the proposed Sites Electrical Switchyard.

In addition, lower voltage overhead distribution lines would be connected to the proposed Golden Gate Dam, Sites Dam, South Bridge, and Stone Corral and Lurline Headwaters recreation areas. Electricity provided to Golden Gate Dam would likely come from the Sites Pumping/Generating Plant site through an easement along Funks Creek to the dam. Electricity to Sites Dam, South Bridge, and the two recreation areas would likely come from an existing overhead distribution line that parallels Sites Lodoga Road. The power line would be extended to Sites Dam along the canyon walls, through the Stone Corral Recreation Area (following roads when available), along the new Stone Corral Road to the South Bridge. From Sites Dam, the power line would be extended approximately 3.1 miles southwesterly to the Lurline Headwaters Recreation Area. Power on the west side of the Sites Reservoir inundation area, including Antelope Island Recreation Area, would be extended across the proposed South Bridge from the proposed substation.

[6] The overhead power line cannot be constructed within the same permanent easement as the pipeline because the footprint of the transmission tower/pole footings would impede access to the pipeline during future maintenance activities.

Construction. The proposed Sites/Delevan Overhead Power Line construction disturbance area would be completely contained within a new permanent easement. The permanent easement would be approximately 150 feet wide along the entire alignment and would accommodate construction activities, staging areas, and stockpile areas. A portion of the existing agricultural fields within the overhead power line alignment would need to be fallowed and not watered during construction of tower/pole footings and placement of towers. Anticipated major construction activities include clearing and grading the construction workspace, placing necessary construction materials at staging areas, excavating and constructing tower/pole footings, erecting the overhead power line towers/poles, and stringing the conductor.

The overhead power line would cross an existing PG&E natural gas pipeline and an overhead power line. The pipeline crossing would be accomplished by siting the towers/poles away from the pipeline. The crossing of high-voltage lines requires special precautions during construction and has specific design requirements to maintain minimum clearances from each other under conservative line operating conditions. At this crossing location, the proposed overhead power line towers/poles would be constructed to meet design and utility requirements.

The overhead power line would be an aboveground feature, with the footings of the towers/poles resulting in a permanent change in land use and loss of wildlife habitat. Assuming up to 144 overhead power line towers/poles, each with a concrete pad for a base, over the entire length of the overhead power line, the total permanent acreage that would be affected would be approximately 5 acres.

Operations. Operation of the proposed Sites/Delevan Overhead Power Line and associated distribution lines would be an unmanned activity.

Maintenance. The proposed Site Delevan Overhead Power Line and associated distribution lines would require only periodic maintenance (once or twice a year), which would include equipment inspections and vegetation maintenance. Permanent easements and limitations on uses (row crops only) would be maintained to provide future access.

3.1.1.6 Project Buffer

The Project buffer (Figure 3-1) would consist of the total amount of land that would be acquired for the Project beyond the facility footprints, out to the nearest existing parcel boundaries. If the nearest parcel boundary is less than 100 feet beyond the facility footprint, the Project Buffer would extend beyond the parcel boundary to result in at least a 100-foot buffer. The proposed Project Buffer would surround the proposed Sites Reservoir Complex, Holthouse Reservoir Complex, including all facilities located between these two facilities; the proposed TRR and associated facilities; and the proposed Delevan Pipeline Intake/Discharge Facilities.[7] Because the intent of the Project Buffer is to create a “buffer” around Project facilities, while following existing parcel boundaries, the area and width of the buffer around Project facilities would vary. The Project Buffer would serve several purposes:

- Avoiding splitting parcels and rendering parcel remnants unusable by existing landowners
- Providing a buffer between Project facilities and adjacent existing land uses to avoid potential conflicts in land uses

[7] The proposed Sites/Delevan Overhead Power Line, Delevan Pipeline, TRR Pipeline, and TRR Pipeline Road would not have an associated buffer. These Project facilities would not require additional lands for long-term operation and maintenance. The Delevan and TRR pipelines would be underground features that would have periodic aboveground structures that include access structures, blowoff structures, air valve structures, and an outlet and energy dissipater structure. The TRR Pipeline Road would be located above the TRR Pipeline. The Sites/Delevan Overhead Power Line would result in aboveground development only at each overhead power line tower/pole.

- Preventing shoreline development around the proposed Sites Reservoir
- Preventing livestock access to the reservoirs, and prevent livestock wastes from entering the proposed reservoirs

Construction. The lands within the Project Buffer would remain undeveloped; the existing vegetation would be maintained as wildlife habitat and protected from fuelwood harvest, grazing, and other forms of environmental degradation. Existing structures would be demolished, and the remaining land would be managed as wildlife habitat. Existing agricultural lands would not be maintained as agriculture but would be converted and managed as wildlife habitat.

The Project Buffer boundary would be fenced using standard three-strand barbed wire fences with posts in areas where the parcels are not already fenced, so that the entire Project Buffer boundary would be fenced. A fuel break would be constructed around the perimeter of the Project Buffer.

Operations. Not applicable.

Maintenance. Maintenance activities that are proposed to be undertaken within the Project Buffer boundary include fence maintenance and periodic boundary fuel break maintenance.

3.1.2 Alternative B

Alternative B (see Figures 1-6B and 3-1) would include the following primary facilities:

- Sites Reservoir capacity: 1.8 MAF
- Sacramento River diversions: Existing Tehama-Colusa Canal (Red Bluff) (2,100-cfs) and GCID Main Canal (Hamilton City) (1,800-cfs) pumping plants, no diversion at the Delevan Pipeline Intake/Discharge Facilities
- Delevan Pipeline operation: 1,500-cfs release only
- Hydropower Generation capability: approximately 96 MW

Approximate permanent facility footprint sizes by complex for Alternative B are provided in Table 3-12.

Table 3-12
Permanent Facility Footprint − Alternative B

Complex Name	Size (acres)
Sites Reservoir Complex	17,300
Holthouse Reservoir Complex	600
Terminal Regulating Reservoir Complex	300
Delevan Pipeline Complex	10
Overhead Power Lines and Substations	10
Project Buffer	10,000

Note: Acreages are based on permanent footprint; overlap of facilities (e.g., the Sites Pumping/Generating Plant located within the footprint for the Sites Inlet/Outlet Approach Channel) occurs in some cases. Construction footprint estimates are conservative and described in resource analysis chapters, where applicable.

Alternative B would include the same Project facilities and features described in Section 3.1.1 Alternative A and listed in Table 3-1. Facilities identical to Alternative A (e.g., Holthouse Reservoir, TRR, and associated facilities) are not discussed below to minimize redundancy.

3.1.2.1 Sites Reservoir Complex

Sites Reservoir Inundation Area

Alternative B would be situated in the identical location as Alternative A west of the town of Maxwell (Figure 3-1) but would include a larger Sites Reservoir and associated facilities. The reservoir would have a storage capacity of 1.8 MAF, a maximum water surface elevation of 520 feet above msl (the minimum operating water surface would be at elevation 340 feet), and an inundation area of approximately 14,200 acres. The inundation area of the proposed 1.8-MAF Sites Reservoir would be created by filling a portion of the Antelope Valley after the construction of 11 dams. The proposed dams include Golden Gate Dam on Funks Creek, Sites Dam on Stone Corral Creek, and nine saddle dams on the northern end of the reservoir, between the Funks Creek and Hunters Creek watersheds (Alternative B dams are detailed below). As was the case for Alternative A, many areas within Sites Reservoir Inundation Area would be used for staging of materials and equipment prior to and during construction of other Project components (e.g., the Sites Reservoir dams).

Construction. The total construction disturbance area within the Sites Reservoir Complex would consist of the proposed inundation area footprint and a temporary construction disturbance area. Anticipated ground-disturbing activities during construction include the following:

- **Clearing and Grubbing.** Approximately 90 percent of the proposed reservoir inundation area footprint is composed of annual grasslands; as a result, clearing and grubbing would not be needed in this area. The remaining approximately 10 percent consists of blue oak woodland, agricultural crops, and other vegetation, which would be cleared. Cleared vegetation materials would be disposed of at an appropriate landfill/green waste facility or onsite as appropriate and necessary.
- **Demolishing Existing Structures.** Within the Sites Reservoir Inundation Area, approximately 20 houses, 25 barns, and 40 other structures (combination of sheds, silos, and a pump houses) would be demolished once all property owner negotiations were completed. Existing septic tanks and other underground storage tanks would also be removed. In addition, many miles of fencing and asphalt would be removed as necessary. Demolition debris would be transported and disposed of at an approved landfill(s).
- **Relocating the Cemetery.** Two private cemeteries would be relocated.
- **Salt Lake.** Construction activities related to Salt Lake for the proposed 1.8-MAF Sites Reservoir would be the same as for Alternative A.

Operations. Operations of the proposed 1.8-MAF Sites Reservoir would be the same as for Alternative A.

Maintenance. Maintenance of the proposed 1.8-MAF Sites Reservoir would be the same as for Alternative A.

Golden Gate Dam, Sites Dam, and Saddle Dams

Eleven dams would be needed to create the proposed 1.8-MAF Sites Reservoir (Figure 3-1). The reservoir would be formed by the proposed Golden Gate Dam, Sites Dam, and two additional saddle dams than would be needed for Alternative A. Alternative B would include nine saddle dams along the northern perimeter of the reservoir between the Funks Creek and Hunters Creek watersheds, near the Glenn-Colusa County line. Both the Golden Gate Dam and Sites Dam would be constructed in the same general location as Alternative A; however, the Golden Gate Dam for Alternative B would be farther from the reservoir than under Alternative A. Saddle Dams 1, 2, 4, and 9 would be small-sized dams, with heights ranging from approximately 40 to 50 feet. Saddle Dams 3, 5, 6, 7, and 8 would be medium-sized dams, with heights ranging from approximately 70 to 130 feet. Saddle Dams 3, 5, and 8 would be the tallest and largest of the nine proposed saddle dams, with embankment volumes of approximately 3.5, 1.5, and 1.9 million cubic yards, respectively. Dams would be composed of the same materials identified for Alternative A (Section 3.1.1.1 Sites Reservoir Complex). Table 3-13 lists the proposed height and length of the 11 dams as well as the total volume of materials needed to construct the dam embankments.

Table 3-13
Characteristics of the Proposed Sites Reservoir Dams for Alternative B
(and Alternatives C and D)

Dam	Maximum Height Above Base[a] (feet)	Crest Length (feet)	Total Embankment Volume (cubic yards)
Sites Dam	290	850	3,836,000
Golden Gate Dam	310	2,250	10,590,000
Saddle Dam 1	50	490	93,000
Saddle Dam 2	80	420	86,000
Saddle Dam 3	130	3,810	3,577,000
Saddle Dam 4	40	270	18,000
Saddle Dam 5	100	2,290	1,505,000
Saddle Dam 6	70	530	144,000
Saddle Dam 7	75	1,040	196,000
Saddle Dam 8	105	2,990	1,915,000
Saddle Dam 9	45	340	49,000
Total			**22,009,000 cubic yards**

[a]Base is defined as ground surface elevation.

The crest elevation of all 11 dams would be 540 feet, providing 20 feet of freeboard. Crest widths and embankment slopes would be the same as Alternative A.

Saddle Dams 2, 3, and 5 would have fairly flat slopes on the left abutments[8] which require low dam heights (less than approximately 10 feet high). At these locations, the dam embankments would be strictly providing residual freeboard. Therefore, the typical saddle dam sections would be replaced at these locations with a small homogenous impervious embankment with a bentonite slurry wall for foundation seepage control. The crest elevation and width and slopes of the homogeneous embankment would match

[8] Abutment direction refers to looking downstream. Therefore, the dam's left abutment would be the abutment on the left side of the dam when looking downstream.

that of the saddle dams. Construction of the slurry wall configuration is a more economical option than construction of the typical embankment and excavation section. The slurry wall would be excavated to a depth corresponding to the moderately weathered bedrock surface, with average dimensions estimated at 20 feet deep by 5 feet wide. At the left abutment of Saddle Dam 2, the slurry wall section would also provide a defensive measure to control foundation seepage if displacement occurs along the Salt Lake Fault. At this location, the slurry wall was extended to a depth of 40 feet to minimize the potential of foundation seepage along the fault zone. Locations of the borrow materials for construction of the dams would be similar to those described for Alternative A, however, more material (22 million cubic yards) would be required for Alternative B.

Similar to Alternative A, the signal spillway at the proposed 1.8-MAF Sites Reservoir would be located at Saddle Dam 6. The purpose of the signal spillway would be to release water in the event that water is still being pumped into the reservoir after the PMF has been stored (a very unlikely occurrence). If the PMF were to occur when the reservoir is at maximum pool (elevation 520.0 feet), the water surface elevation would rise to 525.2 feet (with full PMF retention). The dam crest elevation would be 540.0 feet, still leaving almost 15 feet of freeboard. The potential for such an event and necessary actions would be addressed as part of the Emergency Action Plan as identified for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

For the proposed 1.8-MAF Sites Reservoir, a "morning glory" spillway[9] would be provided on a cut bench on the left abutment of the saddle dam. The outlet pipe would be installed under the dam on a cut bench on the dam abutment foundation. On the downstream side of the dam, the pipe would be installed downslope to the creek. An energy dissipating structure would be located at the end of the pipeline to control the discharge of water to the creek. The spillway would consist of one 7-foot-diameter concrete pipe sized primarily for inspection and maintenance activities. The spillway pipe inflow elevation would be set at 526.0 feet, just above the estimated pool level with full PMF containment.

Construction. The total construction disturbance area for the 11 proposed dams would be approximately 160 acres. The total construction disturbance area would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, borrow areas, and access roads. The construction disturbance area for the dams would be within the construction disturbance area for the proposed Sites Reservoir Inundation Area.

