B. Description of Proposed Project

B.1 Introduction

Section B describes the Jefferson-Martin 230 kV Transmission Line Project (the "Proposed Project") proposed by Pacific Gas & Electric (PG&E). The information is intended to provide a detailed description of project construction and operation, serving to provide a common understanding of the project parameters in Section D, where environmental impacts are evaluated. Section B.2 provides a description of the Proposed Project and its components. Section B.3 describes the construction that would be associated with the Proposed Project, and Section B.4 describes operation and maintenance procedures.

B.2 Description of the Proposed Project

B.2.1 Overview of the Proposed Project

The Proposed Project would be located in the County of San Mateo, including the Towns of Hillsborough and Colma, and the Cities of Brisbane, Daly City, San Bruno, and South San Francisco. The regional location of the Proposed Project is illustrated in Figure B-1 and the proposed overhead and underground route segments are illustrated in Figures B-2a and B-2b, respectively.

The Proposed Project would consist of the following major components:

- Installation of a new approximately 27-mile 230 kV transmission line with overhead and underground segments
- Rebuilding the existing Jefferson-Martin 60 kV double-circuit power line
- Construction of a new transition station near the intersection of San Bruno Avenue and Glenview Drive just east of Skyline Boulevard/Highway 35
- Modification of the existing Jefferson and Martin Substations to accommodate the new 230 kV transmission line
- Modifications to equipment at the existing San Mateo, Ralston, Millbrae and Monta Vista Substations
- Modification of Hillsdale Junction Switching Station for the new 60 kV arrangement.

Table B-1 presents a summary of the major components of the Proposed Project, while the sections that follow Table B-1 provide additional detail about each of the subject components.

B.2.2 230 kV/60 kV Overhead Lines

The overhead line portion of the Proposed Project would consist of the removal of the existing double-circuit 60 kV power line and replacing it with a new double-circuit line consisting of a single 230 kV circuit and a single 60 kV circuit between Jefferson Substation and the proposed transition station. In addition, primary and secondary optic ground wires would be strung along the conductors to provide dedicated fiber strands for communications purposes during project operation.

Figure B-1. Proposed Project – Regional Location

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Figure B-2a. Overview of Proposed Project – Southern Segment
For security reasons this figure is not included in the online version of the report.

Figure B-2b. Overview of Proposed Project – Northern Segment
For security reasons this figure is not included in the online version of the report.

Table B-1. Summary of Proposed Project Components

230 kV Overhead Transmission Line

- Voltage: 230 kV
- Conductors: single-circuit, 954 kcmil ACSS each circuit with three phases; conductor diameter: 1.196 inches
- Shield wire/fiber optic ("OPGW") cable diameter: 0.695 inches (approximate),for communication and shielding
- Structure types: self-supporting lattice towers and tubular steel poles
- Structure heights: approximately 95 feet to 150 feet (exclusive of any EMF reduction measures that may be required)
- Approximate distance between structures: 700 to 1,500 feet

60 kV Overhead Power Line

- Voltage: 60 kV (Insulated at 115 kV)
- Conductors: Single-circuit, 477 kcmil ACSS, each circuit with three phases; conductor diameter: 0.846 inches
- Minimum ground clearance: 30 feet
- Shield wire/fiber optic, structure types, structure heights, and approximate distance between structures: see 230 kV description, above

230 kV Underground Transmission Line

- Voltage: 230 kV
- Conductors: single-circuit, cross-linked, polyethylene-insulated, solid dielectric, single conductor cable, copper conductor, metallic impervious sheath with temperature sensing fiber, polyethylene outer jacket, the circuit comprising three cable phases (three cables total)
- Cable Diameter: 4 inches or more
- Cable terminations: porcelain outer, premolded dielectric inner, silicon oil filled, about 9 feet in height
- Conduit Type: 6-inch PVC in 4-way concrete duct bank (2 x 2), envelope dimensions 24 inches by 24 inches; plus one additional position for fiber-optic cable (for communication of cable protection equipment)
- Minimum Depth: 36 inches to top of duct
- Splice Vaults: Reinforced concrete, 24 ft. long x 10 ft. wide x 10 ft. deep (outside dimensions); three splices per vault, bonding/cross-bonding/ grounding
- Total number of splice vaults: 40-43
- Total number of cable terminations: 6
- Lightning Arresters: metal oxide varistor type, one per phase, about 6 feet in height
- Total number of lightning arresters: 6

Transition Station

- Support structure type: post and beam steel, low profile termination structure, supports cable terminations and lightning arresters
- Total number of termination structures: 1
- Dead-end structure type: post and beam steel, full-tension dead-end tower single-circuit vertical configuration to a horizontal configuration
- Structure height: 47 feet
- Install masonry wall around transition structure site and control building

Jefferson Substation Modifications

- Remove existing 230 kV bus and install 230 kV ring bus
- Install transformers; control, protection, and communication equipment; install 4 230 kV breakers with disconnect switches and one 60 kV bus parallel breaker
- Install standard lighting (low-intensity wattage mounted on approximately 25' structures near bus and facing towards the ground)
- Relocate (replace and remove) existing Monta Vista-Jefferson 230 kV transmission Tower 19/84
- Modify tower structure arms of the Monta Vista-Jefferson 230 kV transmission tower just west of I-280 to realign with moved Tower 19/84
- Replace one tower with a tubular steel pole within substation
- Install new tubular steel pole 0/1A within fenceline on far side of the substation from Cañada Road
- Install four new dead-end structures; remove two wood poles

San Mateo Substation Modifications

- Replace 8-ohms series reactor with switchable series reactor
- Install bypass circuit switcher and disconnect switches
- Relocate trailer office within substation

Ralston Substation Modifications

- Install station bypass switch
- Upgrade 60 kV MOAs and high-side bus
- Replace existing 60 kV MOAs structures with new dead-end structures
- Install new tubular steel pole along southern border

Martin Substation Modifications

- Install three, 134 MVA, 230/115 kV transformers and one 230 kV underground termination structure
- Terminate the new 230 kV breakers with disconnects
- Add 1 bay to existing breaker and one half-scheme
- Install three 230 kV breakers with disconnect; series reactor (230 kV) with circuit switcher bypass; control, protection, and communication equipment

Hillsdale Junction Switchyard

- Remove string bus
- Install two 60 kV breakers
- Install new tubular steel pole to west of existing fenceline

System Protection

- Install redundant protection on existing poles and towers between Jefferson and Martin Substations

Figures B-3a through B-3v (presented at the end of this section) provide detailed illustrations of the overhead portion of the proposed route, including the existing and proposed tower locations. Approximately 100 existing structures would be replaced. The new towers would be an average of approximately 20 feet taller than the existing structures. At the north end of the overhead segment, the proposed new 230 kV circuit would turn eastward and cross over Skyline Boulevard near existing Tower 14/96. This existing tower would be replaced by a new tubular steel pole located just south of the existing structure.

The portion of the existing double-circuit 60 kV power line between existing Tower 14/96 and Sneath Lane Substation would be reconductored and would remain at 60 kV. PG&E anticipates that the existing lattice steel pole 14/97 would remain in place, but may require the installation of new lattice sections. PG&E also anticipates that the existing lattice structure near Sneath Lane Substation (existing Tower 14/98) would remain unchanged, with the exception of insulator changes. Based on preliminary engineering conducted by PG&E, which takes into account local topography, length of span, and pole angle, the increase in height between existing and proposed towers at proposed Towers 14/96 and 14/97 would be 50 and 30 feet, respectively. The final design of these structures may change based on final engineering.

PG&E states that it would reconfigure the substations so that a single-circuit 60 kV line could replace the existing double-circuit 60 kV line, providing the same level of service, and maintaining the existing load of the double-circuit line. The three substations that currently tap both 60 kV circuits are the Ralston, Carolands, and Watershed Substations, while the arrangements at the other 60 kV substations only tap one of the circuits.

Ralston, Carolands, and Watershed substations are presently normally supplied by one of the Jefferson-Martin 60 kV circuits with the other 60 kV circuit used as an alternate supply should outage of the normal supply circuit occur. During an outage, switches at or near the substation transfer from the primary supply circuit to the alternate supply current. With the Proposed Project, these substations would use the new upgraded 60 kV circuit as both the normal and alternate supply by using new switches that would sectionalize the line at or near the substation. These switches would allow the substation service to be transferred to the section of line (either to the north or to the south of the substation) that was not affected by the outage.

The Proposed Project would also include two 60 kV circuit breakers at Hillsdale Junction switching station to sectionalize the new upgraded 60 kV line. The sectionalizing results in reduced 60 kV line exposure to Watershed, Ralston, and Crystal Springs substations, which would enhance their reliability. In addition, while the new Jefferson-Martin 230 kV circuit would not directly connect to the 60 kV substations, it would enhance reliability by providing increased capability and redundancy of 230 kV supply to this entire area by installing a third 230 kV circuit to Jefferson Substation.

B.2.2.1 Location and Routing

The overhead portion of the project would originate at Jefferson Substation (milepost [MP] 0.0) and continue northward to the proposed transition station location on the northwest corner of San Bruno Avenue and Glenview Drive (MP 14.7), as shown in Figures B-3a through B-3v located at the end of Section B. For much of the route, the line would travel next to Interstate 280 (I-280), and would be on the Peninsula Watershed lands owned by the City and County of San Francisco (CCSF). (Refer to Section D.2, Land Use, for a detailed description of land uses adjacent to the route.)

The existing line is a double-circuit 60 kV line built on lattice steel towers and lattice steel poles. The rebuilt line would also be a double-circuit line with the westernmost circuit energized at 230 kV. The easternmost circuit would remain energized at 60 kV and would utilize 115 kV insulators and support hardware. This new 60 kV line would be capable of carrying the combined load of the two existing 60 kV circuits.

