Attachment A. Detailed Project Description

The information in this Project Description is taken from the Mitigated Negative Declaration for the Project published in October 2013. It has been edited slightly to remove extraneous information, including references, which can be found in the MND.

Figures referenced in the text are found at the end of this attachment. The figures retain their original numbering from Chapter 4 of the MND.

1. Project Overview

The Embarcadero-Potrero 230 kV Transmission Project (Project) would include construction, operation, and maintenance of a new 230 kV transmission line between the Embarcadero Substation, at the corner of Fremont and Folsom Streets, and the Potrero Switchyard on Illinois Street between 22nd and 23rd Streets in San Francisco. The new transmission line would interconnect the upgraded 230 kV bus at Embarcadero Substation and to a new 230 kV switchyard to be installed adjacent to the existing 115 kV Potrero Switchyard

The new transmission line would be located primarily offshore in the San Francisco Bay, with shorter segments underground in paved city streets. The new single-circuit 230 kV transmission line would be approximately 3.5 miles long, including approximately

- 2.5 miles installed offshore in the San Francisco Bay,
- 0.4 miles installed in horizontal directional drills (HDD) between onshore transition points and the bay, and
- 0.6 miles installed underground in paved areas (Spear Street, Folsom Street, and 23rd Street east of Illinois Street).

The timeline for construction and testing would be approximately 22 months. Building the new transmission line would require approximately 15 months of work offshore and in city streets, overlapping with 22 months of work to develop the new Potrero 230 kV Switchyard.

Figure 4-2 illustrates the project location.

2. Project Components

Table A-1 provides an overview of the proposed transmission line sections.

Table A-1. Transmission Line Sections, Approximate Length

Transmission Line Section	Approximate Length
Northern Underground Segment: Embarcadero Substation to HDD Transition Manholes on Spear Street	0.4 mi
Northern HDD Segment	0.2 mi
Submarine Segment at Typical Cable Burial Depth – Offshore	2.5 mi
Southern HDD Segment	0.2 mi
Southern Underground Segment: Potrero Switchyard to HDD Transition Manholes on 23rd Street	0.2 mi
Overall Length: Embarcadero Substation to Potrero Switchyard	3.5 mi

The Project consists of three major elements:

1. Construction of an approximately 3.5-mile, single-circuit 230 kV transmission line in a submarine configuration. The route would be as shown on Figure 4-2, with land-based interconnections to the Embarcadero Substation and Potrero Switchyard, as follows:
   - 0.6 miles of underground cable installed in a single underground duct bank with polyvinyl chloride (PVC) conduits from the substations to the landing point for the submarine cables, using open trenching;
   - 0.4 miles of transitional sections, with cables installed in high-density polyethylene (HDPE) conduits using HDD methods, where the submarine cables transitions from onshore to offshore; and
   - 2.5 miles of three parallel submarine cables laid underneath the sea floor of the San Francisco Bay.
2. Termination of the new cable into the 230 kV bus at Embarcadero Substation; see Figure 4-3. The new cable would terminate at Embarcadero Substation at either a new gas-insulated switchgear (GIS) that is under development or, if the new switchgear is delayed, the termination would occur at a modified substation bus inside the existing Embarcadero Substation.
3. Construction of a new 230 kV switchyard near the existing 115 kV Potrero Switchyard at the termination of the new cable, including interconnection of the new 230 kV switchyard and the existing 115 kV Potrero Switchyard via up to two new 230/115 kV transformers; see Figure 4-4. The new switchyard interconnects the 230 kV and 115 kV systems within the City, allowing power to flow from the 115 kV system up to the 230 kV system or from the 230 kV down to the 115 kV system, depending upon system conditions at the time.

In addition, construction would involve use of equipment staging sites, laydown yards, equipment and material storage areas, and areas to temporarily store excavated materials near the substations and land routes; see Figure 4-5. Commercially available off-site office and yard space may also be used.

2.1 New 230 kV Transmission Line

2.1.1 Underground Cable

Two underground sections would connect the Potrero Switchyard and Embarcadero Substation to HDD transition manholes. The underground land cables would be installed in a buried reinforced concrete-encased duct bank system. The dimensions of the duct bank would be approximately 3 feet 7 inches wide by 3 feet 4 inches in height. The trench to be excavated to install the duct bank would be slightly larger, typically approximately 4 feet 6 inches wide by 10 feet deep. At least 3 feet of cover material, or engineered fill (fluidized thermal backfill), would be placed over the top of duct bank. Installing the duct banks and vaults would require excavation and disposal of approximately 6,000 cubic yards (cy).

The three electrical cables would be contained within three 8-inch-diameter PVC conduits with one additional conduit left open as a spare for future use should a single cable fail. Fiber optic lines for system protection and communication would be housed in two 4-inch-diameter conduits that will be installed alongside the 8-inch-diameter conduits and within the concrete duct bank. Most of the duct bank will be in a two-by-two duct configuration with potential transitions to a flat configuration to clear substructures in areas congested with other underground utilities or to fan out to the termination structures at the switchyards.

***Northern Segment*.** The northern underground segment between Embarcadero Substation and the northern onshore HDD transition on Spear Street would be approximately 0.4 miles. This segment would extend in a reinforced concrete duct bank northeast under Folsom Street from Embarcadero Substation to Spear Street. The route would turn southeast onto Spear Street toward the proposed northern HDD landing location near the end of Spear Street. Under PG&E's proposed design, the northern onshore segment would have four vaults, including three at the cable landing location under or near the Bay Bridge, inside which each of the separated electrical phases of the submarine cable would be spliced to a corresponding phase (A, B or C) of the land cable. From these vaults, the three phases of the land cable would be joined in one duct bank, which would connect to a fourth vault in Folsom Street between Fremont and Main Streets.

The Proposed Project would generally include a minimum 11-foot burial depth for the onshore underground segments, which would both meet low-cost EMF reduction goals on the northern underground segment and also generally allow the cable to clear all other utilities in the right-of-way, with the exception of two large storm sewers at the following locations: (1) in the intersection of Spear and Folsom; and (2) at the end of the route as it turns to enter the Embarcadero Substation. In both cases, PG&E has stated that the trench can feasibly be lowered sufficient additional depth to clear the sewer.

Additionally, due to utility congestion along the northern underground segment, PG&E performed a two-step analysis to establish that there would be sufficient space in Spear and Folsom Streets to install an 11-foot-deep duct bank. First, PG&E obtained preliminary as-built drawings from the San Francisco Department of Public Works based on a recent City sewer replacement and repaving project in Spear Street. PG&E also reviewed underground utility markings on Spear Street made for the City sewer project. The proposed alignment is based on these drawings and markings, and EMF policy goals; the final alignment may vary somewhat from the proposed alignment to account for the actual physical conditions encountered under the streets. Secondly, along Folsom Street, PG&E conducted a visual survey of existing utilities as evidenced by their existing vaults. The survey concluded that the intersections of Folsom Street with Spear Street and with Main Street are crowded with utilities. However, PG&E has stated that there is enough room to install the duct bank between the existing utilities at a depth of 11 feet along the north side of Folsom Street.

Southern Segment. The southern underground segment between Potrero Switchyard and the southern onshore HDD transition would be approximately 0.2 miles. The cable would exit along the southern boundary of the new Potrero 230 kV Switchyard in an underground concrete duct bank and then turn east beneath 23rd Street. The route would continue east to the southern HDD landing location, which will be located within the HDD entry pits and splice vault work zone depicted on Figure 4-9 (Potrero HDD Transition Area). There would be three vaults at the cable landing location in 23rd Street, inside which each phase of the land cable would be spliced to a corresponding, separated phase (A, B or C) of the submarine cable.

Throughout the length of the underground cable, an approximately 12-foot minimum bending radius would be maintained, and proper support and cable restraint would be applied per PG&E Underground Transmission Design Criteria (ETLS068192) and Installation Guide (ETLS072140) standards.

2.1.2 Submarine/Underground Transition Locations

The cables would make two transitions from land to the marine environment: one on the southern end of the route on 23rd Street near Potrero Switchyard and, en route to Embarcadero Substation. At each HDD transition manhole, the onshore entry pits would be up to about 5 feet wide, 8 feet long, and about 6 feet deep, requiring excavation and export of approximately 300 cy of material.

Each transition location requires three HDD borings approximately 1,000 feet in length to extend the three phases of the submarine cable, ground cable, and communications cable from the land. Three HDDs at each transition would be spaced approximately 10 feet apart on land and gradually flared out to form an approximately 33- to 150-foot separation under water. At each HDD transition location, the underground duct bank would split into three single-phase manholes with a vault at each of the three landing locations inside which a phase of the underground cable would be spliced to the separated electrical phases of the submarine cable.

2.1.3 Northern HDD Transition

The HDD rig for the northern landing would be staged in the southeastern-most block of Spear Street, directly under or near the Bay Bridge; see Figure 4-8. This block of Spear Street is a cul-de-sac with no through traffic. The northern HDD transition to the bay would be steeper than the southern HDD transition. Water depth is near 80 feet about 850 feet east of Piers 28 and 30/32 and then slopes up steeply towards the seawall, climbing approximately 25 feet vertically over a 50-foot horizontal distance. Given this steep transition zone, the HDD installation would extend beyond the toe of this slope to locate the exit point within a flatter area. This extension should improve constructability and avoid potentially creating, or being affected by, bay floor stability problems in the area of the steep slope.

2.1.4 Southern HDD Transition

The HDD rig for the southern landing near Potrero Switchyard would be in 23rd Street, within the HDD entry pits and splice vault work zone depicted on Figure 4-9. This location would allow the submarine route to land north of the existing TBC transmission line. Water depth in the bay near the onshore portion of the HDD boring is less than 10 feet for the first 400 feet; it then gradually slopes down and levels off to a depth of approximately 35-40 feet about 1,500 feet from the shoreline.

