CHAPTER 2
PROJECT DESCRIPTION

2.1 PROJECT NEED AND OBJECTIVES

On December 20, 1995, the California Public Utilities Commission (CPUC) issued a policy decision providing for the restructuring of the California electric industry. In this decision, the CPUC requested that Pacific Gas and Electric Company (PG&E) and Southern California Edison Company (Edison), the state's two largest utilities, voluntarily divest at least 50 percent of their fossil-fueled generating assets to address concerns over their possible market power in the restructured electricity market. In September 1996, California's electric industry restructuring legislation, Assembly Bill 1890 (AB 1890), was signed into law. AB 1890 endorsed a competitive generation industry separate from utility power transmission and distribution operations. (See Attachment B, Regulatory Background, for a discussion of electric industry restructuring.) Both AB 1890 and several CPUC decisions have required that generation assets be valued for the purpose of calculating the competitive transition charges, or CTCs, associated with the assets.[1] Sale is one method of measuring the market value of PG&E's generation assets.

In response to AB 1890 and the CPUC decisions, PG&E filed Application No. 96-11-020 with the CPUC in November 1996 to sell (divest) three of its fossil-fueled generating plants. Since that time, the three plants have been sold by auction. To further divest itself of its fossil-fueled generating resources, PG&E is now proposing to divest three of its fossil-fueled power plants, and all of its geothermal generating facilities. PG&E's objectives with respect to the proposed sales are as follows:

1. Take advantage of the expected favorable market for sale of generating facilities in 1998.
2. Provide an objective measure of the market value of the plants through the proposed competitive auction process.
3. Position PG&E for the competitive future.

The CPUC's primary project objectives include the following:

1. Facilitate the state's electric industry restructuring by helping to foster a competitive generation market.
2. Provide an objective measure of the market value of the plants.

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[1] A CTC is defined as a non-bypassable charge on each customer of the utility distribution company (UDC), including those who are served under contracts with non-utility suppliers, for recovery of the utility's transition costs. Refer to Attachment C, System Economic and Operational Characterization, for a more detailed discussion of CTCs.

3. Provide entities interested in participating in the California market a fair opportunity to acquire existing generation assets.
4. Facilitate its desire and the legislature's mandate to transition quickly to a competitive market.
5. Serve the financial interests of affected ratepayers.

2.2 PROJECT SETTING AND BACKGROUND

2.2.1 INTRODUCTION

PG&E filed Application No. 98-01-008 with the CPUC January 15, 1998 to divest four power plants. PG&E amended the application on July 17, 1998, and now seeks authority to divest three of its fossil-fueled power plants and all of its geothermal generating facilities through a competitive auction process (PG&E, 1998a). The Independent System Operator (ISO), the agency responsible for the operation and control of the statewide transmission system, has designated each unit at each of the plants as "must-run" and, as such, each plant will be subject to a Reliability Must-Run Agreement (RMRA).[2] PG&E proposes to sell the plants in the following four packages:

- Delta Power Plants (includes the Pittsburg Power Plant and the Contra Costa Power Plant)[3]
- Potrero Power Plant
- Geysers Power Plant, Sonoma County Units
- Geysers Power Plant, Lake County Units

The locations of these plants are shown in Figure 2.1. Prospective buyers may submit proposals for the purchase of any individual plant and/or for the purchase of any combination of plants, with the following exceptions: (1) prospective buyers must bid on the Delta plants as one package; and (2) the two sets of Geysers units (the Sonoma County units and the Lake County units) may not be bundled with each other or any other plant in the bidding process.

In order for the sales to be approved, the CPUC must determine, among other things, that the proposed sales are in the public interest, and these plants would no longer be necessary and useful in PG&E's performance and duties to the public. Since each of the plants proposed for sale is designated as "must run" for reliability by the ISO, the CPUC would also need to determine, in accordance with Public Utilities Code §362, that the terms and conditions of the sales would "ensure that facilities needed to maintain the reliability of the electric supply remain available and operational." The CPUC has approval authority over the general terms of the Purchase and Sale Agreement and the Operation and Maintenance Agreement of each proposed sale.

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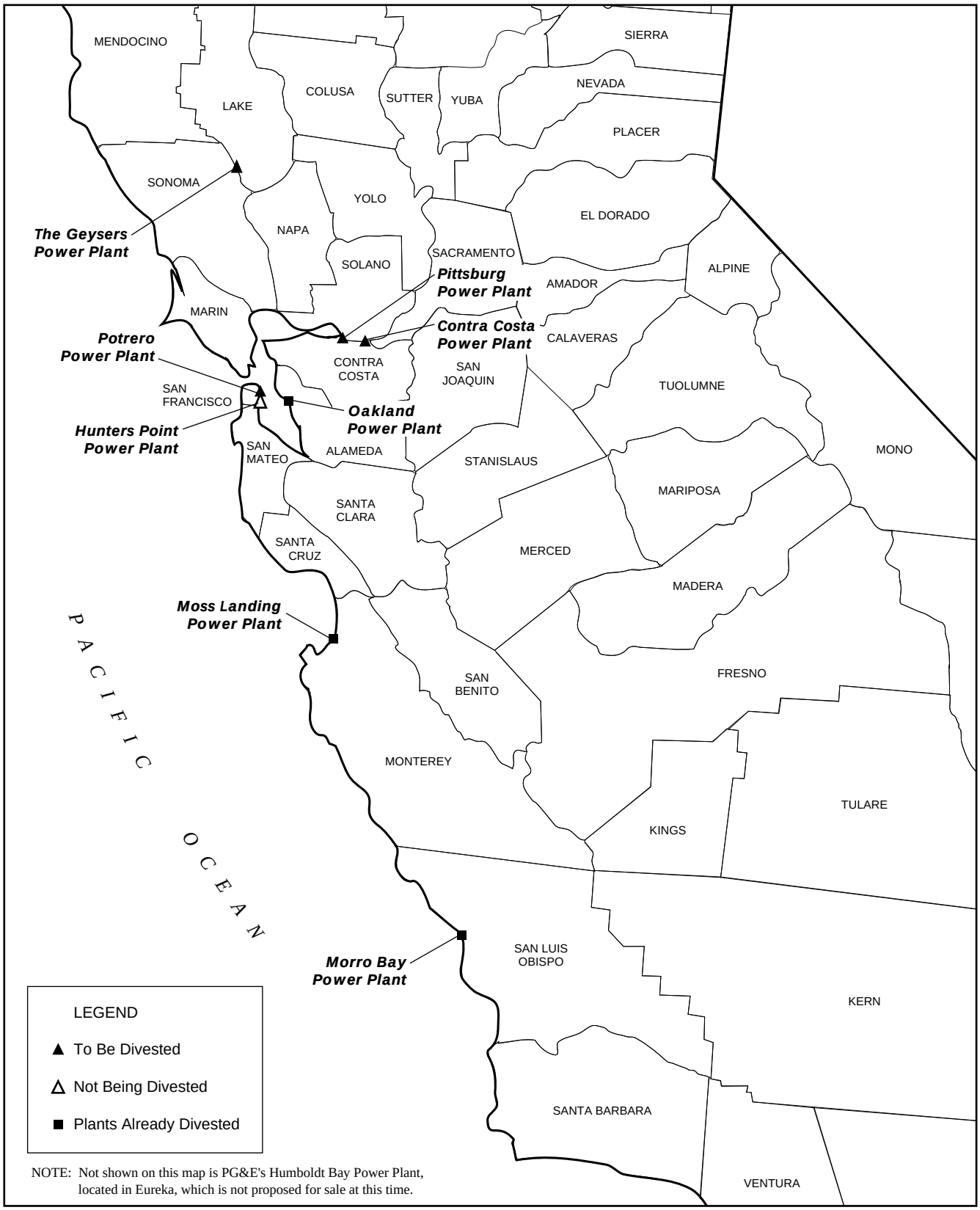
2 A "must-run" unit is a generating unit that is subject to an agreement between the unit owner and the ISO under which, in return for certain payments, the ISO is entitled to call upon the owner to run the unit or to provide ancillary services when required by the ISO to maintain electrical system reliability.

3 The two Delta plants are proposed to be sold as a package since, under existing regulations, their operations must be coordinated to comply with certain environmental permits.



Divestiture of Electric Generation Assets / 980125 ■

SOURCE: Environmental Science Associates

Figure 2.1
Locations and Divestiture Status of the Pacific Gas and Electric Company Power Plants

The fossil-fueled plants (Potrero Power Plant, Pittsburg Power Plant, and Contra Costa Power Plant) are located in San Francisco and Contra Costa Counties and consist of a mix of 10 steam turbine units and three combustion turbine units. Each of these plants primarily generates electricity from steam turbines and boilers fueled by natural gas. The Potrero Power Plant also generates electricity from combustion turbines that burn distillate fuel oil rather than natural gas. By selling the three fossil-fueled plants, PG&E would divest itself of 3,065 megawatts (MW) of net generating capacity that have accounted for about 45 percent of the utility's total fossil-fuel generation over the past five years.[4]

The Geysers Power Plant has 14 generating units (at 11 sites) with a total net installed design capacity of 1,224 MW. Two of the units at the Geysers Power Plant are in Lake County and are being sold as a package separate from the 12 Sonoma County units. The Lake County units have 246 MW of combined net generating capacity, while the Sonoma County units account for the remaining 978 MW of combined generating capacity. Over the last five years, generation from all of the units at the Geysers Power Plant has accounted for roughly 6.6 percent of the total generation from PG&E's system, and all of its geothermal energy.

Generally speaking, all of PG&E's plants are relatively old, and generally operate as load-following resources used to meet changing loads, peak-demand conditions and reliability. The steam turbine units at the fossil-fueled plants are typically operated such that they have small capacity factors (i.e., they operate at a level that is well below their full design capacity on an annual average basis).[5] Combustion turbines, which serve as peaking units, have even smaller capacity factors.

With respect to the proposed divestiture, PG&E plans to transfer all facilities, equipment, permits (e.g., air and water), land interests, and other entitlements for use that are required for continued operation of the plants. PG&E will retain facilities and equipment at each site that relate to transmission or distribution facilities. Other than minor construction activities that may be necessary to separate generation from transmission and distribution facilities, the proposed divestiture does not directly involve any planned expansion, modification or dismantling of existing facilities and structures.

The Geysers Power Plant is supplied with natural steam from geothermal steam wells under agreements between PG&E and two steam suppliers, Unocal-Thermal and Calpine.[6] Steam for the 12 Sonoma County units is provided under agreements with Unocal-Thermal, while steam for

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4 The generating capacity of a unit is expressed in megawatts. One megawatt (MW) provides enough energy to power 1,000 average California homes per day. Net generation refers to the gross amount of energy produced by a unit minus the amount of energy the unit consumes. Generation is typically measured in megawatt-hours (MWh), kilowatt-hours (kWh), or gigawatt-hours (GWh).

5 Capacity factor is defined as the ratio of power actually produced by a generating unit to the maximum power it could possibly produce in the same time period. Capacity factor (cf) = (amount generated, in kilowatt-hours or megawatt-hours) ÷ (rated generating capacity, also in kilowatt-hours or megawatt-hours, for the same time period).

6 Union Oil California (Union) and its subsidiary, NEC Acquisition Company (NEC), are collectively referred to as Unocal, and Thermal Power Company (Thermal Power), which was acquired by Calpine in September 1994, is referred to as Thermal. Calpine is the successor to Signal Oil and Gas Company, with whom PG&E entered into a steam supply agreement in 1973.

the two Lake County units is provided under a Calpine Agreement. PG&E plans to transfer its rights and obligations under these steam contract agreements to the new owner(s). The Unocal-Thermal agreements contain various provisions, including provisions for effluent disposal, quantities of contaminants, cleanup and environmental mitigation, steam pricing, lease for the use of land, and rights of first refusal to purchase the generating units. PG&E's latest agreements with Unocal-Thermal expire on October 1, 2035. The Calpine Agreement also contains various provisions, including provisions for land and access rights, effluent disposal, an environmental surveillance program, and enhancement of wildlife habitat. The Calpine Agreement is effective for as long as any unit remains in commercial operation. Much like Unocal-Thermal's right of first refusal to the Sonoma County units, Calpine has the right of first refusal to the Lake County units.

PG&E's current divestiture application, as amended July 17, 1998, does not include its 112 hydroelectric units (3,910 MW), Hunters Point Power Plant (423 MW), Humboldt Bay Power Plant (105 MW), three mobile combustion turbines (45 MW), or the Diablo Canyon Nuclear Power Plant (2,160 MW).[7] PG&E is currently considering the divestiture of its hydroelectric assets.

2.2.2 TERMS OF THE PROPOSED SALES

POTRERO, PITTSBURG, AND CONTRA COSTA POWER PLANTS

As summarized in PG&E's Proponent's Environmental Assessment (PEA) (PG&E, 1998b), PG&E's Application No. 98-01-008, as amended in July 1998, seeks authority to sell the fossil-fueled power plants under the following terms and conditions:[8]

1. The three plants will be offered for sale through a competitive bidding process to buyers who are qualified to ensure that the plants operate when needed for system reliability and to conduct any required decommissioning in a responsible manner. Qualified entities would be permitted to bid on and purchase more than one facility, although the Contra Costa and Pittsburg Power Plants must be bought as a package.

2. All generating units at a site will be sold to the same buyer, along with equipment, land, and other interests required for generation operations at the site.

3. PG&E plans to retain ownership and control of the switchyards and any transmission-related facilities.

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7 PG&E recently sold by auction the following power plants: 1) Morro Bay Power Plant, located within San Luis Obispo County in the City of Morro Bay (1,478 MW); 2) Moss Landing Power Plant, located in Monterey County, east of the community of Moss Landing (1,002 MW); and 3) Oakland Power Plant, located within Alameda County in the western part of the City of Oakland (165 MW). The sale of these plants to affiliates of Duke Energy Power Services, Inc. was approved by the CPUC on December 16, 1997. The sale closed on July 1, 1998.

8 The PEA (1998b) describes the terms and conditions for the sale of four fossil-fueled plants, one of which PG&E applied to withdraw from the sale in July 1998. The terms and conditions presented in the PEA continue to apply to the three fossil-fueled plants proposed for divestiture.

4. PG&E would identify and retain liabilities associated with any soil and groundwater contamination existing prior to sale, off-site disposal prior to sale, and ongoing operations of the switchyards and transmission facilities. To control the potential costs associated with these liabilities, the proposed Purchase and Sale Agreement gives PG&E the right to conduct post-sale remediation. PG&E would be responsible for remediating the contamination for which it retains liability if and when such remediation is required by law. The buyer would be required to indemnify PG&E against liabilities arising from buyer and third-party post-sale activities. In addition, the buyer will agree not to develop the site for residential or certain other uses.

5. The buyers for Contra Costa, Pittsburg, and Potrero Power Plants will be required to enter into suitable "must-run" contracts with the ISO.

6. PG&E will operate the plants at the direction of the new owner pursuant to an Operation and Maintenance Agreement (O&M Agreement) that would have a term of two years after the sale closes (assuming the plants remain in operation).

PG&E's proposed sale and regulatory approval process for the three power plants is designed to complete the divestiture of these plants by the third quarter of 1998 or as soon thereafter as practical.

GEYSERS POWER PLANT

As summarized in PG&E's PEA (PG&E, 1998c), PG&E's Application No. 98-01-008 also seeks authority to transfer all rights and obligations under its steam contracts, and all facilities, equipment, permits, land interests, and other entitlements required for the operation of the Geysers Power Plant units. The power plant has 12 operational units in Sonoma County (Units 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18 and 20) and two in Lake County (Units 13 and 16). The Sonoma County units are being sold as a package separate from the Lake County units. PG&E will retain almost all facilities and equipment related to transmission and distribution, and rights to access the property for transmission, distribution, and remediation purposes, as described in Items 3 and 4, below. Sale of the power plant is proposed to occur under the following terms and conditions:

1. The Geysers Power Plant will be offered for sale through a competitive bidding process to buyers who are qualified to ensure that the plant operates when needed for system reliability, and, when no longer needed, to conduct any required decommissioning in a responsible manner.

