Chapter 2—Project Description

2.1 Project Overview

2.1.1 Project Facilities

The Jefferson-Martin 230 kilovolt (kV) Transmission Project is needed to meet the projected electric demand in the cities of Burlingame, Millbrae, San Bruno, South San Francisco, Brisbane, Colma, Daly City, and San Francisco (the north of San Mateo County area) (refer to Figure 2-1). As proposed by PG&E, and as further described in this PEA, the Project includes:

- Installation of a new approximately 27-mile-long 230 kV transmission line with overhead and underground segments, with the first 14.7 miles of this line to be installed on a rebuilt version of PG&E's existing Jefferson-Martin 60 kV double-circuit transmission line and the remaining 12.4 miles to be installed in a new underground duct bank, as further described in this PEA.
- Rebuilding the existing Jefferson-Martin 60 kV double-circuit tower line to enable the east side to operate at 60 kV and the west side at 230 kV.
- Construction of a new transition station near the intersection of San Bruno Avenue and Glenview Drive just east of Skyline Boulevard / Highway 35 to transition from the 14.7-mile overhead 230 kV transmission line to the 13-mile underground 230 kV transmission line.
- 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 as described in Section 2.3.5.
- Modification of Hillsdale Junction switching station for new 60 kV arrangement as described in Section 2.3.5.

2.1.2 Project History

This Project represents the culmination of a comprehensive, long-term planning process undertaken by several key stakeholders over a period of more than three years. In April 1999, PG&E and the California Independent System Operation (ISO) formed a stakeholders study group to evaluate the adequacy of power supply to San Francisco and north of San Mateo County and to identify the best alternatives to meet future demand. This effort was initiated following the December 1998 disturbance that interrupted electric service to a significant portion of San Francisco and the northern Peninsula.

Participants included PG&E, the ISO, the City and County of San Francisco (CCSF), the California Public Utilities Commission (CPUC), the California Energy Commission (CEC), generating companies, and others.

In October 2000, the stakeholders study group submitted a report entitled *San Francisco Peninsula Long-Term Electric Transmission Planning Technical Study* to the ISO Board of Governors. The report concluded that, unless new generation resources are built in San Francisco, new 230 kV transmission facilities will be needed to meet customer demand by summer 2006. The stakeholders group assumed (without the benefit of feasibility studies, environmental analysis, or project-specific cost estimates) that such new transmission facilities could originate at Jefferson Substation or San Mateo Substation on the peninsula, or come across the San Francisco Bay from Moraga Substation east of Oakland. After consideration of feasibility, reliability, and cost, the stakeholders group selected the Jefferson-Martin Project (i.e., a new 230 kV line from Jefferson Substation to Martin Substation, without regard to route, together with related system modifications) as the preferred electrical solution. The stakeholders group further found that the Jefferson-Martin Project would increase transmission capacity by about 400megawatt (MW and recommended it to the ISO Board of Governors for approval.

Later in October 2000, the ISO Board of Governors approved the Jefferson-Martin Transmission Project (without regard to route) and the initiation by PG&E of permitting-related activities for the Project.

Subsequently, PG&E completed feasibility studies and updated cost estimates for the three main electrical alternatives discussed during the stakeholder process and for several routing variants of the Jefferson-Martin Project for presentation to the CPUC. This information was included in an April 4, 2002, letter to the ISO, to supplement PG&E’s February 19, 2002, request for further ISO Board of Governors’ approval of the Jefferson-Martin Project in light of the updated feasibility and cost information.

In April 2002, the ISO confirmed the Jefferson-Martin Project is needed by September 2005 to meet the identified reliability concerns in the San Francisco area. The ISO Board of Governors also granted its final approval for construction and addition to the ISO-controlled grid of the Jefferson-Martin Project, without regard to route, rather than the Moraga-Potrero or San Mateo-Martin concepts or the “no project” or “wait for new generation” alternatives. In response to comments from community groups, the ISO Board of Governors also instructed its staff to work with CCSF and interested stakeholders toward their goal of closing the Hunters Point Power Plant (Hunters Point).

While the ISO is responsible for transmission planning in California, the CPUC retains exclusive jurisdiction over the siting of ISO-approved transmission projects and is the lead agency with respect to such projects under the California Environmental Quality Act (CEQA). Therefore, in the Application of which this PEA is a part, PG&E seeks from the CPUC a Certificate of Public Convenience and Necessity (CPCN) identifying the selected route for the ISO-approved Project, based on environmental review of PG&E’s proposed route and alternatives thereto, as required by CEQA, and authorizing construction of the Project along the CPUC-selected route, consistent with Public Utilities Code section 1001. This PEA includes detailed environmental analysis of PG&E’s proposed route, together with other information required by CPUC rules, in order to assist the CPUC in preparing its Initial Study of the Project pursuant to CEQA.

FIGURE 2-1 (PAGE 1)

FIGURE 2-1 (BACKSIDE OF PAGE 1)

2.2 Project Purpose and Need

2.2.1 Statement of Objectives

The basic objectives of the Jefferson-Martin Project are as follows:

- **Meet Electric Demand –** The first basic Project objective is to ensure that the electric system includes adequate capacity to safely and reliably serve the San Francisco and north of San Mateo County area, even under reduced generation scenarios. This is the basic purpose of the project.
- **Comply with Planning Criteria –** The second basic Project objective is to ensure that the north of San Mateo County area transmission system will continue to meet planning standards and criteria established by the ISO and the North American Electric Reliability Council (NERC) to ensure the safety and reliability of the transmission system. These planning criteria must be met by the Project. Compliance with these criteria would also result in continued consistency with the pre-ISO planning guide entitled "Supplementary Guide for Application of the Criteria for San Francisco," which was considered as part of the October 2000 stakeholder study.
- **Create a More Diverse Transmission System in the Area –** The third basic Project objective is to further increase transmission system reliability in the San Francisco and north of San Mateo County area by providing a second independent major transmission line pathway into the area. By meeting this objective, the Project would eliminate the "all eggs in one basket" concern that currently exists in the area.
- **Implement the ISO Board of Governors' April 2002 Resolution –** The fourth basic Project objective is to implement the April 2002 ISO Board of Governors' resolution approving the Jefferson-Martin Project for addition to the ISO-controlled grid, consistent with the ISO Tariff as adopted by the Federal Energy Regulatory Commission pursuant to the Federal Power Act.

Under California law, any routing alternative the CPUC approves for this Project must satisfy these basic Project objectives (CEQA Guidelines, Section 15126.6)

2.2.2 Summary of Project Purpose and Need

The Jefferson-Martin Project is needed by September 2005 in order to meet the basic Project objectives listed above, thereby ensuring an adequate level of electric supply and transmission system reliability in the north of San Mateo County area.

The north of San Mateo County area is supplied by a combination of transmission and local generation. Major transmission serving the area is sited within a single corridor. The continued availability of existing local generation is in question because of age and increasingly stricter air emissions standards. The development of new generation likewise remains uncertain. Thus, PG&E cannot assume that additional load-serving capacity will be added in a timely manner to the area by third party generators and must account for the possibility that the presently available level of capacity could actually decrease. At the same time, load growth is expected to continue (albeit perhaps at a rate lower than that expected prior to 2001 when the energy crisis and economic downturn resulted in a significant drop in peak demand in the north of San Mateo County area).

Because any peak demand forecast has inherent uncertainties—and the sudden, large drop in peak demand observed in 2001 further increases those uncertainties in this case—PG&E considered a range of peak demand forecasts as part of its long-term transmission planning for the north of San Mateo County area. PG&E also analyzed a variety of generation buildout and retirement scenarios intended to capture all reasonably anticipated generation supply levels. Three peak demand forecasts along with eight generation scenarios were analyzed for a total of 24 separate scenarios.

As discussed in more detail below, unless the Jefferson-Martin Project is operational by 2005 or summer 2006, the existing transmission system[1] will fail to meet applicable planning criteria and otherwise prove inadequate under 15 of the 24 scenarios analyzed. Analysis of the most likely generation scenario demonstrates that the Jefferson-Martin Project is needed by 2005 or summer 2006 regardless of whether the low, medium, or high load forecast is considered. Even under the minority of scenarios under which the Project might not be needed by 2005 or summer 2006, the Project is still needed; while it may be possible to defer the Project if one is willing to assume, for example, that all existing generation will remain in place, major new generation resources will be promptly approved and constructed, and load growth will occur at slower-than-expected levels, the fact remains that reliability criteria violations will eventually occur.

Prudent planning dictates, and the ISO Board of Governors has already determined, that the Jefferson-Martin Project should be constructed in time to meet demand and avoid outages under all reasonably likely scenarios. Completing the Jefferson-Martin Project by September 2005 would ensure adequate capacity to handle normal peak demand and avoid reliability criteria violations despite the uncertainties in generation availability and peak electric demand in San Francisco and north of San Mateo County. It would also increase reliability in the area by introducing a second major transmission pathway. Finally, completion of the Jefferson-Martin Project by September 2005 would implement the ISO's April 2002 decision to approve the Project in accordance with the ISO Tariff.

2.2.3 Electric Supply Issues

2.2.3.1 Existing Power System Facilities and Capabilities

An electric power system consists of power plants, transmission substations, distribution substations, and overhead or underground electric lines. Electricity is generated at power plants and transmitted to transmission or distribution substations via high-voltage transmission lines of voltages 500 kV, 230 kV, 115 kV, and 60 kV. At PG&E's distribution substations, power is "stepped down" from transmission voltages of to distribution level voltages of 4 kV, 12 kV, 21 kV or 34.5 kV. Power is then delivered to customers using overhead or underground distribution lines.

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[1] For purposes of this study, the existing transmission system was assumed to include the ISO-approved Project to reconductor and convert to 115 kV operation the existing San Mateo-Martin No.4 60 kV circuit. This Project is currently scheduled to be operational before the Jefferson-Martin Project.

Electric demand in San Francisco and north of San Mateo County is supplied by transmission lines and local power plants. There are two power plants located in San Francisco: PG&E's Hunters Point and Mirant's Potrero power plants. Hunters Point has a total active generating capacity of 213 MW from one combustion turbine and one steam unit. Potrero has a total generating capacity of 357 MW from three combustion turbines and one steam unit. Thus, existing in-City generation in San Francisco provides approximately 570 MW of total generation capacity assuming no forced or maintenance outages. There is also a small 28 MW cogeneration power plant, United Airlines Cogen, near the San Francisco International Airport.

All major transmission lines importing power into the area are located in a single corridor along Highway 101 between Martin Substation (just south of the San Francisco boundary) and San Mateo Substation. Transmission facilities in the San Mateo-Martin corridor include one 230 kV underground cable, and six overhead circuits on three double-circuit tower lines. The overhead circuits consist of five 115 kV and one 60 kV transmission circuits. Taken together, and considering no outages, these facilities are capable of importing about 1230 MW of power into the north of San Mateo County area.

In addition to the regional transmission system described above, lower-capacity 60 kV transmission also exists along highway I-280 from Jefferson Substation in San Mateo County to Martin Substation in the City of Brisbane. These 60 kV transmission facilities supply local communities and Hetch-Hetchy Water and Power facilities generally located along the I-280 corridor. PG&E substations that are energized to Jefferson-Martin 60 kV circuits include Ralston, Hillsdale Junction, Hillsdale, Half Moon Bay, Carolands, Sneath Lane, and Pacifica; these existing Jefferson-Martin 60 kV circuits also provide power to the following non-PG&E substations: Watershed, Crystal Springs, San Andreas, and San Bruno. Communities served by these facilities, which will remain necessary after completion of the Jefferson-Martin Project, include San Mateo, Belmont, Hillsborough, Burlingame, San Bruno, South San Francisco, Pacifica, and Half Moon Bay. PG&E has designed the Jefferson-Martin Project so that it can be completed without service interruptions in areas served by these facilities.

As shown in Figure 2-2, transmission power for the north of San Mateo County area is currently supplied from San Mateo Substation. Four 230 kV transmission circuits connect to San Mateo Substation. The Pittsburg-San Mateo Nos. 1 and 2 circuits primarily deliver power to the San Mateo Substation from power plants interconnected to the Pittsburg Switchyard: Pittsburg Power Plant, Los Medanos Energy Center, and Delta Energy Center. The Ravenswood-San Mateo Nos. 1 and 2 circuits link San Mateo Substation to Ravenswood Substation, which is in turn interconnected to PG&E's 500/230 kV Tesla Substation and Newark Substation by the Tesla-Ravenswood and Newark-Ravenswood 230 kV circuits. In addition to delivering power from Bay Area power plants, these circuits deliver power from the 500 kV Western United States power grid received at the Tesla 500/230 kV Substation. The 500 kV system is interconnected with inter- and intrastate power plants.