All other proposed construction activities would be the same as described for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

Operations. All proposed operations activities are the same as described for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

Maintenance. All proposed maintenance activities are the same as described for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

Sites Pumping/Generating Plant and Electrical Switchyard

The location and function of the Pumping/Generating Plant would be the same as Alternative A shown on Figure 3-7. The proposed generating plant would have a total pumping capacity of 3,900 cfs (less than

[9] A morning glory spillway is an uncontrolled spillway with a funnel-shaped outlet that allows water to spill into the funnel rather than spilling over the dam.

Alternative A given no Delevan Intake on the Sacramento River) and a release capacity of 5,100 cfs. Table 3-14 summarizes the pump and pump/turbine configuration for the 3,900-cfs plant.

Table 3-14
Proposed Sites Pumping-generating Plant Configuration for Alternative B

Unit Type	Number of Units	Net Head (feet)	Pumping Capacity Per Unit (cfs)	Generating Capacity Per unit (cfs)	Total Plant Pumping Capacity (cfs)	Total Plant Generating Capacity (cfs)
Pump – Francis Vane (dual speed)	2 (+1 standby)	323	300	-	3,900	5,100
		195	300	-		
Pump/Turbine - Reversible Francis (dual speed)	4 (+1 standby)	323/310	663	1,020		
		195/182	663	1,020		
Pump/Turbine - Reversible Francis (dual speed)	2	323/310	332	510		
		195/182	332	510		

Construction. The total site footprint of the proposed Sites Pumping/Generating Plant and associated construction activities would be the same as Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

Operations. All proposed operations activities would be the same as described for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

Maintenance. All proposed operations activities are the same as described for Alternative A (Section 3.1.1.1 Sites Reservoir Complex).

South Bridge and Roads

Proposed roads for Alternative B would be the same as Alternative A with the exception of the Saddle Dam access road to Saddle Dam 10. The access road from the Golden Gate Dam Crest Road is only needed for Alternative A. This would reduce the roadway length by 0.30 mile.

Construction, operations, and maintenance of South Bridge and the Project roads for Alternative B would be the same as those described for Alternative A.

3.1.2.2 Delevan Pipeline Complex

Delevan Pipeline Discharge Facility (No Intake)

Alternative B would include only a release structure to make controlled releases to the river and no intake facilities at the Sacramento River. The proposed release structure (Delevan Pipeline Discharge Facility, Figure 3-13B) would be located at the same site as shown for the Delevan Pipeline Intake/Discharge Facilities for Alternative A (Figure 3-13A). The diameter of the proposed Delevan Pipeline would be reduced in stages from 12 feet to 8 feet, then to 4 feet before reaching the proposed energy dissipating valve house. The valve house would be located just above the design Sacramento River flood level at the site, which is at an approximate elevation of 82 feet.

The energy dissipating valves would be 48-inch-diameter fixed cone valves located in confining vaults to control excessive spray and help dissipate the energy. From the valve structure, released water would flow down a short channel section before reaching a proposed baffle block spillway leading down to the river for a maximum release flow of 1,500 cfs. The baffle block spillway could control the release of water to the river regardless of the river level and provide aeration benefits.

The valve house, channel, and spillway would be located within the current river overbank area so that the facilities do not encroach within the flow area when the river is at its maximum design level. The downstream side of the spillway exposed to the river would be fitted with fish barrier racks to prevent migrating adults fish from entering the spillway chute. The clear spacing of the bars in the rack would be 1.5 inches.

At the maximum design flow, the width of the spillway structure would be designed to maintain the release velocity from the structure at or below 2 fps at the minimum river design level at an elevation of 51 feet. As described for Alternative A, a wide berm or ring levee would be constructed behind the flood protection levee to provide additional protection for the mechanical and electrical equipment.

Construction. The total construction disturbance area would be approximately 10 acres. Other activities would be similar to Alternative A including the need to relocate the Maxwell Irrigation District and Tuttle Ranch pipelines that are located within the construction disturbance area. As would be done as part of Alternative A, either a temporary bypass pipeline would be constructed to provide water to Maxwell Irrigation District users, or arrangements would be made for supplemental water to be conveyed into the CBD for the Maxwell Irrigation District to pick up for delivery to its users. A temporary bypass pipeline would be constructed to provide water to Tuttle Ranch to irrigate its orchards.

Operations. Proposed release operations would be such that a maximum 1,500 cfs would be discharged to the river channel. A SCADA system would control all operational modes. The system would be located onsite and would broadcast status information to a manned remote location. The SCADA system provides a means to control the release without staffing the onsite facilities. No diversions would occur.

Maintenance. Similar to Alternative A, the proposed Delevan Pipeline Discharge Facility would likely be staffed daily to maintain, operate, and monitor the facility. It is anticipated that employees would be onsite during release (predominantly in summer) activities. Activities would include the following:

- Inspection and periodic maintenance of fish barrier rack and debris removal as needed
- Periodic removal of accumulated sediment
- Inspection and periodic maintenance of equipment

Delevan Pipeline

The approximately 13.5-mile-long, release-only Delevan Pipeline would convey water from the proposed Holthouse Reservoir to the Sacramento River for releases. The capacity of the Delevan Pipeline to convey water from Holthouse Reservoir to the Sacramento River would be 1,500 cfs. The pipeline would consist of two 12-foot-diameter reinforced concrete pipes.

Construction. All construction activities would be the same as described for Alternative A.

Operations. All operations activities would be the same as described for Alternative A.

Maintenance. All maintenance activities would be the same as described for Alternative A.

Construction. Construction of this facility would be the same as described for Alternative A (Section 3.1.1.4 Delevan Pipeline Complex)

3.1.2.3 Overhead Power Lines and Substations

Overhead power lines and substations would be similar to Alternative A; however, new east-to-west aligned overhead power lines from the proposed substation near Holthouse Reservoir, east to the Delevan Discharge Only facility would not be required for Alternative B.

Construction. Construction of this facility would be the same as described for Alternative A; however, Alternative B would require fewer towers/poles than Alternative A. Assuming up to 40 overhead power line towers/poles for the power lines west of the TRR, each with a concrete pad for a base for the length of the overhead power line, the total permanent acreage impact would be approximately 1 acre.

Operations. Operation of this facility would be the same as Alternative A.

Maintenance. Maintenance of this facility would be the same as Alternative A.

3.1.3 Alternative C

Alternative C (see Figures 1-6C and 3-1) would include the following primary facilities:

- Sites Reservoir capacity: 1.8 MAF
- Sacramento River diversions: Existing Tehama-Colusa Canal (Red Bluff) (2,100-cfs) and GCID Main Canal (Hamilton City) (1,800-cfs) pumping plants, and proposed Delevan Pipeline Intake/Discharge Facilities (2,000-cfs)
- Delevan Pipeline operation: 2,000-cfs intake and 1,500-cfs release
- Hydropower Generation capability: approximately 118 MW

Approximate permanent facility footprint sizes, by complex for Alternative C, are provided in Table 3-15.

Table 3-15
Permanent Facility Footprint – Alternative C

Complex Name	Size (acres)
Sites Reservoir Complex	17,300
Holthouse Reservoir Complex	600
Terminal Regulating Reservoir Complex	300
Delevan Pipeline Complex	25
Overhead Power Lines and Substations	20
Project Buffer	10,000

Note: Acreages are based on permanent footprint; overlap of facilities (e.g., the Sites Pumping/Generating Plant located within the footprint for the Sites Inlet/Outlet Approach Channel) occurs in some cases. Construction footprint estimates are conservative and described in resource analysis chapters, where applicable.

Alternative C would include the same Project facilities and features described in Section 3.1.1 Alternative A or Section 3.1.2 Alternative B and listed in Table 3-1. Facilities identical to Alternative A or B (e.g., Holthouse Reservoir, TRR, and associated facilities) are not discussed below to minimize redundancy.

3.1.3.1 Sites Reservoir Complex

<u>Sites Pumping/Generating Plant and Electrical Switchyard</u>

The proposed approximately 5,900-cfs Sites Pumping/Generating Plant would be the same as that for Alternative A (Section 3.1.1.1 Sites Reservoir Complex), except for the net head. The maximum water surface elevation for Alternative C would be approximately 40 feet higher than for Alternative A so the net head for the pumps and pump/turbines would be slightly larger compared to Alternative A. Table 3-16 summarizes the pump and pump/turbine configuration for the proposed approximately 5,900-cfs Sites Pumping/Generating Plant.

Table 3-16
Sites Pumping-generating Plant Configuration for Alternative C

Unit Type	Number of Units	Net Head (feet)	Pumping Capacity Per Unit (cfs)	Generating Capacity Per Unit (cfs)	Total Plant Pumping Capacity (cfs)	Total Plant Generating Capacity (cfs)
Pump – Francis Vane (dual speed)	2 (+1 standby)	330	870	-	5,980	5,100
		202	870	-		
Pump – Francis Vane (dual speed)	2	330	435	-		
		202	435	-		
Pump/Turbine – Reversible Francis (dual speed)	4 (+1 standby)	330/310	663	1,020		
		202/182	663	1,020		
Pump/Turbine Reversible Francis (dual speed)	2	330/310	332	510		
		202/182	332	510		

3.1.4 Alternative C_1

Alternative C_1 (see Figures 1-6C1 and 3-1) is identical to Alternative C, except that it would not include any hydropower generating facilities at the Sites Pumping/Generating Plant, TRR Pumping/Generating Plant, or Delevan Pumping/Generating Plant. There would be no pump storage operation included with the alternative, resulting in a need to modify Funks Reservoir (rather than construct a new Holthouse Reservoir as would be required for all other alternatives). Approximate permanent facility footprint sizes, by complex for Alternative C, are provided in Table 3-17.

Table 3-17
Permanent Facility Footprint − Alternative C_1

Complex Name	Size (acres)
Sites Reservoir Complex	17,300
Holthouse Reservoir Complex	400
Terminal Regulating Reservoir Complex	300
Delevan Pipeline Complex	25
Overhead Power Lines and Substations	20
Project Buffer	10,000

Note: Acreages are based on permanent footprint; overlap of facilities (e.g., the Sites Pumping/Generating Plant located within the footprint for the Sites Inlet/Outlet Approach Channel) occurs in some cases. Construction footprint estimates are conservative and described in resource analysis chapters, where applicable.

Table 3-1 provides a summary comparison of the key Project facilities of all alternatives. With the exception of the Project facilities and features described in the following sections related to Alternative C_1 features, Alternative C_1 would include the same Project facilities and features described in Section 3.1.1.1 Sites Reservoir Complex. Facilities identical to Alternative A are not discussed below to minimize redundancy.

3.1.4.1 Modified Funks Reservoir (Holthouse Reservoir Complex)

Alternative C_1 would require the existing Funks Reservoir (Figure 3-14) be modified to serve as a forebay/afterbay to manage releases from Sites Reservoir. The proposed modifications to Funks Reservoir are necessary to provide capacity to operate the new conveyance system. A proposed bypass pipeline would be needed to route the Tehama-Colusa Canal flows around Funks Reservoir during construction similar to all other alternatives.

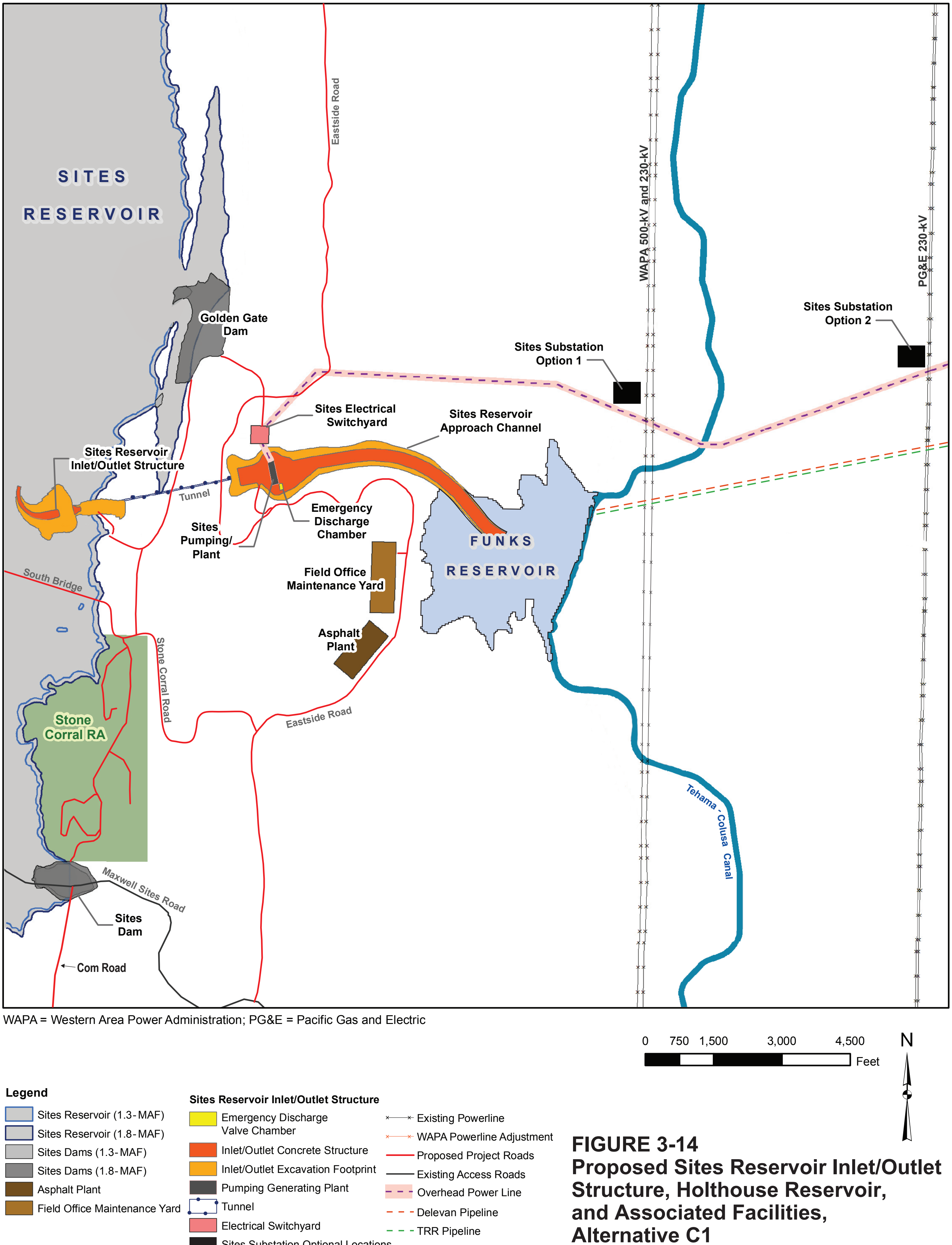
The existing Funks Reservoir serves as an offstream storage reservoir to regulate releases for downstream irrigation users served by the Tehama-Colusa Canal. It has a 2,250-acre-foot total design capacity with a surface area of 230 acres at elevation 205 feet. A 40-foot-high compacted earthfill dam impounds the reservoir on the east. Its crest elevation is 214.0 feet, and it is 1,450 feet long. The dam base was excavated to an elevation of approximately 160 feet. The Tehama-Colusa Canal conveys water through Funks Reservoir with an inlet at the northeast end adjacent to the dam spillway and an outlet to the southeast. Both inlet and outlet have a gated release. The Funks Reservoir spillway is controlled by three 25-foot by 20-foot radial gates. The spillway overflow discharge capacity is 25,000 cfs with all gates fully open.

