Operation

Operation and maintenance of the facility includes the fish screen facility, the screen-cleaner system, the blow-out panels, the sediment removal system, the SCADA system, the fish screen structure, lighting, and maintenance schedules.

The fish screen facility would operate in three different operational modes: the intake mode, the discharge mode, and the emergency mode.

Intake Mode

Intake mode occurs when the diversion is going to be pumping water from the Sacramento River to Sites Reservoir. The intake mode would be when the facility sees the largest flows and velocities. Flow of water would move through the fish screen into the afterbay, and finally be pumped 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 occurs when water from Sites Reservoir would flow back through the generating units in the pumping/generating plant to generate electricity, and then through the fish screen and into the Sacramento River. During this operation, the fish screen-cleaning mechanism would not need to be operating because it is on the river side of the fish screen; the sediment removal system would remain in operation; and the SCADA system would be monitoring water levels and pressures across the screen. The size of the forebay pond is large enough that return flows from the pumping/generating plant will be distributed evenly through the screens into the river.

Emergency Mode

When the diversion is operating in intake or discharge mode and a pressure differential greater than 1.5 feet across the fish screen occurs, emergency mode is activated. The pumps would stop operation to allow the forebay to fill up to match the water surface of the Sacramento River. If the pressure differential grows to above 3 feet, then the two blow-out 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 of the different operational modes. The system would be on site, and would broadcast status information to a manned remote location. The SCADA systems provide a means to control the diversion without staffing the onsite facility.

Sediment Removal Fish Screen Bay Sediment Removal System

The fish screen bay sediment removal system consists of piping and jetting nozzles that remove sediment buildup from the bottom of the fish screen structure. Over time, sediment would build up on the floor of the fish screen structure, but the sediment removal system prevents that buildup. The sediment removal system would operate for approximately 10 minutes per bay three times per week, and would suspend the built-up sediment, which is then removed with the flows through the structure.

The forebay sediment removal system requires special equipment to remove built-up sediment between the fish screen and the levee piping. Depending on sediment load in the river, the forebay would need to be cleaned approximately once per year, removing approximately 3 to 5 feet of sediment (3,800 to 6,300 cubic yards) during each cleaning. To remove the sediment, a long-reach excavator is required, in combination with a suction dredge. The suction dredge would remove sediment from approximately 40 percent of the forebay that the long-reach excavator cannot reach. The suction dredge would have a pump that is in the range of 50 to 60 horsepower, and would pump the sediment at a rate of approximately 600 to 700 gallons per minute through approximately 500 feet of 6- to 8-inch-diameter discharge line to the sediment disposal area southwest of the forebay, as shown on Figure B.3-33.

Delevan Pipeline Discharge Facility, Alternative B

Because Alternative B does not include the SRPGP, the Delevan Pipeline Discharge Facility would be required at the Sacramento River to make releases to the river in a controlled fashion. Figure B.3-56 and Figure B.3-57 show details for the proposed discharge structure. The Delevan Pipeline would be reduced in stages from 12 feet in diameter, to 8 feet, then to 4 feet before reaching the energy dissipating valve house. The valve house would be 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 in confining vaults to control excessive spray and help dissipate the energy. From the valve structure, release water would flow down a short channel section before reaching a baffle block spillway leading down to the river. The system is designed for a maximum release flow of 1,500 cfs. The baffle block spillway is selected because it can convey the water to the river in a controlled fashion regardless of the river level. Guard (isolation valves) will be located just upstream of the energy dissipation valves to isolate the energy dissipation valves for inspection and maintenance.

The valve house, channel, and spillway would be in the current river overbank area so that the facilities do not encroach in 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 adult 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 3 fps at the minimum river design level at an elevation of 51 feet.

The piping leading up to the valve house would include air/vacuum relief valves in a vault and a flow metering vault, as shown on Figure B.3-56. Air/vacuum valve vault details would be similar to those shown on Figure B.3-58.

