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SECTION 9.0

Alternatives

A range of reasonable alternatives to the proposed CPP are identified and evaluated in this section. The alternatives considered include the "No Project" alternative (that is, not developing a new power generation facility) as discussed in Section 9.1. Section 9.2 discusses the alternative site locations for constructing and operating CPP. Alternatives to the linear facilities (electric, natural gas, and water) are presented in Section 9.3. Section 9.4 presents alternative combined cycle configurations to the combustion turbine and steam turbine arrangement currently proposed for CPP. Alternative power generation technologies are discussed in Section 9.5. In addition, this section describes the site selection criteria used in determining the proposed location of CPP. Electric transmission connection alternatives are addressed in this section as well as in Section 5.0; alternative natural gas supply line routes are addressed here and in Section 6.0; and alternative waterline routes are discussed here and in Section 7.0. References used in preparation of this section are listed in Section 9.6.

9.1 No Project Alternative

9.1.1 Description

If the "No Project" alternative is selected, the District would not receive authorization to construct and operate a new power generation facility. As a result, the proposed facility would not be developed at this time and would remain at least temporarily as annual grassland pasture. Subsequently, energy that would have been produced by the proposed facility would need to be generated by another available source; common available sources include older power generation facilities that consume more natural gas and release greater quantities of air pollutants. In addition, under this alternative, the District's customers and the people of California would have less total generating capacity and, therefore, a less reliable and less competitive electric system.

The purpose of this generating facility is to provide a source of clean, reliable energy for the Sacramento area and the District's customers. It also intends to put to use that land and infrastructure that was originally developed by the District for the purpose of generating most of the region's energy needs. With CPP, the District is responsible to the ratepayers to avoid financial risks of project failure.

The "No Project" alternative is not considered feasible because it neither meets the objectives of providing power nor does it meet the District's business plans to rely less upon the purchase of power from outside the District.

9.1.2 Potential Environmental Impacts

CPP will produce electricity for the energy market while consuming less fuel and discharging fewer air emissions for each energy unit generated when compared to other existing, older fossil fuel generation facilities. This is a beneficial environmental impact.

Potential environmental impacts from the “No Project” alternative would result in greater fuel consumption and air pollution because new generating facilities, including CPP, would not be brought into operation to displace production from older, less efficient, higher air emissions power plants.

9.2 Proposed and Alternative Sites

When the District first anticipated a need for additional firm power generation, they evaluated a variety of sites with respect to infrastructure, ability to serve the District, and the potential for conflicts with other land uses. Based on this analysis, the District constructed a substantial facility at the Rancho Seco Nuclear Generation Plant (Rancho Seco Plant) that was subsequently decommissioned at the request of the ratepayers. The District, however, continues to own the facility, the transmission capability, water rights, property, and land use compatibility suitable to develop the site for its original purpose (i.e., electrical generation). Therefore, there is an overwhelming value to using the existing facility for its intended purpose.

9.2.1 The Proposed Site

The proposed CPP site is located at the southern edge of Sacramento County. The site covers approximately 30 acres of the 2,480-acre compound at the Rancho Seco Plant. The site is owned and maintained by the District and was selected for the following reasons:

- The site is close to the existing transmission substation at the Rancho Seco Plant, with access to PG&E, and through PG&E, the ISO electrical markets. The proposed project site will allow power delivery without constructing significant new transmission lines, thereby reducing potential impacts on the environment.
- Sufficient land (in excess of 35 acres plus a construction laydown area) was available.
- The District has a contract for and has historically paid for, a sufficient water supply that is already delivered to the site by the Folsom-South Canal. Water quality is excellent, allowing a high level of cycling before disposal.
- The site is close to an existing water supply requiring minimal impact on the environment for purposes of constructing additional water supply infrastructure.
- The site is proximate to present and future gas supplies (Lodi) for future reliability.
- Development of the site would not cause loss of significant environmental resources.
- The site is located in a rural area with few residences nearby.
- The project uses would be consistent with neighboring utility uses, and would be consistent with the original intended (and zoned) use of the site (i.e., power generation).
- The site is zoned for a generating facility.

9.2.2 Alternative Sites

The District also identified and evaluated the suitability of several other properties for CPP. As part of this assessment, the properties that were less than 25 acres in size were eliminated from further consideration because of their inability to support the project's space requirements. Three other potential sites that had sufficient land area were identified.

9.2.2.1 Alternative Site Selection Criteria

Alternative sites were evaluated with respect to the following criteria:

- Adequate size and shape to contain the proposed facilities and other site improvements
- Compatibility with local land use plans and zoning ordinances
- Compatibility with existing land uses and the presence of site improvements
- Availability of water, electric transmission, and natural gas interconnections
- Potential for less than significant environmental impacts (e.g., biological, cultural/paleontological, visual, noise, and flooding)
- Location within the District service area
- Proximity of the site to future sources of gas supply to provide reliability

The alternative site locations, shown on Figure 9.2-1, were evaluated using the above criteria. The characteristics of each alternative site are presented in Table 9.2-1.

TABLE 9.2-1
Site Selection Criteria

Alternative Site	Site Size	Zoning Designation	Current Land Use/ Improvements
Site 1 (Carson Ice-Gen Plant)	55 acres	Open Space	Vacant/Adjacent to Carson Ice-Gen and the Sacramento Regional Wastewater Treatment Plant
Site 2 (Procter & Gamble)	<5 acres	Industrial	Vacant/Industrial
Site 3 (Campbell)	<10acres	Industrial	Industrial

9.2.2.2 Alternative Site Description and Feasibility

In this section, each of the alternative sites is described and analyzed based on its feasibility for use. Environmental considerations are presented in Section 9.2.2.3.

9.2.2.2.1 Site 1

Site 1 (Carson Ice-Gen Facility) is located on the south side and adjacent to the existing District Carson Ice-Gen Facility, 20 miles north of the proposed site. The site is a 55-acre parcel of relatively flat land that functions as buffer land around the regional wastewater treatment plant. The site is located in Sacramento County and is zoned Open Space.

Because of Carson Ice-Gen, Site 1 has some infrastructure facilities, but would require upgrades to the transmission system. Reclaimed water and suitable land might be available, but the county of Sacramento controls the water and owns all of the surrounding property. Negotiations regarding water use would leave the District vulnerable to any water restrictions the County would impose. The County has expressed its intent to lease, rather than sell the property, which could also leave the District vulnerable to the right to lay out the plant and use the land in the best interests of its customers. There are residential communities less than 1 mile east, north, and south of the proposed facility. Residential communities are generally unfavorable to siting new power generation in the vicinity of housing.