In most cases, the new transmission line towers and poles would be replacing the existing towers and poles near their existing locations, as shown in Figures B-3a through B-3v. The proposed locations of the new towers are subject to further siting refinement through detailed engineering.

The Proposed Project would require two communication lines on separate routes to ensure reliable operation by achieving physical redundancy. The primary communication line would follow the new 230 kV transmission line route. The secondary communication line would utilize existing transmission and distribution facilities located for the most part in franchised public streets. The proposed secondary communication line would travel approximately 3.3 miles on an existing 115 kV transmission pole line, approximately 2.6 miles on distribution pole lines, and approximately 0.4 miles in underground conduits from Jefferson Substation to Redwood Substation, where it would join an existing fiber cable that goes to Martin Substation via San Mateo Substation.

B.2.2.2 Structures

PG&E is proposing to use lattice steel towers throughout most of the line, as is the case with the existing 60 kV line. The exceptions to use of lattice towers would be at locations where existing structures consist of lattice steel poles. In these sites, 230 kV tubular steel poles would replace the existing lattice steel poles. Figures B-4 and B-5 illustrate two types of lattice towers that PG&E proposes to use. "Heavy-angle" lattice towers would be used at locations where the transmission line direction changes. "Tangent" towers would be used where the line is running in a straight segment without angles. Figure B-6 illustrates a tubular steel pole (TSP) tangent structure.

The new transmission line towers and poles would generally be larger and taller than the existing structures, as necessary to support the heavier weight of the new line, to provide for the necessary electrical ground clearance, and also as a result of greater separation between the conductor phases (see Table B-2). Within the overhead section, there are a number of service taps (connections) from the existing 60 kV power line. These taps would be transferred to the eastern circuit, which would remain energized at 60 kV. New tower-mounted line selector switches would likely be necessary at some tap locations. The Applicant is currently planning to install the overhead portion of the project using a combination of land-access or helicopter construction techniques, as described in greater detail in Section B.3.

With respect to engineering, the benefits of using lattice towers versus tubular steel poles are that they can be installed by helicopter because they are relatively lightweight, require smaller foundations (which can be installed by lower impact methods if required), and are more economical for use in heavy-angle and long-span applications. On the other hand, tubular steel poles occupy slightly smaller total footprint than lattice towers, can be installed more quickly than lattice towers and with less manpower, can be designed to accommodate specific applications (e.g., tap locations), and can be more economical for use in tangent-angle and short-span applications.

PG&E is proposing replacement of approximately 100 towers. New towers would be in the immediate vicinity of the existing 60 kV power line tower locations to reduce potential impacts and allow use of existing access for construction and maintenance. A list of the existing and new tower types and heights is also provided in Table B-2.

Figure B-4. Typical Heavy-Angle Lattice Steel Tower

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Figure B-5. Typical Tangent Lattice Steel Tower

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Figure B-6. Typical Tangent Tubular Steel Pole

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Table B-2. Existing and Proposed Structures

Existing Tower Number	Existing Structure Type	Existing Tower Height (feet)	Proposed New Tower Number	Proposed New Structure Type	Proposed New Tower Height (feet)	Height Difference (feet)
—	—	—	0/1	TSP	116.5	116.5
0/2A	WP	55	—	—	—	-55
0/2A	WP	60	—	—	—	-60
0/3	LAT	89.5	0/2	LAT	115	25.5
0/4	LAT	89.5	0/3	LAT	115	25.5
0/5	LAT	117	0/4	LAT	135	18
0/6	LAT	97	0/5	LAT	120	23
1/7	LAT	108	0/6	LAT	131.5	23.5
1/8	LAT	114.5	1/7	LAT	140	25.5
1/9	LAT	90.5	1/8	LAT	106.5	16
1/10	LAT	89.5	1/9	LAT	105	15.5
1/11	LAT	85.5	1/10	LAT	106.5	21
1/12	LAT	87	1/11	LAT	105	18
2/13	LAT	102	1/12	LAT	120	18
2/14	LAT	99	2/13	LAT	141.5	42.5
2/15	LAT	74	2/14	LAT	121.5	47.5
2/16	LAT	89.5	2/15	LAT	136.5	47
2/17	LAT	78.2	2/16A	TSP	90	11.8
—	—	—	2/16B	TSP	75	75
2/18	LAT	84.5	2/17	LAT	95	10.5
3/19	LAT	97	3/18	LAT	120	23
2/20	LAT	112	3/19	LAT	131.5	19.5
2/21	LAT	107	3/20	LAT	125	18
3/22	LAT	119.5	3/21	LAT	140	20.5
4/23	LAT	129	3/22	LAT	136.5	7.5
4/24	LAT	96.5	4/23	LAT	136.5	40
4/24A	LAT	106.5	4/24	LAT	136.5	30
4/25	LAT	104	4/25	LAT	131.5	27.5
4/26	LAT	97	4/26	LAT	115	18
4/27	LAT	89.5	4/27A	TSP	111.5	22
5/28	LAT	84.5	5/28	LAT	105	20.5
5/29	LAT	84.5	5/29	LAT	110	25.5
5/30	LAT	92	5/30	LAT	121.5	29.5
5/31	LAT	99.5	5/31	LAT	125	25.5
6/32	LAT	94.5	5/32	LAT	125	30.5

Table B-2. Existing and Proposed Structures

Existing Tower Number	Existing Structure Type	Existing Tower Height (feet)	Proposed New Tower Number	Proposed New Structure Type	Proposed New Tower Height (feet)	Height Difference (feet)
6/33	LAT	107	6/33	LAT	135	28
6/34	LAT	112	6/34	LAT	135	23
6/35	LAT	87	6/35	TSP	116.5	29.5
6/35A	LSP	58.5	6/35A	TSP	75	16.5
6/35B	LSP	58.5	—	—	—	-58.5
6/36	LAT	87	6/36	LAT	105	18
6/37	LAT	85.5	6/37	LAT	106.5	21
6/38	LAT	89.5	6/38	LAT	106.5	17
7/39	LAT	119	7/39	TSP	140	21
7/40	LAT	119	7/40	LAT	151.5	32.5
7/41	LSP	80	7/41	TSP	90	10
7/42	LSP	80	7/42	TSP	100	20
7/43	LSP	85	*7/43*	TSP	110	25
7/44	LAT	99.5	7/44	TSP	116.5	17
7/45	LSP	80	7/45	TSP	100	20
7/46	LSP	75	8/46	TSP	110	35
8/47	LSP	80	8/47	TSP	110	30
8/48	LAT	109	8/48	LAT	130	21
8/49	LAT	104	8/49	LAT	131.5	27.5
8/50	LAT	89	8/50	LAT	105	16
8/51	LAT	84	8/51	LAT	106.5	22.5
8/52	LAT	74	8/52	TSP	116.5	42.5
8/53	LAT	106.5	8/53	LAT	126.5	20
9/54	LAT	79	9/54	TSP	121.5	42.5
9/55	LSP	90	9/55	TSP	100	10
9/56	LSP	90	9/56	TSP	110	20
9/57	LSP	87.4	9/57	TSP	110	22.6
9/58	LSP	90	9/58	TSP	110	20
9/59	LSP	90	9/59	TSP	100	10
9/60	LSP	90	9/60	TSP	90	0
9/61	LAT	71.5	9/61	LAT	95.5	24
9/62	LAT	84.5	9/62	TSP	106.5	22
9/63	LSP	99	10/63	TSP	110	11
10/64	LSP	70	10/64	TSP	100	30
10/65	LAT	84.5	10/65	TSP	95	10.5
10/66	LSP	80	10/66	TSP	110	30

Table B-2. Existing and Proposed Structures

Existing Tower Number	Existing Structure Type	Existing Tower Height (feet)	Proposed New Tower Number	Proposed New Structure Type	Proposed New Tower Height (feet)	Height Difference (feet)
10/67	LAT	89	10/67	TSP	105	16
10/68	LAT	99	10/68	LAT	131.5	32.5
10/69	LAT	99	10/69	LAT	135.5	36.5
11/70	LAT	71.5	11/70	LAT	96.5	25
11/71	LAT	84	11/71	LAT	95	11
11/72	LAT	74	11/72	LAT	96.5	22.5
11/73	LAT	79	11/73	LAT	106.5	27.5
11/74	LAT	124.5	11/74	LAT	111.5	-13
11/75	LAT	76.5	11/75	LAT	106.5	30
11/76	LAT	76.5	12/76	LAT	101.5	25
12/77	LAT	81.5	12/77	LAT	106.5	25
12/78	LAT	141	12/78	LAT	116.5	-24.5
12/79	LAT	71.5	12/79	LAT	105	33.5
12/80	LAT	119	12/80	LAT	105	-14
12/81	LAT	116.5	12/81	LAT	95	-21.5
12/81A	TSP	81	12/82	TSP	100	19
12/82	LAT	111.5	13/83	LAT	106.5	-5
13/83	LAT	88	13/84	TSP	120	32
13/84	LAT	108	13/85	TSP	120	12
13/85	LAT	91.5	13/86	LAT	135	43.5
13/86	LAT	104	13/87	LAT	125	21
13/87	LAT	91.5	13/88	LAT	130	38.5
13/88	LSP	74	13/89	TSP	100	26
14/89	LSP	70	14/90	TSP	100	30
14/90	LSP	65	14/91	TSP	100	35
14/91	LSP	65	14/92	TSP	100	35
14/92	LSP	70	—	—	—	-70
14/93	LSP	67.4	14/93A	TSP	90	22.6
—	—	—	14/93B	TSP	75	75
14/94	LSP	72.4	14/94	TSP	120	47.6
14/95	LSP	70	—	—	—	—
14/96	LSP	70	14/95	TSP	120	50
14/97	LSP	75	14/97	LSP	105	30
14/98	LAT	91.5	14/98	LAT	91.5	0

B.2.2.3 Right of Way

The current easement owned by PG&E and used for the existing 60 kV power line is typically 50 feet wide. The ROW would need to be expanded to 100 feet in width in most areas, although the ROW width in some specific locations may vary slightly, depending on final engineering. The width of the ROW is primarily determined by electrical clearances for the conductors (wires). Generally, widening the ROW could result in height restrictions for future structures or trees under the wires. However, since the line is located almost exclusively in open space and parklands, the ROW and adjacent areas to the ROW are undeveloped and therefore the expansion of the ROW would not result in restrictions to future growth. At existing Tower 7/39, the new structure would be relocated outside the existing ROW, and therefore would not restrict structure heights at that location.