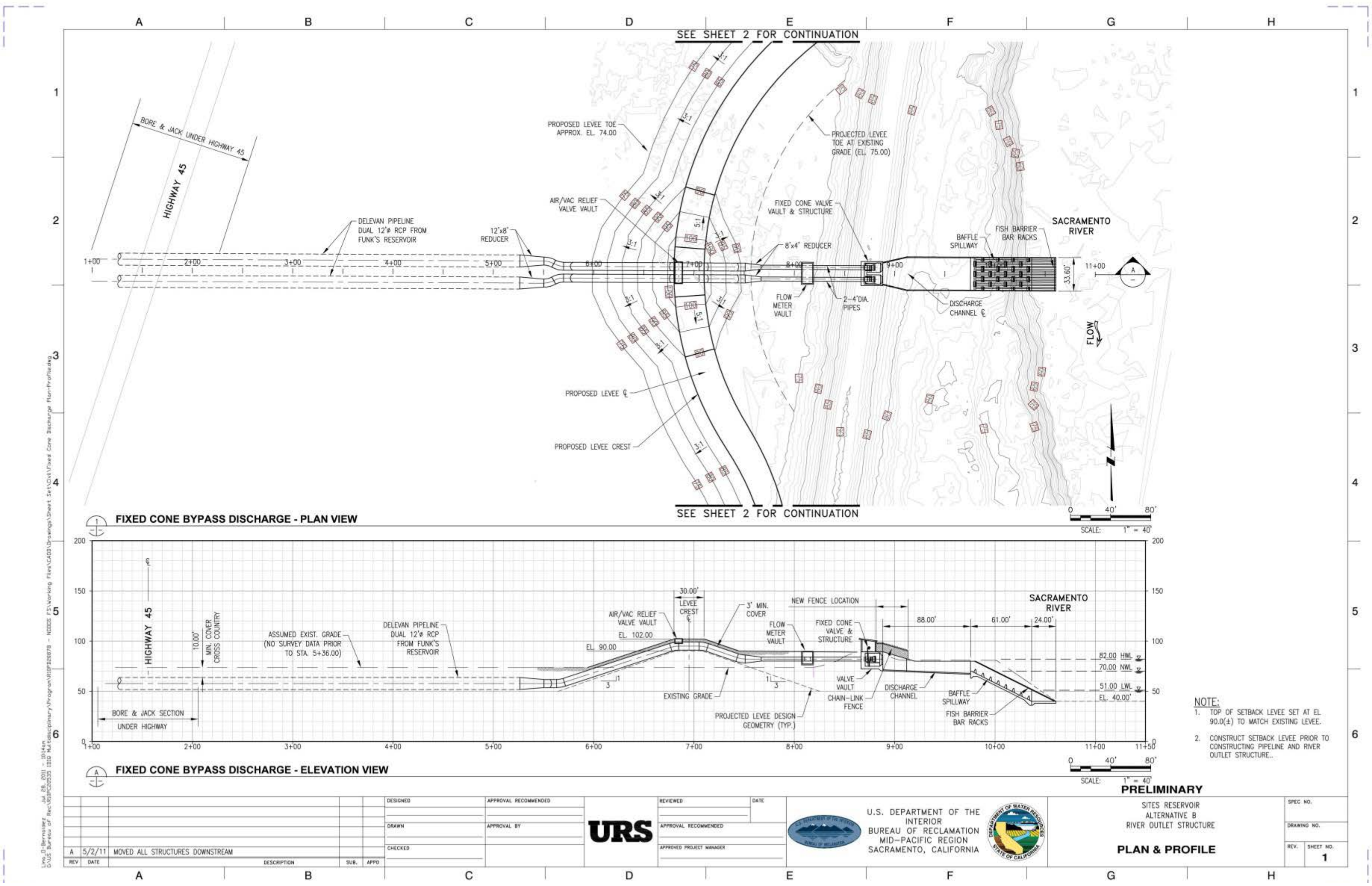

Figure B.3-56. Sacramento River Release Structure Plan

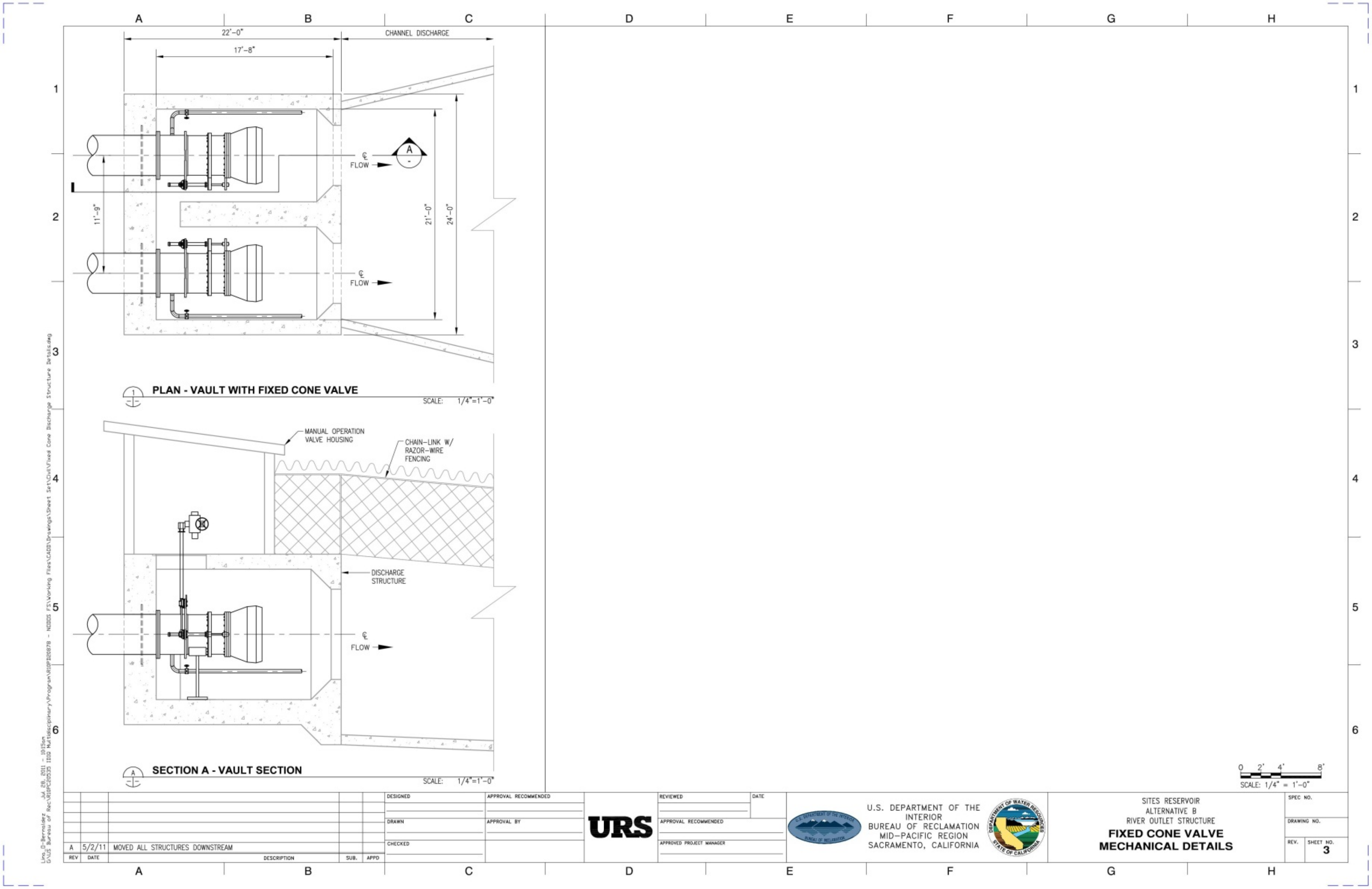

Figure B.3-57. Sacramento River Release Structure Control Valve House

The release structure is in a reach of the Sacramento River that is protected by a Federal project levee system administered by USACE and the Central Valley Flood Protection Board. The top of the levee in the NODOS/Sites Reservoir Project area is at an elevation of 90 feet. Before the levee is breached and construction begins on the valve house and spillway, a setback levee must be constructed around the site, as shown on Figure B.3-56. The setback levee would tie into the existing levee on the northern and southern sides of the site so that there is no interruption of flood protection during construction. In addition, current levee regulations do not permit piping to pass through or under project levees. For this reason, the piping is elevated where it crosses the setback levee so that it is above elevation 90.0.

Construction of the release facility would include the following:

- Constructing the setback levee, along with any slurry walls that might be required to control through-seepage and underseepage.
- Constructing a cofferdam along the shore of the river to permit spillway construction in dry conditions.
- Excavation of the bank and backfilling of the area to construct the spillway, channel, and valve house. Approximately 6,000 cubic yards of excavation would be required.
- Backfilling around the structures and on the waterside of the setback levee, as required.
- Placing riprap rock slope protection for a minimum of 100 feet upstream and downstream of the spillway to control erosion.
- Installing revegetation measures.

Construction of the Delevan Pipeline from the setback levee to Holthouse Reservoir would be the same as described above for conveyance.

Road Relocations and Access Roads

Introduction

This section evaluates the relocation of roads owned by individuals, counties, or other agencies that would be inundated or cut off by the construction of Sites Reservoir. Sites Reservoir would inundate portions of Maxwell-Sites Road and Sites-Lodoga Road, blocking travel between Maxwell and Lodoga. These roads are owned by Colusa County. Approximately 6 miles of the gravel Huffmaster Road would also be inundated. This is a private road, and provides access to properties mostly in the Sites Reservoir area. In addition, because the NODOS/Sites Reservoir Project would include two or three new recreation areas, road access to these sites would also be needed.