9.2.2.2.2 Site 2

Site 2 (Procter & Gamble) is located 20 miles north of the proposed site, in an industrial portion of south Sacramento. The site is bordered by the Procter & Gamble manufacturing plant to the south, the existing District-owned Cogeneration site and peaking unit to the east, and the UPRR to the west. Gas supply is readily available, as is transmission capacity, although both may require substantial upgrades. Water supply would be from the city of Sacramento, and disposal may be problematic. The site is zoned for industrial use, and is located in the city of Sacramento. However, the most compelling limitations are the size of the available vacant land (< 5 acres) and the close proximity of residential and sensitive communities on all sides. This site was considered to be too small to allow the long term reliability and capacity the District desires.

9.2.2.2.3 Site 3

Site 3 (Campbell Soup) is located 15 miles north of the proposed site, adjacent to the District-owned cogeneration facility on Franklin and 47th streets in the city of Sacramento. Like Site 2, this site has a readily available gas supply, and transmission capacity, although both may require substantial upgrades. Water supply would be from the city of Sacramento, and disposal may be problematic. The site is zoned for industrial use. Again, insufficient land area (<10 acres) is available.

9.2.2.3 Environmental Considerations

In this section, the potential environmental impacts of the alternative sites are discussed relative to the proposed site. Potential environmental impacts from use of the proposed site are presented in each of the 16 environmental subsections of Section 8.0 of the AFC.

9.2.2.3.1 Air Quality

The type and quantity of air emissions from the proposed and alternative sites would be identical. However, the impacts on the human population and the environment would differ in the location, proximity, and number of residences and other human habitat in the vicinity of the sites and the terrain surrounding the alternative sites. For all alternative sites there are many more residences and potentially sensitive receptors in close proximity to the proposed facility; therefore, greater potential impacts would result from the relatively remote proposed site. However, in all cases, air quality impacts would not be significant.

9.2.2.3.2 Biological Resources

Biological resources at Site 1 are equivalent to, or possibly greater than those at the proposed site. The habitat is annual grassland and agricultural fields used by burrowing owls, Swainson's hawks, and common grassland species. Vernal pools occur in the general area, but not specifically on Site 1. The value of these resources lies in that they are located in a buffer area surrounding the wastewater plant that is specifically managed to support and enhance wildlife habitat.

Sites 2 and 3 are each located in industrial areas, where habitat value is relatively low and there are few biological resources using the sites. Fairy shrimp and burrowing owls are present in the vicinity of each of these sites, and may also occur on the sites. Each of these sites would require that gas (and possibly water) pipelines cross through substantially residential and urban areas, reducing habitat losses and biological impacts, both of which are favorable.

The proposed site is located within the 2,480-acre parcel owned by the District, and was selected (among other reasons) within this parcel to minimize sensitive wetland and vernal pool habitats to the extent possible. The relatively low direct impact to biological resources from the proposed project attests to sensitivity of the site selection.

9.2.2.3.3 Cultural Resources

Alternative Sites 1, 2, and 3 are located in areas that are highly modified by human activities. Sites 2 and 3 have been graded and cleared for industrial activities. Site 1 has been leveled, plowed, and graded for access roads. The potential for any cultural resources at these sites is low. This makes all sites similar with respect to the potential for encountering cultural resources.

Because Sites 1, 2, and 3 are likely closer to necessary water, gas, and transmission infrastructure there is less potential that construction of the linears would cause impacts to cultural resources. However, since field surveys were completed for the proposed site, it appears the linears can avoid all significant impacts and this is not a determining factor for selection.

Therefore, the potential of affecting cultural resources is similar at the proposed site and alternative sites.

9.2.2.3.4 Land Use

Designated and zoned land uses for the alternative sites are industrial, and therefore consistent with the proposed use for power generation. This contrasts with the proposed site, which is presently agricultural, but was originally planned for Rancho Seco Unit II. Although the alternative sites are zoned for industrial uses, the number of residential and other receptors public is greater than for the proposed site and, therefore, would potentially affect more people. The proposed site, while zoned for agricultural uses, has a Public/Quasi-public land use designation. The area is sparsely populated and has no sensitive receptors (e.g., hospitals, day cares, etc). Therefore, the land uses impacts for the proposed site and the alternative sites are similar.

9.2.2.3.5 Noise

Sites 1, 2, and 3 are zoned for industrial uses, proximate to industrial uses and surrounded by busy streets and other sources of noise. For this reason the additional noise generated by the proposed facility would be potentially detectable by many more individuals, but at the same time masked by the cumulative noise from many other sources. In contrast, the proposed site is sparsely populated, rural, and generally lacks significant noise generators. Although the proposed site is not the preferred location for noise impacts, mitigation can reduce the potential noise generation to an acceptable level. Therefore, the impacts from noise generation are not sufficient to offset the favorable aspects of using the proposed site.

9.2.2.3.6 Public Health

Sites 1, 2, and 3 are significantly closer to a larger number of public receptors, specifically the communities in south Sacramento and Laguna. These sites would likely expose a greater number of the public to potential public health impacts than at the proposed site. However, all public health impacts from CPP are less than significant.

9.2.2.3.7 Worker Health and Safety

CPP has no adverse impact on worker health and safety. Therefore, the worker health and safety impacts from the proposed site and alternative sites are equivalent.

9.2.2.3.8 Socioeconomics

The District pays no taxes to the County, therefore impacts of the project with respect to fees would not differ between the alternatives. Sites 1, 2, and 3 would seem to benefit from being closer to a major metropolitan center (Sacramento) and, therefore, require construction workers to travel a shorter distance than the proposed site. However, this would be offset by commute distances from Stockton and other Central Valley communities being longer. A location in Sacramento would have more hazardous materials support than the rural area of the proposed site. All other socioeconomic impacts from the alternatives are believed to be the same as impacts from the proposed site. With mitigation, no potential socioeconomic impacts are anticipated from any of the sites.

9.2.2.3.9 Agriculture and Soils

With respect to agriculture and soils, the major differences between the proposed CPP site and the alternative sites are their effects on prime agricultural land, erodibility of the land due to construction impacts, and revegetation of the site after construction. The alternative sites are proposed for future industrial development and, therefore, are not presently prime agricultural land. The proposed site, while presently in agricultural production (pasture), was originally planned as the location for Rancho Seco Unit II, and would not remain agricultural land under that plan. Impacts to agricultural lands and soils would be similar for all alternatives.

9.2.2.3.10 Traffic and Transportation

Alternative sites, and the proposed site all have existing roads sufficient to carry required construction and delivery traffic. Because all alternative sites have heavy industry present, each has ready access for heavy equipment, up to and including rail traffic. The potential impacts of additional traffic during construction are potentially less significant in rural south Sacramento County than they would be in the more congested urban areas of Sites 1, 2, and 3. Traffic and transportation impacts, with mitigation, would be comparable for the proposed project and the alternative sites.

