

**AMENDED APPLICATION FOR LICENSE
OF MAJOR UNCONSTRUCTED PROJECT**

**EXHIBIT F
GENERAL DESIGN DRAWINGS OF PRINCIPAL
PUBLIC WORKS**

BLUEWATER RENEWABLE ENERGY STORAGE PROJECT

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EXHIBIT F– GENERAL DESIGN DRAWINGS OF PRINCIPAL PROJECT WORKS

As required under 18 CFR 4.41(g), “Exhibit F consists of general design drawings of the principal project works described under paragraph (b) of this section (Exhibit A) and supporting information used as the basis of design. If the Exhibit F submitted with the application is preliminary in nature, applicant must so state in the application. The drawings must conform to the specifications of Sec. 4.39.

1. The drawings must show all major project structures in sufficient detail to provide a full understanding of the project, including:
 - a. Plans (overhead view);
 - b. Elevations (front view);
 - c. Profiles (side view); and
 - d. Sections.
2. The applicant may submit preliminary design drawings with the application. The final Exhibit F may be submitted during or after the licensing process and must show the precise plans and specifications for proposed structures. If the project is licensed on the basis of preliminary designs, the applicant must submit a final Exhibit F for Commission approval prior to commencement of any construction of the project.
3. Supporting design report. The applicant must furnish, at a minimum, the following supporting information to demonstrate that existing and proposed structures are safe and adequate to fulfill their stated functions and must submit such information in a separate report at the time the application is filed. The report must include:
 - a. An assessment of the suitability of the site and the reservoir rim stability based on geological and subsurface investigations, including investigations of soils and rock borings and tests for the evaluation of all foundations and construction materials sufficient to determine the location and type of dam structure suitable for the site;
 - i. Copies of boring logs, geology reports and laboratory test reports;
 - ii. An identification of all borrow areas and quarry sites and an estimate of required quantities of suitable construction material;
 - iii. Stability and stress analyses for all major structures and critical abutment slopes under all probable loading conditions, including seismic and hydrostatic forces induced by water loads up to the Probable Maximum Flood as appropriate; and
 - iv. The bases for determination of seismic loading and the Spillway Design Flood in sufficient detail to permit independent staff evaluation.
4. The applicant must submit two copies of the supporting design report described in paragraph (g)(3) of this section at the time preliminary and final design drawings are submitted to the Commission for review. If the report contains preliminary drawings, it must be designated a ‘Preliminary Supporting Design Report.’

1.0 DRAWINGS OF MAJOR STRUCTURES

A number of drawings and descriptions have been prepared to describe the major project structures. They are available in both Exhibit A and in this Exhibit. They include in Exhibit A:

1. Proposed Site Plan
 - a. Powerhouse drawings and cross-sections
 - b. Profile of project penstock alignment
 - c. Upper reservoir site plan

This Exhibit F contains enhanced and more detailed electrical and engineering drawings for the electrical components of the Proposed Project.

In addition, please also see Exhibit G, Figure G-1, for detailed maps covering the scope of the project, including primary transmission connection to the interconnected grid.

2.0 DESIGN DRAWINGS

The description and design details of the hydroelectric components of the Proposed Project are required to be located in Exhibit A. Although Section 4 of Exhibit A provides a brief description of the primary connection, drawings and descriptions of various components of the primary connection are provided in this subsection.

The primary connection for the Proposed Project is a 230 kV, three phase, alternating current line interconnecting the proposed project to Southern California Edison's (SCE's) Valley-Serrano 500 kV line at the proposed SCE Alberhill substation. A conceptual single line diagram of the electrical connection appears in Figure F-1.

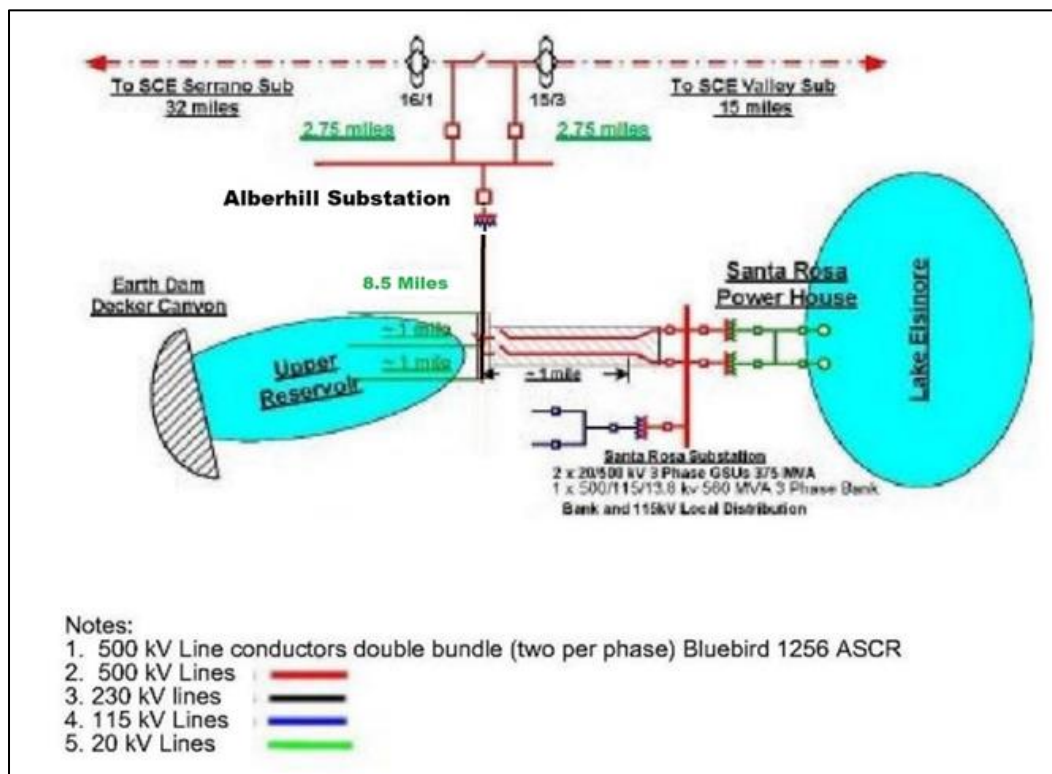


Figure F-1: Project Conceptual Single Line Diagram

Source: The Nevada Hydro Company

2.1 Primary Lines

The Proposed Project will interconnect with the transmission grid at SCE's existing 500 kV Valley-Serrano transmission system in western Riverside County, which extends from points east into the Los Angeles basin. The primary transmission line will extend approximately 8.5 miles from the Santa Rosa substation to SCE's proposed Alberhill Substation.

The proposed primary transmission lines will be designed, constructed, and operated in accordance with the following standards and criteria. Note that although referenced, copies of these documents are not included in this Application, also if and when the standards and criteria are updated, the Applicant will utilize and follow the current standards and criteria.

- NERC/WECC's reliability criteria.¹
- CAISO's reliability criteria² and applicable planning standards.³
- CPUC's "Construction and Operation of Power and Communication Lines" (General Order [GO] 52), "Rules for Overhead Line Construction" (GO-95), "Rules for Construction of Underground Electric Supply and Communications Systems" (GO-128), and "Rules for Planning and Construction of Electric Generation, Line, and Substation Facilities in California" (GO-131-D), current avian protection plan guidelines⁴ and suggested practices.⁵
- SCE design standards, as applicable, and other applicable State and local codes.

2.1.1 Underground Installation

The change from the previously proposed 500 kV high voltage transmission line to 230 kV was made to enable the burial of the primary transmission line where practical. The primary transmission line is being proposed as a buried transmission line along the alignment described in Exhibit G- Figure G-1. The Applicant will work with the City of Lake Elsinore, the unincorporated Village of Summerland, Riverside County and the operators of existing underground utilities to determine the optimal routing for the Primary Transmission Line. There may be areas where underground installation is not possible, not practical or results in unnecessary environmental, or social impact or impacts existing buried facilities. If such cases arise, the Applicant may need to undertake aboveground installation of the primary transmission line through a portion of the route. The applicant therefore provides detail with respect to above ground transmission line installation in Section 2.1.2 if above ground installation is required.

There are multiple underground installation methods available. The method used depends upon a range of factors including land use, and each will have different environmental factors. The main installation methods include direct cable burial, ducted, and surface troughs. Given the nature of development along the proposed transmission route, the ducted cable installation method is the most appropriate.

2.1.1.1 Underground Duct Bank

An alternative to conventional direct burial is the use of ducts to facilitate underground installation. Although a more expensive method, the advantage of a ducted installation is that the ducts can be installed in shorter sections along the cable route leaving shorter sections of exposed trench, reducing risk and disruption to the general public.

The proposed underground power line would consist of concrete-encased duct banks installed underground a minimum of 3 feet below the ground surface. The duct banks contain larger diameter polyvinyl chloride (PVC) conduits (i.e. ducts) that conductor cables can be pulled through and smaller

^{1/} Western Electricity Coordinating Council, Minimum Operating Reliability Criteria, April 6, 2005.

^{2/} The CAISO's reliability criteria, applicable to all existing and proposed facilities interconnecting to the CAISO-controlled grid, constitutes the policies, standards, principles, and guides of the CAISO designed to assure the adequacy and security of the electric transmission system. These criteria are similar to WSCC's criteria for transmission system contingency performance and the NERC's planning standards. The CAISO's reliability criteria, however, contains additional requirements not found in WSCC's criteria and/or the NERC's standards.

^{3/} California Independent System Operator, Planning Standards, February 7, 2002.

^{4/} Edison Electric Institute Avian Power Line Interaction Committee and United States Fish and Wildlife Service, Avian Protection Plan Guidelines, April 2005.

^{5/} Edison Electric Institute Avian Power Line Interaction Committee and the California Energy Commission, Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006, PEIR Final Project Report, CEC-500-2006-022, 2006.

diameter PVC conduits for any needed or future telecommunication cables. Duct bank dimensions would be approximately 3 feet high by 3 feet wide. The duct bank configuration would be designed based on required clearances and the location of existing underground utility lines.

Figure F-2 provides a conceptual illustration of underground transmission line installation once complete.

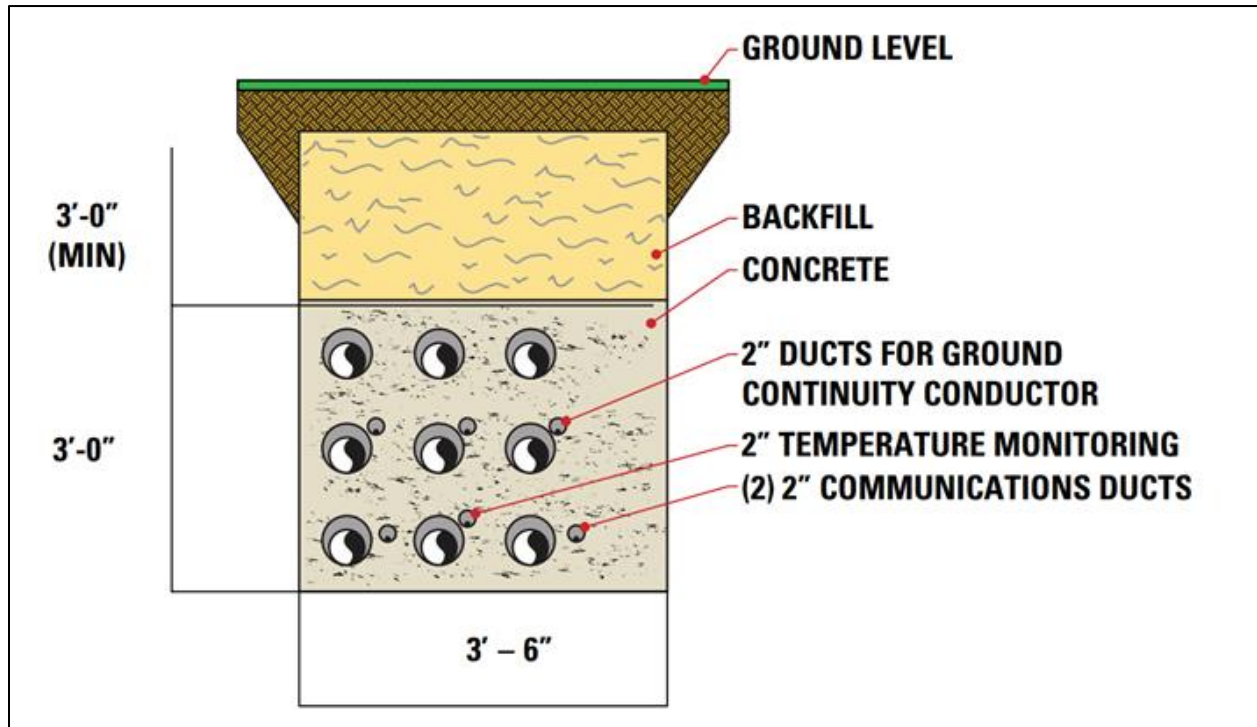


Figure F-2: Underground 230 kV Cable Installation

Source: Xcel Energy Information Sheet

2.1.1.2 Splice Vaults

Splice vaults facilitate pulling of cables through the duct bank and splicing/connecting segments of cable. During operation, splice vaults provide access to the underground cables for maintenance inspections, repairs and replacement, if needed. Concrete splice vaults are constructed of prefabricated, steel-reinforced concrete and measure about 8 foot (long) by 8 foot (wide) by 2 foot (deep)

A typical sequence of underground 230 kV transmission line construction and the trench construction process is illustrated in Figure F-3 and Figure F-4 respectively.