Funks Reservoir would be enlarged by excavating accumulated sediment and expanding the reservoir to the northwest to increase the capacity from an estimated available storage of 1,170 acre-feet to 3,372 acre-feet. In addition, a 12-foot-diameter bypass pipeline would be constructed to route the Tehama-Colusa Canal’s inflow around Funks Reservoir during construction. The bypass pipeline could also be used for rerouting the water from the Tehama-Colusa Canal during maintenance of Funks Reservoir. The existing maintenance access road along the reservoir’s southern boundary would remain.

3.1.5 Alternative D

Alternative D (see Figures 1-6D and 3-1) would include the following primary facilities:

- Sites Reservoir capacity: 1.8 MAF
- Sacramento River diversions: Existing Tehama-Colusa Canal (Red Bluff) (2,100 cfs) and GCID Main Canal (Hamilton City) (1,800 cfs) pumping plants and proposed Delevan Intake/Discharge Facilities (2,000 cfs)
- Delevan Pipeline operation: 2,000-cfs intake and 1,500-cfs release
- Hydropower Generation capability: approximately 118 MW



WAPA = Western Area Power Administration; PG&E = Pacific Gas and Electric

FIGURE 3-14
Proposed Sites Reservoir Inlet/Outlet Structure, Holthouse Reservoir, and Associated Facilities, Alternative C1
Sites Reservoir Project EIR/EIS

With the exception of the Project facilities and features described in the following sections, Alternative D would include the same Project facilities and features described in Section 3.1.3 Alternative C. Facilities identical to Alternative C are not discussed below to minimize redundancy. Approximate permanent facility footprint sizes, by complex for Alternative C, are provided in Table 3-18.

Table 3-18
Permanent Facility Footprint − Alternative D

Complex Name	Size (acres)
Sites Reservoir Complex	17,000
Holthouse Reservoir Complex	600
Terminal Regulating Reservoir Complex	200
Delevan Pipeline Complex	25
Overhead Power Lines and Substations	20
Project Buffer	10,000

Note: Acreages are based on permanent footprint; overlap of facilities (e.g., the Sites Pumping/Generating Plant located within the footprint for the Sites Inlet/Outlet Approach Channel) occurs in some cases. Construction footprint estimates are conservative and described in resource analysis chapters, where applicable.

3.1.5.1 Sites Reservoir Complex

South Bridge and Roads

The proposed reservoir footprint for Alternative D would inundate the same public and private roads as for Alternative C; therefore, Alternative D includes South Bridge and most of the road relocations that were part of Alternative C. However, some of the roads for this alternative are unique. The roadway construction for Sulphur Gap Road from Maxwell Sites Road to Huffmaster Road (9.61 miles) would not be required for Alternative D.

Approximately 5.20 miles of roadway construction from Huffmaster Road to Leesville Road would provide access to Leesville and is unique to Alternative D. This would be a new permanent road. These differences would result in approximately 5 miles less roadway construction under Alternative D than the other alternatives. Approximately 50 miles of new roads would provide maintenance access to the Project facilities, as well as provide public access to the Stone Corral Recreation Area. The locations of proposed roads, the proposed South Bridge, and existing roads near the Sites Reservoir that would be affected by Project construction and/or operation are shown on Figure 3-1.

The South Bridge is the same for all alternatives. The proposed road alignment around the saddle dams on the northern rim to access Saddle Dams 1 and 2 for Alternative D would be the same as Alternative C. Permanent facility access roads constructed from gravel and asphalt would facilitate operation and maintenance activities. These proposed access roads would require new construction or the relocation of existing public county roads and bridges; these activities would follow Caltrans and AASHTO design standards as applicable.

Construction. The total construction disturbance area would consist of approximately 1,300 acres Construction activities are as described in Section 3.1.3 Alternative C.

Operations. Operations are as described in Section 3.1.3 Alternative C.

Maintenance. Maintenance is as described in Section 3.1.3 Alternative C.

Recreation Areas

Construction of the recreation areas would be phased based on public demand. Alternative D would include the development of two recreation areas (Stone Corral Creek Recreation Area and Peninsula Hills Recreation Area) instead of up to five recreation areas that could be developed for each of the other alternatives. Appendix D would include a boat ramp on the western side of the reservoir where the existing Sites Lodoga Road would be inundated. Only two recreation areas under Alternative D is not expected to substantially change the potential impacts on any of the resource areas.

The Stone Corral Recreation Area (Figure 3-9B) would be located on the eastern shore of the Sites Reservoir, north of the existing Maxwell Sites Road and proposed Sites Dam. Access would be provided by either the proposed South Bridge or Eastside Road. The maximum proposed size of the Stone Corral Recreation Area would be 235 acres.

The Peninsula Hills Recreation Area (Figure 3-9E) would be located on the northwest shore of the Sites Reservoir, to the north of the existing Sites Lodoga Road. Access would be provided from the proposed Peninsula Road via the existing Sites Lodoga Road. The maximum proposed size of the Peninsula Hills Recreation Area would be 373 acres. In addition to the Stone Corral and Peninsula Hills recreation areas, a boat ramp would be provided on the western side of the reservoir where the existing Sites-Lodoga Road intersects with the proposed inundation area for the reservoir (Figure 3-9F). The maximum proposed size of the boat ramp area would be 10 acres.

Potential recreation opportunities could include boating, camping, picnicking, fishing, swimming, and hiking. Facilities may include boat launch sites, trails, designated swimming and fishing access, picnic tables, shaded canopies, campfire rings/barbeques, vault toilets, and dumpsters. In addition, gravel parking areas would be provided for camp sites, day-use areas, and boat launch facilities. The approximate number of facilities at each proposed recreation area is listed in Table 3-19.

Table 3-19
Approximate Number of Facilities at the Proposed Recreation Areas

Recreation Areas	Features
Stone Corral Recreation Area	50 campsites (car and recreational vehicle) 10 picnic sites (with parking at each site) 6-lane[a] boat launch site Hiking trails Electricity Potable water[b] 1 kiosk 10 vault toilets
Peninsula Hills Recreation Area	200 campsites (car and recreational vehicle) 1 group camp area[c] 10 picnic sites (with parking at each site) Hiking trails Electricity Potable water[b] 1 kiosk 19 vault toilets
Boat ramp on western side of the reservoir where Sites-Lodoga Road ends at the reservoir	Potable water[b] 1 kiosk 1 vault toilet

[a]Reducing the number of boat lanes with increasing water depth.

[b]Treated water from the reservoir would be the source of potable water.

Construction. It is anticipated that all construction activities associated with Stone Corral and Peninsula Hills Recreation Areas and the proposed boat ramp would occur within the proposed footprint of the recreation areas and the temporary and permanent access road areas. The total construction disturbance area would be approximately 620 acres. However, construction disturbance could be much less because recreational facilities would be designed and constructed to minimize vegetative disturbance, including tree removal.

Anticipated ground-disturbing activities during construction include the following:

- Surveying
- Clearing and grubbing
- Excavating
- Backfilling
- Constructing road and parking lot
- Addressing utility connections
- Installing amenities
- Constructing boat ramp
- Performing site revegetation

Operations. It is anticipated that the proposed recreation areas would not have onsite staff. A fee collection box and camping information would likely be available at the kiosk near each recreation area's entrance. It is expected that the majority of use at the facilities would occur between Memorial Day (end of May) and Labor Day (beginning of September) of each year, but that activities such as hiking and fishing may occur year-round. Regular boat inspections will be conducted to help address the potential for invasive mussels in the reservoir.

Maintenance. Maintenance activities would include collection of overnight and day-use fees at the fee collection boxes, road grading, water system maintenance, trash removal at picnic sites and overnight campsites, vegetation maintenance, restroom/vault toilet cleaning and restocking of paper goods, boat ramp debris removal, lake debris control, lake hazard marking, lake boom and barrier maintenance, signage, fence maintenance, fuels management, and law enforcement. During peak recreation use periods, these activities would likely occur on a daily basis, except for road grading, which is expected to occur once per year before the recreation season. During the non-peak seasons, the activities other than road grading would likely occur on a weekly basis.

3.1.5.2 Terminal Regulating Reservoir Complex

Terminal Regulating Reservoir

Alternative D includes a downsized, 1,200-acre-foot TRR that is located slightly to the south of the location used for Alternatives A, B, C, and C_1. The proposed location is shown on Figure 3-15. The 4,000-foot TRR to Funks Creek Pipeline would not be necessary under Alternative D. As a result of the closer location of the TRR to Funks Creek, only a minor drain/spillway would be required to drain the reservoir for operation and maintenance, and emergency purposes.

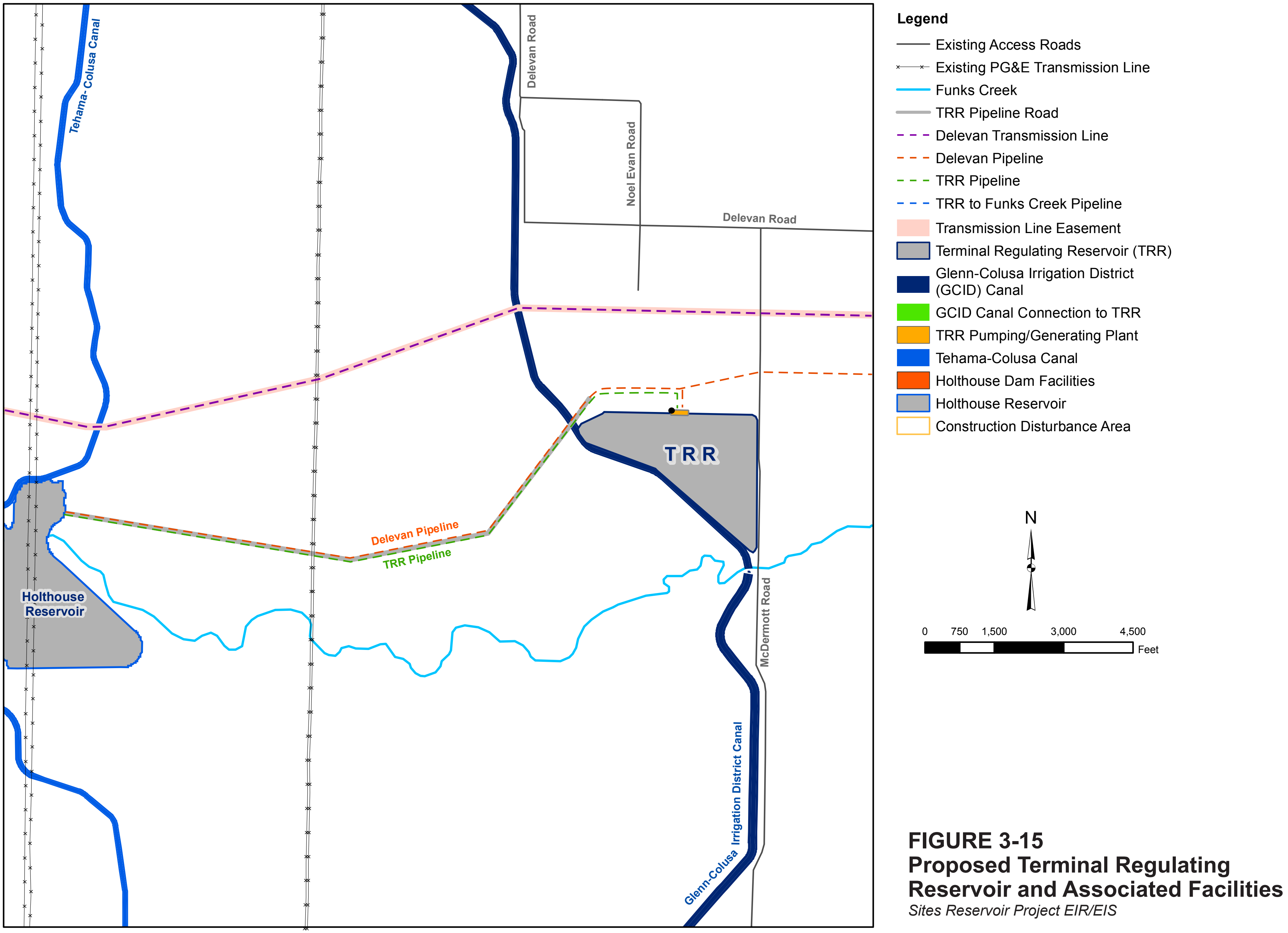


FIGURE 3-15
Proposed Terminal Regulating Reservoir and Associated Facilities
Sites Reservoir Project EIR/EIS

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Construction. The total construction disturbance area would consist of approximately 150 acres. Otherwise, construction would be similar to that described for Alternative C.