Road Relocations

General

Road relocations include the paved route from Maxwell to Lodoga, along with gravel roads for construction, recreation, facility access, and landowner access not provided by the paved road.

Roadway Element Standards

Preliminary feasibility studies of road relocations conformed to the following roadway element standards:

- Both paved and unpaved roads are 52 feet wide
- Maximum grade of 6 percent (California Department of Transportation, Highway Design Standards, 6th ed.)
- Minimum horizontal curvature of 100 feet radius
- Paved roads have 40 foot width of asphalt
- Cut-and-fill side slopes are 2H:1V for depths less than 20 feet, and 1H:1V, with 10-foot benches for depths greater than 20 feet
- Stream crossings require bridges or culverts (For preliminary studies, all culverts and bridges were considered to be the same size. Bridges are 40 feet wide and 80 feet long. Culverts are 6 feet in diameter, and 100 feet in length. The Southern Route has the most stream crossings: 8 bridges and 29 culverts.)

Alternative Alignments

Four alternative road alignments were evaluated: North Road and South Road; and North Bridge Road and South Bridge Road (which include bridge segments), as shown on Figure B.3-58. Road relocation would depend on the final alternative selected, and on other associated features, such as proposed recreation area locations. Bridge routes would provide more direct access with reduced travel times than would road routes around the north or south ends of the reservoir.

The two alternative bridge alignments were selected by attempting to optimize the combined cost for a bridge and new connecting roadways. The alignments of the approaches to the bridges were selected along the ridges rather than along the shoreline of the reservoir, due to the greater environmental sensitivity of the lower elevation areas. The southern bridge alternative would use more of the existing county road between Lodoga and Sites, and would have the shortest travel time; but would result in a longer bridge crossing (8,500 feet). The north bridge alternative would have a much shorter bridge crossing (4,800 feet), but it would involve more new roadway construction than the southern alternative.