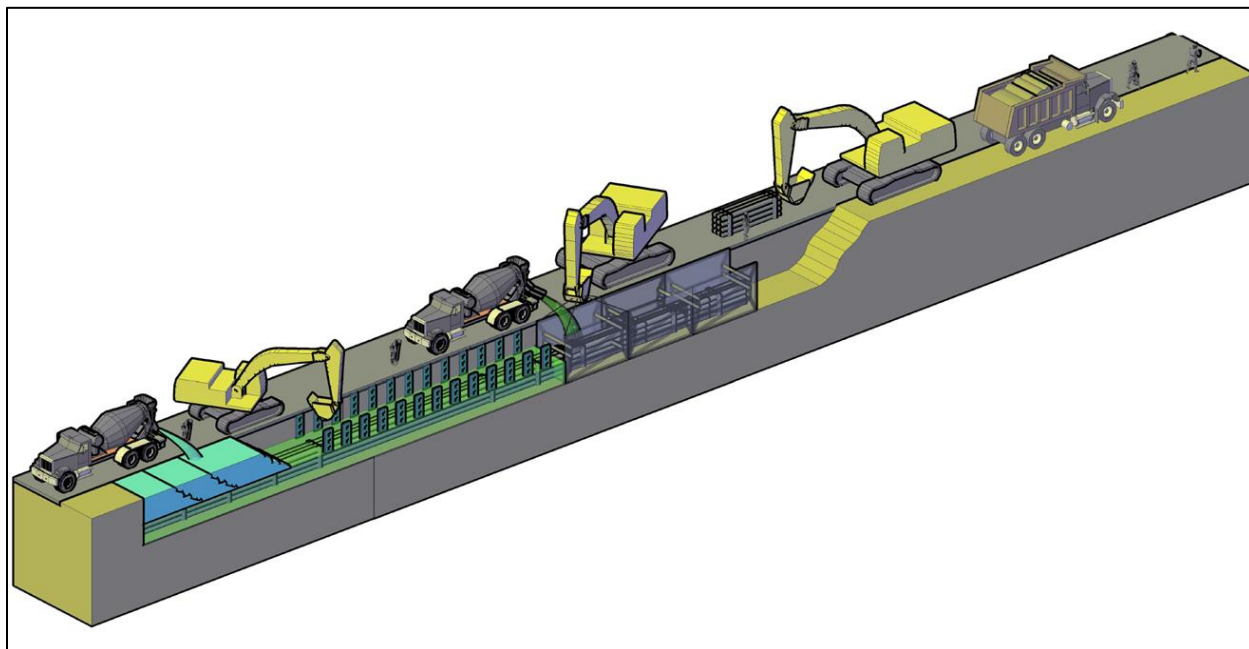


Figure F-3: Typical sequence of construction for underground 230 kV cable installation

Source: Barnard Construction

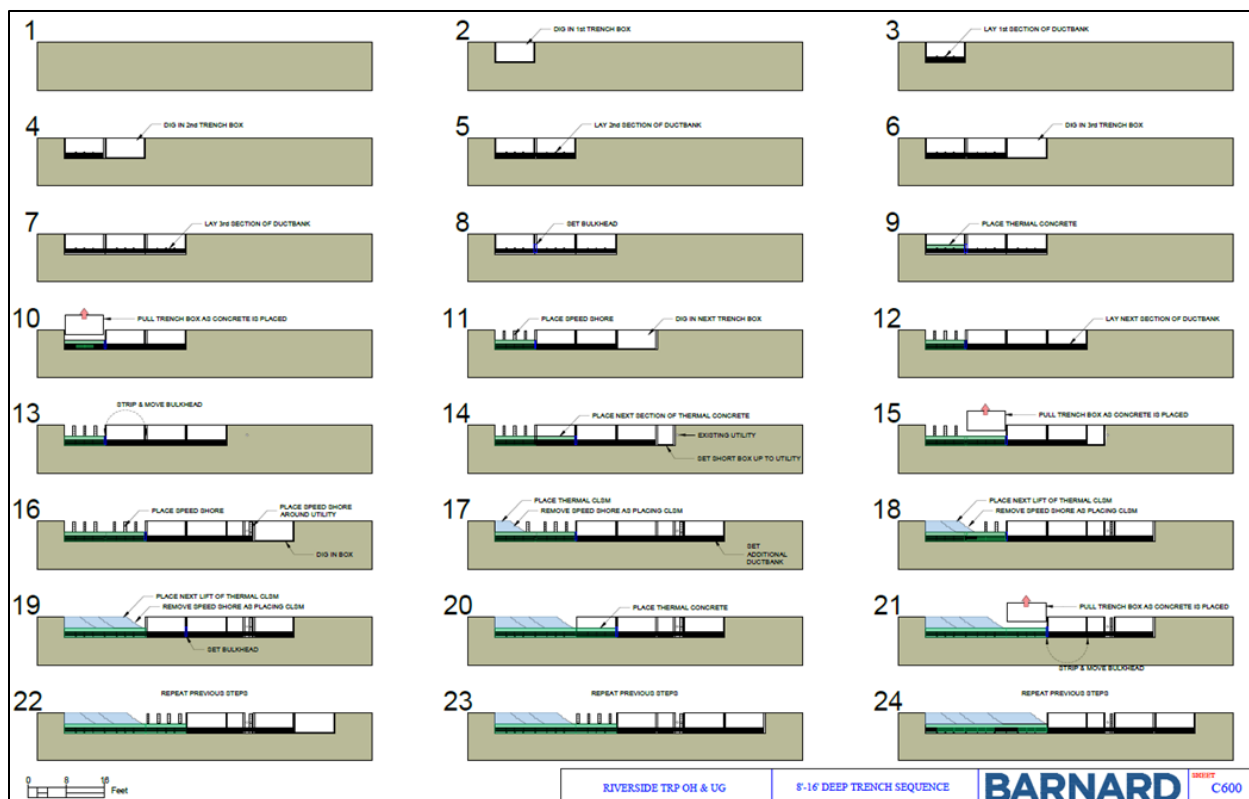


Figure F-4: Typical sequence of construction for underground 230 kV cable installation

Source: Barnard Construction

2.1.1.3 Underground Cable Type

Conductors that transmit electricity need to be electrically insulated. Overhead lines are insulated by air, while underground cable conductors are wrapped in layers of insulating material. Air is the simplest and cheapest insulation and the heat produced by the electricity flowing through the bare overhead conductors is removed by the flow of air over the conductors. When conductors are buried underground, robust insulation is needed to withstand the high voltage.

Advancements in cable technology have furthered the advancement of Cross-Linked Polyethylene Extruded (XLPE) Cables for underground installation which are now used as preference to the more traditional Fluid Filled Cables, especially for higher voltages up to 400 kV. XLPE cables use a central conductor which is insulated by means of cross-linked polyethylene material, which is extruded around the conductor. The absence of fluid in the cable insulation enables a more mechanically robust overall cable construction. XLPE cables require less maintenance, with no ancillary fluid equipment to monitor and maintain.

XLPE cables can be installed in areas such as tunnels, ducts and troughs and may also be buried directly.⁶

An alternative to fluid filled or XLPE cable is the use of gas insulated lines (GIL). This system comprises aluminum/copper conductors that are supported by insulators contained within sealed tubes. These can be installed above ground, in trench or tunnel installations. The tubes are pressurized with a Nitrogen/Sulphur Hexafluoride (SF6) gas to provide the main insulation. The main advantage of GIL is that a higher cable rating can be achieved and the terminations at the cable ends have a lower cost than conventional sealing end compounds. GIL is an emerging technology and recent advancements in this technology have demonstrated that GIL may be preferable in this application. Further work is required before the Applicant will be able to commit to the underground cable type that will be used for the underground installation.

2.1.2 Above Ground Transmission Line Installation

There may be areas where underground installation is not possible, not practical or results in unnecessary environmental, social impact or impacts to the operation of existing buried facilities. If such cases arise, the Applicant may need to undertake above ground installation of the primary transmission line through a portion of the route.

2.1.2.1 Overhead Transmission Towers

In those areas where above ground transmission line is determined to be required (if any) the Applicant proposes to install single circuit 230 kV steel lattice towers which are illustrated in Figure F-5 or double circuit 230kV steel poles as illustrated in Figure F-6. Transmission towers will consist of tangent (suspended) type structures, where the conductors approach and depart the structures in a straight line, and heavier structures, including both angle structures that suspend the conductors and allow limited changes in line direction and dead-end structures which allow for more substantial changes in line direction.

⁶/ Undergrounding high voltage electricity transmission lines - The Technical Issues. The National Grid, [Issue 4: January 2015](#)

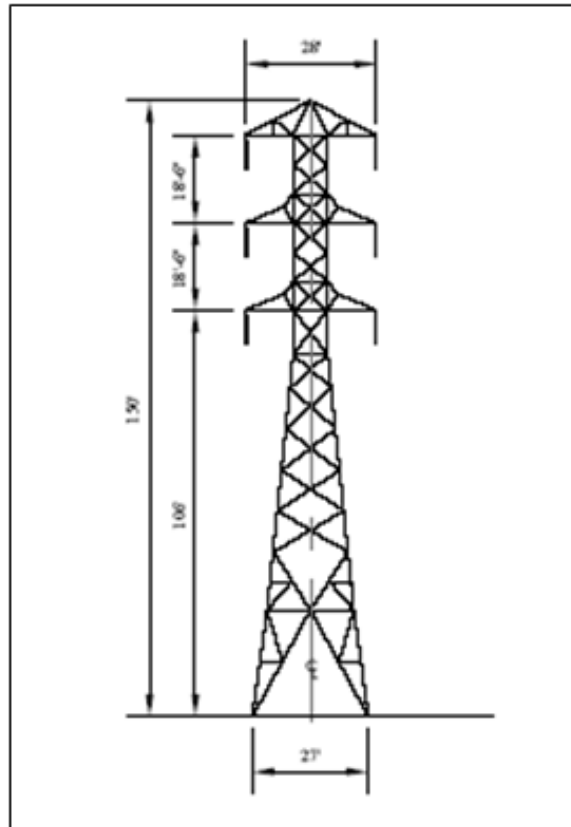


Figure F-5: Typical Single Circuit 230 kV Steel Lattice Tower

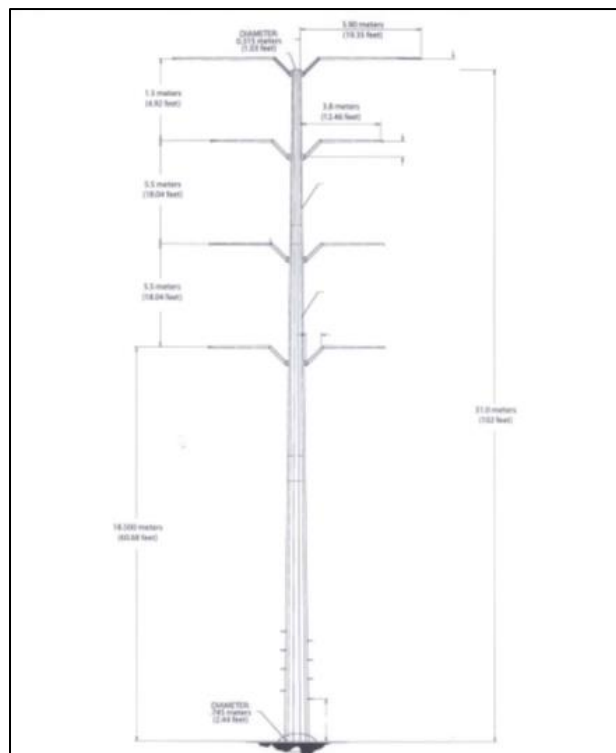


Figure F-6: Typical Double Circuit 230 kV Steel Pole Tower

2.1.2.2 Overhead Transmission Conductors and Cables

Above ground primary connection would use a single circuit line utilizing galvanized lattice structures, with non-specular surface. The conductor size is planned at 1.762 inches in diameter, 2,156 Kcmil (thousands of circular mils) aluminum conductor steel reinforced (ACSR) with a spacing of 18 inches between conductor centers. The connection will have a planned ampacity rating of at least 1,623 amps. All 230 kV air-insulated circuits will be twin-bundled 2156 “Bluebird” ACSR, or equivalent. With this type of conductor, the load flows through the aluminum strands that are formed in a helix around the core of steel strands. The steel strands provide the mechanical tension strength to support the aluminum strands.