Operations. Same as Alternative C.

Maintenance. Same as Alternative C.

GCID Main Canal Connection to Terminal Regulating Reservoir

The connection from the GCID Main Canal to the TRR for the smaller reservoir under Alternative D would be located in the east bank of the canal north of Funks Creek (Figure 3-15). An inlet control structure with multiple radial control gates would be provided to regulate flows into and out of TRR. On the main canal, the existing Funks Check at Funks Creek can be refurbished to help balance and regulate flows in and out of the TRR, or a new check structure could be constructed based on future condition assessments. The benefit to keeping the existing Funks Check operational is that it would minimize impacts to GCID Main Canal operations during TRR construction.

Construction. The total construction disturbance area would consist of approximately 1 acre. It would include the footprint of the facilities, the materials and equipment staging area, the area needed to construct the facilities, and access roads. This construction disturbance area would be within the larger construction disturbance area for the proposed TRR.

Operations. Same as described for Alternative C.

Maintenance. Same as described for Alternative C.

3.1.5.3 Delevan Pipeline Complex

Delevan Pipeline

For Alternative D, the Delevan Pipeline alignment is approximately 50 to 150 feet south of the alignment shown for Alternatives A, B, C, and C_1 (Figure 3-1). This alignment takes advantage of existing easements to reduce impacts on local landowners. The footprint of the Delevan Intake/Discharge Facility is slightly different, but within the footprint described for Alternatives A and B (Figure 3-13C). Otherwise, the characteristics of the Delevan Pipeline are the same as described in Section 3.1.3 Alternative C.

Construction. The total disturbance area from construction activities would be similar to that described for Alternative C.

Operations. Same as Alternative C.

Maintenance. Same as Alternative C.

3.1.5.4 Overhead Power Lines and Substations

Power for the Delevan Pipeline Intake/Discharge Facilities with Alternative D would be provided from the south to avoid placement of new overhead power line corridor next to residences and agricultural operations adjacent to Delevan Road. Instead, a substation would be constructed west of the City of Colusa which would tie into existing WAPA lines. Under Alternative D, a new 115 kV Delevan Overhead Power Line would run north from the proposed substation, adjacent to and in parallel with the existing PG&E 65-kV lines along Highway 45 to the proposed intake/discharge facility on the Sacramento River. Approximately 154 towers/poles would be required (40 towers/poles west of TRR similar to the other alternatives, and 114 in the north to south alignment), for a total of approximately 5 acres of permanent disturbance.

Operation and maintenance would be the same as described above for the other alternatives.

3.2 Construction and Operation/Maintenance Common to All Alternatives

Construction and operation/maintenance activities required to construct, operate, and maintain all facilities and are common to all alternatives are described in this section. Construction, operation, and maintenance activities specific to each Project facility are described under the associated facilities, starting with Section 3.1.1.1 Sites Reservoir Complex. Operations related to Sacramento River diversions and operation of Sites Reservoir to assist in meeting agricultural, M&I, and environmental needs are described in Section 3.3 Diversion and Reservoir Operations Common to All Alternatives.

3.2.1 Construction

Prior to initiation of construction activities, acquisition or establishment of temporary or permanent easements of private properties, either through voluntary or eminent domain processes would be required. Overall, the construction of the Project or any of the Alternatives is expected to last for approximately 8 years to complete all necessary facilities. Several factors affect this anticipated schedule, including funding, implementing agency, environmental compliance, contracting methods and strategies, material and construction equipment availability, lead time for fabrication of major pumping and generating equipment, labor force constraints, weather, and access road capacity limitations. Additional adjustments to the schedule would be addressed as required during Project development and implementation.

At the peak of Project construction, the construction labor force is expected to be approximately 400 workers. Table 3-20 provides a list of the typical construction equipment expected to be present onsite during construction of the major facilities and estimated equipment days.

Construction activities are anticipated to occur between 7:00 a.m. and 7:00 p.m. Nighttime and weekend construction may occur on an as-needed basis and would be coordinated with residents. If nighttime construction is determined to be needed, construction lighting and noise constraints consistent with applicable federal, State, and local requirements would be used. Nighttime construction would not be conducted between 10:00 p.m. and 7:00 a.m. within 1,000 feet of occupied residences. Haul times through residential communities would be limited to 7:00 a.m. to 10:00 p.m. with air brake restrictions in residential communities.

Construction activities associated with the Project would be confined to designated construction disturbance areas. Construction vehicles and equipment would also be parked within these construction disturbance areas. In addition, construction materials would be stored within the construction disturbance areas. Construction bid specifications and design packages would include site designation regarding special or sensitive sites. Special or sensitive sites within the construction disturbance areas where construction equipment and materials would not be allowed would be clearly marked and fenced with orange barrier fencing before any construction or surface-disturbing activity begins. Construction personnel would be trained to recognize these markers and understand the equipment movement restrictions involved. Lath, fencing, or flags would be maintained until final cleanup and/or site restoration is completed, after which they would be removed.

Table 3-20

Estimated Construction Durations and Equipment Days for Construction of Sites Reservoir Project[a,b]

	Sites Reservoir and Dams – Alt A	Sites Reservoir and Dams – Alts B, C, C_1, D	Recreation Areas	Gravel Roads	Paved Roads and Bridges	Sites P/G Plant, Tunnel, and Sites Inlet/Outlet Structure	Funks Reservoir Sediment Removal	Funks Reservoir and Holthouse Reservoir Complex	Pump Installation at the Red Bluff Pumping Plant	GCID Main Canal Facilities Modifications	TRR Reservoir	TRR P/G Plant	TRR and Delevan Pipelines	Overhead Power Lines and Electrical Switchyards	Delevan Pipeline Intake/Discharge Facilities and P/G Plant
Construction Duration in Days - Alts A, B, C_1, C	2,224	2,224	731	1,403	1,403	485	167	826	-	743	487	1,276	549	367	459
Construction Duration in Days - Alt D	-	1,410	390	1,403	1,403	1180	167	950	-	650	530	1,525	800	1,445	1,175
Equipment	**Total Equipment Days per Feature**														
Backfill loader	-	-	-	-	-	-	-	149	-	-	-	-	934	-	-
Backhoe					1,470										
Bobcat	-	-	316	-	-	-	-	-	-	-	-	-	-	-	-
Bulldozer	9,402	17,740	116	279	9,770	1,760	1,336	13,650	-	32	852	1,165	3,086	8	1,165
Compactor	8,136	15,350	-	156	-	-	-	796	-	159	66	200	934	-	200
Concrete material trucks	912	1,720	-	-	-	-	-	472	-	-	-	-	224	-	-
Concrete pumper	1077	2033	-	-	280	306	-	22	-	-	-	104	-	29	104
Concrete trucks	343	648	66	-	2,246	1,030	-	176	-	156	-	416	83	154	416
Crane	-	-	-	-	1,000	350	-	-	40	-	-	200	1,500	474	200
Pile driver/drill rig	1,035	1,952	-	-	105	-	-	85	-	-	-	-	-	95	-
Dump truck	440	830	474	123	6,775	600	-	8	-	768	-	1,250	8,670	14	1,250
Excavator loader	-	-	-	-	-	-	-	-	-	-	152	-		-	-
Excavator	-	-	-	-	26	-	-	-	-	-	-	-	400		-
Fork lift	47	89	121	-	-	510	-	59	40	-	140	400	1,500	82	400
Fuel truck	1,880	3,548	312	93	1,126	552	167	570	-	335	185	333	967	57	333
Grader	4,068	7,675	28	104	2,104	572	-	398	-	-	33	200	467	40	200
Generator	43	81	33		500	200		22	80	156		104	583		104
Grout pump	-		-	-	-	-	-	170	-	-	-	-	-	-	-
Highway trucks	24,023	45,328	282	-	5,011	1,172	16	4,036	30	680	700	1,760	5,190	810	1,760
Jacking equipment	-	-	-	-	-	-	-	-	-	-	-	-	600	-	-
Loader	1,888	3,563	158	41	1,235	400	-	4	-	192	-	125	-	103	125
Material trucks	-	-	-	-	-	2,736	-	-	-	-	-	-	-	-	-
Off-road trucks	14,755	27,840	-	-	4,560	-	-	1,490	-	-	1,520	-	-	-	-
Paving machine	-	-	22	5	80	-	-	-	-	33	20	-	-	-	-
Pipe fabrication equipment	-	-	-	-	-	-	-	-	-	-	-	-	1,000	-	-
Pipe transp. truck	-	-	-	-	-	-	-	-	-	-	-	-	1,100	-	-
Pull truck	-	-	-	-	-	-	-	-	-	-	-	-	-	192	-
Roller	-	-	50	10	925	-	-	-	-	66	-	-	-	-	-
Scissor lift	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-
Scraper	3,604	6,800	-	147	8,736	3,090	2,672	11,460	-	138	652	1,165	13,734	-	1,165
Water trucks	3,761	7,096	144	191	2,252	352	334	2,280	-	205	215	466	967	101	466
Welding truck	-	-	-	-	-	294	-	-	-	-	-	-	-	-	-

[a]Total number of equipment days for Sites Reservoir and Dams under Alternative A are proportionately less than total equipment days under the other alternatives, due to the smaller reservoir size.

[b]The total equipment days per facility are the same for other facility for all alternatives. However, the construction duration in days for Alternative D are different for some of the features, as indicated.

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3.2.1.1 Access Routes

Traffic-generating construction activities associated with the Project would include trucks hauling equipment and materials to and from the worksites and the daily arrival and departure of the construction workers. Construction traffic on local roadways would include dump trucks, bottom-dump trucks, concrete trucks, flatbed trucks for delivering construction equipment and permanent Project equipment, pickups, water trucks, equipment maintenance vehicles, and other delivery trucks. Dump trucks and bottom-dump trucks would be used for earth-moving and clearing, removal of excavated material, and import of other structural and paving materials. Other delivery trucks would deliver heavy construction equipment, job trailer items, concrete forming materials, reinforcing steel and structural steel, piping materials, foundation piles and sheet piling, sand and gravel from offsite sources, new facility equipment, and other miscellaneous deliveries.

Table 3-21 presents the anticipated typical construction access routes to be used for access in the construction to some of the major Project features (routes are illustrated on Figures 3-8A, 3-8B, and 26-1):

Table 3-21
Expected Roadway Access Routes to Project Facilities

Project Feature	Access Route
Sites Reservoir Inundation Area (northern area)	From I-5, travel west on County Road 68, turn south on County Road D, turn west on County Road 69, and continue straight
Sites Reservoir Inundation Area (central area)	From I-5, travel west on Maxwell Sites Road
Sites Reservoir Inundation Area (southern area)	From I-5, travel west on Maxwell Sites Road, turn left on Sulphur Gap Road (new permanent), and turn right on Huffmaster Road
Sites Dam	From I-5, travel west on Maxwell Sites Road
Golden Gate Dam	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, turn left on Eastside Road (new permanent), and turn right on new permanent O&M road From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road, and turn left on new permanent O&M road
Saddle Dams	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, continue straight on North Road (new permanent) for Saddle Dams 7, 8, and 9, or turn left from North Road onto Saddle Dam Road (new permanent) for Saddle Dams 1, 2, 3, 4, and 5, or turn left from North Road onto new permanent O&M road for Saddle Dam 6, or turn left from County Road 69 onto Eastside Road (new permanent) and turn right on new permanent O&M road for the Golden Gate Saddle Dam (Saddle Dam 10) From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road and turn left on new permanent O&M road
Saddle Dam Recreation Area Saddle Dam Road	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, continue straight on North Road (new permanent), and turn left on Saddle Dam Road (new permanent)

Project Feature	Access Route
Temporary Northern Bypass Road	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, continue straight on North Road to the vicinity of Saddle Dam No. 5, continue west and southwest on the paved temporary bypass road to the intersection with Sites Lodoga Road on the west side of the reservoir
Lurline Headwaters Recreation Area Lurline Road	From I-5, travel west on Maxwell Sites Road, turn left on Sulphur Gap Road (new permanent))
Antelope Island Recreation Area	From I-5, travel west on Maxwell Sites Road, turn left on Sulphur Gap Road (new permanent), turn right on Huffmaster Road, and turn left on new temporary construction road
Stone Corral Recreation Area Stone Corral Road	From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road (new permanent), turn left on Stone Corral Road (new permanent), and turn left on Stone Corral Recreation Area Road (new permanent)
Peninsula Hills Recreation Area Peninsula Road	From I-5, travel west on Maxwell Sites Road to Sites Lodoga Road, and turn right on Peninsula Road (new permanent campground spur road) From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road (new permanent), turn left on Stone Corral Road (new permanent), across the South Bridge (new permanent) onto Sites Lodoga Road, and turn right on Peninsula Road (new permanent campground spur road)
South Bridge	From I-5, travel west on Maxwell Sites Road, and turn right on Peterson Road to reach central footings (this route is only available if the bridge is constructed before Sites Dam, which will block access on Maxwell Sites Road) From I-5, travel west on Maxwell Sites Road and continue straight on Sites Lodoga Road to reach the western approach/footings From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road (new permanent), and turn left on Stone Corral Road to reach the eastern approach/footings
Com Road	From I-5, travel west on Maxwell Sites Road, turn left on Com Road (new permanent) at the crest road of Sites Dam From I-5, travel west on Maxwell Sites Road, turn left on Sulphur Gap Road (new permanent), and turn right on Com Road (new permanent)
Eastside Road Sites Pumping/Generating Plant Field Office Maintenance Yard	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, and turn left on Eastside Road (new permanent) From I-5, travel west on Maxwell Sites Road and turn right on Eastside Road (new permanent)
Sulphur Gap Road	From I-5, travel west on Maxwell Sites Road, and turn left on Sulphur Gap Road (new permanent)
North Road	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, continue straight on North Road (new permanent) From I-5, travel west on Maxwell Sites Road, and turn right on Eastside Road (new permanent) and follow to North Road