2. Under the terms of PG&E's Steam Agreements with Unocal-Thermal and Calpine, Unocal-Thermal and Calpine have rights of first refusal to purchase the 12 power units located in Sonoma County and the two power units in Lake County, respectively. To accommodate these rights, potential buyers will be required to bid for units in Sonoma County separately from units in Lake County. Furthermore, even if the right of first refusal is not exercised for the Sonoma County units, the agreements and related land interests and facilities may still only be transferred or sold pursuant to joint, prior written consent of Unocal-Thermal, and such consent may not be unreasonably withheld. In the event that the Lake County and Sonoma County units are sold to separate purchasers, fixed common facilities such as the West Geysers Administration Center, East Geysers Operations Center, and Satellite Communications Center will be transferred to the buyer of the Sonoma County units

3. PG&E will transfer ownership and control of its 21-kilovolt (kV) distribution system and the 4 kV service, which provides house power for the Geysers units. As to the 21 kV line, PG&E will retain final connections, as well as the right to use the line to deliver power to a few end-use customers. PG&E will retain the 115-kV and 230-kV transmission lines. PG&E will retain responsibility for the safety and maintenance of the lines it continues to own, even if the generator also has an interest in the lines. PG&E will provide maintenance services for the 21-kV line under its two-year O&M Agreement with the new owner(s). PG&E will not retain any interest in real estate, except that PG&E will retain rights of access to its retained equipment and for remediation purposes.

4. PG&E will identify and retain liabilities associated with soil and groundwater contamination existing prior to sale (unless caused by a purchaser, steam supplier or land owner, in addition to other limited exceptions) and off-site disposal prior to sale (with certain limited exceptions). PG&E will also retain any liabilities associated with ongoing operations of assets or interests it does not sell. To control the potential costs associated with these liabilities, the proposed Purchase and Sale Agreement gives PG&E the right to conduct post-sale remediation. PG&E would be responsible for remediating the contamination for which it retains liability if and when such remediation is required by law. The buyer will be required to indemnify PG&E against liabilities arising from buyer and third-party post-sale activities. In addition, the buyer will agree not to develop the site for residential or certain other uses and will be responsible for returning the site to its natural condition upon any required decommissioning.

5. The buyers for the Sonoma County units and the Lake County units will be required to enter into suitable “must run” contracts with the ISO.

6. PG&E personnel will operate the plants at the direction of the new owner pursuant to an O&M Agreement that will have a term of two years after the sale closes.

PG&E’s proposed bidding, sale, and regulatory approval process for the Geysers Power Plant is designed to complete the divestiture of the plant by the fourth quarter of 1998 or as soon thereafter as practical.

2.2.3 DESCRIPTIONS OF THE POWER PLANTS TO BE SOLD

The general characteristics of each plant proposed for sale are presented in Table 2.1 and described below.

POTRERO POWER PLANT

The Potrero Power Plant is located in the City and County of San Francisco at 1201 Illinois Street, between 22nd and 23rd Streets, on a 26-acre site formerly occupied by a manufactured gas plant. Figure 2.2 shows the location of the Potrero Power Plant. Figure 2.3 delineates the approximate boundaries of the property being either sold or retained. The plant property is bound by 22nd Street and a paved parking lot to the north; 23rd Street to the south, except for the land that PG&E owns within Warm Water Cove south of 23rd Street; Illinois Street to the west; and the San Francisco Bay to the east. Surrounding land uses primarily include light and heavy industrial uses and commercial businesses. Residences located on Potrero Hill are approximately one-half mile west of the site.

TABLE 2.1
DESCRIPTIONS OF PACIFIC GAS & ELECTRIC COMPANY FACILITIES

Facility Name	Unit[a]	Design Capacity (MW)	Average Capacity Factor (percent)[b]	Net Generation (MWh)[c]	Type[d]	Start-up Year	Fuel (Primary, Back-up)[e]	Percentage of Hours in Service[f]
POTRERO POWER PLANT		**363 MW**						
	3	207 MW	52.3	948,774	Steam turbine	1965	Natural gas, residual fuel oil	82.9
	4	52 MW	1.7	7,734	Combustion turbine	1976	Distillate only	2.4
	5	52 MW	1.7	7,556	Combustion turbine	1976	Distillate only	3.8
	6	52 MW	1.7	7,616	Combustion turbine	1976	Distillate only	3.2
PITTSBURG POWER PLANT		**2,022 MW**						
	1	163 MW	9.8	559,794	Steam turbine	1954	Natural gas only	19.1
	2	163 MW	9.8	559,794	Steam turbine	1954	Natural gas only	19.1
	3	163 MW	9.8	559,794	Steam turbine	1954	Natural gas only	19.1
	4	163 MW	9.8	559,794	Steam turbine	1954	Natural gas only	19.1
	5	325 MW	28.8	820,922	Steam turbine	1960	Natural gas, residual fuel oil	60.4
	6	325 MW	35.5	1,011,200	Steam turbine	1961	Natural gas, residual fuel oil	72.8
	7	720 MW	38.0	2,400,464	Steam turbine	1972	Natural gas, residual fuel oil	61.4
CONTRA COSTA POWER PLANT		**680 MW**						
	6	340 MW	33.0	984,399	Steam turbine	1964	Natural gas, residual fuel oil	56.8
	7	340 MW	33.9	1,009,205	Steam turbine	1964	Natural gas, residual fuel oil	57.9
GEYSERS POWER PLANT		**1,224 MW**						
	5	53 MW	62.8	291,746	Geothermal	1971	Not applicable (steam only)	88.9
	6	53 MW	68.3	317,305	Geothermal	1971	Not applicable (steam only)	87.8
	7	53 MW	52.5	243,787	Geothermal	1972	Not applicable (steam only)	80.0
	8	53 MW	56.8	263,947	Geothermal	1972	Not applicable (steam only)	83.6
	9	53 MW	34.2	158,699	Geothermal	1973	Not applicable (steam only)	55.2
	10	53 MW	37.4	173,673	Geothermal	1973	Not applicable (steam only)	60.3
	11	106 MW	39.4	365,960	Geothermal	1975	Not applicable (steam only)	69.6
	12	106 MW	33.6	312,325	Geothermal	1979	Not applicable (steam only)	78.5
	13	133 MW	61.2	713,715	Geothermal	1980	Not applicable (steam only)	93.7
	14	109 MW	41.7	398,390	Geothermal	1980	Not applicable (steam only)	77.0
	16	113 MW	67.0	663,249	Geothermal	1985	Not applicable (steam only)	96.0

TABLE 2.1 (Continued)
DESCRIPTIONS OF PACIFIC GAS & ELECTRIC COMPANY FACILITIES

Facility Name	Unit[a]	Design Capacity (MW)	Average Capacity Factor (percent)[b]	Net Generation (MWh)[c]	Type[d]	Start-up Year	Fuel (Primary, Back-up)[e]	Percentage of Hours in Service[f]
GEYSERS POWER PLANT (cont.)	17	113 MW	39.0	386,628	Geothermal	1982	Not applicable (steam only)	95.3
	18	113 MW	46.7	462,865	Geothermal	1983	Not applicable (steam only)	87.5
	20	113 MW	42.4	419,828	Geothermal	1985	Not applicable (steam only)	87.1

a Contra Costa Power Plant Units 1-5 were retired as of January 1, 1995, but are included in the proposed sale. Geysers Power Plant Units 1, 2, 3, 4 and 15 are also retired, and PG&E is not proposing to sell them. PG&E will retain ownership of the retired units and will be responsible for their eventual closure. Units 19 and 21 at the Geysers Power Plant were never built.

b Averaged over a five-year period (1993-1997). Indicates the unit's average load, as a percentage of the unit's design capacity.

c Averaged over a five-year period (1993-1997).

d The combustion turbines at the Potrero Power Plant can also be operated as synchronous condensors.

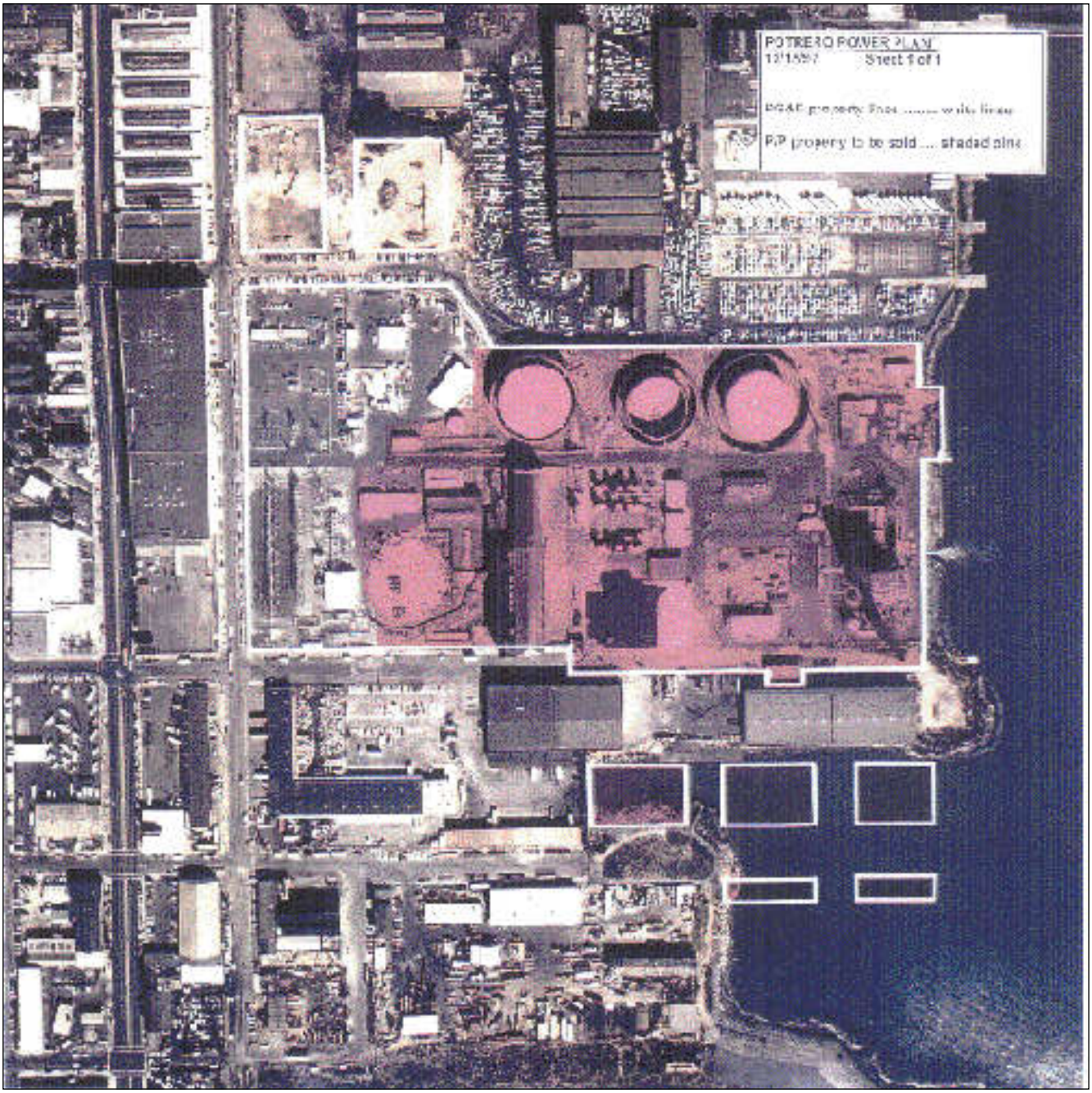
e Back-up fuel capacity is intended to be employed only in emergency situations. The residual fuel oil has a sulfur content of 0.5 percent by weight. Residual fuel oil was last purchased by PG&E in 1991, but is still stored on-site at some of the plants.

f Averaged over a five-year period (1993-1997). Indicates the percentage of time the unit was turned on, but does not necessarily indicate operation at full load. The operating hours shown for the combustion turbines at the Potrero Power Plant include synchronous condensor operating hours.

SOURCES: PG&E, *Application of Pacific Gas and Electric Company for Authorization to Sell Certain Generating Plants and Related Assets Pursuant to Public Utilities Code Section 851 (Application No. 98-01-008)*, January 14, 1998; PG&E, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of Four Bay Area Generating Plants*, before the Public Utilities Commission of the State of California, January 14, 1998; PG&E, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of the Geysers Geothermal Power Plant*, before the Public Utilities Commission of the State of California, January 14, 1998.

SOURCE: USGS; Environmental Science Associates

Figure 2.2
Location of the Potrero
Power Plant



SOURCE: Pacific Gas & Electric

Figure 2.3
Potrero Power Plant
Property Lines

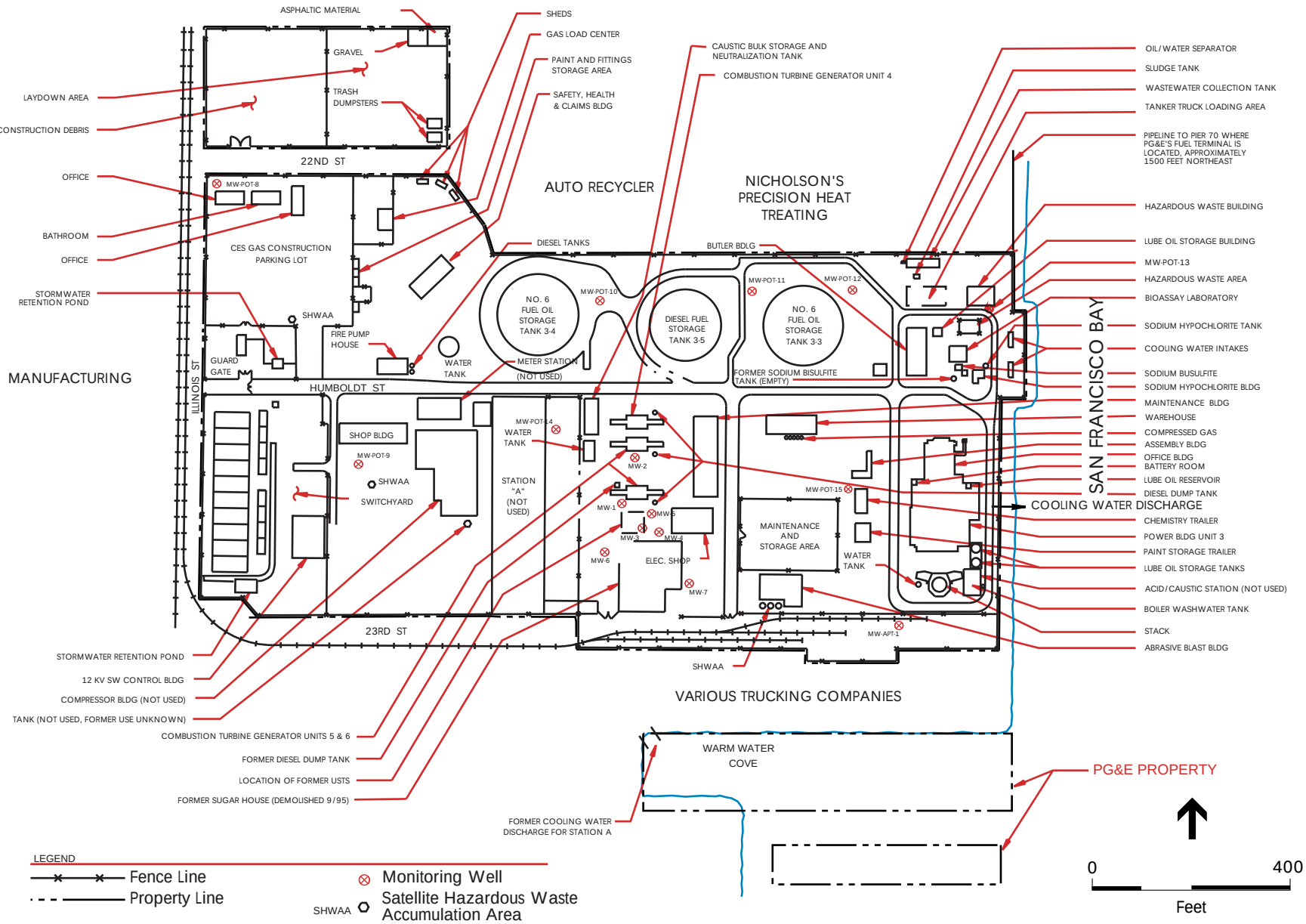
The Potrero Power Plant consists of one boiler and associated cooling water system, a steam turbine, three combustion turbines, and associated facilities (e.g., a switchyard, a control building, fuel oil tanks, and a firewater tank). Figure 2.4 shows the layout of these facilities on the plant site. The boiler that powers the steam turbine (Unit 3) is capable of burning natural gas or residual fuel oil, while the combustion turbines burn only distillate fuel oil.[9] Even though residual fuel oil has not been burned in Unit 3 in recent years, residual fuel oil is present in tanks on site. PG&E is prohibited by BAAQMD Regulation 9, Rule 11 from burning residual fuel oil, except for limited testing purposes and in the event of a natural gas curtailment. The amount of residual fuel oil stored on-site is intended to suffice for three weeks of boiler operation under such an event. The capacity and general characteristics of the power plant are described in Table 2.1.