2.1.2.3 Transition between Underground and Overhead Transmission Lines

Figure F-7 presents a schematic illustration of a transition station between underground and the overhead line (OHL) if such transition(s) are required.

2.2 Substations

Interconnection to the proposed SCE Alberhill Substation will be required where the new primary line will interconnect via a new step-up transformer named Bluewater Substation, with SCE’s existing 500 kV transmission system to the north. In addition, the Santa Rosa substation will also be constructed adjacent to the powerhouse. Each of the proposed substations is described below.

2.2.1 SCE Proposed Alberhill Substation

The Alberhill System Project proposed by Southern California Edison would serve the cities of Lake Elsinore, Canyon Lake, Perris, Menifee, Murrieta, Hot Springs, Temecula, and Wildomar as well as surrounding unincorporated areas of Riverside County. The proposed Alberhill Project would include a number of system components. Those relevant to the Bluewater Project include the construction of the 500/115-kilovolt (kV) Alberhill substation and the construction of two 500-kV transmission lines extending approximately 1.5 mile in length to connect the proposed substation to the existing Serrano–Valley 500-kV transmission line. The Alberhill Substation is proposed to be built on approximately 34 to 40 acres of a 124-acre property located on the northwest corner of the intersection of Temescal Canyon Road and Concordia Ranch Road in unincorporated western Riverside County. SCE designed the proposed Alberhill Project to meet long-term forecasted electrical demand in the proposed Alberhill Project area and to increase electrical system reliability. SCE estimates that construction of the proposed Alberhill Project would take approximately 28 months.

The applicant has a Large Generator Interconnection Agreement (LGIA) in place with SCE and CAISO. The existing LGIA has been submitted to the FERC under Docket 14227. The specified interconnection location is the proposed Alberhill Substation and outlines the technical and commercial aspects of the interconnection requirements including system protection and control requirements. The Applicant will follow the requirements of the interconnection as specified in the LGIA.

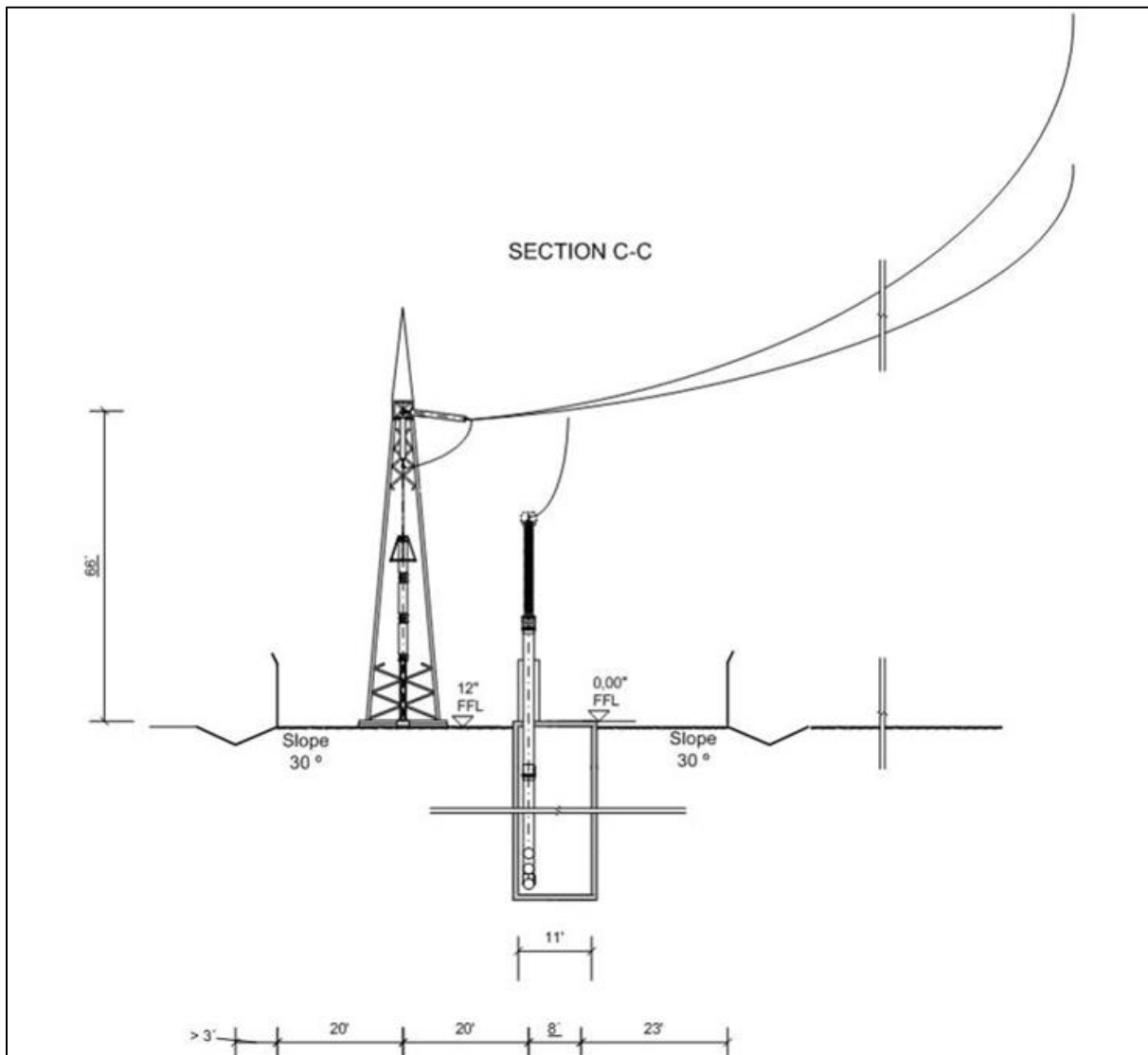


Figure F-7: Typical Transition from Underground to OHL

Source: Siemens Power Transmission & Distribution

2.2.2 Bluewater Substation

Located directly adjacent to the SCE Alberhill substation will be two 500/230/13.8 KV step down transformers, that will compose the interconnection of the 230 KV Blue Water primary transmission system. The first pole drop from SCE will be an air insulated structure at 500 KV. On the project side we will have a gas insulated breaker and a half configuration, PT/CT's, protection, CAISO metering and telemetry cabinets. The two transformers will be 500 MVA each to provide for an N-1 contingency. The 230 KV side will also have a similar gas insulated breaker and a half configuration. In addition, will be CT/PT's with protection and additional telemetry.

Communication between the Bluewater Substation and Santa Rosa Substation will be fiber optic static lines. The 230 KV will transition to air insulated bushings and rise to our first 230 KV structure, starting at mile marker 0.0 Miles.

Normal synchronizing of the project generators will be done at the Santa Rosa Substation. In the event of Black Start operation, (synchronous control) the synchronizing will be done remotely at the Bluewater Substation, through the fiber optic cables.

2.2.3 Santa Rosa Substation

The proposed Santa Rosa Substation is located within the unincorporated area of Lakeland Village in Riverside County. The Substation will provide reliability enhancements to the local distribution system⁷ and later connect the pumped storage facility to the grid.

The new Santa Rosa Substation will be constructed above ground and may later be integrated into the design of the Project powerhouse. 115 kV circuits will supply starting and facilities power required by the Project.

The Santa Rosa Substation provides for a connection for the pumped storage facility's powerhouse to connect to the high-voltage transmission system. The point of connection between the pumped storage facility and the high voltage grid, will be the secondary side of the two 230/20 kV transformers rated at 375 MVA. The generator voltage of the pumped turbine generator is 20 kV.

The proposed Santa Rosa Substation will enclose a breaker and a half, 230 kV configuration. The primary components of the substation include circuit breakers and disconnect switches, switchyard buses and structures, and microwave/telecommunication facilities.

Design parameters are shown on Table F-1.

Table F-1: Santa Rosa Substation Design Parameters

Rated Voltage	230 kV
Rated Frequency	60 Hz
Rated lightning impulse withstand voltage	1000 kV
Rated power frequency withstand voltage (1 min)	740 kV
Rated current busbar	4000 A
Rated current feeder	4000 A
Rated Short – time withstand current	63 kA / 1s
Rated short – circuit breaking current	63 kA
Indoor ambient temperature	-5 C / +40 C
Outdoor ambient temperature	-5 C / +49 C

Source: The Nevada Hydro Company

Lighting requirements for the facility fall within the following regulatory constraints.

The location falls within the 45 mile radius of the Palomar Observatory. Due to ambient light pollution, the County of Riverside has enacted Ordinance No. 655 on June 7, 1988. This Ordinance provides limitations on night-time lighting, to limit impacts on observations from Palomar Observatory.

The facility also falls into Class II, Zone B regulations as specified in Ordinance No. 655. Due to these requirements, lighting will be low-pressure sodium (LPS) lighting. In addition, the lighting levels are not to exceed 4050 Lumens. Under Class II, Zone B, lighting is not limited to time of day.

^{7/} Nevada Hydro notes that these enhancements are necessary only if the Commission does not approve SCE's Alberhill project. If approved, Nevada Hydro will withdraw these enhancements from the project description.

Therefore low pressure sodium lights will be installed throughout the facility, for complete exterior coverage, with lighting levels below 4050 Lumens. This lighting will be photocell controlled for energy conservation.

