Chapter 2—Project Description

2.1 Project Overview

The Tri-Valley 2002 Capacity Increase Project is needed to meet the projected electric demand in the Cities of Dublin, Livermore, Pleasanton, and San Ramon, and in portions of unincorporated Alameda and Contra Costa Counties adjacent to these cities (see Figure 2-1). New transmission and distribution facilities are needed to serve existing and approved development in the Tri-Valley area. Section 2.3 provides a complete description of the project and all temporary and permanent facilities that will be constructed. The major elements of the project include:

Phase 1 (North and South Areas):

- Constructing two new distribution substations. The proposed Dublin Substation would be located 3 miles north of Interstate 580 and 1 mile east of Tassajara Road in Contra Costa County. The proposed North Livermore Substation would be located 3 miles north of Interstate 580 at the intersection of May School Road and North Livermore Avenue.
- Modifying the existing Vineyard Substation to include a 230 kV transmission interconnection.
- Installing 7.9 miles of new 230 kV overhead double-circuit transmission line in PG&E's existing vacant easement to serve the Dublin and North Livermore substations.
- Installing 2.8 miles of new 230 kV overhead double-circuit transmission line and 2.7 miles of 230 kV underground double-circuit transmission line to serve the Vineyard Substation.
- Installing a transition structure to convert the 230 kV overhead transmission line to a 230 kV underground cable system to serve the Vineyard Substation.

Phase 2 (North Area):

- Constructing approximately 10 miles of new 230 kV double-circuit transmission line in PG&E's existing vacant easement from the Contra Costa-Newark 230 kV line southeast to the Tesla Substation. This will connect the Dublin and North Livermore Substations directly to the Tesla Substation.

2.2 Existing Regional Electric System in the Tri-Valley Area

An electric power system consists of power plants, transmission substations, distribution substations, and overhead or underground electric lines. Power is delivered from the generating plants to customers through wires and cables, but the power is converted to higher and lower voltages several times for different purposes. At the generating plants, the electric power is "stepped up" to a higher voltage, known as the transmission voltage. Stepping up to a higher voltage reduces the amount of current that flows through the wires, and therefore allows the power to be delivered from the generating plants to the major load centers with fewer wires. Once the power has been delivered to the major load centers, it is "stepped down" to a lower voltage for delivery to individual customers. Transmission and distribution substations are used to "step up" or "step down" the voltage and to route the power over the transmission and distribution lines. In the PG&E transmission system, power is transmitted at 500, 230, 115, 70, and 60 kV.

In the Tri-Valley area, the electric power is transmitted to the regional substations at voltages of 230 kV and 60 kV. The power is then distributed to customers using overhead or underground distribution lines at voltages of 12 kV or 21 kV**.** The local delivery system, usually at 12 or 21 kV, is further stepped down for individual customer use.

2.2.1 Transmission System

The existing regional transmission system is shown in Figure 2-2. The Tri-Valley area is served by both the 230 kV and 60 kV transmission systems as shown in Figure 2-3.

Eight 230 kV transmission circuits run along the perimeter of the Tri-Valley area. Four of these 230 kV circuits run just northwest of the Tri-Valley area. These are the Pittsburg-Moraga #3 circuit, the Pittsburg-Newark circuit, and the Contra Costa-San Mateo #1 and #2 circuits. Two 230 kV circuits run along the eastern and southern edges of the Tri-Valley area. These are the Contra Costa-Newark #1 and #2 circuits. These six 230 kV circuits deliver power from the Pittsburg and Contra Costa power plants to Bay Area load centers. Two of the circuits (Pittsburg-Moraga #3 and Contra Costa-Newark #1) deliver power to the Tri-Valley area. In addition to these six 230 kV circuits, two circuits skirt the southern edge of the Tri-Valley area. These are the Tesla-Newark and the Tesla-Ravenswood 230 kV circuits. These circuits deliver power from the 500 kV Tesla Substation to Bay Area load centers. The PG&E 500 kV system is part of the Western States power grid, which interconnects inter- and intra-state power plants.

There are three sources of power into the Tri-Valley 60 kV system. Two of these sources are served from the 230 kV lines described above. They are the 230/60 kV, 88 megavolt amperes (MVA) transformer at the San Ramon Substation (which is served from the Pittsburg-Moraga #3 line) and the 230/60 kV, 90 MVA transformer at the Las Positas Substation (which is served from the Contra Costa-Newark #1 line). The third source into the Tri-Valley 60 kV system is the 115/60 kV, 75 MVA transformer at the Newark Substation.

Insert Figure 2-1, Regional Project location (B&W 8.5 x 11)

Insert Figure 2-2, Existing Regional Transmission System (Black &White 8.5 x 11)

(hand insert)

Insert Figure 2-3, Existing Tri-Valley Power Lines and Substations

(11 x 17 color)

Insert Figure 2-3, Existing Tri-Valley Power Lines and Substations

(11 x 17 color)

(even page)

2.2.2 Distribution System

The electric distribution system in the Tri-Valley area is comprised of both 21 kV and 12 kV distribution lines. All substations except Sunol have experienced peak loading beyond their capacity.

21 kV System

The existing 21 kV distribution system is supplied by three major substations: San Ramon, Vineyard, and Las Positas as shown in Figures 2-2 and 2-3.

San Ramon Substation. The San Ramon Substation is located in southern San Ramon and serves customers in San Ramon, Dublin, and portions of Pleasanton, as well as unincorporated areas of Alameda and Contra Costa Counties that surround these cities. The substation consists of four 230/21 kV, 75 MVA power transformers. The San Ramon Substation is supplied by the 230 kV Pittsburg-Moraga #3 line. The station experienced a demand of 281 MW during the 1998 summer peak load period.[1]

Vineyard Substation. The Vineyard Substation is located in central Pleasanton and serves customers in the City of Pleasanton and in unincorporated areas of Alameda County. The Vineyard Substation is served by the Las Positas-Livermore-Vineyard and San Ramon-Radum-Vineyard 60 kV lines. The substation currently consists of one 230/60/21 kV, 75 MVA power transformer and one 60/21 kV, 75 MVA power transformer. However, the distribution capacity is limited by the 60 kV transmission system. Based on the 1999 projected area load, the transmission constrained capacity limit of the Vineyard Substation is 55 MVA when the 60 kV transmission system is operated in its normal looped configuration.[2] When the 60 kV system is operated in a temporary radial configuration, the transmission constrained capacity limit of the Vineyard Substation increases to 79.9 MW. This station experienced a demand of 60.7 MW during the 1998 summer peak load period.

Las Positas Substation. The Las Positas Substation, located in the eastern part of Livermore, serves customers in the City of Livermore and surrounding unincorporated areas of Alameda County. It is supplied by the 230 kV Contra Costa-Newark #1 line. The substation currently consists of two 230/21 kV, 45 MVA power transformers and one 230/21 kV, 75 MVA power transformer. The Las Positas Substation experienced a demand of 90.1 MW during the 1998 summer peak load period.

12 kV System

The existing 12 kV distribution system is supplied by five substations: Livermore, Vasco, Sunol, Radum, and Parks. All of these substations receive power from the existing 60 kV transmission system. A description of the substations follows:

[1] Of this amount, 14.9 MW was fed from San Ramon Substation to an adjacent distribution planning area. “Peak load period” is the amount of energy carried by a utility system during a specific time period (typically 15 minutes). Peak load determines the required system capacity and can be determined at a regional or system-wide level.

[2] A radial configuration for a substation means that only one transmission line supplies a substation. An outage of the transmission line would also cause an outage to the substation it supplies. In a looped configuration, two or more lines are connected to the substation and at least one line can supply the substation if the other lines incur an outage. A looped configuration provides more reliability.

Livermore Substation. The Livermore Substation is located in Livermore and supplies customers in the Central Livermore area. The station currently consists of two 60/12 kV, 12.6 MVA power transformer banks. This station experienced a demand of 27.7 MW during the 1998 summer peak load period.

Vasco Substation. The Vasco Substation is located on the eastern boundary of Livermore and services customers in the area east of Vasco Road. The station currently consists of one 60/12 kV, 8.7 MVA power transformer bank and one 60/12 kV, 9.3 MVA power transformer bank. The substation experienced a demand of 24.4 MW during the 1998 summer peak load period.

Sunol Substation. The Sunol Substation is located east of Sunol and services customers in the Sunol area. During the 1998 summer peak period, the station consisted of one 60/12 kV, 4.5 MVA power transformer bank. The 1998 summer peak load on Sunol Substation was 5.5 MW. In 1999, the transformer bank at Sunol Substation was replaced with a 60/12 kV, 12.5 MVA transformer.

Radum Substation. The Radum Substation is located just north of the Vineyard Substation and services customers in the City of Pleasanton, portions of west Livermore, and unincorporated areas of Alameda County. The station currently consists of two 60/12 kV, 12.6 MVA transformers. The station experienced a demand of 30.8 MW during the 1998 summer peak load period.

Parks Substation. The Parks Substation, located in Camp Parks, serves customers in portions of Dublin and Pleasanton. The station currently consists of one 60/12 kV, 4.5 MVA power transformer bank. The station experienced a demand of 5.1 MW during the 1998 summer peak load period.

Single-Customer Substations. In addition to the substations described above, there are also three single-customer substations and one customer-owned substation. These single-customer substations are Bay Area Rapid Transit (BART), Kaiser, and Iuka. The BART Substation is located in Dublin and supplies electric power to the BART system. The Kaiser Substation provides electric service to the Kaiser facility at 3000 Busch Road in Pleasanton. The Iuka Substation provides electric service to the Lone Star Cement Plant east of Stanley Boulevard in Pleasanton. The customer-owned Cal Mat Substation supplies electric service to the Cal Mat facility on Stanley Boulevard in Pleasanton.