Existing topography was the major controlling factor in choosing the new road alignments. The total lengths of the road and bridge alignment alternatives between Sites and Lodoga, including their corresponding approaches, are summarized below:

- North Road alternative: 39 miles
- South Road alternative: 34 miles
- South Bridge alternative: 25 miles
- North Bridge alternative: 36 miles

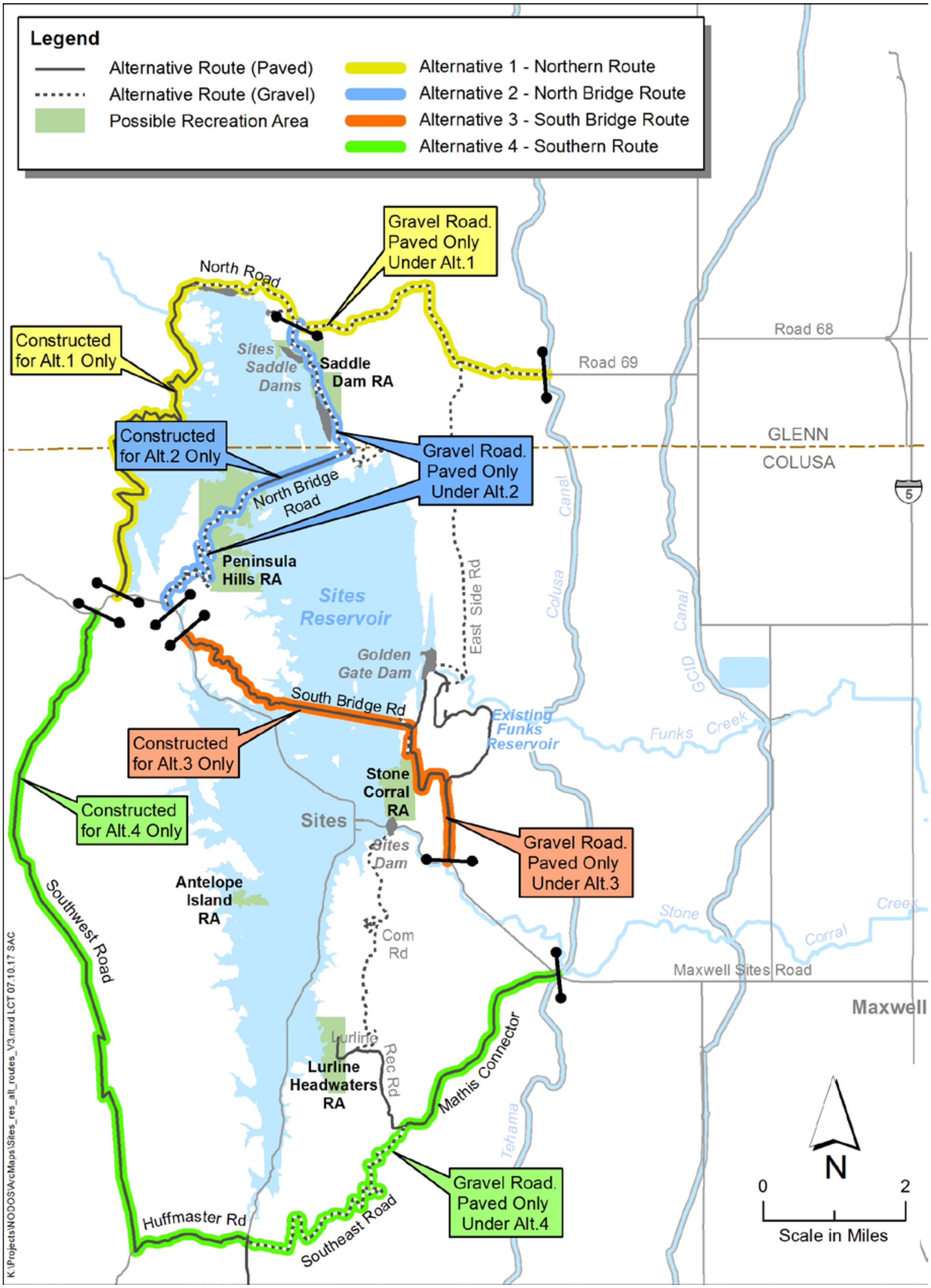

Figure B.3-58. Sites Reservoir Road Initial Relocation Route Alternatives

Conceptual Bridge Designs
Figure B.3-59, Figure B.3-60, and Figure B.3-61 show the preliminary feasibility study bridge designs that define bridge type and span configuration.

Bridge Type
A segmentally constructed concrete box girder bridge using the cantilevered construction method was chosen as the appropriate bridge type for preliminary feasibility study design. The maximum span lengths are 400 feet, using a haunched depth section ranging from approximately 20 feet deep at the columns and 8 feet deep at mid-span. The columns were assumed to be cast-in-place concrete with a hollow, cellular shape supported on 36-inch-diameter drilled shaft piers.

Bridge Width
A 32-foot clear bridge width was chosen as it pertains to Rural Collector Roads. The width for the contiguous rural collector road assumes two 12-foot lanes and 4-foot shoulders, based on a relatively high hourly traffic volume that might occur during summer months with recreational traffic, and given the potential for use by bicycles and motorist emergency pull-outs. A concrete barrier with bicycle-height railing was considered.