Project Feature	Access Route
Holthouse Reservoir Complex Holthouse Reservoir Electrical Switchyard	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, turn left on Eastside Road (new permanent), turn left on access road on south side of Funks Reservoir From I-5, travel west on Maxwell Sites Road and turn right on Eastside Road (new permanent), turn right on access road on south side of Funks Reservoir
Sites Electrical Switchyard Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, turn left on Eastside Road (new permanent), and turn left on new permanent O&M road From I-5, travel west on Maxwell Sites Road, turn right on Eastside Road (new permanent), turn right on new permanent O&M road
Sites Reservoir Inlet/Outlet Structure	From I-5, travel west on Maxwell Sites Road, turn left onto Sulphur Gap Road, to Huffmaster Road, to Peterson Road
GCID Main Canal Facilities Modifications Headgate Modifications Railroad Siphon Modifications	From I-5, travel east on SR 32 and turn left on Canal Road From I-5 northbound, exit County Road 53, immediately turn left onto SR 99, and proceed 1.1 miles north to the intersection with the GCID Main Canal. Turn right at GCID Main Canal; the railroad siphon is approximately 200 feet east of SR 99
GCID Main Canal Connection to the TRR TRR TRR Pumping/Generating Plant TRR Electrical Switchyard GCID Main Canal Connection to the TRR	From I-5, travel west on Delevan Road, and turn left on McDermott Road or turn left on Noel Evan Road
TRR Pipeline TRR Pipeline Road Delevan Pipeline Electrical Switchyard	From I-5, travel west on Delevan Road, turn left on McDermott Road, turn right on temporary construction access road
Delevan Pipeline (western portion) Sites/Delevan Overhead Power (western portion)	From I-5, travel west on Delevan Road, then turn left on Sutton Road, McDermott Road, or County Road D
Delevan Pipeline Intake Facilities Delevan Pipeline Discharge Facility Delevan Pipeline (eastern portion) Delevan Overhead Power Line (eastern end) Delevan Overhead Power Line (northern portion of Alternative D north-south alignment on SR 45)	From I-5, travel east on Maxwell Road, and turn left on SR 45 From I-5, travel east on SR 162, and turn right on SR 45
Delevan Pipeline (central portion) Delevan Overhead Power Line (central portion)	From I-5, travel east on Maxwell Road, and turn left on Four Mile Road or Two Mile Road From I-5, travel east on Delevan Road, and turn right on Four Mile Road or Two Mile Road
Delevan Overhead Power Line (northern portion of Alternative D north-south alignment on SR 45)	From I-5, travel east on Maxwell Road, and turn left on SR 45
Delevan Overhead Power Line (southern portion of Alternative D north-south alignment on SR 45)	From I-5, travel east on Maxwell road and turn right on SR 45

Project Feature	Access Route
Delevan Pipeline (far western portion)	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, and turn left on Eastside Road (new permanent) From I-5, travel west on Maxwell Sites Road, and turn right on Eastside Road (new permanent)
Borrow Areas (Generally Within the Reservoir Inundation Area or Adjacent on Logan Ridge)	From I-5, travel west on County Road 68, turn left on County Road D, turn right on County Road 69, and turn left on Eastside Road (new permanent) From I-5, travel west on Maxwell Sites Road, turn left on right on Eastside Road (new permanent) From I-5, travel west on Maxwell Sites Road, turn left on Sulphur Gap Road (new permanent), turn right on Lurline Road (new permanent, detour during construction), turn right on Huffmaster Road, and travel straight on Peterson Road From I-5, travel west on Maxwell Sites Road

Notes:

I = Interstate Freeway
O&M = Operations and maintenance
SR = State Route

Project-related construction personnel and highway truck trips are identified in Table 3-22. Of the Project construction-related trips, construction worker trips would compose the majority. Construction workers would likely commute to construction sites from regional population centers, including Maxwell, Willows, Orland, Williams, and Colusa, and from other northern California counties when specialty trades or skillsets are not available regionally. The number of construction workers required during peak construction of Project facilities varies by alternative, resulting in different trip distributions for each alternative.

Table 3-22
Project-related Construction Personnel and Highway Truck Trips

Facility	Total Highway Truck Trips	Construction Days	Highway Truck Trips per Day	Total Personnel Trips[b]	Personnel Trips per Day[b]	Construction Trips per Day
Sites Reservoir Inundation Area and Dams	235,240	1,523	154	969,664	637	**868**
Recreation Facilities	2,290	501	5	33,626	67	**74**
South Bridge, Gravel Roads, and Paved Roads	25,055	961	26	297,436	310	**349**
Inlet/Outlet Structure, Tunnel, and Sites P/G Plant	19,540	332	59	56,260	169	**258**
Holthouse Reservoirs Sediment Removal	80	114	1	12,358	108	**109**
Holthouse Reservoir Modification	22,540	566	40	295,708	522	**582**
GCID Main Canal and Headworks Modifications	3,400	509	7	41,608	82	**92**
TRR	3,500	334	10	54,544	163	**179**
TRR Pumping Plant	8,800	874	10	255,200	292	**307**

Facility	Total Highway Truck Trips	Construction Days	Highway Truck Trips per Day	Total Personnel Trips[b]	Personnel Trips per Day[b]	Construction Trips per Day
TRR and Delevan Pipelines	37,910	376	101	55,080	146	**298**
Delevan Intake & P/G Plant	8,800	874	10	257,752	295	**310**
Substations, Switchyards, and Overhead Power Lines	6,810	251	27	49,712	198	**239**
Total Peak Construction Trips per Day						**3,665**

[a]Assumes multiplier of 1.5

[b]Assumes one incoming and one outgoing trip per worker

Notes:

GCID = Glenn Colusa Irrigation District
P/G = pumping and generating
TRR = Terminal Regulating Reservoir

3.2.2 Facility Operation and Maintenance

Project facility operations and maintenance activities would include any activities that must occur to operate and maintain each facility. Operation activities include those related to the movement of water (such as proposed Sites Reservoir level fluctuations, or the intake or release of water through the proposed Delevan Pipeline Intake/Discharge Facilities), the generation/transmission of electricity, the use of roads during operations and maintenance activities, and the recreation activities that would be associated with operations of Sites Reservoir.

Maintenance for the Project facilities would consist of activities such as debris removal, dredging, vegetation control, rodent control, erosion control and protection, routine inspections (dams, tunnels, pipelines, pumping/generating plants, inlet/outlet works, fence, signs, gates), painting, cleaning, repairs, and other routine tasks to maintain facilities in accordance with design standards after construction and commissioning. Routine visual inspection of the facilities would be conducted to monitor performance and prevent mechanical and structural failures of Project elements. Maintenance activities associated with proposed river intakes could include cleaning, removal of sediments, debris, and biofouling materials. These maintenance actions could require suction dredging or mechanical excavation around intake structures; dewatering; or use of underwater diving crews, boom trucks or rubber wheel cranes, and raft- or barge-mounted equipment.

Proposed operations and maintenance activities could occur on a daily, annually, periodically (as needed), and long-term basis. It is estimated that 45 operations and maintenance workers would be needed to perform operations and maintenance activities (based on 3 shifts per day). Table 3-23 shows the estimated equipment and hours of operation for operations and maintenance of the Project facilities for the action alternatives.

Table 3-23
Estimated Equipment Hours for Operation and Maintenance of Sites Reservoir Project

Equipment	Reservoirs, Recreation Facilities, Dams, Roads, Bridges		Intake and Outlet Facilities, Pumping and Generating Plants		Electrical Switchyards and Overhead Power Lines		Tunnels and Pipelines		Estimated Total Hours/Year of Use per Type of Equipment
	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	
Backhoe	4	520	1	520	1	20	1	10	2,630
Bobcat	1	520	1	520	1	20	1	10	1,070
Bulldozer	2	520	1	520	1	20	1	10	1,590
Dump Truck	1	1040	1	260	-	-	1	10	1,310
Excavator	1	24	-	-	-	-	-	-	24
Portable Generator	4	100	4	100	-	-	4	100	1,200
Grader	1	16	1	16	-	-	-	-	32
4WD Vehicle	2	5,050	2	3650	2	20	2	20	17,480
Tractor Mower	2	520	2	520	1	20	1	10	2,110
Motor Boat	2	780	1	520	-	-	1	10	2,090
All-terrain Vehicle	4	200	-	-	-	-	-	-	800
Sedans/Pickups (On-Site)	4	1000	-	-	-	-	-	-	4,000
Pump truck	1	150	-	-	-	-	-	-	150
Fork lift	3	500	-	-	-	-	-	-	1,500
Front End Loader	1	300	-	-	-	-	-	-	300
Air compressor	2	50	1	50	-	-	-	-	150
Water truck	1	250	-	-	-	-	-	-	250
Flatbed/Boom truck	2	250	1	250	-	-	-	-	750

Equipment	Reservoirs, Recreation Facilities, Dams, Roads, Bridges		Intake and Outlet Facilities, Pumping and Generating Plants		Electrical Switchyards and Overhead Power Lines		Tunnels and Pipelines		Estimated Total Hours/Year of Use per Type of Equipment
	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	Average Number of Piece of Equipment	Estimated Hours/Year of Use per Piece of Equipment	
Portable Welders	2	200	1	100	-	-	1	100	600
Scissor Lift	1	150	1	50	-	-	-	-	200
Longer-term Maintenance	One boat-operated dredge and 1 dump truck for 60 hours every 7 -10 years	One boat-operated dredge, 1 crane, and 1 dump truck for 250 hours every year	-	-	-	-	-	-	Variable

Note:

4WD = Four-wheel drive

3.3 Diversion and Reservoir Operations Common to All Action Alternatives

The operations evaluated in this environmental document for all alternatives were developed to provide a range of statewide benefits including ecosystem enhancement actions; water supply reliability improvement for statewide agricultural, urban, and environmental uses (including increasing the survival of anadromous and endemic fish); and improve water quality in the Delta. Most the alternatives would also provide flexible hydropower generation to support integration of renewable energy sources. The Project is intended to improve overall system reliability by making more water available at any given time for release and use for a variety of potential benefits.

The Project is intended to be operated in a cooperative manner with Central Valley Project (CVP) and State Water Project (SWP) facilities to assist in providing additional storage and release capability to support improving stream temperatures, in-stream habitat, supply deliveries (including refuges), instream flows, and water quality requirements to the extent possible each year as determined most needed. Among existing system constraints, the maintenance of the cold-water pool in various existing reservoirs to support suitable (and improved) in-river fishery habitat conditions is a key operational concern that today is increasingly difficult to meet, particularly during dryer years. In addition, providing water to support improved habitat in the Yolo and Sutter bypasses is also increasingly becoming a potential priority.

Providing water to improve storage conditions in CVP and SWP facilities is a primary objective of the proposed alternatives. The Project would be operated to make releases from Sites Reservoir in a cooperative manner with CVP/SWP releases from Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. Often, and especially in drought (driest periods) hydrologic conditions, proposed releases from Sites Reservoir would be made to meet an otherwise CVP or SWP obligation. Sites Reservoir releases would allow an equivalent amount of water to be retained in CVP or SWP storage while meeting requirements for minimum instream flow objectives and Delta salinity control objectives. Through this reduction in CVP and SWP facility releases, storage could be conserved in Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. This increase in storage conditions would substantially improve operational flexibility to provide water for the environment and meet the Project's primary objectives.

All alternatives achieve multiple objectives over a range of hydrologic and operational conditions. Operations in any given year would be a function of the current year hydrology and conditions resulting from the previous year's hydrology and operations. The alternatives provide operational flexibility to provide water in Sites Reservoir storage to the highest priority needs on an adaptive management basis. Implementation of actions to meet the various objectives would be continually evaluated in response to changing system parameters (such as reservoir storage), ecological needs, forecasts of future hydrologic and atmospheric conditions, and system operations.

Summaries of proposed operations for Alternatives A, B, C, C_1, and D are provided in Table 3-24. These tables also show the potential timing and type of operation proposed and evaluated for the range of hydrologic conditions, and the assumed priority of each operation within each class of the hydrologic conditions. The season in which the operation would occur is also described. A final operations plan will be refined based on the findings of the California Water Commission regarding the Sites Project WSIP application, and the defined related benefits and obligations. These findings are expected in late 2017 or early 2018.