The fuel tank farm located along the northern boundary of the plant consists of three aboveground storage tanks with a combined storage capacity of 21.7 million gallons. All three aboveground tanks are being divested. Two of the tanks store residual fuel oil for the boiler, while the third tank stores distillate fuel for the combustion turbines. These fuels may be delivered by truck to the Pier 70 marine terminal, one-half mile north of the plant, and then delivered to the site via a 20-inch residual fuel oil pipeline and a 12-inch distillate fuel pipeline. PG&E leases the Pier 70 terminal from the Port of San Francisco. The lease will be transferred with the plant to a new owner. Distillate fuel is also delivered to the plant via truck. Natural gas is delivered to the plant via transmission pipelines that connect to PG&E's San Francisco Load Center.

A switchyard is located in the southwest portion of the site along the east side of Illinois Street. The switchyard consists of a 12 kV control building and associated equipment. Power generated at the plant is delivered to the switchyard for transmission to the electrical grid system. The switchyard is not part of the sale, and will be retained by PG&E.

The central portion of the plant site is primarily non-operational, meaning no power generation or maintenance activities occur in these areas. Other non-operational areas of the site include a materials storage/laydown area, land immediately north of 22nd Street where four aboveground storage tanks were formerly located, and two submerged parcels of land located within Warm Water Cove, south of the power plant. The non-operational area in the central portion of the plant site includes Station A, a former compressor building, a former meter station building, and a vacant parking lot formerly used for a refinery sugar house and a fuel island. Station A refers to a brick building that once housed PG&E's first power plant. The last generating units were removed from Station A in 1982. The land north of 22nd Street is primarily used as a laydown area to store backhoes, sand, gravel, asphaltic concrete, and two solid waste dumpsters. The land immediately west of the laydown area is currently used to store construction debris. PG&E is divesting all of the above-described non-operational areas, except for the land north of 22nd Street.

[9] The distillate fuel oil or diesel fuel oil that is burned in a combustion turbine is similar to Jet A fuel oil used in jet airplanes. Distillate fuel oil is more refined (less crude) than residual fuel oil.



SOURCE: CDM

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Figure 2.4
Potrero Power Plant
Facility Layout Map

PITTSBURG POWER PLANT

The Pittsburg Power Plant is located at 696 West 10th Street, in an unincorporated area of Contra Costa County, near the City of Pittsburg. Figure 2.5 shows the location of the Pittsburg Power Plant. Figures 2.6a, 2.6b, and 2.6c show the approximate boundaries of the properties being either sold or retained. Specifically, the northern boundary of the plant is located adjacent to Suisun Bay, about 10 miles upstream from the inland boundary of the Carquinez Strait at Martinez and about 5 miles downstream from the Contra Costa Power Plant.

The total site area is about 2,140 acres, including the land west of the site.[10] About one-quarter of the 2,140-acre site is dedicated to utility facilities, with active operations covering roughly 280 acres of that land. In addition, 39 acres are dedicated to marina uses, and roughly 90 acres to a waste disposal site (see the discussion of the "Shell Pond" and the "Carbon Pile" below). The remainder of the site includes mostly unused marshy lands.

The power plant itself is situated on the eastern end of the property. No surface water bodies are present on this portion of the site. A large cooling water canal is located immediately west of the power plant. Mallard Slough bisects the property and contains a Contra Costa Water District water supply pumping plant. A former ammonia plant, owned and operated by Shell Oil Company, was located in the western portion of the property, approximately three miles west of the switchyard, and reportedly operated from 1930 to 1967. The ammonia manufacturing process produced a byproduct called "carbon black" that was stockpiled on the property. Adjacent to the 11-acre carbon black stockpile ("the Carbon Pile") is a 72-acre pond ("Shell Pond") that historically received discharge water from the ammonia plant. Neither the Carbon Pile nor the Shell Pond are included in the area being sold by PG&E.

Surrounding land uses include light industrial, residential, and marina uses. The site is bound by Suisun Bay to the north; the Southern Pacific Railroad and Willow Pass Road to the south; the Pittsburg Marina and residential property to the east; and the Harris Yacht Harbor and commercial property to the west. The Harris Yacht Harbor is located on land leased from PG&E. PG&E would retain the existing lease, as this area is not included in the area to be sold. The plant is also neighbored by several manufacturing and storage facilities, auto repair shops and dismantling yards, and sewage treatment plants. Residential areas and the boating marina are located east of the main power plant portion of the site.

The Pittsburg Power Plant consists of seven boilers, seven steam turbines, and associated facilities (e.g., an electric switchyard, cooling water intake structures, a cooling water canal and a cooling tower, fuel oil tanks, an off-site pipeline terminus, and an on-site marine terminal dock). Figure 2.7 shows the layout of these facilities on the plant site. The plant site also contains non-operational areas and acreage leased for agriculture. The capacity and characteristics of the power plant are described in Table 2.1.

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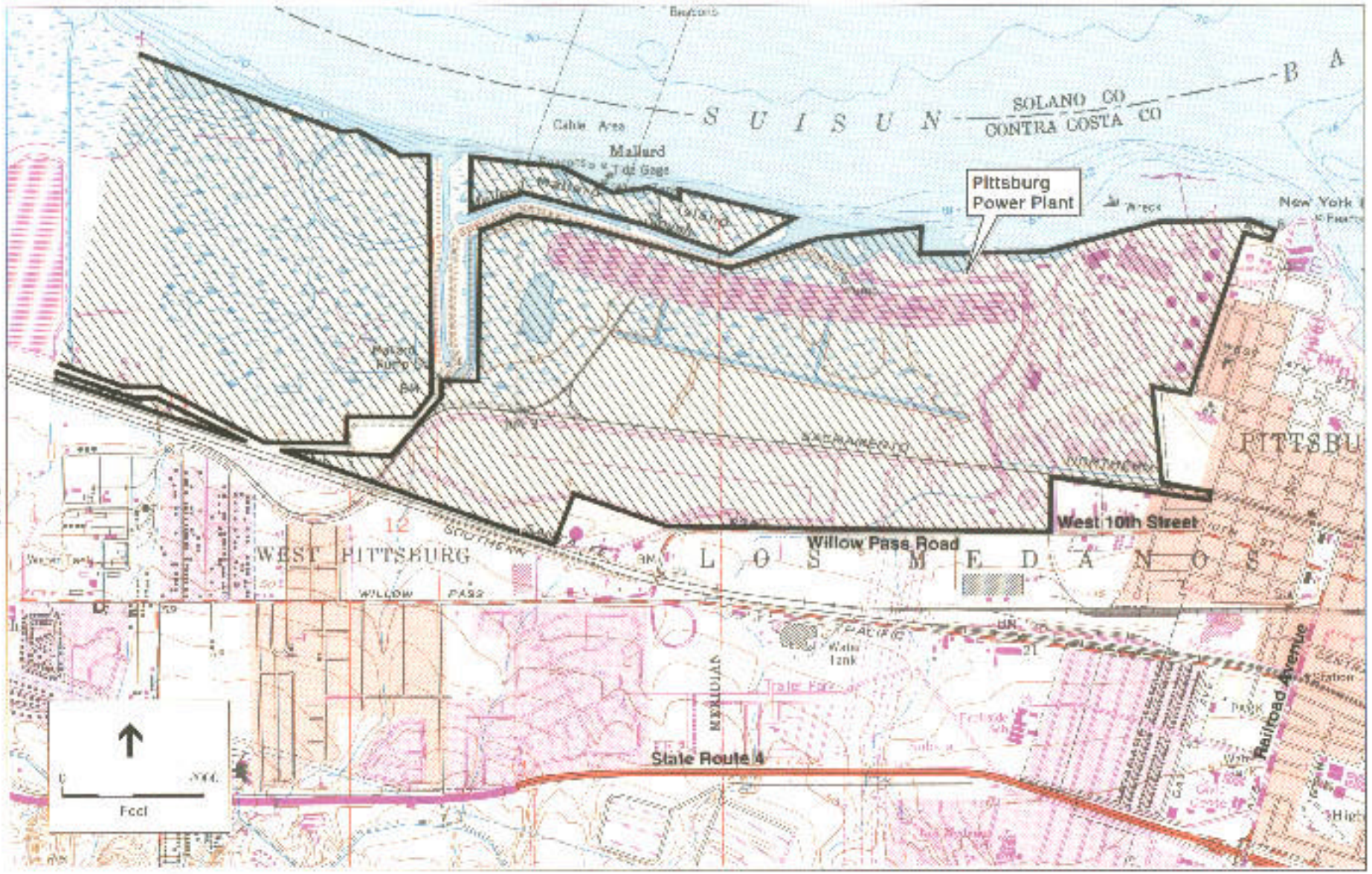
[10] In 1951, PG&E purchased a 280-acre parcel of agricultural land used for grazing and dairy farming. Subsequent property acquisitions through 1974 resulted in the current property area of approximately 2,140 acres. The majority of this additional acreage was obtained from 1972 through 1979 and included the acquisition of Shell Pond, the Carbon Pile, and a detached parcel located south of the railroad tracks, south of McAvoy Boat Harbor.



SOURCE: USGS, Environmental Science Associates

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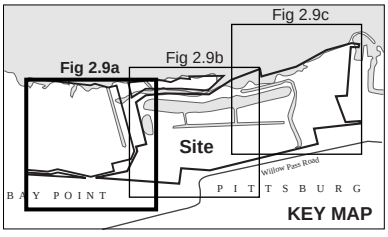
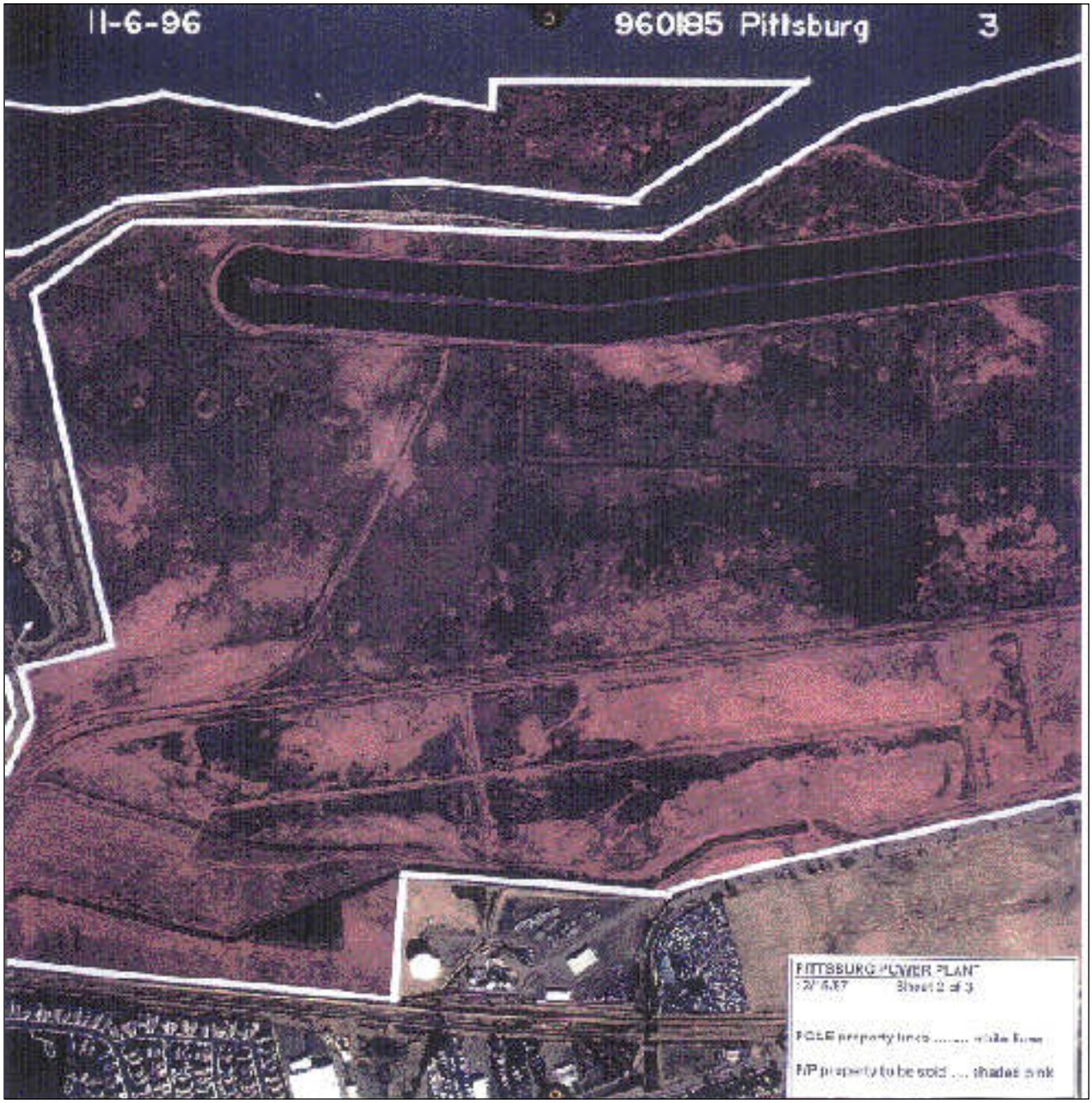
Figure 2.5
Location of the Pittsburg Power Plant

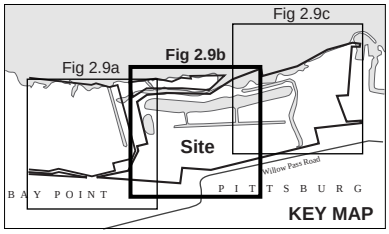


SOURCE: Pacific Gas & Electric

Divestiture of Electric Generation Assets / 980125 ■

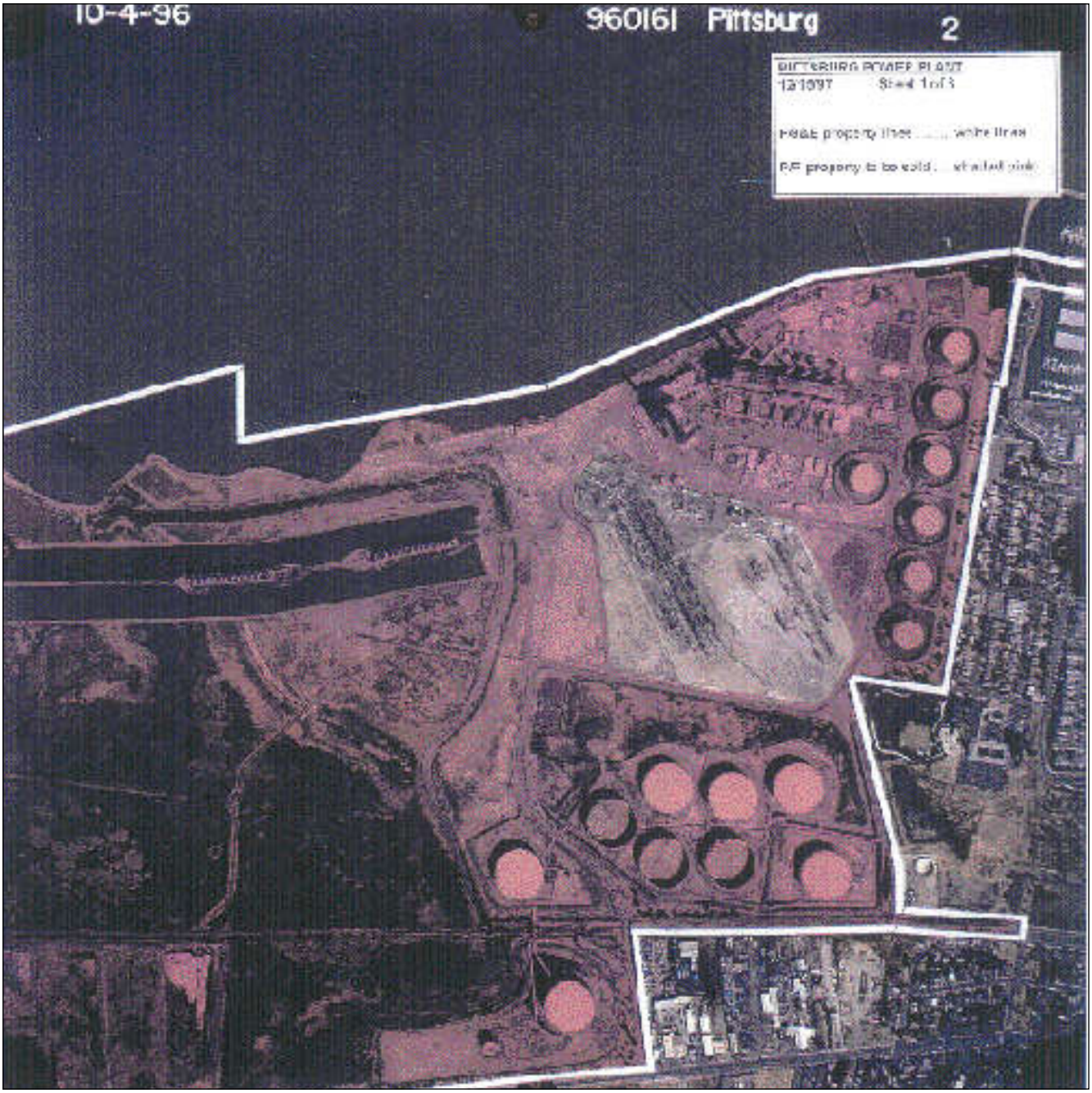
Figure 2.6a
Pittsburg Power Plant
Property Lines