2.1.5 Submarine Cable

The submarine cable system would continue the transmission line with one 230 kV-rated circuit using one single conductor cable per phase. Accordingly, the submarine portion of the transmission line would consist of three parallel cables (one for each phase of the circuit). Circuit ground wire and the communications cables would each be bundled with separate phase cables. The cables would have a minimum separation of approximately 33 feet in the shallower water areas and a maximum separation of approximately 150 feet in deeper water. Typically, submarine cables are separated from one another by a distance equal to two or three times the water depth to provide mechanical protection and facilitate any necessary repairs.

Expected and typical project submarine cable parameters are shown in Table A-2. Along the northern HDD under The Embarcadero, the depth would be a minimum of 50 feet, which would be deeper than typical, to avoid the existing sewer collection/transportation box and the rock dike at the shoreline.

Table A-2. Submarine Cable Parameters, Approximate Distances and Depths

Submarine Cable Component	Approximate Distance or Depth
Approximate Submarine Cable Route	2.5 miles
Maximum Sea Water Depth	80 feet
Typical Cable Burial Depth – Offshore	6–10 feet
Typical Cable Burial Depth – HDD	30 feet

Table A-2. Submarine Cable Parameters, Approximate Distances and Depths

Minimum Cable Burial Depth – Northern HDD at The Embarcadero	50 feet
Expected Minimum Cable Spacing – Offshore	33 feet
Expected Maximum Cable Spacing – Offshore	150 feet
Expected Minimum Cable Spacing – HDD	10 feet

Each of the submarine cables would be directly buried using a hydroplow into the bay floor to a depth of approximately 6 to 10 feet below the bay floor. The water depth is less than 10 feet at The Embarcadero seawall between the piers. The water depth increases to 80 feet approximately 850 feet east of Piers 28 and 30/32, near the proposed northern HDD exit point. The water depth slopes gradually up to 35-40 feet at the southern HDD exit location.

A double copper or steel armored cable with copper conductor, XLPE insulation, and a lead sheath would be used to satisfy the project electrical loading requirements. The sizing is based on the typical HDD depth and conservative design parameters that may be finalized during detailed design.

2.2 Embarcadero 230 kV Bus Upgrade Project

The existing Embarcadero Substation at the corner of Fremont and Folsom Streets in the Rincon Hill area is located inside a multi-story building clad in precast concrete architectural panels and was constructed in 1974. A basement beneath the entire building plan is used for the medium voltage and existing 230 kV cable entries as well as heating, ventilation, and air conditioning (HVAC) equipment. Electrical equipment within the Embarcadero Substation includes air-insulated buses, switchgear, and banks of 230/34 kV and 34/12 kV transformers. The substation is not tied into PG&E's 115 kV transmission network.

PG&E does not propose to modify the existing Embarcadero Substation as part of the project. No new substation work at Embarcadero Substation would be required beyond that already underway in a separate reliability project involving design changes and equipment replacement at Embarcadero Substation (the Embarcadero 230 kV Bus Upgrade Project).

PG&E would terminate the proposed Embarcadero-Potrero cable at the new gas-insulated switchgear currently under development as part of the Embarcadero 230 kV Bus Upgrade Project.

If the new switchgear is delayed, until the Bus Upgrade is complete, PG&E would modify the substation bus inside the northwest corner of the existing Embarcadero Substation to allow temporary termination of the Embarcadero-Potrero cable.

2.3 Potrero 230 kV Switchyard

The existing Potrero Switchyard is located on Illinois Street between 23rd and 22nd Streets. The facility is an open yard that operates as a 115/12 kV substation; however, for naming consistency, PG&E refers to the site as Potrero Switchyard rather than a substation. Currently, there is no 230 kV equipment at the existing Potrero Switchyard. To accommodate the proposed 230 kV cable, the project would include construction of a new 230 kV switchyard and 230/115 kV substation within about one acre on a parcel owned by NRG Potrero LLC. PG&E would need to acquire this property through a fee simple transaction or condemn the property for utility use. The site is located on 23rd Street, adjacent to and east of the existing switchyard; see Figure 4-4.

Due to space constraints at the proposed site, the new 230 kV switchyard would feature gas-insulated switchgear (GIS) housed in an estimated 8,500-square-foot building with basement. The switchgear, associated automation and control systems, and station service systems (i.e., AC power equipment to supply the building) would be inside. Up to 8,000 cy would need to be excavated and exported for the building basement and duct bank between the new switchyard building and the 115 kV buses at the south end of the existing Potrero Switchyard.

The proposed Potrero 230 kV Switchyard and GIS building area would require acquisition of a site of approximately 1.025 acres or 44,700 square feet. Impermeable surfaces would include the building roof of approximately 8,500 square feet and concrete or paved outdoor equipment areas of approximately 10,000 square feet. Additionally, the remainder of the yard (approximately 26,000 square feet) would likely have a combination of gravel and concrete/asphalt surfaces. Preliminary foundation evaluation suggests deep-foundation systems may be needed for some of the structures within the new Potrero 230 kV Switchyard, including the GIS building.

The basement of the new GIS building would contain electrical conduits, trays and cables to interconnect the electrical equipment on the main floor. The layout would include a spare bay with space for an additional 230 kV transformer and shunt reactor. Duct banks to the existing 115 kV Potrero Switchyard and the proposed submarine cable would enter and exit the new 230/115 kV substation building via the basement.

The building height would be approximately 34 feet above grade to accommodate the GIS electrical equipment and a parapet wall, and building dimensions would be approximately 136 feet by 62 feet. The building's cladding would be a light neutral color with a non-reflective finish. Including the outdoor equipment, the new Potrero 230 kV Switchyard would cover an area of approximately 0.7 acres (measuring all areas within the perimeter wall and façade). Outdoor equipment would be partitioned from the GIS building with firewalls. The proposed outdoor equipment includes one new 230/115 kV transformer, one new 230 kV shunt reactor, and their respective cable-to-air bushing connections. These would be shielded from the street by a new 10-foot-tall masonry wall around the perimeter of the new 230 kV switchyard, except for the southern front of the GIS building, which would act itself as the perimeter boundary on that side. The perimeter wall would include a minimum of one 20-foot-wide access gate via 23rd Street, and the facility perimeter would be set back at least 3 feet away from the southern property line to allow for new landscaping. An existing gate from 23rd Street onto the Michigan Street alignment would be widened to allow for access to the western side of the facility through another gate in the perimeter off of the Michigan Street alignment. The gate in the brick wall that currently fronts Station A may need to be widened and the wall modified to allow adequate ingress, egress, and internal circulation access for large transformer equipment and future maintenance activities. Modification of discrete sections of the brick wall may include complete or partial removal. Any potential modification or removal of Station A buildings would be in compliance with the San Francisco Building Code Chapters 16B-C ("Unreinforced Masonry Building [UMB] Ordinance") to meet applicable seismic safety requirements. NRG Potrero LLC and the City and County of San Francisco have a Settlement Agreement for the Station A buildings[1] that tolls compliance with the UMB Ordinance pending preparation of a Site Plan for the redevelopment of the entire former Potrero Power Plant site, including treatment of the Station A buildings.

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[1] The "Station A buildings" consist of a small group of unreinforced masonry buildings on the NRG property consisting of the Station A, Meter, Compressor and Gatehouse buildings.

Portions of the exterior yard areas that would not require Spill Prevention, Control, and Countermeasure (SPCC) oil containment may have some provisions for stormwater mitigation or control (such as pervious pavement, detention, and/or landscaping) depending on City building code requirements. Final design would be dependent on the results of the geotechnical investigation and possible chemical analysis of the site soil.

The existing SPCC/stormwater collection facilities at the Potrero 115 kV Switchyard (near the intersection of Illinois and 23rd Streets) would be used wherever possible and economically feasible. Storm water transport would be either by gravity flow (surface or piped), or pumping may be required depending on final hydraulic design. Small amounts of additional temporary water storage (500 to 1,000 gallons) may be utilized as part of the water transference system from the new 230 kV switchyard to the existing 115 kV switchyard area.

The proposed 230 kV switchyard would connect to the existing 115 kV switchyard through twelve underground 115 kV cables (i.e., two cables per phase per 115 kV bus); see Figure 4-16. The cables would be connected to the existing 115 kV switchyard using six single-phase tubular steel termination poles, approximately 10 feet high, with insulated terminals to a total height of approximately 17 feet. The new poles would likely be at the south end of the existing 115 kV bus, near 23rd Street. The height of the existing 115 kV bus structure is approximately 34 feet.

All new substation equipment, including cable terminations, would be seismically qualified to the High Level of Institute of Electrical and Electronics Engineers (IEEE) 693. The new 230 kV switchyard building would meet the requirements for Occupancy Category III of the California Building Code (CBC).

3. Project Construction

This section includes an overview of the proposed construction methods and those typically used for construction of the underground and offshore portions of a 230 kV transmission line, and for work at Potrero Switchyard and Embarcadero Substation. This section includes discussion of the following:

- General construction considerations, including work areas;
- Traffic controls and lane closures;
- Staging areas;
- Easements and right-of-way;
- Underground transmission line construction;
- Substation and switchyard construction;
- Submarine cable installation, including installing the HDD transitions;
- Construction phasing; and
- Workforce and equipment.

3.1 General Construction Considerations

Other than staging, all onshore transmission line-related construction activities would be conducted in temporarily closed lanes along the project route. Lane closures would require additional detailed design and planning because city streets along the route would typically need to have one travel lane and one parking lane closed by PG&E during duct bank construction. Staging areas are discussed separately. Existing commercially available office and yard space may be used by contractors or agencies.

3.1.1 Work Areas

Trenching work areas would extend typically about 1,500 feet in length by 12 feet wide with work crews excavating and securing the trench walls via shoring. Once the shoring process is complete for approximately 500 feet, another crew would install the duct bank, and the trench would be backfilled and pavement restored. Approximately 150 feet to 300 feet of trench would be open at any one time. Staging and excavation for each vault would require approximately 1,500 square feet of work space. The sequential layout of the construction work area from the front end would include:

- 100 feet of traffic control taper/buffer zone;
- 500 feet of logistical work area for the trenching and trucking activities;
- 150 feet of trench excavation;
- 150 feet of conduit installation and backfilling;
- 300 to 400 feet of trench paving; and
- 200 feet of work area for temporary paving activities at the tail end of the construction operation.