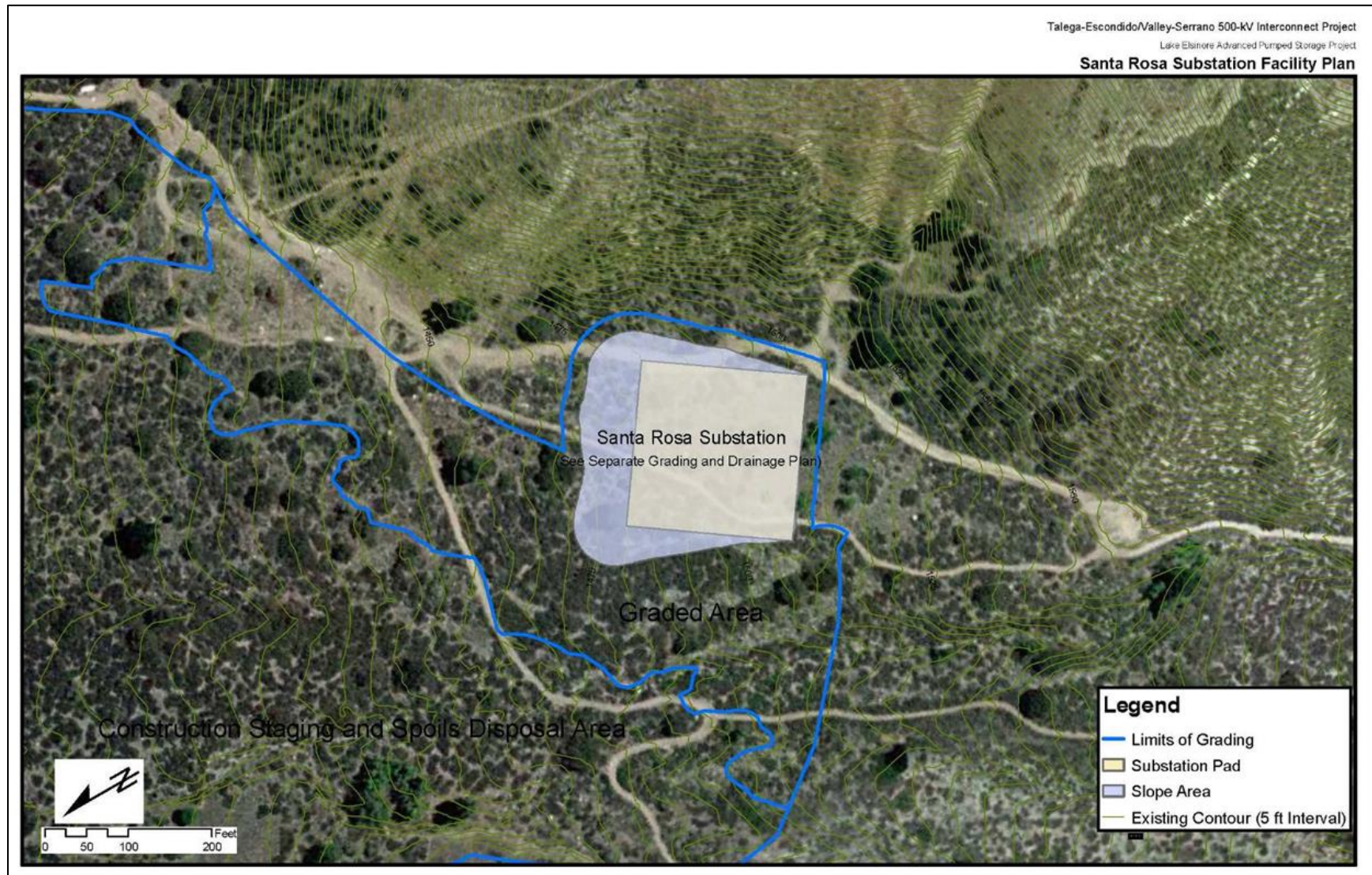


Figure F-8: Santa Rosa Grading Plan

Source: The Nevada Hydro Company

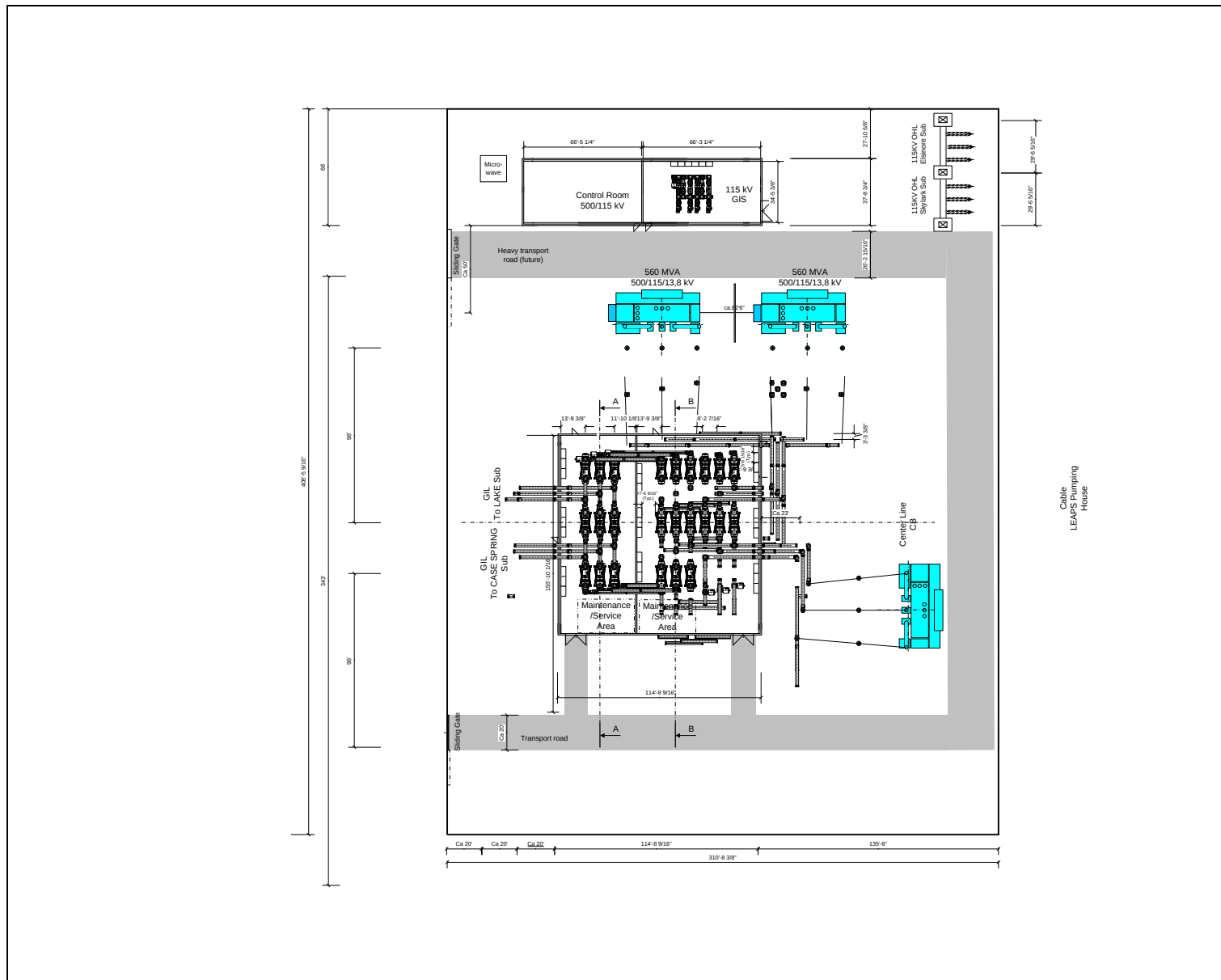


Figure F-9: Santa Rosa Substation Site – Conceptual Site Plan

Source: Siemens Power Transmission & Distribution

2.3 Telecommunications

Overhead shield wires will be used to protect the electrical conductors from lightning strikes. These wires would be aluminum-coated steel-stranded wire with a fiber-optic core for communication purposes. Some of the fibers in the fiber-optic core would be used for control and monitoring of protective relaying and communication equipment between facilities. The remaining static wire will be insulated at 4.16 kV for any required tower lighting. In addition, the power will be used approximately every mile for communications equipment, and fiber repeaters as required.

Fiber will be utilized throughout the project for communications. One static wire on all transmission towers has a fiber core. Fiber is also used extensively underground, and in all project works.

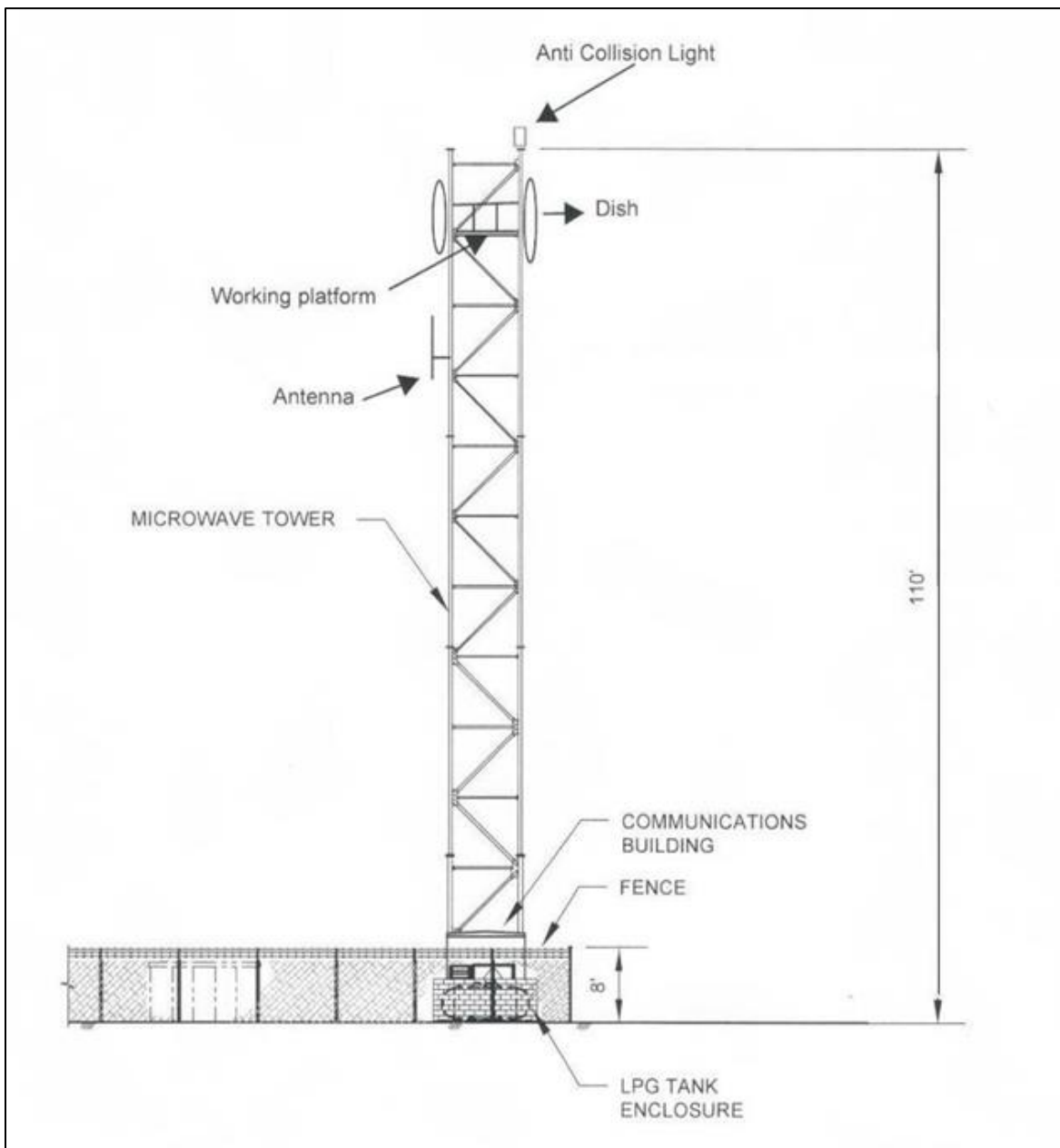


Figure F-10: Representative Communication Tower

Source: Siemens Power Transmission & Distribution

Microwave will be utilized throughout the project for control and telemetry. This is line of site communications, and will require microwave towers at all substations, powerhouse and at major project locations.

Telephone will be utilized throughout the project locations for communications and security.

Finally, radio will be utilized through the Project for radio line of sight communications, telemetry, security, communications, and internet. UHF, VHF, Cell, GHz, and Wi-Fi frequencies are commonly used both dish & antenna. Communications towers will be required adjacent to all major project facilities. It is anticipated that Santa Rosa Substation and the Project Powerhouse will require 100 ft. to 300 ft. towers for line-of-sight communications. The towers will be equipped with antenna platforms and anti-collision lights. A representative communications tower may be seen in Figure F-10.

2.4 System Upgrades

Separately addressed below are upgrades and other modifications to the existing CAISO high voltage system that have been identified as needed to accommodate power flows from the Project through interconnection facilities studies (IFS).

The Applicant notes that SCE and the CAISO, have responsibility to identify upgrades to the utilities' respective existing systems that may be needed to accommodate the Project. The applicant reports here the upgrades that these entities have identified to date.

It is the Applicant's understanding that some of the upgrades identified below will require certain improvements to existing substations and other facilities. Because these modifications would occur in areas that are already graded and surfaced, only minimal additional disturbance to those areas would be anticipated as a result of any project-related improvements.

These utility-identified upgrades and improvements to existing SCE facilities are described below. The list of improvements may, however, be subsequently modified in accordance with the provisions of the large-generator interconnection agreements (LGIAs) that have been executed between the Applicant and SCE and the CAISO.