Under the ISO-approved Jefferson-Martin Project, the additional power to be delivered into the north of San Mateo County area would be supplied from a different immediate source, Jefferson Substation. Jefferson Substation is supplied by two 230 kV circuits that receive power, via Monta Vista Substation, from the 500 kV Western United States power grid received at the Metcalf 500/230 kV Substation. As noted above, the 500 kV system is interconnected with inter- and intrastate power plants.

2.2.3.2 Transmission Supply Diversity

While the existing transmission system is in compliance with all applicable reliability criteria, new transmission projects serving the area should be designed to increase the diversity of transmission supply. Presently, San Mateo is the sole 230 kV transmission supply substation for the north of San Mateo County area. A catastrophic event causing disruption to San Mateo Substation would disrupt transmission supply to the entire area. In addition to originating at a single source, the major transmission lines presently serving the area are concentrated in a single corridor. As part of its long-term planning for the north of San Mateo County area, PG&E developed potential projects that would be supplied by a substation other than San Mateo Substation and could be constructed without having to utilize the San Mateo-Martin corridor, in order to diversify the transmission system serving the area. The Jefferson-Martin Project approved by the ISO meets this objective thereby eliminating the "all-eggs–in-one-basket" reliability drawback.

2.2.3.3 Generation Uncertainty

Hunters Point Unit 4 and Potrero Unit 3 began commercial operation in November 1958 and December 1965, respectively. Even with the best maintenance efforts, their old age and increasingly stricter emission requirements for oxides of nitrogen ("NO_x") will likely push them to retirement once new generation or, in the case of Hunters Point, other replacement resources are built. Indeed, PG&E has agreed with CCSF to retire the Hunters Point unit once replacement resources are available. In April 2002, the ISO instructed its staff to work with CCSF and interested stakeholders toward their goal of closing the Hunters Point Power Plant.

New power plant construction in San Francisco continues to be uncertain and volatile. Currently, there is only one active generation proposal, Mirant's proposed Potrero 7 Power Plant Project. The proposed Potrero project would be a nominal 540 MW natural gas-fired combined cycle plant generating facility. In May 2000, Mirant filed an application for certification (AFC) with the California Energy Commission (CEC). The CEC determined the AFC to be data adequate in October 2000. The CEC's Final Staff Assessment (FSA) on the proposed project was issued on February 11, 2002[2]. Environmental mitigation issues brought up by the CEC staff are being discussed with and considered by the project developer. After almost two years since the AFC was accepted, this project still has not received its CEC permit. PG&E understands that CCSF continues to oppose approval of this project.

PG&E has no ability to control whether Mirant's proposed plant or other in-city generation is approved in time to meet demand in the area, nor may it unilaterally decommission its own Hunters Point plant consistent with applicable ISO transmission system reliability

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[2] CEC staff filed its FSA on February 11, 2002. Based on the CEC's website, in the FSA, staff recommends that the Energy Commission license the Potrero Power Plant Unit 7 Project with mitigation, including replacement of the proposed once-through cooling system with an alternative cooling system. If Mirant continues with its current proposal to use a once-through power plant cooling system that utilizes water from San Francisco Bay, staff would not support approval of the project.

FIGURE 2-2

FIGURE 2-2 (BACKSIDE)

criteria until replacement resources are available. Nonetheless, given the uncertain status of both facilities, it is possible that one or both facilities will be unavailable circa 2005–06. Prudent transmission planning requires PG&E and the ISO to account for this possibility. Therefore, PG&E has designed the Jefferson-Martin Project to meet demand and comply with applicable reliability criteria under a variety of reasonably likely generation buildout and retirement scenarios.

2.2.4 Area Load Growth[3]

2.2.4.1 Load Growth Projections: High, Medium, and Low Scenarios

Before the recent energy crisis and current economic downturn, the north of San Mateo County area had been experiencing rapid economic expansion. Between the years 1998 and 2000, peak electric demand increased from 1,130 MW to 1,245 MW[4], or an average of about 57 MW per year. Peak electric demand in 2001 dropped by 122 MW to 1,123 MW.

While there is uncertainty in any load growth forecast the present uncertainty is especially large in light of California’s changing energy and economic environment. For purposes of this Project, PG&E accounted for this uncertainty by examining three different load forecasts (“High,” “Medium,” and “Low”) to bracket plausible demand outcomes in its capacity-planning efforts.

The load forecast used in the October 2000 San Francisco Stakeholder Technical Report was developed in September 1999 and included actual historical load data through and including year 1999. It is considered as the “High” forecast based on today’s conditions. Since 1999, PG&E has developed additional load growth forecasts: one in December 2000, one in June 2001, and one in August 2002. The December 2000 forecast was developed for use in PG&E’s 2001 system assessment and Electric Transmission Grid Expansion Plan and is considered as the “Medium” forecast. The June 2001 and August 2002 forecasts are “Low” forecasts and were developed to consider the impact on future load growth of the energy crisis, heightened conservation efforts, economic downturn and their continuing impacts. For purposes of this analysis, PG&E has utilized the August 2002 forecast as the Low demand scenario because it is the most current[5]; as can be seen on Table 2-1, the two forecasts are very close in any event. The December 2000 and June 2001 forecasts were reviewed and accepted by the ISO and CEC forecasting staff. The four forecasts are presented in Table 2-1 and depicted in Figure 2-3.

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[3] The area for which data are provided includes the City of San Francisco and the northeast portion of the Peninsula in San Mateo County, which covers Burlingame, Millbrae, South San Francisco, Daly City, Serramonte, Westborough, Colma, and Brisbane.

[4] San Francisco accounted for about 950 MW of the 1245 MW total in year 2000.

[5] The August 2002 forecast includes actual as opposed to projected peak load data for year 2001 and is therefore more accurate.

TABLE 2-1
Peak Summer Electric Demand (MW) in San Francisco and Northern San Mateo County

Historical[1]						**1998**	**1999**	**2000**	**2001**
						1,130	1,199	1,245	1,123
Forecast	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
SFLT[2] Study (“High”)	1,408	1,443	1,482	1,516	1,551	1,586	1,621	1,654	1,689
Dec 2000 (“Medium”)	1,249	1,287	1,352	1,383	1,401	1,439	1,477	1,515	1,553
Jun 2001	1,187	1,206	1,259	1,284	1,301	1,329	1,358	1,386	1,415
Aug 2002[2] (“Low”)	1,226	1,239	1,259	1,275	1,290	1,306	1,323	1,339	1,356

[1] For historical demand, this table presents the sum of actual transmission flows and generation dispatch as measured by PG&E’s Energy Management System.

[2] San Francisco Long-Term

TABLE 2-1
Peak Summer Electric Demand (MW) in San Francisco and Northern San Mateo County

Historical[1]	**1998**	**1999**	**2000**	**2001**

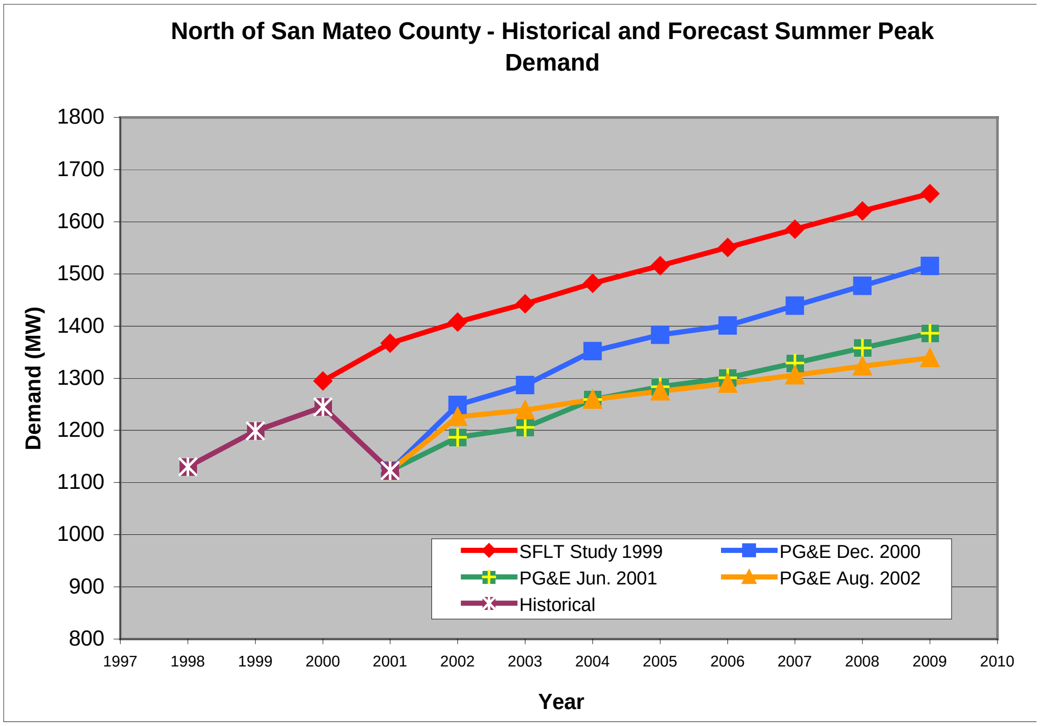

Figure 2-3: North of San Mateo County – Historical and Forecast Summer Peak Demand

As can be seen from the Table 2-1, forecast demands have changed dramatically over the last three years. Any forecast of long-term future peak demands involves uncertainties. The present situation of a sudden, significant drop in demand because of heightened energy conservation during the recent energy crisis and a general economic downturn provides an even greater challenge for forecasting. The forecasts developed in 1999 and 2000 were completed during a time of a robust California economy. The August 2002 forecast were developed considering impacts of the recent energy crisis and economic downturn and specifically considers 2001 summer peak data.[6] When the California economy eventually recovers, the demand forecast will again change. Depending upon the extent of the recovery, demand could return to previous levels and could again grow at or near the previous pace. Under these circumstances it is appropriate to consider a range of reasonably plausible demand forecasts. As discussed in Section 2.2.3, PG&E conducted its planning studies for this Project using the “High,” “Medium,” and “Low” forecasts.

2.2.4.2 Methodology Used to Develop Load Growth Forecast

The methodology[7] used to develop the San Francisco Long Term Study, the December 2000, and the August 2002 forecasts are described below.

San Francisco Long-Term Study Group Forecast (September 1999)

This forecast was developed by the study group that included the CCSF, CEC, California Independent System Operator, and PG&E representatives in September 1999. The starting point for this forecast was the individual distribution forecasts for San Francisco division and Peninsula division. This north of San Mateo study involved six separate distribution planning areas (DPAs) in PG&E’s San Francisco and four DPAs in the Peninsula divisions. These DPA forecasts used PG&E’s traditional load forecasting model based on a “least-square” linear regression analysis.[8] Historical and projected block loads, representing individual large loads exceeding 1.5 percent of the individual DPA total load, were included in each separate DPA study. The block load forecasts for all of San Francisco totaled an average of about 19 MW per year from 1999–2004. From 2005 through 2009, the study assumed that block loads would continue at 80 percent of this value, or 15 MW per year. The separate DPA forecasts were then added together to form the total study area forecast. This noncoincident peak load forecast was reduced by 5 percent to reflect forecast coincident peaks.

December 2000 Forecast

The December 2000 forecast was developed for use in PG&E’s 2001 system assessment and Electric Transmission Grid Expansion Plan. At that time, this forecast was reviewed and accepted by the CAISO and CEC forecasting staff. This forecast uses a “top-down” approach to forecast summer peak loads for a local area. This method starts with a forecast of total system peak demand. This demand is then allocated to each of PG&E’s local divisions,

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[6] These forecasts beyond 2006 are based on trends of the load growth forecast between 2002 and 2006.

[7] This section describes the methodology describes forecast PG&E distribution substation loads. Also in the north of San Mateo area are single customer substations, which have their own forecasted loads. These substations are Bayshore (supplying BART), Airport and Station MA (both supplying the San Francisco International Airport), and Santa Paula and Shaw Road (both supplying BART). For Bayshore, historical values were used for the other non-PG&E substations, PG&E used demand forecasts provided by the individual customers.