Work areas for the HDD landing sites would be located in Spear Street and in 23rd Street. The work area for the northern HDD landing site would be approximately 500 feet by 60 feet at the Spear Street cul-de-sac, and the work area for the southern HDD landing site would be 800 feet by 50 feet along 23rd Street. An additional 800 feet of 23rd Street would be used for staging, which would extend the temporary lane closure and loss of parking between Illinois Street and the shoreline.

Cable pulling would occur after installing the underground conduits, pouring the concrete duct bank and backfilling the trench. Each cable reel and crew would require an area approximately 200 feet by 12 feet. Cable installation would occur between the southern onshore section termination at Potrero Switchyard and the Bay to land transition manholes on 23rd Street; between the northern onshore section termination at Embarcadero Substation and the Folsom Street manhole; and from that manhole to the Bay to land transition manholes at the Spear Street cul-de-sac. In conjunction with the area used by the reel trailer carrying the 12-by-6-foot-wide reels, the cable puller would also require an area approximately 100 feet by 12 feet wide.

Cable splicing procedures would typically require a single crew truck directly adjacent to each manhole. Actual splicing would occur within the buried manhole with aboveground support. The work area required for this activity is typically approximately 75 feet by 12 feet.

At work areas for trenching or HDD installation, electricity will be provided by portable “whisper-quiet” generators. The project would not require generators at the Potrero Switchyard construction area, nor at the connection to the Potrero 115 kV bus, as the old power plant station service line and/or existing distribution lines would be used as temporary power sources.

3.1.2 Dewatering and Groundwater Handling

Dewatering of the trench would be conducted using a pump or well points. Groundwater encountered during underground construction would be pumped into containment tanks and tested for turbidity and pH values. PG&E would discharge the pumped water into the storm sewer system when the water meets quality standards; otherwise, PG&E would dispose of it in accordance with state and federal standards.

Control containment and discharge could be performed in a variety of ways on site, such as by using holding tanks (e.g., truck trailer “Baker tanks”) that allow acceptable de-sedimentation prior to discharge. Other control containment and discharge methods could include pumping ground water directly to water trucks for haul off to a treatment facility, or with prior agreement and any necessary ministerial permits, discharge to a sewer. To discharge to a sewer, PG&E would prepare a special request for discharge and treatment of the estimated amount, as well as the cost of discharge, that would be submitted to the San Francisco Public Utilities Commission (SFPUC) Bureau of Environmental Regulation Management. Additionally, PG&E would need to obtain a water supply of approximately two 2,000-gallon truckloads per day for dust control during construction, likely through coordination with the SFPUC. The request for water supply and dewatering flows would be developed during final design.

3.1.3 Excavated Materials

During construction, materials removed during trench excavation would be placed directly into trucks and removed from the area and disposed of off-site. The estimated total amount of materials to be disposed of is 6,000 cy for onshore trenches, duct banks, and vaults, 300 cy for the HDD pits, and 8,000 cy for the Potrero 230 kV Switchyard basement, for a project total of 14,300 cy. Materials that are used for construction of the underground conduits, such as concrete, plastic conduit, and asphalt, would be stored onsite during construction or at staging areas.

All excavated material would be removed from the site and hauled off to an appropriate landfill based on the pre-construction characterization of soils. Since numerous dump trucks would be required for the hauling operation, trucks would be staged for rotating hauling activities. Dust control and wet sweeping best management measures would be implemented during excavation.

Pre-characterization of soils would be completed prior to construction via soil borings throughout the route. The soil borings would be reviewed and characterized for proper disposal to a landfill that on a predetermined basis can accept the different classes of soil found at the project site. In addition, once construction commences, a site-specific hazardous waste manifest system would be used for each soil disposal truck. It should be noted that, to the extent feasible, all excavated material would be hauled off immediately and not be stored on- or off site.

3.1.4 Vegetation Clearance

All onshore portions of the transmission line would be underground, and all work areas would be in city streets or paved areas. In the event that vegetation clearance is needed, disturbance would be minimized to that needed for safe access.

There are over 110 trees planted along the sidewalks that line the northern project route on The Embarcadero, Spear Street, and Folsom Street near the Embarcadero Substation. Depending on the precise location of the underground line (determined during final design), some of these trees may need to be removed or trimmed. One entire row of 18 sweetgum trees (2 to 3 inches in diameter and 10 to 15 feet tall) on Spear Street between Folsom Street and Harrison Street could potentially be trimmed or removed during construction.

Temporarily disturbed areas would be restored to preconstruction condition once construction is complete. Any roots from trees and deep-rooted shrubs encountered during trenching or excavation would be pruned above the underground transmission line duct bank to avoid interference.

3.1.5 Erosion Control and Pollution Prevention

PG&E would prepare and implement an Erosion and Sediment Control Plan as part of a Stormwater Pollution Prevention Plan (SWPPP) that would be prepared for the Proposed Project. Erosion control and pollution prevention measures in the SWPPP would address elements such as track-out controls, stockpile handling, dewatering discharge, drain inlet protection, and replacement of any disturbed pavement or landscaping.

3.1.6 Cleanup and Post Construction Restoration

The Proposed Project would occur in areas that are either paved, landscaped, or graveled, such as at the existing Potrero Switchyard and the affected portions of NRG property. Restoration would consist of removing the construction equipment and materials and repaving, restoring landscaping, or recovering with gravel or depending on the original condition of the site.

All work areas, whether vegetated or not, would be restored to conditions equal to or better than preconstruction conditions. Vegetated areas disturbed by the project could include limited street or landscaped areas that would be replanted per agreement with the City or landowner. As part of the final construction activities, PG&E would restore all removed curbs, gutters, street surfaces, and sidewalks, repave all removed or damaged paved surfaces, restore landscaping or vegetation as necessary, and clean up the job site.

Trash and litter at the job site would be collected in bins or appropriate containers easily accessible to construction crews and removed to the staging areas for off-haul to the appropriate solid waste facility. PG&E expects to characterize soils for disposal in-situ, and spoils and asphalt/concrete waste would be hauled off for appropriate disposal following characterization. All hazardous materials and hazardous wastes would be handled, stored, and disposed of in accordance with all applicable regulations, by personnel qualified to handle hazardous materials.

3.2 Traffic Controls and Lane Closures

All lane closures would be identified in more detail by a Traffic Management Plan that PG&E must develop in consultation with the City. The City would likely require a full lane of pavement restoration which in turn would require a two lane closure over a 1,500 foot work area. PG&E would apply for a Special Traffic Permit from the San Francisco Municipal Transportation Agency (SFMTA). PG&E would submit a Traffic Management Plan as part of this application. For the short-term closures of underground transmission line construction, appropriate traffic controls would be implemented during trenching and during vault installations. Traffic controls would include but not be limited to typical traffic control cones, candles, electronic signage board and temporary fixed warning signs for workmen prior to work zone in both directions, and/or Type III barricades, as specified in the Special Traffic Permit from the City of San Francisco. PG&E expects most work in temporarily closed lanes would be in franchise along the onshore portion of the route. Overall, lane closures would generally extend along one city block, or potentially portions of two blocks where working near an intersection, at any given time. However, exact lane closures can only be determined following detailed investigations into existing utilities and final construction planning. No new access roads would be developed for this project.

PG&E would also apply for a ministerial Excavation Permit from the San Francisco Department of Public Works (DPW) to allow trenching from the two landings through franchise to PG&E's properties at the transmission line termination points. The Transbay Joint Powers Authority and San Francisco Planning Department have no independent permitting jurisdiction relative to the Proposed Project. However, the Transbay Joint Powers Authority and SFMTA would be involved during review of PG&E's Traffic Management Plan, where relevant for the Special Traffic Permit.

PG&E would coordinate provisions for emergency vehicle and local access with City personnel. PG&E's coordination with emergency responders would occur prior to construction and during the construction phase. PG&E proposes to coordinate daily with all first responders to exchange information regarding the locations of crews and work areas. Additionally, for trenching in areas where access is needed crossing the trench line, steel plates would be on hand and immediately placed to provide access for the needed response.

3.3 Staging Areas

3.3.1 Onshore Staging

In addition to the use of closed lanes for underground work areas, PG&E expects that onshore staging for the Proposed Project would occur in one or more of three possible staging locations, and along 23rd Street, as follows:

- Staging Alternative 1 would be located on NRG Potrero LLC property north of 23rd Street east of Illinois Street, to the north of the proposed Potrero 230 kV Switchyard. The L-shaped area is approximately 0.76 acres extending north of the proposed switchyard construction work area, comprising of three rectangular shaped areas approximately 135 feet by 145 feet, 120 feet by 25 feet, and 160 feet by 65 feet.
- Staging Alternative 2 would be located on NRG property in a paved area to the east of the proposed Potrero 230 kV switchyard. The L-shaped area is approximately 1.5 acre, comprising of two rectangular shaped areas approximately 325 feet by 140 feet and 90 feet by 220 feet.
- Staging Alternative 3 would be located on Port of San Francisco property on Amador Street near Cargo Way. It is a rectangular paved area, with an estimated area of approximately 2.3 acres (430 feet by 230 feet).

Figure 4-5 illustrates the potential locations for staging onshore activities. In addition, PG&E or agency contractors could decide to use commercially available office or yard space in San Francisco and the Port of Oakland to base their operations; any such existing office or yard space will have already been subject to city permitting requirements.

HDD staging would occur along 23rd Street and in the public street. This area would be used for all pipe fusion and pipe casing work to stage both the northern and southern HDD. The work area in 23rd Street would extend to the water's edge, where fused sections of the HDPE conduit would be connected to a small boat, floated, and tugged to the points of each HDD exit.