Table 3-24
Description of Proposed Seasonal Schedule for Project Operations

Objective	Detail of Operation	Priority of Operation[a]	Year Type Most Suitable for Operation[b]	Months Most Suitable for Operation[c]											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
General Operation															
Conveyance (All Alternatives)	Diversions at Red Bluff (Tehama-Colusa Canal), at Hamilton City (GCID Main Canal) and at the proposed Delevan Pipeline could occur in any month. Diversions of flows would only be allowed once SWRCB Water Right Decision 1641 (D-1641) (SWRCB, 1999), CVPIA 3406(b)(2), 2008 Biological Opinion (USFWS, 2008) and 2009 Biological Opinion (NMFS, 2009) requirements were met and SWP Article 21 demands were satisfied, and other Delta flow diversions (e.g., Freeport Regional Water Project, Los Vaqueros Reservoir, cities of Fairfield, Vacaville, and Benicia) were satisfied. Diversions would be restricted by Sacramento River bypass criteria at Red Bluff, Hamilton City, Wilkins Slough, and Freeport. Symbols highlight the period in which diversion operations would occur, with the November through March season having more symbols.	N/A	N/A	++	++	++	+	+	+				+	++	++
Seasonal Storage Operation (All Alternatives)	Fill Sites Reservoir during flow events throughout the winter and spring and drain during peak release periods throughout the summer and fall. The months in which the high and low storage points would occur in the typical seasonal cycle are indicated.	N/A	N/A	Fill Cycle High Point			Drain Cycle Low Point							Fill Cycle	
Water Supply Operations															
CVP Contractors (Alternatives A, B, C, C_1)	Improve water supply reliability for CVP contractors through integrated operations with CVP facilities. Symbols indicate the typical agricultural diversion pattern.	AVG-4	AN, BN, D				++	+	+	+	++	+	+		
SWP Contractors (Alternatives A, B, C C_1)	Improve water supply reliability for SWP contractors through integrated operations with SWP facilities.	DP-1	BN, D, C				++	++	+	++	++	+	+		
Sites Project Authority (including (Alternative D)	Provide storage releases to participating TCCA Districts on an as-needed basis to supplement CVP Agricultural Water Service Contract deliveries. Provide storage to GCID and Reclamation District 108 to supplement CVP Settlement Contract deliveries. Provide supplemental water supplied to Project participants outside the Sacramento Valley to improve water supply reliability	Authority-1	AN, BN, D, C				++	++	++	++	++	+	+		
Incremental Level 4 Water Supply for Wildlife Refuges (All Alternatives)	Provide water toward meeting Incremental Level 4 wildlife refuge water needs north-of-the-Delta and south-of-the-Delta to supplement refuges supplies up to Level 4 criteria (CVPIA). Symbols highlight periods in which provision of water would occur.	AVG-3	AN, BN, D									++			
Water Quality Operation															
Delta Water Quality (Alternatives A, B, C, C_1)	Improve water quality conditions at urban/municipal and industrial intakes by augmenting Delta outflow above base D-1641 operations for up to 6 months. Symbols highlight periods in which Delta outflow benefits could be augmented.	AVG-1	AN, BN, D							++	++	++	++	++	+
Water Quality (Alternative D)	Upstream release actions would improve water quality conditions by augmenting Delta inflow and outflow. Operations could augment Delta flows above base D-1641 operations for up to 6 months. Symbols highlight period in which Delta benefits could be augmented.	AVG-1	AN, BN, D							++	++	++	++	++	+
Hydropower Operation															
Flexible Hydropower Generation (All Alternatives)	Include dedicated pump/generation facilities with a dedicated afterbay/forebay of 6,500 acre-feet allowing more than 30 hours per week of uninterrupted operation and generation.	N/A	ALL					+	++	++	++	++	++	+	+
Ecosystem Enhancement Storage Account (EESA) Actions/Operation															
EESA-1: Shasta Coldwater Pool (All Alternatives)	Improve the reliability of cold-water pool storage in Shasta Lake to increase operational flexibility to provide suitable water temperatures in the Sacramento River. This action would operationally translate into the increase of Shasta Lake May storage levels, and improved retention of cold-water pool storage, with particular emphasis on Below Normal, Dry, and Critical water year types.	DP-1	BN, D, C					+	++	++	++	++			
EESA-2: Sacramento River Flows for Temperature Control (All Alternatives)	Provide releases from Shasta Dam of appropriate water temperatures, and subsequently from Keswick Dam, to improve water temperatures year-round at levels suitable for all species and life stages of anadromous salmonids in the Sacramento River between Keswick Dam and Red Bluff Pumping Plant, with particular emphasis on the months of highest potential water temperature-related impacts (i.e., July through November) during Below Normal, Dry, and Critical water year types.	DP-2	BN, D, C						+	++	++	++	+	+	

Objective	Detail of Operation	Priority of Operation[a]	Year Type Most Suitable for Operation[b]	Months Most Suitable for Operation[c]											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EESA-3: Folsom Lake Cold Water Pool (All Alternatives)	Increase the availability of cold-water pool storage in Folsom Lake, by increasing May storage and retaining cold-water pool storage, to allow additional operational flexibility to provide suitable water temperatures in the lower American River. This action would use additional cold-water pool storage by providing releases from Folsom Dam (and subsequently from Nimbus Dam) to help provide water temperatures at levels suitable for juvenile steelhead over-summer rearing and fall-run Chinook salmon spawning in the lower American River from May through November during all water year types.	DP-2	D, C					+	++	++	++	++	+	+	
EESA-4: Stabilize American River Flows (All Alternatives)	Stabilize flows in the lower American River to minimize dewatering of fall-run Chinook salmon redds (i.e., October through March) and steelhead redds (i.e., January through May), and reduce juvenile anadromous salmonids isolation events, particularly from October through June. Reduce the reliance upon Folsom Lake as a "real-time first response facility" to meet Delta objectives and demands, particularly from January through August, to reduce flow fluctuation and water temperature-related impacts to fall-run Chinook salmon and steelhead in the lower American River.	DP-2	ALL	++	++	++	++	++	+	+	+		+	+	+
EESA-5: Habitat Improvement (Summer/Fall)[e] (All Alternatives)	Upstream release actions could provide supplemental flow during summer and fall months (i.e., May through December) to improve X2 position and increase estuarine habitat, reduce entrainment, and improve food availability for anadromous fishes and other estuarine-dependent species (e.g., delta smelt, longfin smelt, Sacramento splittail, starry flounder, and *Crangon franciscorum*). Shading highlights period in which flow would be augmented (operation coordinated with Water Quality action).	AVG-2	ALL					+	+	++	++	++	++	++	+
EESA-6: Lake Oroville Coldwater Pool (All Alternatives)	Improve the reliability of cold-water pool storage in Lake Oroville to improve water temperature suitability for juvenile steelhead and spring-run Chinook salmon over-summer rearing and fall-run Chinook salmon spawning in the lower Feather River from May through November during all water year types. Provide releases from Oroville Dam to maintain water temperatures at levels suitable for juvenile steelhead and spring-run Chinook salmon over-summer rearing and fall-run Chinook salmon spawning in the lower Feather River. Stabilize flows in the lower Feather River to minimize redd dewatering, juvenile stranding, and isolation of anadromous salmonids.	DP-2	BN, D, C					++	++	++	++	++	+	+	+
EESA-7: Stabilize Sacramento River Fall Flows (All Alternatives)	Stabilize flows in the Sacramento River between Keswick Dam and the Red Bluff Pumping Plant to minimize dewatering of fall-run Chinook salmon redds (for the spawning and embryo incubation life stage periods extending from October through March), particularly during fall months. Avoid abrupt changes. Operations would be limited to not adversely impacting cold-water pool operations in dry and critical years. Shading highlights period of greatest effect on stabilization or flows on a daily basis.	AVG-1	AN, BN, D	++	+	+						+	++	++	++

[a]Priority of operation "DP" indicates that the operational priority has a driest period's emphasis and "AVG" indicates an average-to-wet hydrologic emphasis. The number 1-4 indicates priority within the associated hydrologic emphasis. "N/A" indicates that operations are not or cannot be easily defined within the priority structure of the scenario. "Authority" indicates Sites Project Authority operation on an as-needed basis subject to storage availability.

[b]Year type most suitable for operation is the D-1641 40-30-30 year types that are reflected in operations studies; operations in these year types occur when supplies would be available in Sites Reservoir to support the operation, when the operations criteria in the scenario allow for prioritization of the operations, and when conditions are suitable for developing the benefit associated with the operation.

[c]"Two symbols (++) in the cells indicate months in which conditions would be most suitable to the operations; one symbol (+) in the cell indicates the months that would be less suitable to the operations; operations in these months would occur when supplies are available in Sites Reservoir to support the operation, when the operations criteria in the scenario allow for prioritization of the operations, and when conditions are suitable for developing the benefit associated with the operation.

[d]Implementation of this action would include increasing the reliability of floodplain inundation in the Sutter and Yolo bypasses. In coordination with the operation of proposed bypass water control devices (e.g., the proposed Fremont Weir Adult Fish Passage Modification Project), this action would make water available to facilitate better management of the frequency, duration, and timing of inundation within the floodplain of the Sacramento River and the Sutter and Yolo bypasses. This action could provide flow to create floodplain inundation, extend the duration of floodplain inundation, or influence the timing of floodplain inundation. Water made available through Sites Reservoir releases could be used to temporarily increase or continue the flow of water through the weirs for the purpose of incrementally improving floodplain rearing for juvenile salmonids, spawning Sacramento splittail, and other sensitive aquatic species.

[e]Implementation of this action is anticipated to be lower priority and would likely not be implemented in lieu of other actions such as increasing the reliability of floodplain inundation in the Sutter and Yolo bypasses.

Notes:
AN = Above normal
AVG = Average
BN = Below normal
C = Critical
CVPIA = Central Valley Project Improvement Act
D = Dry
DP = Driest periods
GCID = Glenn-Colusa Irrigation District
N/A = not applicable
NMFS = National Marine Fisheries Service
TAF = thousand acre-feet
SWRCB = State Water Resources Control Board
USFWS = U.S. Fish and Wildlife Service

3.3.1 Operational Scenario

The proposed operational scenario for each alternative incorporates three primary components:

- Operating criteria for diversion of water when all other regulatory criteria are met (including diversion rate in cfs, duration of the diversion, the season of diversion and the water year type of the diversion) from the Sacramento River to fill the Sites Reservoir
- Operating criteria for timing and rate of releases of water to achieve the primary objectives of the Project (and associated benefits) in specific year types (such as drought or driest periods) and other hydrologic conditions
- Cooperative operations[10] of the Project with SWP and CVP operations and facilities

The operation scenarios incorporate operational flexibility to adapt to a range of hydrologic conditions, address various future uncertainties, and allow for consideration of a range of future water management actions.

3.3.1.1 Diversions to Sites Reservoir

The proposed Sites Reservoir would be filled through the diversion of Sacramento River water that originates from unregulated tributaries to the Sacramento River downstream from Keswick Dam. These unregulated tributaries contribute over 3 MAF of flow to the Sacramento River on an average annual basis. Less than 1 percent of diversions to Sites Reservoir are assumed to be provided by flood releases or spills that flow through Lake Shasta. Sacramento River water would be diverted at the existing Hamilton City and Red Bluff diversion locations, described in detail above for all alternatives; Sacramento River water would also be diverted via a new Delevan intake and pipeline for all alternatives other than Alternative B. Flows available for diversion are considered river flows, in addition to those required to meet the following:

- Senior downstream water rights, existing CVP and SWP and other water rights diversions including SWP Article 21 (interruptible supply), and other more senior flow priorities (diversions associated with Freeport Regional Water Project and existing Los Vaqueros Reservoir)
- Existing regulatory requirements including State Water Resources Control Board (SWRCB) Water Right Decision 1641 (SWRCB, 1999), CVPIA 3406(b)(2), the 2008 Biological Opinion (USFWS, 2008), and the 2009 Biological Opinion (NMFS, 2009), and other instream flow requirements
- Flow conditions needed to maintain and protect anadromous fish survival and Delta water quality

A description of proposed minimum bypass flow requirements to protect existing and future water uses are provided below.

3.3.1.2 Sites Reservoir Diversion Bypass Flow Protection

Sacramento River flow diversions to Sites Reservoir would only take place when flow monitoring indicates that bypass flows are present in the river due to storm event flows. Several existing and additional proposed bypass flow criteria were assumed at specified locations, as part of the Project. These

[10] The term "cooperative operations" refers to the proposed approach that water from Sites Reservoir could be used, in some cases, as a substitute for water from these other reservoirs. The needs and uses of the CVP and SWP systems could be enhanced by operating Sites Reservoir (a new source of water storage) in cooperation with the other reservoirs.

flow criteria are designed to make certain that available water would be diverted into Sites Reservoir to maintain and protect existing downstream water uses, as follows.

- A bypass flow of 3,250 cfs downstream from Red Bluff Diversion Dam must be present to maintain flows in the upper Sacramento River that are required in SWRCB WR 90-5 to prevent dewatering salmonid redds and maintain water temperatures. Diversions at Red Bluff Pumping Plant for filling Sites Reservoir would only be allowed when flows in the river were above the 3,250 cfs bypass flow criteria.
- Diversions at the Hamilton City intake for Glenn-Colusa Canal currently require a bypass flow of 4,000 cfs to prevent fish entrainment. Diversions at Red Bluff Pumping Plant and Glenn-Colusa Canal intake for filling Sites Reservoir would only be allowed when flows in the river were above the 4,000-cfs bypass flow requirement downstream from Hamilton City.
- Diversions for filling Sites Reservoir would only be allowed when flows below Wilkins Slough were above 5,000 cfs, given the current minimum flow requirements. Wilkins Slough Navigation Control Point minimum flows currently range from 3,250 to 5,000 cfs, depending on hydrologic conditions.
- Diversions for filling Sites Reservoir would only be allowed when a Sacramento River flow of 15,000 cfs is present at Freeport in January; 13,000 cfs in December and February through June; and 11,000 cfs in all other months. This flow threshold was designed to protect and maintain existing downstream water uses and water quality in the Delta.

3.3.1.3 Diversions to Fill Sites Reservoir Storage

Diversions of available Sacramento River water to Sites Reservoir using existing TCCA and GCID conveyance facilities could occur at any time during the year, given the flow conditions described above are present in the river. Deliveries for TCCA and GCID service areas would have first priority at the existing TCCA and GCID intakes with diversions to Sites Reservoir using the unused capacities of the two canals.

Diversions through the proposed Delevan Pipeline (all alternatives other than Alternative B) could also occur at any time of the year assuming Sacramento River flow conditions are above the bypass flow criteria described above. In summer months, preference would generally be given to Sites Reservoir releases to the river, resulting in limited diversions to storage, given the pipeline could only convey flows in one direction at a time.