B.2.3 Overhead to Underground Transition Station

As discussed above, the Proposed Project would require a transition station to convert the 230 kV overhead transmission line to the underground line. The proposed transition station would be located at a Caltrans parcel near San Bruno and Skyline Boulevard and is depicted in Figure B-7a. Roadwork and grading would be needed before construction of the transition station in the open area parcel.

There are two basic transition structure types:

- **Transition Tower**: This type of transition structure has a dead-end structure with the appearance of a tubular steel pole. This dead-end structure would have a height similar to regular support poles, approximately 100 feet tall. The three phases of the transmission line would approach this type of dead-end structure in the same vertical plane. Figure B-7b illustrates two transition towers for a double-circuit 230 kV line.
- **Transition Station:** Also known as a low-profile station, this is the type of transition structure that PG&E is proposing for the Proposed Project. It would have a dead-end structure with a maximum height of 47 feet, but would be approximately 36 feet wide. This width would be required because for this station type, the three phases of the transmission line would approach the dead-end structure in the same horizontal plane. Figure B-7c illustrates a transition station under construction on a double-circuit 230 kV line.

The transition station would be set back approximately 25 feet to the west from Glenview Drive and about 50 feet north of San Bruno Avenue. The station would have an 8-foot-high masonry wall, enclosing an area of approximately 80 feet by 100 feet. A ground grid and conduit system would be installed. Besides a dead-end structure for the incoming 230 kV overhead circuit and support structures for cable terminations and surge arresters, there would be a control building and underground vault within the masonry wall enclosure, approximately 10 feet by 10 feet by 13 feet, that would house protection and telecommunication equipment. Installation and outside dimensions of the underground vault would be about 24 feet by 10 feet by 10 feet. Figure B-8 depicts a conceptual landscaping plan for the transition station.

B.2.4 230 kV Transmission Underground Line

The underground portion of the Proposed Project would consist of a single-circuit 230 kV transmission line that would begin at the transition station (San Bruno Avenue and Glenview Drive) and would be constructed in city streets, the San Francisco Bay Area Rapid Transit (BART) ROW, and Guadalupe Canyon Parkway to the terminus of the line at the Martin Substation.

Figure B-7a. Proposed Transition Station

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Figure B-7b. Transition Tower
Figure B-7c. Transition Station

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Figure B-8. Conceptual Landscape Design

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B.2.4.1 Location and Routing

The 12.4-mile underground, single-circuit 230 kV transmission line section would begin at the proposed transition station. Detailed illustrations of the underground portion of the proposed route are depicted in Figures B-3l through B-3v, presented at the end of this section. The new 230 kV solid-dielectric underground cables would proceed to the east along San Bruno Avenue for 1.7 miles, crossing under I-280, to the BART ROW, which is at the intersection of San Bruno Avenue and Huntington Avenue. Here, the route would turn north and follow the BART ROW under Huntington Avenue to Sneath Lane where the BART ROW diverges to the east from Huntington Avenue. The proposed route would follow the BART ROW to Lawndale Avenue for 3.4 miles. At Lawndale Avenue the route would turn east and proceed east in Lawndale Avenue to Hillside Boulevard. At the intersection of Hillside Boulevard and Hoffman Street, the route would turn northeast on Hoffman Street for a distance of 0.45 miles, then proceed northwest on Orange Street for 0.2 miles to Guadalupe Canyon Parkway.

At Guadalupe Canyon Parkway the route would turn northeast and proceeds within Guadalupe Canyon Parkway for 3.7 miles to Bayshore Boulevard, then turn north on Bayshore Boulevard for 0.7 miles into the southern side of Martin Substation.

B.2.4.2 Structures and Equipment

The underground transmission line would consist of three separate cables; each would be cross-linked, polyethylene-insulated (XLPE) solid-dielectric, copper-conductor cables and all would be in a buried concrete-encased duct bank system. The trench for the proposed duct bank system would typically be approximately two feet wide and six feet deep. Depending on soil conditions, existing utility placement, and requirements to allow appropriate cover and repaving, the total excavation for the trench in some areas may vary (see Figures B-9, B-10, and B-11). The duct bank is planned to hold four 6-inch polyvinyl chloride (PVC) ducts. The 230 kV cable system would include fiber optic wires to monitor the operating temperature of the underground cables. An additional fiber optic cable would be located in a 4-inch PVC duct, which would provide for substation communication and protection. The duct bank would be used exclusively by PG&E (i.e., PG&E would not lease available fiber capacity to other companies). The cable system would be designed to carry a minimum load of 420 megavolt-amperes (MVA).

B.2.4.3 Right of Way

During construction of underground facilities, a temporary construction easement would be required. The width of the workspace within the existing roadway would be set forth by the encroachment permits to be issued by the cities. A conceptual depiction of the right-of-way (ROW) activities for the underground 230 kV transmission line is shown in Figure B-12a; Figure B-12b presents photographs of underground 230 kV transmission line construction.

B.2.5 Substations

B.2.5.1 Jefferson Substation

Jefferson Substation is located east of I-280 and is accessed by Cañada Road, about one mile south of Edgewood Road in San Mateo County (MP 0.0) (see Figure B-2a). The transmission substation currently receives 230 kV power from Monta Vista Substation in Cupertino, Santa Clara County.

Figure B-9. Typical Duct Bank Installation of 230 kV Single-Circuit Solid Dielectric Cable

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Figure B-10. Typical Reduced-Height Duct Bank within Paved Streets

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Figure B-11. Typical Reduced-Width Duct Bank within Paved Streets

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Figure B-12a. Typical Underground Construction Process within Roadways

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At the substation, the 230 kV power is stepped-down to the 60 kV level before being transmitted to the surrounding 60 kV electric system. The new 230 kV single circuit for the Proposed Project would originate at Jefferson Substation. In addition, the existing double-circuit 60 kV line that would be changed to a single circuit would be replaced starting at the Jefferson Substation because only one 60 kV circuit would be operated under the Proposed Project. Work necessary to accommodate the Proposed Project would include equipment modifications within the substation and the relocation and addition of transmission poles, as described below. The modifications to the existing Jefferson Substation are depicted in Figure B-13.

To prepare for the new 230 kV circuit, some of the existing equipment in the 230 kV yard would have to be removed and new equipment would be added. The replacement and rearrangement would require modification to the existing fenceline and substation perimeter road within the existing substation boundaries. The existing Jefferson 230 kV single bus would be replaced by a ring bus configuration for higher service reliability. This arrangement allows for any circuit breaker to be removed from service for maintenance without an outage on the other equipment while maintaining the integrity of the ring bus. The bus would include four new 230 kV breakers with disconnect switches.

The two existing Monta Vista lines that provide 230 kV service to the substation would be relocated and terminated on the new 230 kV ring bus with dead-end structures. To be able to relocate the Monta Vista lines, one tower would have to be relocated to the east of the existing tower location within the existing parking lot area, and the existing location would be restored. This transmission tower is currently located near the edge of Cañada Road, at the edge of a willow riparian area with little screening vegetation. The tower would be moved to a new location within the existing parking lot in a disturbed non-native grassland area. The proposed new tower location would be farther from the road and better screened from vision by the perimeter landscaping. The old tower next to the road would be removed.

The existing Transformer Bank No. 1 230 kV cable termination would be relocated from the existing 230 kV bus and terminated on the new 230 kV ring bus with a dead-end structure. This would include removing the existing 230 kV tower within the substation, connecting bank No. 1 to the existing 230 kV bus, and replacing it with a new tubular steel pole near the existing location. The new tubular steel pole (Tower 0/1) would be located within the fenceline at the eastern edge of the developed substation area away from Cañada Road.

The existing station ground grid and conduit systems would be expanded to include the new equipment. Four dead-end structures would be installed, two for the 230 kV Monta Vista line, one for the 230 kV Jefferson-Martin line, and one for the 230 kV/60 kV transformer bank. These structures would be located within an existing graded area screened from Cañada Road.

For installation of the new 230 kV ring bus, PG&E is proposing to relocate the existing fence and roadway and grade within the existing 230 kV yard. The fenceline would be expanded on the west side of the substation into the parking lot and within the substation property line to accommodate the new ring bus. Similarly, the existing interior substation road would be expanded to the new fenceline to enable operations and maintenance vehicles to access the substation equipment. This will require grading, including selective removal of trees for the fence and road relocation would be required, in addition to the equipment installation.

At the 60 kV yard, a bus parallel breaker position would be added. A new breaker would be installed to facilitate line breaker maintenance. The modifications to the 60 kV yard would take place within the existing substation fenceline.

Figure B-12b. Installation of Underground Transmission Line

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Figure B-13. Jefferson Substation Proposed Modifications

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Other proposed modifications to the Jefferson Substation include upgrades to control and protection systems for reliability, which would occur within the existing substation fenceline. Finally, some minor modifications would be required to one tower of the Monta Vista–Jefferson 230 kV tower west of I-280.