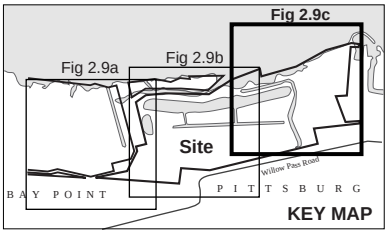




SOURCE: Pacific Gas & Electric

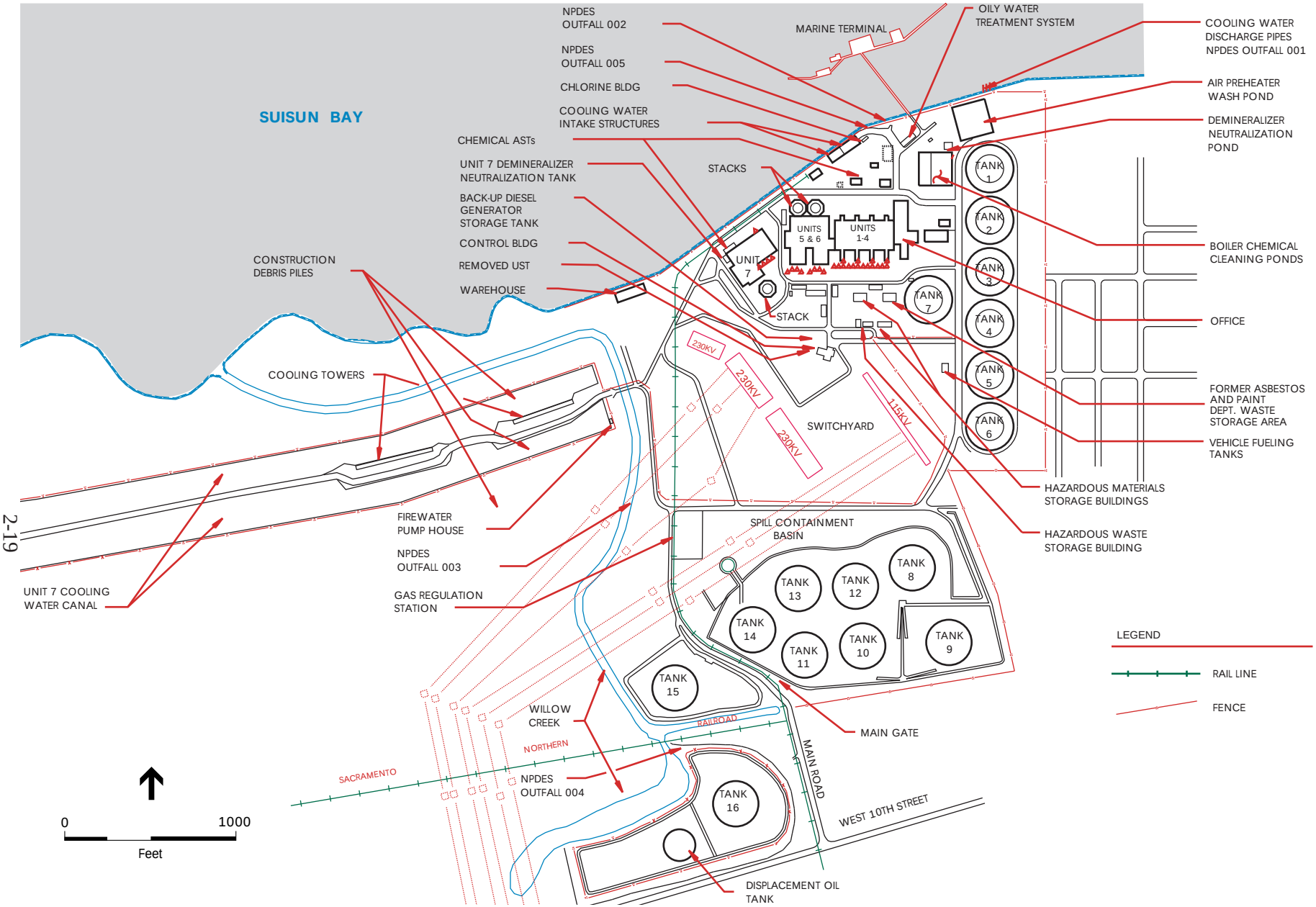
Figure 2.6b
Pittsburg Power Plant
Property Lines





SOURCE: Pacific Gas & Electric

Figure 2.6c
Pittsburg Power Plant
Property Lines



SOURCE: CDM

Figure 2.7
Pittsburg Power Plant
Facility Layout Map

The plant cooling system uses "once-through" cooling water drawn through intake structures from Suisun Bay for Units 1 through 6 and from a cooling water canal for Unit 7 (see Figure 2.7). Cooling water circulates through condenser tubes that cool the steam used to rotate the turbines. The cooling water is then returned to Suisun Bay (from Units 1-6) and to the cooling water canal (from Unit 7). The steam condensate is returned to the boilers to be reused as steam. The cooling water canal and intake towers are included in the area being sold by PG&E.

Natural gas is the primary fuel used by the seven units at the Pittsburg Power Plant. Natural gas is delivered to the plant via a 20-inch transmission pipeline from PG&E's Antioch Gas Terminal. Two of the three boilers associated with Units 5, 6 and 7 are also capable of burning residual fuel oil. However, PG&E is prohibited by BAAQMD Regulation 9, Rule 11 from burning residual fuel oil, except for limited testing purposes and in the event of a natural gas curtailment. Located on the plant site are four service tanks and twelve aboveground storage tanks capable of storing fuel oil. Of these sixteen tanks, nine of them (Tanks 1, 3, 5, 6, 10, 11, 12, 15 and 16) are essentially empty, containing less than two feet of oil that cannot be pumped out and would have to be drained. Only seven of the sixteen tanks (Tanks 2, 4, 7, 8, 9, 13 and 14) contain usable fuel oil. Displacement oil is stored in an additional tank. The displacement oil is used to purge and preheat pipes when switching from burning natural gas to residual fuel oil in the boilers. The two tank farm areas are in the northeast and southeast portions of the property and are accessible through both a marine terminal and a fuel oil line that provide connections to five major nearby refineries. Tanks 1 through 7 are located along the eastern boundary of the site, while Tanks 8 through 16 and the displacement oil tank are located at the southeastern corner of the site adjacent to the main gate. The combined fuel storage capacity for the plant is approximately 5.7 million barrels of oil. Between 1974 and 1976, a 42-mile-long underground pipeline was constructed between Richmond and Antioch to transport fuel oil from Chevron's Richmond Refinery to the Pittsburg and Contra Costa Power Plants. The Richmond-Pittsburg portion of this pipeline has not been used for continuous deliveries of oil for power generation since 1982 and may be sold by PG&E (separate from this divestiture application). Four other major refineries are either currently connected to or may connect to the fuel oil line that supplies the Pittsburg tank farm. The marine terminal dock, which extends about 650 feet into Suisun Bay to the edge of the ship channel, is located at the northeast corner of the site and can be used for offloading fuel from tanker vessels. The dock supports a 12-inch and a 20-inch pipeline for unloading oil to the storage tanks. The terminal has not been used in about six years, but is still available for oil deliveries. All of the fuel-related facilities, except the pipeline connecting the plant to Chevron's Richmond Refinery, are being sold with the plant.

The non-operational area comprises the area west of the switchyard and Tanks 8 through 16. No power generation or maintenance activities are conducted in this area. PG&E also owns a detached 40-acre parcel located about three miles west of the switchyard and south of the railroad tracks. Two persons, tenants of PG&E, live in trailers and maintain approximately 65 cattle in the southwest portion of the site adjacent to the Harris Yacht Harbor. Several equipment storage trailers, sheds, vehicles, and various types of equipment are maintained and stored at this location. The non-operational areas, except for the Shell Pond, the Carbon Pile, and some areas

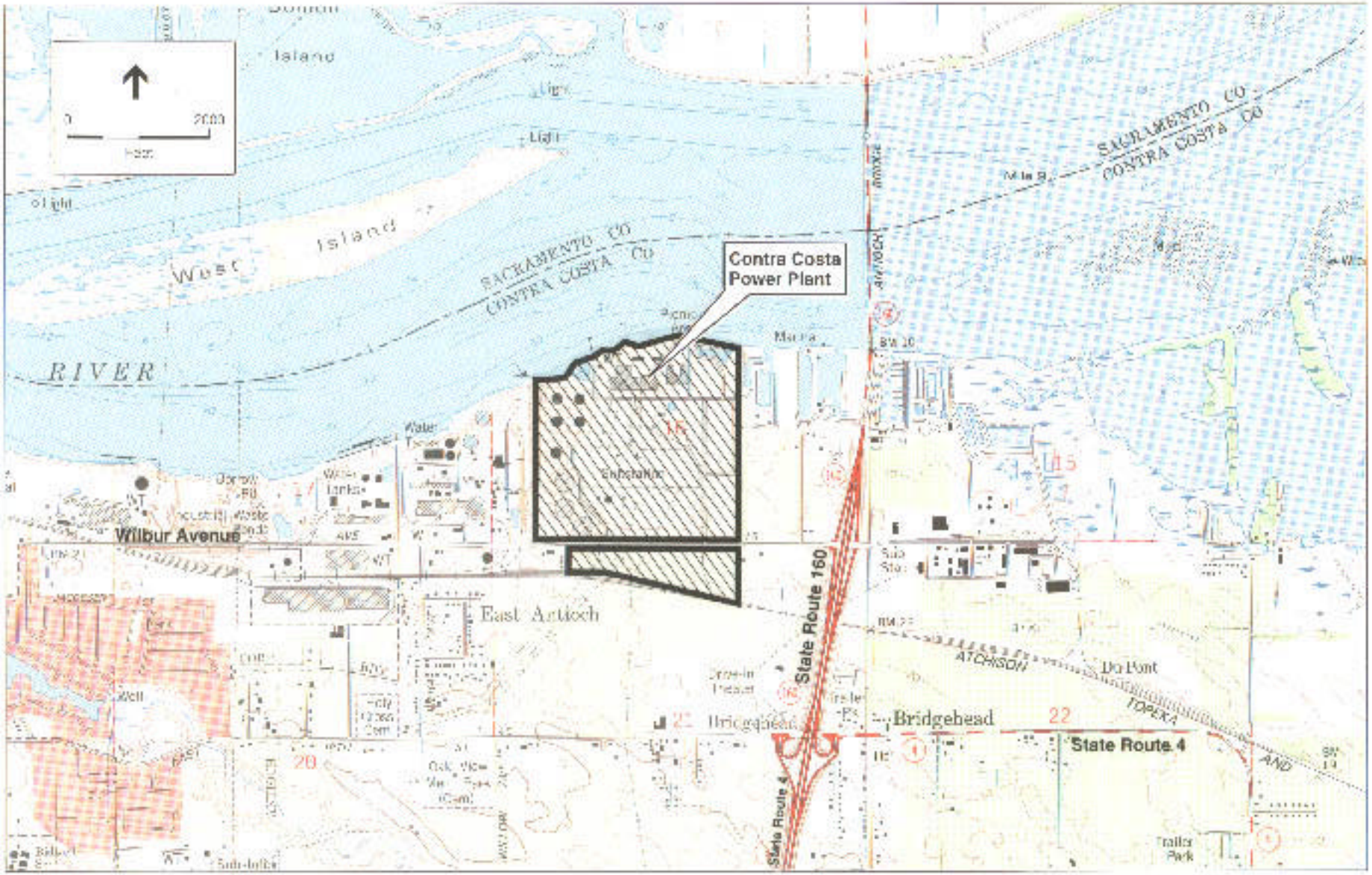
west of the plant, are being sold with the plant. In addition, PG&E will retain approximately 33 acres that contain the switchyard and transmission lines and other areas necessary for transmission purposes.

CONTRA COSTA POWER PLANT

The Contra Costa Power Plant is located on a 198-acre site in the unincorporated area of Contra Costa County alongside the Bay Delta. The power plant is located about 2.5 miles east of the Antioch town center on the southern bank of the San Joaquin River near the Antioch Bridge. Figure 2.8 shows the location of the Contra Costa Power Plant. Figure 2.9 delineates the approximate boundaries of the property being either sold or retained. The river system east of the plant is characterized by marshes, wetlands, mudflats, and shallow bays. The plant site is bound to the north and northwest by the Bay Delta; by a paperboard manufacturing facility to the west; by the Atchison, Topeka, and Santa Fe railroad tracks and right-of-way to the south; by undeveloped open space, a chemical manufacturing facility, and a boating marina to the east; by a power generating facility to the southwest; and by parkland to the northeast. A residential area is also located to the southwest. Shoreline access areas in the plant vicinity include various piers and boat launches. Roughly 30 acres on the southern portion of the property, between Wilbur Avenue and the railroad tracks, are leased for agricultural use and are planted with grapevines. PG&E's Pacific Service Employees Association recreational facility is located in the northeast corner of the site and is part of the property being sold.

The Contra Costa Power Plant consists of ten boilers, seven steam turbines, and associated facilities (e.g., an electric switchyard located in the central portion of the plant, buildings for offices and turbine generators, cooling water intake structures and discharge channels, fuel oil tanks, pipelines, and an inactive marine terminal). Only two of the steam turbine units (Units 6 and 7) are currently operational. Of the 10 boilers at the site, Boilers 1 through 8 have been retired and are incapable of operating. Generating Units 1 through 5 have also been retired. However, the generators at Units 4 and 5 have been converted to synchronous condensers, which are used to respond to changing system conditions and upsets by providing voltage support to the electrical grid. The operation of Units 4 and 5 does not result in air emissions nor electricity generation. Figures 2.10a and 2.10b show the locations of these facilities on the plant site. The plant site also contains non-operational areas used for employee recreation, sand storage, and agriculture. These areas are being sold with the plant. The capacity and characteristics of the power plant are described in Table 2.1.

The boilers for Units 6 and 7 are capable of burning natural gas or residual fuel oil. However, PG&E is prohibited by BAAQMD Regulation 9, Rule 11 from burning residual fuel oil, except in the event of a natural gas curtailment. Natural gas is delivered to the plant via the same 20-inch transmission pipeline from PG&E's Antioch Gas Terminal that serves the Pittsburg Power Plant. When running continuously, the boilers providing steam to Units 6 and 7 can each burn up to 2.7 million cubic feet of natural gas per hour.