2.4.1 SCE Upgrades

2.4.1.1 Upgrades to High Voltage System

The station should allow enough space for future installation of two 230 kV Capacitor Banks. In addition, protection relays associated with the 230 kV system will be installed at each of the two remaining line positions as follows:

- Two G.E. C60 breaker management relays
- One SEL-311L line current differential (digital F.O. channel)
- One G.E. L90 line current differential (digital F.O. channel)
- One G.E. D 60 directional comparison pilot relaying (digital F.O./MW channel)
- One RFL 9745 tele-protection channel DTT (digital F.O. channel)
- One RFL 9745 tele-protection channel DTT (M/W channel)

Other station elements will include:

- One 32/64 digital fault recorder
- One Ethernet service drop
- One SEL-2030 connected to all three SEL-311L relays
- Telecommunications tower and microwave dish antenna
- Perimeter fence with double barbed wire and a double door 20 ft. gate around the substation
- Grounding grid to cover the substation area and additional 10 ft. outside the perimeter fence
- Grading and site preparation for the substation area and additional 10 ft. outside the perimeter fence
- A 25 foot wide paved driveway around the 500 kV switchyard to provide access to the relay room
- All required control cable trenches from the relay room to the 500 kV switchyard

In addition, the Serrano Substation will be upgraded as follows:

- Upgrade the Serrano-Valley 500 kV line protection as needed to change the line to a new Alberhill-Serrano 500 kV transmission line
- Replace the existing LFCB relay with a new SEL-311L line current differential relay and modify the existing D60 and L90 relays to change the existing transfer trip schemes from Valley Substation to Alberhill
- Reconfigure the existing digital channel from Valley Substation to Alberhill and modify the existing SEL 2030 telecommunications processor with Ethernet to provide connection to the new SEL relay

Further, the Valley Substation will be upgraded as follows:

- Upgrade the Serrano-Valley 500 kV line protection as needed to change the line to the new Alberhill 500 kV transmission line
- Replace the existing LFCB relay with a new SEL-311L line current differential relay and modify the existing D60 and L90 relays to change the existing transfer trip schemes from Serrano Substation to Alberhill
- Reconfigure the existing digital channel from Serrano Substation to Alberhill and modify the existing SEL 2030 telecommunications processor with Ethernet to provide connection to the new SEL relay
- The Etiwanda Generating Station will be upgraded as follows:
- Replace the 2000A wave trap on the Vista 220 kV line position with 3000A rated wave trap, with N-2 contingency rating of 3210A to support the maximum N-2 line loading of 3071A
- Replace twenty-four 63 kA 220 kV circuit breakers with new 80 kA rated circuit breakers and upgrade the Etiwanda 220 kV switchyard to 80 kA rating.

Based on this assumption, it is expected that, in addition to the work herein, the following additional upgrades would be required:

- Replace twenty-eight 220 kV disconnect switches
- Replace twenty-four 220 kV surge arresters
- Replace all line and bank vertical risers with tubular conductors;
- Replace all 4/0 CU connectors to the ground grid with new 350 kCMIL ACSR
- Install new sections of 350 kCMIL ACSR ground grid and connect to the existing 4/0 CU grid

2.4.1.2 Telecommunication Upgrades

Telecommunication upgrades will include:

1. Dual communication channels on separate routes to support the line protection relays on the new Alberhill-Serrano and Alberhill -Valley 500 kV transmission lines.
2. New microwave path from Alberhill to the existing Santiago Peak Communication Site. At the following substations, the noted changes will also be required:
 - At the Alberhill Substation, install new light wave, microwave (including dish antennas), channel equipment for 500 kV line protection communications tower, fiber optic cable, and DC system, plus new voice and data network infrastructure (operations phones, modem lines, LAN connections to relays, etc.)
 - At the Serrano Substation, install new light wave and channel equipment for 500 kV line protection, plus incremental addition of voice and data network infrastructure (rack phones, modem lines, LAN connections to relays, etc.).
 - At the Valley Substation, install new light wave and channel equipment for 500 kV line protection, plus incremental addition of voice and data network infrastructure (rack phones, modem lines, LAN connections to relays, etc.).
 - At the Santiago Peak Communications Site, install new microwave and dish antennas to link the Lake Switchyard to Serrano and Valley Substations for 500 kV line protection.
 - At the Mira Loma Substation, install new light wave equipment to link the Lake Switchyard to Serrano Substation for 500 kV line protection.

Install dual communication channels and OPGW on separate routes to support the line protection relays on the new line.

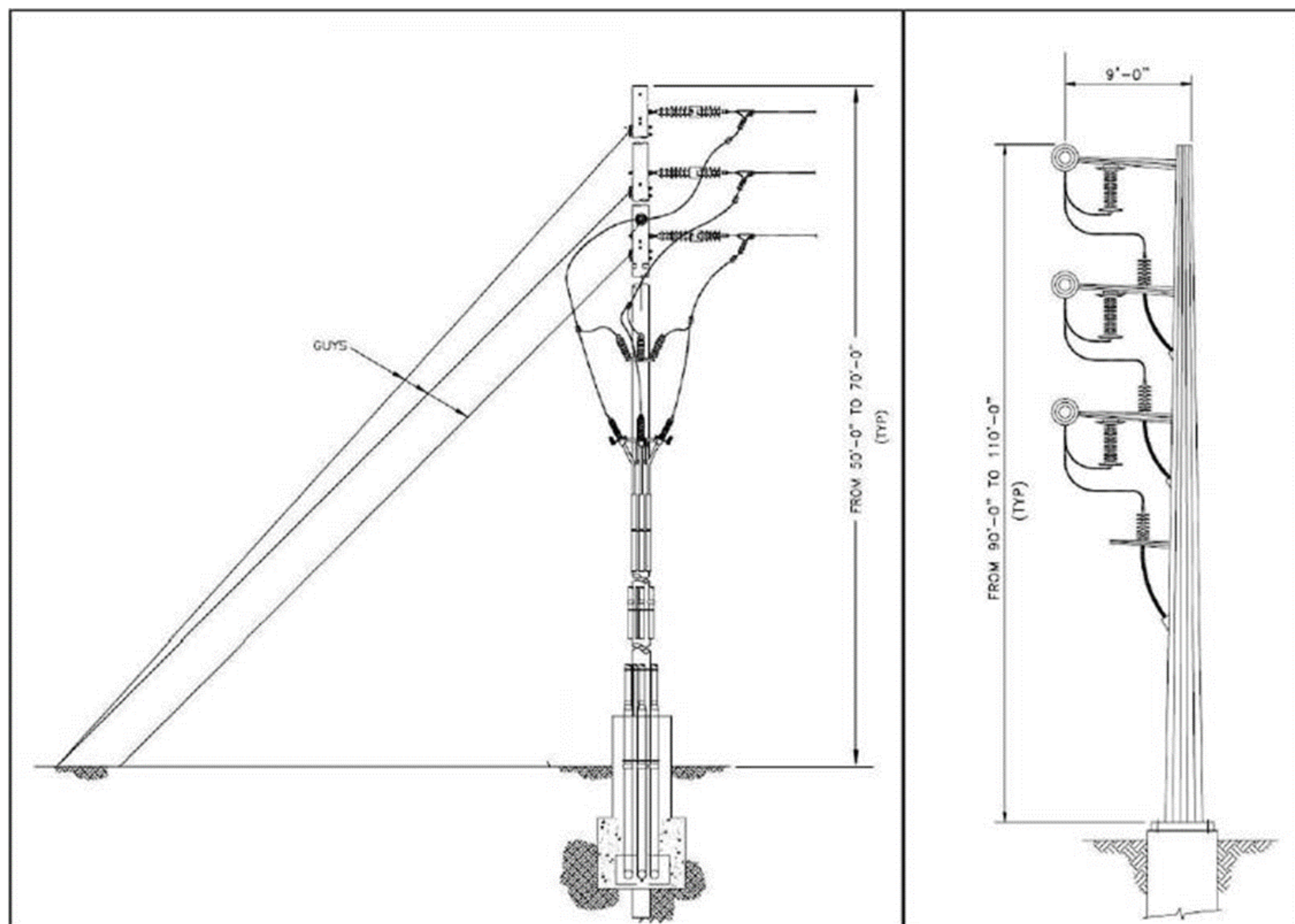


Figure F-11: Typical Single Circuit 69 kV Steel Cable Pole

Source: SDG&E

3.0 SUPPORTING DESIGN REPORT

A preliminary supporting design report is intended to document the geological conditions, stability calculations, supplementary data and other background information that has been developed to date. The Applicant has chosen to rely on the information contained in the FEIS to meet this Commission requirement. A final supporting design report will be provided at the conclusion of additional geotechnical and other studies, and when detailed engineering and design has been completed.

3.1 Site Suitability

The Applicant believes that the previously provided geotechnical reports under FERC Docket 14227 adequately supports the suitability of the site for the proposed project.

3.2 Logs and Geologic Reports

Copies of logs and reports prepared by the Applicant's geotechnical consultant, Genterra, may be found in Volume 12 of the previously submitted License Application, under "Supporting Design Reports.

3.3 Construction Materials Sites and Estimates

For the purposes of this discussion, the Project consists of two components: the pumped hydro component and the electrical components associated with the primary line connecting the facility to the grid. Construction activities for each would include establishment of staging areas for materials and equipment, development of access roads and spur roads to reach construction sites and development of support staging areas. All construction activity areas are designated on figures referenced individually in the following discussion.

3.3.1 General Approach to Project Construction

For the primary transmission line, underground installation would involve duct, vault and cable installation in sequence. Any overhead transmission line construction would involve new tower construction which would include clearing of footing locations, installation of foundations, tower assembly, and tower erection. After towers are in place, crews would proceed with stringing of conductor and overhead ground wires. Once transmission line construction is complete, clean-up of construction sites and demobilization of personnel and equipment would occur. The exact construction methods employed and the sequence with which construction tasks occur would be dependent on final engineering, contract award, conditions of permits, and contractor preference.

For the pumped storage component, construction activities would include clearing and laydown area preparation for materials and equipment, excavation spoil temporary and permanent disposal area clearing, grading and drainage construction, upper reservoir clearing and overburden stripping for the reservoir and embankment foundations, and general construction trailer set-up with utilities, temporary fencing, and parking areas. Areas for disposal or stockpile areas for natural earth stripping materials would be identified or temporary stockpile areas would be designated in the event that the stripping materials are re-used in the construction of the dam. Tunnel spoil stockpile or disposal areas will also be cleared and graded to drain off and around the spoils.

Temporary construction support facilities such as temporary office trailers and parking areas would be established. Temporary utilities would be established near the tunnel outlet area and at the upper reservoir, with local sources of power, telephone, water, and sanitary facilities provided. If local utilities are unavailable, all power will be provided by portable generators, and all water and sanitary facilities would be supplied and serviced remotely.

In general, construction efforts would occur in accordance with accepted construction industry standards. Construction activities above ground generally would be scheduled during daylight hours (7:00 A.M. to 5:00 P.M.), Monday through Saturday. Underground construction may proceed round-the-clock, Monday through Saturday or under an alternate extended schedule, if permitted. When different hours or days are necessary, the Applicant would obtain variances, as necessary, from the jurisdiction in which the work would take place. All materials associated with construction efforts would be delivered by truck or helicopter to established staging and material laydown areas. Delivery activities requiring major street use such as Grand Avenue or Ortega Highway would be scheduled to occur during off-peak traffic hours.

Previously disturbed areas would be used during construction wherever possible. Once sites for construction areas are proposed, biological and cultural resource reviews would be conducted before final site selection. The size of individual construction areas would vary from a fraction of an acre to up to as much as 10 acres, depending on its purpose for construction. In addition to construction materials and equipment, these areas may contain trash and recycle bins. Preparation of the construction areas will include site clearing and grubbing, site grading and drainage preparation, and in all cases, the implementation of Storm Water Pollution Prevention Plan (SWPPP) best management practices.

The following sections provide more detailed information about the construction tasks that would be associated with the overall Project.

3.3.1.1 Primary Staging Areas

Primary staging areas would be used to stage equipment and materials during the primary transmission line construction activities. Materials and equipment typically staged at these staging areas would include, but would not be limited to, concrete vaults, underground cable wheels, overhead tower steel bundles, tubular steel poles, spur angles, palletized bolts, rebar, wire reels, insulators and hardware, heavy equipment, light trucks, construction trailers, and portable sanitation facilities.

The primary transmission line would include several staging yards that would be selected based on accessibility to construction locations and proximity to transmission line and substation access roads.

Where possible, previously disturbed areas would be used. In addition to construction materials and equipment, these staging areas may contain trash and recycle bins. Preparation of the primary staging areas would include the application of road base, installation of perimeter fencing, and implementation of SWPPP best management practices.

In addition to the primary staging areas, secondary staging areas would be established for short-term utilization near construction sites. Where possible, the secondary staging areas would be sited in areas of previous disturbance along the construction corridors. Final siting of these staging areas would depend upon availability of appropriately zoned property that is suitable for this purpose. The number and size of the secondary staging areas would be dependent upon a detailed ROW inspection and would take into account, where practical, suggestions by the successful bidder for the work. Preparation of the secondary staging areas would include installation of perimeter fencing, and implementation of SWPPP best management practices. Application of road base may also occur, depending on existing ground conditions at the yard site.