The annual diversion amount would range between zero in critical and dry years, to more than 1,000 thousand acre-feet (TAF) in wetter years. Based on modeling results, the average annual diversions for Sites Reservoir would range from 480 to over 540 TAF of available Sacramento River flow, depending on the alternative. The majority of diversions would generally occur in December through March of wet and above normal water years, but could occur at any time during the year if the flow criteria described above could be met and capacity were to exist within the diversion facilities described below.

The existing TCCA and GCID diversion facilities and main canals would be used for all alternatives, and a new proposed Delevan Pipeline and Delevan Pipeline Intake/Discharge Facilities (for all alternatives other than Alternative B) would be used to divert and convey water to the proposed reservoir. Total river diversions would be no greater than 5,900 cfs at any one time, in total, across the three diversion points. Deliveries for TCCA and GCID service areas would have first priority with diversions to Sites Reservoir using the unused capacities of the two canals. Water provided for local uses would be conveyed through existing or proposed upland facilities. Both the TCCA and GCID diversion facilities have state-of-the-art fish screens in place and would divert in months when water was available according to the criteria identified above, depending on year type and Sites Reservoir levels. The proposed Delevan Pipeline diversion facility would be constructed for Alternatives A, C, and D with a similar fish screen that would meet federal and state criteria and divert water in a similar manner, according to a prescribed operational approach accounting for the same criteria identified above.

Tehama-Colusa Canal Authority Red Bluff Pumping Plant and Canal – The Red Bluff Pumping Plant, located on the Sacramento River near Red Bluff, would be used as the primary diversion point and would have a total conveyance capacity to divert up to 2,100 cfs after the installation of two additional 250 cfs pumps to the existing pump grouping at the Red Bluff Pumping Plant. Any unused capacity remaining after meeting existing agricultural demands would be used, as necessary, to convey water to fill Sites Reservoir by conveying water via the Tehama-Colusa Canal. Approximately 50 to 60 cfs of the Tehama-Colusa Canal capacity is assumed to be used for existing winter operations.

Glenn-Colusa Irrigation District Hamilton City Pumping Plant and Main Canal – The GCID Hamilton City Pumping Plant would be used to divert water from the Sacramento River and the GCID Main Canal used to convey water to Sites Reservoir. This facility has a 3,000 cfs diversion capacity at the Sacramento River intake and the GCID Main Canal capacity at the TRR is 1,800 cfs. Diversions at the GCID diversion facility would be made to supplement those made at the Red Bluff Pumping Plant and the Delevan Pipeline facility described below. Unused Main Canal capacity, remaining after existing agricultural operations, would be used as necessary to convey water to the Sites Reservoir.

Delevan Pipeline Intake/Discharge Facilities (all alternatives other than Alternative B) – The proposed Delevan Pipeline Intake/Discharge Facilities would divert up to 2,000 cfs from the Sacramento River and convey water through the Delevan Pipeline to Sites Reservoir when flows were available. Diversions through the proposed Delevan Pipeline would occur at any time of the year, as needed, in conjunction with the two existing diversions described above, according to the same criteria identified above. It is anticipated in summer months the pipeline would often be used to release flow to the river. Preference would generally be given to release operations resulting in limiting diversions to storage in the summer given the pipeline could only convey flows in one direction at a time.

3.3.1.4 Releases from Sites Reservoir

The Project and each of the alternatives would be operated to achieve a variety of benefits associated with the Project's primary objectives in specific year types and times of year, as determined most needed. A maximum of up to 2500 cfs could be released from the Delevan Pipeline to meet downstream needs. Typical releases would be 1,500 cfs. Additional releases could also be made at Funks Creek, Stone Corral Creek, the TCCA Canal, and the GCID Main Canal to support other downstream uses. In drought conditions, priority operations would include:

- Support improved cold-water pool conservation and stabilize Sacramento River fall flows for improving spawning and rearing successes of anadromous fish
- Provide water to the Cache Slough area via the Yolo Bypass in summer
- Provide for incremental Level 4 refuge deliveries per CVPIA
- Provide water for Site water users North and South of the Delta
- Potentially improve flows to stabilize river flows in the fall to help protect fish habitat

The reservoir outlet structures included in the Project would allow withdrawal of water from the reservoir over a range of depths to manage release temperatures to match Sacramento River temperatures to the extent possible; and, as such, releases would be managed to limit potential temperature effects.

3.3.1.5 Hydropower Generation

Hydropower generation would be an incidental benefit of conveying water through specific Project facilities (for all Project alternatives other than Alternative C_1) and would be influenced by the timing of releases and movement of water and seasonal operational decisions. Four categories of hydropower operations are anticipated:

- Seasonal hydropower as produced by the normal water operations of the Project. As the Project pumps or releases water for its normal operation, power would be consumed or generated by Project hydropower facilities.
- Daily pump-back hydropower operation would be determined by the leftover capacity in the proposed Sites Pumping/Generating Plant and Holthouse Reservoir. When those facilities had capacity, the Sites Reservoir would release water through the Sites Pumping/Generating Plant into Holthouse Reservoir during on-peak electrical times to generate high revenue power. During off-peak times, water would be pumped back into Sites Reservoir.
- The Project alternatives could release water through the Sites Pumping/Generating Plant to generate power to firm up other renewable power sources (such as wind and solar) in times when such sources typically produce less power. Similarly, power could be consumed by pumping water into Sites Reservoir from Holthouse Reservoir when renewable sources peak and the grid has a surplus of power that can be "saved" for later generation when the renewable peak has diminished.
- Hydropower could also reduce greenhouse gas emissions when paired with solar and wind energy. To ensure that the greenhouse gas emissions from construction activities are mitigated within the first 15 years of operation, the Project would: (1) obtain at least 20 percent of the power used for pumping water from the Sacramento River and the proposed Holthouse Reservoir into the Sites Reservoir from wind and/or solar energy, and (2) use at least 20 percent of the Project's generated power and/or served pump load to provide integration services needed to firm up highly variable wind and/or solar generation. The 20 percent integration with wind and/or solar energy goal will be achieved with variable speed pumping-generating units installed at the Sites Reservoir Project pumping/generating plants.

3.3.2 Ecosystem Enhancement Storage Account

Sites Reservoir would be operated in a cooperative manner with other state and federal reservoirs to support ecosystem benefits and enhancements, including actions to increase survival of anadromous and endemic fish populations. Operational actions would include improving conditions related to water temperatures, river flows, and releases to improve Delta water quality.

The operation of Sites Reservoir to provide a variety of ecosystem benefits would allow for the potential development and administration of an ecosystem enhancement storage account, which could be managed by either the Authority or the State to provide water for ecosystem and water quality purposes. Such an account could provide a pool of dedicated storage to manage in cooperation with existing operations to improve cold-water conservation storage, stabilize river flows during critical fisheries periods, increase flows through certain watercourses and/or facilities (e.g., Yolo Bypass), improve water quality, and/or enhance habitat restoration.

During early development of this Project, meetings were held with the Sacramento River Flow Regime Technical Advisory Group. This Technical Advisory Group included environmental advocacy groups, academics, and representatives from federal and California water resource and wildlife agencies (the Technical Advisory Group is described in more detail in Chapter 36 Consultation and Coordination). The Technical Advisory Group was convened in 2007 to identify benefits and potential impacts of the Project to the flow regime of the Sacramento River and related ecosystem processes. Through meetings that continued for more than two years, the group and proponents of Sites Reservoir identified a list of potential operational strategies for the Project that could be used to improve ecosystem conditions related to increased survival of anadromous and endemic fish populations. These operational strategies include operations in cooperation with the Authority and Reclamation for the Project to divert, store, and release water to meet obligations that would otherwise be met through the operations of Shasta Lake, Trinity Lake, Folsom Lake, or Lake Oroville. In this manner, these cooperative operational strategies could improve ecosystem conditions by:

- Improving the reliability of cold-water pool storage in Shasta Lake in May to increase operational flexibility to provide flows in late summer and fall to maintain suitable water temperatures in the Sacramento River, with particular emphasis on Below Normal, Dry, and Critical water year types
- Increasing available water in Shasta Lake to increase operational flexibility to release flows from Keswick Reservoir to maintain appropriate mean daily water temperatures year-round at levels suitable for all species, races, runs, and life stages of anadromous salmonids in the Sacramento River between Keswick Dam and Red Bluff, with particular emphasis on the months of highest potential water temperature-related impacts (i.e., July through November) during Below Normal, Dry, and Critical water year types
- Increasing available water in Shasta Lake to increase operational flexibility to release flows from Keswick Reservoir in a manner to stabilize flows in the Sacramento River between Keswick Dam and the Red Bluff to minimize dewatering of fall-run Chinook salmon redds, especially during spawning and embryo incubation life stage periods from October through March
- Improving the reliability of cold-water pool storage in Folsom Lake in May to increase operational flexibility to provide appropriate flows with suitable water temperatures in the lower American River for juvenile steelhead over-summer rearing and fall-run Chinook salmon spawning from May through November during all water year types
- Increasing available water in Folsom Lake to improve operational flexibility to release flows from Lake Natoma in a manner to stabilize flows in the lower American River to: 1) minimize dewatering of fall-run Chinook salmon redds from October through March; 2) minimize dewatering of steelhead redds from January through May; and 3) reduce the occurrence of stranding of juvenile anadromous salmonids due to isolation events that occur when flows of 4,000 cfs or greater are reduced to less than 4,000 cfs, particularly from October through June
- Improving the reliability of cold-water pool storage in Lake Oroville in the spring to increase operational flexibility to provide appropriate flows with suitable water temperatures in the lower Feather River for juvenile steelhead and spring-run Chinook salmon over-summer rearing and fall-run Chinook Salmon spawning from May through November during all water year types

- Increasing available water in Lake Oroville and Thermalito Reservoir to increase operational flexibility to release flows in a manner to stabilize flows in the lower Feather River to: 1) minimize redd dewatering, 2) minimize juvenile stranding, and 3) reduce the occurrence of isolation or stranding of anadromous salmonids
- Providing water to assist in meeting Incremental Level 4 wildlife refuge water needs north of the Delta and south of the Delta to supplement refuge supplies up to Level 4 criteria (CVPIA).
- Coordinating upstream actions to provide supplemental Delta outflow during summer and fall months (i.e., May through December) to help maintain X2 west of Collinsville and improve flood availability for estuarine species
- Operating in a flexible manner to support storage and associated releases that could be adaptively managed to support operational actions found to produce the greatest benefits over time. Ecosystem-specific objectives could include the release of water through the Colusa Basin Drain into the Yolo Bypass to deliver nutrient-laden water into the Cache Slough area and increase Delta Smelt productivity.
- Operating Sites Reservoir diversions and releases to increase the reliability of floodplain inundation in the Sutter and Yolo bypasses. In coordination with the operation of proposed bypass water control devices (e.g., the proposed Fremont Weir Adult Fish Passage Modification Project), this action would make water available to facilitate better management of the frequency, duration, and timing of inundation within the floodplain of the Sacramento River and the Sutter and Yolo bypasses.

3.4 Proposed Operations by Alternative

Table 3-25 identifies the proposed operations specific to each alternative including diversions, releases, and hydropower generation. Facilities are grouped into "complexes" based on function and location to assist the reader in understanding and tracking facilities by and across alternatives. The proposed complexes include the following:

- Sites Reservoir Complex
- Holthouse Reservoir Complex
- Terminal Regulating Reservoir (TRR) Complex
- Delevan Pipeline Complex
- Overhead Power Lines and Substations,
- Project Buffer

As detailed in Section 3.3 Diversion and Reservoir Operations Common to All Action Alternatives, operations are similar for all alternatives; however, Alternative D includes additional Sites Reservoir priority operations to provide water to meet unmet demands and supplement existing CVP allocations to participating CVP TCCA contractors and CVP Settlement Contractors in the Colusa Basin.

Additional identification and description of the primary facilities associated with each of the alternatives is provided in Section 3.1 Sites Reservoir Project Alternatives.

Table 3-25
Comparison of Project Operations by Alternative

Project Features/Facilities	Alternatives				
	A	B	C	C_1	D
Diversion Facilities (maximum diversion up to 5,900 cfs using any or all diversion facilities)					
Tehama-Colusa Canal Diversion – Red Bluff Pumping Plant (primary diversion point under most conditions; existing)	Up to 2,100 cfs diversion (primarily in wetter years/winter months)	Same as A	Same as A	Same as A	Same as A
GCID Main Canal Diversion – Hamilton City Pumping Plant (existing)	Up to 1,800 cfs diversion (primarily in wetter years/winter months)	Same as A	Same as A	Same as A	Same as A
Delevan Pipeline Intake and Pumping Plant (proposed)	Up to 2,000-cfs diversion (primarily in wetter years/winter months)	No diversion (discharge through Delevan Pipeline only)	Same as A	Same as A	Same as A
Discharge Facilities (maximum discharge up to *5,100* cfs using any or all discharge facilities)					
Delevan Pipeline Discharge Facilities	Up to 2,500-cfs release (primarily in drier years/spring & summer months; power generation)	Same as A	Same as A	No power generation	Same as A
Holthouse Reservoir to Tehama-Colusa Canal	[2,100 cfs]	Same as A	Same as A	Same as A	Same as A
Holthouse Reservoir to Funks Creek	1,500 cfs	Same as A	Same as A	Same as A	Same as A
Terminal Regulating Reservoir to GCID Main Canal	900 cfs	Same as A	Same as A	Same as A	Same as A
Sites Reservoir Complex					
Sites Reservoir Inundation Area	1.3 MAF	1.8 MAF	Same as B	Same as B	(same as B)
Sites Pumping/Generating Plant and Electrical Substation/Switchyard	5,900-cfs pumping 5,100-cfs generating	3,900-cfs pumping (same as A for generating)	Same as A	5,900 cfs (no generation)	Same as A

Project Features/Facilities	Alternatives				
	A	B	C	C_1	D
Holthouse Reservoir Complex					
Holthouse Reservoir	6,500 acre-feet	Same as A	Same as A	Modified Funks Reservoir; 3,372 acre-feet; bypass pipeline to route Tehama-Colusa Canal flows around Funks Reservoir during construction	Same as A
Terminal Regulating Reservoir (TRR) Complex					
Terminal Regulating Reservoir	2,000 acre-feet	Same as A	Same as A	Same as A	1,200 acre-feet
TRR Pumping/ Generating Plant and Electrical Switchyard	1,800-cfs pumping/900-cfs generating	Same as A	Same as A	1,800-cfs pumping (no generation)	Same as A
Delevan Pipeline Complex					
Delevan Pipeline Intake/Discharge Facilities	See above under "Diversion" and "Discharge" facilities	No diversion; see above under "Diversion" and "Discharge" facilities	See above under "Diversion" and "Discharge" facilities	See above under "Diversion" and "Discharge" facilities	See above under "Diversion" and "Discharge" facilities

Notes:

cfs = cubic feet per second
fps = feet per second
I-5 = Interstate 5
MAF = million acre-feet
PG&E = Pacific Gas and Electric
WAPA = Western Area Power Authority

3.5 Environmental Commitments Included as Part of the Project and Alternatives

The following standardized environmental measures, plans, protocols, and BMPs would be incorporated into the Project (for all alternatives), including construction contractor specifications, as appropriate, to avoid or minimize potential impacts during construction and operations/maintenance. These commitments are generally based on current adopted rules and regulations, established regulatory agency plans, policies, or programs, or accepted industry standards:

3.5.1 Worker Environmental Awareness Program

A Worker Environmental Awareness Program (WEAP) would be prepared, and all construction crews and contractors would be required to participate in WEAP training prior to starting work on the Project. The WEAP training will include a review of the special-status species as well as cultural, archaeological, paleontological, and other sensitive resources and areas that could exist in the Project area; the locations of sensitive biological resources and their legal status and protections; measures to be implemented for avoidance of these sensitive resources; and review of other required environmentally related resources. A record of all personnel trained will be maintained.