B.2.5.2 Ralston Substation

Ralston Substation is northeast of the I-280 and State Route 92 (SR 92) junction and is accessed from the east, using a local existing access road at MP 5.1 (see Figure B-14). The existing 60 kV Ralston Substation would be looped through to the new single 60 kV circuit from the Watershed Tap at MP 2.7 (see Section B.2.7.5 for a description of the Watershed Tap). A station bypass switch would be added; existing 60 kV Motor Operated Air Switches (MOAS) and the high-side bus would be upgraded to handle higher through-current. Existing 60 kV MOAS lattice steel structures would be replaced by four new dead-end structures that are similar to the transition station dead-end structure (see Section B.2.3). The dead-end structures are where the power lines would physically connect to the substation and would be a typical, H-frame configuration for tap line pull-off structures, constructed of steel and would be approximately 35 feet high. The dead-end structures would connect to one new single-circuit steel pole to be placed along the southern border of the substation. Outside of the substation fence, two new H-frame structures would be added to bring the line under the 230 kV circuit.

The majority of the southern border of the substation has been previously graded as an access road around the substation. A new lattice steel tower (Tower 5/27) would replace the existing lattice tower and wood pole tap structures. As a result of the additional required ground clearance, the new tower would be approximately 20 feet higher than the existing tower. The station ground and conduit system would be modified and expanded within the existing substation footprint. The modifications to the existing Ralston Substation are depicted in Figure B-14.

B.2.5.3 Carolands Substation

The Carolands Substation is located at MP 8.8, east of Skyline Road, which provides access to the substation. The substation would continue to be energized from the Hillsdale Junction Switchyard under normal operating conditions. If needed, Carolands could be served from the Millbrae Substation through the normally open switch at Millbrae Tap. The existing lattice tower adjacent to the substation would be replaced with a new tubular steel pole for structural engineering purposes. The existing termination structures at Carolands Substation would continue to be used under the Proposed Project. The proposed modifications to the Carolands Substation are shown in Figure B-15.

B.2.5.4 Martin Substation

The Martin Substation is located southwest of the intersection of Bayshore Boulevard and Geneva Avenue in the Cities of Brisbane and Daly City. Relocation of fence, roadway, existing wood poles, and tubular steel poles near the southern perimeter of the substation is proposed to expand the existing 230 kV yard for a new 230 kV bus bay and a new 230 kV underground cable termination with series reactors (see Figure B-16).

A new, complete 230 kV breaker-and-a-half bus bay with three new breakers and disconnect switches would be installed. This would involve relocating three existing wood distribution poles approximately 50 to 75 feet south of their existing location to clear the area for the new 230 kV bay. PG&E proposes to replace these wood poles with wood poles of similar height (approximately 60 to 65 feet). The wood distribution pole relocation would occur within the existing fenceline. Additionally, the existing San Mateo–Martin No. 2 transmission line would be moved by relocating the two existing wood poles for the line approximately 50 feet west of the existing positions within the fenceline. The existing tubular steel poles would be replaced with new tubular steel poles of the same height to accommodate the 230 kV line.

After the new 230 kV bay is constructed, the existing 230 kV Martin-Embarcadero underground cable would be moved to one of the new bay positions. This arrangement would allow the new 230/115 kV, 420 MVA, transformer bank to be placed next to the existing Transformer Bank No. 7. Termination of the new bank would be located in the area vacated by the existing 230 kV cable. This work would take place within the existing fenceline.

At the 230 kV yard, new cable terminations and switchable series line reactors would be installed. The fenceline would be expanded within the existing property line to accommodate the installation. Expansion of the substation perimeter road outside of the existing fenceline to accommodate the expansion is proposed to allow access to the equipment.

With the addition of the new 230/115 kV transformer bank, the entire 115 kV bus would need to be reconductored to 4-inch aluminum tubing and bundled 2300 kcmil aluminum cable. Five new breakers are proposed for the 115 kV yard. Three of these breakers would replace two sectionalizing breakers and one parallel breaker at the same height as the existing breakers. Two new breakers would also be needed to accommodate the new bank connection to the 115 kV bus and would be approximately 25 feet high.

B.2.5.5 Monta Vista and Millbrae Substations

At these substations, electrical work would be performed inside the existing enclosed control rooms to upgrade protection and communication equipment for the new 230 kV Jefferson-Martin circuit and the 60 kV circuit, respectively. No changes would be visible from outside the control room. The Monta Vista Substation is in Cupertino, and the Millbrae Substation is located in the City of Millbrae.

B.2.5.6 San Mateo Substation

The San Mateo Substation is not connected to the Jefferson-Martin transmission line; it is located in eastern San Mateo County adjacent to Coyote Point. At this substation, a switchable series reactor with 8 to 16 Ohms range (8 Ohms per step) would replace an existing 8-Ohms series reactor on the San Mateo–Martin 230 kV Underground Cable No. 1. The new series reactors, a circuit switcher, and disconnects would be located in the area presently used by the Substation Construction Field Office. The trailer office would be relocated prior to construction. PG&E plans to relocate the trailer office on-site within the existing fenceline and disturbed area.

The new series reactor bypass switch would be placed in the area vacated by the existing reactors. The new equipment would be the same height as the existing equipment being replaced. The San Mateo Substation is within the regional transmission system for the project in the City of San Mateo.

B.2.6 Hillsdale Junction Switchyard

The Hillsdale Junction Switchyard is located at MP 6.4, east of I-280 and accessed from the south of the site using an existing dirt road. The bus arrangement at the existing Hillsdale Junction Switchyard would be modified to accommodate two new 60 kV breakers. The breakers are needed to increase service reliability by protecting the line section between Hillsdale Junction and Ralston Substation, and between Hillsdale Junction and Carolands Substation. A string bus would be removed to accommodate

Figure B-14. Ralston Substation Modifications

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Figure B-15. Carolands Substation Modifications

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Figure B-16. Martin Substation Proposed Modifications

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the two breakers to be installed at the substation. The work for the bus and breaker modification would take place within the existing substation fenceline. A new, single-circuit tubular steel pole (no tower number) would be installed outside and to the west of the existing switchyard footprint, north of proposed Tower 6/35. The modifications to the existing Hillsdale Junction Switchyard are depicted in Figure B-17.

B.2.7 Power Line Taps (60 kV Connections)

B.2.7.1 Crystal Springs Tap

Between Hillsdale Junction Switchyard and Carolands Substation is the Crystal Springs Tap, at MP 7.1. The tap to Crystal Springs is presently located on the west side of the existing 60 kV Jefferson-Martin double-circuit tower line. The new Crystal Springs Tap would be reconnected to the single 60 kV circuit, which would be on the east side of the proposed new tubular steel pole, Treatment 7/39. The new tubular steel pole would replace an existing tubular steel pole. During construction of this segment of the line, the San Francisco Public Utilities Commission (SFPUC) has indicated that generators would need to be provided for the Crystal Springs pumps. The modifications to the existing Crystal Springs Tap are depicted in Figure B-18.

B.2.7.2 Millbrae Tap

Tower 12/78 at the Millbrae Tap would be replaced near MP 12.4. The tap would be reconnected to the 60 kV circuit on the east side of the newly built power line. The existing line selector switches mounted on the tower would be replaced but the status of these switches would remain unchanged. The modifications to the existing Millbrae Tap are depicted in Figure B-19.

B.2.7.3 San Andreas Tap

The San Andreas Tap would be reconnected to the 60 kV circuit on the east side of the newly built tubular steel pole (Tower 12/81A) at approximately MP 12.9.

B.2.7.4 San Bruno Tap

The San Bruno Tap at MP 14.4 would be reconnected to the 60 kV circuit on the east side of proposed Tower 14/93B. The modifications to the existing San Bruno Tap are depicted in Figure B-20.

B.2.7.5 Watershed Tap

The Watershed Tap is the southernmost tap off the 60 kV circuit, at MP 2.7. An existing lattice steel tower at the Watershed Tap would be replaced by two tubular steel poles, new Towers 2/16A and 2/16B. The tap connection to Watershed Substation would be coming off the pole located on the east side. A three-way switch would be mounted on that pole to allow operational flexibility. The modifications to the existing Watershed Tap are depicted in Figure B-21.

B.3 Project Construction

This section presents an overview of construction methods typically used for construction of overhead and underground transmission lines and for substation modifications. An overview of construction equipment that PG&E expects to use is presented in Section B.3.1, followed by descriptions of construction activity and method descriptions that are anticipated to be required to construct the Proposed Project (Sections B.3.2 and B.3.3). Section B.3.4 describes methods that PG&E would employ to prevent interruptions in electric service during construction.

B.3.1 Equipment

Table B-3 lists typical equipment that is used for construction of transmission line projects. It is expected that this equipment would be used to construct the Proposed Project.

B.3.2 Construction of Overhead Line

Approximately 14.7 miles of overhead transmission line would be installed from Jefferson Substation to the proposed transition station. The proposed transmission line would be a double-circuit line (one circuit 230 kV and one circuit 60 kV) that would replace an existing, double-circuit 60 kV system. The work would be completed using conventional transmission tower construction methods (drill rig and crane) and helicopter installation. The area to be traversed by the proposed overhead line is mostly owned by CCSF.

B.3.2.1 ROW Requirements

An easement of 100 feet wide would be required for the 230/60 kV double-circuit transmission line, although easement width in some specific locations may vary slightly, depending on final engineering. The easement width is specified by the CPUC's General Order 95 governing transmission line safety, and would be determined based on the lateral distance between the conductors, and the swing of the conductors caused by wind.

B.3.2.2 Construction Activities for Transmission Line

The procedures for bringing personnel, materials, and equipment to each structure site, constructing the supporting structure foundations, erecting the supporting structures, stringing the conductors, and removing the existing structures would vary along the route alignment.