[8] Least square or multivariable linear regression is a method of approximating a general trend without matching individual data points. The regression is a “best fit” straight line through a set of known data points and can be used to project the trend into the future.

including the San Francisco and Peninsula divisions based on historical demand values. For the local area peak[9], this allocation is then adjusted to a 1-in-10 year adverse weather condition and noncoincidence of the local division peak with the system peak. Future local area peak demand growth is based on allocating forecast total system growth to the local areas. This allocation is based on the relative division forecast nonsimultaneous load growth developed by distribution planners using PG&E's traditional "least-square" linear regression analysis.

August 2002 Forecast

The August 2002 forecast used PG&E's traditional load forecasting model based on a "least-square" linear regression analysis. This forecast focused on the specific historical loads of the study area north of San Mateo substation. The analysis used the combined loads of two separate planning areas), each much larger than the DPAs considered as part of the 1999 (High) forecast: one for all of San Francisco and one covering all of the involved substations in the north of San Mateo County area. No block loads were added to the forecast since no single large load addition met the required 1.5 percent of the area peak load criteria, as those areas were defined for purposes of this forecast. (Note that the treatment of block loads is a significant difference between the 2002 [Low] and the 1999 [High] forecast.) The result of this methodology is a forecast of non-coincident peak loads for the distribution substations. This non-coincident peak load forecast was reduced by 5 percent to reflect forecast coincident peaks.

2.2.4.3 PG&E's Customer Energy Efficiency Program

PG&E uses a program of voluntary reduction in electricity use known as Customer Energy Efficiency (CEE). PG&E has had an active CEE program over the past two decades. Its cumulative reduction of use has been substantial. For any given planning area, the historical CEE energy and peak demands experienced year by year and thus their impacts are automatically included in PG&E's forecasts of peak growth. Such is the case within the north of San Mateo County area. Thus, the demand forecasts presented in Table 2-1 for this Project already account for any load reductions that could result from aggressive locally focused CEE. PG&E will continue its efforts to reduce the load growth rate in the area as a matter of policy and business practice. However, the projected CEE benefits (no more than 2 MW to 7 MW in the Project Area) clearly will not defer the required capacity addition (approximately 400 MW).

2.2.5 Planning Criteria

The Project is needed to ensure reliable service for meeting customer electric demand without overloading the existing electric facilities that supply San Francisco and the northern peninsula area. The ISO establishes grid planning criteria to ensure the safety and reliability of transmission systems.[10] Pursuant to these criteria, PG&E uses both normal and

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[9] For the December 2000 forecast, the San Francisco, Peninsula and East Bay divisions were combined to define the local area.

[10] Included as part of the ISO California Grid Planning Criteria are the Planning Standards and Guidelines of the North American Electric Reliability Council (NERC), an international organization focused on coordinating power system reliability in North America. The area covered by NERC is divided into ten regional councils. PG&E is a member of the Western Electricity Coordinating Council, one of the regional councils. In February, 2002, the California ISO modified its Grid Planning Criteria to include, among other changes, the San Francisco Greater Bay Area Generation Outage Standard. This Standard applies to the San Francisco Greater Bay Area and requires that the system normal condition assumes that three

emergency ratings for transmission infrastructure equipment.[11] Normal ratings are equipment operating limits for continuous use. Emergency ratings are slightly higher equipment operating limits that are allowed for short durations. Projects that propose to increase transmission capacity to meet load growth must satisfy the grid planning criteria. The criteria that are applied in evaluating whether a project satisfies the grid planning criteria are Categories A , B, and C, as described below.

- Category A: Normal ratings of equipment will not be exceeded with all generators, lines, and transformers in service. The voltage must be maintained within normal limits under these conditions.[12] No loss of load is allowed.
- Category B: Emergency ratings of equipment will not be exceeded with the loss of a single circuit, generator, or transformer or of a single circuit and a single generator. The voltage must be maintained within emergency limits under these conditions. No loss of load, except as noted in the footnote below, is allowed.[13]
- Category C: Emergency ratings of equipment will not be exceeded with the loss of a single circuit, generator, or transformer, or of a single circuit and a single generator; followed by manual system adjustments, and then followed by loss of another single circuit, generator, or transformer. The voltage must be maintained within emergency limits under these conditions. Loss of load, except as noted in the footnote below, is allowed.[14]

In accordance with the above criteria, PG&E uses computer models to assess the adequacy of its high-voltage electric system. The system is modeled to simulate performance under various load levels and operating assumptions.

Prior to formation of the ISO, PG&E used grid planning criteria specific to the north of San Mateo transmission corridor (presently called "Supplementary Guide for the Application of

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generating units are off-line: one 50 MW CT in the Greater Bay Area but not on the San Francisco Peninsula; the largest single unit on the San Francisco Peninsula; and, one 50 MW CT on the San Francisco Peninsula. Traditional contingency analysis, based on the standards specified in the NERC, WECC (including voltage stability), and ISO standards (such as single line outage, single generator line outage, etc.) would be conducted on top of this base condition. The one exception is that when screening for the most critical single generation outage, only units that are not on the San Francisco Peninsula should be considered.

[11] Overhead-transmission-line ratings are based on the conductor tensile strength, distance above the ground, conductor temperature, and ambient weather conditions. Underground cable ratings are based on the loading cycle on the cable, thermal resistivity of the soil surrounding the cable, and ambient temperature conditions. Transformer ratings are based on maximum temperature rise, hot-spot temperature, and ambient weather conditions.

[12] Normal voltage and emergency limits are based on average customer equipment voltage requirements and CPUC Electric Rule 2.

[13] "Planned or controlled interruption of generators or electric supply to radial customers or some local network customers, connected to or supplied by the faulted component or by the affected area, may occur in certain areas without impacting the overall security of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) electric power transfers." (NERC Planning Standards, Table 1, footnote b).

[14] "Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, or the curtailment of contracted firm (non-recallable reserved) electric power transfers may be necessary to maintain the overall security of the interconnected transmission systems." (NERC Planning Standards, Table 1, footnote d). CAISO Planning Standards specify that: "Involuntary load interruptions are an acceptable consequence in planning for ISO Planning Standard Category C and D disturbances (multiple contingencies with the exception of the combined outage of a single generator and a single transmission line), unless the ISO Board decides that the capital project is clearly cost effective (after considering all the costs and benefits)." In cases where this application would result in the elimination of a project or relaxation of standards that would have been built under past planning practices, these cases will be presented to the ISO Board for a determination as to whether or not the projects should be constructed. (CAISO Planning Standards; February 7, 2002, page 3).

the Criteria for San Francisco" and included in Appendix A-5. These criteria may be viewed as a specific application of the NERC Planning Standards and Guidelines and the ISO Grid Planning Criteria. PG&E continues to use the specific criteria discussed in the Supplementary Guide for San Francisco, as well as other conditions of the ISO Grid Planning Criteria, to determine whether a project satisfies grid planning criteria.

As electric demand increases, power line conductors and power transformers will reach and exceed their rated capacities. When the demand on the equipment exceeds its rated capacity, the equipment becomes overheated and can be damaged.[15] The electric system is designed with protective and control equipment to prevent this type of damage. Circuit breakers remove equipment from service when equipment failure occurs or when preset design limits are reached. However, removing equipment from service will lead to power outages in the areas served by the affected power lines and transformers.

2.2.6 Electric Transmission System Requirements

Given the uncertainties in local generation availability and future load growth, scenario analysis was performed to evaluate the impact of different demand forecasts and generation assumptions on the need for the Jefferson-Martin 230 kV Transmission Project. The analysis is based on results of power flow analysis for conditions specified in the CAISO grid planning criteria. Put simply, PG&E asked whether for each scenario analyzed, planning criteria violations would be expected, and, if so, when would the predicted violations materialize.

Three different peak demand forecasts were considered: High (SF Long Term Study Forecast); Medium (December 2000 Forecast); and Low (August 2002 Forecast). For each peak demand forecast, generation uncertainties were evaluated by considering whether or not: (a) Potrero 7 is assumed to have been constructed; (b) Hunters Point Power Plant is assumed to have been retired; and (c) Potrero Unit 3 is assumed to have been shutdown. Hence, with each peak demand forecast, eight different generation scenarios are evaluated. There are three peak demand forecast scenarios, so the total number of scenarios evaluated is 24 (3 times 8).

Based on power flow analysis, transmission load serving capability of the north of San Mateo County area transmission system was determined for each of the scenarios. The peak demand forecasts were then compared with this total load serving capability to determine the timing of need. More specifically, the Jefferson-Martin Project is needed under any scenario under which the peak demand forecast exceeds the total load serving capability without the project (i.e., transmission overloading and planning criteria violations would occur without the project).

Figure 2-4 graphically displays the results of PG&E's analysis of the three load-forecast scenarios for the generation scenario of Potrero 7 not constructed, Hunters Point retired in 2006, and Potrero 3 in service, the most probably generation scenario, see Table 2-2 below.

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[15] The electrical and mechanical properties of materials in the equipment will irreversibly degrade when the heat build-up exceeds design thresholds. For example, prolonged overheating of power line conductors will cause the conductors to lose elasticity and eventually fail mechanically. The conductors can then drop to the ground and become a safety hazard. Likewise, when a power transformer becomes overheated, the insulating materials in the transformer are degraded and permanent damage and equipment failure can occur.

As shown above, by 2006 all peak demand forecasts (i.e., the High, Medium, and Low forecasts) would exceed load serving capability without the Jefferson-Martin project installed. Were the capacity to be added by the Jefferson-Martin Project unavailable, demand under all three load growth scenarios would exceed available supply. The figure shows all three peak demand forecasts crossing the portions of the load serving capability bar represented by the Jefferson-Martin Project as early as 2006. Consistent with the Supplementary Guide for Application of the Criteria for San Francisco, the transmission