The proposed HDD staging site along 23rd Street (Figure 4-9) would be approximately 1,600 feet in length by 20 feet wide. Approximately half or 800 feet of the staging area would be located in the public street, and would result in the temporary loss of street parking for 70 spaces. The remainder of the closure along 23rd Street would be approximately 800 feet by 40 feet for the southern HDD landing work area.

3.3.2 Submarine Work Staging

Crews for submarine work would need to board crew boats from an existing commercial marina such as the Yerba Buena Island Marina, and be taken to the designated anchoring locations of the project vessels. PG&E has not proposed any specific anchoring points or locations for staging the marine crews. Given that anchoring locations vary each day based on local ship traffic, project-related vessels and barges would be directed daily regarding anchoring locations via the Vessel Traffic Service of San Francisco and the U.S. Coast Guard.

3.4 Easements and Right-of-Way

The onshore portions of the project, including the two HDD termination points, would be located primarily in franchise in city streets or PG&E-owned property with the exception of a portion of the southern landing area. At the northern landing area, the line would pass through City streets and areas owned by the State of California (Caltrans, for the portion under the Bay Bridge). The portion of the submarine route in the San Francisco Bay would require a license from the Port of San Francisco.

The southern landing location at 23rd Street would require approximately 23,200 square feet of right-of-way acquisition from the shoreline to a gate located approximately 760 feet west from the shoreline. In addition, the Potrero 230 kV Switchyard site would need to be acquired in fee simple or by condemnation from landowner NRG Potrero LLC, and a License would need to be obtained from the Port for use of Port property

A Temporary Construction Easement approximately 40-feet wide and permanent easements would be negotiated by PG&E and acquired from private property owners. PG&E indicates that all private property is in Port's jurisdiction. Two sections of the cable are in private property. The first is in the DHL NRG Potrero LLC property at 401 23rd Street. The NRG parcel extends 760 feet from the shoreline to the franchise area. Both a temporary and a narrower permanent easement would be required in that area.

The second piece of the cable route in private property is approximately 100 feet long connecting the proposed Potrero 230 kV Switchyard to the proposed cable in franchise in 23rd Street. This property would be part of the switchyard acquisition from landowner NRG. A portion of cable route that extends approximately 400 feet appears to be outside the Port's jurisdiction but is within franchise in 23rd Street.

3.5 Underground Transmission Line Construction

This section describes the proposed construction methods for construction of the underground transmission line. Installation of the underground transmission line, duct banks, and splice vaults would be completed using a cut-and-cover method (open trenching) along the majority of the route. The major underground construction activities would begin with vault installation, followed by trenching and duct bank installation, and, finally, cable installation.

3.5.1 Trenching/Duct Bank Installation

Prior to trenching, PG&E would notify other utility companies (via the Underground Service Alert [USA]) to locate and mark existing underground structures along the proposed alignments, and also would conduct exploratory excavations (potholing) to prove the locations for proposed facilities as needed. PG&E would apply for a ministerial Excavation Permit from the City for trenching in City streets. No complete long-term road closures would be expected during trenching, although one-way traffic controls as well as short-term road closures up to 1,500 feet would be necessary to allow for certain construction activities and to maintain public safety.

After the route is marked, the pavement within the trenchline would be removed. Trenching activity requires one work crew progressively excavating, hauling off material, and backfilling. Upon reaching final trench excavation depth, a second work crew secures the trench walls via shoring. Once the shoring process is complete, a third installs PVC conduit to provide a raceway for the electrical cable. Upon completion of PVC conduit laydown, the trench is backfilled and the trench alignment temporarily paved. This progression would continue between each HDD transition area and the points of termination at Embarcadero Substation and Potrero Switchyard. Final roadway restoration and asphalt paving would be completed once the cable is fully installed, tested and released to operations. This avoids having to break the final pavement to replace any section of cable should it failed during testing.

Trenching would progress at an approximate rate of 50 feet per day. The length of open trench at any one time would typically be 150 feet to 300 feet on any street, depending on the City's permitting requirements. Steel plating would be placed over the trench to maintain vehicular and pedestrian traffic across areas that are not under active construction. Traffic controls would also be implemented to direct local traffic safely around the work areas. The total surface of the trench plates over backfilled areas would vary between approximately 100 to 500 feet in length each day until it has reached a surface large enough (typically 300 feet) for temporary pavement restoration. Trench paving would likely occur once a week to minimize the amount of trench plates on the road.

As the trench for the underground 230 kV cable is completed, PG&E would install PVC cable conduits and concrete encasement duct bank. The duct bank cover would measure at least 36 inches. The typical dimensions of a single circuit reinforced duct bank are approximately 3 feet 7 inches wide by 3 feet 4 inches deep, although typical dimensions may vary depending on soil stability and the presence of existing substructures. The trench would be widened or shored where needed to meet California Occupational Safety and Health Administration (OSHA) safety requirements.

Where the electrical transmission duct bank would cross or run parallel to other substructures (which have operating temperatures at earth temperature), a minimum radial clearance of 12 inches would be required. These substructures include gas lines, telephone lines, water mains, storm lines, and sewer lines. In addition, a 5-foot minimum radial clearance would be required where the new duct bank crosses another heat-radiating substructure at right angles. A 15-foot minimum radial clearance would be required between the duct bank and any parallel substructure whose operating temperature significantly exceeds the normal earth temperature. Such heat-radiating facilities may include other underground electric transmission circuits, primary electric distribution cables (especially multiple-circuit duct banks), steam lines, or heated oil lines.

PG&E would identify utilities during final design, evaluate their proximity and potential for induced current and/or corrosion, and in coordination with the utility-system owner, determine whether steps are necessary to reduce the potential to induce current or cause corrosion. PG&E would take the necessary steps in coordination with those utility system owners to minimize any potential effects through measures, such as increased cathodic protection or utility relocation. The steps are summarized as follows:

- During final design, prepare study of corrosion and induced currents.
- Send results of study to each affected utility system owner for review and comments.
- Owners submit requirements for protection of each of their facilities.
- PG&E makes changes accordingly or compensates owner for future protection measures, per the owner's preference.

Once the PVC conduits are installed, thermal-select or controlled backfill would be transported, placed, and compacted. A road base backfill or slurry concrete cap would be installed, and the road surface would be restored in compliance with the City permits. While the completed trench sections are being restored, additional trenchline would be opened farther down the street. This process would continue until the entire conduit system is in place.

All backfilling material would be engineered material called flowable thermal concrete (FTC), and flowable thermal backfill (FTB). Each has unique properties specific to its application, while both are designed to have thermal characteristics for heat displacement. For a typical trench, the bottom 2 feet encases the PVC conduit with FTC, while the remainder of the trench would be filled with City-approved “diggable control density fill” FTB to the roadway sub-base level. From that point, all restoration would be based upon matching the street’s existing sub-base and surface, i.e., asphalt, concrete, or combination of the two. The excavated material would not be used as backfill. The estimated total amount of excavated materials to be removed for trenches, duct banks, and vaults is 6,000 cy.

The total duration of trench excavation and manhole installation, not including cable pulling and HDD operations, is estimated to take approximately four months along the northern underground segment, and two months along the southern underground segment. Cable pulling is a standalone operation that would be performed after the vaults are installed, the duct bank is fully poured, and the trench backfilled and temporarily paved. Final paving restoration would be scheduled after the cable is fully installed and operative. The San Francisco paving permit would likely require a full lane of pavement restoration which in turn would require a two lane closure over a 1,500 foot work area. Final paving would take 5 days along Spear and Folsom Streets and 2 days on 23rd Street.

Equipment necessary for trenching in closed lanes and HDD work areas include pavement saw cutting equipment, pavement grinder, excavators, and dump trucks. Pavers would be used for restoration. PG&E expects 4 dump trucks to be used to haul trench and excavation materials and import backfill to the project. The number of daily total haul truck trips would depend upon the rate of the trenching, which is estimated to progress at an approximate rate of 50 feet per day over 6 months. Jackhammers would be used when needed to break up sections of concrete that the saw-cutting and pavement-breaking machines cannot reach. Other miscellaneous equipment would include a concrete saw, various paving equipment, and pickup trucks. In general, no equipment would be left at the trench site overnight, with the exception of an excavator.

3.5.2 Vault Installation

The typical complete pre-cast vault installation would take 4 to 7 days, working 10 hours per day from breaking ground to finishing grade. For each vault, the excavation would be approximately 34 feet long, 14 feet wide and up to 15 feet deep. Excavation for vaults of this size would require shoring components such as driven sheet piles, or slide rail steel sheeting. Once the initial excavation and shoring is installed, preparation of the sub-base would consist of the installation of crushed rock for leveling purposes. If present, groundwater would be tested and either pumped out to a controlled containment or discharged as would occur during trenching.

Once the vault preparation steps (excavation, shoring and finish grade leveling) are completed, setting the vault is performed via sectional lifts of the three vault pre-cast sections using either a hydraulic or a lattice type crane. With all sections of the vault set in place, backfilling can start as the shoring is removed.

Lane closures would be required at each vault location according to the following sequence:

1. Vault installation would be a stand-alone operation performed prior to trenching/duct bank installation, which would require a 4- to 7-day lane closure period for each vault.
2. Conduit cleaning/proofing would be performed after the duct bank is completely installed and backfilled. It requires a 2-day lane closure period.
3. Cable pulling would require a 2-day lane closure period per cable phase (6 total days of lane closure).
4. Racking/splicing would require 2 to 3 days at the landing single phase vaults and 7 to 9 days at the Folsom Street three-phase vault.

While the estimated total lane closure at each vault is 20 days, conduit cleaning/proofing, cable pulling and racking/splicing can only be sequential for a total of 13 days sustained closure at a single vault location.

The major equipment required for vault installation would consist of an excavator, pickup trucks, end dump trucks, stake trucks for material, 75-ton crane, crane riggers truck, tractor trailers for sheet piling delivery, tractor trailers for delivery of precast concrete manhole sections, and possibly water trucks and/or containment water tanks.