PG&E anticipates that approximately 1,000 to 5,000 gallons of water per day would be used for dust suppression along the overhead line segment. The amount of water would vary depending on the length of access roads being used each day, the road surface conditions, the weather conditions, including temperature and wind speed, as well as other site-specific conditions. PG&E does not expect to require significant amounts of jobsite water for foundation construction or other activities. However, this could change if unexpected conditions arise. For example, actual soil properties or groundwater elevations may require alternative construction practices that could require additional water. These alternative practices include slurry displacement to prevent cave-in of unstable ground formations and intrusion of groundwater into the drilled hole during the installation of the foundations.

Figure B-17. Hillsdale Junction Modifications

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Figure B-18. Crystal Springs Tap Modifications

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Figure B-19. Millbrae Tap Modifications

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Figure B-20. San Bruno Tap Modifications

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Figure B-21. Watershed Tap Modifications

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Table B-3. Equipment Expected to be Used During Construction

Equipment	Use
Expected Equipment Required for Overhead Construction	
Crawler tractor; motorized grader	Road construction
Tractor-mounted backhoe	Install drainage
Truck-mounted auger	Install fences and poles
½-ton pickup; crew-cab truck; 4x4 SUVs	Transport personnel
Air compressor	Drive pneumatic tools
Trucks and trailers (2-60 tons)	Haul materials
Mechanics service trucks	Service vehicles
Crawler-mounted auger	Excavate foundations
Tiltbed and lowboy trailers	Haul equipment
Backhoe	Excavate foundations
Concrete mixer trucks	Haul concrete
Tool van	Tool storage
Mobile office trailer	Supervision and clerical office
15-, 30-, and 80-ton cranes (mobile)	Erect structures
Tensioners (truck mounted); pullers (truck-mounted)	Install conductor
Reel trailers with reel stands (semitrailer or truck mounted type)	Haul conductor
Tractors (semi-type)	Haul conductor
Take-up trailers (sock line); reel winders	Install conductor
Line truck	Install clearance structures
Helicopter	Install sock line, haul material, remove and install some structures
Fuel trucks	Dispense fuel to heavy equipment and helicopters in field
Tractor, D7 Caterpillar; converter dolly; 4x4 ATV	Install conductor
Concrete pump truck	Foundation
Boom Truck	All construction activities
Worker-lift	Lift workers to perform work on structures
Water truck	Fire control, dust control
Expected Equipment Required for Underground Construction	
Pickup trucks	Transport construction personnel
2-ton flatbed truck	Haul materials
Flatbed boom truck	Haul and unload materials
Rigging truck	Haul tools and equipment
Mechanic truck	Service and repair equipment
Winch truck	Installing and pulling rope into position in conduits
Cable puller truck	Pulling transmission cables through conduits
Concrete trucks	Transporting and pouring of back-fill slurry
Fuel trucks	Dispense fuel to heavy equipment and helicopters in field
Worker-lift	Lift workers to perform work on structures
Shop vans	Store tools
Crawler backhoe	Excavate trenches (excavate around obstructions)
Large backhoe	Excavate trenches (main trencher)
Dump trucks	Hauling of trench and excavation spoils/importing backfill
Large mobile crane	Lifting/loading/setting of 20-ton cable reels and pre-fabricated splice vaults and lifting cable ends on terminating structures
Small mobile cranes (< 12 tons)	Load and unload materials
Transport	Haul structural materials
Cable reel trailers	Transporting cable reels and feeding cables into conduits
Splice trailer (40 ft)	Splicing supplies / air conditioning of manholes
Air compressors	Operate air tools
Air tampers	Compact soil
Rollers	Repaving streets over trench and manhole locations
Portable generators	Construction power
Horizontal dry boring equipment	For horizontal bores
Water trucks	Fire control, dust control
Street sweepers	Dust control

Low volume vegetation that is removed along the overhead transmission line route during construction such as weeds and brushes would remain onsite and be mixed with the soil at the time of backfill/compaction. PG&E would consult with the landowner regarding tree disposal issues. If the landowner does not object, to minimize the likelihood of spreading sudden oak disease, PG&E's current practice is to leave the tree debris on site in a manner that would avoid the over accumulation of potential fire fuels. If the landowner specifies a particular disposal location, PG&E would try to accommodate it. If on-site disposal were not possible, vegetation debris would be hauled offsite by truck for disposal at an approved disposal site.

PG&E proposes to construct the transmission line in five steps as defined below:

Step 1 – Site Access and Preparation. PG&E proposes to use temporary staging sites in addition to the Jefferson Substation and the proposed transition station site for fabrication of some of the lattice steel structures to be installed between Jefferson Substation and the transition station. The staging sites would be identified as part of the PG&E's proposed helicopter operation Lift Plan. The cable pulling sites would be used to remove the existing conductors and install the new conductors. For each activity, each site would be occupied for one to two weeks.

Helicopter staging sites would be used to deliver personnel and materials to the structure sites for the installation of the foundations, towers, and conductor. Numerous locations are under consideration by PG&E for helicopter staging areas. PG&E states that the most likely staging site would be within the Pulgas Ridge Open Space Preserve, north of the Edgewood Road and Edgewood County Park. This site would be used during helicopter installation of at least five towers, four in Edgewood Park and one near Crystal Springs Road (Tower 6/38). Helicopters could be used at many more locations. PG&E wishes to retain the option to install up to 56 towers using helicopters. To facilitate helicopter work for the numerous tower sites, additional potential helicopter staging sites have been identified in the vicinity of the Ralston Substation near the Hillcrest Juvenile Home and homes in the San Mateo Highlands, between MP 7 and 8 near homes in Hillsborough, within the Crystal Springs Golf Course, between MP 10 and 11 near homes in Hillsborough and Burlingame, and on either side of Skyline Boulevard near San Bruno Avenue.

Helicopter installation and staging would bring loaded helicopters near populated areas that would need to be protected against the dangers of helicopter use. The Federal Aviation Administration (FAA) would require roads and homes to be evacuated if a loaded helicopter would pass over. Property could also be damaged by high winds in the vicinity of helicopter operations.

When helicopters are used to facilitate foundation construction in sensitive areas, the required staging sites would each be used for two to three months. When the sites are used for the assembly of towers and their subsequent transport and installation, each site would be used for two to six months. During the removal of the existing conductors and installation of the new conductors, the sites would be used to support the helicopter operations. However, PG&E has indicated that it would need to have access to and use of these sites for material storage and other construction operations throughout the entire period of construction for the overhead component of the project (approximately 13 months).

The duration of site use is presented for the major activity. In order to minimize the overall construction-related disturbance, PG&E intends to utilize construction-staging sites for multiple construction staging purposes. During periods between major activities little or no activity would occur at the sites. Once identified, the staging areas would be subject to pre-construction surveys and environmental analyses.

The majority of the tower sites are accessible from existing paved and dirt roads. However, some tower sites would require establishment of cross-country access roads or reestablishment of existing roads that have been out of service and have vegetation encroachment. In addition, several access roads would require tree and brush removal or trimming. Table B-4 summarizes the tower sites for which access road improvements are proposed.

Table B-4. Overhead Construction Access Road Improvements

Proposed Tower Number	Type of Improvement Proposed
1/9	Lengthen existing unpaved access road by vegetation clearing and grading
1/11	Oaks and areas of mixed riparian forest would be removed. Some oaks would require trimming.
1/12	Install temporary bridge over incised portion of canyon, or establish unpaved access road by crossing grassland in vehicle. Oaks and other native trees near road may need to be removed or trimmed
2/17, 3/18, 3/19, 3/20	Tree trimming and/or minor clearing might be required
3/21	Reestablish existing unpaved access road by grading. Tree trimming might be required
3/22	Tree trimming and brush removal would be required
4/23, 4/24	Brush clearing would be required
4/25, 11/72	Lengthen existing unpaved access road by grading

An estimated three access roads would be lengthened over grassland areas to access tower sites that have no existing access. These extended roads would require grading. All access roads would need to be 16 feet wide. One access road is estimated to require grading to reestablish the existing road. The installation of a temporary bridge may be required near Tower 1/12 to avoid disturbance to an intermittent drainage and associated riparian vegetation.

Step 2 – Install Support Structure Foundations. PG&E proposes to install drilled pier, spread footing,[1] direct buried steel mat (grillage)[2] type footing, and/or other foundations at each of the approximately 100 new structure sites for the overhead transmission line. Material removed during the process would be placed in a location specified by the landowner and/or disposed of according to all applicable laws. Temporary disturbance around each structure site would be limited to approximately a 100-foot diameter centered on the new tower. Disturbance would result from soil compaction from placement of crane outrigger pads and from vehicle tracks, as well as from movement of workers and equipment. Lattice steel tower and tubular steel pole structure foundation installation would include the following activities:

- **Lattice Steel Towers.** Placement of each lattice steel tower would require four foundations, one for each structure leg. For drilled pier foundations, each hole would be about 4 feet in diameter and 11 to 15 feet deep. Workers would place reinforcing steel in each hole along with stub angles, which become part of the tower leg itself. Concrete forms that reach up to 2 or 3 feet above natural ground level would be placed over each hole, and concrete would be placed around the reinforcing steel and stub angles up to the top of the form. The diameter of the concrete forms above ground (tower footings) would be approximately 2½ feet, dependent on localized soil parameters and final structure design requirements.

  For spread footings, a rectangular concrete pad would be constructed for each tower leg. The size of the pads would vary depending on the requirements of the structure, but generally the pads would be 6 feet by 6 feet and would be buried below the natural ground surface. A concrete projection similar to that of a drilled pier foundation would extend approximately 2 feet above natural ground level. Reinforcing steel and stub angles similar to those used in the drilled pier foundations would be used.

  For grillage footings, steel mat fabricated from heavy steel bars would be connected to the stub angles and buried approximately 6 feet beneath the ground surface. Only the tower leg would be visible from the surface.