9.2.2.3.11 Visual Resources

Sites 1, 2, and 3 are all located in industrial areas that have low visual aesthetic qualities. The proposed site is located in an open viewscape, but is adjacent to the existing Rancho Seco Plant. The potential for visual resources impacts associated with each of these sites varies depending on the relative visibility of the sites from roads and residences and the length and potential visibility of any new transmission lines that development of a generating facility on the site would require. However, the project is generally consistent with uses at each of the sites and, therefore, would have similar impacts on visual resources.

9.2.2.3.12 Hazardous Materials Handling

The same quantity of hazardous materials would be stored and used at the proposed site as at the alternative sites. A breach in the ammonia tank at the proposed site would have little to no effect on the population due to the design controls that would prevent off-site migration. However, Sites 1, 2, and 3 are located near greater number of residences. Although the same design controls would be in place at those locations, the potential for affecting a larger population would be greater public concern at the alternative sites.

9.2.2.3.13 Waste Management

The same quantity of waste will be generated at the proposed site as at the alternative sites. The environmental impact of waste disposal should not differ between the proposed and alternative sites.

9.2.2.3.14 Water Resources

The source of water for the alternative sites would be very different than the proposed site. Water available to Sites 1, 2, and 3 consist of groundwater, municipal drinking water, or potentially treated wastewater from the SRWTP (Site 1 only). Groundwater in Sacramento County is generally recognized to be in or near overdraft conditions. Additional withdrawals have potential adverse impacts on the availability and potential quality of groundwater. Also, there are concerns that large groundwater withdrawals could re-direct contaminated groundwater plumes from well-known sites such as Aerojet and Kiefer Road landfill.

The use of treated wastewater is encouraged by the CEC, but the SRWTP is not yet in a position to provide this product. The quality, reliability, and availability of treated wastewater is also uncertain. Finally, for Sites 2 and 3, delivering treated wastewater would require substantial infrastructure (pipelines) through residential and urban areas with consequent disruptions to traffic, public health, and similar concerns. Also, the use of wastewater for cooling has implications for waste management. Effluent from the project would need to be disposed, and this would not necessarily be acceptable to the City wastewater system.

A primary motivation for locating the proposed project at Rancho Seco is the ready availability of a reliable and high quality water supply. The District already has a contract for sufficient water from the Folsom-South Canal, which was obligated for the operation of electrical generation (i.e., the Rancho Seco Plant). As the Rancho Seco Plant is decommissioned, this will make water available for CPP.

The lack of water resources could be resolved by redesigning the project to replace the cooling tower with an air-cooled condenser. However, this project change would result in a significant reduction in electrical generation output, especially during the warm summer months when electrical demand is high, and a substantial increase in cost. This reduction in efficiency would not be in the best interests of District ratepayers.

9.2.2.3.15 Geologic Hazards and Resources

As described in Section 8.15, Geological Resources, the proposed site is potentially subject to seismically induced ground-shrinking, liquefaction, and has high shrink-swell potential. The alternative sites are also potentially subject to the same geologic hazards. Therefore, the geologic hazard impact from the proposed site and the alternative sites is equivalent and can be effectively addressed with proper foundation design.

9.2.2.3.16 Paleontological Resources

The proposed site and the alternative sites have the potential to adversely impact paleontological resources as a result of deep excavations in those areas where fill is not present and the site has not been disturbed by agriculture or other activities. Therefore, all sites have an equivalent potential for the presence of paleontological resources.

9.2.2.4 Selection of the Proposed CPP Site

The primary reasons for selecting the proposed CPP site were as follows:

- Availability of sufficient land (the District already owns it)
- Availability and reliability of a water supply (the District has long-term contract for it)
- Consistency with both existing (industrial) and intended (electrical generation) uses of the proposed site
- Ability to mitigate all potential environmental impacts
- Minimizes potential exposure of urban and residential population
- Efficient use of ratepayer resources
- The proposed site is not as physically constrained as some of the alternative sites due to electrical transmission lines and natural gas pipelines crossing these sites. The alternative sites do not have all those characteristics, thereby making them less desirable for the location of CPP.
- There is sufficient land available for the plant site and for construction parking and laydown areas.

Table 9.2-2 compares the potential environmental characteristics of the proposed CPP site with Alternative Sites 1 through 3.

The proposed site location is superior or equal to all of the alternative sites. In most cases, its impacts are the same as, or in some cases less than, the best alternative site. In addition, since the proposed site will require less development of linear facilities than most of its alternatives, the overall impact to the environment is likely to be lower.

TABLE 9.2-2
Comparison of Alternative Sites to the Proposed Site

Characteristic	Proposed Site	Site 1	Site 2	Site 3
Potential presence of sensitive species/ habitat	Moderate	High	Low	Low
Potential cultural/ archaeological sensitivity	Maybe	Maybe	Maybe	Maybe
Potential land use incompatibility	No	No	No	No
Proximity to sensitive noise receptors	Up to 150 residents within 1 mile	Up to 6,000 residents north, east, and south	Up to 10,000 residents within 1 mile	Up to 10,000 residents within 1 mile
Potential for sensitive public health receptors	Low	Moderate	Moderate	Moderate
Removal of prime farm land	No	No	No	No
Size of parcel	Adequate	Adequate	Minimum	Minimum
Traffic & transportation	Low	Low	Moderate to High	Moderate to High
Potential visual sensitivity	Moderate	Moderate - Low	Low	Low
Risk to humans from off-site migration of hazardous materials	Low	Moderate	High	High
Reliable water supply	High	Moderate	Low	Low
Impact on groundwater supply	None	Moderate	High	High
Adequate gas supply nearby	No	Yes	No	No
Adequate electrical transmission capacity	Yes	No	No	No
Impacts of linears	Moderate	Low	High	High
Efficiency for ratepayers	High	Low	Low	Low
Potential paleontological sensitivity	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate

9.3 Alternative Linear Facilities

Linear facilities required for CPP include an electric transmission line, a natural gas supply line, and water supply lines (see Figure 2.1-1). The proposed linear facilities are presented in Section 2.0, Project Description; Section 5.0, Electric Transmission; Section 6.0, Natural Gas Supply; and Section 7.0, Water Supply. In addition, the environmental impacts of the proposed linear facilities are discussed in several of the environmental sections, including Section 8.2, Biological Resources; Section 8.3, Cultural Resources; and Subsection 9.3.1, Electric Transmission Lines.

9.3.1 Electric Transmission Line

Due to the proximity of the proposed project site to the Rancho Seco Plant substation, only one alternative electrical transmission line route was considered. The route was selected to parallel the existing 230-kV PG&E route to the switchyard at the Rancho Seco Plant, and pole locations were sited to avoid filling wetlands and vernal pools between CPP and the Rancho Seco Plant. No other environmentally favorable alignment could be defined and, therefore, no alternative was considered.