2.3 Project Purpose and Need

2.3.1 Statement of Objectives

The objectives for the Tri-Valley Project are to:

- **Meet Electric Demand**—Relieve the electric system deficiency that will occur in the Tri-Valley area by the year 2002, and ensure the ability of the system to safely and reliably serve the area before any interruptions in service or emergency conditions result from this deficiency. This is the basic purpose of the project.

- **Comply with Planning Criteria**—Ensure that the Tri-Valley area transmission system will continue to meet the California Independent System Operator (ISO) Grid Planning Criteria for safety and reliability, as well as meet the Planning Standards and Guidelines of the North American Electric Reliability Council (NERC). These planning criteria must be met by the project.

Meet Electric Demand

Favorable land costs and availability, the BART extension, and relative proximity to the greater Bay Area continue to fuel growth in electric demand in the Tri-Valley area. Major residential and commercial developments are in various planning, approval, or construction stages. The total electric demand in the Tri-Valley area is forecast to almost double from 510 MW in 1998 to about 950 MW within the next 15 to 20 years. These load growth forecasts are discussed in Section 2.3.2. As a result of this load growth, PG&E forecasts that the ability of the electric system to safely and reliably serve the area will be exceeded by 2002 unless the project is built.

Service interruptions can occur as a result of increased electric demand. As 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.[3] 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.

The increase in demand in the Tri-Valley area could also result in low system voltages. Low voltage can cause service interruptions for customers with voltage-sensitive equipment. Low voltage is also a concern with the expansion of high technology industry in the area. Extremely low voltage will also interrupt air conditioning and refrigeration and will stall electric induction motors.[4]

Comply with Planning Criteria

The project is needed to ensure that the transmission system can safely and reliably supply power to the Tri-Valley area. The California ISO establishes grid planning criteria to ensure the safety and reliability of transmission systems.[5] Pursuant to these criteria, PG&E uses both normal and emergency ratings for transmission infrastructure equipment.[6] Normal

---

[3] 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.

[4] Induction motors are commonly used in alternating-current electric applications such as fans and pumps.

[5] 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 Systems Coordinating Council, one of the regional councils.

[6] 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.

ratings are equipment operating limits for continuous use. Emergency ratings are slightly higher equipment operating limits that are only allowed for short durations. Projects that propose to increase transmission capacity to meet load growth must satisfy the grid planning criteria. The likely planning scenarios that are applied in evaluating whether a project satisfies the grid planning criteria are Categories A and B, 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.[7] 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.[8]

PG&E uses computer models to assess the adequacy of its high-voltage electric system with respect to the above criteria. The system is modeled to simulate performance under various load levels and operating assumptions. If the performance of any part of the system fails to meet the planning criteria, solutions to correct the problem are developed. Based on a comprehensive analysis including environmental, engineering, and economic factors, the proposed project was determined to be the best infrastructure-based alternative for meeting the electric needs of the Tri-Valley area.

2.3.2 Area Load Growth (The Problem)

2.3.2.1 Approved Development in the Tri-Valley Area

In 1997, PG&E began an extensive review of Tri-Valley area land use plans. As part of this effort, PG&E met with, and/or reviewed information supplied by, local city and county representatives, the Association of Bay Area Governments (ABAG), and developers from Shappell Homes, Dublin Ranch, North Livermore, Windemere, and Schaefer Ranch, among others. This effort revealed that a considerable amount of development has recently been approved in the Tri-Valley area, and that PG&E will be required to serve many new commercial and residential customers.

There is significant commercial development in the Hacienda (550,000 square feet) and Bishop Ranch (1,000,000 square feet) Business Parks, and several large new residential developments have been approved or are currently being constructed. These developments include: Dublin Ranch Phase 1 (847 homes), Vineyard Specific Plan (189 homes), Ruby Hills (240 homes), Windemere Phase 1 (2,249 homes), Gale Ranch Phase 1 (1,216 homes), Santa Rita Properties (390 homes), Summerhill Homes (340 homes), Schaefer Ranch (480 homes), Circle E & Henry Ranch (198 homes), Hacienda Apartments (320 units), Park Sierra Apartments (200 units), and South Livermore Specific Plan (1,533 homes). Many of the developments listed above also include multiple phases. Appendix B lists the total

---

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

8 "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)

number of residential units planned, per year, for each of these approved residential developments, as well as for several proposed but not yet approved developments. Figure 2-4 shows the location of proposed development in the Tri-Valley area. As shown in the figure, considerable new planned and approved growth will occur in the next few years. In Chapter 5, Figures 5-1 through 5-6 show existing general land use designations and land use conditions in the project area.

Most of the large residential and commercial developments currently planned in the area have already been approved by local governmental agencies. As such, they would not be subject to any pending “limited growth” ballot initiatives that are being discussed in the local jurisdictions. The estimated peak electric load associated with these new developments alone is approximately 110 MW.[9] While construction of the approved developments could extend beyond the 1999 to 2002 timeframe, it is clear that the projected capacity deficiencies will occur in the Tri-Valley area even if no new development is approved. In the event that PG&E’s annual load forecast updates indicate that the load growth is not materializing as forecast, then the proposed project will be phased in at a slower pace.

2.3.2.2 Load Growth Projections

Upon compiling information concerning approved development, PG&E calculated the expected increases in electric load for the years 1999 to 2007. An overview of PG&E’s load forecasting methodology follows.

PG&E’s traditional load forecasting model is based on a “least square” linear regression analysis[10] in which PG&E determines the expected base future annual increase in peak load based on 7 years of historical peak load data. This load projection is then adjusted for historic and future block loads and load transfers into or out of the distribution planning area (DPA). These incremental block loads must also be built into the forecast as appropriate. As described in PG&E’s Guide for Planning Area Distribution Facilities, attached as Appendix A, to qualify as a block load addition to the linear regression-based load growth forecast, a single new business load must be greater than 1.5 percent of the area peak load and represent more than one-third of the DPA’s annual growth rate. Therefore, to qualify as a block load, a new Tri-Valley business load must be 5.3 MW in the San Ramon-Vineyard 21 kV DPA and at least 1.9 MW in the Livermore 21 kV DPA.

[9] This estimate assumes that each new home will require an average of 7 kW at peak periods and that commercial developments will require an average of 7 kW per square foot at peak periods.

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

Insert Figure 2-4. Tri-Valley Land Use Map, Planned and Proposed Development

(11 x 17 color)

Insert Figure 2-4. Tri-Valley Land Use Map, Planned and Proposed Development

(11 x 17 color)

even page

PG&E's Tri-Valley load growth projections are presented graphically in Figure 2-5. This figure shows actual historic load growth for 1992 to 1998. Post-1998 capacity figures assume implementation of short-term modifications from 1999 to 2001 to increase capacity. The peak demand loads in the Tri-Valley area increased by 145 MW between 1994 and 1998. As explained in Section 2.3.2.3, the peak demand load in the Tri-Valley area is expected to increase by approximately 34 MW per year for 1999 to 2004. Between 1998 and 2002, the Tri-Valley area will experience an increase of 134.6 MW in peak load demand.

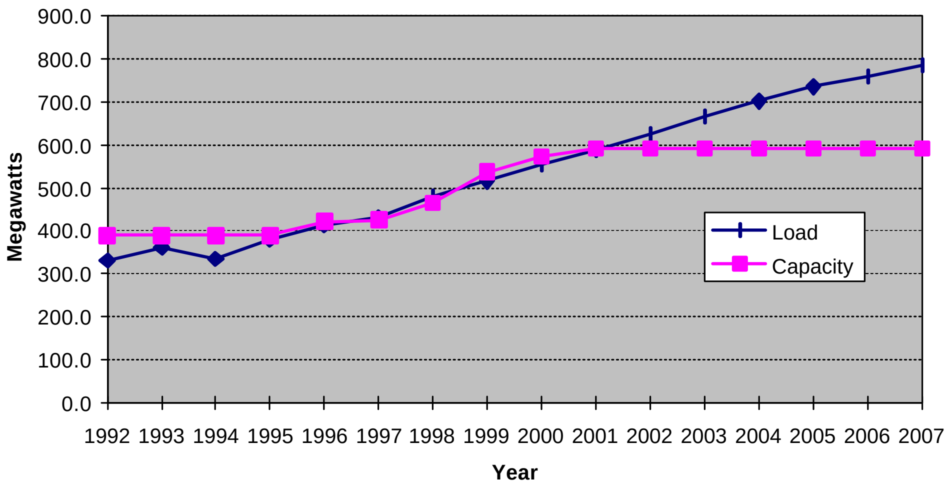

Figure 2-5
Tri-Valley Load Growth
Versus Capacity (Without Project)

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 demand impacts have been subsumed within the peak load demands experienced year by year and thus their impacts are included in the forecast of peak growth. Such is the case within the Tri-Valley area. As for future potential CEE impacts, PG&E's Local Integrated Resource Plan (LIRP) study indicates that only 4 MW per year could be obtained through aggressive locally focused CEE. This falls well short of the capacity needs in the project area, and therefore can only be viewed as an augmentation to other non-traditional wires solution options.

2.3.2.3 Distribution Planning Area Forecasts

The Tri-Valley area consists of three distinct distribution planning areas (DPAs) as follows:

- San Ramon-Vineyard 21 kV (average base growth[11] of 15.9 MW per year)
- Livermore 21 kV (average base growth of 5.6 MW per year)
- Tri-Valley 12 kV (average base growth of 4.5 MW per year)

[11] Base growth rates do not include block loads.

The load growth projections cited above provide the initial trend line-based estimates (based on documented load growth for the previous seven years).