3.3.1.2 Vegetation Clearance

Minimal vegetation clearing will be performed as required for construction of the project components. Care will be taken to minimize soil disturbance during construction and restoration, plus for temporary construction disturbance, areas will be developed with agency concurrence as part of the design and mitigation process.

3.3.1.3 Erosion and Sediment Control and Pollution Prevention during Construction

In compliance with the CWA, site construction activities would be consistent with National Pollutant Discharge Elimination System (NPDES) program requirements, which would include development of an SWPPP for the site before construction commences. The SWPPP would focus on implementation of Best Management Practices and other actions during construction to protect the quality of waters near the construction site.

Construction of new substations and associated access roads would require earthwork activities. Construction sites would first be cleared of vegetation and loose rock and then graded to provide a near-level surface with site slope designed to collect and control drainage that minimizes surface erosion. Sites would be graded such that water would run toward the direction of the natural drainage. In addition, drainage would be designed to prevent ponding and erosive water flows that could cause damage to the tower footings.

Soils generated from the grading activities would be tested to determine if environmental contamination is present before soil removal for disposal. During grading operations, dust would be controlled by measures outlined in the SWPPP.

Construction debris from activities at each substation site would be placed in appropriate onsite containers and periodically disposed of per applicable regulations.

3.3.2 The Pumped Hydro Component

Bluewater will have an installed generating capacity of 500 MW and pumping capacity of 600 MW, provided by two single-stage reversible Francis-type pump turbine units operating under an average net head of approximately 1,500 feet. The facility will firm up and store renewable energy, primarily wind energy⁸, and will be one of the most efficient storage facilities in the world, rated at approximately 83.3% net at the 500 kV primary levels.

Modern pumped storage units produce all five ancillary services. In addition, the unit and regulator designs provide fast response dynamics, tied directly to the intermittency of renewable products. Grid operations and protection designs must take in to account these grid-enhancing products, and make sure they are properly integrated into the CAISO controlled grid. Some ancillary products can be provided simultaneously, and regulation is provided both directions, (in generation and pumping modes).

The facility currently consists of two 250 MW Voith Siemens Hydro Power Generation synchronous generators, 600 MW of pump load, step-up transformers, and appurtenant facilities. This federal hydroelectric project is being licensed by FERC⁹ (FERC P-14227) under the provision of the FPA and is being

⁸/ Pumped storage can minimize the system impact of integrating large volumes of intermittent wind resources into the power grid by absorbing electricity generation during high-wind periods that would otherwise cause operational problems for system operators. Pumped storage can be used in tandem with wind resources to shift delivery of wind energy from off-peak to on-peak period during the day and smooth out production spikes (Source: California Energy Commission, Integrated Energy Policy Report, CEC-100-2-5-007CMF, November 2005, p. 146).

⁹/ FERC's authority to license hydropower projects is found in Part 1 of the FPA. Section 4(e) of the FPA (16 U.S.C. 797[e]) empowers FERC to issue licenses for projects that: (1) are located on navigable waters; (2) located on non-navigable waters over which Congress has Commerce Clause jurisdiction, were constructed after 1935, and affect the interests of interstate

permitted by the Forest Service under the provisions of the National Forest Management Act (NFMA). Section 15(e) of the FPA (16 U.S.C. 808[e]) specifies that any license issued by FERC shall be for a term that FERC determines to be in the public interest but not less than 30 years nor more than 50 years from the date of issuance. A 50 year federal hydropower license, with the potential for subsequent relicensing for an extended term beyond 50 years, has been assumed herein.

The Project facility will conform to and comply with FERC's "Engineering Guidelines for the Evaluation of Hydroelectric Projects."¹⁰ As stipulated in Part 12 (Safety of Water Power Projects and Project Works) therein, the licensee must use sound and prudent engineering practices in any action relating to the design, construction, operation, maintenance, use, repair, or modification of a water power project or project works (Section 12.5). Requirements include the preparation of an "emergency action plan" (EAP) developed in consultation and cooperation with appropriate federal, State, and local agencies responsible for public health and safety and designed to provide early warning to upstream and downstream inhabitants, property owners, operators of water-related facilities, recreational users, and other persons in the vicinity who might be affected by a project emergency (Section 12.20). The EAP shall conform to FERC guidelines (Section 12.22) and must be filed no later than 60 days before the initial filling of the upper reservoir begins (Section 12.23).

Because the proposed upper reservoir's impoundment would be classified as a "high hazard dam" or "high hazard potential structure,"¹¹ the EAP will be developed in accordance with FERC¹² and Federal Emergency Management Agency¹³ (FEMA) regulations, guideline, and manuals. Final dam design and specification shall be subject to the findings of the design-level seismic investigation conforming to FERC,¹⁴ FEMA,¹⁵ and applicable California Department of Water Resources - Division of Safety of Dams¹⁶ (DSOD) standards.

As required, the Applicant's "standard technical information document" (STID) will include a surveillance and monitoring plan (SMP) providing the details of how the owner will monitor and evaluate the

or foreign commerce; (3) located on public lands or reservations of the United States (excluding national parks); and/or (4) using surplus water or water power from a federal dam. Jurisdiction applies regardless of project size. Section 10(a)(1) of the FPA (16 U.S.C. 803[a][1]) establishes the comprehensive development standard which each project must meet to be licensed Source: Federal Energy Regulatory Commission, Report on Hydroelectric Licensing Policies, Procedures, and Regulations – Comprehensive Review and Recommendations Pursuant to Section 603 of the Energy Act of 2000, May 2001, pp. 9-11).

^{10/} Federal Energy Regulatory Commission, Engineering Guidelines for the Evaluation of Hydroelectric Projects, April 1991, updated July 1, 2005.

^{11/} Federal Emergency Management Agency, Federal Guidelines for Dam Safety – Hazard Potential Classification System for Dams, April 2004.

^{12/} Federal Energy Regulatory Commission, Guidelines for Preparation of Emergency Action Plans, November 1979, revised September 1988.

^{13/} Federal Emergency Management Agency, Federal Guidelines for Dam Safety, April 2004; Federal Emergency Management Agency, Federal Guidelines for Dam Safety – Emergency Action Planning for Dam Owners, April 2004; Federal Emergency Management Agency, Federal Guidelines for Dam Safety – Selecting and Accommodating Inflow Design Floods for Dams, April 2004.

^{14/} Op. Cit., Engineering Guidelines for the Evaluation of Hydropower Projects, April 1991, updated July 1, 2005; Federal Energy Regulatory Commission, Guidelines for Public Safety at Hydropower Projects, March 1992.

^{15/} Federal Emergency Management Agency, Federal Guidelines for Dam Safety – Earthquake Analysis and Design of Dams, May 2005.

^{16/} Parts 1 and 2 of Division 3 (Dams and Reservoirs) of the CWC; Chapter 1 of Division 2, Title 23 (Waters) of the CCR; and Current Practices of the Department in Supervision of Dams and Reservoirs. Sections 6000-6004.5 of the CWC identify dams and reservoirs that are in State jurisdiction. Dams and reservoirs owned by the United States are not subject to State jurisdiction, except as otherwise provided by federal law.

performance of the dam and project structures. The SMP will include the requirement to periodically submit a surveillance and monitoring report (SMR) presenting, evaluating, interpreting, and providing findings on the overall performance of the dam.¹⁷

Signage, conforming to FERC standards, will be placed at the hydropower facilities.¹⁸ Excluding the afterbay, the project's facilities will be landscaped to provide screening along abutting street frontages. Final landscape plans for those facilities located on NFS lands will be developed in coordination with the Forest Service.

Presented below is a brief discussion of the key facilities that collectively comprise the Project, including non-energy-related facilities that are associated with the project.

3.3.2.1 Decker Canyon Upper Reservoir

Proposed is the creation of a new approximately 110-acre open reservoir (forebay), located in the south fork of Decker Canyon (Sections 21 and 22, T6S, R5W, SBBM USGS 7.5-Minute Alberhill Quadrangle),¹⁹ at the headwaters of San Juan Creek, at MP 11.7. The proposed upper reservoir (forebay) is located within the TRD, at elevations 2660 to 2792 feet above msl, on land under Forest Service jurisdiction. The proposed reservoir site is located adjacent to and south of Killen Truck Trail/South Main Divide Truck Trail (Forest Route 6S07) (South Main Divide Truck Trail), an all-weather, County-maintained two-lane road²⁰ extending eastward from SR-74 (Ortega Highway).

The proposed upper reservoir is not intended for the storage of potable water and no water treatment activities, other than as may be associated with vector control or oxygenation, are proposed therein. No public access to the reservoir site and no recreational contact with the water within that reservoir would be authorized. Access to and waters stored within the upper reservoir will, however, be made available for firefighting purposes.

The new upper reservoir capacity will be approximately 7,000 acre-feet (AF) (approximately 5,500 AF live storage and approximately 1,500 AF reserve storage). A 20 foot wide crushed stone/gravel pathway will be provided around the embankment to allow access for maintenance and inspection. Access will be restricted by signage and an approximately 8 foot high chain-link fence located on the outer side of the crest roadway. Surface water channels will be constructed within the perimeter access corridor. The sides and bottom of the upper reservoir will be provided with an impermeable dual liner (i.e., clay and double geomembrane) system to minimize water loss and seepage. The liner system will allow for steepened reservoir side slopes by protecting the side slopes from rapid drawdown damage (e.g., sloughing, erosion, and landslide) and will protect the reservoir floor from erosion and scour.

In addition to the use of low-permeability soil for the impermeable layer of the floor and side slopes, the upper reservoir will incorporate a double-liner system. The liner system will include a high-density polyethylene (HDPE) liner, drainage layer under the primary geomembrane to collect and convey leakage, secondary HDPE geomembrane under the drainage layer to separate leakage from native groundwater, secondary seepage collection system under the secondary geomembrane to relieve water pressures from

¹⁷/ An outline of the Applicant's SMP is presented in "Supplement No. 1 to Geotechnical Feasibility Report – Preliminary Guidelines for a Monitoring and Surveillance Program, Lake Elsinore Advanced Pumped Storage Project, Riverside County, California" (GENTERRA Consultants, Inc., October 16, 2003), included in the FLA.

¹⁸ Federal Energy Regulatory Commission, Safety Signage at Hydropower Projects, October 2001.

¹⁹/ Latitude: 33.37N; Longitude: 117.2532W.

²⁰/ South Main Divide Truck Trail (Killen Trail) links State Route 74 (SR-74 or Ortega Highway) to the residential area of Rancho Capistrano (Morrell Potero) and to the eastern portion of the TRD. At its eastern terminus, South Main Divide Truck Trail becomes Forest Route 7S04 which extends southward to Tenaja Road, near the southeastern border of the TRD.

under the liner system, and grading preparation as needed to protect the liner system from sharp bedrock protrusions.

Redundant controls will be provided to protect against over-pumping. Three independent systems will be installed to monitor and control the water level in the upper reservoir and to ensure that all units operating in the pumping mode will be tripped before the water level exceeds the final design capacity. These monitoring devices will be coordinated and interlocked in operation to preclude the possibility that failure of a device or a combination of devices and/or any human operating error will allow safe operating levels from being exceeded. For this reason, and since the upper reservoir has no contributory drainage area, no reasonable possibility of exceeding maximum water level will exist.

An intake/outlet structure located in the upper reservoir will interconnect the new upper reservoir with the powerhouse through a single 25 foot diameter nominal conveyance channel and tunnel, with a gated inlet structure. Radial gates, slide gates, or an emergency bulkhead will be installed to shut off water flow from the upper reservoir in the event of an emergency or for inspection and repair.

The proposed upper reservoir will be designed for and will accommodate access by firefighting helicopters and other firefighting personnel. Helicopters will be able to utilize reservoir waters to fill suspended “bambi buckets” or other devices for fire suppression. A windsock or similar device will be installed in a clearly visible location adjacent to the reservoir to assist pilots by indicating wind conditions during firefighting events. In addition, the reservoir’s waters can be pumped from the upper reservoir by mobile water pumping equipment for other fire-response purposes.

The proposed upper reservoir design includes: (1) an approximately 200 foot high main embankment dam²¹ located on the southwest side of the reservoir; (2) maximum and minimum pond elevation of approximately 2792 feet and 2660 feet above msl, respectively; (3) a crest elevation of 2800 feet above msl; and (4) an inlet at elevation of approximately 2600 feet above msl feet for the intake structure.