3.5.3 Cable Pulling, Splicing, and Termination

The proposed cable system would consist of three major components: the cable, splices that connect cable sections, and terminators that connect the cable to the equipment at the substations. Cable installation would occur after the underground vaults, duct banks and HDDs are installed.

Cable Pulling

The cable for the Proposed Project would consist of three individual cables (one per electrical phase) and a communication fiber optic cable. Pulling between two vaults typically would take approximately 2 to 3 days, working 10 hours per day. To pull each cable through the duct bank, a cable reel would be placed at the end of a duct bank section in a vault, and a pulling rig would be placed at the other end of the duct bank section in another vault. With a small rope called a “fish line,” a larger rope would be pulled into the duct. The large rope would be attached to pulling eyes on a conductor end, and the large rope would pull the conductor into the duct. To ease pulling tensions, a lubricant would be applied to the conductor as it enters the duct. The three electric phases and one communication cable would be pulled through their individual ducts at the rate of two of the three sections between vaults per day.

Cable Splicing

Prior to starting the actual splicing, the vaults would be outfitted with steel racks that would ensure the cable splices are securely affixed to the vault’s inner walls. A splice trailer would be positioned adjacent to the vault manhole openings, and a mobile power generator would be located directly behind the trailer. The vaults must be kept dry twenty four hours per day to prevent water or impurities contamination of the unfinished splices. Racking and splicing is estimated to take 2 to 3 days at each landing single-phase vault and 7 to 9 days at the Folsom Street three-phase vault.

Cable Termination

At the southern end of the route, the cable would continue underground into the new Potrero 230 kV Switchyard building basement where it would terminate. At the northern end of the route, the cable would continue underground into the building of the Embarcadero 230 kV Bus Upgrade. Terminating the cable at the substations would take approximately 7 days at each end.

3.5.4 Jack and Bore or Microtunneling Construction

Jack and bore or microtunneling construction methods would be used if traditional open trenching cannot be used or existing utilities must be avoided in certain underground locations. Where the submarine to underground transition occurs, the trenchless construction method would be HDD.

If a jack and bore segment must be used for a segment of underground cable installation, a casing would be advanced into the soil while the soils are removed by an auger rotating inside the casing. A steel casing would be used initially while the hole is being drilled to be replaced by a final casing. To minimize power losses from magnetic induction, the final casing would normally be made of nonmagnetic materials such as a fiberglass-reinforced polymer mortar. The internal PVC conduits would then be installed in the casing using plastic spacers to keep the conduits separated. The annular space between conduits and casing would then be filled with thermal grout.

Microtunneling would use a remotely controlled boring machine combined with the pipe jacking technique to directly install cable underground as an alternative to avoid having long stretches of open trench. Typical microtunnel equipment would include the boring machine, a hydraulic jacking system to jack the conduit, a closed loop slurry system to remove the excavated tunnel spoil, a slurry cleaning system to remove the spoil from the slurry water, a lubrication system for the exterior of the conduit during installation, and a guidance system to provide installation accuracy.

3.6 Substation and Switchyard Construction

3.6.1 Potrero Switchyard

Potrero Site Preparation

Activities needed to prepare the Potrero Switchyard for construction of the new 230 kV switchyard and 230/115 kV substation would include contractor equipment and personnel mobilization, utility locations, surveys, and similar construction support. Construction areas would be delineated, including the affected portions of the NRG site, the existing switchyard, and the staging area. Public safety systems (fencing, signage, etc.) would be put in place as part of final preparations before beginning construction work.

Soil contamination is known to exist at the proposed switchyard location. The extent of soil removal necessary would be determined prior to mobilization, with the preliminary estimate being less than 8,000 cy for this site. Excavation, soil export, and import activities would be completed before below-grade construction activities begin. Adequate laydown space would be prepared to receive materials required for initial construction activities at the NRG site and at the staging areas.

Potrero 230 kV Switchyard Building and Perimeter Fencing

Developing the switchyard building and completing the basement would involve constructing the building and developing site access on 23rd Street. The new switchyard would be prepared for the installation of the transformer and shunt reactor.

Preliminary foundation evaluation by PG&E suggests deep-foundation systems may be needed for some of the structures within the proposed Potrero 230 kV Switchyard, including the GIS building. Construction of the GIS building basement and its foundation system may require sloped-excavation or earth-retention around the perimeter of the basement excavation. Final determination would be made after the geotechnical investigation. If an earth-retention system is required for basement construction, vertical elements of the following types may be used: drilled or inserted soldier beams and timber lagging; continuous drilled piers (tangent or secant); or sheet piles. Determination of shoring type would be highly dependent on subsurface materials encountered during the geotechnical investigation and the depth of groundwater.

The foundation support at the new Potrero 230 kV Switchyard, including sheet piles or any other vertical elements, would be built using a non-pile (hammer) driving method, such as the Tubex grout injection method. The Tubex grout injection method uses a drill table to force a pile into the ground, then grout is injected under high pressure into the soil, a reinforcing cage or dowels are placed, and the pile is filled with concrete. This method minimizes vibration and noise, and no soil removal would be required for installing the foundation support, since the grout would be injected into the native soil. Design and final selection of these elements would be based on both the final geotechnical recommendations and the results of competitive bidding by specialty contractors qualified to perform shoring installation.

Interconnection of the 115 kV/230 kV System

Following development of the new switchyard building, PG&E would establish a new 115 kV connection between the new 230 kV switchyard and the existing Potrero Switchyard. A duct bank would be constructed from the new switchyard building to the two existing 115 kV buses at the south end of the existing Potrero Switchyard. The work would require coordination with existing underground features inside the switchyard property.

Existing Potrero Switchyard Modifications

Modifications to the existing Potrero Switchyard would include installing six tubular steel termination poles to transition the 115 kV cables from the new switchyard and duct bank and to connect to the existing 115 kV buses. Relocation of existing circuit breakers and other equipment would be necessary to secure adequate space to install new high voltage cable terminations, switches, and related structures.

Equipment Installation and Testing

Equipment installation would begin following completion of the switchyard building. The conceptual building design would provide for multiple installation functions to proceed concurrently. Cabling and equipment testing could take place alongside assembly work. Much of the cable installation work at the switchyard building would take place in the basement vault beneath the equipment.

Cable Connection, Energizing, and Commissioning

With the previous steps complete, the new 230 kV cables would then be connected into the new switchyard and substation equipment. Energizing and final testing would then take place. Immediately following termination and testing, the cables may be energized and final switchyard tests performed. The switchyard may be commissioned and tests associated with the interconnection with Potrero Switchyard completed; alternatively, in the event the Embarcadero-Potrero 230 kV cable is not available for use, 115 kV power could be sourced from Potrero Switchyard for testing the new 230 kV switchyard equipment.

Spill Prevention, Control, and Countermeasures

PG&E would prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan for the new Potrero 230 kV Switchyard, which would specifically describe the containment of equipment containing more than 50 gallons of oil. PG&E proposes local containment for the new 230 kV transformer and shunt reactor. The SPCC Plan would include engineered and operational methods for preventing, containing, and controlling potential releases (e.g., construction of retention pond, moats, or berms) and provisions for quick and safe cleanup.

Depending on final hydraulic design, any collected stormwater would be either transferred by pumped pressure piping or gravity flow (surface or piped) to the existing 115 kV switchyard SPCC oil containment basin (near the intersection of Illinois and 23rd Streets), or after provisions for oil/water separation, directly into the stormwater collection system at the new 230 kV switchyard. Small amounts of additional temporary water storage (500 to 1,000 gallons) may be used as part of the water transference system from the new 230 kV switchyard area to the existing 115 kV switchyard area.

3.6.2 Embarcadero Substation

Since the connections at Embarcadero Substation would be made into either the existing structure or the upgraded 230 kV bus, the proposed work would only involve cable connection, energizing, and commissioning. The underground cable would be brought directly into the cable connection point of the gas insulated switchgear of the upgraded bus at Embarcadero Substation. The new 230 kV cable would then be connected into the new substation equipment. Energizing and final testing would take place, and immediately following termination and testing, the cable could be placed into service.

3.7 Submarine Cable Installation

The cables would be installed into the bottom sediments of the San Francisco Bay by hydroplow or other similar cable-burying technique, at a depth varying from approximately 6 to 10 feet below the floor of the bay. The Proposed Project would use a hydroplow that is pulled along the seabed behind a barge.

3.7.1 Submarine Cable Installation Procedures

The transmission cables would be buried, where feasible, a minimum of 6 feet under the surface of the sediments to protect the cables from mechanical damage. The hydroplow barge would typically be pulled into position via two commercial tugboats, and the barge anchors would be positioned to allow the barge to kedge between them along the cable route. Kedging is a process by which a ship is moved slowly along the surface of the water towards the fixed point of the anchor. Once in position, the moored barge would be propelled via two diesel engines — one for steering, the other for kedging anchor.

The barge would tow the hydroplow, a water jet that consists of a long blade mounted to either a sled- or tire-mounted submerged vehicle. The hydroplow blade contains water nozzles on the leading edge that displace the sediment using high-pressure water. PG&E proposes to use a hydroplow with low pressure water jets that would generally be engaged below the seabed, which would act to attenuate or dampen noise generated by the water jets and to minimize the underwater noise. Deck-mounted water pumps take water from the bay to the plow for jetting; the pumps draft water from a vertical suction line that is set from the barge approximately 3 feet below the surface. The intake line would be equipped with a wire-mesh screen to screen debris and reduce potential entrainment.