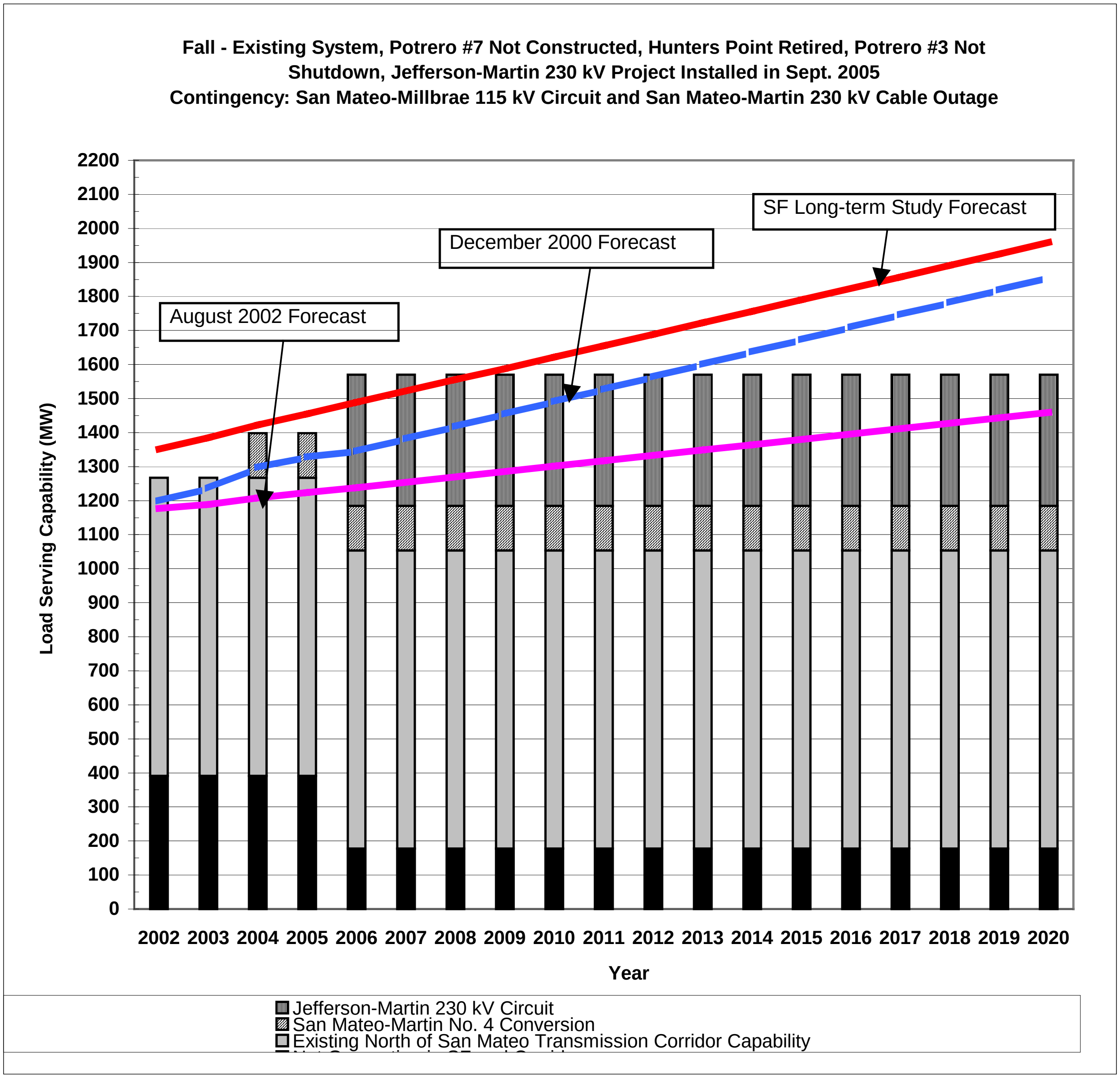

Figure 2-4: Results Analysis of Three Load Forecast Scenarios

planning criterion (as specified in the figure) is the fall condition[16] with Potrero 3 on maintenance overhaul, outage of the San Mateo-Martin 230 kV cable, and outage of the San Mateo-Millbrae 115 kV circuit. Appendix A-5 includes similar figures for all eight generation scenarios with the three peak demand forecasts. The latest date by which the Project would be needed can be similarly determined from these figures for all 24 scenarios. However, the Project is eventually needed under every scenario.

The results of the analysis for the 24 scenarios are summarized below in a decision tree format, Table 2-2.

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[16] Planning for fall conditions based on fall loads at 96 percent of forecast summer peak loads. Figure has adjusted forecasts for fall accordingly.

TABLE 2-2
Results of Scenario Analysis

Demand Forecast	**Potrero 7 (560 MW) Constructed[17]**	**Hunters Point Retired**	**Potrero 3 Shutdown**	**Jefferson-Martin Needed by 2005 or 2006**	**Probability**
High (SF Long Term Forecast)	No	Yes	Yes	Yes	0.04
			No	Yes	0.15
		No	Yes	Yes	0.00
			No	Yes	0.01
	Yes	Yes	Yes	Yes	0.10
			No	Yes	0.03
		No	Yes	Yes	0.01
			No	No, by 2009	0.00
Medium (Dec 2000 Forecast)	No	Yes	Yes	Yes	0.04
			No	Yes	0.15
		No	Yes	Yes	0.00
			No	No, by 2008	0.01
	Yes	Yes	Yes	Yes	0.10
			No	Yes	0.03
		No	Yes	No, by 2008	0.01
			No	No, by 2013	0.00
Low (Aug 2002 Forecast)	No	Yes	Yes	Yes	0.04
			No	Yes	0.15
		No	Yes	Yes	0.00
			No	No, by 2017	0.01
	Yes	Yes	Yes	No, by 2011	0.10
			No	No, by 2014	0.03
		No	Yes	No, by 2018	0.01
			No	No, by 2028	0.00

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[17] This planning analysis for Potrero No.7 considers total outage of Unit 7 a single contingency because a common mode failure (the condenser) for the plant has been identified.

As shown in Column 5 of Table 2-2, 15 of the 24 scenarios, including each of the three most probable scenarios, show a need for the Jefferson-Martin Project by summer 2006.

Further evaluation in the form of decision analysis was performed by using probabilities for the different events. The probabilities assumed were P("High," "Medium," or "Low" demand forecast) = 1/3[18], P(Potrero 7 constructed) = 40 percent[19], P(Hunters Point Retired after 2005)=95 percent[20], P(Potrero 3 shutdown if Potrero 7 constructed)=80 percent[21], P(Potrero 3 shutdown if Potrero 7 not constructed)=20 percent[22]. Resulting probabilities for the 24 scenarios are shown in Column 6 of Table 2-2.

The probabilities for the each of the 24 scenarios can be accumulated by year to determine the cumulative probabilities for need of the Jefferson-Martin Project by year. This result is displayed graphically in Figure 2-5.

As illustrated in Figure 2-5, results of the scenario analysis shows about an 84 percent probability of need for the Jefferson-Martin Project by 2006 summer, and about 96 percent probability of need by 2011. Thus, even after taking into account peak demand and generation uncertainties associated with planning the supply to this area, the decision analysis results show a very high probability that the Jefferson-Martin Project will be needed by 2006 summer.

To provide the extent of overloading that may occur without the Jefferson-Martin Project, power flow results (using General Electric (GE) Power Flow software for 2006 and the most probable scenario for the "Medium" peak demand forecast) are provided below in Table 2-3 and 2-4. This scenario has Potrero 7 not constructed, Hunters Point retired, and Potrero Unit 3 in service. In these results, overloading is indicated if loadings are over 100 percent. The table also provides results assuming the Jefferson-Martin Project has been constructed and is operational.

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[18] Because of forecasting uncertainties, equal probability was given to each forecast.

[19] Slightly less than 50 percent probability was given because of lack of CCSF and community support, and general economic conditions for power plant development.

[20] A high probability of shutdown was given as PG&E has an agreement with CCSF to shut down the facility, and ISO directed staff to work with CCSF and the community to achieve their goal of shutting down the plant.

[21] This probability reflects the fact the need for Unit 3 is diminished if Unit 7 is built, resulting in likely shutdown.

[22] The need for Unit 3 is increased if Unit 7 is not built, resulting in a lower probability of its shutdown.

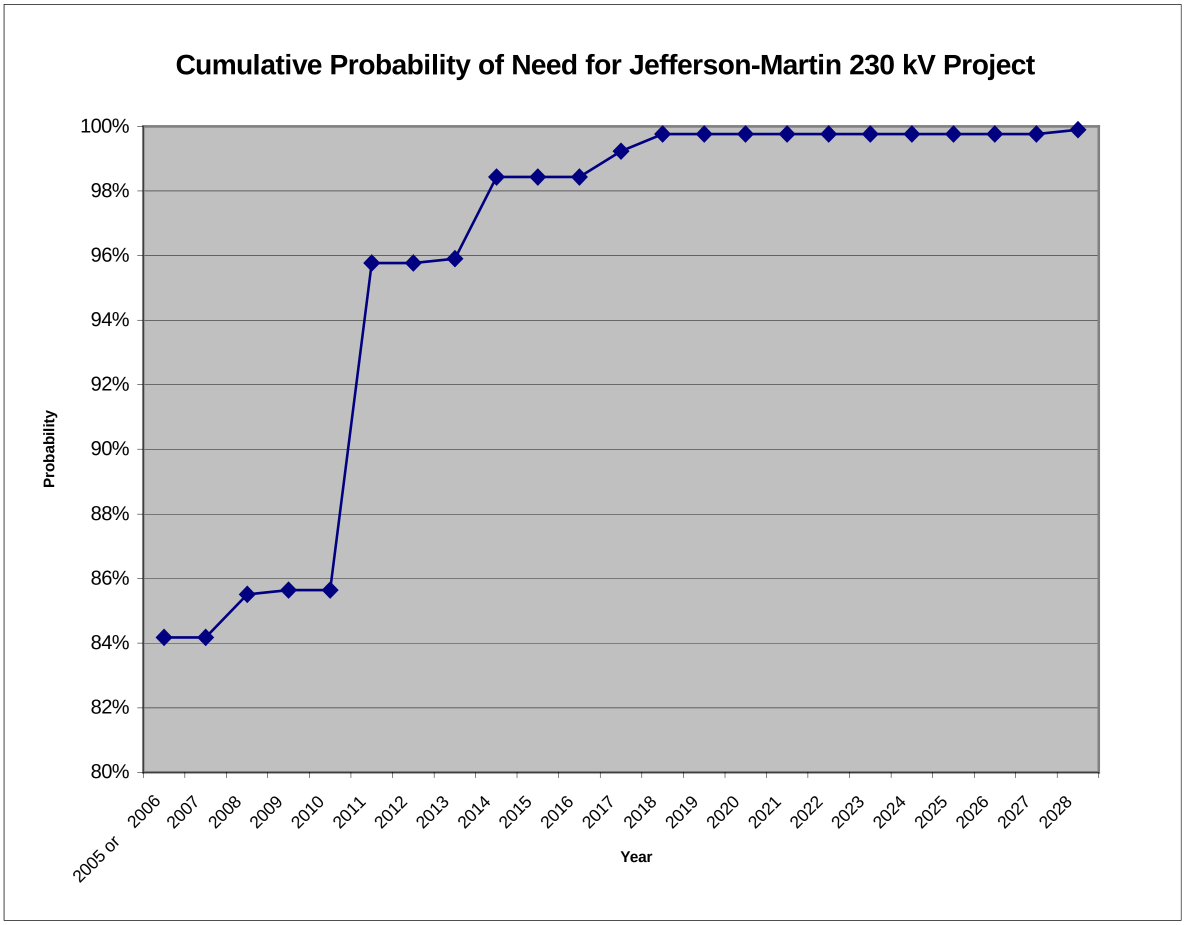

Figure 2-5: Cumulative Probability of Need for Jefferson-Martin 230 kV Project

TABLE 2-3

Modeled Most Probable Scenario for the “Medium” Peak Demand Forecast—Summer

Season	Conditions	Overloaded Peninsula Corridor Facilities	Percent Loading Before the Project	Percent Loading After the Project
Summer	San Mateo-Martin230 kV Cable and San Mateo-Millbrae 115 kV Circuit Outage	Burlingame-Martin 115 kV Circuit	99	72
		SFIA(MA)-East Grand 115 kV Circuit	97	73
	San Mateo-Martin230 kV Cable and San Mateo-East Grand 115 kV Circuit Outage	Burlingame-Martin 115 kV Circuit	99	71
	Potrero Unit 3, Potrero Unit 4, and San Mateo-Martin 230 kV Cable Outage	Burlingame-Martin 115 kV Circuit	102	75
		SFIA(MA)-East Grand 115 kV Circuit	100	75
		San Mateo-SFIA(MA) 115 kV Circuit	97	75
		San Mateo-Millbrae 115 kV Circuit	97	75
		Millbrae-Martin 115 kV Circuit	96	68

TABLE 2-4
Modeled Most Probable Scenario for the “Medium” Peak Demand Forecast—Fall

Season	Conditions	Overloaded Peninsula Corridor Facilities	Percent Loading Before the Project	Percent Loading After the Project
Fall	San Mateo-Martin230 kV Cable and San Mateo-Millbrae 115 kV Circuit Outage with Potrero Unit 3 in Overhaul	Burlingame-Martin 115 kV Circuit	115	84
		SFIA(MA)-East Grand 115 kV Circuit	111	83
		San Mateo-SFIA(MA) 115 kV Circuit	106	82
		San Mateo-Shaw Road 115 kV Circuit	106	78
		SFIA-UAL Tap 115 kV Circuit	106	75
		San Mateo-Martin 115 kV No. 3 Circuit	104	76
		San Mateo-Burlingame 115 kV Circuit	103	76
		UAL Tap-Martin 115 kV Circuit	101	73
		Shaw Road-Martin 115 kV Circuit	99	73
		San Mateo-SFIA 115 kV Circuit	95	71
	San Mateo-Martin230 kV Cable and San Mateo-East Grand 115 kV Circuit Outage with Potrero Unit 3 in overhaul	Burlingame-Martin 115 kV Circuit	114	83
		Millbrae-Martin 115 kV Circuit	109	77
		San Mateo-Millbrae 115 kV Circuit	106	81
		San Mateo-Shaw Road 115 kV Circuit	105	77
		San Mateo-Martin 115 kV No. 3 Circuit	103	75
		San Mateo-Burlingame 115 kV Circuit	102	75
		SFIA-UAL Tap 115 kV Circuit	99	70
		San Mateo-SFIA 115 kV Circuit	98	74
		Shaw Road-Martin 115 kV Circuit	98	72
		UAL Tap-Martin 115 kV Circuit	95	68
	Potrero Unit 3, Potrero Unit 4, and San Mateo-Martin 230 kV Cable Outage with Potrero Unit 5 in overhaul	Burlingame-Martin 115 kV Circuit	101	75
		SFIA(MA)-East Grand 115 kV Circuit	99	75
		San Mateo-Millbrae 115kV Circuit	96	75
		San Mateo-SFIA(MA) 115 kV Circuit	96	75
		Millbrae-Martin 115 kV Circuit	95	69

These results demonstrate that, under the most probable generation scenario and assuming “Medium” demand, multiple overloads will occur as early as 2005 if the Jefferson-Martin Project is not online before then. With the Project in place, by contrast, all line loadings are within acceptable levels under all examined contingencies. In short, the Jefferson-Martin Project as proposed by PG&E will solve the identified problem.