9.3.2 Natural Gas Supply Lines

Four alternative natural gas supply line routes were considered for the project. The route and alternative gas pipeline alignments were selected on the basis of engineering and construction feasibility, length of pipeline, cost, and the potential for environmental impacts. Potential impacts were evaluated with respect to specific criteria, as follows:

- Potential for biological mpacts
- Potential for cultural impacts
- Land use compatibility
- Permitability and right of way
- Difficulty of construction and construction costs
- Ease of maintenance and operation
- Potential for reinforcements, future loads and interconnects

Three alternative gas supply alignments were evaluated as described below:

Alternative alignments along the proposed route (G2, G3). This alternative is generally similar to G1. But as an alternative to using Western Pacific Railroad right of way, this route would proceed east on Dwight Road to Franklin Boulevard and south on Franklin Boulevard to Core Road, then east on Core Road to the railroad right of way. At Ed Rau Road, another alternative alignment becomes available: proceed south on Ed Rau Road to Eschinger Road, then east on Eschinger Road to where the proposed route once again meets Eschinger Road. These alternate alignments are shown on Figure 6.1-1.

Carson Ice-Gen Northeast Corridor Routes (G4,G5). The Carson Ice-Gen Northeast corridor alternate is shown on Figure 6.1-1. The Northeast Corridor routes follow Dwight Road east to Franklin Boulevard, and continue east along Big Horn Boulevard to Bruceville Road. At this juncture Route G4 turns north on Bruceville Road at its juncture with Big Horn Boulevard and runs east on Sheldon Road to Bader Road. Turning south on Bader Road, the route proceeds to Pleasant Grove School Road, where it turns east. The route runs east on Pleasant Grove School Road to Grant Line Road. Alternate route G5 continues southeast along Big Horn Boulevard to Laguna Boulevard, turning east on Laguna Boulevard, crossing Highway 99, and continuing east on Bond Road to Grant Line Road, and northeast on Grant Line Road, where it follows the same route as G1.

In this vicinity, the PG&E electric tower lines cross Grant Line Road. The possible use of this tower line as a route was explored and subsequently discarded due to the lack of access to the alignment for most of the route. The towers follow a direct route, but the lack of a maintenance road and continuous access to the route made it infeasible for further consideration as a gas supply route.

At the intersection of Grant Line Road and Wilton Road, the route turns southeast on Wilton Road to Dillard Road. For approximately two-thirds of this distance the Central California Traction Company Railroad (CCTR) tracks run parallel to the roadway. At Dillard Road, however, Route G1 continues southeast and south along the CCTR right of way to the east projection of Valensin Road, then east to Colony Road. Alternatively, the route could turn northeast at Dillard Road, and southeast and south on Colony Road to Valensin Road.

This route goes through more populated and developed areas than Route G1 and has potential for land use compatibility issues, permitability and right-of-way issues, and higher maintenance and operations costs. This route would be more disruptive to traffic during construction compared to the proposed route. It would also be more expensive to construct.

Procter & Gamble Cogen Facility Corridors (G6,G7). The Procter & Gamble Cogen facility is located on 83rd Street, at 24th Avenue; the tie-in point is on Fruitridge Road, at 83rd Street. From that point, the two identified route corridors share a common path: east on Fruitridge Road to the CCTR right of way, and southeast to Florin Road. At that point the two routes split. The pipeline alternative routes that start at Procter & Gamble are shown on Figure 6.1-1.

Route G6 continues along the CCTR right of way to the vicinity of Sheldon, where it converges with Route G5 from the Carson Ice-Gen, and follows that corridor to CPP.

Route G7: The southeast route turns east on Florin Road, and follows Florin Road several miles to the Folsom-South Canal right of way, at which point it turns south, following the Folsom-South Canal right of way south to the existing District pump station, north of Twin Cities Road. From there, the route follows the existing District water line easement east to the CPP.

The Procter & Gamble alternative routes do not provide suitable gas supply without significant upstream pipeline parallel reinforcement. There is also a significant impact to gas supply, efficiency, and operations for the cogeneration facility at Procter & Gamble. Additionally, the pipeline does not offer the same flexibility for connecting to future gas pipelines from the south as the proposed route. This may have an affect upon plant reliability. The Procter & Gamble Southwest Corridor alternative route has significant land use compatibility issues and will be disruptive to traffic during construction. The Procter & Gamble Southeast Corridor alternative route has significant permitability and right-of-way issues. Due to these cumulative impacts, the Procter & Gamble alternate routes were not studied further.

There are significant differences among the various alternative routes. All biological and cultural factors were determined to be mitigatable. The proposed route (G1) was considered to be more consistent with future land uses, in that the gas pipeline would pass through fewer residential areas where schools, day care centers, convalescent hospitals, and other potentially sensitive receptors were likely to be present. With respect to permitability and right of way, all alternatives were similar. Difficulty and cost of construction criteria favored route G1 highly over G4 or G5. Maintenance and operation costs were similar for all alternatives. The potential for reinforcements, future loads, and interconnects heavily favored route G1. This is because future gas supplies are likely to approach Sacramento from the west or southwest. If and when these additional supplies become available, connection to the G1 will be much shorter than connection to G4. The advantage of future connections is to provide the District with a range of options for gas supply that will reduce costs and increase reliability for the CPP.

The proposed route was field-surveyed for potential biological and cultural/paleontological impacts. Potential impacts from the construction and use of proposed routes are discussed in Sections 8.2, 8.3, 8.9, and 8.16.

9.3.2.1 Environmental Considerations

The expected environmental impacts of the alternative natural gas supply lines are presented below.

9.3.2.1.1 Air Quality

Except for short-term temporary emissions from construction equipment, the natural gas supply line has no impact on air quality. Therefore, the air quality impacts of the proposed transmission line and the alternative transmission lines were considered equivalent.

9.3.2.1.2 Biological Resources

All biological impacts that would result from pipeline construction and operation were considered mitigatable through a combination of seasonal and location avoidance, education, micro-alignment, and where impacts are unavoidable—compensation. Although the proposed route (G1) and Alternate G2 were considered more biologically sensitive than the other routes, particularly along the northern part of the corridor, they had less potential impact on the urban, residential, and industrial areas of south Sacramento. Also, the more significant portions of the alignment are in the vicinity of Consumnes River and Laguna Creek, which is common to all alignments and could not be reasonably avoided. Because all impacts were considered mitigatable, the biological impacts did not turn out to be the determining factor in pipeline alternative selection.

9.3.2.1.3 Cultural Resources

A predictive analysis was used to determine which alignments had a greater potential for encountering cultural resources. After field surveys were performed, only one relatively minor cultural resource was located (reported under confidential cover), and, therefore, this did not become a determining characteristic for pipeline alignment selection.