- **Tubular Steel Poles.** Placement of tubular steel pole structures would require the use of a large auger to dig a single large foundation hole. The foundation hole would be between approximately 5 feet and 7 feet in diameter and from 15 to 30 feet deep. A cage of reinforced steel with anchor bolts would be installed and concrete would be placed in the hole. During the concrete curing period of one month, workers would remove the concrete forms and restore the ground around the foundations.

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1 Spread footing is a platform that gives stability to a foundation wall or other structure.

2 Grillage is a tower footing with a framework of galvanized steel, with wide-flange beams and channels.

Step 3 – Remove Existing Facilities. After access routes have been established and the new foundations installed, the existing double-circuit 60 kV line would be dismantled and each tower would be removed by section. To maintain electric service, the dismantling and removal of the entire line cannot occur at one time. Each section of line between the existing substations would have to be de-energized, dismantled, removed, and replaced, and the new line segment re-energized prior to starting on the next section. This sectional approach to construction does not need to proceed in a linear fashion between sections and can move from the completion of one section to the commencement of any other section of the project. This ability to jump between sections allows for construction activities to continue along the length of the Proposed Project and meet all environmental timing and engineering constraints.

Before line dismantling begins, temporary crossing guard structures would be installed at all road crossings and any other locations where the existing conductors could potentially come in contact with electrical or communication facilities and/or vehicular traffic during removal. These structures would be placed at the edge of the roadway and would not require grading. Where lines would be pulled across Caltrans facilities, such as I-280, SR 92, and SR 35 (Skyline Boulevard), Caltrans typically requires that either a net be installed over the highway or that traffic be halted and the roads closed temporarily as lines are pulled. Temporary closures of freeways and other public roads would also be required by the Federal Aviation Administration (FAA) during transport of equipment and materials for tower removal by sky-crane (helicopter). These closures would be performed in accordance with permits that typically require closures to be during low traffic flow times. See Section D.12, Transportation/Traffic, for a more detailed discussion.

Conductor removal preparation activities require locating 38 pull and tension sites, ranging from approximately 0.02 to 1 acre in size. Figure B-3 (detail of Proposed Project) at the end of this section illustrates proposed locations of the cable pulling sites and the dimensions of each site. (These sites would also be utilized for the new conductor installation on the new line towers after dismantling and removal.)

The conductor removal operation would begin with unclipping the conductor from the existing insulator string and installing the conductor in stringing blocks. Stringing blocks are rollers attached to the lower end of the insulators. Sheaves[3] would allow the individual conductors to be pulled through each structure onto reels at the tension end of each segment or pulling section within the segment.

When the pull and tension equipment is set in place, a sock line (a small cable used to pull in the conductor) would be attached to the existing conductors. After the conductors are attached to the sock line, they would be pulled out. This involves pulling the conductor through each tower under a controlled tension to keep the conductors and sock line elevated above crossing structures, roads, and other facilities.

After the conductors are pulled out, the sock line would be removed from the structures. The temporary crossing guard structures would be left in place for use during the installation of the new conductors. After the removal of the conductor, the lattice structures would be dismantled and removed by either conventional methods (using cranes) or by aerial methods (using helicopters). The steel pole structures would be dismantled and hauled away from either the site or the staging area by truck.

PG&E's construction contractor would hire a recycling company to dispose of the towers. The recycling company would then dismantle the towers and haul the debris away to a recycling plant. In the past, PG&E has used Simsmetal America for recycling services; if this firm is selected for the Proposed Project, debris would likely be taken to its recycling plant in Richmond, California.

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[3] Sheaves are rollers attached to the lower end of the insulators that are, in turn, attached to the ends of each supporting-structure cross arm. The sheaves allow the individual conductors to be pulled through each structure, until the conductors are ready to be pulled up to the final tension position.

After the existing towers have been removed, the existing foundations would be jack-hammered to 18 inches below grade; debris would be removed from the site by truck for disposal at an approved site, and the hole backfilled with soil and replanted.

Step 4 – Erect Support Structures. The new supporting structures (towers or poles) for the Proposed Project would be erected in sections between substation and/or tap locations as described above. The construction duration for each of the construction sections would range from 4 to 12 weeks, depending on the number of new structures to be installed and the construction methods that would be used at each structure site. The new towers and poles would be installed either by conventional methods or by helicopter for each new structure.

It is anticipated that a temporarily pole(s) or structure(s) would be built near the location of the substation and/or tap locations and the conductors would be temporarily moved to these temporary structure(s). PG&E plans to use wood poles as the temporary structures. These wood poles would vary in height depending on site-specific factors. Based on preliminary engineering, PG&E expects that the temporary poles would be between 80 to 115 feet tall. PG&E expects that it would install the poles into augured holes, approximately 30 inches in diameter. These holes would typically be backfilled with either native soil or crushed rock. PG&E expects that any required guy anchors would be placed in holes approximately three feet by seven feet and backfilled with native soil or concrete. The exact number of anchors required for each pole would vary and would not be known until final engineering has been completed.

The following paragraphs describe the process for erecting lattice steel towers and tubular steel pole structures.

- **Lattice Steel Towers.** The proposed double-circuit lattice steel towers would have three vertical support levels, each supporting two phases consisting of a single conductor on each side of the tower. The western circuit would be operated at 230 kV, and the eastern circuit would be operated at 60 kV. Figures B-4 and B-5 illustrate typical double-circuit lattice steel tower configurations.

  Steel tower components, packaged in bundles by tower type, would be dispatched to the staging areas or to the tower site itself. Individual towers that are assembled immediately adjacent to the tower foundations would be raised into place using a large crane. A smaller crane would also be used to assemble tower sections and to lift heavy steel members into place during assembly.

  Individual towers that are assembled at staging sites would be transported to the tower locations by helicopter. Some of the existing tower locations do not have access roads and PG&E would need to install proposed towers at these locations via helicopter. Helicopter installation can be utilized only with lattice tower structures and not with TSPs because TSPs are too heavy for helicopters to lift. A minimum of five tower locations would require installation by helicopter because of restricted ground-level access. Four of these locations are within Edgewood Park (Towers 0/2, 0/3, 0/4, and 0/5) and the fifth is near Crystal Springs Road (Tower 6/38). As described under Step 1 above, PG&E has identified up to 56 lattice tower structures that could be installed by helicopter. PG&E wishes to retain the option to maximize helicopter use to save installation time and minimize ground disturbance.

  For installation by helicopter, a typical tower would require two to three "lifts" or trips to each lattice tower location. The first lift would transport the lower portion of the tower and subsequent lifts would transport the upper portion(s) of the tower. After the structure is set on the foundation, crews would tighten all bolts, attach insulators to the crossarms, and prepare the towers for the conductor stringing operation.

- **Tubular Steel Poles.** The double-circuit tubular steel poles would also have three crossarms, each supporting a phase conductor on each side of the crossarm. Figure B-6 illustrates a typical tubular steel pole structure. The pole shafts would be delivered to the pole site in two or more sections. For safety and ease of construction, the poles would be assembled on the ground. The sections would be pulled together with a winch and the cross arms bolted to the pole. Insulators would be attached to the crossarms and secured. A large crane would erect the poles and set them on the anchor bolts embedded in the concrete foundation. Finally, the securing nuts on the foundation would be tightened.

Step 5 – String Conductors. Before conductor installation begins, temporary clearance structures would be installed at road crossings and other locations where the new conductors could accidentally come into contact with electrical or communication facilities and/or vehicular traffic during installation. PG&E proposes to use a set of temporary clearance structures at all roads and railroad crossings, and at all other power line crossings. These temporary clearance structures are wood pole structures that resemble an "H," placed on each side of the roadway. These structures would be placed at the edge of the roadway and would not require grading; they would not interfere with traffic. These structures would prevent the conductor from being lowered or falling into the traffic below.

Conductor installation preparation activities would use the same pull and tension sites described in Step 3 (removal of existing facilities), and follow similar procedures, in reverse. The conductor stringing operation begins with installation of insulators and sheaves or stringing blocks. The sheaves are rollers attached to the lower end of the insulators that would be, in turn, attached to the ends of each supporting structure cross arm. The sheaves would allow the individual conductors to be pulled through each structure until the conductors are ready to be pulled up to the final tension position.

When the pull and tension equipment is set in place, a sock line (a small cable used to pull in the conductor) would be pulled from tower to tower using a helicopter to place the sock line into the sheaves. After the sock line is installed, the conductors would be attached to the sock line and pulled in or "strung" using the tension stringing method. This involves pulling the conductor through each tower under a controlled tension to keep the conductors elevated above crossing guard structures, roads, and other facilities.

After the conductors are pulled into place, wire or conductor sags would be adjusted to a pre-calculated level. The conductors would be then clamped to the end of each insulator as the sheaves are removed. The final step of the conductor installation would be to install vibration dampers and other accessories. The temporary crossing guard structures would be removed at this time.

Packing crates, spare bolts, and construction debris would be picked up and hauled away for recycling or disposal during construction. PG&E would conduct a final survey to ensure that cleanup activities have been successfully completed.

B.3.2.3 Construction of Substation Modifications

Section B.2.5 described the components of the Proposed Project that would occur at each substation. New structures in the Jefferson and Martin Substations and at the other substation, switchyard, and tap sites would be developed within the existing property line and generally within areas previously disturbed for substation access. Reinforced concrete footings and slabs would be constructed to support structures and equipment. PG&E would extend the existing buried conduit installation to cover the expanded area for the electrical control and communication cables. PG&E would extend the existing grounding mat to cover the modified area and install gravel over the new area to match the existing gravel level.