2-22

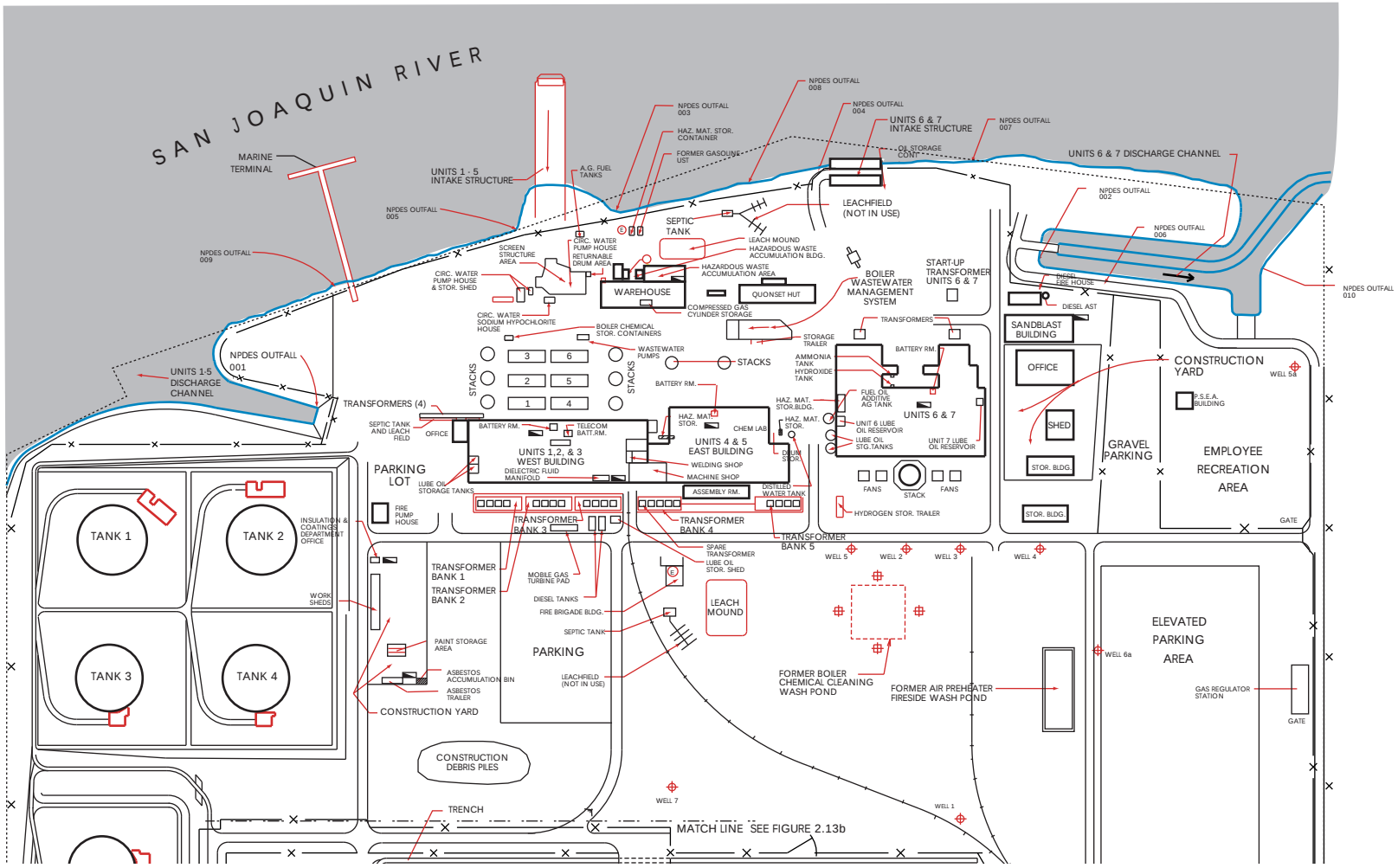
SOURCE: CSOS, Environmental Science Associates

Figure 2.8
Location of the Contra Costa Power Plant

SOURCE: Pacific Gas & Electric

Divestiture of Electric Generation Assets / 980125 ■

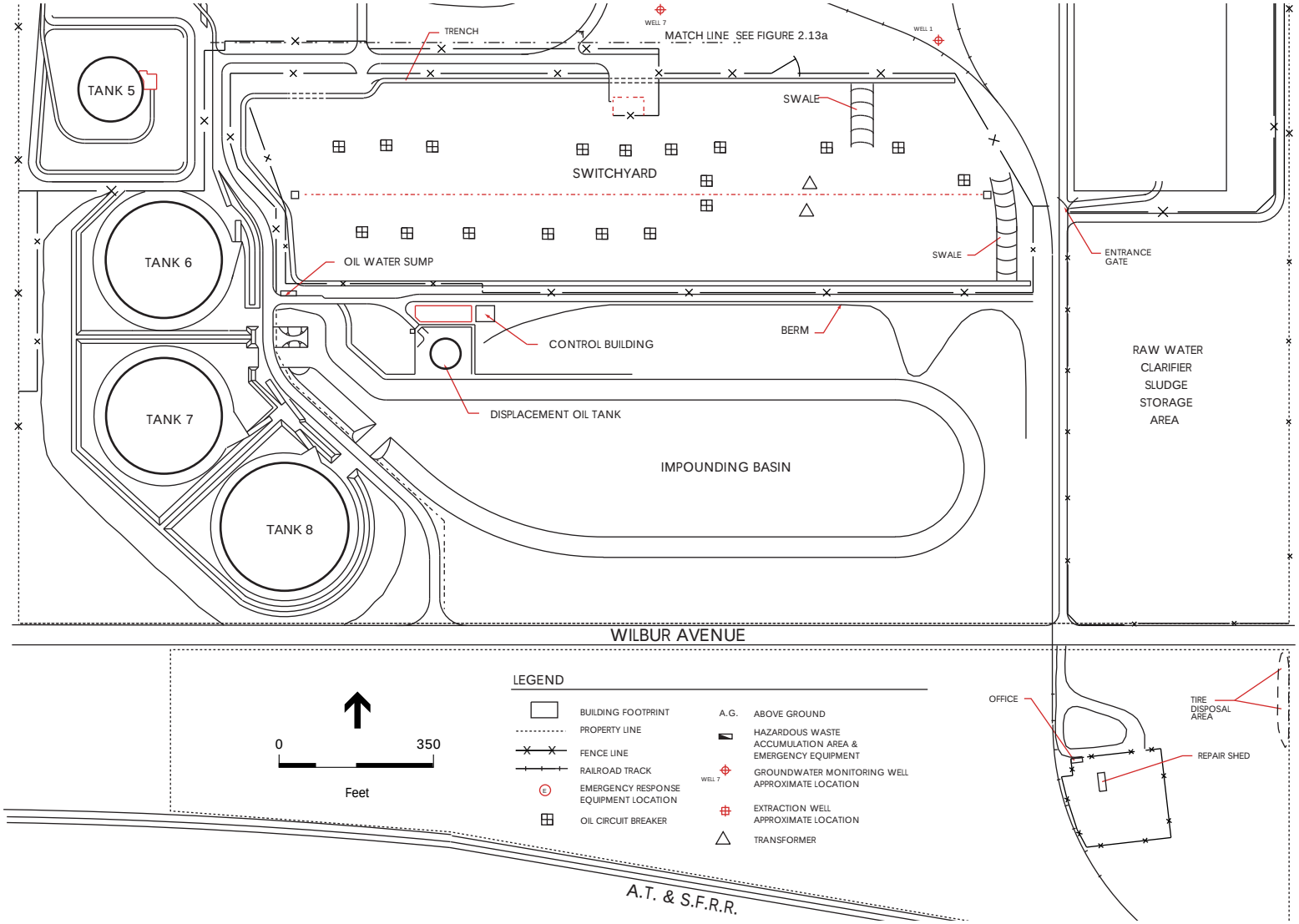
Figure 2.9
Contra Costa Power Plant
Property Lines



SOURCE: CDM

Divestiture of Electric Generation Assets / 980125

Figure 2.10a
Contra Costa Power Plant
Facility Layout Map (North)



SOURCE: CDM

Figure 2.10b
Contra Costa Power Plant
Facility Layout Map (South)

There are nine aboveground fuel tanks located in a fuel tank farm on the western portion of the property with a combined storage capacity of 2.2 million barrels of oil. All of these tanks are included in the sale. Though not currently used, residual fuel oil is stored in eight of these tanks, two of which are used as service tanks. Displacement fuel oil, stored in the remaining tank, is used to purge and preheat pipes prior to burning residual fuel oil in the boilers. There are two options for fuel oil delivery to the site. First, fuel oil delivery to the plant can be made via a pipeline that connects to the Pittsburg Power Plant fuel tank farm. The last deliveries of residual fuel oil through this pipeline were made in 1990. The fuel oil line connection between the plants is being sold as part of the package. The second option for oil delivery to the plant is via a 300-foot-long pier and marine terminal that extends from the northwest shoreline of the plant into the San Joaquin River. This marine terminal used to accommodate a 20,000-barrel barge and included a 12-inch pipeline for pumping fuel oil from the barge to the fuel storage tanks at the site. The oil pipeline was drained and capped, and a 300-foot section has been removed. The dock has been in caretaker status since 1984, and significant dredging of the waterway and repairs or replacements would be required to allow barges to moor again to restore marine deliveries of oil.

An area located in the southwest corner of the property is permitted to receive raw-water clarifier sludge from the Pittsburg and Contra Costa Power Plants.[11] This material is currently classified as an unregulated solid waste assumed to be suitable for Class III landfill disposal at the time of plant decommissioning. A second area north of the clarifier-sludge disposal area contains soil and sand excavated during plant construction activities. In 1995, some of this stored sand was donated to the U.S. Fish and Wildlife Service to rebuild a large dune area at the Antioch Dunes National Wildlife Refuge. These areas are included in the area being sold with the plant.

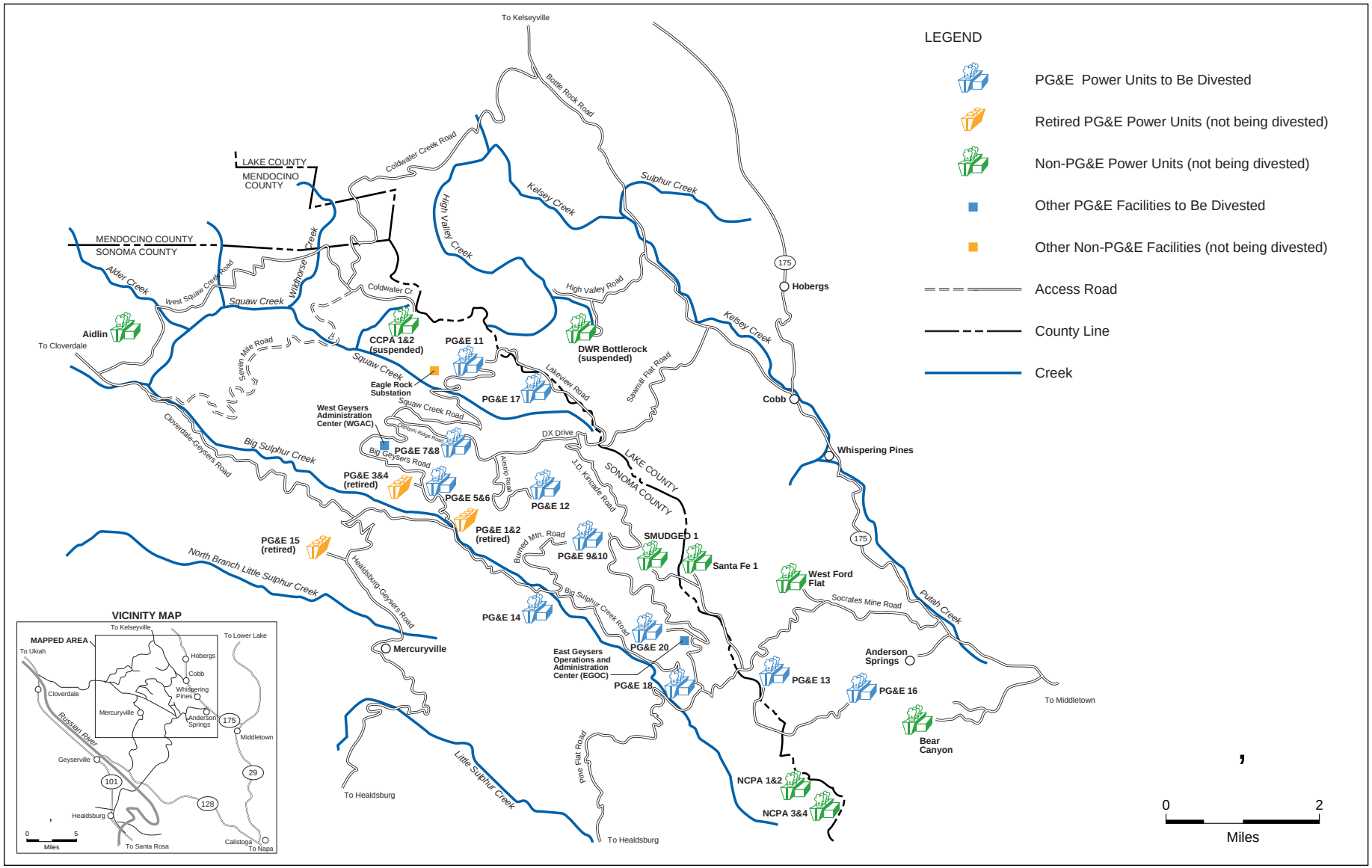
The switchyard is located in the central portion of the plant, south of the main buildings and north of the impoundment basins. PG&E will retain the switchyard.

GEYSERS POWER PLANT

The Geysers Power Plant is located in the Geysers Geothermal Area of the Mayacmas Mountains in Sonoma and Lake Counties, approximately 27 miles northeast of Healdsburg. Several rivers, including Big Sulphur Creek, Little Sulphur Creek, Hot Springs Creek, Bear Canyon Creek, Squaw Creek, and Andersen Creek, flow through the Geysers area. The land in this area is principally used for the exploration, development and utilization of geothermal energy. Other land uses in the area primarily include recreation and mining. Recreation is generally restricted to large deer-hunting clubs and smaller parcels of land with cabins scattered throughout the area. Mining is for aggregate and gold and used to include mercury mining.

Operations at the Geysers Power Plant began in 1960. Currently, PG&E operates 14 steam turbine units at 11 separate sites. Figure 2.11 shows the location of the 14 units relative to major highways, major creeks, the Sonoma and Lake County border, and other non-PG&E power

[11] Raw water is passed through a clarifier prior to use in the boilers for steam production.



NOTE: The two units in Lake County (Units 13 and 16) are being sold as a separate package from the Sonoma County Units.

SOURCE: Geysers Geothermal Association; Environmental Science Associates

Figure 2.11
Location of the Geysers Power Plant Units

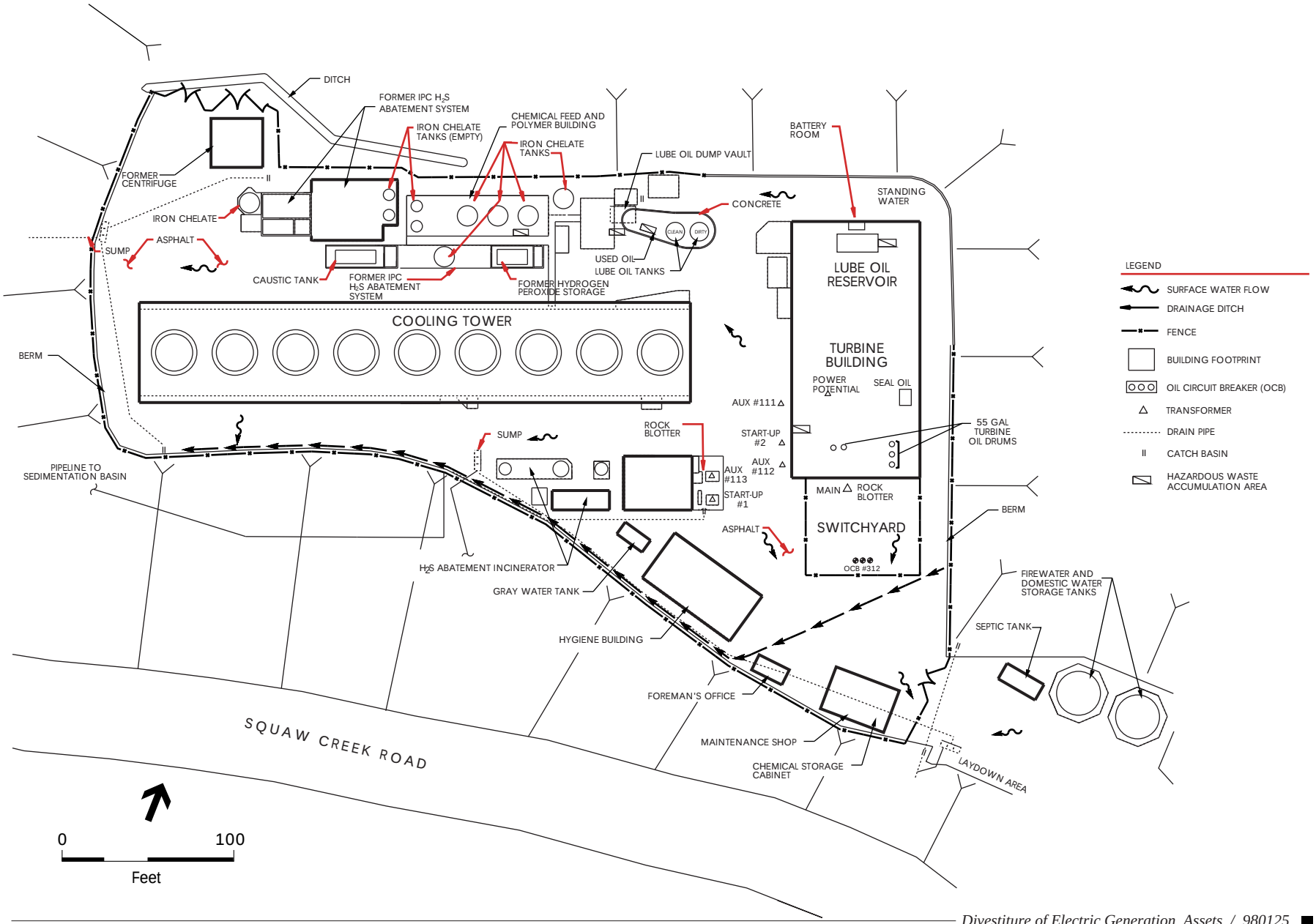
generating units in the Geysers Geothermal Area. Figure 2.11 also shows the locations of retired PG&E units not being sold. Figures 2.12 and 2.13 show the facility layouts at Units 11 and 13, respectively. Unit 11 is equipped with an incinerator abatement system, while Unit 13 is equipped with a Stretford Abatement System (see discussion under Geysers Power Plant, below, for a description of these hydrogen sulfide [H_2S] abatement systems). Other units with these types of abatement systems have similar but not identical facility layouts (see Attachment F for the facility layout maps for other units being divested). Primary access to the plant site is via Geysers Road in Sonoma County and Socrates Mine Road in Lake County.