9.3.2.1.4 Land Use

The proposed gas supply line routes primarily pass through County right of way land or agricultural land. A large portion of the alternative routes crossed urban, residential, and industrial zones, where impacts of pipeline construction would be likely to be more significant. Therefore, a slight preference was given to the proposed route. See Section 8.4, Land Use, for additional information on existing land use, future land designations, and zoning.

9.3.2.1.5 Noise

Other than short-term temporary impacts from construction, the alternative natural gas supply line will not produce noise. Therefore, the noise impact from the alternative routes is equivalent to the proposed route.

9.3.2.1.6 Public Health

The natural gas supply line has no impact on public health. Therefore, the public health impacts from the proposed gas supply route and the alternative gas supply routes are equivalent.

9.3.2.1.7 Worker Health and Safety

The natural gas supply line has no impact on worker health and safety. Therefore, the worker health and safety impacts from the proposed gas supply route and the alternative gas supply routes are equivalent.

9.3.2.1.8 Socioeconomics

All of the alternatives and the proposed route are of similar lengths and would require a similar workforce. Therefore, the socioeconomic impacts from the alternatives will essentially be the same as impacts from the proposed natural gas supply route.

9.3.2.1.9 Agriculture and Soils

Wherever gas pipelines cross through agricultural areas, they would be buried below the plow depth (typically 5 feet) so as not to interfere with any agricultural uses. The impacts of the proposed gas supply line route are similar to those of the alternatives.

9.3.2.1.10 Traffic and Transportation

The proposed natural gas supply route will have a minimal short-term impact on traffic and transportation during construction of the line but no impact during operation of the line. The alternative routes would have a potentially greater impact on traffic and transportation as they cross through predominantly urban, residential, and industrial areas.

9.3.2.1.11 Visual Resources

Since the proposed natural gas supply route and all alternative routes will be underground, and all surface disturbance will be restored, there would be no visual impact from any of the routes.

9.3.2.1.12 Hazardous Materials Handling

The natural gas supply line has no impact on hazardous materials handling. Therefore, the hazardous materials handling impacts from the proposed natural gas supply route and the alternative routes are equivalent.

9.3.2.1.13 Waste Management

The natural gas supply line has no impact on waste management. Therefore, the waste management impacts from the proposed natural gas supply route and the alternative routes are equivalent.

9.3.2.1.14 Water Resources

The natural gas supply line has no impact on water resources. Therefore, the water resources impacts from the proposed natural gas supply route and the alternative routes are equivalent.

9.3.2.1.15 Geologic Hazards and Resources

Because it will be placed underground, the natural gas supply line will have a minimal impact on geologic hazards and resources during the construction period and will be exposed to earthquake disruption during the operating life of the line. The proposed natural gas supply route and the alternative routes are in the same geologic area and are expected to be environmentally equivalent from a geological point of view.

9.3.2.1.16 Paleontological Resources

The proposed and alternative routes are located in an area with a moderate sensitivity rating because artificial fill material and significant ground disturbance due to roadway, residential, agricultural, or industrial construction activities are present.

9.3.3 Water Supply Lines

Water is delivered to the pump station at the Rancho Seco Plant, and in a nearly straight line from the pump station to CPP, crossing over upland habitat between two parts of a historical vernal pool complex (See Section 8.2). Because this line avoids most direct impacts, no practical alternative that would have fewer impacts could be identified. Therefore, no alternatives to the proposed alignment for the waterline were evaluated.

9.4 Alternative Project Configurations

The proposed nominal 1,000-MW configuration of CPP is the result of a variety of design and operating considerations. The main factors affecting the configuration include available gas turbine-generator sizes, economies of scale for both construction and operation of the plant, fuel supply logistics, power transmission capacities, and forecast market demand for electrical power. The proposed design configuration consists of the latest generation of commercially demonstrated combustion gas turbine technology, commonly referred to as "F" technology.

Other configurations were investigated including a smaller (500-MW) capacity plant and a design with three combustion turbines and two steam turbines. After thorough review of the engineering, operations, and market considerations, two phases each having two combustion turbines with one steam turbine providing a nominal 1,000-MW plant capacity (500 MW per phase) configuration was selected as the most viable alternative for CPP.

9.5 Alternative Technologies

Although CPP will be owned by a local, publicly-owned electric utility, the generating technology to be used must be selected with consideration for the efficient and competitive production of power in a deregulated market. The District actively develops and supports a variety of energy sources, including hydroelectric, wind, solar and historically even nuclear power. However, the District requires some component for baseload that is not dependent on annual rainfall or solar conditions. Other technologies were considered using the selection methodology described below, but were rejected in favor of the natural-gas-fired, combined-cycle technology, which is the basis of this application. The selection methodology and other technologies considered are described in the following subsections.

9.5.1 Selection Methodology

Technologies considered were primarily those that could provide base load or load-following power as opposed to those that would provide peak or intermittent power. The reason for using this screening criterion was that the economic viability of the facility is paramount to the ratepayers of the District. Two intermittent technologies with no fuel cost, solar and wind, were also examined to see if they might be economically viable in the deregulated electricity market.

The selection methodology included a stepped approach with each step containing a number of criteria. The selected technology would have to pass Steps 1 and 2 and provide the lowest or near lowest cost in Step 3. The steps are:

Step 1. Commercial Availability—The technology had to be proven commercially practical with readily available, reliable equipment at an acceptable cost.

Step 2. Implementable—The technology had to be implementable; that is, it could meet environmental, public safety, public acceptability, fuel availability, financial, and system integration requirements.

Step 3. Cost-effective—The technology had to be cost-competitive, not only with existing generating units, but also with units that would likely enter the newly deregulated market near the time CPP begins commercial operation. Cost included both capital and O&M costs, which would translate into a bus bar cost represented in cents per kilowatt-hour.

The methodology was applied to a number of base load and load-following technologies in the following subsections.

9.5.2 Technologies Reviewed

The technologies reviewed can be grouped according to the fuel used. Fuels included were oil and natural gas, coal, nuclear reactions (usually using radioactive materials as fuel), water (hydro, ocean conversion, geothermal), biomass, municipal solid waste, and solar radiation.

9.5.2.1 Oil and Natural Gas

These technologies use oil or natural gas and include conventional boiler-steam turbine units, combustion turbines in various configurations, and fuel cells.

9.5.2.1.1 Conventional Boiler-Steam/Turbine

Fuel is burned in a furnace/boiler to create steam, which is passed through a steam turbine that drives a generator. The steam is condensed and returned to the boiler. This is an aging technology, which is able to achieve a maximum thermal efficiency on the order of 35 to 40 percent. Applying the review methodology, the technology is definitely commercially available and could probably be implemented. Because of its relatively low efficiency, it tends to emit a greater quantity of air pollutants per kilowatt-hour-generated than more efficient technologies. Furthermore, its cost of generation is relatively high, on the order of 5.5 to 7.5 cents per kilowatt-hour, depending on fuel costs. This technology, therefore, does not satisfy Step 3 and was eliminated from consideration.