San Ramon-Vineyard 21 kV DPA. The San Ramon-Vineyard DPA is served by the San Ramon and Vineyard Substations and provides power to the cities of San Ramon, Dublin, and Pleasanton as well as unincorporated areas of Alameda and Contra Costa Counties. The increase in load growth in this DPA is primarily from new and planned residential and commercial development. The commercial development is occurring primarily in the Hacienda and Bishop Ranch Business Parks. Significant residential development is occurring in large greenfield areas (open space areas where no development currently exists). These residential developments include:

- The Bernal property, Ruby Hills, and the Vineyard Specific Plan in Pleasanton
- The Santa Rita Development in Dublin
- Schaefer Ranch and Dublin Ranch in Alameda County
- Windemere and Gale Ranch in Contra Costa County

The load growth study for the San Ramon-Vineyard 21 kV DPA indicates a base growth rate of 15.9 MW per year. With the adjustments for load transfers and block loads, the DPA load is projected to increase by approximately 20 MW per year between 1998 and 2005. After 2005, the annual increase will fall to about 16 MW. This load growth pattern results in a 26.8 MW normal capacity deficiency and a 37 MW emergency capacity deficiency by the summer of 2002 as shown in Table 2-1. Individual substation loads, capacities, and the projected capacity shortfall in 2002 are shown in Table 2-2.

TABLE 2-1
Distribution Planning Area Load Versus Capacity
San Ramon – Vineyard 21 kV DPA

	1998	1999	2000	2001	2002
Normal Capacity (MW)	318.7	365.2	365.2	384.2	384.2
Emergency Capacity (MW)	303.7	355.4	355.4	374.0	374.0
Load (MW)	326.8	351.6	364.8	389	411

Note: 1998 is actual load, 1999 through 2002 are projected loads.
Post-1998 capacity figures assume implementation of various short-term modifications and improvements designed to provide more capacity prior to construction of the Tri-Valley Project (see Section 2.3.1, footnote 5).

TABLE 2-2
Individual Substation Load Versus Capacity
San Ramon – Vineyard 21 kV DPA

	1998			2002			2002
	Load (MW)	Normal Capacity (MW)	Emergency Capacity (MW)	Load (MW)	Normal Capacity (MW)	Emergency Capacity (MW)	Projected Shortfall (MW)
San Ramon	266.1	263.7	243.5	300.1	285.3	275.1	14.8
Vineyard	60.7	55	60.2	89.6	79.9	79.9	9.7
Parks	n/a	n/a	n/a	21.3	19	19.0	2.3

Note: 1998 is actual load, 2002 is projected load. The Parks Substation is not currently part of the 21 kV system.

Livermore-Las Positas 21 kV DPA. The Livermore DPA serves Livermore and surrounding unincorporated areas of Alameda County from the Las Positas Substation. The traditionally derived load forecast for this DPA indicates a base growth rate of 5.6 MW per year. The future load growth is due primarily to new commercial and residential developments occurring in both the northern and southern portions of Livermore. The largest potential development is slated for the North Livermore area, where 12,500 residential units and 89 acres of commercial development are planned, but not yet approved (see Figure 2-4).

The load growth study for the Livermore-Las Positas 21 kV DPA indicates a growth rate of 5.6 MW per year. With adjustments for future load transfers and block loads, the load is projected to increase by approximately 15 MW per year between 1998 and 2004. After 2004, the area's annual increase will drop back to about 11 MW per year. This pattern results in a 12.7 MW normal capacity deficiency and a 39.3 MW emergency capacity deficiency by the summer of 2002. Tables 2-3 and 2-4 show the planning area and substation capacity problems.

TABLE 2-3
Distribution Planning Area Load Versus Capacity
Livermore - Las Positas 21 kV DPA

	1998	1999	2000	2001	2002
Normal Capacity (MW)	98.6	117.6	136.6	136.6	136.6
Emergency Capacity (MW)	110	110	110	110	110
Load (MW)	90.1	107.7	120.8	136.6	149.3

Note: 1998 is actual load, 1999 through 2002 are projected loads.
Post-1998 capacity figures assume implementation of various short-term modifications and improvements designed to provide capacity prior to construction of the Tri-Valley Project.

TABLE 2-4
Individual Substation Load Versus Capacity
Livermore - Las Positas 21 kV DPA

	1998			2002			2002
	Load (MW)	Normal Capacity (MW)	Emergency Capacity (MW)	Load (MW)	Normal Capacity (MW)	Emergency Capacity (MW)	Projected Shortfall (MW)
Las Positas	90.1	98.6	110	149.3	136.6	110	12.7

Note: 1998 is actual load, 2002 is projected load.

Tri-Valley 12 kV DPA. The Tri-Valley DPA includes portions of both the San Ramon-Vineyard 21 kV and Livermore-Las Positas 21 kV DPAs and is supplied by the Livermore, Radum, Vasco, Parks, and Sunol Substations. The majority of new business loads in the Tri-Valley area will be served from the 21 kV system.

The load growth study for the Tri-Valley 12 kV DPA indicates a growth rate of 4.5 MW per year with no projected deficiencies during the 2002 summer peak load period. Deficiencies on the 12 kV systems will be avoided by converting portions of the 12 kV system to 21 kV as needed to prevent overloads.

2.3.2.4 Load Growth Summary

Combination of load projections for the three DPAs indicate that the overall Tri-Valley load will increase by approximately 34 MW per year between 1998 and 2004, then fall off to about 30 MW annually. Area buildout is expected to occur around 2015 to 2020, at which time peak load in the Tri-Valley area will be approximately 980 MW. By 2002, the total load is estimated to be 645 MW, while the total capacity will be only 608.8 MW. Therefore, the total shortfall as of 2002 will be approximately 36.2 MW.

2.3.3 Electric System Requirements (The Solution)

2.3.3.1 Distribution System Requirements

To meet the expected load growth and demand for electricity in the Tri-Valley area, PG&E plans to increase the capacity of the distribution system, including installation of new distribution lines, expansion of an existing substation, and construction of new substations. New distribution substations are needed because capacity and physical space in existing distribution substations, as well as availability of distribution line routes, are limited.

San Ramon-Vineyard Distribution Planning Area

The San Ramon-Vineyard DPA is currently served at 21 kV by the San Ramon and Vineyard Substations, and at 12 kV by the Parks, Radum, and Sunol Substations. The majority of the expected load growth will occur on the 21 kV distribution system. The existing 12 kV distribution system is loaded to capacity and cannot provide relief to the 21 kV system.

Recent completion of the work listed below added 46.5 MW of distribution capacity to the San Ramon-Vineyard 21 kV distribution system, increasing the effective capacity of the system to 365.2 MW.

- One new 21 kV distribution circuit was installed from the Tassajara Substation.
- The entire load on the San Ramon 2102 circuit was transferred to the new Tassajara Substation circuit.
- The San Ramon 2102 circuit was rerouted in a southerly direction to serve the load in the San Ramon-Vineyard DPA.
- A new 21 kV distribution circuit was installed from the San Ramon Substation in a southerly direction to serve load in the San Ramon-Vineyard 21 kV DPA.
- A new 21 kV distribution circuit was installed from the Vineyard Substation to serve load in the San Ramon-Vineyard 21 kV DPA.
- One existing 21 kV distribution circuit was transferred from the Vineyard Substation transformer bank #1 to transformer bank #2 to accommodate the 60 kV radial feed operating solution.

Between 1999 and 2000, the area load on the San Ramon-Vineyard 21 kV system is expected to grow by 28 MW[12], resulting in an expected 2000 summer peak load of 364.8 MW. By the

[12] Table 2-1 indicates a load increase of 13 MW between 1999 and 2000. However, in 2000, 15 MW of load will be transferred from the San Ramon-Vineyard DPA to the Walnut Creek 21 kV DPA via the new Tassajara feeder. The projected load

year 2000, the distribution facilities at the San Ramon Substation will be loaded to their full capacity. In addition, the Vineyard Substation (which is limited by the 60 kV transmission system) will be at full capacity. See Table 2-2 for a comparison of the area load and the capacity of the San Ramon Vineyard DPA.

Between 2000 and 2002, the total load on the San Ramon-Vineyard 21 kV system is expected to increase by 46.2 MW, resulting in an expected 2002 summer peak load of 411 MW. The San Ramon Substation will be loaded to its distribution capacity limit of 285.3 MW, and the Vineyard Substation will be loaded to its 60 kV transmission-constrained capacity of 79.9 MW. The effective capacity of the Vineyard Substation is 79.9 MW when the 60 kV transmission system is operated in a radial configuration. Operation of the 60 kV transmission system in a radial configuration during peak load periods was initiated in 1999 to increase the effective distribution capacity of the Vineyard Substation. When the 60 kV transmission system is operated in its normal looped configuration, the distribution capacity of the Vineyard Substation is limited to 55 MW. These transmission constraints limit the ability of the Vineyard Substation to serve additional distribution load in the San Ramon-Vineyard 21 kV DPA.

Construction of the proposed Dublin Substation and conversion of the Vineyard Substation to 230 kV will eliminate the projected capacity deficiencies on the San Ramon-Vineyard 21 kV distribution system in the year 2002. The proposed transmission reinforcement to the Vineyard Substation will eliminate the transmission constraints and allow for the installation of additional 21 kV circuits from the substation. The new 21 kV Vineyard Substation circuits will provide the necessary distribution capacity to serve new and existing customers south of Interstate 580 in the San Ramon-Vineyard DPA. The additional distribution capacity at the Vineyard Substation will allow for transfer of load from the San Ramon Substation to the Vineyard Substation, thereby providing loading relief to the San Ramon Substation. The new Dublin Substation will provide the necessary distribution capacity to serve new and existing customers north of Interstate 580 in the San Ramon-Vineyard DPA. The new Dublin Substation will also provide loading relief to San Ramon Substation.

Livermore-Las Positas Distribution Planning Area

The Livermore-Las Positas DPA is currently served at 21 kV by the Las Positas Substation and at 12 kV by the Livermore and Vasco Substations. The majority of the expected load growth will occur on the 21 kV distribution system. The existing 12 kV distribution system is loaded to capacity and cannot provide relief to the 21 kV system.