2.2.7 Conclusion

Absent a timely CPCN from the CPUC selecting an approved route and authorizing construction of the ISO-approved Jefferson-Martin Project, available supply will likely exceed peak demand in the north of San Mateo County area, thereby leading to violations of applicable planning criteria and resultant outages. The Project is needed by 2006 under each of the three most likely generation and demand scenarios. Moreover, the Project is needed by 2006 under 15 of the 24 scenarios and is eventually needed under every scenario. Prudent planning requires the Project be approved and built before any of these reasonably plausible scenarios materialize. Completion of the Jefferson-Martin Project by September 2005 will (1) ensure that the electric supply system in the north of San Mateo County area can safely and reliably meet the reasonably forecasted demand for electricity, even under scenarios involving low levels of in-City generation; (2) ensure that the electric supply system in the north of San Mateo County area remains in compliance with applicable planning criteria, even under scenarios involving low levels of in-City generation; (3) establish a second major transmission pathway into the north of San Mateo County area, thereby further improving reliability in the area; and (4) implement the April 2002 ISO Board of Governors' resolution approving the Jefferson-Martin Project (without regard to route) for addition to the ISO-controlled grid.

2.3 Description of the Project

2.3.1 Project Components

The Project components are shown on Figure 2-6 and are listed below. Detailed information on all Project components and construction methods is provided in Subsection 2.6. The Project consists of:

- Installation of a new, approximately 27-mile-long 230 kV transmission line with overhead and underground segments, with the first 14.7 miles of this line to be installed on a rebuilt version of PG&E's existing Jefferson-Martin 60 kV double-circuit transmission line and the remaining 12.4 miles to be installed in a new underground duct bank, as further described in this PEA.
- Rebuilding the existing Jefferson-Martin 60 kV double-circuit tower line to enable the east side to operate at 60 kV and the west side at 230 kV. Approximately 100 structures will be replaced.
- Construction of a new transition station near the intersection of San Bruno Avenue and Glenview Drive just east of Skyline Boulevard / Highway 35 to transition from the 14.7-mile overhead 230 kV transmission line to the 12.4-mile underground 230 kV transmission line.
- 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 as described in Section 2.3.5.

INSERT FIGURE 2-6 PROJECT COMPONENTS
PAGE 1 OF 2
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INSERT FIGURE 2-6 PROJECT COMPONENTS
PAGE 2 OF 2
(11 X 17; COLOR)

- Modification of Hillsdale Junction switching station for new 60 kV arrangement as described in Section 2.3.5.
- Access Roads: Existing access roads will be used to the extent possible. In limited areas new cross-country access and access roads will be developed as proposed in Appendix A-1, Construction Methods Report Table.
- Pull Sites: these are areas used by the construction crews to pull and tension sock lines and inductors between towers and are shown in Appendix A-1, Construction Methods Report Table.

2.3.2 230 kV Transmission Line—230 kV/60 kV Overhead Section

The Proposed Project consists of the removal of the existing double-circuit 60 kV transmission line and replacing it with a new double-circuit transmission line consisting of a single 230 kV circuit and a single 60 kV circuit (Segment 1 Overhead), between Jefferson Substation and the proposed transition station. The rebuilt line will utilize PG&E standard 230 kV transmission structures, which will be approximately 20 feet taller than the existing structures on the average. Approximately 100 existing structures will be replaced. The portion of the new transmission line between the proposed transition station and the Sneath Lane Substation will be reconductored and will remain at 60 kV. A few of these existing lattice steel poles may need to be raised approximately five feet. The Project also involves the construction of a new underground 230 kV circuit (Segment 1 Underground, Segments 2 through 5) between the proposed transition station and Martin Substation, described in Subsection 2.3.3, 230 kV Transmission Line-Underground Section.

PG&E is reconfiguring the substations so that the existing double-circuit 60 kV line can be replaced by a single-circuit 60 kV line, providing the same level of service, and maintaining the existing load of the double-circuit line.

2.3.2.1 General Description

The overhead section of the Project consists of the removal of a portion of the existing double-circuit 60 kV overhead power line to accommodate both a new single circuit 230 kV transmission line and a new single circuit 60 kV power line between Jefferson Substation and the proposed transition station. The overhead section of the Project is illustrated as the portion of Segment 1 from the Jefferson Substation to the transition station on Figure 2-6.

2.3.2.2 Location and Routing

The overhead section of Segment 1 originates at Jefferson Substation (MP 0.0) and continues northward to the proposed transition station location on the northwest corner of San Bruno Avenue and Glenview Drive (MP 14.7), as shown on Figure 2-6. For much of the route, the line travels next to I-280 with crossings over the Peninsula Watershed lands owned by the CCSF (refer to Chapter 5, Land Use, Recreation, and Agricultural Resources for further description).

The existing line is a double-circuit 60 kV line built on lattice steel towers and lattice steel poles. The rebuilt line will also be a double-circuit line with the western-most circuit energized at 230 kV. The eastern-most circuit will remain energized at 60 kV and will utilize 115 kV insulators and support hardware. This new 60 kV line will be capable of carrying the combined load of the two existing 60 kV circuits. The 230 kV circuit will be conductored with an aluminum and steel cable approximately 1.2 inches in diameter (954 ACSS 54/7 conductor). The 60 kV circuit will be conductored with a 0.85-inch-diameter aluminum and steel cable (477 ACSS 24/7 conductors).

A single 144-fiber optical groundwire will be installed the full length of the line above the 230 kV circuit to support control and protection systems for the electric facilities. The cable pulling sites identified for the transmission line will be used for installation of the conductor and optical groundwire. No shield wire will be installed above the 60 kV circuit.

With few exceptions, the new transmission line towers and poles will be replacing the existing towers and poles near their existing locations, as shown in Appendix A-2, Tower List. A preliminary overview of the proposed tower locations is shown in the Black & Veatch Plan and Profile Report accompanying the PEA. The proposed locations of the new towers are subject to further siting refinement through detailed engineering.

2.3.2.3 Structures

PG&E will use lattice steel towers throughout most of the line, as is the case with the existing 60 kV line. The exception will be at locations where existing structures consist of lattice steel poles. These existing lattice steel poles will be replaced by 230 kV tubular steel poles. A list of the existing and new tower types and heights is also provided in Appendix A. These new structures are shown in Figures 2-7, 2-8, and 2-9.

PG&E is proposing replacement of these approximately 100 towers 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.

The new transmission line towers and poles will 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. (PG&E evaluated the possibility of modifying the existing towers in place, but determined that the existing towers are generally of insufficient size and height to accommodate the proposed facilities consistent with current tower design criteria.) PG&E is currently planning to install the overhead Project using a combination of land-access or helicopter construction techniques, as described in greater detail in Section 2.5.

Within the overhead section of Segment 1, there are a number of service taps (connections) from the existing 60 kV power line. These taps will be transferred to the eastern circuit, which will remain energized at 60 kV. New tower-mounted line selector switches are expected at some tap locations.

2.3.2.4 ROW

The current easement owned by PG&E and used for the existing 60 kV power line is typically 50 feet. The ROW will need to be expanded typically to 100 feet in width, although 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 under the wires. However, since the line is located almost exclusively in open space and park lands, 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 location 7/39, the new

INSERT FIGURE 2-7

INSERT FIGURE 2-7 (BACKSIDE)

INSERT FIGURE 2-8

INSERT FIGURE 2-8 (BACKSIDE)

INSERT FIGURE 2-9

INSERT FIGURE 2-9 (BACKSIDE)

structure will be relocated outside the private property, beyond the existing ROW, and therefore, will not restrict structure heights at that location.

Portions of the overhead route are in regions known to host endangered species habitat for the Bay Checkerspot butterfly, the San Francisco garter snake, the California red-legged frog, and a number of serpentine-related rare plants (refer to Section 6, Biological Resources, for further discussion). Permits will be required from the various federal, state, and county agencies to perform the overhead line work, replace towers, and string new conductors (see Section 2.7 for a summary of permit requirements identified for the Project).

2.3.3 230 kV Transmission Line—Underground Section

2.3.3.1 General Description

The underground portion of the Project consists of a single circuit 230 kV transmission line that will begin at the transition station and 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. The underground portion of the route is depicted on Figure 2-6 and consists of the underground portion of Segment 1 and Segments 2 through 5.

2.3.3.2 Location and Routing

The 12.4 mile underground, single-circuit 230 kV transmission line section begins at the proposed transition station located at the northwest corner of the intersection of San Bruno Avenue and Glenview Drive, near Skyline Boulevard (Highway 35). The underground section is depicted in Figure 2-6 as Segment 1 Underground and Segments 2 through 5. Segment 1 Underground of the proposed route for the new 230 kV solid-dielectric cable proceeds to the east along San Bruno Avenue for 1.7 miles, crossing under I-280, to the intersection with El Camino Real. Segment 2 begins at the intersection with El Camino Real and San Bruno Avenue and continues east along San Bruno Avenue to the BART ROW, which is at the intersection of San Bruno Avenue with Huntington Avenue. The route turns north (left) and follows the BART ROW under Huntington Avenue to Sneath Lane where the BART ROW diverges to the east from Huntington Avenue following the BART ROW to McLellan Drive for 3.4 miles (Segment 2, Project Milepost (MP) 0.0 to MP 3.4).

Segment 3 follows the McLellan Drive Extension to Hillside Boulevard, then follows Hillside Boulevard to Hoffman Street in Daly City. The McLellan Drive Extension is a street currently under construction by the City of South San Francisco. McLellan Drive will connect El Camino Real and Hillside Boulevard, along the border of the Town of Colma and City of South San Francisco. The proposed 230 kV transmission line route turns northeast (right) from the BART ROW at the South San Francisco Station along Mission Road, follows the alignment of McLellan Drive to Hillside Boulevard, and proceeds northwest on Hillside Boulevard for 2.2 miles to Hoffman Street (Segment 3, MP 0.0 to 2.2).

At the intersection of Hillside Boulevard and Hoffman Street, the route then turns northeast (right) on Hoffman Street for 0.45 miles, proceeding northwest (left) on Orange Street for 0.2 miles to the intersection of Orange Street and Guadalupe Canyon Parkway (Segment 4, MP 0.0 to 0.7).

In Segment 5, the route then proceeds northeast within Guadalupe Canyon Parkway for 3.7 miles, turns north (left) on Bayshore Boulevard for 0.7 miles to enter the southern side of

Martin Substation. The approximate length of the underground section is estimated to be 12.4 miles.

2.3.3.3 Structures and Equipment

The underground transmission line will consist of three, cross-linked, polyethylene-insulated (XLPE) solid-dielectric, copper-conductor cables in a buried concrete-encased duct bank system. The trench for the duct bank system will typically be approximately 2 feet wide and 6 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 2-10, 2-11, and 2-12). The duct bank will hold four 6-inch polyvinyl chloride (PVC) ducts. The 230 kV cable system will include fiber optic wires to monitor the operating temperature of the underground cables. An additional fiber optic cable will be located in a 4-inch PVC duct, which will provide for substation communication and protection. The cable system will be designed to carry a minimum load of 420 megavolt-amperes (MVA). The duct-bank will be routed primarily in public street ROW within the BART ROW between San Bruno Avenue and the proposed McLellan Drive extension and under Guadalupe Canyon Parkway to Bayshore Boulevard.