3.5.2 Environmental Site Assessment

Federal and state regulations and policies, including the Comprehensive Environmental Response, Compensation and Liability Act, All Appropriate Inquiry, California Public Resources Code 21151.4, and the Certified Unified Program administered by the respective county agencies, would require environmental site assessment procedures (due diligence) for future development on or near any potentially hazardous or contaminated sites. A Phase I Environmental Site Assessment (ESA) would be conducted as appropriate for property considered for purchase, transfer, retirement, or sale in fee or easement for the Project. The evaluation would assess the potential for hazardous substance contamination in accordance with all applicable federal, state, and local statutes and regulations. Subsequent actions, such as Phase II ESA and III ESA, would be taken as necessary and appropriate. A Phase II ESA would involve sample collection and analysis to identify and characterize contamination as needed. A Phase III ESA would provide a plan for design and implementation of mitigation or remediation (including, but not limited to, removal of underground storage tanks, drums, buried waste, or other items potentially associated with contamination) and would identify the proper storage, handling, transport, and disposal of designated and hazardous waste if so required.

3.5.3 Construction Management Procedures

Required construction management procedures would be incorporated into all construction contractor specifications to avoid or minimize construction-related impacts, including those on public health and safety, in accordance with applicable federal, state, and local laws and regulations. All adjacent property owners would be notified of Project construction activities prior to initiation of construction. The plan would include the following standard requirements and would be incorporated into the construction specifications for all contractors:

- Informing contractors and subcontractors of work hours, modes and locations of transportation, and parking for construction workers
- Locating overhead and underground utilities

- Obtaining all necessary utilities excavation or encroachment permits
- Staging utility line modifications and relocations in a manner that minimizes interruption of service
- Requiring worker health and safety provisions
- Identifying all approved truck routes, access roads, and management
- Providing stockpiling and staging procedures
- Issuing terms and conditions of all Project permits and approvals
- Providing local and regional emergency response services contact information
- Providing construction notification procedures for Glenn, Colusa, and Tehama county police, public works, fire departments, and other public service providers
- Making all required lighting during construction be directional in nature to minimize glare impacts to humans and wildlife

3.5.3.1 Fire Safety and Suppression

The Authority would incorporate into contract specifications that all contractors would be required to implement onsite BMPs to reduce the potential for accidental fires, including:

- Making sure all motorized equipment used during construction has an approved spark arrestor.
- Preparing a fire safety plan for Glenn and Colusa county review. This plan would include precautions to carry out during high-fire danger, a list of fire-suppression equipment and tools to have on hand, a description of available communications, specifications for the supply of water to have on hand, and descriptions of other actions that would reduce the risk of ignition and facilitate immediate control of an accidental fire.
- Having easily accessible fire-suppression equipment available at all work locations.

3.5.3.2 Construction Equipment, Truck, and Traffic Management

The following measures would be implemented as part of all applicable contractor specifications to minimize potential road and traffic impacts in and near the Project area, related to facility construction, access to all work sites, and hauling of necessary materials:

- Identifying specific haul and access routes with all contractors when multiple facility sites are under construction concurrently, so that Project-generated construction traffic is dispersed to the extent practicable and necessary.
- Installing traffic control devices, as specified in Caltrans' Manual of Traffic Controls for Construction and Maintenance Work Zones, where needed to maintain safe driving conditions, including use of signage to alert motorists of construction activities, potential hazards, and travel detours, as well as the use of flaggers when appropriate.
- Prior to construction, ensuring that the Authority or its contractors would survey and describe the pre-construction roadway conditions of all existing roads to be used for access to Project facilities. Within 30 days after construction is completed, the Authority would survey these same roadways to identify

any damage that has occurred. Roads damaged by construction would be repaired to a structural condition equal to the condition that existed prior to construction activity.

During operations and maintenance, truck and other maintenance equipment will be used in a manner to limit impacts and use per applicable federal, state, and local regulations.

3.5.4 Stormwater Pollution Prevention Plan, Erosion Control, Management, and Dewatering

The Project is subject to construction-related stormwater permit and dewatering requirements of the federal Clean Water Act National Pollutant Discharge Elimination System program. The Authority and Reclamation would obtain required permits through the Central Valley Regional Water Quality Control Board before any Project-related ground-disturbing construction activity occurs. As required by the SWRCB Construction General Permit, a stormwater pollution prevention plan (SWPPP) would be prepared and implemented before construction starts and throughout the Project construction period that identifies BMPs to prevent and minimize the introduction of contaminants into surface waters. In addition, all BMPs identified below would be implemented as necessary during all Project operation and maintenance activities anticipated to require ground disturbance.

The objectives of the SWPPP would be to: 1) identify pollutants and their sources, associated with Project construction activities, which may affect stormwater quality and identify BMPs to reduce pollutants in stormwater discharges during and after construction; and 2) identify non-stormwater discharges and develop a plan to eliminate, control, or treat all non-stormwater discharges. BMPs (which would also be employed during operation and maintenance activities as necessary) would include site management/BMP installation, non-stormwater management; erosion and sediment controls; and an inspection, monitoring, and maintenance program, including:

- Temporary erosion control measures (e.g., silt fencing, weed-free straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrances) would be employed for all disturbed areas. The SWPPP would also include development of site-specific structural and operational BMPs to prevent and control impacts on runoff water quality, measures to be implemented before each storm event, inspection and maintenance of BMPs, and monitoring of runoff quality by visual and/or analytical means.
- No disturbed surfaces would be left without erosion control measures in place during the winter and spring months.
- Sediment would be retained onsite by a system of sediment basins, traps, or other appropriate measures.
- Post-construction erosion control measures would be implemented (including silt fencing, weed-free straw bale barriers, fiber rolls, hydraulic mulch/seeding, and vegetative plantings) and monitored to ensure minimization of water quality and associated impacts. Revegetation treatments would be integrated into grading plans to create favorable planting environments that would aid plant establishment and natural regeneration. Whenever feasible, local native plant species would be used.
- Groundwater/dewatering would be handled so as to avoid impacts non-stormwater discharges.

During operations and maintenance, Project facilities including, but not limited to, roads (including access roads), other paved and unpaved surfaces, structures, and equipment, will be properly maintained so as to avoid the potential for erosion and sediment/siltation into local waterbodies and in compliance with all applicable federal, state, and local regulations. Project operation and maintenance erosion and sediment control plans will be prepared and implemented as determined necessary, depending on the specific activity and potential for erosion or other impacts.

3.5.4.1 Compliance with the Requirements of RWQCB Order No. 5-00-175

Groundwater pumped as part of construction-related dewatering will be contained onsite during construction within bermed areas adjacent to construction areas to avoid impacts to surface waters. As necessary, the Authority will ensure that the water is pumped into Baker tanks or approved equivalent with either a filter or gel coagulant system or other containment to remove sediment as required. Remaining water will be discharged to a designated receiving water body or via land application, in accordance with the requirements of RWQCB Order No. 5-00-175. On upland areas, sprinkler systems may be used to disperse the water in support of revegetation efforts. BMPs, as described in the SWPPP, will also be implemented to retain, treat, and dispose of groundwater. Measures will include, but are not limited to:

- Directly conveying pumped groundwater to a suitable land disposal area capable of percolating flows
- Retaining pumped groundwater in surface facilities to reduce turbidity and suspended sediment concentrations
- If contamination is suspected, testing water collected during dewatering for contamination prior to disposal
- Treating (i.e., flocculating) pumped groundwater to reduce turbidity and concentrations of suspended sediments if turbidity exceeds RWQCB effluent limitations as defined in General Order 5-00-175.

3.5.4.2 Spill Prevention and Hazardous Materials Management

Hazardous materials and hazardous wastes including fuels, oils, grease, and lubricants would be used and stored for construction, operation, and maintenance of the proposed Project. These materials would be used, stored, and disposed of in accordance with applicable regulations (Chapter 4 Regulatory Requirements and Permit Summary and Chapter 28 Public Health and Environmental Hazards). As part of the SWPPP, a spill prevention and control plan would be developed and implemented to minimize effects from spills of hazardous or petroleum substances during construction and operation/maintenance of the Project. The spill prevention and control plan would include measures to avoid the accidental release of chemicals, fuels, lubricants, and non-stormwater into channels and account for all applicable federal, state, and local laws and regulations, including the Resource Conservation and Recovery Act. Spill prevention kits would always be in proximity when hazardous materials would be used (e.g., crew trucks and other logical locations). Feasible measures would be implemented so that hazardous materials would be properly handled by all reasonable means when working in or near any waterway. No fueling would be done within the ordinary high water mark, immediate floodplain, or full pool inundation area, unless equipment would be provided so that any accidental fuel spill would not be able to enter the water, contaminate sediments that may come into contact with water, or damage wetland or riparian vegetation. Any equipment that was readily moved out of the channel would not be fueled in the channel or immediate floodplain. For all fueling of stationary equipment at the construction sites, containments would be provided to the degree that any spill would not enter the channel or damage wetland or riparian vegetation. Equipment would not be serviced within the ordinary high water mark or immediate floodplain, unless the equipment stationed in these locations could not be readily relocated (e.g., pumps and generators).

Additional BMPs designed to avoid spills from construction equipment, as well as equipment used for the operation and maintenance of Project facilities, would also be implemented. These would include the following:

- Storing hazardous materials in double containment
- Disposing all hazardous and nonhazardous products in a proper manner
- Monitoring onsite vehicles for fluid leaks and regular maintenance to reduce the chance of leakage
- Providing containment (a prefabricated temporary containment mat, a temporary earthen berm, or other measure can provide containment) of bulk storage tanks having a capacity of more than 55 gallons

In addition, existing federal, state, and local worker safety and emergency response regulations require that if any unforeseen hazardous conditions are discovered during construction, the contractor coordinate with the appropriate agencies, including Colusa and Glenn counties, for the safe handling, sampling, transportation, and disposal of encountered materials. The contractor will also be required to comply with California Occupational Safety and Health Administration's worker health and safety standards that ensure safe workplaces and work practices.

3.5.5 Mosquito and Vector Control

All Project contractors shall coordinate with Glenn County Mosquito and Vector Control District and the Colusa County Environmental Health Department (including the Colusa County Mosquito Abatement District) related to implementation of standard local, state, and federal vector control requirements during construction of all Project facilities. These local vector control agencies have been monitoring and controlling mosquitos in the Project's primary study area for several years for public health purposes. This function would not change with Project implementation. The Authority will collaborate with the local vector control agencies concerning the Project's operation and maintenance activities, including the recreational component, to minimize potential human health impacts.

3.5.6 Groundwater/Dewatering Water Supply

In the unlikely event that adjacent existing well users experience temporary, localized impacts to groundwater availability during construction of Project facilities due to construction dewatering (rather than climatic conditions or an increase in non-Project groundwater production), such that an existing local well no longer temporarily supports its current use, an alternate water supply will be provided to the landowner during the construction dewatering period.

3.5.7 Visual/Aesthetic Design, Construction, and Operation Practices

Standard and best practice approaches will be implemented during the design, construction, and operation phases to minimize visual/aesthetic impacts to potential residents and other viewers from the construction and operation of all Project facilities, including:

- Using native trees, bushes, and shrubs for screening at the Project facilities that may substantially degrade the existing visual character of the site(s), in a manner that does not compromise facility safety and access

- Incorporating high-quality site design and architecture that does not detract from the rural nature of the surroundings
- Locating, designing, and constructing retaining walls and erosion control devices or structures to avoid detracting from the scenic quality of surrounding areas to the extent possible

3.5.8 Emergency Action Plan

An emergency action plan would be implemented for Project construction and operation. The plan would include emergency notification flowcharts, notification procedures, inundation maps, and a variety of other important emergency response protocols for notifying downstream entities if an emergency release was anticipated to occur. The emergency action plan would address potential and actual emergency conditions and any uncontrolled release of water, including release of any water through the signal spillway. These plans are typically reviewed annually and periodically tested through tabletop and functional exercises and drills.