9.5.2.1.2 Supercritical Boiler-Steam/Turbine

This technology is basically the same as the conventional boiler-steam/turbine except that considerably higher pressures are employed. While the efficiency increases, more expensive materials are required to construct the units. Consequently, the cost of power produced is about the same as conventional units. Therefore, this technology was also eliminated.

9.5.2.1.3 Simple Combustion Turbine

This technology uses a gas or combustion turbine to drive a generator. Air is compressed in the compressor section of the combustion turbine, passes into the combustion section where fuel is added and ignited, and the hot combustion gases pass through a turbine, which drives a generator and the compressor section of the combustion turbine. The combustion turbines have a relatively low capital cost with efficiencies approaching 40 percent in the larger units. Because they are fast starting and have a relatively low capital cost, they are used primarily for meeting high peak demand (about 1,000 hours/year), when their relatively low efficiency is not a concern. Applying the review methodology, this technology is definitely commercially available, and could be implemented. Because of its relatively low efficiency it tends to emit a greater quantity of air pollutants per kilowatt-hour-generated than more efficient technologies and its cost of generation if it were base-loaded is relatively high, on the order of 5.5 to 7.5 cents per kilowatt hour, depending on fuel costs. The technology, therefore, does not satisfy Step 3 and was eliminated from consideration.

9.5.2.1.4 Conventional Combined-Cycle

This technology integrates combustion turbines and steam turbines to achieve higher efficiencies. The combustion turbine, which drives a generator, would normally exhaust its hot combustion gas to the atmosphere, but in the combined-cycle technology, the exhaust gas is passed through a heat recovery steam generator creating steam, which is used to drive a steam turbine/generator. The resulting efficiency for the system is 50 to 54 percent, considerably above most other alternatives. This relative high efficiency results in lower air emissions per kilowatt-hour-generated and a relatively low cost of 3.5 to 5 cents per kilowatt-hour. In addition, natural gas fuel emits little sulfur dioxide and little particulate matter. For these reasons, the system is considered the benchmark against which all other base load technologies are compared. Applying the review methodology, this technology is definitely commercially available and can be implemented. Because of its high efficiency and low cost of generation, this technology satisfies Step 3. This technology is the one selected for CPP as well as most other new base load and load-following units being developed in the United States.

9.5.2.1.5 Kalina Combined-Cycle

This technology is similar to the conventional combined-cycle except water in the heat recovery boiler is replaced with a mixture of water and ammonia. Overall efficiency is expected to be increased 10 to 15 percent. This technology, however, is still in the testing phase with tests recently completed on a 3-MW unit in Southern California. Applying the review methodology, the technology fails to pass Step 1 because it is not commercially available and was, therefore, eliminated from consideration.

9.5.2.1.6 Advanced Gas Turbine Cycles

There are a number of efforts to enhance the performance and/or efficiency of gas turbines by injecting steam, intercooling, and staged firing. These include the steam-injected gas turbine (SIGT), the intercooled steam recuperated gas turbine, the chemically recuperated gas turbine, and the humid air turbine cycle. With the exception of the SIGT, none of the technologies are commercially available and, therefore, fail to pass Step 1 of the review methodology. The SIGT is marginally commercially available and might pass Steps 1 and 2 of the review methodology, but its efficiency is lower than conventional combined-cycle technology and, therefore, fails Step 3 of the methodology. Consequently, all of these technologies were eliminated from consideration.

9.5.2.1.7 Fuel Cells

This technology uses an electrochemical process to combine hydrogen and oxygen to liberate electrons, thereby providing a flow of current. The types of fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane. With the exception of the phosphoric acid fuel cell and possibly the molten carbonate fuel cell, none of these technologies are commercially available and, therefore, fail Step 1. The phosphoric acid fuel cell has been operated in smaller size units and the molten carbonate fuel cell has completed testing. At this time, however, neither of these technologies are cost-competitive with conventional combined-cycle technology and, therefore, fail Step 3 of the review methodology.

9.5.2.2 Coal

The technologies that use coal for fuel include conventional furnace/boiler steam turbine/generator, fluidized bed steam turbine/generator, integrated gasification combined cycle, direct-fired combustion turbine, indirect-fired combustion turbine, and magnetohydro-dynamics.

9.5.2.2.1 Conventional Furnace/Boiler Steam Turbine/Generator

Coal is burned in the furnace/boiler, creating steam that is passed through a steam turbine connected to a generator. The steam is condensed in a condenser, passed through a cooling tower, and returned to the boiler. Designs include stoker, pulverized coal, and cyclone. The efficiency of this technology is equivalent to a conventional gas/oil-fired steam turbine/generator unit (i.e., 35 to 40 percent), but because of the usually lower price of coal compared to natural gas, the technology can be cost-competitive under most conditions. The tons of air emissions per kilowatt-hour generated by a coal plant are greater than for a conventional combined-cycle because of the composition of coal relative to natural gas and because of the coal plant’s lower efficiency, resulting in more fuel consumed per kilowatt-hour. Applying the review methodology, the technology is definitely commercially available (Step 1). The technology should be implementable in California except for possible public perception that large coal-fired units cause visible air emissions (untrue with modern units). In addition, coal would have to be imported from outside California (resulting in increased truck and/or train traffic), and the time to construct a facility would probably be about twice that for a conventional combined-cycle unit. The technology may therefore not satisfy the criteria of Step 2. In addition, the generation cost of the technology could be greater than for a combined-cycle (Step 3). Because of the potential problems under Step 2 and the potentially higher cost in Step 3, the technology was eliminated from consideration.

9.5.2.2.2 Atmospheric and Pressurized Fluidized Bed Combustion

Both of these technologies burn coal in a hot bed of inert material containing limestone that is kept suspended or fluidized by a stream of hot air from below. Water coils within the furnace create steam that drives a steam turbine/generator. The combustion chambers of the pressurized units operate at 150 to 250 psig to increase efficiency. Efficiencies of atmospheric fluidized bed combustion (AFBC) are on the order of 35 to 40 percent, and pressurized units (pressurized fluidized bed combustion [PFBC]) are between 40 and 45 percent. The technology is commercially available for the AFBC technology at least up to the 160-MW size. The PFBC technology is not commercially available. Applying the review methodology, the AFBC may satisfy the criteria of Step 1, but the PFBC is eliminated from consideration. Implementation of the AFBC technology in California is possible, particularly for cogeneration applications (several new units have recently been constructed). Coal would have to be imported from outside California, increasing train and truck traffic. Therefore, the technology should satisfy the criteria of Step 2, although possibly not for the 1,100-MW size that the District has planned. The generation cost of the technology, however, could be greater than for a combined-cycle (Step 3). Due to the lack of a commercially proven unit in the 1,100-MW range, and the potentially higher cost, the AFBC technology was eliminated from consideration.