2.3.3.4 ROW

During the construction of the facilities, a temporary construction easement will be required. The width of the work space within the existing roadway will be set forth by the encroachment permits to be issued by the cities. A conceptual depiction of the ROW activities for the underground 230 kV transmission line is shown in Figure 2-13.

2.3.4 Transition Station

As discussed above, the Project will require a transition station to accommodate the change from the 230 kV overhead to the underground line.

A transition station is needed to bring the overhead circuit to underground. The proposed station is located at a Caltrans parcel near San Bruno and Skyline Boulevard and is depicted in Figure 2-14. Roadwork and grading will be needed before construction of the transition station in the open area parcel. The transition station will be set back approximately 25 feet from Glenview Drive and about 50 feet from San Bruno Avenue. The station will have an 8-foot-high masonry wall, enclosing an area approximately 80 feet by 100 feet. A ground grid and conduit system will be installed. Besides a dead-end structure for the incoming 230 kV overhead circuit and support structures for cable terminations and surge arresters, there will be a control building and underground vault within the masonry wall enclosure, approximately 10’ x 10’ x 13’, erected to house protection and telecommunication equipment. The control building will be within the masonry wall enclosure. Installation and dimensions of the underground vault will be about 24' X 10' X 10' outside dimensions.

2.3.5 Substations

2.3.5.1 Jefferson Substation

Jefferson Substation is east of I-280 and is accessed by Cañada Road, about 1 mile south of Edgewood Road in San Mateo County (MP 0.0). The transmission substation currently receives 230 kV power from Monta Vista Substation in Cupertino, Santa Clara County.

Insert Figure 2-10

[8.5 X 11 B&W]

INSERT FIGURE 2-10 (BACKSIDE)
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INSERT FIGURE 2-11
[8.5 X 11 B&W]

INSERT FIGURE 2-11 (BACKSIDE)
[8.5 X 11 B&W]

INSERT FIGURE 2-12
[8.5 X 11 B&W]

INSERT FIGURE 2-12 (BACKSIDE)
[8.5 X 11 B&W]

INSERT FIGURE 2-13

INSERT FIGURE 2-13 (BACKSIDE)
[8.5 X 11 B&W]

INSERT FIGURE 2-14

INSERT FIGURE 2-14 (BACKSIDE)
[8.5 X 11 B&W]

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 Project will originate at Jefferson Substation. In addition, the existing double-circuit 60 kV line that will be changed to a single circuit will be replaced originating at the Jefferson Substation. Work necessary to accommodate the Project includes equipment modifications within the substation and the relocation and addition of transmission poles, as described below. The main modifications to the existing Jefferson Substation are depicted on Figure 2 15.

To prepare for the new 230 kV circuit, some of the existing equipment in the existing 230 kV yard of the substation will be removed and new equipment will be added nearby or in place of the previous equipment. The replacement and rearrangement will require modification to the existing fenceline and substation perimeter road within the existing substation boundaries. The existing Jefferson 230 kV single bus will 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 230 kV Monta Vista lines will be relocated and terminated on the new 230 kV ring bus with dead-end structures. To be able to relocate the existing 230 kV Monta Vista lines, the transmission line Tower 19/84 will be relocated to the east of the existing tower location within the existing parking lot area, and the existing location will 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 will be moved to a new location within the existing parking lot in a disturbed nonnative grassland area. The new tower is farther from the road and is better screened by the perimeter landscaping. The old tower next to the road will be removed.

The existing Transformer Bank No. 1 230 kV cable termination will be relocated from the existing 230 kV bus and terminated on the new 230 kV ring bus with a dead-end structure. This includes 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 (TSP 0/1) will 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 will be expanded to cover the new equipment.

Four dead-end structures (refer to Figure 2-16 for depiction of a similar dead-end structure) will 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 are located within an existing graded area screened from Cañada Road.

To install the new 230 kV ring bus, PG&E will relocate the existing fence and roadway and grade within the existing 230 kV yard for the new ring bus. The fenceline will 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 will be expanded to the new fenceline to enable operations and maintenance vehicles to access the substation equipment. Grading, including selective removal of trees for the fence and road relocation, in addition to the equipment installation, will be minor and is planned to occur within the substation property and away from Cañada Road.

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

Other modifications to the Jefferson Substation include upgrades to control and protection systems, which will occur within the existing substation fenceline. Finally, some minor modifications will be required to Tower 19/83 of the Monta Vista-Jefferson 230 kV tower west of I-280, to realign the line with the new location of Tower 19/84.

2.3.5.2 Ralston Substation

Ralston Substation is northeast of the I-280 and SR-92 junction and is accessed from the east, using a local existing access road at MP 5.1 (see Existing Land Use, Figure 5.3, Map 2). The existing 60 kV Ralston Substation will be looped through by the new single 60 kV circuit from the Watershed Tap at MP 2.7 (see Section 2.3.3.2). A station bypass switch will be added; existing 60 kV Motor Operated Air Switches (MOAS) and the high-side bus will be upgraded to handle higher through-current. Existing 60 kV MOAS lattice steel structures will be replaced by four new dead-end structures, similar to the transition station dead-end structure (refer to Figure 2-15 for depiction of similar structures). The dead-end structures will be a typical, H-frame configuration for tap line pull-off structures, constructed of steel and approximately 35 feet high. The dead-end structures will 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 will 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) will replace the existing lattice steel Tower 5/27 and wood pole tap structures.

As a result of the additional required ground clearance, the new tower will be approximately 20 feet higher than the existing tower. The station ground and conduit system will be modified and expanded within the existing footprint.

2.3.5.3 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 (see Chapter 5, Existing Land Use, Figure 5.3, Map 2). The bus arrangement at the existing Hillsdale Junction Substation will 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, and Hillsdale Junction and Carolands substations. A string bus will be removed to accommodate the two breakers to be installed at the substation. The work for the bus and breaker modification will take place within the existing substation fenceline. A new, single-circuit TSP (no tower number) will be installed outside and to the west of the existing substation footprint, north of new Tower 6/35.

INSERT FIGURE 2-15
[8.5 X 11 B&W]

INSERT FIGURE 2-15(BACKSIDE)
[8.5 X 11 B&W]

INSERT FIGURE 2-16

[8.5 X 11 B&W]

INSERT FIGURE 2-16 (BACKSIDE)
[8.5 X 11 B&W]

2.3.5.4 Carolands Substation

The Carolands Substation is located at MP 8.8, east of Skyline Road, which provides access (see Chapter 5, Existing Land Use, Figure 5.3 Map 3). The substation will 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. No construction is planned at this substation location.

2.3.5.5 Martin Substation

The Martin Substation is located to the southwest of the intersection of Bayshore Boulevard and Geneva Avenue. Relocation of fence, roadway, existing wood poles and TSPs near the southern perimeter of the substation will be performed 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 2-16).

A new, complete 230 kV breaker-and-a-half bus bay with three new breakers and disconnect switches will 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. The plan is 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 TSPs would be replaced with new TSPs of the same height.

After the new 230 kV bay is constructed, the existing 230 kV HZ-1 Martin-Embarcadero underground cable will be moved to one of the new bay positions. This arrangement allows the new 230/115 kV, 420 MVA, transformer bank placed next to the existing Transformer Bank No. 7. Termination of the new bank will be located in the area vacated by the HZ-1 cable. This work would take place within the existing fenceline.

At the 230 kV yard, new cable terminations and switchable series line reactors will be installed. The fenceline will 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 fenceline expansion is proposed to allow access to the equipment. The 8 to 24 Ohms range reactors (8 Ohms per step) will be equipped with bypass circuit switchers, surge arresters, disconnect switches, and bypass switch.

With the addition of the new 230/115 kV transformer bank, the entire 115 kV bus would need to be reconductored to 4” aluminum (AL) tubing and bundled 2300 kcmil AL cable. Five new breakers are needed 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 115 kV bus and would be approximately 25 feet in height.

2.3.5.6 Monta Vista and Millbrae Substations

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

2.3.5.7 San Mateo Substation

A switchable series reactor with 8 to 16 Ohms range (8 Ohms per step) will replace an existing 8-Ohms series reactor on the San Mateo-Martin 230 kV Underground Cable No. 1. The new reactor will be complete with one circuit switcher, three disconnect switches, and one bypass switch. The new series reactors, a circuit switcher and disconnects will be located in the area presently used by the Substation Construction Field Office. The trailer office will be relocated prior to construction. It is planned to be relocated on-site within the existing fenceline and disturbed area.

The new series reactor bypass switch will be placed in the area vacated by the existing reactors. The new equipment will be of 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.

2.3.6 Taps (60 kV Connections)

2.3.6.1 Watershed Tap

The Watershed Tap is the first tap off the 60 kV circuit from Jefferson, at MP 2.7. Existing lattice steel Tower 2/17 at the Watershed Tap will be replaced by two tubular steel poles, new Tower 2/16A and 2/16B. The tap connection to Watershed Substation will be coming off the pole located on the east side. A three-way switch will be mounted on that pole to allow operational flexibility.

2.3.6.2 Crystal Springs Tap

Between Hillsdale Junction 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 Spring tap will be reconnected to the single 60 kV circuit, which is on the east side of the proposed new tubular steel pole, Structure 7/39. The new TSP will replace the existing TSP. During construction of this segment of the line, the San Francisco Public Utilities Commission (SFPUC) has indicated that generators will need to be provided for the Crystal Springs pumps.

2.3.6.3 Millbrae Tap

Tower 12/78 at Millbrae Tap will be replaced near MP 12.4. The tap will be reconnected to the 60 kV circuit on the east side of the newly built tower line. The existing line selector switches mounted on the tower will be replaced but the status of these switches will remain unchanged.

2.3.6.4 San Andreas Tap

The San Andreas Tap will be reconnected to the 60 kV circuit on the east side of the newly built TSP 12/81A at approximately MP 12.9.

2.3.6.5 San Bruno Tap Connection

The San Bruno tap at MP 14.4 will be reconnected to the 60 kV circuit on the east side of the newly built Tower 14/93B.

2.4 Project Facilities Detail

Table 2-5 summarizes the primary facilities and equipment associated with all Project components.

TABLE 2-5
Summary of Project Facilities Modifications

Jefferson Substation Modification

- Remove existing 230 kV bus and install 230 kV ring bus
- Install transformers
- Install control, protection, and communication equipment
- Install 4 230 kV breakers with disconnect switches
- Install 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 TSP within substation
- Install new TSP 0/1A within fenceline on far side of the substation from Cañada Road
- Install four new dead-end structures
- Remove two wood poles

230 kV Overhead Transmission Line Facility

- 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

TABLE 2-5
Summary of Project Facilities Modifications

60 kV Overhead Transmission Line Facility

- Voltage: 60 kV (Insulated at 115 kV)
- Conductors: Single-Circuit, 477 kcmil ACSS, each circuit with three phases
- Minimum ground clearance: 30 feet
- Conductor diameter: 0.846 inches
- Shield wire/fiber optic: See 230 kV description, above
- Structure types: See 230 kV description, above
- Structure heights: See 230 kV description, above
- Approximate distance between structures: See 230 kV description, above

230 kV Underground Transmission Line Facilities

- 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)
- 230 kV splices, 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 Structure

- 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
- Total number of dead-end structures: 1
- Install masonry wall around transition structure site
- Install control building

TABLE 2-5
Summary of Project Facilities Modifications

Hillsdale Junction Switchyard

- Remove string bus
- Install two 60 kV breakers
- Install new TSP to west of existing fenceline

San Mateo Substation

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

Ralston Substation Modification

- 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 TSP along southern border

Martin Substation Modification

- Install three, 134 MVA, 230/115 kV transformers
- 230 kV underground termination structure (1)
- 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
- Install series reactor (230 kV) with circuit switcher bypass
- Install control, protection, and communication equipment

System Protection

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

2.5 Project Construction

This section includes an overview of construction methods typically used for construction of the overhead and underground transmission lines and for substation modifications. An overview of equipment expected to be used is presented first, followed by construction activities and methods.

2.5.1 Equipment

Equipment that is expected to be used during construction of the Project is listed in Table 2-6.