Geothermal power is commonly recognized as a "green" generating resource because of the low levels of greenhouse gases that are emitted during the power generation process. The steam used to operate these units originates from a fractured reservoir above a magma heat source that lies beneath an area of several hundred square miles near the south and east end of Clear Lake. The dry steam in this reservoir is at a pressure of several hundred pounds per square inch and a temperature of approximately 450 degrees Fahrenheit (see discussion below under Geysers Geothermal Field).

The steam is produced from wells ranging in depth from 6,000 to more than 12,000 feet and is gathered and transported via pipelines to the generating units. PG&E purchases the steam from steam suppliers (i.e., Unocal-Thermal and Calpine) who own and operate the steam field and the pipelines. PG&E was the only electric generator at the Geysers area until 1982. There are now 23 electric generating units operating in the Geysers Geothermal Area. The nine steam units not owned by PG&E are operated by Calpine, Central California Power Agency (CCPA), Geothermal Energy Partners, Ltd. (GEO), Northern California Power Agency (NCPA), Sacramento Municipal Utility District (SMUD), and Santa Fe Geothermal, Inc. In addition to Unocal-Thermal and Calpine, steam suppliers for these units include CCPA, NCPA, and GEO.

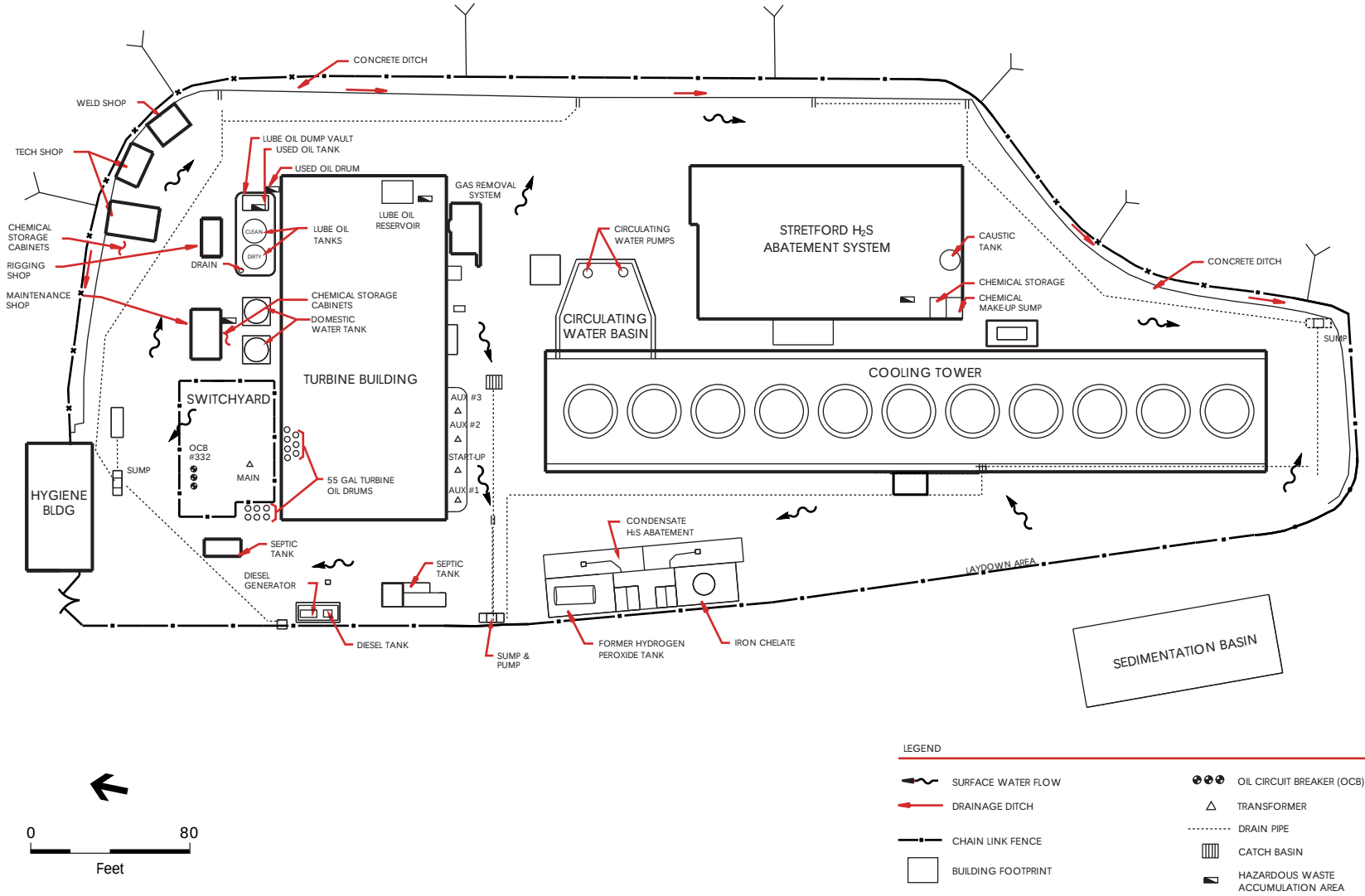
The capacity and characteristics of PG&E's geothermal units being divested are described in Table 2.1.

As described earlier in this chapter, the Sonoma County units are being sold separately from the Lake County units. While the Sonoma and Lake County units have historically been operated as a combined generating facility, they can be operated independently and operate under separate steam field agreements (see discussion under the Introduction at the beginning of this chapter). The 12 generating units comprising the Sonoma County units are located at nine separate sites. In addition to these 12 electric generating units, this sale package includes the East Geysers Operations and Administration Center (EGOC) and the West Geysers Administration Center (WGAC). Both the EGOC and the WGAC have automotive garages and underground gasoline and diesel fuel storage tanks. The EGOC contains the administrative offices, a warehouse, and other facilities. The WGAC has a maintenance shop, a sandblast facility, and other facilities. Figures 2.14 and 2.15 show the facility layouts for the EGOC and WGAC sites, respectively. There are no comparable auxiliary buildings associated with the Lake County units (Units 13 and 16). PG&E will retain ownership and control of the transmission lines from each of the units. PG&E will transfer the 21-kV and 4-kV service lines and retain the 115-kV and 230-kV transmission lines.



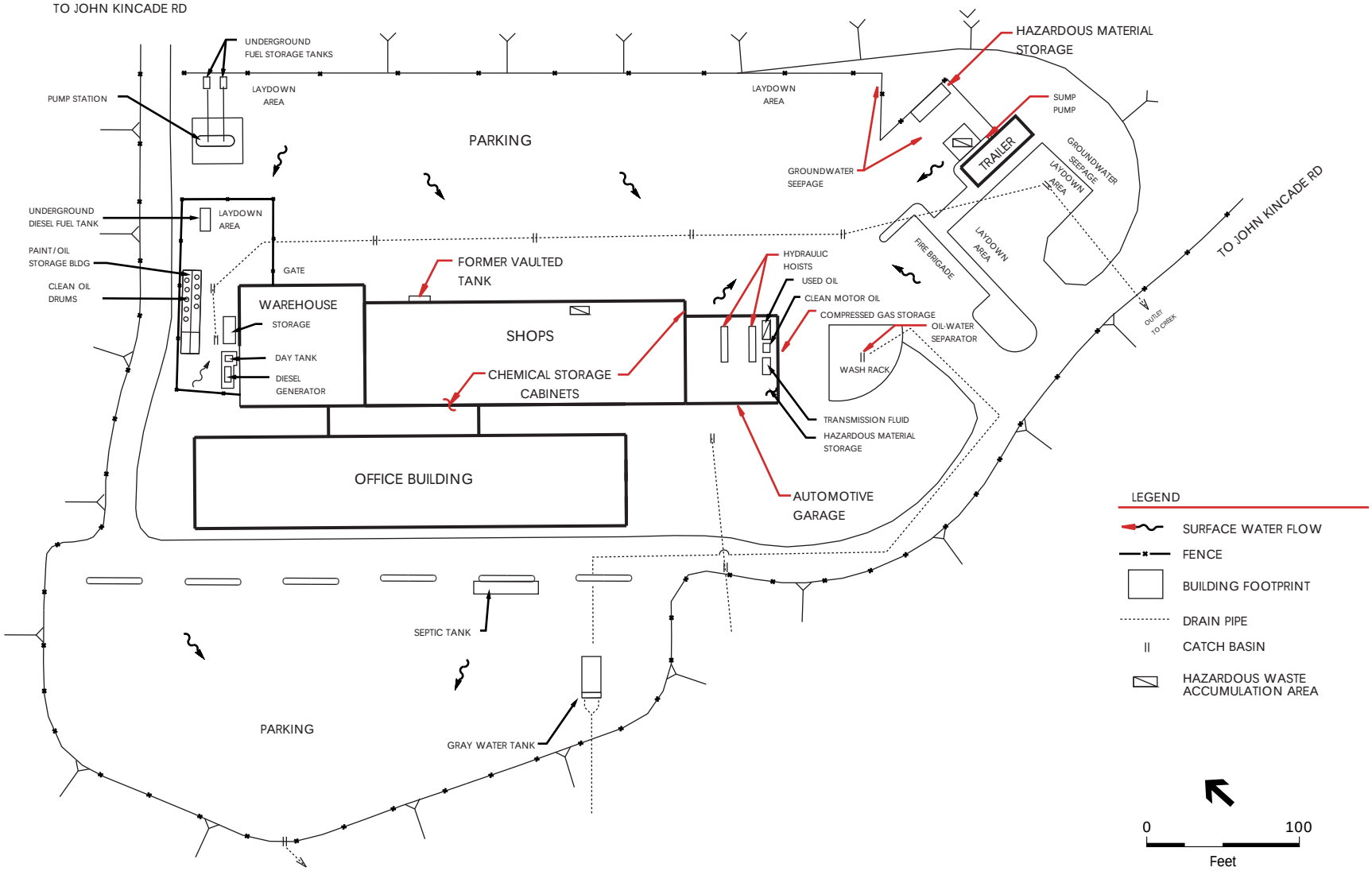
SOURCE: CDM

Figure 2.12
Geysers Power Plant
Facility Layout Map - Unit 11



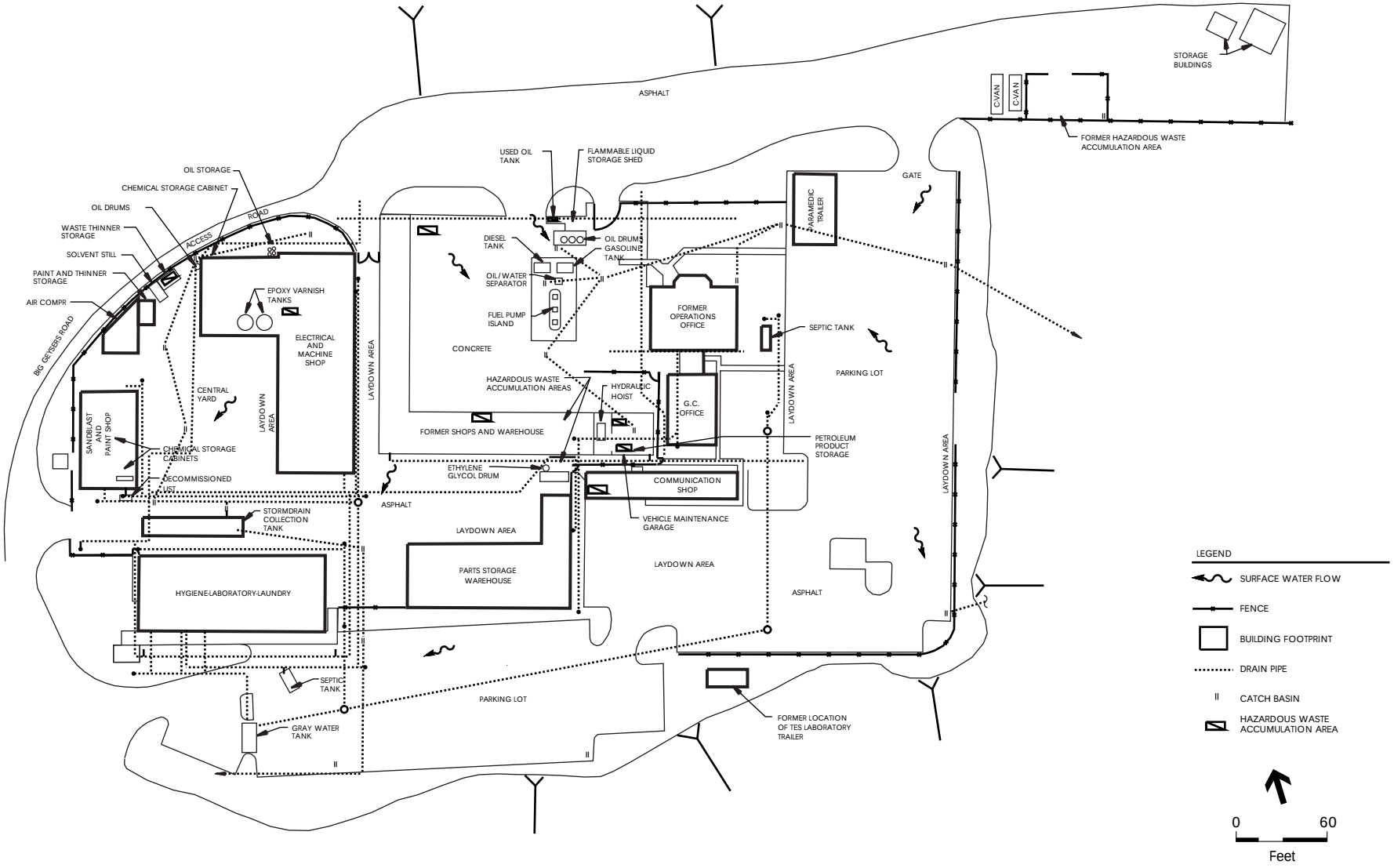
SOURCE: CDM

Figure 2.13
Geysers Power Plant
Facility Layout Map - Unit 13



SOURCE: CDM

Figure 2.14
Geysers Power Plant Facility Layout Map
East Geysers Operations
and Administration Center (EGOC)



SOURCE: CDM

Figure 2.15
Geysers Power Plant
Facility Layout Map
West Geysers Administration Center (WGAC)

2.2.4 DESCRIPTION OF THE POWER GENERATION PROCESS

Several characteristics of the Geysers Power Plant make its operations, associated environmental impacts, and regulatory system different from the fossil-fueled plants (Potrero, Contra Costa, and Pittsburg). For example, because these units use naturally heated geothermal steam as their energy source, the power plant does not require the use of fuel (e.g., natural gas or residual fuel oil) for steam generation, as do the fossil-fueled plants. The power generation processes for the combustion turbines and steam turbines at the fossil-fueled power plants to be divested are summarized below, followed by a summary of the power generation process for the Geysers Power Plant generating units.

FOSSIL-FUELED GENERATING UNITS

Each of the three fossil-fueled plants for sale predominately generates electricity by burning natural gas in boilers to heat water and create steam that is then used to drive rotating steam turbine generators that produce electricity. The steam gives up its energy as it passes through the turbo-generator and is then condensed back into water. The Potrero Power Plant also contains combustion turbines that burn distillate fuel oil to drive their generators.