Structures would be erected to support busses, circuit breakers, switches, overhead conductors, instrument transformers and other electrical equipment, as well as to terminate incoming transmission lines. Structures within the substation would be grounded to the station grounding grid. Workers would set the equipment on slabs and footings, and would either bolt or weld the equipment securely to meet the applicable seismic requirements. Equipment slated for installation includes high-voltage circuit breakers and air switches, structures and bus work, high-voltage instrument transformers, control and power cables, metering, relaying, and communication equipment.

At each substation, switchyard, and tap structure modified for the Proposed Project, a temporary electrical solution (commonly referred to as a "shoo-fly") would be installed to ensure that the structure remains in service during the modifications. Near the existing tap structures at each location, one to three (depending on the orientation of the wires) wood poles would be placed in the ground without foundation and guy-wired for stability. The temporary tap structures would connect the conductors as necessary for the structure to remain in service.

B.3.2.4 Overhead Line Construction Duration and Workforce

The length of time required for constructing the overhead 230 kV transmission line for the Proposed Project is estimated to be approximately 13 months, including site access preparation, transmission structure foundation installation, removal and installation of transmission structures, substation modifications, conductor stringing, and cleanup. The estimated construction duration for each section between the substations and tap structures is presented in Table B-5.

Table B-5. Estimated Construction Duration per Section for Overhead Transmission Line

Construction Section	Construction Duration (approximate)
Jefferson Substation to Ralston Substation	5 months
Ralston Substation to Hillsdale Substation	2 months
Hillsdale Substation to Carolands Substation	4 months
Carolands Substation to Millbrae Tap	5 months
Millbrae Tap to Transition Station	4 months

An estimated 24 separate construction crews would be needed to perform the site preparation, foundation installation, tower removal/installation, substation modifications, conductor stringing, and cleanup. Each major construction activity would be performed by between two and six crews, and each crew would range from 4 to 12 crew members, for an estimated total of about 100 to 200 crew members for the overhead transmission line construction over the 13-month period.

B.3.3 Construction of 230 kV Underground Transmission Line

Figure B-12 depicts the typical underground construction process within roadways. Approximately 13 miles of underground 230 kV single-circuit transmission line would be installed from the proposed transition station to the Martin Substation. The work would be completed using a cut-and-cover construction method (open trenching) for the underground power line, duct banks, and splice vaults.

Soil sampling and pothole information would be used to design backfills, final circuit alignments, and foundations before construction. Soil information would be provided to construction crews to inform them about soil conditions and utility locations. If hazardous materials were encountered in soils from the trench, work would be stopped until the material is properly characterized and appropriate measures are taken to protect human health and the environment. Hazardous materials would be handled, transported, and disposed of in accordance with federal, State, and local environmental regulations, including Chapter 6.95 of the California Health and Safety Code and Title 22 of the California Code of Regulations.

Standard erosion and dust control measures would be used during construction, including installation of sediment and erosion control best management practices (BMP) to protect biological resources, roadways, and adjacent properties. Watering for dust control would also be employed.

B.3.3.1 Right of Way Requirements

Most of the proposed underground transmission line would be installed in city streets pursuant to PG&E's existing franchise agreements with local governments. However, PG&E would need to acquire private ROW from BART for the portion of the proposed route from San Bruno Avenue to McLellan Boulevard Extension. With respect to this portion of the route, a permanent easement of 25 feet would be required for the 230 kV underground transmission line. The final easement width would be determined through consultation with BART authorities. In addition, final engineering would determine whether additional permanent or temporary ROWs would need to be acquired from other private property owners.

PG&E would restrict installation of any aboveground structure or foundation to within the predefined easement areas. Deep-rooted vegetation that could compromise the integrity of the electric system would not be permitted within the easement areas. Conditions of the easement would require the property owner to notify PG&E should any change in the overburden depth be contemplated.

Temporary lane closures along streets as required for underground construction would be coordinated with the local jurisdictions. PG&E is a member of the California Joint Utility Traffic Control Committee, which in 1996 published the *Work Area Protection and Traffic Control Manual*. The traffic control plans and associated text depicted in this manual conform to the guidelines established by the Federal and State Departments of Transportation. PG&E would follow the recommendations in this manual regarding basic standards for the safe movement of traffic upon highways and streets in accordance with Section 21400 of the California Vehicle Code. These recommendations include provisions for safe access of police, fire, and other rescue vehicles. In addition, PG&E would obtain roadway encroachment permits from the local jurisdictions and would submit a traffic management plan subject to agency review and approval.

B.3.3.2 Construction Activities and Methods

Step 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 alignment.

After the trench route is marked and encroachment permits are obtained, the roadway pavement above the trench would be broken into manageable pieces for removal. The typical trench for duct bank installation would be approximately two feet wide, with a depth of six to seven feet. The trench would be widened and shored where needed to meet Cal OSHA safety requirements. At about 40 to 43 points along the trench, larger excavations would be opened to install splice vaults, discussed below. A maximum open trench length of 150 to 300 feet on each street would be typical at any one time, depending on local permit requirements. Provisions for emergency vehicle and local access would be provided. The width of the workspace would be set by the encroachment permit to be issued by the cities.

PG&E anticipates that approximately 500 to 1,000 gallons a day of water would be required for street cleaning during underground duct bank construction. Otherwise, small amounts of water would be used during underground construction activities, including borings.

As the trench for the underground 230 kV transmission line is completed, PG&E would install the cable conduit, reinforcement bar, ground wire, and concrete conduit encasement (duct bank). Depending on soil conditions, existing utility placement, and requirements to allow appropriate cover and repaving, the total excavation (i.e., width and/or depth) for the trench may vary. The duct bank would have a minimum cover of 36 inches. Approximately every 1,600 feet, splice vaults would be incorporated for installing cables and splicing sections of cables together.

The majority of the route would be in the two-by-two duct bank configuration with occasional rolling of ducts into a flat or verbal configuration in order to clear substructures in highly congested areas or to fan out to termination structures. Typically, the duct bank would consist of four 6-inch PVC conduits positioned in a two-by-two arrangement; the typical duct bank installation is illustrated in Figure B-9. As shown in Figure B-9, the underground cables would be contained within 6-inch PVC conduit pipes, which themselves would be housed in reinforced concrete duct banks. The circuit would be capable of carrying 420 MVA at the normal conductor temperature rating of 90 degrees centigrade. The 420 MVA load on this circuit would be met using copper conductor extruded dielectric (XLPE) cable. To achieve this performance, the circuit would be installed in a common duct bank, with special cross-bonding of cable sheaths to reduce heat generated by sheath losses.

When the electrical transmission duct bank crosses or runs parallel to other substructures (which have operating temperatures not exceeding basal earth temperature), typically a minimum radial clearance of 12 inches is required from these substructures. These types of substructures include gas lines, telephone lines, water mains, storm lines, and sewer lines. In addition, a five-foot minimum radial clearance is required when the new electrical transmission duct bank crosses another heat-radiating substructure at right angles. A 15-foot minimum radial clearance is required between the electrical transmission duct bank and any paralleling substructure whose operating temperature significantly exceeds the normal earth temperature. Examples of heat radiating facilities are additional underground transmission circuits, primary distribution cables (especially multiple-circuit duct banks), steam lines, or heated oil lines.

Once the PVC conduits are installed, thermal-select or controlled backfill would be imported, installed, and compacted. A road base back-fill or slurry concrete cap would then be installed, and the road surface would be restored in compliance with the locally issued permits. While the completed trench line sections are being restored, additional trench line would be opened further down the street. This process would continue until the entire conduit system is in place.

Step 2 – Vault Installation. As discussed above, PG&E would excavate and place up to approximately 43 pre-formed concrete splice vaults at approximately 1,600-foot intervals during trenching for pulling cables and housing cable splices. The vaults would be used initially to pull the cables through the conduits and to splice cables together. During operation, vaults provide access to the underground cables for maintenance, inspections, and repairs. Vaults would be constructed of steel-reinforced concrete (either prefabricated or cast-in-place), with inside dimensions of approximately 22 feet long, 8 feet wide, and 8 feet deep. The vaults would be designed to withstand the maximum credible earthquake in the area, as well as heavy truck traffic loading.

The total excavation footprint for a vault would be approximately 26 feet long by 12 feet wide and 10 feet deep. Installation of each vault would take place over a 3-day period with excavation and shoring of the vault pit being followed by delivery and installation the vault, filling and compacting a backfill, and repaving of the excavation area.

Step 3 – Cable Pulling. Following installation of the conduit system, PG&E would pull each cable segment into the conduit bank and splice at vaults along the route and terminate cables at the transition station and the Martin Substation. Cable would be pulled through individual ducts at the rate of two of the three segments between vaults per day.

Step 4 – Cable Splicing and Termination. After cable installation is completed, the cables would be spliced at all vaults. A splice trailer would be located directly above the vaults' manhole openings for easy access by workers. A mobile power generator would be located directly behind the trailer.

The dryness of the vault must be maintained 24 hours per day to ensure that unfinished splices are not contaminated with water or impurities. Normal splicing hours would be 8 to 10 hours per day with some workers remaining after hours to maintain splicing conditions and guard against vandalism and theft. These conditions are essential to maintaining quality control through completion of splicing. As splicing is completed at a vault, the splicing apparatus setup is moved to the next vault location and the splicing is resumed.

Cables would rise out of the ground at the transition station and at Martin Substation, and they would terminate on support structures. A scaffold would be installed at each support structure for installing cable terminations. Cable terminating would occur for 8 to 10 hours per day, similar to splicing.

Step 5 – Special Construction Methods (Horizontal Dry Boring). In parallel to the main tasks outlined above, a horizontal bore (jack and bore) of steel casings would be used under the concrete channels at Twelve Mile Creek and Colma Creek. Both creeks are channelized in open trapezoidal reinforced concrete channels at the crossing locations. A steel casing 30 inches in diameter would be installed under each concrete channel at least five feet below the bottom of the channel or as required by the San Mateo County Flood Control District. The dry boring operation under the concrete channels is proposed to occur within the BART ROW. An area approximately 25 feet by 100 feet would be used at this location for laydown and boring. A shored trench of approximately 15 feet deep would be used as a receiving area for the bore casing.