9.5.2.2.3 Integrated Gasification Combined-Cycle

An integrated gasification combined-cycle (IGCC) system gasifies coal to produce a medium Btu gas that is used as fuel in a combustion turbine, which exhausts to a heat recovery steam generator that supplies steam to a steam turbine/generator. The coal gasifier is located at the same site as the combustion turbine, HRSG, and steam turbine/generator and is sized to supply the combustion turbine and integrated with it and the rest of the equipment to provide an integrated generating system. While a 100-MW unit has been fully tested in California, the technology is not yet fully commercially available. Applying the review methodology, the IGCC will not meet the Criteria of Step 1. Implementation of the IGCC technology in California is possible except that coal would have to be imported from outside California (resulting in increased truck and/or train traffic). The generation cost of the technology could be competitive with a conventional gas-fired, combined-cycle (Step 3) but this is a relatively unknown factor. Due largely to the lack of full commercial availability, particularly in the 1,100-MW range, IGCC technology was eliminated from consideration.

9.5.2.2.4 Direct- and Indirect-Fired Combustion Turbines

Direct-fired units burn finely powdered coal directly in the combustion chamber of the combustion turbine, while indirect-fired units burn the coal in a fluidized bed or other combustor, and use a heat exchanger to transfer the heat from the combustion gases to air, which is then expanded through the turbine. Neither of these units is commercially available; therefore, they fail to meet the criteria of Step 1 of the selection methodology and were eliminated from consideration.

9.5.2.2.5 Magnetohydrodynamics

High temperature (3,000 ºF) combustion gas is ionized and passed through a magnetic field to directly produce electricity. This technology is not commercially available; therefore, it fails to meet the criteria of Step 1 of the review methodology and was eliminated from consideration.

9.5.2.3 Nuclear

This technology includes nuclear fission and nuclear fusion. Nuclear fission breaks atomic nuclei apart, giving off large quantities of energy. For nuclear fission, pressurized water reactors and boiling water reactors are commercially available. Also for nuclear fission, there are high-temperature gas cooled reactors and liquid metal fast-breeder reactors, which are not commercially available. While nuclear fission is a viable base load technology heavily used in France and Japan, it is currently out of favor politically in the United States and particularly in California. In addition, California law prohibits new nuclear plants until the scientific and engineering feasibility of disposal of high-level radioactive waste has been demonstrated. To date, the CEC is unable to make the findings of disposal feasibility required by law for this alternative to be viable in California. Therefore, the technology is not implementable and fails to meet the criteria of Step 2 of the review methodology. The technology was eliminated from consideration.

Nuclear fusion forces atomic nuclei together at extremely high temperatures and pressures, giving off large quantities of energy. Nuclear fusion is not available commercially and it is not clear if, or when, it will become available. Therefore, the technology fails to meet the criteria of Step 1 of the review methodology and was eliminated from consideration.

9.5.2.4 Water

These technologies use water as "fuel," and include hydroelectric, geothermal, and ocean energy conversion.

9.5.2.4.1 Hydroelectric

This technology uses falling water to turn turbines that are connected to generators. A flowing river, or more likely a dammed river, is required to obtain the falling water. This technology is commercially available. Most of the sites for hydroelectric facilities have already been developed in California, and any remaining potential sites face formidable environmental licensing problems. It is doubtful that this technology could be implemented and it would fail to meet the criteria of Step 2 of the review methodology. If a proposed project could meet the criteria of Step 2, the cost would probably be considerably higher than the cost of a conventional combined-cycle, which would cause its elimination under Step 3 of the review methodology. Therefore, it was eliminated from consideration.

9.5.2.4.2 Geothermal

These technologies use steam or high-temperature water (HTW) obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. There are vapor-dominated resources (dry, super-heated steam), and liquid-dominated resources (HTW), which use a number of techniques to extract energy from the HTW. Geothermal is a commercially available technology. However, geothermal resources are limited, and most if not all economical resources have been discovered and developed in California.

9.5.2.4.3 Ocean Energy Conversion

A number of technologies use ocean energy to generate electricity. These include tidal energy conversion, which uses the changes in tide level to drive a water turbine/generator; wave energy conversion, which uses wave motion to drive a turbine/generator; and ocean thermal energy conversion, which employs the difference in water temperature at different depths to drive an ammonia-cycle turbine/generator. While all of these technologies have been made to work, they are probably not fully commercially available. Even if they were commercially available, they are considerably more costly than conventional combined-cycle technology and they would therefore fail to meet the criteria of Step 3 of the review methodology. Therefore, they were eliminated from consideration.

9.5.2.5 Biomass

Major biomass fuels include forestry and mill wastes, agricultural field crop and food processing, construction, and urban wood wastes. Several techniques are used to convert these fuels to electricity, including direct combustion, gasification, and anaerobic fermentation. While these technologies are available commercially on a limited basis, their cost tends to be high relative to a conventional combined-cycle unit burning natural gas.

This technology does not meet the criteria of Step 3 of the review methodology and was eliminated from consideration.

Municipal solid waste (MSW) consists of extracting energy from garbage by burning or other means such as pyrolysis or thermal gasification and is commonly referred to as waste-to-energy (WTE). The best-known methods incorporate mass burn and refuse-derived fuel (RDF) facilities. Both mass burn and RDF are commercially available methods of MSW technology. Other methods are co-firing with coal, using fluidized-bed furnace/boilers, and pyrolysis or thermal gasification. There is only one 10-MW mass burn unit operating in California and no RDF facilities or facilities using the other methods. The economic feasibility of MSW technology depends heavily on the level of the “tipping fee” in the vicinity of the MSW facility. The tipping fee is the price charged by landfills for depositing waste or garbage in the landfill, and it is usually expressed in dollars per ton. In effect, a waste collection company would pay the WTE facility for taking and burning its garbage, resulting in a negative fuel cost to the WTE. A recent study for development of a WTE facility in the San Francisco area estimated that the tipping fee would have to be approximately $80 per ton for a facility to be economical. The current market tipping fee in the area ranges from $30 to $40 per ton. This technology fails to satisfy the criteria of Step 3 of the review methodology, which requires the technology to be cost-competitive. Therefore, this technology was eliminated from consideration.

9.5.2.6 Solar

9.5.2.6.1 Radiation

Solar radiation (sunlight) can be collected directly to generate electricity with solar thermal and solar photovoltaic technologies or indirectly through wind generation technology in which the sunlight causes thermal imbalance in the air mass, creating wind. Wind generation and two types of solar generation, thermal conversion and photovoltaics, were considered as alternative technologies to the combined-cycle. These are described in the following subsections.