TABLE 2-6
Equipment Expected to be Used During Construction

Equipment	Use
Equipment Required for Overhead Construction:	
Crawler tractor	Road construction
Motorized grader	Road construction
Tractor-mounted backhoe	Install drainage
Truck-mounted auger	Install fences and poles
½-ton pickup	Transport personnel
Crew-cab truck	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)	Install conductor
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)	Install conductor
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	Install conductor
Converter dolly	Install conductor
4x4 SUVs	Transport personnel
Concrete Pump Truck	Foundation
Boom Truck	All construction activities
Worker-lift	Lift workers to perform work on structures
4x4 ATV	Install conductor
Water truck	Fire control, dust control
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

TABLE 2-6
Equipment Expected to be Used During Construction

Equipment	Use
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

2.5.2 Segment 1—230/60 kV Double-Circuit Overhead Transmission Line

Approximately 14.7 miles of overhead transmission line would be installed from Jefferson Substation to the new transition station. The proposed transmission line is a single circuit 230 kV and single 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, as detailed in Appendix A.

2.5.2.1 ROW Requirements

An easement of typically 100 feet wide is required for 230/60 kV double-circuit transmission line, although some specific locations may vary slightly, depending on final engineering. The easement width is specified by the CPUC's General Order 95 related to safe conductor clearances that are dependent upon the lateral distance between the conductors, and the swing of the conductors caused by wind.

2.5.2.2 Construction Activities and Methods

The procedures for bringing personnel, materials, and equipment to each structure site, constructing the supporting structure foundations, erecting the supporting structure, stringing the conductors, and removing the existing structures will vary along the route alignment. PG&E will generally construct the transmission line in the following four steps:

> *Step 1—Site Access Preparation.* PG&E is proposing to use temporary staging sites in addition to the Jefferson Substation and the 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 will be identified as part of the helicopter operation Lift Plan to be developed, as described in Chapter 11, Hazards and Hazardous Materials. The area to be traversed is mostly owned by the CCSF. Once identified, these areas will be subject to preconstruction surveys and environmental analyses.
>
> The majority of the tower sites are accessible from existing paved and dirt roads. However, some tower sites will require establishment of cross-country access roads or reestablishment of existing roads that have been out of service and have vegetation encroachment. Table 2-7 summarizes the tower sites for which access road improvements are proposed. Appendix B-7 lists an estimated nine access roads that may need vegetation removed.
>
> An estimated three access roads will be lengthened over grassland areas to access tower sites that have no existing access. These extended roads will require grading. One access road is estimated to require grading to reestablish the existing road. Of those roads to be reestablished, the installation of a temporary bridge may be used near Tower 1/12 to avoid disturbance to an intermittent drainage and associated riparian vegetation. An alternative would consist of creating a new access road around the end of the incised portion of the canyon.

TABLE 2-7
Overhead Construction Access Road Improvement

New Tower Number	Type of Improvement Proposed
1/9	Lengthen existing unpaved access road by vegetation clearing and grading
1/12	Install temporary bridge over incised portion canyon, or establish unpaved access road by crossing grassland in vehicle
3/21	Reestablish existing unpaved access road by grading
4/25	Lengthen existing unpaved access road by grading
11/72	Lengthen existing unpaved access road by grading

> In accordance with proposed mitigation measures to protect biological resources, PG&E will flag and avoid areas determined to be environmentally sensitive.

Step 2—Installing the Supporting Structure Foundations.

PG&E will install drilled pier, spreadfooting, direct buried steel mat (grillage) type footing, and/or other foundations at each new structure site for the overhead transmission line.

Material removed during the process will be placed in a location specified by the landowner and/or disposed of according to all applicable laws. Temporary disturbance around each structure site will be limited to approximately a 100-foot diameter centered on the tower. Disturbance will consist of soil compaction from placement of crane outrigger pads and from vehicle tracks, as well as movement of workers and equipment. Restoration of disturbed areas is addressed in Chapter 6, Biological Resources.

- **Lattice Steel Towers.** Placement of lattice steel towers will require four foundations, one for each structure leg. For drilled pier foundations, each hole will be about 4 feet in diameter and 11 to 15 feet deep. Workers will place reinforcing steel in each hole along with stub angles, which formulate part of the tower leg itself. Concrete forms that reach up to 2 or 3 feet above natural ground level will be placed over each hole, and concrete will 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) will be approximately 2-½ feet, dependent on localized soil parameters and final structure design requirements.

  For spread footings, a rectangular concrete pad will be constructed for each tower leg. The size of the pads will vary depending on the requirements of the structure, but generally the pads will be 6’ x 6’ and will be buried below the natural ground surface. A concrete projection similar to that of a drilled pier foundation will extend approximately 2 feet above natural ground level. Reinforcing steel and stub angles similar to those used in the drilled pier foundations will be used. The diameter of the concrete forms above ground (tower footings) will be approximately 2-½ feet.

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

- **Tubular Steel Poles.** Placement of tubular steel pole structures will require the use of a large auger to dig the foundation hole. The foundation hole will be between approximately 5 feet and 7 feet in diameter and from 15 to 30 feet deep. A cage of reinforced steel and with anchor bolts will be installed and concrete will be placed in the hole. During the concrete curing period of 1 month, workers will remove the concrete forms and restore the ground around the foundations.

Step 3: Removal of Existing Facilities

After access routes have been established and the new foundations installed, the existing line will be dismantled and removed by section. PG&E system loading and operational constraints on the existing lines will not allow for the dismantling and removal of the entire line at one time. Each section of line between the existing substations will have to be de-energized, dismantled, removed, replaced, and 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 Project and meet all operational and environmental constraints.

Before line dismantling begins, temporary crossing guard structures will be installed at all road crossings, railroad 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 will be placed at the edge of the roadway and will not require grading. Where lines will be pulled across Caltrans facilities, such as I-280, SR92, and SR35, (Skyline Boulevard), Caltrans typically requires that either a net is installed over the highway or traffic is halted and the roads closed temporarily as lines are pulled. Temporary closures of freeways would be required as well during transport of equipment and materials for tower installation and removal by sky-crane. These closures will be performed in accordance to permits which typically require closures to be during low traffic flow times. See Chapter 13, Transportation/Traffic, Impact 13.1 for a more detailed discussion.

Conductor removal preparation activities require locating 38 pull and tension sites, ranging from approximately .02 to 1 acre in size. Refer to Appendix A-3, Cable Pulling Sites Table for the cable pulling sites and for the dimension of each site. (These sites will also be utilized for the new conductor installation on the new line towers after dismantling and removal.)

The conductor removal operation begins with the unclipping of the conductor from the existing insulator string and installing the conductor in stringing blocks. The stringing blocks are rollers attached to the lower end of the insulators. The sheaves 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) is attached to the existing conductors. After the conductors are attached to the sock line, they are pulled out using the reverse tension stringing method. 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 will be left in place for use during the installation of the new conductors.

After the removal of the conductor, the structures will be dismantled and removed by either conventional methods using cranes or by aerial methods using helicopters. The structures will be dismantled and hauled away from either the site or the staging area by truck.

After the existing towers have been removed, the existing foundations would be jack-hammered to 18 inches below grade, debris removed and the hole backfilled with soil and replanted.

Step 4 —Erecting the Supporting Structures

The new supporting structures for the Project will be erected in sections between substation and/or tap locations to enable existing service to continue during construction. The substations and/or tap locations that will comprise the construction sections are presented in Section 2.5.1.4. The specific new structures that will comprise each construction section are provided in Appendix A and the construction duration at each of the construction sections will range from 4 to 12 weeks, dependent on the number of new structures to be installed and the construction methods that will be used at each structure site. The new towers will be installed by either conventional methods or by helicopter, as detailed in Appendix A, for each new structure.

When equipment or material is carried across a roadway by sky-crane, including I-280, SR92 and SR35, and other public roads, temporary traffic closures will be required as described in Chapter 13, Transportation / Traffic, Impact 13.1.

- **Lattice Steel Towers.** The double-circuit lattice steel towers will have three vertical support levels, each supporting two phases consisting of a single conductor on each side of the tower. The western circuit will be operated at 230 kV, and the eastern circuit is operated at 60 kV. Figure 2-7 and 2-8 illustrate typical double-circuit lattice steel tower configurations.

  Steel tower components, packaged in bundles by tower type, will be dispatched to the staging areas or to the tower site itself. Individual towers that are assembled immediately adjacent to the tower foundations will be raised into place using a large crane. A smaller crane will 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 will be transported to the tower locations by helicopter.

  For installation by helicopter, a typical tower will require two to three “lifts” or trips to each lattice tower location. The first lift will transport the lower portion of the tower and subsequent lifts will transport the upper portion(s) of the tower. After the structure is set on the foundation, crews will tighten all bolts, attach insulators to the crossarms, and prepare the towers for the conductor stringing operation. Refer to Appendix A-1, Construction Methods Report Table for preliminary determination of the structure construction method (crane or helicopter) for each structure of the overhead transmission line

- **Tubular Steel Poles.** The double-circuit tubular steel pole structures will also have three cross arms, each supporting a phase conductor on each side of the cross arm. Figure 2-9 illustrates a typical tubular steel pole structure. The pole shafts will be delivered to the pole site in two or more sections. For safety and ease of construction, the poles will be assembled on the ground. The sections will be pulled together with a winch and the cross arms bolted to the pole. Insulators will be attached to the cross arms and secured. A large crane will erect the poles and set them on the anchor bolts embedded in the concrete foundation. Finally, the securing nuts on the foundation will be tightened.

Step 5—Conductor Stringing

Before conductor installation begins, temporary clearance structures will 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 will 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 will be placed at the edge of the roadway and will not require grading; they will not interfere with traffic. These structures will prevent the conductor from being lowered or falling into the traffic below.

Conductor installation preparation activities will use the same pull and tension sites described in Step 3, 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 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.

When the pull and tension equipment is set in place, a sock line (a small cable used to pull in the conductor) is pulled from tower to tower using a helicopter to place the sock line into the sheaves. After the sock line is installed, the conductors are 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 are adjusted to a pre-calculated level. The conductors are then clamped to the end of each insulator as the sheaves are removed. The final step of the conductor installation is 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 will be picked up and hauled away for recycling or disposal during construction. PG&E will conduct a final survey to ensure that cleanup activities have been successfully completed as required.

2.5.2.3 Substation Modifications

New structures in the Jefferson and Martin substations and at the other substation and tap sites as detailed in Section 2.3.3 will be developed within the existing property line and generally within areas previously disturbed for substation access. Reinforced concrete footings and slabs will be constructed to support structures and equipment. PG&E will extend the existing buried conduit installation to cover the expanded area for the electrical control and communication cables. PG&E will extend the existing grounding mat to cover the modified area and install gravel over the new area to match the existing gravel level.

Structures will be erected to support busses, circuit breakers, switches, overhead conductors, instrument transformers and other electrical equipment, as well as to terminate incoming transmission lines. PG&E will use structures as detailed in Section 2.3.3. Structures within the substation will be grounded to the station grounding grid. Workers will set the equipment on slabs and footings, and will 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 and tap structure modified for the Project, a temporary electrical solution (commonly referred to as a "shoo-fly") will be installed to ensure that the substation remains in service during the modifications. Near the existing tap structures at each location, 1 to 3 (depending on the orientation of the wires) wood poles will be placed in the ground without foundation and guy-wired for stability. The temporary tap structures will connect the conductors as necessary for the substation to remain in service.

2.5.2.4 Construction Duration and Workforce

The length of time required for constructing the overhead 230 kV transmission line for the Project along PG&E's proposed route 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 clean-up. The estimated construction duration for each section between the substations and tap structures will vary, as presented in Table 2-8.

TABLE 2-8
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 estimate of 24 separate construction crews will be needed to perform the site preparation, foundation installation, tower removal/installation, substation modifications, conductor stringing and clean-up. Each major construction activity will be performed by between two and six crews, and each crew will 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.

2.5.3 230 kV Underground Transmission Line—Segment 1 Underground and Segments 2 through 5

Figure 2-13 depicts the typical underground construction process within roadways. Approximately 13 miles of underground 230 kV single-circuit transmission line would be installed from the 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 will be used to design backfills, circuit alignments, and foundations before construction. Soil information will be provided to construction crews to inform them about soil conditions and utility locations. As described in Chapter 11, Hazards and Hazardous Materials, if hazardous materials are encountered in soils from the trench, work will be stopped until the material is properly characterized and appropriate measures are taken to protect human health and the environment. Hazardous materials will 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 will be used during construction, as described in Chapter 14, Air Quality, and Chapter 9, Hydrology and Water Quality. These methods include installation of sediment and erosion control measures according to best management practices (BMP) to protect biological resources, roadways, and adjacent properties. Watering for dust control will also be employed.