Evaluation of Road Travel Times
Road travel times were estimated using the alternative bridge alignments between Maxwell and Lodoga, and included both existing and new road segments. Both road-grade profile and horizontal curvature were considered to estimate average driving speeds. The maximum assumed speed used for this evaluation was 55 mph for straight, flat (grade of less than 2 percent) roadways. A speed reduction of 10 percent was taken for road grades between 2 and 4 percent, and a reduction of 20 percent was taken for grades greater than 4 percent. The speed reductions for horizontal curvature were 30 percent for moderate road curvature, and 60 percent for high curvature. Based on these criteria, the total road distances (between Maxwell and Lodoga), average driving speeds, and travel times for the four road alternatives are summarized in Table B.3-15.

Comparison of Alternative Alignments
Table B.3-15 shows that the South Bridge Route would have the shortest travel time between Maxwell and Lodoga, estimated at approximately 33 minutes. However, this route would have the highest cost of the four alternatives. To identify the preferred route, all variables would need to be evaluated, including not only construction costs, operations and maintenance costs, and travel times, but also environmental issues, as well as identifying who would be the most frequent road users. Users would include weekend recreational traffic and daily traffic (e.g., travel to and from school).

It is noted that the North Road Route is partly along the shoreline of Sites Reservoir, and has nearly 10 miles of roadway with high curvature. To reduce the length of high-curvature roadway, the roadway could be straightened somewhat by constructing causeways with culverts across small inlets/bays.