Each submarine cable for the transmission line would be fed from the barge down to the seabed through the blade and would exit at the foot of the blade to be laid directly into the sea bottom sediments. The length and angle of the blade would determine the burial depth of the cable. As the blade moves forward and the cable is placed in the momentarily opened trench, the majority of the fluidized sediments behind the blade fall back into the trench, effectively burying the cable. PG&E proposes to use this cable-laying method as a means of avoiding environmental disturbance that could otherwise occur through traditional mechanical trenching methods. The cable laying process is expected to require 24 to 36 hours of plowing time for each of the three cables, with 1 day needed before and after the hydroplowing to mobilize and demobilize. A team of approximately 21 people would be needed in-water and at the project site to perform the installation.

3.7.2 Alternative Submarine Cable Installation Procedures

PG&E developed the submarine cable route as part of a preliminary design to avoid known rocky soil conditions and any existing buried cables so that the proposed three submarine cables would be buried by hydroplow for their entire lengths. Nonetheless, either rocky soil conditions, existing (but unknown) cables crossing the route, or other seismic safety design considerations may not allow the cables to be buried. At these locations, the cables would be laid directly on the bottom of the bay for a short distance until they can again be buried into the sediments. To protect such segments of exposed cable from future damage by anchors, fishing gear, etc., concrete "blankets" or steel half-pipe sections would be placed over them. Typically, this might be done for 100 feet to either side of a crossing, at 50 feet in width (200 feet by 50 feet total area). PG&E's preliminary engineering indicates that no such blankets or pipe would be needed. Final design review prior to construction would include a review of existing conditions. However, to allow flexibility should the need arise in final design evaluations, PG&E assumes that up to 5 percent of the route, or 650 feet in length by 50 feet in width, may need to be covered by blankets or pipe on the seafloor.

3.7.3 Submarine to Land Transitions

Installing the submarine-to-land transition conduit would occur using shore-based HDD. PG&E proposes to use this drilling method as a means of avoiding disturbance of the shoreline. Each of the three phases of submarine cable would transition from land to water in separate HDPE conduits installed by HDD methods from the two HDD transition locations inland to exit points on the bottom of the bay. On the land side, the HDD conduit would transition to the underground duct bank conduits through a transition manhole. The submarine cable would be pulled through the conduits and spliced to a land cable type inside this vault at the onshore transitions.

The Proposed Project would use a typical HDD installation with a guided drill head to open the initial hole followed by a series of increasingly larger drill bits to bring the opening to the desired final diameter. After the hole is at the specified diameter, the internal conduits would be bundled together and pulled at one time through the hole. The detailed design of the HDD installation would be done during the final design stages.

At each landing zone, HDD operations would last for approximately 6 to 7 weeks, starting with securing the area around the HDD pit, which generally includes closing one lane and closing street parking at least on one side. PG&E would coordinate construction with DHL at the southern transition along 23rd Street or its extension into the DHL facility to ensure continued commercial access during construction.

Work would include the following steps:

- Excavating the HDD entry pit and inserting the HDD rig.
- Drilling the HDD bore holes.
- Excavating an adjacent exit (receiving) pit at the exit of the bore hole to capture mud, which would be pumped up to a barge and disposed of per appropriate regulations.
- Pulling fused sections of HDPE pipe as conduit into the bore holes.
- Connecting the ends of HDPE pipes into the transition splice vaults.
- Pulling the submarine cables back through the HDPE pipes and then into the splice vaults.
- Splicing the submarine cable to the underground land cable in the splice vaults.
- Restoring the area to pre-construction conditions.

The horizontal drilling rig and support equipment would be rigged up within the available temporary workspace. Plastic sheeting would be placed under the drill rig and any support equipment that could have a potential for a hydraulic, fuel, or oil leak. Silt fencing, erosion control, and spill containment would also be provided around the drilling equipment in order to ensure no run-off would leave from the site. A temporary chain link fence would be installed around all of the drilling equipment.

Prior to the drill reaching the underwater exit, the fluids would be circulated through the HDD back to the drill rig and collected and cleaned for reuse. Before the end of the drilling operation, the HDD exit location would be identified and a localized excavation would be made in the seafloor sediments at the exit point to receive the heavy drilling fluids when the pilot hole is exited and during the pipe pulling operations.

At the proposed northern landing zone in Spear Street, the HDD entry points and final path would be determined during final design. Excavation for the HDD pit would likely occur within approximately 700 feet from the shoreline, and the drill would continue approximately another 1,000 to 2,300 feet to the exit point at the bottom of the bay floor. The HDD would transition to a depth of up to approximately 150 feet below ground, and would need to be at least 50 feet deep to pass below both the sewer transport/storage box under The Embarcadero and the seawall between Piers 28 and 30/32. This path would be above the bedrock layer, below the piles that support the seawall, and primarily within Colma Formation clayey sand deposits and bay muds. This drill path would also be a sufficient distance away from the steep offshore slope, permitting a smooth transition to direct burial of the cable within the bay floor.

At the proposed southern landing zone in 23rd Street, the HDD would begin at entry points and follow a path to be determined during final design. Excavation for the HDD pit would occur within the HDD entry pits and splice vault work zone depicted on Figure 4-9. The HDD would transition to a depth of approximately 30 to 50 feet below ground level and proceed approximately another 1,000 feet to an exit point at the bottom of the bay floor. This path would stay above and close to the bedrock layer and within bay mud. No seawall or deep pile obstructions were identified by PG&E along this section of shoreline.

PG&E estimates that HDD activity and drill rig use at each of the HDD locations (north and south) would occur over 13 days per each of the three borings, for a total of 39 days total at each the northern and southern HDD landings. Each day is expected to include 10 hours of drilling, for a total of 390 hours at each transition; working 6 days per week, HDD operations would last 6 to 7 weeks. The duration of 39 days at each landing is the best estimate available to PG&E.

PG&E expects to include acoustical performance specifications for contractors to use silencing during HDD activities to minimize the sound levels. The precise details of lane and parking space closures in the cul-de-sac on Spear Street would depend on final design.

HDD Entry and Exit Pits

HDD entry pits would be up to about 5 feet wide, 8 feet long, and 6 feet deep and would be covered with steel plates during non-working hours. These pits would be used only for fluid containment before pumping the fluid to the control equipment for cleaning and re-circulation. Exit (receiving) pits in the bay would be up to about 24 feet by 12 feet long and 7 feet deep.

Excavation of entry pits would require saw cutting the asphalt and excavating with a backhoe. Receiving pits would be excavated using a clamshell dredger from a work barge anchored above the exit points. Shoring would be used for the entry (containment) pit, but no shoring would be undertaken in the exit (receiving) pits. The sides of the offshore pits would be sloped sufficiently such that shoring would not be necessary.

Pilot Hole Drilling

Pilot hole drilling would be discontinued approximately 50 to 75 feet away from the exit point, to leave a "plug" of soil between the drilled hole and the sea floor. At that location, the drill pipe would be "tripped" out of the hole and the hole would be forward-reamed to a diameter of about 20 inches (assuming a 14-inch outside diameter HDPE conduit).

Following the pilot hole, reaming tools may be used to enlarge the opening to accept the proposed lines. The reaming tools are generally attached to the drill string at the exit point of the pilot hole and then rotated and drawn back to the drilling rig, thus progressively enlarging the pilot hole with each pass. During this process, drilling fluid typically consisting of bentonite clay and water would be continuously pumped into the hole to remove cuttings and maintain the integrity of the hole.

Reaming would be followed by “swabbing” to test the condition of the hole. Drilling fluids would be pumped into the hole during both of these operations. As a result of leaving the 50-foot to 75-foot plug in the bottom of the hole, all drilling fluids used during these processes would flow back to the entry point through the bore-hole annulus for re-circulating.

Pullback of Pipe, Conduit, and Cable

After swabbing the hole, the final 50 feet to 75 feet would be exited to the sea floor at which time some fluids would drain into the exit pits and containment sump. Once the hole has been sufficiently enlarged, the HDPE conduit and line would be attached behind the reaming tool on the exit side of the crossing and pulled back through the drill hole toward the drill rig, completing the crossing.

The pipe and casing of the HDPE conduit would be assembled and fused at the work area onshore within 23rd Street shown on Figure 4-9 (Potrero HDD Transition Area). Since the pipe would be a lightweight and durable conduit for the cable, it would be connected to a small boat and dragged until the pipe is floating on the water. Using the same boat, the conduit would then be tugged along the surface of the water to the area of each HDD exit.

The HDPE pipe would be floated into place, the front end sunk and hooked up to the drill pipe, and the pullback would proceed. Detailed construction plans to be completed by the HDD contractor would specify whether or not part of the HDPE conduit would be rested on a barge to help guide it into the bore opening, or whether the pipe would simply be submerged to the bore opening from the surface of the water. As the pipe is pulled into the drilled hole, it would displace its volume of drilling fluids to the exit pit and containment sump for approximately half the length of the pipeline, at which time the flow would begin to turn around to the entry pit where it would be contained in frac tanks for either re-use or disposal. In addition to the displacement volume, additional drilling fluid would be pumped during the pullback and would flow to the exit containment sump.

Divers would attach the HDPE conduit and submarine cable to the end of the HDD, and the cable would be pulled back onshore. After installation of the cable, divers would pump these fluids into tanks on the barge for transfer by vacuum trucks to an approved disposal site.

Pumps would not be expected to run continuously. Pumps for drilling fluids would only operate when drilling occurs and would not operate when pull back occurs. Pull-back could potentially require over-night work should pull-back necessitate prolonged work hours. If soil conditions are such that the integrity of the hole cannot be readily maintained with daytime only activities, HDD operations would have to proceed on a 24-hour basis.

3.8 Construction Phasing

The timeline for construction and testing would be 22 months with initiation of service targeted for early 2016. The transmission line would require 15 months of work and this would overlap with 22 months of for development of the Potrero 230 kV Switchyard. It is assumed that construction would occur 10 hours per day, 5 days per week. (The preliminary schedule is provided in the body of the MMRCP.)