2.5.3.1 ROW Requirements

Most of the proposed underground transmission line will be installed in city streets pursuant to PG&E's existing franchise agreements with local governments. However, PG&E will need to acquire private ROW from BART for the portion of the proposed route from San Bruno Avenue to McLellan Boulevard Extension (Segment 2). With respect to this portion of the route, a permanent easement of 25 feet wide is typically required for the 230 kV underground transmission line. The final easement width will be determined through consultation with the BART Authority. In addition, final engineering will determine whether additional permanent or temporary ROWs will need to be acquired from other private property owners.

PG&E will restrict installation of any above-ground structure or foundation within any easement areas. Deep-rooted vegetation that could compromise the integrity of the electric system will also be restricted. Conditions of the easement will 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 as described in Chapter 13, Transportation / Traffic. 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 will 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 will obtain roadway encroachment permits from the local jurisdictions and will submit a traffic management plan subject to agency review and approval.

2.5.3.2 Construction Activities and Methods

As illustrated in Figure 2-13, the major construction activities associated with installation of underground cable are as follows:

Step 1 – Trenching/Duct Bank Installation

Prior to trenching, PG&E will 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 will be removed. The pavement will be broken into manageable pieces for removal. The typical trench for duct bank installation would be approximately 2 feet wide, with a depth of 6 to 7 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 permitting. Provisions for emergency vehicle and local access will be provided. The width of the work space will be as set forth in the encroachment permit to be issued by the cities.

As the trench for the underground 230 kV transmission line is completed, PG&E will install the cable conduit, reinforcement bar, ground wire, and concrete conduit encasement (duct bank). As discussed above, the typical trench for duct bank installation would be approximately 2 feet wide, with a depth of 6 to 7 feet. 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 (see Figure 2-10, 2-11, and 2-12). 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 will 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 (Figure 2-10). Typically, the duct bank will consist of four 6-inch PVC conduits positioned in a two-by-two arrangement. As shown in Figure 2-10, the underground cables would then be contained within the 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 5-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 will 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 will 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 will pull each cable segment into the conduit bank and splice at several predetermined locations (vaults) along the route and terminate cables at the transition station and the Martin Substation. Cable will be pulled through individual ducts at the rate of completing two of the three segments between vaults per day.

Step 4 – Cable Splicing and Termination

After cable installation is completed, the cables will be spliced at all vaults. A splice trailer would be located directly above the 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 hours would be 8 to 10 hours per day, similar to splicing.

Step 5 – Special Construction Methods (Horizontal Dry Boring)

In parallel to the main tasks outline above, a horizontal bore (jack and bore) of steel casings will 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 will be installed under each concrete channel at least 5 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 racked PVC conduit bundles would be arranged in a circular pattern. The conduit bundles would be 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 3 weeks.

Step 6 – 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 trench and vaults.

In roadways, trucks will be used to off-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, as described in Chapter 13, Transportation/Traffic. 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 will restore all paved surfaces, restore landscaping or vegetation as necessary, and clean up the job site.

2.5.3.3 Construction Duration and Workforce

The length of time required for constructing the underground 230 kV transmission line for the Project 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 duration for each segment will vary, based on the length of each segment and is summarized in Table 2-9.

TABLE 2-9
Estimated Construction Duration for Underground Transmission Line

Project Segment	Affected Streets	Construction Duration (approximate)
Segment 1	San Bruno Avenue	6 to 7 months
Segment 2	BART ROW	9 to 11 months, including completing bore work at completion of vault installation task (approximately 1 month per bore)
	Twelve Mile Creek Bore	
	Colma Creek Bore	
Segment 3	McLellan Extension	5 to 6 months
	Hillside Boulevard	
Segment 4	Hoffman Street	6 to 7 months
	Orange Street	
Segment 5	Guadalupe Canyon Parkway	6 to 7 months
	Bayshore Boulevard	

An estimated total of 15 separate construction crews will perform the trenching, vault installation, cable pulling and splicing work, including 1 crew to perform the bore work at the creek crossings. Each major construction activity will be performed by between 1 and 5 crews and each crew will range from 4 to 22 crew members, for a total of approximately 150 to 250 crew members for these tasks.

2.5.4 Potential Service Interruptions During Construction

Interruption to electric service for customers of the existing 60 kV line will be avoided 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 is the Crystal Springs Watershed Tap; work in this area will require service to be temporarily lost at this tap, which serves the Crystal Springs pumps. Generators will be temporarily installed at this isolated location to provide service during construction.

In addition, potential interruption in utility services for the entire Project will 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.

2.6 Operation and Maintenance Procedures

2.6.1 General System Monitoring and Control

Substation monitoring and control functions will be connected to the existing PG&E computer system by a telecommunication circuit. Protective relay communication will be through a power line carrier system.

2.6.2 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 will ensure continued safe operation of the Project. PG&E will inspect all of the structures from the surface annually for corrosion, misalignment, and excavations. Ground inspection will occur on selected lines to check the condition of hardware, insulators, and conductors. This inspection will include checking conductors and fixtures for corrosion, breaks, broken insulators, and failing splices.

The number of trips and vehicles used expected for operations and maintenance procedures for the Project will be similar to that for the existing double-circuit 60 kV overhead transmission line. No increases in frequency of inspections or maintenance are expected as a result of the Project in the overhead section, over the inspections and maintenance currently required for the existing towers and line.

2.6.3 Operation and Maintenance Procedures

2.6.3.1 General System Monitoring and Control

System monitoring and control functions will be connected to the San Mateo Center at the San Mateo Substation and the Golden Gate Distribution Operations computer system at Martin Substation. Protective relay communication will be through a power line carrier system. Relay action would cause an alarm to come on at San Mateo Substation, prompting reference to the Supervisory Control and Data Acquisition (SCADA) system and appropriate corrective action.

In PG&E's Planning Memorandum #94-01, the Computer and Network Operations (CNO) Department has validated the design criteria currently used in planning and designing the telecommunications networks that service electric operations applications. This validation 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 will exceed 99.999 percent (<5.23 minutes / year).
6. Telecommunication transit time in the channel will be less than 8 milliseconds.

(Design Criteria Reference: Western Systems Coordinating Council (WSCC) Reliability Criteria for Transmission System Planning (Rev. 12/109/92), page G-10: PG&E and other member systems in the WSCC have agreed to abide by the WSCC Reliability Criteria.)

PG&E's Protection Engineering specified that the proposed Jefferson-Martin 230 kV 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 protection relaying applications.

The primary path would use the tower line in the form of one optic ground wire strung along the conductors. This would provide dedicated fiber strands for the relaying equipment.

The alternate path would travel 3.3 miles on a 115 kV transmission pole line, 2.56 miles on distribution pole lines, and 0.34 mile in conduits from Jefferson Substation to Redwood Substation, where it would join an existing fiber cable that goes to Martin Substation via San Mateo Substation.

Because the alternate path consists of adding wire to existing transmission and distribution poles in an operation similar to regular on-going maintenance measures, no impacts would result from this portion of the Project.

2.6.3.2 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 will 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 Project.

Collection devices used to collect the data 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 will 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 6 months.

Data stored in microprocessor relays and fault recorders, and additional data stored in remote terminal units or data concentrators, will be downloaded at the request of Operations Engineering or System Protection following significant system events. These data will be stored in electronic form by the requesting department for not less than 6 months. Data will be stored so that it can be transmitted to the CAISO for analysis.

2.6.3.3 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, will ensure continued safe operation of the Project. PG&E will inspect all of the structures from the surface annually for corrosion, misalignment, and excavations. Ground inspection will occur on selected lines to check the condition of hardware, insulators, and conductors. This inspection will include checking conductors and fixtures for corrosion, breaks, broken insulators, and failing splices.

PG&E guideline G006 Rev. 1 outlines a uniform process to be used in the prioritization and inspection of overhead transmission lines to which the proposed Jefferson-Martin 230 kV Project would be subjected. The guideline incorporates Reliability Centered Maintenance (RCM) philosophies and is consistent with 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; the best position for visual inspection of the various components; provide a consistent system-wide methodology for the types of inspection being performed; and describe maintenance tasks that can be performed by one or two person inspection crews.

2.7 Permit Requirements

The CPUC is the lead agency for this Project under CEQA. In accordance with CPUC General Order 131-D, PG&E is submitting this PEA as part of its Application for a Certificate of Public Convenience and Necessity (CPCN) for this Project. As needed, PG&E will also obtain permits, approvals, and licenses from, and will participate in reviews and consultations with, federal, state, and local agencies as shown in Table 2-10.

TABLE 2-10
Permit Requirements

Permits	Agency	Jurisdiction/Purpose
Federal Agencies		
Nationwide or Individual Permit (Section 404 of the Clean Water Act)	U.S. Army Corps of Engineers	Waters of the United States, including wetlands
Section 7 consultation (through U.S. Army Corps of Engineer’s review process)	U.S. Fish and Wildlife Service (USFWS)	Consultation on federally-listed species; incidental take authorization (if required)
Lift Plan Permit	Federal Aviation Administration (FAA)	Helicopter Construction Plans

TABLE 2-10
Permit Requirements

Permits	Agency	Jurisdiction/Purpose
Section 106 of the NHPA Review (through U.S. Army Corp of Engineer's review process)	Advisory Council on Historic Preservation	Cultural Resource Management Plan (if appropriate)
State Agencies		
Certificate of Public Convenience and Necessity	CPUC	Overall Project approval and CEQA review
National Pollutant Discharge Elimination System—General Construction Storm Water Permit	California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region	This permit applies to all construction Projects that disturb more than 5 acres
Section 401 Water Quality Certification (or waiver thereof)	RWQCB	Requests RWQCB's certification that the Project is consistent with state water quality standards
Road Closures	Caltrans	I-280, SR92, and SR35 closures during sky-crane material overflights
Endangered Species consultation	California Department of Fish and Game (CDFG)	Consultation on state-listed species; incidental take authorization (if required)
Section 1601 Streambed Alteration Agreement	CDFG	Modifications to shoreline protection at San Andreas Lake
Consultation (through CEQA review process)	State Historic Preservation Officer	Cultural resources management (if appropriate)
Authority to Construct/Permit to Operate	Bay Area Air Quality Management District	Demolition of existing towers
Local Agencies		
Habitat Conservation Plan (HCP) Site Activity Permit	San Mateo County	Work in Guadalupe Canyon Parkway
Roadway Encroachment and Closure Permit	San Mateo County	Permit to install guard poles in roadway ROW, temporary road closures
Roadway Encroachment and Closure Permit	City of Brisbane, Daly City, Town of Coma, Town of Hillsborough, City of South San Francisco, City of San Bruno	Permit to install guard poles in roadway ROW, temporary road closures
Grading and Building Permits	City of Brisbane, Daly City, Town of Coma, Town of Hillsborough, City of South San Francisco, City of San Bruno	Permission to conduct grading and building activities
Trail Closures	San Mateo County Parks and Recreation/SFPUC	Permission to close trail during construction

2.8 Agency Information Program

PG&E reviewed the proposed route with Assemblyman Lou Pappan, administrative agencies, and staff at the federal, state, regional, and local levels, as well as with members of the environmental community and local property owners. A summary of the comments received on the Project is provided in PG&E’s Application for a CPCN.

2.9 Intended Uses of a CPUC EIR

Assuming that the CPUC prepares an EIR to evaluate the potential impacts of the Jefferson-Martin Project, it is anticipated that the EIR will be used by the CPUC as the CEQA document for the CPUC's consideration and approval of the Jefferson-Martin Project.

The EIR will also be used by other state and local agencies acting as responsible agencies under CEQA. The state and local agencies anticipated to be acting as responsible agencies are listed in Table 2-10.

The EIR may also be used by federal agencies as part of the information considered by the agency in making approval decisions that may be required for the Project. Federal agencies that might use the EIR in this way are listed in Table 2-10.

Finally, the EIR may be used as the CEQA document for any additional agency approvals that are either necessary or desirable for implementation of the Jefferson-Martin Project.

2.10 Project Schedule

Figure 2-17 provides a summary of the proposed schedule for the Jefferson-Martin Project.

INSERT FIGURE 2-17
Summary of the Proposed Schedule
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INSERT FIGURE 2-17 (BACKSIDE)
Summary of the Proposed Schedule
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