The higher the proportion of the fuel energy that can be converted into electricity, the higher the efficiency of the conversion process and the less fuel consumed for each kilowatt-hour (kWh) of electric energy produced. Because fuel costs are such a high proportion of the cost of converting fuel energy into electricity, the fuel conversion efficiency, or heat rate, of a given plant is one of the primary determinants of how and when the plant is dispatched to supply electricity.

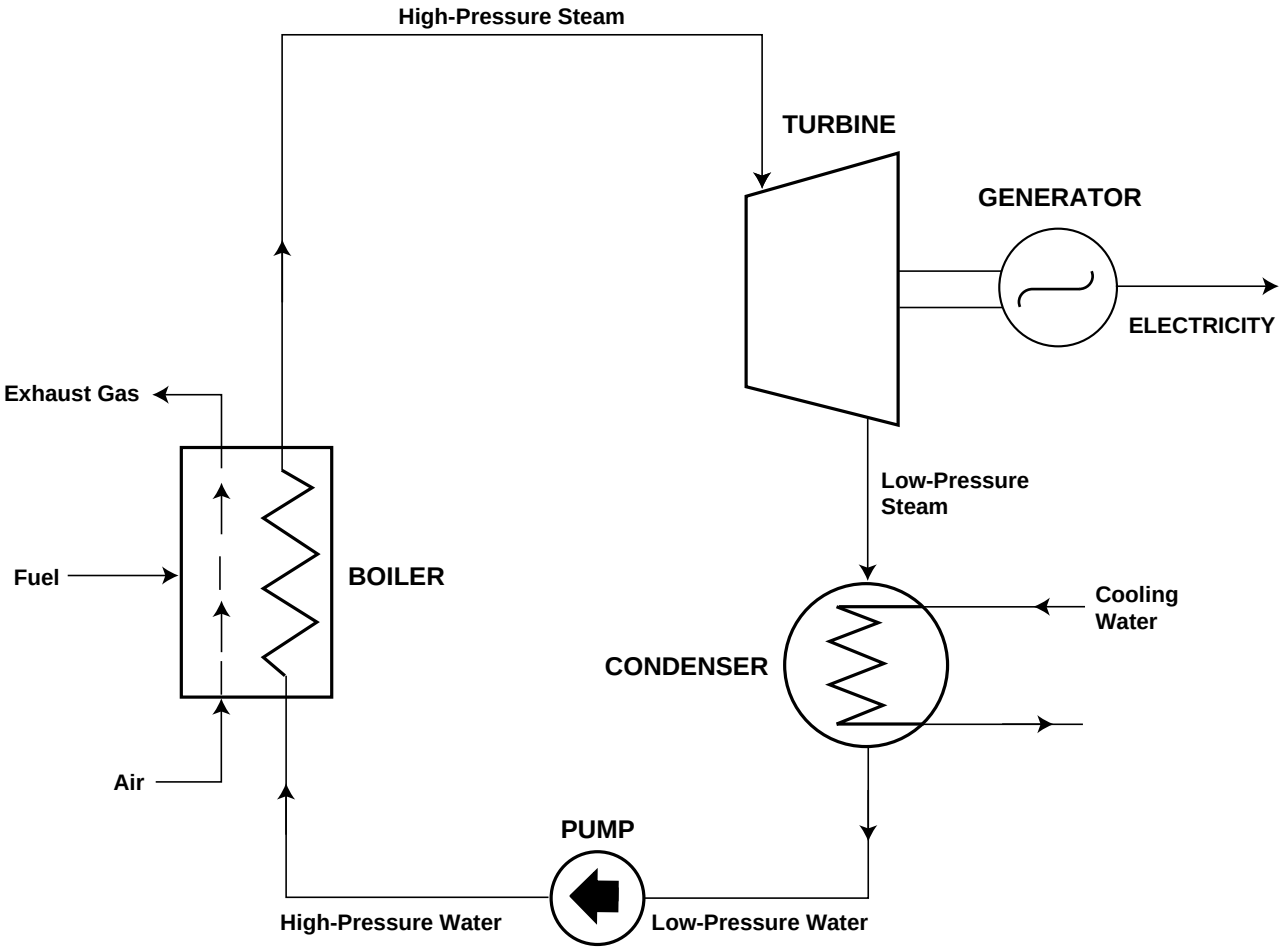
Logically, for environmental and cost reasons, it is desirable to maximize operation of the most efficient units.

Combustion Turbine

The combustion turbines consist of a compressor, a combustor, and a power turbine. The compressor provides pressurized air to the combustor, where distillate fuel is burned. Hot combustion gases leave the combustor and enter the turbine section. In the turbine section, the gases expand and cause the turbine to rotate. The rotating turbine powers the compressor and generator, resulting in the production of an electric current.

Steam Turbine

Figure 2.16 shows a schematic flow diagram of the four basic components of a typical steam turbine unit's power production cycle at a fossil-fueled plant. In this process, fuel combustion in the boilers is used to generate heat and vaporize water from enclosed tubes that pass through the boiler. The high-pressure steam is then piped to the turbine, where it expands and causes the turbine to rotate. The rotating turbine generates an electromagnetic field that creates an alternating electric current. This process converts the heat energy in the steam to mechanical energy. After passing through the turbine, the steam is condensed, cooled and recycled through



SOURCE: Pacific Gas and Electric; Environmental Science Associates

Figure 2.16

Schematic Flow Diagram of the Power Generating Process
for a Typical Steam Turbine Unit at a Fossil-Fueled Power Plant

the system again. Exhaust gas from the fuel combustion process in the boilers passes through an exhaust stack where it is released.

The natural gas used to fuel the boilers is delivered to the plants via a pipeline. Natural gas is continuously delivered only as it is burned in the boiler; it is not stored on site. Residual fuel oil, used as a back-up fuel at these sites, may be delivered via pipeline, barge, oil tanker, or by truck. Distillate fuel oil used in the combustion turbines at the Potrero plant is delivered via a pipeline.

Water is used throughout the power production cycle of a steam turbine unit; water is used for boiler steam production and cooling purposes. Each of the three plants draws water from a nearby river or bay to use for boiler steam production and to cool and condense the spent steam from the turbine. Water used in steam production is purified prior to use in the boilers. Once the steam has passed through the turbine and has been condensed, it can be recirculated to the boiler. Typically, the water used to condense the steam only passes through the cooling cycle once and is then discharged into its original water body, usually at a temperature above ambient levels. This cooling process is called "once-through" cooling and is used at all the steam units, except Pittsburg Power Plant Unit 7. Another method for cooling the condensed steam is to use a "cooling tower." In a cooling tower, water is recycled into a cooling pond for reuse, thereby using less water than the once-through cooling process. Only Pittsburg Power Plant Unit 7 uses a cooling tower.

GEOTHERMAL GENERATING UNITS

Geysers Geothermal Field

The Geysers Geothermal Area, located in the Mayacmas Mountains, is an unusual area of hot springs and steam vents. The area is roughly 5.5 miles long and 1 mile wide and is drained by Big Sulphur Creek. The main natural thermal area or reservoir is located along Geyser Creek, a tributary of Big Sulfur Creek, and is only about 1,300 feet long and 600 feet wide. Geyser Canyon contains numerous hot springs, with temperatures ranging from about 100 degrees Fahrenheit to boiling. Several small steam vents also occur in this area; geothermal wells are located just east of Geyser Creek (Norris and Webb, 1990).

Major vapor-dominated geothermal reservoirs, such as the Geysers steam field, are rare. Because these types of reservoirs do not maintain dynamic equilibrium between reservoir leakage and recharge, they eventually boil off or drown, meaning they no longer produce steam. For a vapor-dominated reservoir to exist, an unusual combination of geologic conditions must be present. These conditions include the following: (a) relatively permeable reservoir rock that will contain geothermal fluids; (b) relatively impermeable cap rock that will confine fluids and minimize either leakage or recharge by cooler water; (c) a potent source of heat; and (d) a source of water. These conditions are present at the Geysers steam field.

The Geysers steam field is of particular interest because it is the source of the largest geothermal power operation in the world. Power development began in the Geysers Geothermal Area in 1921 when the first steam wells were drilled. The Geysers Geothermal Area is unusually

favorable for power generation because it produces dry steam with few corrosive products, apart from sulfur (California Energy Commission, 1982). The following paragraphs briefly describe the major components of the Geysers steam field.

Reservoir Geology

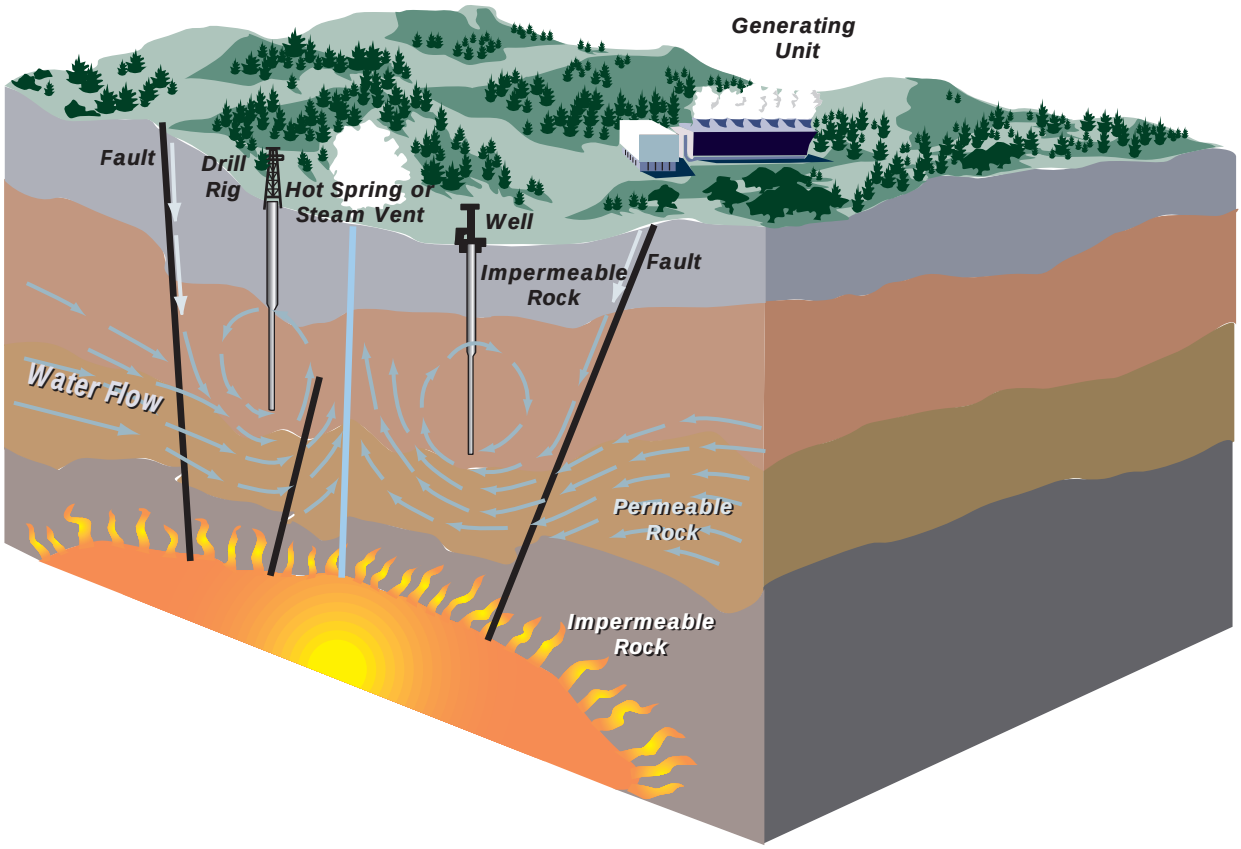
The geology of the Geysers Geothermal Area is extremely complex. Bedrock in and around the Geysers reservoir is comprised of ancient marine rocks known as the Franciscan Assemblage. The Franciscan Assemblage rocks were subjected to periods of significant eastwardly displacement during oceanic plate movement and vertical offset that resulted in a complex series of strongly fractured and faulted rock slabs. The vertical faults now separate the major rock units in the Geysers area and have resulted in down-faulting in the main geothermal area. Approximately 2 million years ago, the Franciscan rocks were intruded by shallow magma associated with volcanism in the Coast Range Mountains (Thompson, 1992). The body of intrusive magma constitutes the reservoir's heat source. The magma heats the groundwater that infiltrates from the surface through the overlying permeable bedrock and returns it to the surface as steam. The rocks overlying the magma "heat source" include a layer of sandstone. The sandstone is inherently impermeable, and thus serves to contain and control the flow of geothermal fluids that migrate through the complex network of faults and fractures. This containment and flow within the reservoir constitutes one of the important mechanisms that retains the unique equilibrium at the Geysers steam field.

Geothermal Heat and Fluid Flow

Heat is the primary energy resource of a geothermal reservoir. Most of the heat in a steam field is stored in the reservoir rocks. The bedrock in the Geysers reservoir may contain 16 times as much stored heat as its geothermal fluids. The temperature of the reservoir is fairly uniform at about 470 to 480 degrees Fahrenheit. These temperatures produce saturated or slightly superheated steam with wellhead pressures of 120-150 pounds per square inch (psi). The source of the heat is likely the molten magma chamber located under Mount Hanna (California Energy Commission, 1982).

Geothermal fluids (steam or hot water) are the medium by which the heat stored in the reservoir can be brought to the ground surface for commercial use. The life of a geothermal reservoir can be limited by inadequate quantities of fluid even though it contains abundant heat. The location and the amount of fluid in the Geysers steam field are uncertain. During drilling, hot water is often encountered just above and near the margins of steam-producing zones. This water is considered by some scientists to be natural condensate formed where steam encounters cooler rock surrounding the reservoir. Figure 2.17 shows the circulation of heated underground water at the Geysers Geothermal Area.

The life of the Geysers steam field is dependent on the continued availability of geothermal fluids. There is probably some natural recharge of geothermal fluids or the reservoir would boil off. A natural source of recharge includes precipitation that percolates into the reservoir through fractures associated with volcanic vents and faults. Other sources of recharge include: (1) spent



SOURCE: *Geology of California © 1990*, Environmental Science Associates

Figure 2.17
Conceptual Diagram of the Circulation of Heated Underground Water at the Geysers Geothermal Area

steam condensate (water) from the power generation process that is then reinjected into the reservoir; and (2) surface water from Big Sulphur Creek that is used to augment reservoir performance (California Energy Commission, 1982). Also, wastewater injection is being evaluated as a viable means of recharging fluids to the steam field (see discussion under Steam Field Decline, below, for details on current wastewater injection projects).

Geysers Power Plant Units

Generally speaking, steam is drawn from wells, purified, transported through insulated pipes, pressurized, and converted into electrical power. The steam turbines at the Geysers Power Plant operate much like those at the three fossil-fueled power plants, with the exception that there is no need for a process to heat water and turn it into steam.

In a typical generating unit at the Geysers Power Plant, geothermal steam is expanded through a steam turbine and cooled and condensed into water using water from a cooling tower. As in the fossil-fueled steam turbines described above, steam is used to rotate the turbine and to generate electric power. The condensate is then pumped back to the cooling tower where it is cooled. The cooled water from the cooling tower is recirculated to the condenser located at the exit of the steam turbine. Excess condensate, about 5 to 30 percent of the incoming steam, is returned to the steam supplier (i.e., Unocal-Thermal or Calpine) for reinjection into the steam field.

The geothermal steam contains small amounts of "non-condensable gases," including hydrogen sulfide gas (H_2S). These gases are removed from the condenser and transferred to an H_2S abatement system. After converting the H_2S component of the gas into other sulfur by-products (e.g., elemental or molten sulfur), the remaining non-condensable gases are routed into the cooling tower and exit to the atmosphere. Table 2.2 describes the four types of abatement systems used at the Geysers Power Plant and identifies the units to which these systems apply. As shown in Table 2.2, each of the units at the power plant has more than one H_2S abatement system available for use. Figures 2.18 and 2.19 show a schematic flow diagram of the power generating process for a typical geothermal unit equipped with a Stretford Abatement System and an Incinerator System, respectively.

Steam Field Decline

The amount of steam available from the geothermal steam field that powers the Geysers Power Plant has been declining since 1987. The reduction in steam availability has caused the units at the plant to be run below historic capacity levels. As a result, net annual geothermal electricity generation has decreased from 9.7 billion kWh in 1987 to 4.0 billion kWh in 1995. A primary factor causing the decrease in PG&E's geothermal generation has been a decline in the pressure and availability of steam from the steam fields. According to PG&E's PEA, the decrease in geothermal generation is also partially attributable to the terms of the steam pricing contracts and the resultant high price of generation at the Geysers Power Plant relative to other types of generation, such as hydroelectric.