Recent installation of a new 21 kV distribution circuit from the Los Positas Substation added 20.0 MW of distribution capacity to the 21 kV distribution system, thereby increasing the effective capacity of the system to 117.6 MW.

Between 1999 and 2001, the total load on the Las Positas 21 kV system is expected to increase by 28.9 MW, resulting in an expected 2001 summer peak load of 136.6 MW. To supply this load, an additional 21 kV circuit would be necessary from the Las Positas Substation before the 2000 summer peak load period. The long-term plan is for the North

growth in the San Ramon-Vineyard DPA in 2000 is 28 MW, but due to the 15 MW “out of area” load transfer, Table 2-1 shows a load increase of 13 MW.

Livermore Substation to serve the area north of Interstate 580 and for the Las Positas Substation to serve the area south of Interstate 580. Constructing the last 21 kV circuit from the Las Positas Substation north of Interstate 580 would not fit into the long-term plan and would strand that investment within one year because the North Livermore Substation would be constructed by 2003 when a 10.5 MW deficiency is expected to occur.

The 2002 summer peak load on the Las Positas 21 kV system is expected to be 149.3 MW, which will exceed the capacity of the 21 kV system by 12.7 MW. Both of the 45 MVA transformer banks at the Las Positas Substation will be loaded to their design capacity. The 75 MVA bank at the Las Positas Substation would still be loaded to approximately 84 percent of its effective capacity. The installation of an additional 21 kV circuit on the 75 MVA transformer could add 15 MW of additional capacity to the 21 kV system and load the transformer to its full capacity. However, even with this additional circuit, a 10.5 MW deficiency would occur in 2003.

Construction of the proposed North Livermore Substation will eliminate the projected capacity deficiencies on the Las Positas 21 kV system in the year 2002. The new North Livermore Substation will provide the necessary distribution capacity to serve new and existing customers north of Interstate 580 in the Livermore 21 kV DPA. Additionally, the distribution capacity at the North Livermore Substation will allow for the transfer of load from Las Positas Substation to North Livermore Substation. This will provide loading relief to Las Positas Substation and allow Las Positas Substation to serve new and existing customers south of Interstate 580 in the Livermore 21 kV DPA. Construction of North Livermore Substation will also allow for the installation of future 21 kV circuits that will eliminate future distribution capacity deficiencies expected to occur in the years beyond 2002. Future expected circuit additions at the North Livermore Substation include installing the first transformer bank and two 21 kV circuits in 2002. Additional transformer banks and 21 kV circuits would be installed in the future as needed.

Summary

The addition of the new North Livermore and Dublin Substations, together with the proposed upgrade of the existing Vineyard Substation, will provide the distribution capacity necessary to meet the peak load demand that will exist by 2002 as a result of approved growth.

2.3.3.2 Transmission Requirements

The increase in electric demand and the resulting need to upgrade the Vineyard Substation and build two new distribution substations in the northern Tri-Valley area requires construction of new transmission lines to provide electricity to these substations.

North Area—Phase 1

In the northern Tri-Valley area (located to the north of Interstate 580), two new distribution substations are necessary to meet the projected electric demand. However, there are no existing transmission lines at the locations of the proposed Dublin and North Livermore Substations (see Figure 2-6). New transmission lines are needed to connect these new substations to an existing source of power. The most accessible transmission line with the capacity to support the new loads is the Contra Costa-Newark 230 kV line. PG&E proposes to serve the new Dublin and North Livermore Substations from the Contra Costa-Newark

#2 circuit because it has more capacity available than the Contra Costa-Newark #1 circuit, as illustrated in Table 2-5.

TABLE 2-5
Forecasted Percent Loading for Contra Costa-Newark Circuits (2002)*

	Normal	Emergency	Emergency Condition
Circuit #1	93 %	96 %	Tesla-Newark line outage
Circuit #2	63 %	69 %	Tesla-Newark line outage

* Percent loading is provided relative to the facility ratings: normal ratings for "all lines in service" conditions (as described in Category A in Section 2.3.1) and emergency ratings for emergency conditions (as described in Category B in Section 2.3.1).

By constructing the proposed North Area transmission line, PG&E will connect the new Dublin and North Livermore Substations to the Contra Costa-Newark #2 circuit, thereby providing north area customers with an adequate source of power.

South Area

As described in Section 2.3.2, the 60 kV transmission facilities serving the southern Tri-Valley area are currently at their maximum load-serving capability even though PG&E recently re-rated several critical segments of the 60 kV system from 2 feet per second to 4 feet per second wind speed rating to increase capacity. The capacities of the 230/60 kV transformers at the San Ramon and Las Positas Substations were also increased by performing specific transformer heat run analyses using PG&E's Transformer Capability Analysis Program (TCAP). Despite these measures, it will still be necessary for PG&E to operate the system using a radial configuration whenever the load the at the Vineyard Substation is forecasted to exceed 55 MW to prevent overloading during peak load periods in 1999, 2000, and 2001. Although the radial operation mode will allow the Vineyard Substation banks to supply 79.9 MW of capacity, this is only a stopgap measure (see Section 2.2.2, footnote 2). Because of these constraints, additional distribution circuits have been constructed from other substations, such as San Ramon and Tassajara, to accommodate the load growth in the southern Tri-Valley area. The existing and new San Ramon 21 kV circuits are long and have more miles of line which causes low voltage and reduced service reliability. Generally, a four-mile radius around a substation is used as a rule of thumb for designing where the distribution circuits should be located to serve the majority of the load.

Additional reinforcement is needed to meet the area's electric demand. The existing Vineyard Substation will be converted from a 60/21 kV substation to a 230/21 kV substation and supplied by looping the substation from the Contra Costa-Newark #2 230 kV circuit. The Contra Costa-Newark 230 kV line, part of which is located in the Tesla-Newark corridor, is the closest transmission line with available capacity to serve the upgraded Vineyard Substation. As shown in Table 2-5, the Contra Costa-Newark #2 circuit is best equipped to handle the additional loading.

The conversion of the Vineyard Substation to a 230/21 kV substation will enable it to accommodate additional load in the area and provide relief to the 60 kV system. This will also enable the 60 kV system to operate in the more reliable network/loop configuration, even during peak loading periods.

Table 2-6 summarizes the results of PG&E's power flow studies on the 60 kV system for 2002, with and without the proposed project, during normal operating conditions using a 4 feet per second rating on line sections that have been re-rated. "No Project" power flows were performed for both radial and network configurations. The results indicate that without the project, several overload conditions will occur even if the system is operated in radial configuration. Expected overloads are shown on Table 2-6 as any number at or over 100. Even though certain line segments show loading of less than 100 percent, they are served by lines that have loadings greater than 100 percent, which could result in damage to the equipment. See Figure 2-7 for a graphic depiction of the relationship between the various lines segments and substations and the percent loading. As shown in the "With Project" column, implementing the proposed project will prevent overloads and will allow the 60 kV system to operate in a network configuration even during peak loading periods.

Table 2-7 shows the results of PG&E's power flow studies on the 60 kV system in 2002, with and without the project, during an emergency condition caused by a line outage. Emergency equipment ratings were used in the analysis. The ratings used for the 230/60 kV transformers were the "increased capacity" ratings from TCAP. Because the 60 kV system has no emergency capability when operated in a radial configuration—in case of an outage, loads will be dropped—no powerflow tabulation was done for the radial configuration; only the results of the network configuration are shown.

Table 2-7 shows that without the proposed reinforcement, the 60 kV system will not be able to handle any emergency condition. This is indicated by the multiple expected overloads (percent loading equal to or greater than 100). For the Las Positas transformer and the Las Positas-Livermore line, the effect of the loss of the San Ramon-Radum line is so severe that the GE Power Flow software was unable to solve the case. However, PG&E's analysis shows that implementing the proposed reinforcement will eliminate the expected emergency overloads. As noted in the "With Project" column, construction of the proposed project will reduce the percent loading for all lines and transformers under all conditions to less than 100.

Summary

The existing transmission system cannot supply the necessary electric power to the substations. This is true in the North Area because there are no transmission facilities at the site of the proposed Dublin and North Livermore Substations, and in the South Area because the existing 60 kV system presently serving the Vineyard Substation is incapable of handling the projected electric demand. Therefore, construction of two new 230 kV transmission lines connecting these three substations to the existing Contra Costa-Newark #2 circuit is required.

Insert Figure 2-6, Proposed Transmission Line Routes and Substations

(11 x 17 color)

Insert Figure 2-7. Transmission System Forecasted 2002 Load

(11 x 17 color)

TABLE 2-6
Year 2002 Tri-Valley 60 kV Normal Loading

Equipment	Rating	No Project Network (%)	No Project Radial (%)	With Project Network (%)
Transformer				
San Ramon 230/60 kV	88 MVA	136	149	85
Las Positas 230/60 kV	90 MVA	123	119	<75
Lines				
San Ramon-Radum	760 Amps	152	166	94
Las Positas-Livermore	760 Amps	130	126	<75
Livermore-Vineyard	760 Amps	121	126	n/a[1]
Radum-Vineyard	827 Amps	86	99	n/a[1]
Newark-Livermore	325 Amps	<75	82	<75
Newark-Vallecitos-Vineyard	281 Amps	121	n/a[2]	n/a[1]
Livermore-Radum	760 Amps	n/a[3]	n/a[3]	<75
Newark-Vallecitos-Radum	281 Amps	n/a[3]	n/a[3]	<75

[1] Not applicable; this line section will be reconfigured when the project is implemented.
[2] Not applicable; a radial configuration cannot be used at the present time.
[3] Not applicable; this electrical configuration does not exist at the present time.