Construction hours would typically be between 7 a.m. and 8 p.m., or during times set through coordination with the City and County of San Francisco. Trenching would progress at an approximate rate of 50 feet per day, and approximately 150 feet to 300 feet of trench would be open at any one time. The total duration of trench excavation and manhole installation, not including cable pulling and HDD operations, is estimated to take approximately four months for the northern underground segment along Spear and Folsom Streets and two months for the southern underground segment on 23rd Street. If trenching work would cause potential traffic congestion, the project may require nighttime work to avoid traffic disruption.

Along the trench route in city streets, PG&E would also require 4 to 7 days for installing each vault, 2 days for conduit cleaning/proofing, 2 days for cable pulling, and 2 to 3 days for racking and splicing at the landing single phase vaults and 7 to 9 days at the Folsom Street three-phase vault. Although some work may overlap, in total, each vault location would have approximately 13 days of sustained lane closure. Work to complete the two HDD transitions, install HDPE conduit, and pullback cable would take 129 days. Final paving restoration would be scheduled after the cable is fully installed and operative; final paving would take 5 days along Spear and Folsom Streets and 2 days on 23rd Street.

3.9 Workforce and Equipment

Construction would involve a workforce of 15 to 75 people at any one time. Approximately 30 construction personnel and approximately 8 truck drivers would be employed for excavation and conduit installation using two excavation crews. Approximately 20 construction personnel would be employed during cable installation, 15 construction personnel during the HDD installations, and 25 construction personnel during the submarine cable installation. The number of employees would peak at approximately 75 construction personnel, including switchyard workers, supervisors, and inspectors. PG&E expects to hire approximately 20 percent of its construction workforce locally (roughly 10 to 15 employees). Up to 40 round-trips (80 one-way trips) would occur for workers traveling to and from each work site daily.

4. Operation and Maintenance

Once the project is built and energized, PG&E's existing local maintenance and operations group would assume monitoring and control duties and maintenance, inspection, and security roles, as needed, with support from a marine contractor. Aside from contracted stand-by marine transportation and technical support, no additional staff would be hired by PG&E after the transmission project is energized and placed into service.

Monitoring and control functions for the new facilities would be connected to the existing PG&E computer system by telecommunications. Regular inspection of transmission lines, substations, instrumentation and control, and support systems is critical for safe, efficient, and economical operation. Early identification of items needing maintenance, repair, or replacement would ensure continued safe operation of the project. Aboveground components would be inspected at least annually for corrosion, equipment misalignment, loose fittings, and other common mechanical problems. The underground portion of the line would be inspected regularly from inside the vaults to avoid disturbing traffic using city streets.

Routine inspection of the underground terminals would occur every three months, and detailed video and infrared inspection of vaults, splices, and terminals would occur every two years. A Distributed Temperature Sensing system of fiber optics integrated in the body of the cable would be used to monitor the submarine and underground cable.

4.1 Submarine Cable

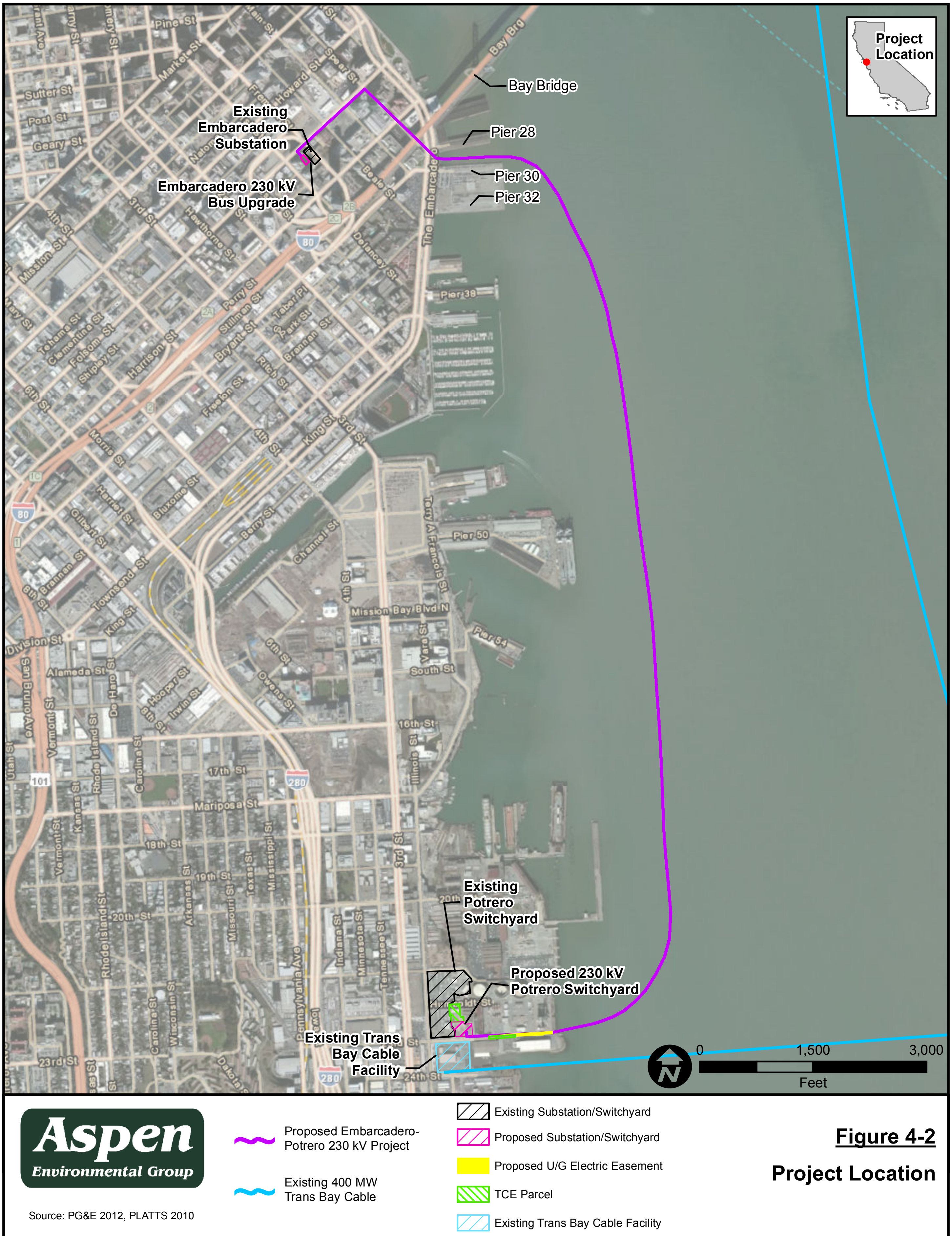
4.1.1 Recording on Maritime Maps

Once the submarine cables are installed they would be recorded by the Coast Guard and given to NOAA for publication. PG&E would publish a Local Notice to Mariners (LNM) via Coast Guard District 11. This would provide advisory to the San Francisco Vessel Traffic Service (VTS) to allow the management of waterway traffic over VHF-FM Channel 14 requiring transit through the project location.

4.1.2 Surveying and Maritime Alert System

PG&E intends to conduct marine surveys at regular intervals after cable installation to assess whether potential seabed topography changes have occurred along the cable route. A cable-tracking system may be deployed as part of the route survey to confirm cable burial depth.

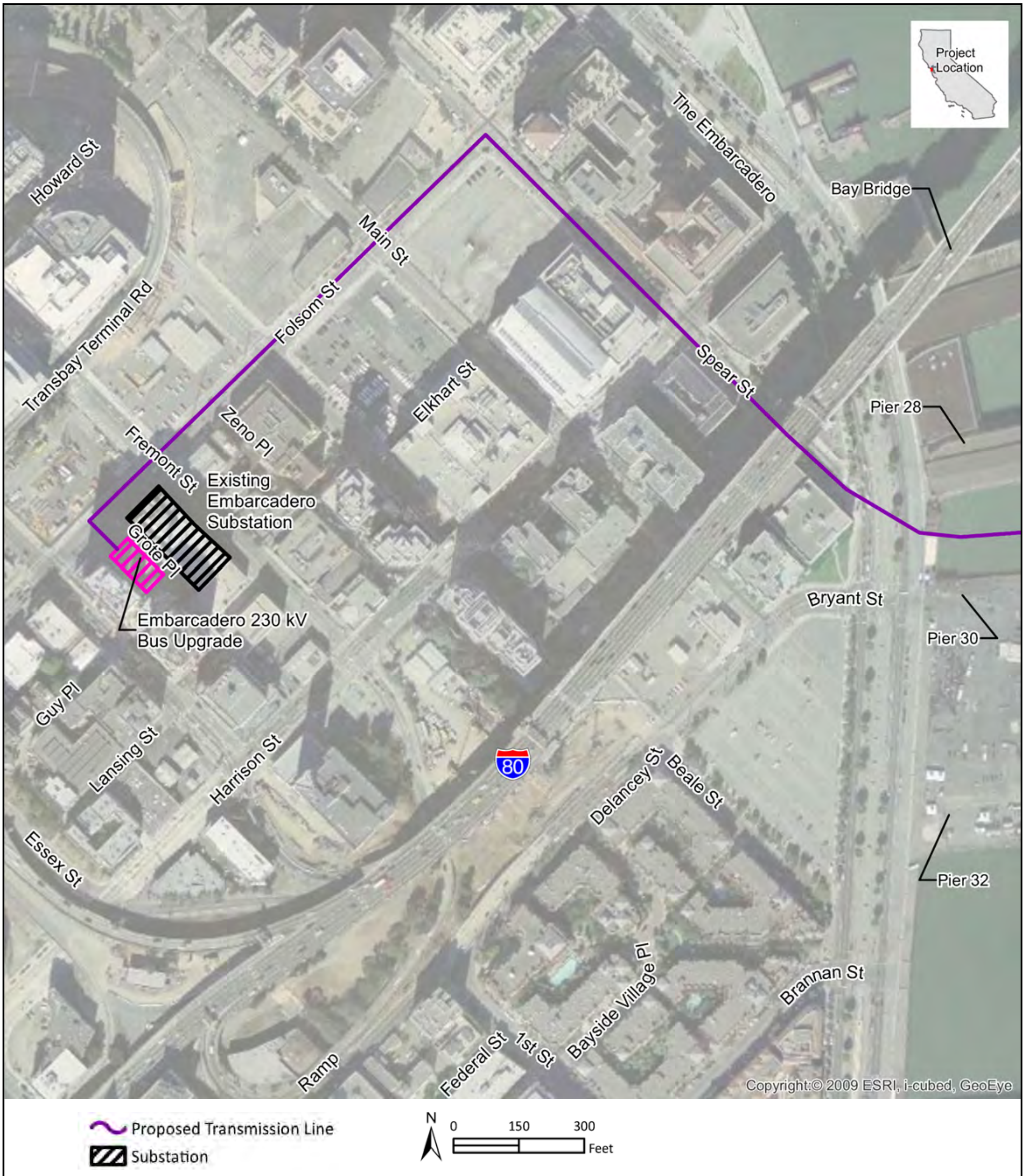
Besides promoting the new cable awareness and engaging stakeholders by registering the new cable on navigational maps, PG&E intends to implement an operation and maintenance strategy that would include an automatic identification system (AIS) vessel monitoring to ensure the new cable security. The system would use live vessel position in conjunction with the cable location information to create automatic warnings if the cable is at risk due to abnormal shipping activities such as vessels that are off-course or moving at unusual speed.