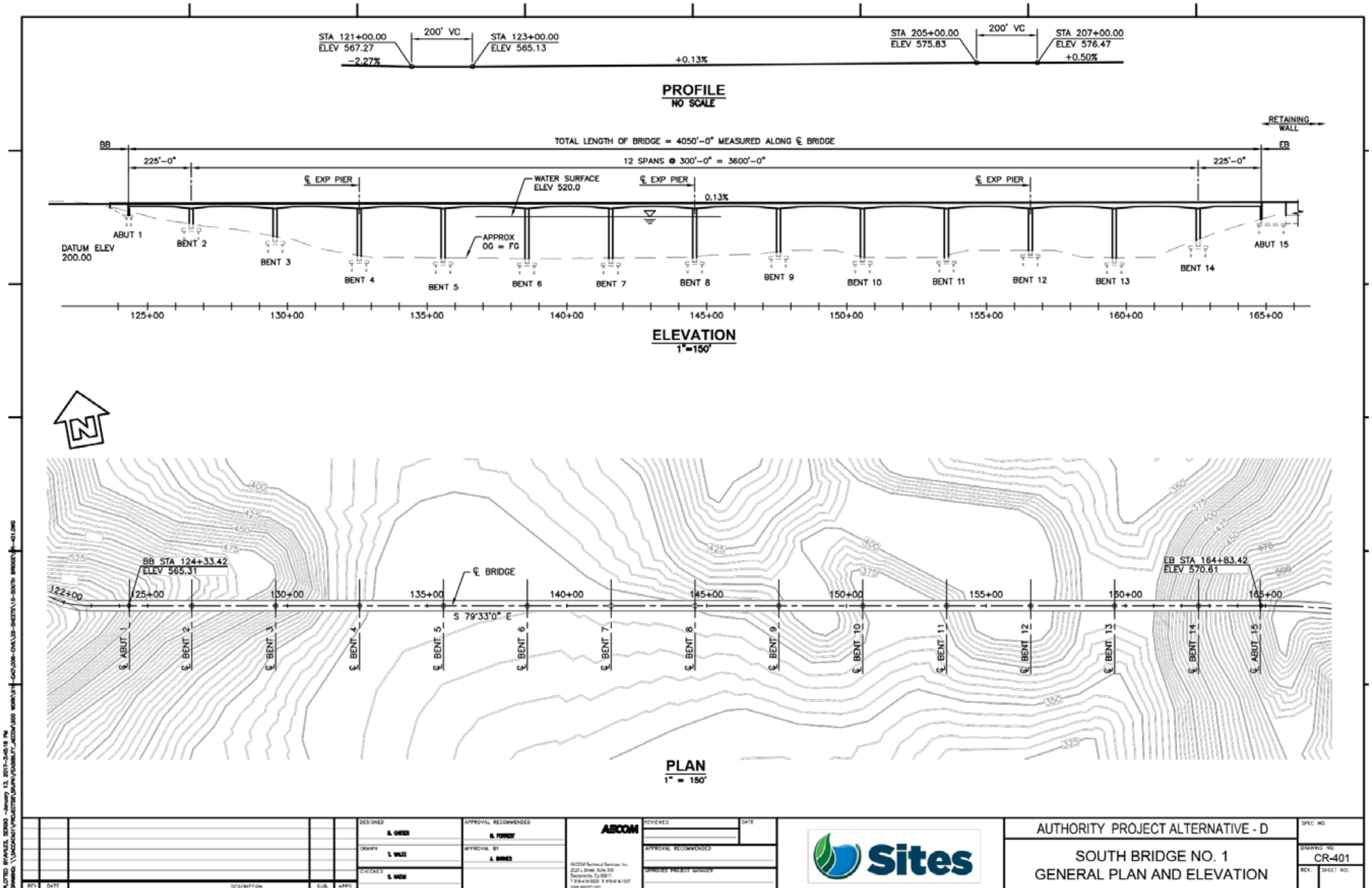

Figure B.3-59. South Bridge Plan and Profile, Sheet 1

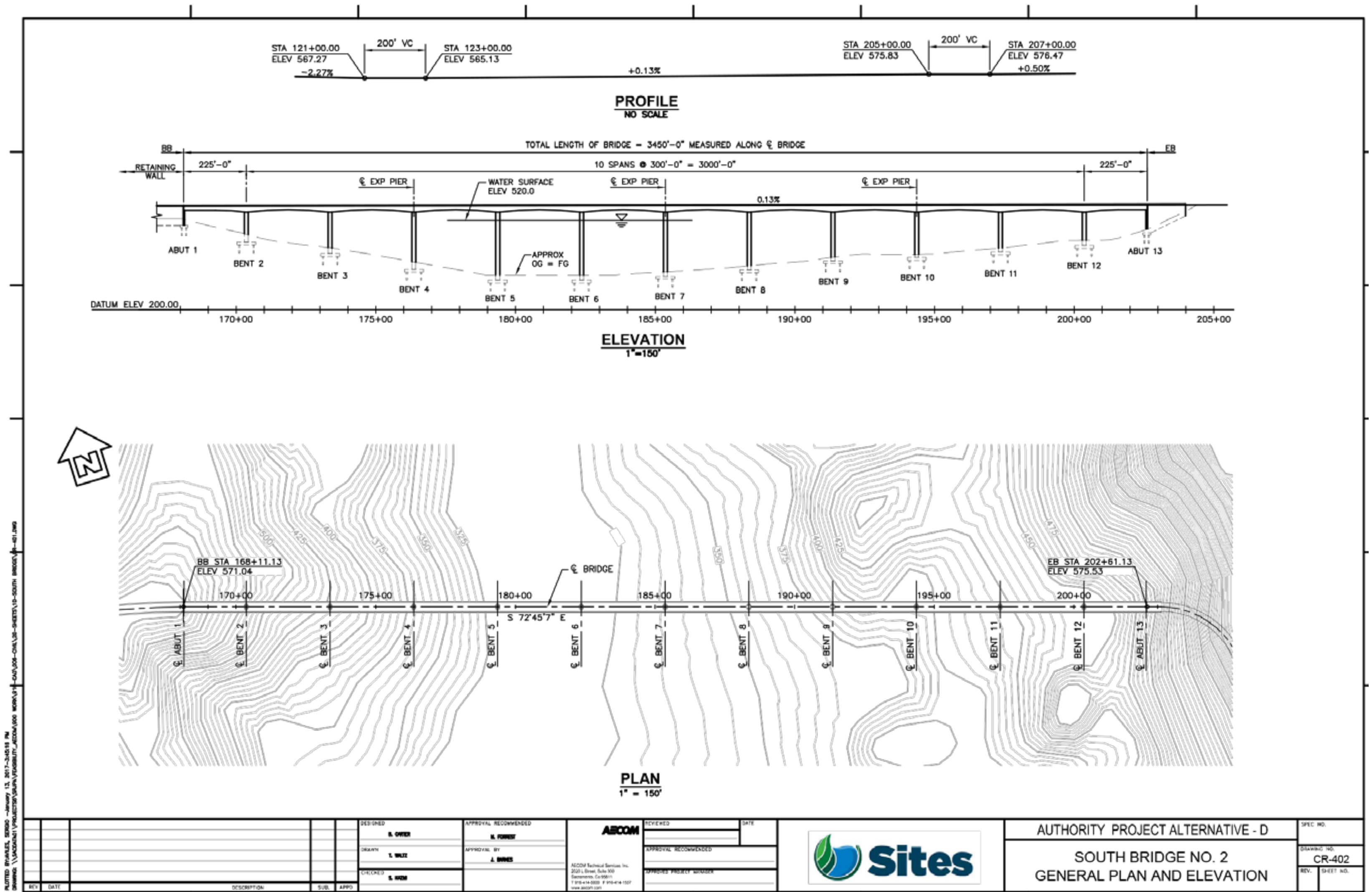

Figure B.3-60. South Bridge Plan and Profile, Sheet 2

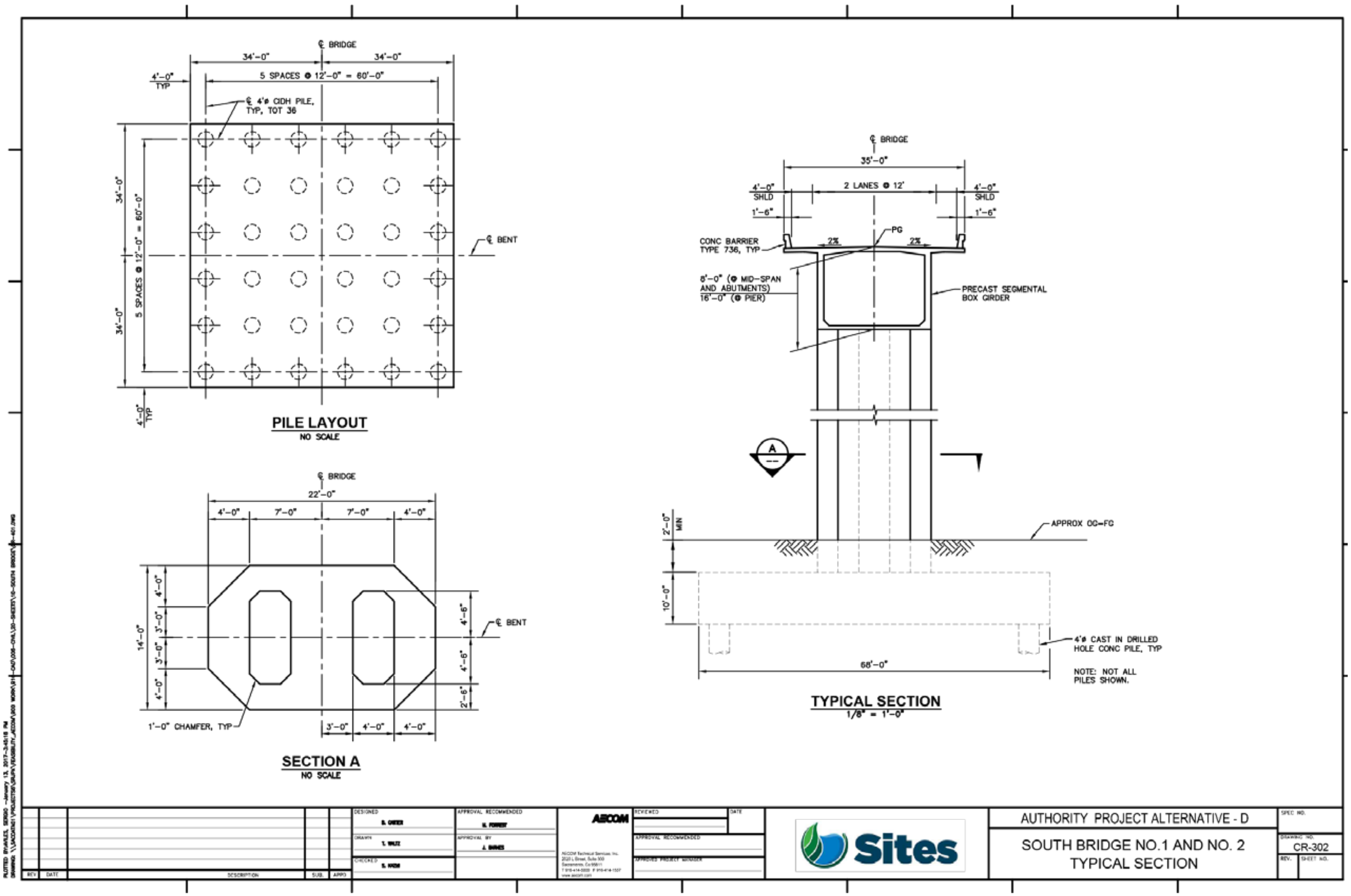

Figure B.3-61. South Bridge Foundation and Pier Details

Table B.3-15. Road Travel Time Summary

Road	Distance (miles)	Driving Speed (mph)	Driving Time (minutes)	Cost ($million)
Existing Road	24	50	29	N/A
North Road Alternative	39	45	58	105
South Road Alternative	34	45	49	129
North Bridge Alternative	36	50	47	149
South Bridge Alternative	25	50	33	195

Key:
mph = miles per hour
N/A = not applicable

Construction Sequencing

Work at the Sites Dam site would cut off the road between Maxwell and Lodoga. It would be preferable to have the new road alignment completed by the time work starts at the Sites Dam. The existing Maxwell-Lodoga Road, however, could be used until the embankment dam fill reaches the existing roadway level, at which time traffic would be diverted to the new road alignment. This approach would require safety and traffic control implementations in the construction zone.

Temporary Northern Bypass Road

A new temporary bypass road at the north end of Sites Reservoir is 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 TC Canal. From there, the planned access road would follow existing ranch roads and trails and connect back to Sites Lodoga Road on the west side of the proposed reservoir outside the inundation area. 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. The bypass road would be paved for public use. No additional environmental impacts would be anticipated since the route follows existing County roads, roads already planned for the project, and new segment that is located within the reservoir footprint.