The required fill volume of the dam is about 3.0 million cubic yards (CY). Grading operations will be conducted in compliance with applicable National Pollutant Discharge Elimination System (NPDES) permit requirements.²²

While most of the excavation will come from within the area of the reservoir itself, alternative dam designs are presented in Section 6.2. Additional excavation materials may come from the powerhouse, shafts, and penstock tunnels. Excavated and/or imported materials will be used to construct the dam and other earth structures required for the impoundment. Materials may be trucked to and from the upper reservoir site along SR-74, via Main Divide Truck Trail.

Embankment material would consist of silty sand and rock materials generated from excavated granitic bedrock and weathered granite. Depending upon the conditions of the bedrock foundation, the dam may be keyed into the foundation rock and the rock foundation may be grouted. All slope inclinations of the dam’s slopes will be approximately 3:1 (horizontal to vertical) but may be constructed flatter to accommodate ground motion criteria currently being evaluated. A freeboard of 8 feet was used to

^{21/} Dams are defined according to 33 CFR 222.6(h) as all artificial barriers, together with appurtenant works, which impound or divert water and which: (1) are 25 feet or more in height; or (2) have an impounding capacity of 50 acre feet or more. Federal regulations define dams for the purpose of ensuring public safety (Source: United States Environmental Protection Agency, National Management Measures to Control Nonpoint Source Pollution from Hydromodifications, July 2006, p. I-2).

^{22/} California Regional Water Quality Control Board, San Diego Region, Order No. R9-2007-0001, NPDES No. CAS0108758, Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority, January 24, 2007, Section D.2.c(1)(a)(vi)

estimate the height of the dam. The crest of the dam will have a relatively narrow width (approximately 30 feet). The dam would include a concrete-lined emergency spillway and a low-level outlet.

3.3.2.2 Project Tunnels/Shaft

Water will be transferred between the upper reservoir and the powerhouse through a single approximately 25 foot diameter, primarily concrete-lined tunnel. The inlet elevation at the proposed upper reservoir will be about 2600 feet above msl.

A tunnel-boring machine (TBM) or conventional hard-rock mining operation will be used to excavate the headrace tunnels. It is anticipated that the high-head conductor will be excavated into competent granitic bedrock. In general, the pipeline alignments will seek to follow the most direct route between the upper reservoir and the powerhouse, taking into consideration the area's topography and subsurface geotechnical features.

A vertical tunnel will descend from a location northeast of the upper reservoir. The vertical tunnel will connect to a lower sub-horizontal tunnel that would have a gradient of approximately five percent downward toward the powerhouse. The horizontal tunnel will be unlined or concrete-lined where there is adequate rock cover over the tunnel and steel lined where there is inadequate rock cover. The horizontal tunnel would then split into a steel-lined manifold immediately upstream of the powerhouse, directing the water flows to the turbines in the powerhouse.

A double-seated spherical valve will be provided at the inlet for each pump-turbine spiral case. The valves will be used to isolate the pump-turbine from the penstock for inspection and maintenance and to close in an emergency. Draft tube bulkhead gates will be provided to be used in conjunction with the penstock valves for dewatering the pump-turbine water passages.

3.3.2.3 Project Powerhouse

The proposed Santa Rosa Powerhouse site (Section 14, T6S, R5W, SBBM, Lake Elsinore 7.5-Minute USGS Topographic Quadrangle) is approximately located west of the terminus of Santa Rosa Drive, between Ponce Drive and Grape Street, within unincorporated Lakeland Village area of Riverside County. The site is located to the south of SR-74 and west of Grand Avenue.

The proposed underground powerhouse will be situated approximately 2,500 to 3,000 feet from Lake Elsinore, with its roof located 330 feet below surface at elevation 1,163 msl, and with the centerline of the pump/turbine spiral cases at 1,043 msl. The powerhouse will contain two reversible Francis-type pump-turbine/motor generators, nominally rated at 300 MW each when pumping. The elevation of the pump/turbines at 195 feet below the surface of the lake is due to their hydraulic characteristics, so as to provide sufficient suction pressure at the impellers. This suction pressure ensures that the machines will operate without cavitation either in the pump mode or in the turbine mode. The entire water conveyance system (that is the headrace tunnels, the pump/turbine cases, and the tailrace tunnel) is a closed conduit system, so that, when generating, the differential head drop from the upper reservoir (Decker Lake) to the lower reservoir (Lake Elsinore) is the motive energy force and the elevation of the powerhouse, whether above or below the surface of Lake Elsinore does not affect the gross head available to drive the machines.

Each pump/turbine will have adjustable wicket gates controlled by an electronic governor through oil-operated servomotors. Consistent with all Francis-type pump/turbines, the units will operate at relatively constant flow rate while pumping. The pump/turbine runner and wicket gates, as well as other components that may otherwise be susceptible to cavitation, will be of solid stainless steel construction, to prevent cavitation damage.

A service bay will be provided at one end of the powerhouse. Equipment access by overhead crane to the powerhouse will be via a vertical shaft extending from the land surface down to a service bay and laydown area on the generator floor. Personnel will have access via an elevator.

Powerhouse equipment will include an over-head bridge crane supported on high-level beams along the length of the powerhouse. The crane will be sized to handle the heaviest lift during equipment installation and maintenance. The powerhouse cavern housing the pumping/ generating units will be approximately 175 feet long, 250 feet wide, and 160 feet high.

The main powerhouse cavity will contain local operating and control equipment for each unit. The powerhouse roof will be supported by rock bolts or rock anchors with wire mesh and shotcrete for support as needed. The powerhouse will accommodate spherical turbine inlet valves to control flow into the units. The valves will be placed immediately upstream of the spiral case so that they can be handled by the main powerhouse crane.

Galleries for electrical and mechanical services will be provided on the upstream and downstream sides of the powerhouse, respectively. Discharge from the units in the generating mode will pass through the draft tubes into the tailrace tunnel. This tunnel will be D-shaped and concrete-lined.

The power plant's mechanical systems will be designed to maintain suitable and safe conditions for operators and maintenance personnel. Ventilation air in and out of the powerhouse access tunnel will be provided. The major heat-producing units will be cooled by oil-water and air-water heat-exchange systems. A system of ducting, bulkhead controls, and circulating fans will be installed to ensure equitable distribution of air throughout the facility and prevent the accumulation of carbon monoxide (CO) and other gases. Fire doors, incorporating air locks, will be provided at key locations. Fire prevention systems in the underground plant will be conventional deluge-type for the major items of equipment. Tied to these systems will be a system of isolating dampers and bulkheads connected to the ventilation system for control of smoke and fumes. In accordance with fire and building code standards, a high-pressure fire system will supply water to fire hose stations located throughout the facility. Unit dewatering will employ high-capacity pumps in pressurized pump pits.

Two 2,000 kW emergency diesel generators will run an air compressor and essential cooling pumps for the powerhouse complex.

Although computer and programmable logic control (PLC) systems improve plant operation by providing greater flexibility in control, alarming, and sequence of events recording, the essential emergency shutdown controls shall remain hardwired. This will guarantee that a safe and orderly shutdown of the plant can be accomplished in an emergency situation during which the computer and PLC systems have failed.

3.3.2.4 Lake Elsinore Intake/Outlet Structure

Between the powerhouse and lower reservoir, the inlet/outfall structure and its associated conduit (tailrace) will be located within an unincorporated County area. At the lakeshore, the inlet/outlet and other associated improvements extending into Lake Elsinore (e.g., intake headwall structure, reinforced dredged channel, and boat dock) will be constructed within the corporate boundaries of the City.

The lower reservoir will be located near the southwest shoreline of Lake Elsinore. The structure will extend from the portal of the tailrace tunnel to a headwall structure fitted with trashracks at the shoreline. The structure will be designed to provide a maximum discharge velocity of 1.8 feet per second (fps) at the trashracks during generation and a maximum intake velocity of 1.4 fps at the trashracks during pumping. Stoplogs will be provided at the portal so that the tailrace tunnel can be isolated from Lake Elsinore.

A rip-rap lined, reinforced dredged channel at the inlet/outlet (tailrace) structure will be installed to reduce velocities, provide a natural silt trap, and shape a velocity profile into the intake screens, structure, and gates. Following construction, the cofferdam will be removed. A paved maintenance road would provide shoreline access and a boat dock installed to allow for lake access during facility maintenance. The area will be equipped with security cables, warning signs, warning buoys, security cameras, and navigational warning lights.

The tailrace structure for the upper reservoir will consist of a gated inlet structure where the water flows into a horizontal or sloping conduit. Radial gates, slide gates, or an emergency bulkhead will be installed to shut off water flow from the upper reservoir in the event of an emergency and for inspection and repair of the high-head conduit. The intake/outlet structures will be equipped with trashracks to prevent large debris from entering the conduit system. The structure will be located at sufficient depth below minimum operating level to prevent air entrainment. The intake/outlet structure will be reinforced concrete with automated trashracks and stoplogs and will incorporate fish excluders. Fish excluders can be changed seasonally but not automated.

3.3.2.5 Lake Elsinore as the Lower Reservoir

Lake Elsinore will serve as the afterbay for the Project. Lake Elsinore is a relatively shallow lake with a large surface area. The lake, a naturally occurring sink for the San Jacinto River watershed, has been significantly modified for water control.²³ At the current lake outlet sill elevation of 1255 feet above msl, the lake has an average depth of 24.7 feet and the hypolimnetic water volume and surface area are 54,504 AF and 3,606 acres, respectively.²⁴ Waters within the lake are owned by the EVMWD and the real property within the OHWM is owned by and located within the corporate boundaries of the City. Public access to the lakeshore is limited to locations along the lakeshore where property is publicly owned.

Water from Lake Elsinore will be used for the initial filling of the upper reservoir, for the replenishment of evaporative losses from that reservoir, and for any supply waters that may be required within either the Santa Ana River or San Juan Creek watersheds for the mitigation of any project-related water-diminishment or habitat restoration impacts.²⁵

During the facility's operation, waters will be cycled between the existing lower reservoir and the new upper reservoir through a closed loop system.

Under normal operations, approximately 5,000 AF of water will cycle between the two waterbodies, producing an approximately 20-inch maximum horizontal rise or fall of surface water elevations in Lake Elsinore during a weekly cycle (at lake elevation of 1240 feet Above MSL). The typical maximum daily hydraulic drawdown for Lake Elsinore is projected to be about 0.98 feet and the maximum hydraulic drawdown of Lake Elsinore is projected to be about 1.72 feet. The maximum projected drawdown of 1.72 feet per week represents 5,340.3 AF (maximum hydraulic storage). Since much of the shoreline slopes between 4 and 8 percent, the resulting shoreline fluctuation through each cycle will be between approximately 12 and 38 feet. A greater shoreline withdrawal could occur in areas with extremely shallow slope or if drawdown during the facility's operation were to exceed these projections.

²³/ Lichvar, Robert, Gustina, Gregory, Ericsson, Michael, Planning Level Delineation and Geospatial Characterization of Aquatic Resources for San Jacinto and Portions of Santa Margarita Watershed, Riverside County, California, United States Army Corps of Engineers, March 2003, p. 28.

²⁴/ Lake Elsinore and San Jacinto Watershed Authority (Montgomery Watson Harza), Final Program Environmental Impact Report – Lake Elsinore Stabilization and Enhancement Project, SCH No. 2001071042, September 2005, p. 5-19.

²⁵/ All such waters shall be provided under the terms of the existing comprehensive water management agreement between the City of Lake Elsinore and the Elsinore Valley Municipal Water District. Nevada Hydro expects to provide funds to the City in order that it can meet its obligations under this purpose.

It is assumed that the starting elevation of water in Lake Elsinore is 1240 feet above msl. At an elevation of 1240 feet above msl, Lake Elsinore contains 38,518 AF of water. At this elevation, the lake will have its maximum level change based on a given water transfer. At elevation 1247 feet above msl, the capacity of Lake Elsinore is 61,201 AF. The rate of change at this elevation is 37 percent less for the same water transfer.

3.3.2.6 Excavation Volumes

As shown in Table F-2, combined fill volumes of the upper dam at Decker Canyon and the embankments at the intake works at Lake Elsinore are estimated to be 2,839,000 cubic yards. It is therefore expected that excavation and fill volumes will be approximately balanced. Please also refer to Section 2.3.2- Construction Sequence of the FEIS.