Dry boring would begin by digging a bore pit at the sending end and a trench at the receiving end of the bore. The bore pit would be approximately 24 feet long by 8 feet wide and would be approximately 15 feet deep. The elevation at the bottom of the bore pit and the receiving trench would be about the same. The horizontal bore equipment would then be installed in the bore pit. The steel casing would be welded in 10- to 15-foot sections and jacked into the bore as the boring operation proceeds.

The actual volume of soil removed from the bores is estimated to be approximately 110 cubic yards for Twelve Mile Creek and 125 cubic yards for Colma Creek. In addition to the boring machinery, a loader, backhoe, and dump truck would be used at both ends of the bore.

The PVC conduit bundles would be arranged in a circular pattern and assembled completely before being pulled through the steel casing. The setup for the dry boring operation would require a crew of four, while the operation of the bore would only require two or three crew members. The duct pull would require a crew of four to six. The length of time estimated for completing each bore is three weeks.

Vehicle and Equipment Use, and Job Site Cleanup. Throughout construction of the trench, duct bank and vaults, asphalt, concrete, and excavated material would be reused on-site or hauled off by truck for reuse or disposal at an approved disposal site, depending on the spoil characteristics. Approximately 44,000 cubic yards of asphalt and spoil would be removed from the trench and vaults.

In roadways, trucks would be used to haul material, typically as it is excavated from the trenches. As trucks are filled with spoils, they would leave the site and be replaced by empty trucks. The number of truck trips per day would depend upon the rate of the trenching and the size of vault excavation. Jackhammers would be used sparingly to break up any sections of concrete that cannot be reached with the saw-cutting and pavement-breaking machines. Other miscellaneous equipment would include a concrete saw, a pavement breaker, various paving equipment, and pickup trucks. Within the BART ROW excavation areas, excavated material may be temporarily stockpiled prior to off-hauling.

As part of the final construction activities, PG&E would restore all paved surfaces, restore landscaping or vegetation as necessary, and clean up the job site.

Staging Areas. PG&E has not yet identified specific staging areas for the underground portion of the Proposed Project. In general, the underground portion of the route traverses developed urban and suburban areas. Therefore, PG&E would likely rent parking lots, empty industrial sites, or similar spaces adjacent to the ROW. Before determining specific sites, PG&E would first negotiate with current landowners to obtain permission to occupy the sites. By their nature, these types of sites should have very few environmental impacts.

For construction in Guadalupe Canyon Parkway, PG&E expects to be able to make use of disturbed urban/suburban areas at either end of the Parkway for staging areas. Any final decisions on the location of such staging areas can be made only after final engineering determinations and negotiations with landowners in these areas are completed.

B.3.3.3 Construction Duration and Workforce

The length of time required for constructing the underground 230 kV transmission line along PG&E's proposed route is estimated at 12 months, including trenching, installation of the concrete duct bank, vault installation, cable installation, splicing, and terminating. The approximate construction time along each road segment would vary and is summarized in Table B-6.

An estimated total of 15 separate construction crews would perform the trenching, vault installation, cable pulling, and splicing work, including one crew to perform the bore work at the creek crossings. Each major construction activity would be performed by between one and five crews and each crew would range from 4 to 22 crew members, for a total of approximately 150 to 250 crew members for these tasks.

Table B-6. Estimated Construction Duration for Underground Transmission Line

Affected Streets	Construction Duration (approximate)
San Bruno Avenue	6 to 7 months
BART ROW; Twelve Mile Creek Bore and Colma Creek Bore	9 to 11 months, including completing bore work at completion of vault installation task (approximately 1 month per bore)
McLellan Extension / Hillside Boulevard	5 to 6 months
Hoffman Street / Orange Street	6 to 7 months
Guadalupe Canyon Parkway / Bayshore Boulevard	6 to 7 months

B.3.4 Potential Service Interruptions During Construction

Electric service for customers of the existing 60 kV line would be maintained by sequencing the construction of the new overhead line in sections. This sequencing ensures that each substation or tap location remains energized at 60 kV, as only one of the two connections is taken out of service at one time. The only exception would be the Crystal Springs Watershed Tap; work in this area would require service to be temporarily lost at this tap, which serves the Crystal Springs pumps. Generators would be temporarily installed at this isolated location to provide service during construction.

The reconstruction of the existing overhead double-circuit 60 kV power line would begin with the installation of the foundations for new tower structures. The construction crews would install the new foundations without interruption of the existing 60 kV service. The majority of new structures would be placed adjacent to or near the existing structures. In most cases the proposed new structures would be located within a 100-foot-by-200-foot area centered on the existing structure locations, as shown in Table B-2. When all of the foundations within a section have been installed, the existing section of line would be isolated and taken out of service.

The substation or tap on either side of the isolated section would continue to be served by the existing 60 kV line from the opposite direction. When a section of the line has been isolated, removal of the existing structures and existing conductor would begin. While the removal operations are progressing, the installation of the new structures would begin. Once a full section of structures are in place, the new conductors would be installed and tested. After testing, the jumpers on the temporary structure(s) would be re-arranged in such a way that bi-directional service can be restored, or removal and construction of the next section of line can begin. PG&E currently plans to isolate the following line segments to perform the work described above: Jefferson-Ralston, Ralston-Hillsdale, Hillsdale-Carolands, Carolands-Millbrae, and Millbrae-Sneath Lane.

In addition, potential interruption in utility services for the entire Proposed Project would be minimized by PG&E's coordination with the USA ("call-before-you-dig") service, as well as with the local jurisdictions to avoid accidental dig-ins to existing lines.

B.4 Operation and Maintenance Procedures

B.4.1 General System Monitoring and Control

Substation monitoring and control functions would be connected to the existing PG&E computer system by a telecommunication circuit. Protective relay communication would be through a power line carrier system. These functions would be connected to the San Mateo Center at the San Mateo Substation and the Golden Gate Distribution Operations computer system at Martin Substation. Relay action would cause an alarm to sound at San Mateo Substation, prompting reference to the Supervisory Control and Data Acquisition (SCADA) system and appropriate corrective action.

PG&E's design criteria currently used in planning and designing the telecommunications networks that service electric operations applications is the basis for strategic network planning and the engineering of telecommunications systems that support electric operations. The telecommunication design criteria for electric operations applications specifically related to the protection of a 230 kV electric system such as the proposed Jefferson-Martin 230 kV Project is as follows:

1. All telecommunications channels must be dedicated (non-switched); some may require dual paths (i.e., 230 kV cables, remotely protected power apparatus).

2. All telecommunications transmission networks must be electric utility-owned.

3. Use of leased telecommunication circuits is not recommended for primary protection.

4. Use of leased telecommunication channels is accepted for direct transfer trip to cogenerator facilities.

5. Availability of each telecommunication network channel end-to-end would exceed 99.999 percent (< 5.23 minutes/year).

6. Telecommunication transit time in the channel would be less than 8 milliseconds.

PG&E's Protection Engineering specified that the proposed Jefferson-Martin 230 kV Transmission Line Project protection scheme requires two physically redundant communication paths to ensure reliable operation by achieving physical redundancy for the transfer trip circuits. "Static" or "ground" wire would be Optical Power Ground Wire (OPGW), which serves the dual purpose of meeting safety requirements and providing the critical communication medium required for protecting relaying applications.

B.4.2 Data Acquisition Requirements

PG&E Utility Guideline G13168 provides data acquisition requirements, including the type of data to be collected, collection devices, data resolution, data synchronization, and data storage, for substation facilities that have been identified by the ISO as part of a critical protective system. The data acquired would allow the development of a chronology of events for the critical protective system. The design requirements described in this guideline are mandatory for new systems such as the proposed Jefferson-Martin 230 kV Transmission Line Project.

Data collection devices may include remote terminal units, microprocessor relays, data concentrators, and fault recorders. The devices shall be capable of storing data for download via local and/or remote access. Data storage analog and status points that have been collected by remote terminal units or data concentrators routinely would be polled by a SCADA masterstation or EMS computer for the purpose of data storage. Periodically, the data stored in the SCADA masterstation or EMS computer shall be downloaded for long-term storage for a period of not less than six months.

Data stored in microprocessor relays and fault recorders, and additional data stored in remote terminal units or data concentrators, would be downloaded at the request of Operations Engineering or System Protection following significant system events. These data would be stored in electronic form by the requesting department for not less than six months. Data would be stored so that it can be transmitted to the ISO for analysis.

B.4.3 Facility Inspection

The regular inspection of transmission lines, 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 Proposed Project. The Applicant would inspect all of the structures from the surface annually for corrosion, misalignment, and excavations. Ground inspection would occur on selected lines to check the condition of hardware, insulators, and conductors. This inspection would include checking conductors and fixtures for corrosion, breaks, broken insulators, and failing splices.

PG&E guidelines outline a uniform process to be used in the prioritization and inspection of overhead transmission lines to which the Proposed Project would be subjected. The guideline incorporates Reliability Centered Maintenance (RCM) philosophies and is consistent with the CPUC's G.O. 95 Rule 31.2, which states "Lines shall be inspected frequently and thoroughly for the purpose of ensuring that they are in good condition, so as to conform with these rules . . . ."

The overhead line inspection process is designed to: allow system and inspection frequency prioritization; identify component and element criticality; identify the best position for visual inspection of the various components; provide a consistent system-wide methodology for the types of inspections being performed; and describe maintenance tasks that can be performed by one or two person inspection crews.

Figure B-3a through B-3v. Detail of Proposed Project Route

For security reasons this figure is not included in the online version of the report.