Access Roads

General

At a later stage of NODOS/Sites Reservoir Project development, additional roads would be included in the road alignment alternatives to provide access to potential recreation areas and project facilities. Access roads would be needed at four locations around the proposed reservoir.

Two roads would be included on the southeastern side of the reservoir to allow access to a potential recreation area, as well as to an existing communication center. These roads are shown as Lurline Rec. Road and Com Road on Figure B.3-50.

- A road would be included on the eastern side of the reservoir to allow access to Golden Gate Dam, the SPGP, and the potential Stone Corral Recreation Area. The road would also provide access to a landowner. This road is shown as East Side Road on Figure B.3-50.

- Two roads would be included on the northeastern side of the reservoir to allow access to the nine saddle dams and a potential recreation area. One road is shown as an extension of North Road, providing access to Saddle Dams 6 through 9. The other road is unnamed, and provides access to Saddle Dams 1 through 5 and the potential Saddle Dam Recreation Area. Both roads are shown on Figure B.3-50.
- A road would be included on the western side of the reservoir to allow access to the potential Peninsula Hills Recreation Area. Additional access roads may be added, as plans for recreation areas are further developed.

Design Assumptions

The access roads would be unpaved, and classified as rural local roads. Roadway element standards would be as described previously. Because access roads would be included no matter which alternative is chosen, access road costs were incorporated into road relocation cost estimates.