9.5.2.6.2 Thermal

Most of these technologies collect solar radiation, heat water to create steam, and use the steam to power a steam turbine/generator. The primary systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes, and parabolic troughs. Another technology collects the solar radiation in a salt pond and then uses the heat collected to generate steam and drive a steam turbine/generator. While one of these technologies might be considered to be marginally commercial (parabolic trough), the others are still in the experimental stage. All require considerable land for the collection receivers and are best located in areas of high solar incidence. In addition, power is only available while the sun shines so the units do not supply power when clouds obscure the sun or from early evening to late morning. These factors translate into high cost, on the order of 6 to 12 cents per kilowatt-hour, which is well above the market generation price of 3 to 4 cents per kilowatt-hour in January 1998. These systems for the most part fail Step 1, commercial availability, and may not be implementable due to land unavailability and/or the ability to finance. They all, however, fail in being cost-effective and were eliminated from consideration.

9.5.2.6.3 Photovoltaic

This technology uses photovoltaic "cells" to convert solar radiation directly to direct current electricity, which is then converted to alternating current. Panels of these cells can be located wherever sunlight is available. This technology is environmentally benign and is commercially available, since panels of cells can theoretically be connected to achieve any desired capacity. While this technology may have a bright future, at the current time the cost is very high, on the order of 15 to 25 cents per kilowatt-hour. The technology fails Step 3, cost-effectiveness, and was eliminated from consideration.

9.5.2.6.4 Wind Generation

This technology uses a wind-driven rotor (propeller) to turn a generator and generate electricity. Only certain sites have adequate wind to allow for the installation of wind generators and most of the sites that have not been developed are remote from electric load centers. Because even in prime locations the wind does not blow continuously, capacity from this technology is not always available. In California, the average wind generation capacity factor has been 15 to 30 percent. In addition, the technology cannot be depended upon to be available at system peak load since the peak may occur when the wind is not blowing. The technology is commercially available and probably implementable at the proposed sites, although financing may not be available due to its perceived risk. The technology is relatively benign environmentally although visual impacts, land consumption, and effects on raptors are a concern. The cost of generation is on the order of 5 to 10 cents per kilowatt-hour, which is above the cost of the proposed alternative.

9.5.3 Conclusions

All feasible technologies that might be available for base load and load-following operation in California were reviewed using a methodology that considered commercial availability, ability to implement, and cost-effectiveness. Although some technologies, other than the combined-cycle burning natural gas, were commercially available and could be implemented, most would not result in fewer environmental effects than the natural-gas-fired, combined-cycle. In addition, all alternative, commercially available, implementable technologies were less cost-effective than the combined-cycle, and would therefore not be competitive in the deregulated electricity market. Therefore, the conventional combined-cycle technology using natural gas as fuel is the best available technology and the one that should be employed for CPP.

9.6 References

California Energy Commission. 1995. 1994 Biennial Electricity Report (ER94), P300-95-002. November.

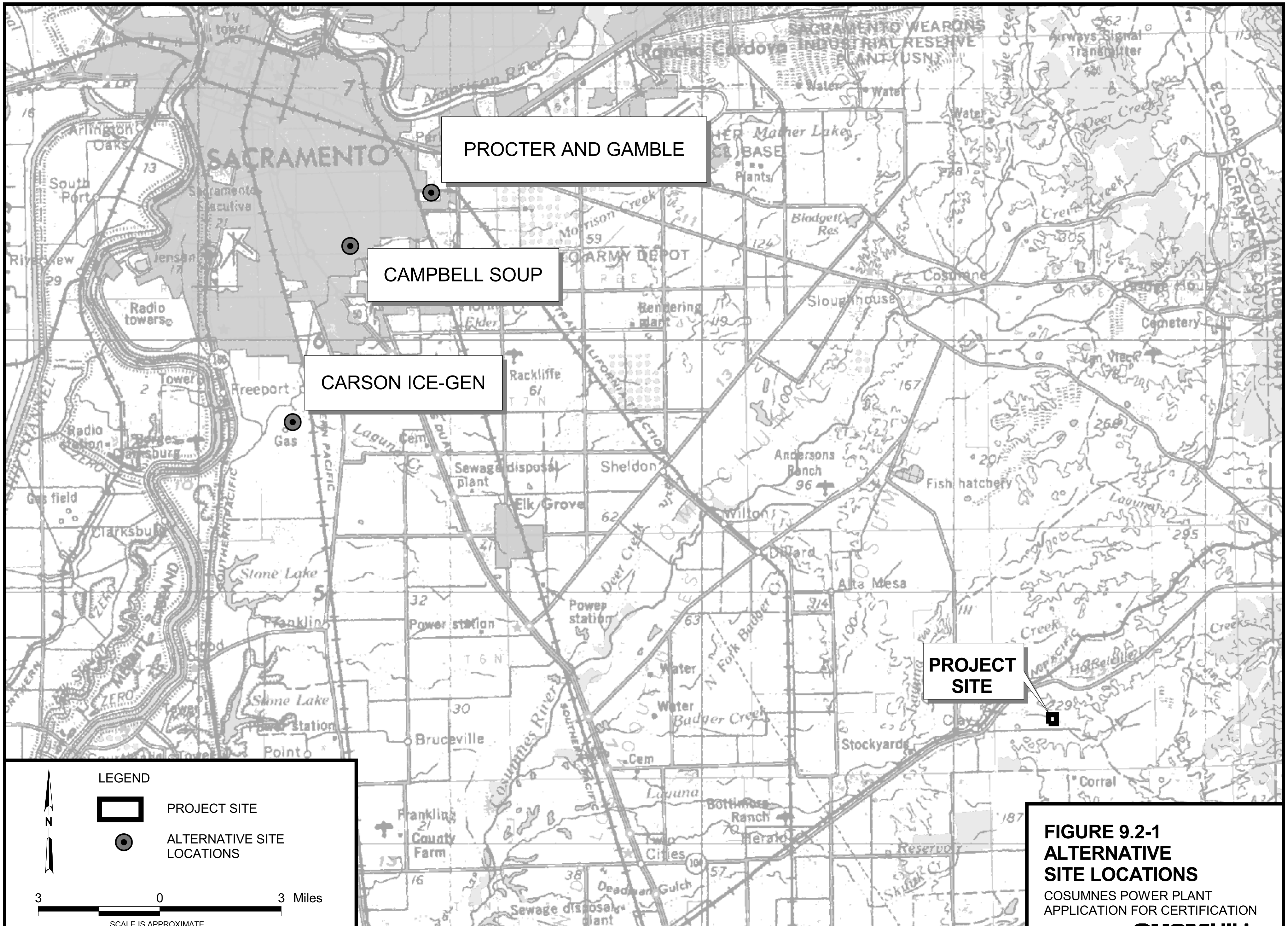

FIGURE 9.2-1
ALTERNATIVE SITE LOCATIONS
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION
CH2MHILL

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