Source: PG&E 2012, PLATTS 2010

Figure 4-2

Project Location



Source: PG&E, 2012.

Figure 4-3
Embarcadero Substation Area

Aspen Environmental Group

Source: PG&E 2012, PLATTS 2010

Proposed Embarcadero-Potrero 230 kV Project

Existing 400 MW Trans Bay Cable

Existing Substation/Switchyard

Proposed Substation/Switchyard

Proposed U/G Electric Easement

TCE Parcel

Existing Trans Bay Cable Facility

Figure 4-4

Potrero Switchyard Area

Aspen Environmental Group

Source: PG&E, 2013.

Figure 4-5
Potential Staging Locations

Source: PG&E, 2012.

Figure 4-8
Embarcadero HDD Transition Area

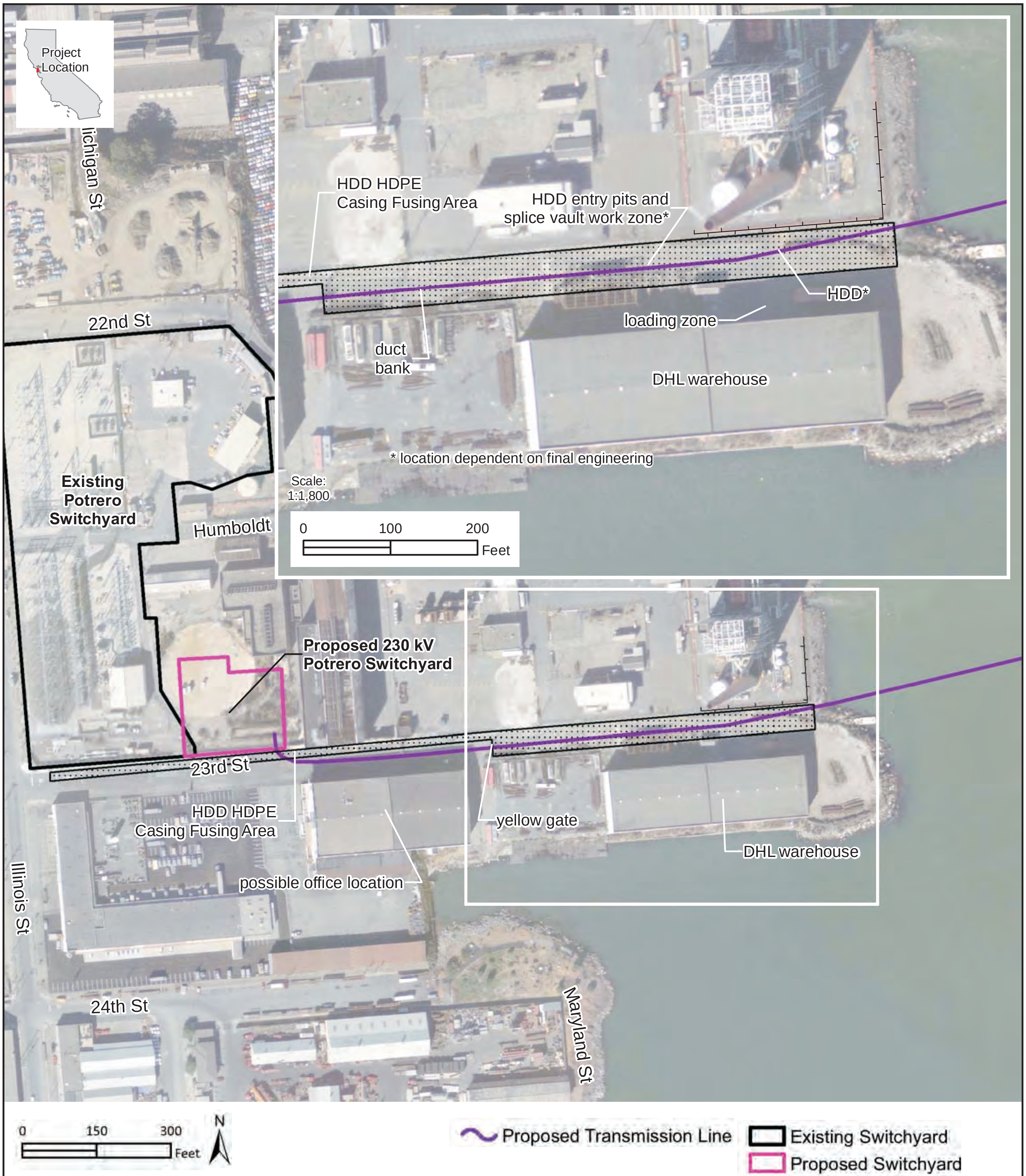
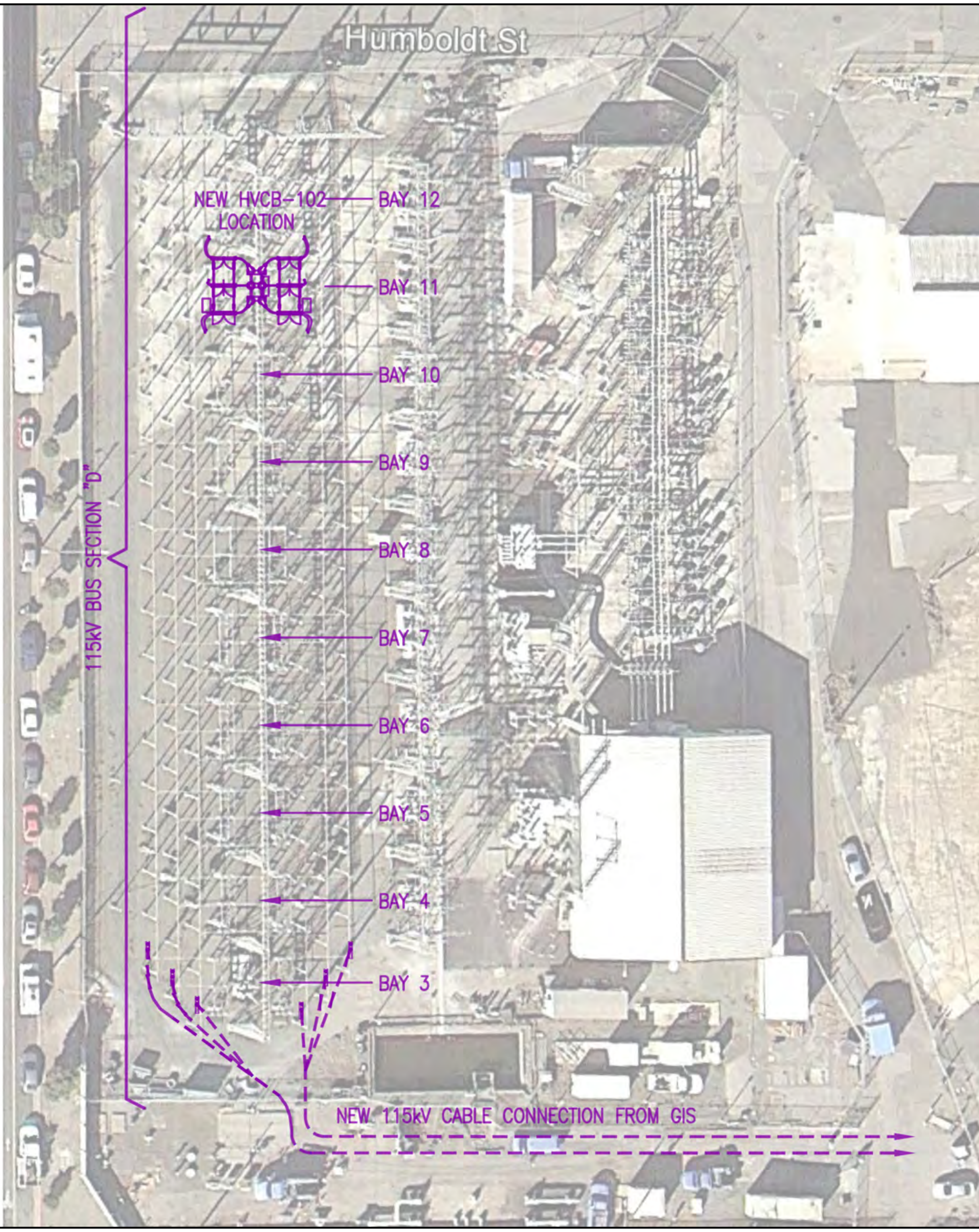


Figure 4-9

Potrero HDD Transition Area

Source: PG&E, 2013a.



Source: PG&E, 2012.

Figure 4-16
Potrero Interconnection with 115 kV System