Electrical Utilities and Utility Relocations

Project Electrical Utility Requirements

Sites Reservoir Pumping/Generating Plant

The NODOS/Sites Reservoir Project site is adjacent to several existing 230 kV transmission lines (PG&E and WAPA). The 230 kV SPGP electrical switchyard would be fed from a new substation located adjacent to one of the existing lines. The final transmission line source(s) would be determined after further power system impact studies are conducted and subsequent power interconnection purchase agreements are developed.

The pumping/generating plant consists of twelve 3-phase, 13.8 kV, variable-speed, motor-generator units. Initial design proposes that all units are sized the same, providing flexible unit operations.

The 230 kV transmission line in the switchyard is connected to circuit breakers that are arranged in a breaker-and-a-half arrangement, with two 230 kV buses. The connections from the switchyard feed four main power stepdown transformers rated 230 kV to 13.8 kV. Each power transformer feeds three pumping/generating units. Two of the transformers also feed station service transformers.

TRR Pumping/Generating Plant

The TRR 230 kV switchyard would be fed from a new 230 kV transmission line from the Sites Pumping/Generating switchyard. The new transmission line would be a single-circuit overhead line using monopole or steel lattice construction. The transmission line would be routed primarily through open country, with no major existing roads or highways along the route.

The pumping/generating plant consists of four (including one future unit), 3-phase, 13.8 kV pumping motors and one generator. The four pumping motors are split into two groups. One group consists of two motors and one generator; the other group consists of two motors and one future motor.

The 230 kV transmission line in the switchyard is connected to two line breakers that are connected in parallel. A normally open, motor-operated, 3-pole, 230 kV disconnect switch is used to tie the two transformer sources together. The tie switch is normally open during normal operation, and is not closed until one of the two line breakers is disconnected for maintenance. When this occurs, the tie switch would be closed to provide power for both groups of motors through the two stepdown transformers from either of the operating line breakers.

Each side of the 230 kV line circuit breaker bushings is connected to a manually operated disconnect switch. These disconnect switches would be opened when the line is not loaded (non-load break) and the breaker is under maintenance.

Delevan Pumping/Generating Plant

The Delevan 115 kV switchyard would be fed from a new 230 kV transmission substation near Colusa. The new transmission source would connect into an existing WAPA 230 kV transmission line. The new substation would step the voltage down to 115 kV to transmit power using smaller transmission line poles. The transmission line would be routed primarily along existing roads and Highway 45.

The pumping/generating plant consists of five (including one future unit), 3-phase, 13.8 kV pumping motors and two generators. The five pumping motors are split into two groups. One group consists of two pumps; the other group consists of three pumps.

The 115 kV transmission line in the switchyard is connected to two line breakers that are connected in parallel. The line breakers are connected to 115 kV to 13.8 kV stepdown transformers. Each transformer feeds one group of motors, a generator, and a station service transformer. A normally open, motor-operated, 3-pole disconnect switch is used to tie the two transformer sources together. The tie switch is normally open, and is not closed until one of the two line breakers is disconnected for maintenance. When this occurs, the tie switch would be closed to provide power for both groups of motors through two stepdown transformers from either of the operating line breakers.

Utility Right-of-Way

The NODOS/Sites Reservoir Project would require the relocation of utilities, including gas pipelines, power lines, telephone lines, and fiber optic cable. Temporary relocations of irrigation supply and drainage canals may also be required along the pipeline alignments. The service lines to a microwave station adjacent to the Sites Reservoir site would also require relocation.

Right-of-Way

Sites Reservoir

The Sites Reservoir inundation area would encompass most of Antelope Valley, including the small community of Sites. The land is mainly non-irrigated pasture, with improvements consisting mostly of farm structures and a few residences. ROW would need to be acquired for the entire area inundated by the reservoir. A Proposed Take Line has been established to provide buffer and access.

Funks Reservoir Enlargement

Funks Reservoir is owned by Reclamation. However, it is assumed that it would be necessary to acquire further ROW for the new Holthouse Reservoir, to be located downstream of the existing Funks Reservoir.

Conveyance

New Sacramento River Conveyance

ROW would need to be acquired for the SRPGP, and the Delevan Pipeline that would convey water from the Sacramento River to Holthouse Reservoir. The maximum capacity considered is 2,000 cfs. The Delevan Pipeline would cross through an area primarily consisting of rice fields. Permanent acquisitions would need to be made for the conveyance facilities, and temporary acquisitions would need to be made for construction easements.

Tehama-Colusa Canal Conveyance

No ROW acquisition is required for the T-C Canal modifications. Reclamation currently owns the lands occupied by and adjacent to RBDD, the T-C Canal, and the Corning Canal. Additional land would be needed for staging and for disposal/storage of sediment from future dredging operations.

Glenn-Colusa Irrigation District Canal

No additional ROW would be required for modifications to the GCID Canal. GCID has a combination of permanent easements (ROWs) and fee ownership for lands occupied by and adjacent to the GCID Canal, and related structures and facilities. Additional temporary easements and ROW agreements would be needed for the TRR earthwork borrow and disposal sites, and contractor staging areas. Approximately 200 acres of new ROW would specifically be needed for the TRR-Holthouse Pipeline.

Recreation

The proposed Sites Reservoir has been identified by DWR and CALFED as an important proposed facility under consideration in California, and its recreational component has opportunities to serve the growing Sacramento and Red Bluff regions for generations to come.

Appendix E contains a detailed evaluation of five potential recreation areas considered for the NODOS/Sites Reservoir Project.