TABLE 2-7
2002 Tri-Valley 60 kV Emergency Loading

Equipment	Rating	No Project (%)	With Project (%)	Line Outage
Transformer				
San Ramon 230/60 kV	105 MVA	196	95	Las Positas-Livermore
Las Positas 230/60 kV	117 MVA	142	<75	Radum-Vineyard
		--not solved--[1]	<75	San Ramon-Radum
Lines				
San Ramon-Radum	1,030 Amps	198	94	Las Positas-Livermore
Las Positas-Livermore	1,030 Amps	149	<75	Radum-Vineyard
		--not solved--[1]	<75	San Ramon-Radum
Livermore-Vineyard	1,030 Amps	161	n/a[2]	Radum-Vineyard
Radum-Vineyard	972 Amps	150	n/a[2]	Las Positas-Livermore
Newark-Livermore	378 Amps	205	<75	Las Positas-Livermore
Newark-Vallecitos-Vineyard	326 Amps	238	n/a[2]	Las Positas-Livermore
Livermore-Radum	1,030 Amps	n/a[3]	<75	
Newark-Vallecitos-Radum	326 Amps	n/a[3]	<75	

[1] GE PSLF software (Version 11) was used to perform the power flow analysis. In the case of a San Ramon-Radum line outage in 2002, the power flow was unable to solve the case because the model results exceeded the software solution thresholds. This indicates that the outage will be particularly severe.
[2] Not applicable; this line section will be reconfigured when the project is implemented.
[3] Not applicable; this electrical configuration does not exist at the present time.

North Area—Phase 2

Although the Contra Costa-Newark 230 kV #2 circuit is best equipped among existing transmission lines in the Tri-Valley area to serve the Dublin and North Livermore Substations and the upgraded Vineyard Substation, continued load growth in Tri-Valley and other areas will eventually cause this circuit to exceed its emergency capacity unless further reinforcements are constructed. To determine the year that Phase 1 of the proposed project will reach its capacity, PG&E transmission planners performed several power flow studies, including normal and emergency conditions in different years. Based on the load growth projections described in Section 2.3.2.2, these power flow studies indicated that the most serious expected future overload would occur under emergency conditions in the event of a line outage while the Pittsburg Power Plant Unit #7 is out of service. The emergency overload is first expected to occur in 2004 on the Contra Costa-Las Positas line due to a potential Newark-Tesla line outage while Pittsburg #7 is out.

The power flow studies also indicated that implementing Phase 2 by disconnecting the new Dublin and North Livermore Substations from the Contra Costa-Newark #2 line and feeding them instead from the Tesla Substation will prevent the expected overload. The bus voltages at the proposed Dublin and North Livermore Substations will also be significantly improved during emergency conditions (that is, a line and/or generation unit out of service). Therefore, construction of the Phase 2 transmission line will supply the new Dublin and North Livermore Substations with an adequate source of power even after continued growth in the Tri-Valley area and elsewhere causes peak load demand to exceed the capacity of the Contra Costa-Newark #2 circuit.

Currently, numerous third party commercial generation plants for the Bay Area are being considered for development. These large scale generation units could have a major impact on the line loading and current flow direction in the PG&E system. New units are anticipated near Pittsburg and Antioch and in the south San Jose area. However, the timing and ultimate success of these plants is not clear. The expected need for the 230 kV expansion in Phase 2 is estimated to be between 2004 and 2007 depending on the location and timing of future development.

2.4 Description of the Project

2.4.1 North Area—Phase 1

Two new 230 kV substations will be dedicated to serving the load growth north of Interstate 580, and a new 230 kV transmission line in PG&E's existing vacant right-of-way will provide power to the substations. Each substation will have an associated distribution system to provide power to customers. Detailed information on all project components and construction methods is provided in Sections 2.5 and 2.6.

North Livermore and Dublin Substations

The North Livermore and Dublin Substations will be un-manned, fenced and walled, remote-controlled facilities on 5-acre parcels (see Figure 2-6 for the locations and Figure 2-8 for the plan view). They will require weekly inspections of equipment for normal maintenance. During emergency operations, there may be numerous visits by up to

Insert Figure 2-8, Plan view of Dublin and North Livermore Substations

(11 x 17 Black and White) (hand insert)

Insert Figure 2-8

Even page

10 persons for switching and repair work. The North Livermore Substation will be constructed inside an earthen landscaped berm, with a precast concrete wall structure and vegetation appropriate for the setting. The substation will be set back approximately 60 feet from North Livermore Avenue to allow for any future widening of the roadway. The setback will also accommodate the length of driveway required to handle a mobile tractor trailer in the event of a transformer exchange. This will allow the normal traffic flow on North Livermore Avenue to be uninterrupted.

The Dublin Substation will be located just north of PG&E's existing right-of-way, approximately 1 mile east of the proposed extension of Tassajara Road in Contra Costa County. The proposed substation site is located in rolling rangeland used for cattle grazing. PG&E proposes to construct the Dublin Substation without landscape screening during its initial years of operation. The ranch parcel is remote and lies north of an approved development within Alameda County, and south and east of approved development in Contra Costa County. PG&E estimates that it may be 10 to 15 years before the Dublin Substation site becomes surrounded by residential development. Once development agreements have been finalized, PG&E will install landscape measures appropriate to the surrounding setting and uses. The original purchase of 5 acres will allow for the additional placement of appropriate screening around the working substation without service interruptions. Approximately 0.4 miles of existing rocked farm road will be improved to allow for two-way construction traffic. An additional 0.5 miles of new all-weather access road will need to be built to the substation.

The interior of both the North Livermore and Dublin Substations will be paved with a 20-foot wide ring road to allow for maintenance and access to all large equipment within the substation. The remainder of the substation surface will be compacted and rocked with gravel to provide an all-weather surface. Four 21-foot by 36-foot metal-clad switchgear buildings will also be included. The spill prevention, control, and countermeasure (SPCC) ponds will be consistent with Title 40 of the Code of Federal Regulations. Oil containment facilities will be sized to contain 110% of the oil volume of the largest oil filled equipment (45 MVA transformers).

Each substation will ultimately consist of four 230/21 kV, 45 MVA transformers with a total capacity of approximately 180 MW. As described previously, these substations will serve the existing and planned developments located north of Interstate 580.

Substation Equipment

Major equipment at both the North Livermore and Dublin Substations will include the following:

- 230 kV bus structures including 230 kV bus sectionalizing switches (for transmitting 230 kV power)
- Two 230 kV circuit breakers (for switching and protecting 230 kV transmission lines from the Newark Substation and Contra Costa Power Plant)
- Four 230/21 kV power circuit breakers (for switching and protecting four 230/21 kV power transformers)

- Four 230 kV distribution power transformers
- Four 21 kV metal-clad switchgears
- Capacitor banks

In addition to the above, PG&E will install related electrical equipment at the North Livermore and Dublin Substations, such as 230 kV disconnecting switches, reactors, instrument transformers, metal-clad switchgear, protective relaying, metering and control equipment, supervisory control and data acquisition equipment, telemetering equipment, auxiliary alternating current (ac) and direct current (dc) power system, electrical grounding system, and underground conduits or trench systems. Figure 2-8 provides a plan view of the equipment to be installed at both the North Livermore and Dublin Substations.

230 kV Transmission Line

The proposed 230 kV transmission line route is shown on Figure 2-6. It will connect to PG&E's existing Contra Costa-Newark transmission line and will terminate in the west at the proposed Dublin Substation. The maximum right-of-way needed is 60 feet on each side of the centerline (or 120 feet total). The route crosses primarily grassland and is within an existing PG&E vacant right-of-way that is approximately 75 feet wide. Approximately 45 additional feet of right-of-way would need to be acquired (or about 22 feet on each side of the existing easement).

From the Contra Costa-Newark Line, the route heads west for 6.9 miles and crosses the Contra Costa-Alameda County line. The first 4 miles traverse due west. At the 4-mile mark, the route turns 20 degrees in the southwest direction. It continues 0.7 miles and then makes a 12 degree turn towards the north and continues for 1.3 miles. The route makes a final 8 degree turn north, heading almost due west, and traverses 0.9 miles before terminating at the Dublin Substation site. The total distance for the route is 6.9 miles.

A new 230 kV transmission line along North Livermore Road is also necessary to connect the North Livermore Substation to the new transmission line described above. The connecting line will travel south along the west side of North Livermore Road from the existing corridor to the new substation. The total distance for the route is approximately 1 mile.

The proposed 230 kV transmission line connecting the North Livermore and Dublin Substations to the Contra Costa-Newark line will support two circuits of conductor known as 1,113,000 circular mils of all-aluminum conductor (1113 kcmil AAC). This conductor is 1.22 inches in diameter. Each circuit will consist of three phases (three wires) and one shield wire at the top of the tower to protect the system from lightning strikes.[13] A new 80- to 150-foot lattice-type steel tower structure compatible with the existing Contra Costa-Newark 230 kV double-circuit transmission line, as shown in Figure 2-9, will be used to intercept circuit #2 of the Contra Costa-Newark 230 kV transmission line. A new 60- to 80-foot single-circuit lattice tower will be installed on each side of the new double-circuit structure to allow each of the two circuits of the new line to pass under circuit #1 of the Contra Costa-Newark line. This configuration of three lattice-type steel structures will

[13] The shield wire could include a fiber-optic cable system.

facilitate the transition to lattice towers or tubular steel pole structures (ranging in height from 80 to 150 feet), as shown in Figures 2-9, 2-10, and 2-11, which will be used from the intersection point to the new Dublin and North Livermore Substations.

Distribution Lines

Ultimate distribution circuit construction from the North Livermore and Dublin Substations would involve the installation of twelve 21 kV distribution circuits from each substation, with some potentially located in PG&E easements. The 21 kV distribution circuits will be a combination of overhead conductors on poles and underground cable in conduit.