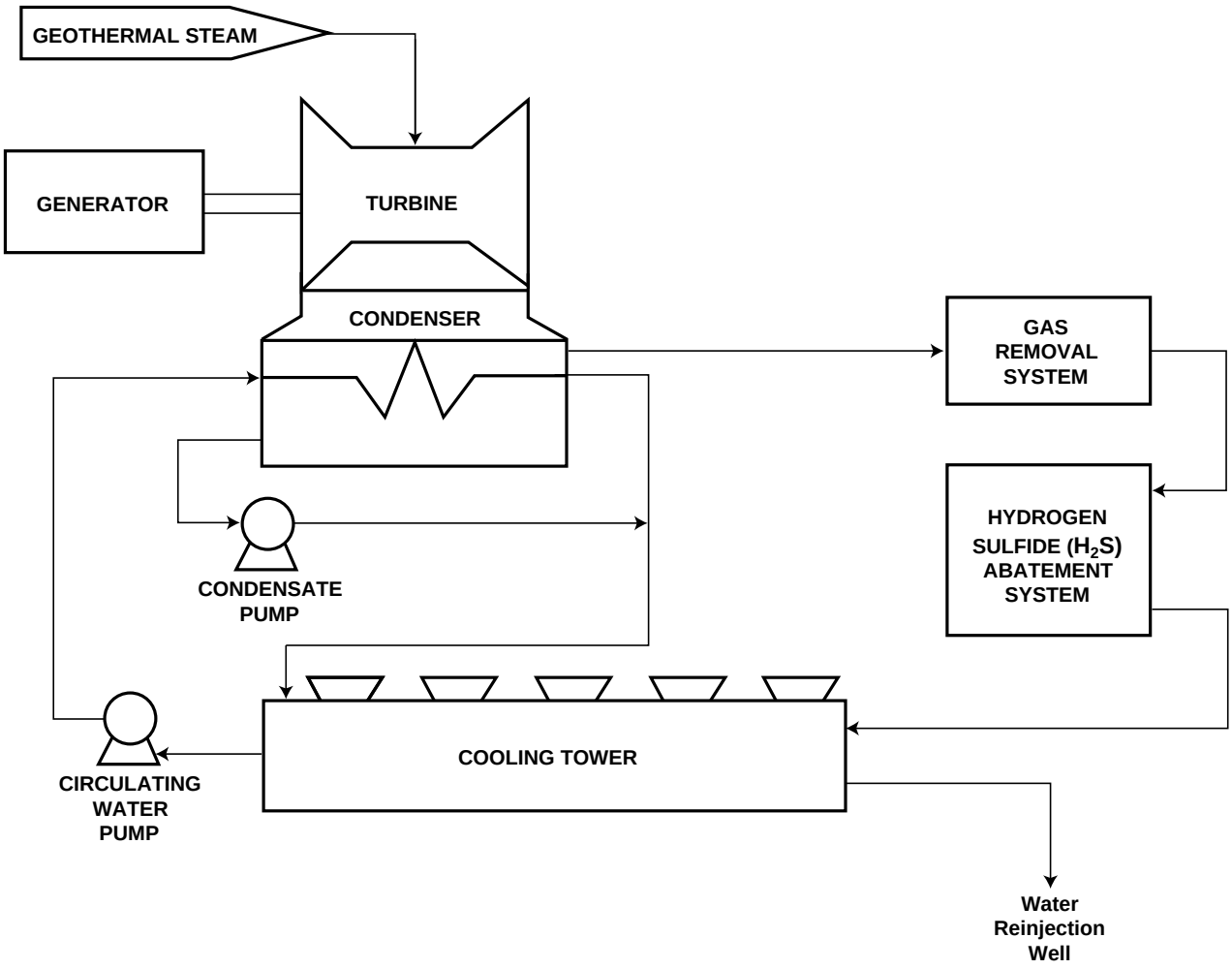
TABLE 2.2
HYDROGEN SULFIDE (H_2S) ABATEMENT SYSTEMS
AT THE GEYSERS POWER PLANT

Abatement System	Units
Incinerator: System burns H_2S to form sulfur dioxide that is then scrubbed in a quench tower and dissolved into quench water. The quench water is then transferred to the cooling tower basin.	5, 6, 7, 8, 11 and 12
Caustic: Sodium hydroxide is added to the cooling water at the inlet of the condenser and used to absorb H_2S.	5, 6, 7, 8, 9, 10, 11 and 12
Stretford: System chemically oxidizes the H_2S into elemental sulfur.	13, 14, 16, 17, 18 and 20
Metal Chelate: An iron chelate solution and air are added to the circulating water. The iron chelate solution, oxygen, and H_2S react together to produce elemental sulfur that remains suspended in the circulating water.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18 and 20

SOURCE: PG&E, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of the Geysers Geothermal Power Plant*, January 14, 1998.

The injection of water (either condensate from the electric power generation process or water from other sources) into injection wells in the steam fields is believed to increase the amount of recoverable steam pressure and to increase the reliability of steam delivery. Currently, the condensate from PG&E's Geysers Power Plant is returned to the steam suppliers (i.e., Unocal-Thermal and Calpine) for reinjection into the steam field. In addition, it is expected that the recently initiated wastewater injection project in Lake County, the Southeast Regional Wastewater Treatment Plant (SERWTP) Facilities Improvement Plan and Geysers Effluent Injection Project, may produce additional steam sufficient to provide an additional 50 to 80 MW of generating capacity, about two-thirds of which would be available for the Geysers Power Plant. The primary purpose of that project is to dispose of SERWTP wastewater effluent by injection into the Southeast Geysers geothermal field for purposes of power production. Treated wastewater from the City of Clearlake in Lake County is the primary source of the water (raw lake water diverted from Clearlake provides make-up water to maintain scheduled flows) pumped to the Southeast Geysers area. The pipeline originates from the SERWTP in Lake County and is now able to deliver up to 6 million gallons per day of effluent to the Southeast Geysers in Lake and Sonoma counties. At the Geysers, the effluent is directed into a system of distribution lines that feed into injection wells. After deep injection into the geothermal reservoir, the water is converted into steam and used to power the generating units.

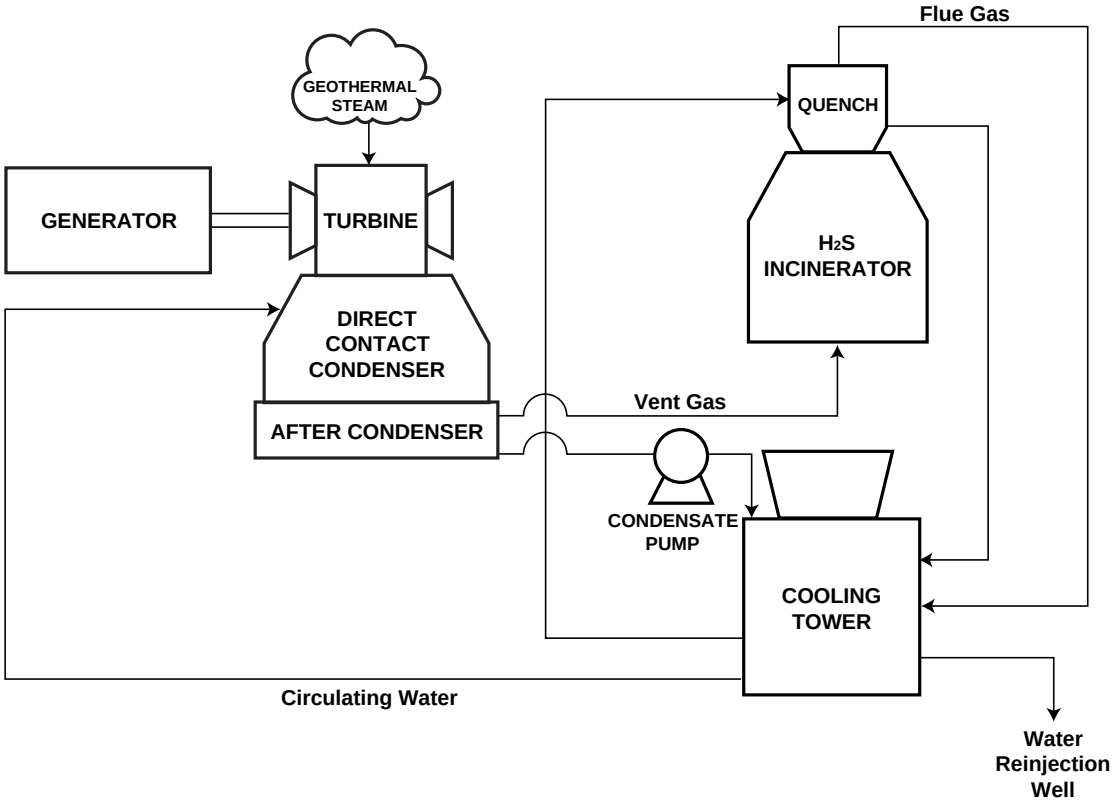
The Lake County Sanitation District (LACOSAN) has a long-term contract with Unocal, Calpine and the Northern California Power Agency to supply this wastewater to the steam fields controlled and maintained by those agencies. The Unocal and Calpine steam fields, using the injected effluent, produce steam for PG&E's units in the Southeast Geysers area. As planned



SOURCE: Pacific Gas and Electric; Environmental Science Associates

Figure 2.18

Schematic Flow Diagram of the Power Generating Process for a Typical Unit at the Geysers Power Plant Equipped with a Stretford Abatement System



SOURCE: Pacific Gas and Electric; Environmental Science Associates

Figure 2.19
Schematic Flow Diagram of the Power Generating Process
for a Typical Unit at the Geysers Power Plant
Equipped with an Incinerator System

development occurs in the area, the pipeline could provide as much as 8-9 million gallons of effluent per day by 2021.

Early results from the injection of wastewater from the Southeast Geysers effluent pipeline have been encouraging. There has been about a 7 percent (60 MW) increase in capacity in the Southeast Geysers field as reported by staff at the Geysers Power Plant. Based upon these early results, it is possible that the importation of wastewater from the pipeline could, at the least, stabilize current steam field capacity in the Southeast Geysers and could possible increase the steam available for the generation of electricity. The proportion of that supply which is used for injection in steam fields supplying PG&E's units (Units 13, 16, 18 and 20) is expected to yield a net power generation of roughly 123 million kilowatt-hours (kWh) per year.

The City of Santa Rosa is considering a similar wastewater injection project that could provide an additional 80 to 100 MW of generating capacity at the plant. The Environmental Impact Report (EIR) for this project was certified on April 20, 1998. National Environmental Policy Act review for this project is currently in progress. (See Chapter 5, Cumulative Impacts, for a more detailed discussion of this project.)

2.3 PROJECT APPROVALS

PG&E's proposed sale of the three fossil-fueled power plants and the Geysers Power Plant will be reviewed by the CPUC pursuant to Section 851 of the Public Utilities Code. In part, Section 851 states that:

> "No public utility … shall sell … the whole or any part of its plant, system, or other property necessary or useful in the performance of its duties to the public, or any franchise or permit or any right thereunder … without having secured from the [C]ommission an order authorizing it to do so."

Because the CPUC must determine whether the transfer of ownership of these plants would be adverse to the public interest, implementation of the proposed divestiture application entails discretionary decision-making by the CPUC. The CPUC is therefore the Lead Agency for this project, as defined in Section 15362 of the CEQA Guidelines, and is responsible for preparing this EIR.

This EIR may also be used by the Bay Area Air Quality Management District (BAAQMD) in considering an amendment to its rule governing emissions from power plants (Regulation 9, Rule 11). The BAAQMD could simply amend the rule so that it applies to non-utility power plant owners, or it could also make more substantive changes to the rule. Such potential rule changes are considered in Section 4.5, Air Quality, of this EIR.

Finally, divestiture of the four power plants will require the transfer or re-issuance of permits and other regulatory approvals or consents necessary for the sales to close. In some cases, transfers of existing permits will be ministerial, and the permits will be reviewed in light of the operations of the buyer when they come up for renewal. Other permit transfers or re-issuance of permits for

individual power plants may trigger review or approval by responsible agencies. Table 2.3 lists major environmental permits for the plants to be sold and the applicable responsible agencies.

TABLE 2.3
PARTIAL LIST OF FEDERAL, STATE, REGIONAL AND LOCAL PERMITS AND REQUIREMENTS APPLICABLE TO PG&E'S PROPOSED DIVESTITURE[a]

Agency	Permit Type/ Approval Required	Potrero	Contra Costa	Pittsburg	Geysers
Local					
Contra Costa County Fire Protection District	Hazardous Materials Storage Permit		X	X	
County of Sonoma Department of Health Services	Underground Storage Tank Permits[b]				X
San Francisco Department of Public Health	Hazardous Materials Registration Certificate	X			
San Francisco Department of Public Works	Industrial Wastewater Discharge Permit (Class I)	X			
State and Regional					
Bay Area Air Quality Management District (BAAQMD)	Federal Title V Permit[c]	X	X	X	
	Federal Title IV Permit[c]	X	X	X	
	Permits to Operate/ Authority to Construct	X	X	X	
Northern Sonoma County Air Pollution Control District	Permits to Operate[d]				X
	Permits to Operate Treatment Facility[d,e]				X
	Federal Title V Permit[c,d]				X
	Permit to Operate Air Pollution Control System, Sandblast Facility[f]				X
Lake County Air Quality Management District	Permits to Operate[g]				X
	Federal Title V Permit[c]				X
California Department of Fish and Game	Striped Bass Monitoring and Mitigation Agreement		X	X	
	Section 2081 Endangered Species Memorandum of Understanding		X	X	

TABLE 2.3 (Continued)
PARTIAL LIST OF FEDERAL, STATE, REGIONAL AND LOCAL PERMITS AND REQUIREMENTS APPLICABLE TO PG&E'S PROPOSED DIVESTITURE[a]

Agency	Permit Type/ Approval Required	Potrero	Contra Costa	Pittsburg	Geysers
California Department of Fish and Game (continued)	Authorization to Conduct Research on a State-Designated Endangered, Threatened or Rare Plant (Dicanthelium)				X
California Department of Occupational Safety and Health	Steam Boiler Permits	X	X	X	
	Permits to Operate Liquefied Petroleum Gas Tanks[h]				X
	Permit to Operate Air Pressure Tanks[i]				X
	Pressure Vessel Permits	X	X	X	
Department of Toxic Substances Control (DTSC), Region 2	Hazardous Waste Facility Permit (Resource Conservation and Recovery Act Part B Permit)			X	
	Hazardous Waste Tiered Permit (Tier 4 Conditional Authorization)		X		
Central Valley Regional Water Quality Control Board (RWQCB)	National Pollution Discharge Elimination System (NPDES) Permit		X		
	Waste Discharge Requirements (WDR) for Clarifier Sludge Disposal		X		
San Francisco Regional Water Quality Control Board (RWQCB)	National Pollution Discharge Elimination System (NPDES) Permits	X		X	
	Waste Discharge Requirements (WDR) for Class I/II Surface Impoundments			X	
San Francisco Bay Conservation and Development Commission (BCDC)	BCDC Permit			X	
State Lands Commission	Marine Terminal/Public Lands Lease			X	
State Water Resources Control Board (SWRCB)	Aboveground Petroleum Storage Tank[b]	X			X

TABLE 2.3 (Continued)
PARTIAL LIST OF FEDERAL, STATE, REGIONAL AND LOCAL PERMITS AND REQUIREMENTS APPLICABLE TO PG&E'S PROPOSED DIVESTITURE[a]

Agency	Permit Type/ Approval Required	Potrero	Contra Costa	Pittsburg	Geysers
County of Sonoma Department of Health Services	Aboveground Petroleum Storage Tank[b]				X
Federal					
U.S. Fish and Wildlife Service, National Marine Fisheries Service	Section 10(a) Endangered Species Incidental Take Permits[c]		X	X	

[a] List does not include building and land use permits.
[b] Applies only to Administration Center and Operations Center at the Geysers Power Plant.
[c] Permit application is pending.
[d] Applies to Units 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18 and 20.
[e] Treatment facilities are identified as Vent Gas Treatment Facility or Stretford Air Pollution Control System, depending on the type of treatment facility at a particular unit.
[f] Applies to the West Administration Center.
[g] Applies to Units 13 and 16.
[h] Applies to Units 5, 6, 7, 8, 11 and 12.
[i] Applies to Units 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 20, the Administration Center, Operations Center, and Maintenance Shop.

SOURCES: PG&E, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of Four Bay Area Electric Generating Plants*, January 14, 1998; PG&E, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of the Geysers Geothermal Power Plant*, January 14, 1998.

REFERENCES – Project Description

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