Table F-2: Excavation Volumes

Project Component	Excavation volume (cu yards)
Upper reservoir (will be re-used in dam where possible)	2,036,000
Penstock, (headrace, including adits, inlets etc))	177,500
Powerhouse cavern	207,000
Powerhouse access shaft	53,000
Powerhouse draft tubes	6,000
Penstock (tailrace)	65,000
Ventilation shaft	500
Surge shaft	32,000
Lower reservoir intake	200,000
Santa Rosa Tunnel	33,000
Ridge Tunnel	56,000
Total volume	2,866,000

Source: The Nevada Hydro Company

3.3.3 Electrical Components

The electrical components of the project have been thoroughly described for the CPUC, and is repeated here. These components consist of above and below ground components as well as substations and switchyard.

3.3.3.1 Transmission Line Construction

This section describes the specific plans for each of the construction area types and individual components of the primary transmission line. This includes the activities associated with the Santa Rosa substation and the new transmission line construction.

3.3.3.1.1 Setup, Pulling and Splicing Work Areas

The dimensions of the area needed for the stringing setups associated with wire installation are variable and depends upon terrain. On average, however, pulling and splicing equipment set-up sites require an area of 200 feet by 200 feet (0.92 acre); however, crews can work from within a slightly smaller area when space is limited. These locations require level areas to allow for maneuvering of the equipment. When possible, pulling and splicing locations would be located on existing level areas and existing roads to minimize the need for grading and cleanup. Splicing locations may only be known after final design is accomplished.

Each pulling location would include one puller positioned at one end and one tensioner and wire reel stand truck positioned at the other end. Specialized support equipment such as skidders and wire crimping equipment would be strategically positioned to support the operations.

Temporary construction work area disturbances would be temporary and the land would be restored to its previous condition following completion construction activities. Estimates of the land disturbance associated with this activity are provided in Table F-3.

Table F-3: Estimate of Land Disturbance for Santa Rosa Substation Site

	Santa Rosa Substation	
	Dimensions (Ft)	Area of Disturbance (Ac)
Substation Pad	310 ft W 407 ft L	2.90 ac
Side Slope Grading		2.11 ac.
Primary Access Road	Santa Rosa Avenue	County Rd.
Total Estimated		5.01 ac.

Source: The Nevada Hydro Company

3.3.3.1.2 Underground Transmission Line Construction

For the purpose of calculating the area of disturbance associated with the installation of the primary underground transmission line, it can be assumed that a 10-foot wide permanent easements will be required along the length of the primary transmission line. Resulting in an area of 10.3 acres. The transmission line will be within or parallel existing disturbance along its entire length, thereby minimizing environmental impacts.

3.3.3.1.3 Disposal of Removed Material

3.3.3.1.3.1 Material Removed during Mining Operations

At mobilization, the tunneling operations would begin as critical path tasks, with construction of the Upper Reservoir at Decker Canyon is a priority. At Decker Canyon, an area will be set aside immediately for the temporary deposition of removed materials from tunneling associated with the Ridge Tunnel and the vertical access shaft and the upper part of the lower section of the Santa Rosa Tunnel. These materials will eventually be used in the construction of the dam at the Upper Reservoir in Decker Canyon.

The vertical access shaft at the upper end of the Santa Rosa Tunnel will progress downwards to the designated lowest elevation (approximately 2,100 feet msl) and then the crew will move into the lower section and progress in the direction of the Santa Rosa site. Work will also commence as soon as possible after mobilization in the lower section of the Santa Rosa Tunnel at the Santa Rosa Substation location, and the crew will move toward the vertical access shaft. The two crews will meet up in the lower section. Materials removed from the vertical access shaft (approximately 8,500 cubic yards) and from the lower section down to the meeting point (approximately 13,000 cubic yards) will be taken to the top and will be deposited at the Decker Canyon temporary site. The remaining approximately 19,000 cubic yards removed from the Santa Rosa Tunnel from the Santa Rosa end will be utilized in the grading to a level condition of the Santa Rosa Substation area, for which approximately 20,000-25,000 cubic yards are needed.

3.3.3.2 Substation Construction

3.3.3.2.1 General Construction Considerations – All Sites

Construction of new substations, substation expansions, and associated access roads would require earthwork activities. Construction sites would first be cleared of vegetation and loose rock and then graded to provide a near-level surface. Soils generated from the grading activities would be tested to determine if environmental contamination is present before soil removal for disposal. During grading operations, dust would be controlled by measures outlined in the SWPPP.

Installation of new equipment and structures at each substation requires excavation for major reinforced concrete footings, GIS equipment slabs, transformer foundations oil containment pits and water separators. In parallel with the foundation excavation cable duct trenches are dug. Soil from these excavations would be redistributed on substation property.

Construction debris from activities at each substation site would be placed in appropriate onsite containers and periodically disposed of per applicable regulations. All construction will be performed by licensed experience substation construction contractors under the control of a general site contractor. Major civil portions of the work including earth work, foundations cable trenching, ground mat, drainage SWPPP, etc. will be performed by the civil contractor. The electrical installation will be performed by qualified electrical contractor this work involves equipment assembly, installation, cable and wiring terminations, etc.

The Applicant plans to enter into a turn-key project agreement with a major firm for overall electrical system level design, high voltage equipment supply and substation construction. This firm will develop overall EPC requirements incorporating design standards from SCE. The general contractor or Engineer Procure and Construct (EPC) will select qualified subcontractors including specialized contractors for fiber cable splicing, paving access roads within the switch yards, fencing, environmental screening and testing, painting, etc. This firm will provide supervisory field engineers for equipment assembly and commissioning. Detail design will be performed by a major EPC contractor who will also serve as the general site contractor. Construction design and construction drawings will be prepared by the EPC contractor, and all design will be prepared by or under the supervision of a California Professional Engineer (PE). Commissioning and energization will be conducted by a joint commissioning team consisting of the Project Engineers and SCE field engineers in cooperation with CAISO.

Drainage:

The drainage for any site would be developed during final engineering design to control surface runoff. Typical drainage improvements would consist of concrete swales, ditches, and culverts. Surface runoff from existing upslope areas would be modified to direct the flow around the substation facility. Surface runoff would be mitigated as needed through the use of earthen berms and energy dissipation devices, such as filter cloths, slope drains, and riprap placed near drain openings. All of these methods are designed to minimize the velocity of surface water runoff and protect the landscape from erosion.

In compliance with the CWA, site construction activities would be consistent with NPDES program requirements, which would include development of an SWPPP for the site before construction commences. The SWPPP would focus on implementation of Best Management Practices and other actions during construction to protect the quality of waters near the construction site.

Access:

The primary facility access would be via a new 30-foot-wide asphalt concrete paved road with 5 foot wide compacted dirt shoulders connecting the main substation entrance to the exterior access roads.

Paving:

For all sites, asphalt concrete paving would be applied to the facility access road and to all designated internal driveways over an aggregate base material and a properly compacted sub-grade, as recommended by the results of geotechnical investigation at the site.

Surfacing:

For all sites, those areas within the substation perimeter that are not paved or covered with concrete foundations or trenches would be surfaced with a 4-inch layer of untreated, ¾-inch nominal crushed rock. The rock would be applied to the finished grade surface after all grading and below grade construction has been completed.

Spill Control and Countermeasures (SPCC) Plan:

A SPCC plan would be required for all sites. Under United States Environmental Protection Agency (EPA) CWA regulations, the owner of a substation facility is required to implement an SPCC plan if the facility meets the following three criteria:

The facility is not related to transportation.

The oil containing equipment at the facility has an aggregate of at least 1,320 gallons (only considering containers that are 55 gallons or more) or an underground oil storage capacity of at least 42,000 gallons.

There is a reasonable expectation of discharge into or upon navigable waters of the United States or adjoining shorelines. In addition, regulations by the State of California independently require that an SPCC plan be implemented for any facility with an aboveground oil storage capacity of at least 10,000 gallons. The total storage capacity of the oil containing equipment of the interconnection facilities at the Lake Switchyard exceeds 1,320 gallons; therefore it would trigger the threshold for the EPA requirement for an SPCC plan. The Applicant would proceed with preparation of an SPCC plan in accordance with state and federal requirements.

Storm Water Pollution Prevention Plan (SWPPP). Storm water management measures would be in place to ensure that contaminants are not discharged from the site. A SWPPP would be developed that would define areas where hazardous materials would be stored; where trash would be placed; where rolling equipment would be parked, fueled and serviced; and where construction materials, such as reinforcing bars and structural steel members, would be stored. Erosion control during grading of the unfinished site and during subsequent construction would be in place and monitored as specified by the SWPPP. One or more basins would be established to capture silt and other materials that might otherwise be carried from the site by rainwater surface runoff. Site improvements may result in impervious areas from all concrete foundations used for equipment and structures, and asphalt and concrete driveways. Management of drainage from these areas would be addressed in the facility drainage plan.

Perimeter Security. All alternative sites would require 8-foot-high chain link perimeter fence with barbed wire and double drive gates.

The following section describes the site-specific construction activities that would be associated with the Santa Rosa Substation.

3.3.3.2.2 Santa Rosa Substation

Site Preparation:

The conceptual plan for the Santa Rosa Substation site is presented in Figure F-9. Prior to the start of grading, the entire area to be graded would be stripped of all organic matter and loose rocks. Any waste material encountered would be removed as required by the environmental and geotechnical investigations. Waste collected from these stripping operations would be tested for contamination. Once

the surface has been cleared, the grading operations would begin. An estimated 15,000 cubic yards of material removed from the Santa Rosa Tunnel would be added to the 5,000 cubic yards areas of material cut from the higher elevation of the site and placed as fill over the lower elevation to match the 500 kV substation elevation. During grading operations, dust would be controlled by measures outlined in the SWPPP.

Foundation Excavation:

Foundations of various sizes would be constructed throughout the substation pad to support equipment and steel structures. In addition, a network of partially buried concrete trenches approximately 200 feet in total length would be installed. Excavations of these foundations and trenches would commence following the completion of grading and other yard improvements, and would continue for several weeks. The estimated total volume of soil that would be excavated for foundation and trenches is about 1,800 cubic yards, and would be spread on a portion of the substation property.

3.3.4 Construction Workforce and Equipment

The construction workforces have been estimated, Table F-4 present those estimates of workforce for the elements of the Proposed Project.

Table F-4: Project Construction Equipment/Workforce

Project Construction Equipment Type	Number	Hrs/Day No. of shifts x hrs/shift	No. days/week
CAT 436 Rubber Equipment Backhoe	1	2x10	5
Ready Mix Truck	3	2x10	5
150-Ton Crane	1	2x10	5
250-Ton Crane	1	2x10	5
25-Ton Crane	1	2x10	5
60-Ton Crane	1	2x10	5
CAT D10R Dozer	1	2x10	5
CAT D6 Dozers	5	2x10	5
CAT D8R Dozer	3	2x10	5
CAT Motor Graders	1	2x10	5
Misc. Compressors & Generators	20	2x10	5
Portable Light Plants	10	2x10	5
CAT Loaders	6	2x10	5
CAT Compactors	2	2x10	5
CAT Scrapers	4	2x10	5
CAT Rock Trucks	5	2x10	5
Crew & Supervisory Pickups	20	2x10	5
Grout Plant	1	2x10	5
Tunnel Drill Jumbos	4	2x10	5
Tunnel Scoop Trams	4	2x10	5
Water Trucks	5	2x10	5

Project Construction Equipment Type	Number	Hrs/Day No. of shifts x hrs/shift	No. days/week
Tunnel Boring Machine	1	2x10	5
Over the road Haul Trucks	20	2x10	5
Workforce	Number		
Laborers	40		
Teamsters	25		
Heavy Equipment Operators	60		
Tunnel Personnel	70		
Carpenters	10		
Ironworkers	10		
Mechanics & Welders	5		
Supervisory	35		

Note: Equipment and Personnel needs vary for the anticipate 5-year duration of the project.

Source: The Nevada Hydro Company

3.4 Stability and Stress Analysis

A stability and stress analysis will be performed as part of the detailed engineering and design work. Results will be provided.

3.5 Seismic Loading Bases

Two areas have been assessed to date. They are active faulting and ground motion. Additional studies will be undertaken as part of the additional work required for the detailed engineering and design. This additional work will include the Spillway Design Flood analysis.

4.0 COPIES OF SUPPORTING DESIGN REPORT

Two copies of the final supporting design report will be provided to the Commission for review at the time preliminary and final design drawings are submitted.