2.4.2 North Area—Phase 2

When the transformer loading at the North Livermore and Dublin Substations approaches the current carrying limit of the Contra Costa-Newark 230 kV circuit, it will be necessary to construct approximately 10 miles of double-circuit, looped-configuration transmission line to the Tesla Substation (see Figure 2-6). This line would be constructed from the present loop location on the Contra Costa-Newark line using PG&E’s vacant easement position through the Altamont Pass to a breaker position at Tesla Substation. Transmission towers would include those shown in Figures 2-9, 2-10, and 2-11.

PG&E owns a 75-foot-wide transmission easement acquired in the 1960s that extends from Tesla Substation on Patterson Pass Road in eastern Alameda County to the San Ramon Substation in the City of San Ramon on Alcosta Boulevard. The proposed Phase 2 plan uses this easement from its intersection with the Contra Costa-Newark 230 kV transmission line near Vasco Road to its origin at Tesla Substation. This easement traverses gently to moderately sloped grazing land, mostly encumbered with windfarms through the Altamont Hills. Some relocations of this easement may be necessary at the Browning Ferris Industries (BFI) Landfill at Vasco Road and within some of the windfarm development where there are encroachments on PG&E’s easement.

2.4.3 South Area

The Tri-Valley Project includes system reinforcement in the South Livermore area. The project components are shown in Figure 2-6 and are listed below. Detailed information on all project components and construction methods is provided in Sections 2.5 and 2.6. The project includes:

- Construction of a 2.8-mile-long overhead and 2.7-mile underground 230 kV double-circuit transmission line loop from PG&E’s existing Contra Costa-Newark transmission line corridor to the Vineyard Substation.
- Modification of the Vineyard Substation to accommodate the new 230 kV transmission circuits.
- Installation of additional 21 kV distribution circuits from Vineyard Substation.

Vineyard Substation Modification

One existing 60/21 kV transformer bank would be replaced with a 230/21 transformer bank. Accordingly, the existing 230/60/21 kV transformer bank would be changed from

60 kV to 230 kV**.** The existing 60 kV circuit switches would be changed to 230 kV switches. Three existing 60 kV overhead line terminations would be removed and two new 230 kV underground cable termination stations would be installed. One 230 kV power circuit breaker would be installed for 230 kV underground cable line. Two 21 kV outlet circuits would be built. The area that would be occupied by the new equipment is within the existing footprint of the substation.

230 kV Transmission Line

Overhead Segment

The proposed overhead 230 kV transmission line route would originate approximately 1.0 mile east of the entrance to the Vallecitos Nuclear Center along Route 84 (see Figure 2-6). The line would originate in PG&E's existing Tesla-Newark transmission line corridor, which is occupied by four rows of standard lattice steel towers. It would connect with the existing Contra Costa–Newark transmission line and travel north for approximately 2.8 miles through moderately steep sloped rangeland toward the City of Pleasanton from the south. The route would transition to underground approximately halfway to the Vineyard Substation. The facilities and equipment would be the same as described for the North Area overhead transmission line except that only lattice steel towers, as shown in Figure 2-9, will be used.

To connect the new Vineyard 230 kV transmission line to the Contra Costa-Newark 230 kV line, a new single-circuit lattice tower and two short dead-end towers would be installed in a parallel position just south of, and adjacent to, the Contra Costa-Newark line. Each dead-end tower would carry two circuits northward under the existing transmission line to a new tower located between the Contra Costa-Newark line and the Stanislaus-Newark line. From this tower, the double-circuit lines would pass over the lines in the corridor and northward to the Vineyard Substation.

Transition Structure

The transition structure will be constructed below the natural ridgeline where, in part due to landscape screening, it will not be visible from the City of Pleasanton. The transition structure will consist of two dead-end structures for terminating both 230 kV overhead circuits, two low-profile support structures for cable terminations and lightning arresters, and two splice vaults for splicing cables and facilitating access for future repairs to the cables or cable terminations. Other equipment located at the site will include cable sheath arresters, conductor jumpers, grounding conductors, fiber-optic facilities, fencing, and outdoor lighting. The layout will require an area of approximately 0.2 to 0.5 acres, including vehicle access, and will be graded flat or in a terraced layout. An access road to the transition structure will be built from the City of Pleasanton Kottinger Ranch water storage tank site. A transition structure similar to the one proposed for the project is shown in Figure 2-12.

Underground Segment

The underground segment begins at Milepost M2.8 (see Figure 2-6) and traverses the ridge to the existing Kottinger Ranch water tank in south Pleasanton. To obtain overhead transmission line easements north of the access road to the city's water tank, residents would have to be displaced from their homes. PG&E therefore determined that an underground transmission line was the most feasible option.

After passing the water tank, the route continues down an existing paved road and into city streets. The city streets include Benedict, Smallwood, and Bernal. The underground segment would continue down Bernal until reaching the existing Vineyard Substation. The underground easement will be 30 feet wide in open country with an additional 30-foot-wide temporary construction easement. Within the City of Pleasanton, the underground transmission line would be placed within city streets. One trench approximately 3 to 5 feet wide by 6 to 8 feet deep would be required.[14] The 230 kV underground transmission line would consist of six cross-linked, polyethylene-insulated, solid dielectric cables (two circuits) in a double-circuit duct bank. The duct bank would consist of nine 6-inch polyvinyl chloride (PVC) ducts, encased in concrete in a trench between the transition structure at Milepost M2.8 and the Vineyard Substation at Stanley Boulevard and Bernal Avenue.

Transmission Line Right-of-Way

The proposed Vineyard 230 kV extension from the Tesla-Newark corridor will require the modification of an existing tower and two short dead-end tap towers within PG&E's existing corridor south of Route 84. Once the proposed line travels north and clears the existing PG&E easements, a new 120-foot easement will be required. This easement will place basic restrictions on development within its boundaries. The present and foreseeable land use for the proposed alignment is cattle grazing with a County General Plan minimum development requirement of 200 acres per dwelling unit. The majority of the alignment traverses fairly rugged terrain with side slopes exceeding 35 percent. Once the alignment crosses over the ranch property, it approaches a ridgeline that approximates the southern boundary of the City of Pleasanton. The proposed overhead alignment south of this point back to Route 84 is not visible from within the city.

At the approximate city limit line, PG&E will transition the overhead electrical circuits to a solid dielectric underground cable system. There are two typical kinds of high-voltage underground transmission systems. The first, a "pipe-type" system, is a low-pressure, oil-filled, encased system used to control the heat generated in the cables. The second, a solid dielectric system, includes cable of a sufficient size in a PVC duct and is easier to install and repair. The solid dielectric system therefore avoids the complexity of oil-filled piping and oil pumping stations that are needed approximately every 3,000 feet. PG&E is working with representatives of the transition structure property to construct the underground alignment with consideration for future access plans. PG&E would construct an all-weather road over the top of the cable system for access and protection. Once the cable system traverses the undeveloped property, it will enter city streets and be designed and constructed to comply with City of Pleasanton franchise requirements.

14 Although the 230 kV underground transmission line will only require a 3-foot-wide trench, the portion of the route that is between Hearst Drive and Arroyo Valle may require a wider trench to accommodate future distribution circuits. The 230 kV circuit will need to be offset from the anticipated 21 kV distribution circuit due to access and heat rejection requirements. Therefore, the trench in this portion of the route will be constructed to a 5-foot width. By constructing a combined trench, PG&E will minimize construction impacts in the City of Pleasanton.

Insert Figure 2-9, Typical Lattice Steel Tower

Insert Figure 2-10, Typical tubular steel Pole

(8 ½ x 11 Black and White)

Insert Figure 2-11, Typical Tubular Steel Pole with Underbuild

(8 ½ x 11 Black and White)

Insert Figure 2-12 Typical Transition Structure

(8 ½ x 11 Black and White)

2.5 Project Facilities Detail

Table 2-8 summarizes the primary facilities and equipment associated with all project components.

TABLE 2-8
Summary of Project Facilities

North Livermore and Dublin Substations (Per Station)
• Developed acreage: 5 acres, fenced, with access road • Transformers, line traps, control, protection, and communication equipment • Transformer size: four 230/21kV, 45 megavoltamperes (MVA) transformers per station at ultimate buildout • Line and power transformer switching equipment • Bus structures • Telecommunication facilities (phone line or microwave tower) • Dead-end structures • Four 21 kV switchgear sets • Capacitor banks
230 kV Overhead Transmission Line Facilities (North and South Areas)
• Voltage: 230 kV • Conductors: double-circuit, 1113 kcmil all aluminum, each circuit with three phases • Minimum ground clearance: 32 feet • Conductor diameter: 1.22 inches • Shield wire diameter: 0.385 inches • Structure types: self-supporting (galvanized gray) lattice towers and tubular steel poles • Structure heights: 80 feet to 150 feet • Approximate distance between structures: 800 to 2,000 feet
Vineyard Substation Modification
• Transformer size at ultimate buildout: four 230/21kV, 75 megavoltamperes (MVA) transformers • 230 kV underground termination structures: 2 positions • Extend bus structure for the new 230 kV line position connection • Line switching equipment • Line traps, control, protection, and communication equipment • Reconnect transformer bank #1 high side to accept 230 kV transmission • Replace transformer bank #2 to accept 230 kV transmission • Install 21 kV breakers and associated equipment for new 21 kV distribution circuits • Capacitor banks

TABLE 2-8
Summary of Project Facilities

230 kV Underground Transmission Line Facilities (South Area)

- Voltage: 230 kV
- Conductors: double-circuit, cross-linked, polyethylene-insulated, solid dielectric, single conductor cable, 2500-kcmil copper conductor, metallic impervious sheath, polyethylene outer jacket, each circuit with three cable phases, six cables total
- Cable Diameter: 4 inches or more
- Cable terminations: porcelain outer, pre-molded dielectric inner, silicon oil filled, about 9 feet in height
- Conduit Type: 6-inch PVC in 9-way concrete duct bank (3 x 3), envelope dimensions 32 inches by 32 inches
- Minimum Depth: 36 inches to top of duct
- Splice Vaults: Reinforced concrete, 18 ft. long x 5 ft. wide x 8 ft. deep, 3 splices per vault
- Total number of splice vaults: 13 per circuit (total of 26)
- Total number of cable terminations: 12
- Lightning Arresters: metal oxide varistor type, one per phase, about 6 feet in height
- Total number of lightning arresters: 12

Transition Structure

- Support structure type: post and beam steel, low profile termination structure, supports cable terminations and lightning arresters
- Total number of termination structures: 2
- Dead-end structure type: post and beam steel, low profile dead-end structure, slack span from dead-end tower double-circuit vertical configuration to a horizontal configuration
- Structure height: 25 to 30 feet
- Total number of dead-end structures: 2

2.6 Project Construction

The construction work force for the Tri-Valley Project will average approximately 60 to 70 workers over a 12-month period. The work force will vary depending on the activities in progress. During surveying, site preparation, and access road preparation, 10 to 20 workers will be needed. Between 40 and 50 workers will be needed during the most active period when multiple phases of the work are being completed simultaneously. As an example, tower assembly and erection activities could be underway in the North Area while tower foundations are being installed in the South Area. As phases of the work are completed, the work force will gradually decline. A small work force of 10 workers will remain to complete required project clean-up activities. Equipment that will be used during construction of the project is listed in Table 2-9.

TABLE 2-9
Equipment Used During Construction

Equipment	Use
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 trailer	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 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
Tractor, D7 Caterpillar	Install conductor
Converter dolly	Install conductor
4x4 SUVs	Transport personnel
Equipment Required for Underground Construction:	
Pickup trucks	Transport construction personnel
2-ton flatbed truck	Haul materials
Flatbed boom truck	Haul and unload materials
Rigging truck	Haul tools and equipment
Mechanic truck	Service and repair equipment
Winch truck	Installing and pulling rope into position in conduits
Cable puller truck	Pulling transmission cables through conduits
Cement trucks	Transporting and pouring of back-fill slurry
Shop vans	Store tools
Crawler backhoe	Excavate trenches (excavate around obstructions)

TABLE 2-9
Equipment Used During Construction

Equipment	Use
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

2.6.1 North Area

North Livermore and Dublin Substation Construction

PG&E will grade the proposed Dublin and North Livermore Substation sites to ensure adequate compaction and surface drainage. PG&E will initially install a 7-foot-high chain-link fence with a 1-foot barbed-wire outrigger around the perimeter of both substations to provide security and protect the public from contacting the high-voltage equipment.

Reinforced concrete footings and slabs will be constructed to support structures and equipment. PG&E will install buried conduit throughout the substation site for electrical control cables. After the trenches are dug, conduit will be placed on a bed of sand, and then soil will be backfilled and compacted to match the adjacent grade.

PG&E will install a grounding mat approximately 18 inches below the substation soil grade to protect workers from electrical shock in the event of a ground fault. Trenches will be dug in both directions across the station, and copper conductors will be installed, creating a grounding mat across the entire substation. Soil will be backfilled and compacted to match the adjacent grade. Gravel or crushed rock will be installed over the substation to a depth of approximately 4 inches to provide electrical isolation for workers in the substation.

Structures will be erected to support switches, electrical conductors, instrument transformers, and other electrical equipment, as well as to terminate incoming and outgoing power lines. PG&E will use fabricated tubular steel structures. Structures within the substation will be grounded to the station grounding grid. Workers will set all equipment on slabs and footings, and will either bolt or weld the equipment securely to meet seismic requirements.

230 kV Transmission Line

Right-of-Way Requirements

An easement of between 100 to 120 feet wide is required for 230 kV double-circuit transmission lines. The width depends on the lateral distance between the conductors, swing of the conductors caused by wind, and the distance specified by the CPUC's General Order 95 related to safe conductor clearances.

Construction Methods

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

- ***Step 1—Site Access Preparation.*** PG&E will use temporary laydown areas approximately 2 acres in size for constructing the proposed 230 kV transmission line. The North Livermore and Dublin Substation sites will be used as transmission line material laydown areas. Each site is 5 acres in size. This eliminates the need to impact any additional areas along the route.

  PG&E would construct approximately 7.9 miles of overhead transmission line in the North Area. The area to be traversed is primarily used for cattle grazing, and although it is somewhat remote, there is a developed road network used by property owners for managing their cattle operations. Construction equipment will be able to travel on approximately 4.8 miles of existing farm road, but may need to use cross-country routes (over grassland) in the dry season for approximately 4 miles. Some existing roads may need to be improved and/or widened to allow equipment access. All material removed for this purpose would be compacted in the existing roadway. Grades in excess of 15 percent will be evaluated to determine whether aggregate base (gravel) would be required (with the landowner's approval) to improve vehicle traction.

  Less than 1 mile of new all-weather (gravel) road, approximately 12 feet wide, would need to be constructed to provide access to some sites. Most of the new road construction is a half-mile segment necessary to connect the proposed Dublin Substation site to an existing county road. Proposed access road locations are shown in Figure 2-13.

  Access roads will be maintained when required for operation and/or maintenance of the transmission facilities; otherwise, the land will be restored to its original condition. 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 foundations at each structure site in the North Area. 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 a 100-foot radius around the foundation. Disturbance will consist of soil compaction from placement of crane outrigger pads and from vehicle tracks. If necessary, restoration of the area will include reseeding according to landowner instructions. However, most of the area will return to pre-existing conditions after the first spring rain season.

- **Lattice Steel Towers.** Placement of lattice steel towers will require boring four holes, one for each structure leg. 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.
- **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 rebar cage 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 place backfill around the foundations.

- ***Step 3—Erecting the Supporting Structures.***
  - **Lattice Steel Towers.** The double-circuit lattice steel towers will have three cross arms, each supporting two phases consisting of a single conductor on each side. Figure 2-9 illustrates a typical double-circuit lattice steel tower configuration. Steel tower components, packaged in bundles by tower type, will be dispatched to each tower site. Individual towers will be assembled immediately adjacent to the tower foundations and 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. After the structure is set on the foundation, crews will tighten all bolts to specified torques, attach insulators to the crossarms, and prepare the towers for the conductor stringing operation.
  - **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 2-10 illustrates a typical tubular steel pole structure. The pole shafts will be delivered to the 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 4—Conductor Stringing.*** Before conductor installation begins, temporary clearance structures will be installed at road crossings and other locations where the new conductors may accidentally come in 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 lines. These structures will be placed at the edge of the roadway and will not require grading. Conductor installation preparation activities require locating pull and tension sites at 2- to 3-mile intervals as shown in Figure 2-13. These sites will be approximately 1 acre in size.

  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 helicopters 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 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 structures would be removed at this time.

Packing crates, loose 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.

Distribution System

21 kV Wood Pole Installation. Placement of wood poles for the 21 kV distribution lines from North Livermore and Dublin Substations will require the use of an auger to dig the hole for the pole. The hole will be approximately 3 feet in diameter by 9 feet deep. The wood poles will be delivered to the site and the insulators and cross arms bolted to the poles. The poles will be assembled on the ground both for ease of construction and safety. The assembled poles will be lifted into the air with a line truck, set in the hole, and then backfilled.

21 kV Circuit Underground Installation. The 21 kV distribution system consists of underground electrical cables, conduits, substructures, subsurface equipment, and pad-mounted equipment. Underground electric facilities will be installed within the road easements as needed to serve existing and future customers. The conduits (duct) would be

installed in a trench approximately 3 feet wide and 8 feet deep. The conduit would have a minimum cover of 36 inches.

Conductor Installation. For overhead conductor installation, a steel cable is fed through stringing sheaves at the end of each insulator. The cable is then attached to the conductor and the conductor is pulled off the reels through a tensioner and strung to the other end.

Insert Figure 2-13, Access Roads, Pull and Tension Sites. (11 x 17 color)

Figure 2-13, Access Roads, Pull and Tension Sites. (11 x 17 color)

(even page)

2.6.2 South Area

Vineyard Substation Modification

New structures in the Vineyard Substation will be developed within the existing fenced area. 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 fabricated tubular steel structures. 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 and line traps, control and power cables, metering, relaying, and communication equipment.

230 kV Overhead Transmission Line

The procedures for bringing personnel, materials, and equipment to each structure site, constructing the supporting structure foundations, erecting the supporting structure, and stringing the conductors will vary along the route alignment. PG&E will construct the transmission line in four steps as described for the North Area transmission line. Transmission line materials will be stockpiled on General Electric property through a land rental agreement. Sufficient paved area exists on this property and no natural ground disturbance would be necessary. To construct the overhead portion of the South Area transmission line (approximately 2.8 miles), PG&E would construct approximately 0.8 miles of new all-weather (gravel) road. Construction vehicles would use 3 miles of an existing farm road and drive cross country over 0.8 miles of grazing land.

230 kV Underground Transmission Line

Construction Methods

The duct bank containing the solid dielectric cables would be installed in a trench approximately 3 feet wide and 8 feet deep. The duct bank would have a minimum cover of 32 inches. Approximately every 1,500 feet, splice vaults would be incorporated for installing cables and splicing sections of cables together. Each circuit would be capable of carrying 400 MVA per circuit at the normal conductor rating of 90 degrees centigrade. Cables would rise out of the ground at the transition station and at the Vineyard Substation, and they would terminate on support structures.

Approximately 2.7 miles of underground 230 kV double-circuit transmission line would be installed from Milepost 2.8 to the Vineyard Substation. The work would be completed using cut and cover construction (open trenching) of the underground power line, conduits, and duct banks.

Soil sampling and potholing will be conducted before construction. Soil information will be provided to construction crews to inform them about soil conditions and utility locations. 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. These methods include installation of sediment and erosion control structures according to best management practices (BMPs) to protect biological resources, roadways, and adjacent properties. Watering for dust control will also be employed.

Temporary lane closures along residential streets as required for underground construction would be coordinated with the City of Pleasanton as described in Chapter 11, 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 City of Pleasanton and will submit a traffic management plan subject to agency review and approval.

To construct the transition station, provide year-round maintenance access, and protect the underground cableway from accidental dig-ins, PG&E proposes to construct 0.4 mile of new roadway over the underground cable. This new road will connect the transition station to the existing access road leading to the water tank above Benedict Court. The water tank access road, approximately 0.4 mile long, would be used to install the remaining segment of underground cable before reaching city streets. The remaining length of underground cable will be installed within City of Pleasanton streets per the existing city franchise agreement.

Horizontal Dry Boring. Because open trenching through Arroyo Valle Creek is not desirable, horizontal dry boring will be used for underground construction at the Bernal Avenue Bridge. Up to two steel casings between 30 and 42 inches in diameter will be installed under the creek at least 5 feet below the creek bed or as required by the permitting agency. The dry boring operation under the creek would begin at the north end of the bridge in an underground easement area leading to the Vineyard Substation. An area approximately 25 feet by 100 feet would be used at this location for laydown and boring. A shored trench of approximately 20 feet deep would be used as a receiving area for the bore casing. The bore would be approximately 5 feet below the creek bed and approximately 15 feet below Bernal Avenue.

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 by 8 feet wide and would be approximately 20 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 creek bore is estimated to be approximately 100 cubic yards. All spoils and asphalt would be loaded straight from the bore area onto trucks for removal. At no time would spoils be stored on site. 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. Once boring is complete, the trench would be extended to meet the exposed cable at the south end of the bridge where the conduits would be joined together.

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 the bore is 3 weeks.

Construction Activities. As illustrated in Figure 2-14, the major construction activities associated with installation of underground cable are as follows:

- Saw cut the pavement for the trench and splice vaults
- Excavate a trench for the electrical conduit bank
- Haul away and dispose of trenched and excavated spoils
- Install the cable conduit, reinforcement bar, ground wire, and concrete conduit encasement (duct bank)
- Excavate and place pre-formed concrete splice vaults
- Backfill the trench
- Pull cable into the conduit bank and splice at several predetermined locations (vaults) along the route
- Terminate cables at Vineyard Substation and at transition structures
- Horizontal bore of one or two steel casings under Arroyo Valle Creek near Bernal Avenue
- Restore all paved surfaces, restore landscaping as necessary, and clean up the job site

Vehicles and Equipment. A dump truck would be on site during excavation activities. As trucks are filled with spoils, they would leave the site and be replaced by empty trucks. The number of truck trips per day would depend upon the rate of the trenching and the size of vault excavation. Jackhammers would be used sparingly to break up any sections of concrete that cannot be reached with the saw-cutting and pavement-breaking machines. Other miscellaneous equipment would include a concrete saw, a pavement breaker, various paving equipment, and pickup trucks.

Trenching. To construct the underground duct bank, the roadway would be temporarily trenched. The width of the work space will be as set forth in the encroachment permit to be issued by the City of Pleasanton. The typical trench would be approximately 3 feet wide, with a depth of 6 to 8 feet. A maximum open trench length of 600 feet on each street would be typical at any one time, with provisions for emergency vehicle and local access. Additionally, the trench would be wider or shored where needed to meet Cal/OSHA safety requirements. Prior to trenching, PG&E will notify other utility companies (via the Underground Service Alert or USA) to locate existing underground structures along the proposed alignment.

After the trench route is marked and encroachment permits are obtained, work begins with a concrete saw cutting the trench line. The trench pavement would be broken into manageable pieces for removal and the trench dug to a depth of 6 to 8 feet. At about 12 points along the trench, larger excavations would be opened to install splice vaults. Throughout construction, asphalt, concrete, and spoils would be hauled off by truck to an approved Class III disposal site. Approximately 11,000 cubic yards of asphalt and spoil would be removed, resulting in approximately 1,100 truck trips during excavation.

Vaults. Approximately 26 underground vaults (13 per circuit) would be installed 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 18 feet long, 5 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 vaults will be installed in pairs placed end-to-end and overlapping in order to separate circuits into respective vaults. The circuits are spliced in separate vaults in order for maintenance workers to work safely on a de-energized circuit while the second circuit remains energized. An electrical fault from an energized splice or cable inside of a vault could injure or be fatal to a worker. The total excavation footprint for the pair of vaults would be approximately 40 feet long by 15 feet wide. 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 of both vaults, filling and compacting a backfill, and repaving of the excavation area.

Equipment Installation. Following trench excavation, nine 6-inch PVC conduits would be racked in a three-by-three arrangement. As shown in Figure 2-15, 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 400 MVA load on this circuit would be met using approximately 2500-kcmil copper conductor extruded dielectric (XLPE) cable. To achieve this performance, both circuits 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

Insert Figure 2-14 Typical Underground Construction Process Within Roadways

(8 ½ Black and White)

operating temperatures not exceeding basal earth temperature), a minimum radial clearance of 12 inches is required from these substructures. These types of substructures include electric 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.

The majority of the route will be in the three-by-three duct bank configuration with occasional rolling of ducts into a flat configuration in order to clear substructures in highly congested areas or to fan out to termination structures. The main duct bank will split into two separate duct banks leading into each splice vault.

Backfilling and Paving. Once the duct bank is 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.

Cable Installation and Splicing. Cable will be pulled through individual ducts at the rate of approximately two pulls per day. After cable installation is completed, the cables will be spliced between all vaults and riser structures. 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.

Construction Duration

The length of time required for constructing this phase of the project is approximately 13 months. Trenching, installation of the concrete duct bank, and vault installation would be completed within 5 months, while cable installation, splicing, and terminating would require approximately 6 months. Underground construction will require approximately 10 to 20 crew members.

Right-of-Way Requirements

In undeveloped property, the conduit will be placed in the center of a 30-foot easement (to be acquired) that can be placed within a future roadway system. PG&E will restrict any above ground structure or foundation within the easement. Deep rooted vegetation that could compromise the integrity of the electric system will also be restricted. The easement

Insert Figure 2-15 Typical Duct Bank Installation of 230 kV Double-Circuit Dielectric Cable

(8 ½ Black and White)

language will require the property owner to notify PG&E should any change in the overburden depth be contemplated. This is necessary to ensure public safety and system integrity. In developed areas, the underground portion of the transmission line will be placed in city streets and will comply with City of Pleasanton franchise agreements.

2.6.3 Service Interruption During Construction

The following actions will be taken to avoid service interruptions:

- Customers will receive electricity from alternative sources where feasible
- Temporary distribution connections and construction may be implemented to maintain service during construction

2.6.4 Operation and Maintenance Procedures

General System Monitoring and Control

Substation monitoring and control functions will be connected to the Newark Switching Center and the Hayward Distribution Operations computer system by a telecommunication circuit. Protective relay communication will be through a power line carrier system.

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.

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)	Threatened and Endangered Species Biological Opinion
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, San Francisco Bay Region (RWQCB)	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
Endangered Species Consultation (through CEQA review process)	California Department of Fish and Game	Consultation on state-listed species; incidental take authorization (if required)
Section 1601 Streambed Alteration Agreement	California Department of Fish and Game	Dry boring under Arroyo Valle
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	Air emission reduction and monitoring
Local Agencies		
Roadway Encroachment Permit	County of Alameda	Permit to install distribution lines in roadway right-of-way
Roadway Encroachment Permit	Cities of Livermore and Pleasanton	Permit to install distribution facilities in roadway right-of-way
Welding, Grading, and Building Permits	Cities of Livermore and Pleasanton	Permission to conduct welding, grading, and building activities

2.8 Public Information Program

PG&E conducted individual briefings with elected officials, administrative agencies, and staff on 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.

PG&E distributed a briefing packet to community leaders and media representatives that included the following information:

- Tri-Valley Region Demand / Capacity Map detailing each area's megawatt usage and system capacity.
- Tri-Valley Upgrade Project Overview outlining the need for the project and the steps PG&E is taking to upgrade the system.
- Tri-Valley Upgrade Questions and Answers highlighting some of the most frequently asked questions about the project and the timing of the upgrade.
- Glossary of Commonly Used Terms to help the layperson and news reporters understand the basic language of the upgrade project.

PG&E also sent a project newsletter consisting of a map and description of the preferred project to community leaders and media representatives.

PG&E designed a web site with easy access from the main PG&E site or directly from the World Wide Web. The web site contains the same information as the briefing packets distributed to community leaders, but it can be easily updated and augmented with new project information. Web site visitors can communicate directly with PG&E through an attached e-mail system.

Two task forces were created to educate community policy makers and regional business leaders about the need for additional electric capacity in the Tri-Valley area. Input received from these groups helped PG&E select transmission line routes and substation sites that are likely to be acceptable to the public.

Several newspaper editorials and articles have been written supporting the project. The following documents are in Appendix C, Public Information Program:

- C1—Individual meetings with elected officials
- C-2—Individual meetings with public agency staff
- C-3—Presentations to city councils with attached presentation materials
- C-4—Business / developer task force members
- C-5—Public agency task force members
- C-6—Agendas and attendees for all business / developer and public agency task force tours and meetings
- C-7—"Tri-Valley Upgrade" packet, with attached list of recipients
- C-8—Preferred Project Mailing with attached list of recipients
- C-9—Newspaper articles and editorials concerning the Tri-Valley Project.

2.9 Intended Uses of a CPUC EIR

Assuming that the CPUC prepares an EIR to evaluate the potential impacts of the Tri-Valley 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 Tri-Valley 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 Tri-Valley Project.

2.10 Project Schedule

Figure 2-16 provides a summary of the proposed schedule for the Tri-Valley Project.

Insert Figure 2-16 (Summary of the proposed schedule)

(8 ½ Black and White) hand insert